

Deeply Practical Project Management

How to plan and manage projects using the
Project Management Institute (PMI®) best practices
in the simplest, most practical way possible.

William Stewart PhD, PMP
DeeplyPracticalPM.com

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*“All success is rooted in either luck or failure.
If you begin with luck, you learn nothing but arrogance.
However, if you begin with failure and learn to evaluate it,
you also learn to succeed. Failure begets knowledge.
Out of knowledge you gain wisdom, and it is with wisdom
that you can become truly successful.”*

– Standish Group, *Chaos Report*, 1995,
first comprehensive review of project performance.



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*“Or you can take a training course, and learn
from the experience of thousands of others.”*

– Just Saying, recently.

PM Process One Page Summary



- **Initiation:**
 - Objective – Agree a one sentence description of the end result.
 - Business Case – Prepare a top-level estimate of the cost and benefits.
 - Project Manager – Assign a single individual to plan and manage the project.
- **Planning:**
 - Core Project Team – Identify key personnel to lead planning and execution.
 - Requirements – Interview everyone to collect the detail behind the Objective.
 - Deliverables – Identify all the work products required to get the project done.
 - Precedence Diagram – Flowchart the deliverables, the structure of the plan.
 - Estimates – The resources, time, and cost estimates for each deliverable.
 - Schedule – Baseline the schedule and the critical path driving the end date.
 - Budget – Roll up the deliverable costs, sometimes graphed across time.
 - Risks – Identify the risks and include enough time and budget in the plan.
- **Monitoring & Control:**
 - Weekly Heartbeat – Status the issues and risks with the core team weekly.
 - Change Control – Analyze and get approval of scope changes before adding.
 - User Reviews – Ensure several iterations of user reviews of work in progress.
 - Monthly Heartbeat – Formally present project status to stakeholders monthly.
- **Closing:**
 - Acceptance + Close contracts + Lessons learned + Celebration + Final report.



Preface

“Everything should be made as simple as possible, but no simpler.” - Albert Einstein

Complexity is the challenge in project management. Therefore, simplicity and practicality is the solution.

This reference provides a deeply practical description of how to use the Project Management Institute (PMI®) best practices to manage your projects through every stage of their life-cycle. The processes are mapped across the project time-line, and the specific actions you need to take and documentation you need to prepare are explained at each step in a cohesive, easy to follow thread. The use of software tools to support each step of the process is described. Templates are provided for all the key project management documents. At the end of the reference you will not only understand project management, you will be able to implement it.

The material has been refined from more than 25 years of use and more than 10 years of feedback from thousands of people from dozens of organizations. It is proven, practical, and complete, providing an end-to-end road-map that you can use as a checklist to apply the PMI process to your projects of any size, in any domain, to maximize their scope, schedule, cost, and risk performance.

Whether you have a project you need to manage right now, or just wish to get a solid grounding in deeply practical application of the PMI processes, this reference can help. It starts with an overview, and then describes each step of the PM life-cycle:

1. Overview – First, a solid grounding in the essential things every project manager needs to know, including a section on the project manager role, requirements, and skills.
2. Initiation – The first step, how to set up your project so the rest of the process can be productive and efficient.
3. Planning – The heart of the reference, how to extremely efficiently figure out your project’s scope, schedule, budget, and risks *before* you start, including a section on risk management.
4. Execution – How to assemble and manage the team, and design and build the project result.
5. Monitoring & Control – How to track and manage your project, communicate with stakeholders, and get assistance when you need it, including a section on earned value management (EVM).
6. Closing – How to close the contracts, team, and project, and provide continuity to any next steps.

I hope this reference helps you both personally and professionally. May all your triple constraints be balanced!

Author Bio



William (Bill) Stewart is a Project Management Institute certified Project Management Professional (PMP), and has delivered more than 220 onsite project management courses to more than 2,200 people. He has worked for large corporations, the Canadian Federal government, academia, and founded a software startup. He has hands-on experience with project management, risk management, systems integration, systems engineering, and software engineering. He has been a keynote speaker twice at International Project Management Association (IPMA) conferences.

Bill is currently a management consultant helping clients work better and get more done. Previously, he founded and ran the cloud computing company Cirrus Computing for ten years. Before that, he spent 14 years in aerospace, where he served as company System Engineering Manager and Software Manager, Project Manager for system integration projects from \$250K to \$55M, and in a range of senior roles on other projects up to \$3B. His first real job was with the Canadian Public Service, to establish and manage a computing centre supporting 4,500 personnel, where he developed and deployed software to manage enterprise-wide course scheduling, resource management, personnel management, and payroll, and developed and taught two programming courses accredited by Seneca College.

Bill received a Ph.D. in Computer Science from the University of New Brunswick for a thesis on algorithms that build geodesic domes in multiple dimensions in optimum space and time. While at UNB, he also taught eleven undergraduate courses and served as Principle Investigator on a secure network modeling project. His professional training includes Leadership, Entrepreneurship, Project Management, Risk Management, System Architecture, and System Engineering. He has taught courses in Program Management, Project Management, Risk Management, Cost and Schedule Control, and Negotiating.

Bill is author of the first web published book at LivingInternet.info, with contributions from many creators of the Internet. He wrote the original “Fun Standard” at FunStandard.org, a collection of best practices for having organizational fun. His [paper](#) on public financing of political parties was [credited](#) in the Canadian House of Commons when the federal party financing bill passed in 2003. He lives in Ottawa, Canada, with his wife and two children.

Objectives



This reference describes how to:

- Very efficiently plan your project to figure out the scope, schedule, budget, and risks before it starts.
- Get stakeholder buy-in and senior management support at the beginning of the project, and maintain it throughout.
- Manage scope change as the project progresses so you can find the things inevitably missed, without making it better and better until it blows up.
- Manage the schedule critical path so you can focus on the most important items, without getting bogged down in the weeds.
- Estimate, allocate, track, and manage the budget and its most important drivers to obtain the best cost performance possible.
- Identify the risks, mitigate them as early as possible, and manage the risk budget so surprises can be handled within the project plan.
- Constructively communicate with the sponsor, customer, and stakeholders about the project progress, and obtain their assistance when needed.
- Understand how to use the key software tools to support the project management life-cycle.
- Gain a deeply practical understanding of the PMI process for those that wish to obtain a PMI PMP or CAPM certification.



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Project Management Overview

The Foundation

“The loftier the building, the deeper must the foundation be laid.”

– Thomas Kempis, 1380 - 1471.



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Chapter Summary



What Is Project Management?

Project Management provides a set of proven processes, templates, and tools, refined from experience with trillions of dollars of effort, and collected by the Project Management Institute (PMI), to help you:

- Plan. With a small amount of effort, develop an optimized plan, so you know the scope, schedule, cost, and risks before you start, and the project can begin with everyone on-board with accurate expectations.
- Manage. Once underway, smoothly determine the project status, forecast performance, constructively communicate to management, and make adjustments to manage the outcome as closely to the original plan as the circumstances allow.

The PMI best practices are generic, and can help with anything you don't know how to do, in industry, government, or non-profit:

- E.g. business process, construction, consulting, contracts, facilities, financial, human resources, legal, logistics, management, manufacturing, operations, policy, retail, services, social services, support, technology, etc.
- Not just industry, it's the standard in governments around the world – note the number of references to the PMI standard by the following government websites: [Brazil gov.br](#) (6,200), [Canada Treasury Board](#) (85), [China gov.cn](#) (246), [EU europa.eu](#) (392), [Indonesia go.id](#) (144) [Nigeria gov.ng](#) (31), [Turkey gov.tr](#) (1,990), [UK gov.uk](#) (249), [USA .gov](#) (4910).



Who Can Use Project Management?

Everyone in an organization can use project management:

- Whether or not directly involved with projects, everyone is effectively the project manager of their own work, and can use many of the best practices within their area to help them plan and manage their efforts.
- When the entire organization views all new efforts as projects, using the same language and processes, then it increasingly operates like a well-functioning team, with each person supporting from their position.

You don't need a certification to manage projects, but it helps:

- Most people don't necessarily need Project Management Institute certification as a Project Management Professional (PMP®) or Certified Associate in Project Management (CAPM), they just need the skills, which this course provides.
- However, the PMP and CAPM are meaningful certifications, showing a solid grounding in the best practices, so are sometimes required by organizations to manage projects above a certain size, and are often a required qualification for consulting engagements.
- This course provides a deep grounding in the PM process for anyone wishing to obtain a PMP or CAPM certification, and will significantly help with passing the exam.



Application To Small Projects

How does the project management process apply to small projects?

- Don't skip any steps, just don't spend more time than required in planning.
- The up-front project planning is just to estimate the time and cost to within +/- 10% of the likely reality, and get enough information you can track it later, detailed planning can be done later during execution when the project starts.

The trick is to make a first estimate of the size of the project during the initiation stage, and then spend just 5% of that estimate during planning – e.g:

- For an estimated 40 hour project, spend about 2 hours planning.
 - For an estimated 20 day project, spend about a day planning.
 - For an estimated 60 day project, spend about 3 days planning.
- May be spread across time.

Produce all the key planning documents – if the project is small then it will be quick and easy, and they will fit in just a few pages:

- Requirements, work breakdown structure, precedence diagram, estimates, schedule, costs, and risk register.

Now you have a standard, organized, baselined plan:

- Even for a very small project, you have removed significant uncertainty, and greatly improved the chances of an efficient, organized success.
- You have simple documentation that you can use to clearly explain the project to your management and anyone else involved or interested.



Where Projects Come From

Projects should be grounded in some unfulfilled Need, a problem or opportunity that provides a good reason to carry them out, for example:

1. The time required for approval of facility repairs is too long.
2. Management cannot obtain timely decision information.
3. There is an opportunity to sell a product or service.
4. The organization has no presence in South America.
5. The community has no local soccer league.

What if there is a clear need, but not enough information to initiate a project – to even baseline an objective or provide a first level business case estimate?

- Conduct a Feasibility Study (or Needs Assessment), expending a small amount of effort to determine if a project should enter the initiation stage:
 1. Are there potential ways to reduce the time for facility repair approvals?
 2. Could required decision information be obtained from the existing data?
 3. Does the organization have the capability and resources to provide the product or service?
 4. Could a South American presence be developed with a feasible effort?
 5. Is there enough interest to establish a community soccer league?



Why Processes Are Useful

"It could take some people a little while to get used to 10-digit dialing, according to a University of Saskatchewan psychology professor: 'People will find themselves having to have the number written down beside them more often.'"

– TheStarPhoenix.com, February 26, 2013.

How many items can a person keep in their mind at the same time?

- Only three to four – this is why phone numbers are split into sets of 3 to 4 digits.

This has several very important implications for any kind of management:

- Human beings are the smartest animals on this planet... but that's not saying very much - we should have humility about our capabilities.
- The simple written list is still our most powerful and under-utilized tool.
- Interruptions and task switching greatly reduce our productivity.
- *Documented processes capture proven best practices so we don't forget them, and don't have to re-learn them.*

The project management processes in particular captures proven best practices from millions of person-years of experience across many decades:

- A simple framework that can handle any kind of project from any domain.
- Designed specifically to minimize work, time, money, and risk.
- Greatly aids monitoring and control and the likelihood of project success.



*“The world’s leading not-for-profit membership association
for the project management profession.”*

– [PMI®](#)

The title “Project Manager” was first formalized in the 1950’s.

The Project Management Institute (PMI) was established in 1969.

The first *Project Management Body Of Knowledge* (PMBOK®) Guide collecting the best practices was published in 1983.

There are now more than a million PMI members in more than 180 countries.

The PMI offers several different certifications, with well more than 1M holders:

- Project Management Professional (PMP®) – best known
- Certified Associate in Project Management (CAPM)
- Program Management Professional (PgMP®).
- PMI Risk Management Professional (PMI-RMP®).
- PMI Scheduling Professional (PMI-SP®).

- And others:
- Portfolio Management Professional (PfMP)®
 - PMI Professional in Business Analysis (PMI-PBA)®
 - PMI Agile Certified Practitioner (PMI-ACP)®

PMP & CAPM Certifications



“It wasn’t easy.”

– Everyone that has ever taken the PMP exam.

Application Requirement	PMP	PMP	CAPM
Education	Secondary degree (high school, associate’s degree, or global equivalent)	Four-year degree (bachelor’s degree or global equivalent)	A secondary degree (high school or global equivalent)
Hours Experience In Some Area Of PM	7,500 in last 8 years	4,500 in last 8 years	N/A
Hours PM Training	35	35	23

The exam is computer generated multiple choice available at many local testing centers:

- Format. PMP: 200 questions, four hours; CAPM: 150 questions, three hours.
- Content. 70% knowledge of the PMBOK®, 30% practical understanding.
- Recommended Strategy. Go through the questions in multiple passes, answering just the easy ones on the first pass, then the ones you can do with a bit of thinking, then leaving the time-consuming ones for last.

Maintenance for the PMP needs 60 Professional Development Units (PDU's) every three years, earned through PM training, seminars, reading, and related activities.



Project Definition

“A project is a temporary endeavor undertaken to create a unique product, service, or result.”
– PMBOK® Guide.

The formal definition is useful because it tells you when you have a project, and so the project management process will be helpful:

- Temporary. Not regular operational work that continues day after day, but something for which a team forms, plans an effort, produces a product, service, or result, and then goes on to something else.
- Unique. You start out not knowing one or more of scope, schedule, budget, and/or risks, so you need a best practice process to plan it first, and provide some documentation so you can monitor and control the effort as it proceeds and know right away if it is going off track.

If you do a project, and then do the exact same effort again, it's no longer a project, it's a process, since now you know exactly how much work it is, how long it'll take, what it'll cost, and the risks.

It's when you don't know how to do something that the project management process really helps.



Program Definition

“A program is a group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually.”

– PMBOK® Guide.

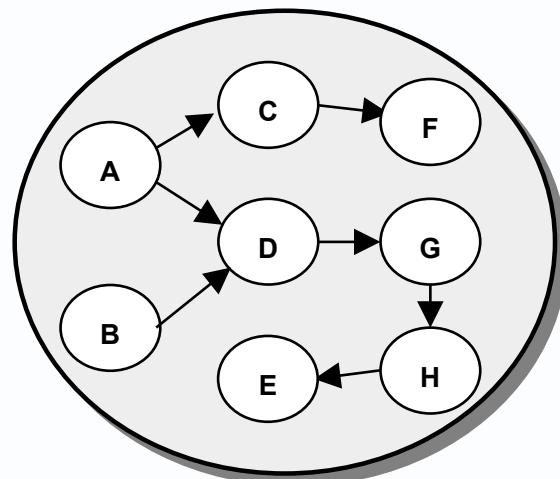
There is no limit to the size of a project – a program is not a large project.

A program is a management concept, created when there is a high-level coordination requirement for largely separate but linked efforts:

- Related Projects. There are multiple projects that share something: outputs, inputs, budgets, people, etc., often to achieve a larger goal.
- Coordinated Way. Therefore they need a “program manager” to oversee them and make decisions to optimize the projects as a group.

Communicate with the program manager to ensure they understand your project's needs.

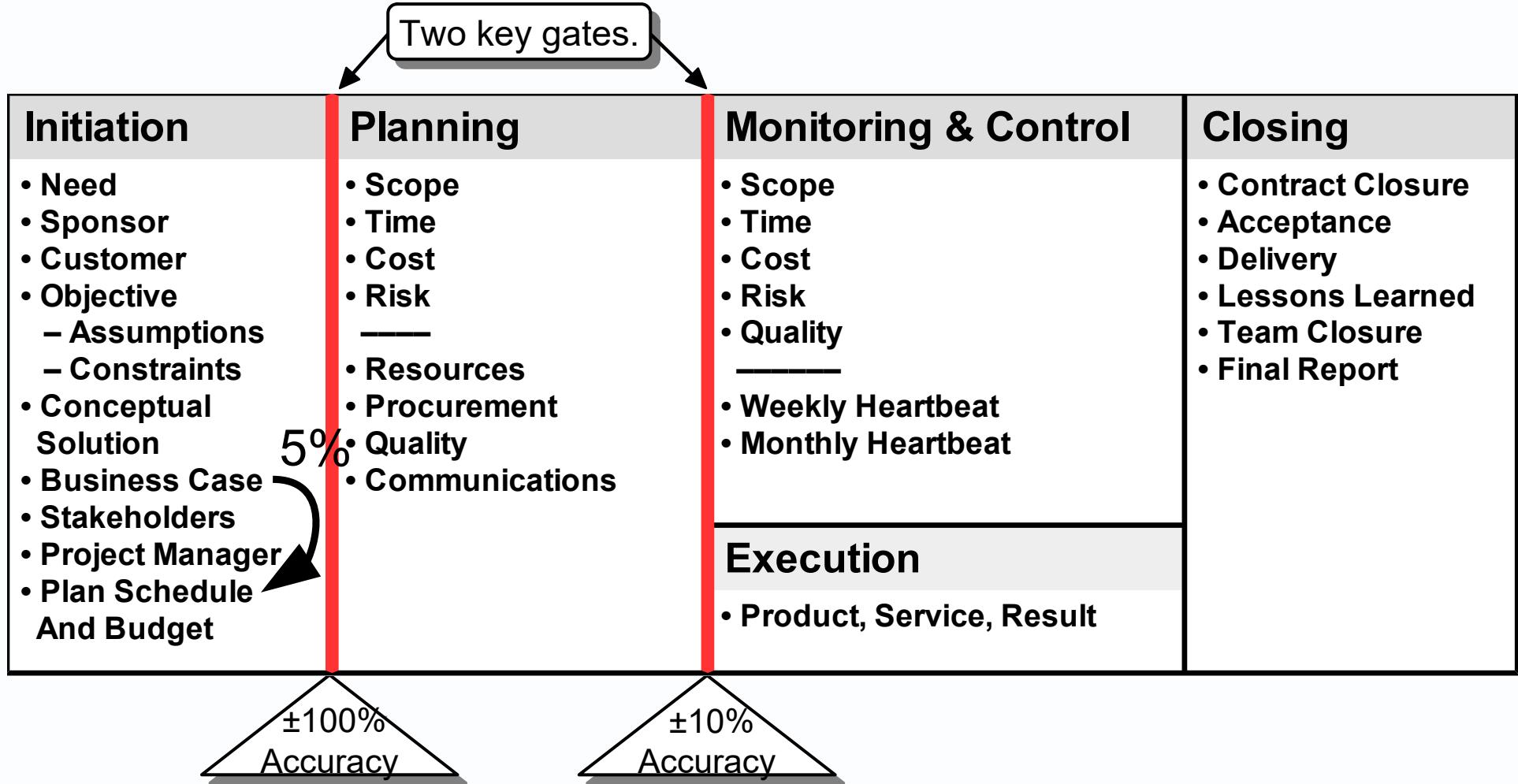
Provide lots of notice about your project's schedule changes.



If there needs to be interaction between individual areas of effort more often than once a month, it is probably better structured as one large project with several area leads.



The Five PM Stages



The main value of the PM process is use of only 5% of the project effort to prepare a plan that has +/-10% accuracy, so the sponsor can adjust scope, schedule, and budget if needed, and everyone has accurate expectations before you start.

Then the planning documentation provides just the right amount of information to enable easy monitoring and control once underway, and provide warning well in advance if the project is off-track and the risk budget is being consumed too fast.



Project Players

There should be specific identification of the key players on a project.

Sponsor:

- Provides the funding, can say yes or no to budget changes.
- Usually selects the project manager, and is their main boss.
- Ensures organization level support for the project.
- Leads solution of problems the project manager can't resolve.

Customer:

- The end-user of the project, often a different person from the sponsor so they can focus on scope definition and user input.

Stakeholders:

- All those affected by or can affect the project – all the groups and people you need to keep involved, informed, and supportive.

Project Manager:

- Authorized and accountable lead for planning and management of the project.

Core Project Team:

- A small group of leads, one from each project domain area, that help plan the project, and then stick around to implement their own plan.

Project Team:

- The full team that comes on board to carry out the project during execution.

Exercise – Project Players



Who are the following key players for your project?

- *Sponsor – owns the budget.*
- *Customer – represents the users.*
- *Stakeholders – all those that can affect or be affected by the project, and you need to keep involved, informed, and supportive.*
- *Core Project Team – small group of leads, one from each domain area, that help plan the project, and then will implement their own plan.*



Project management uses a range of specific techniques to solve individual challenges as described through the course, however two over-arching techniques are used throughout the process to help manage the primary challenge of complexity:

- Divide & Conquer. Break things into simpler pieces, solve them one-by-one, then put the pieces together to solve the whole thing:
 - ➔ Break the project into five much easier to manage stages.
 - ➔ Break the scope into smaller, more manageable size deliverables.
 - ➔ Estimate the deliverables by breaking them down into individual activities, and then roll them up to get the overall deliverable estimate.
- One Thing At A Time. Take care of everything before we are finished, and update existing work whenever required, but do one thing at a time to lay a firm baseline at each step and avoid thrashing back and forth:
 - ➔ First identify all the stakeholders, then decide how to involve and communicate with them in a later step.
 - ➔ First list all possible risks, then analyze them in a separate step.
 - ➔ First build the project schedule and obtain a workable critical path, then review and resolve any resource conflicts that remain.

Project Management Tools



Software tools greatly help support the PM process in several areas. Tools marked FOSS are Free Open Source Software (FreeOpenSourceSoftware.org).

Requirements:

- A spreadsheet can work for up to a few dozen requirements.
- Applications – Doors, Jira (R4J/RMsis), Rational.
- Databases – Microsoft Access, [LibreOffice Base](#) (FOSS).

Work Breakdown Structure:

- The organization chart tool in Microsoft Office (SmartArt / Hierarchy), OrgPlus.
- A mind mapping application like [FreePlane](#) (FOSS).

Precedence Diagram:

- Any drawing tool with “connectors” so the arrows move with the boxes.
- Microsoft PowerPoint, Visio, [LibreOffice Draw](#) (FOSS).

Gantt Chart:

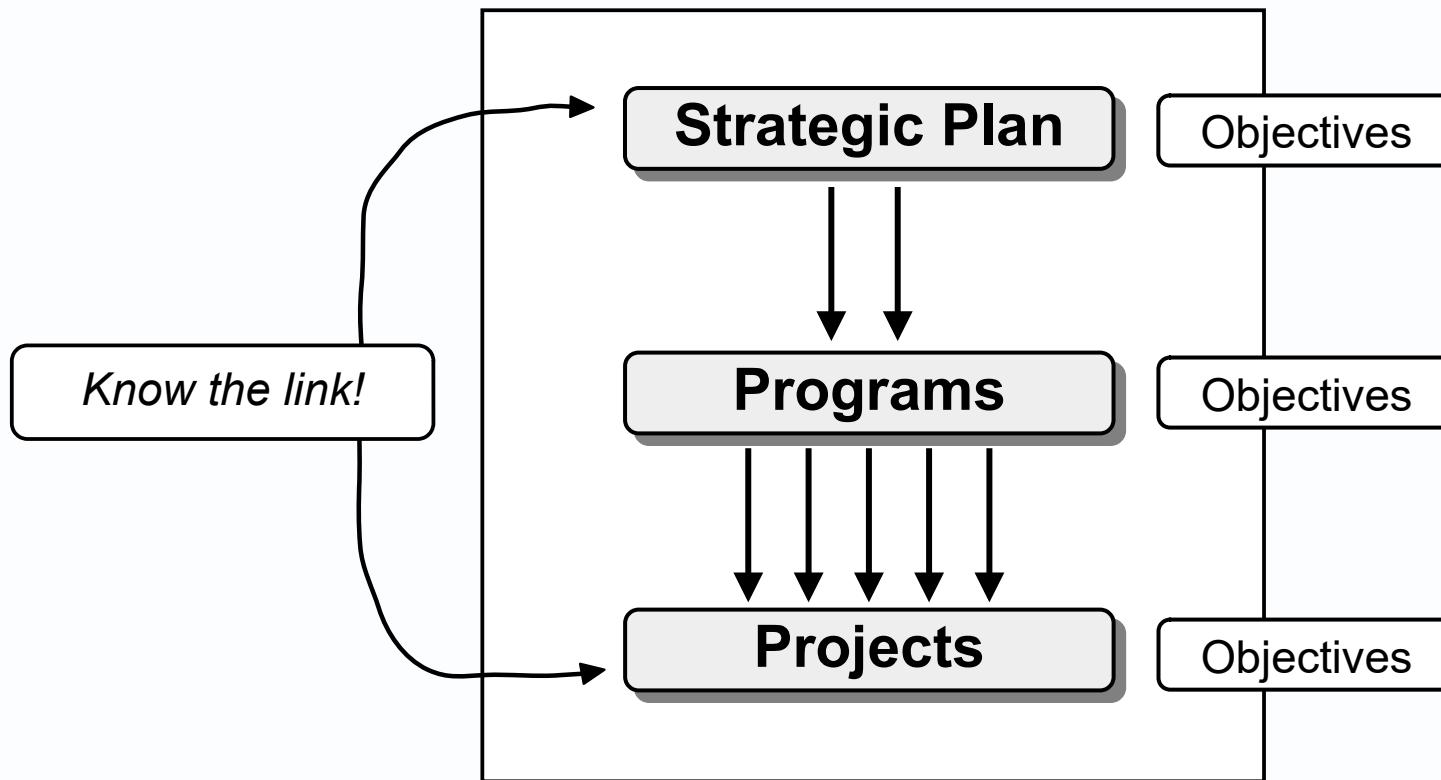
- Microsoft Project, Primavera, [GanttProject](#) (FOSS).

Numerical Analysis (e.g. estimates, risk register):

- Any spreadsheet such as Microsoft Excel or [LibreOffice Calc](#) (FOSS).



Link to Strategic Plan



The strategic plan is the organization leadership's identification of the 3 to 5 key objectives required for organization success over the next 3 to 5 years.

Unless your project is a non-optional operational or compliance effort, it is essential to know, document, and communicate the link to the strategic plan, because projects that:

- Don't support the strategic plan can easily be ignored or canceled.
 - Do support the strategic plan will be supported by senior management, even when they get in trouble.

Exercise – Strategic Plan



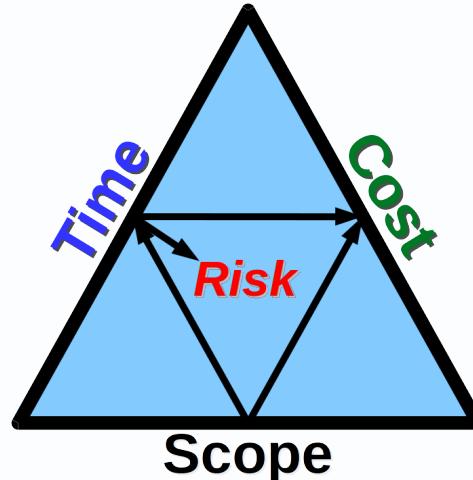
Does your organization have a strategic plan?

- *Is it made available to the whole organization? If not, can you get a copy?*
- *Have you read it? If not yet, can you make sure you understand it?*
- *If your project is not mandatory for operational or compliance reasons, was it selected because it supports the strategic plan?*
- *Can you find one of the objectives in the strategic plan that your project supports?*

Triple Constraint



The most important concept in PM:
“Keep it balanced”



Your Triangular Steering Wheel

1. Baseline Scope First. Figure out the bottom of the triangle, the scope, first:
 - Only then is it possible to accurately plan the full time and cost .
2. The Constraints Are Interrelated. “Just like changing a side of a triangle, a change in any one of these three constraints will cause a change in one or both of the others”:
 - At the end of planning, when stakeholders ask you to reduce budget or schedule.
 - During the project, whenever scope increases.
3. Rebalance Whenever Needed. Whenever one or more constraint is stressed, ask the stakeholders for direction in a positive way, and rebalance as directed:
 - “What is most important to you – the scope, schedule, or budget?”
 - They usually pick two, then preserve those as best you can, and let the third go.
 - The project will then be considered an effective success, since they made the decision as early as possible, and performance was as good as possible in the circumstances.

(The risk budget provides some extra time and cost to help keep the constraints in balance.)



In your experience, what are the main causes of:

- *Project success?*

- *Project failure?*

Standish Group Chaos Report



The Standish Group – first comprehensive review of project performance (1995).

- Called their study the “Chaos Report”, for obvious reasons.

Summary of results:

- Average budget overrun was 190%.
- Average schedule overrun was 222%.

Main causes of project success:

- 1 – User Involvement
- 2 – Executive Management Support
- 3 – Clear Requirements
- 4 – Proper Planning
- 5 – Realistic Expectations
- 6 – Smaller Project Milestones
- 7 – Competent Staff
- 8 – Ownership
- 9 – Clear Vision & Objectives
- 10 – Hard-Working, Focused Staff

Main causes of project failure:

- 1 – Incomplete Requirements
- 2 – Lack of User Involvement
- 3 – Lack of Resources
- 4 – Unrealistic Expectations
- 5 – Lack of Executive Support
- 6 – Changing Requirements
- 7 – Lack of Planning
- 8 – Didn't Need It Any Longer (!)
- 9 – Lack of IT Management
- 10 – Technology Illiteracy



Top 3 Drivers Of Project Success

Across studies, reviews, and lessons learned, there are three key drivers of project success:

1. Scope Definition. Know the full scope before you start – “put your project in ORDer”:
 - Objective – get the stakeholders to agree a one sentence objective describing the project outcome and benefit before anything else happens (see Initiation).
 - Requirements – interview everybody, ask them what is needed to meet the objective, and baseline their input in a Requirements Document (see Planning).
 - Deliverables – get the core project team to identify all the work outputs that need to be created as the project proceeds in order to produce the final result (see Planning).
2. Manage Scope Changes. Control “scope creep”, continual addition of more work without increasing schedule and budget (see Monitoring & Control):
 - Ensure every requested change, no matter how small, is written down.
 - Make sure everyone on the project comments on how it impacts their work.
 - Make a recommendation, and only implement if approved by the sponsor and everyone understands the surprising impact on schedule and budget.
3. User Input. Include sufficient user reviews (see Monitoring & Control):
 - Obtain user comments early – on drafts, first versions, mock-ups, etc.
 - Guard against scope creep by having the users prioritize their comments as 1 (essential), 2 (next project), or 3 (later investigation).
 - Have the project team provide their prioritization since they know how much things cost, and then ask the sponsor for their final decision.
 - Conduct change control on the priority 1's before working them in.

Whenever possible, trade out some existing scope to balance off any new work.



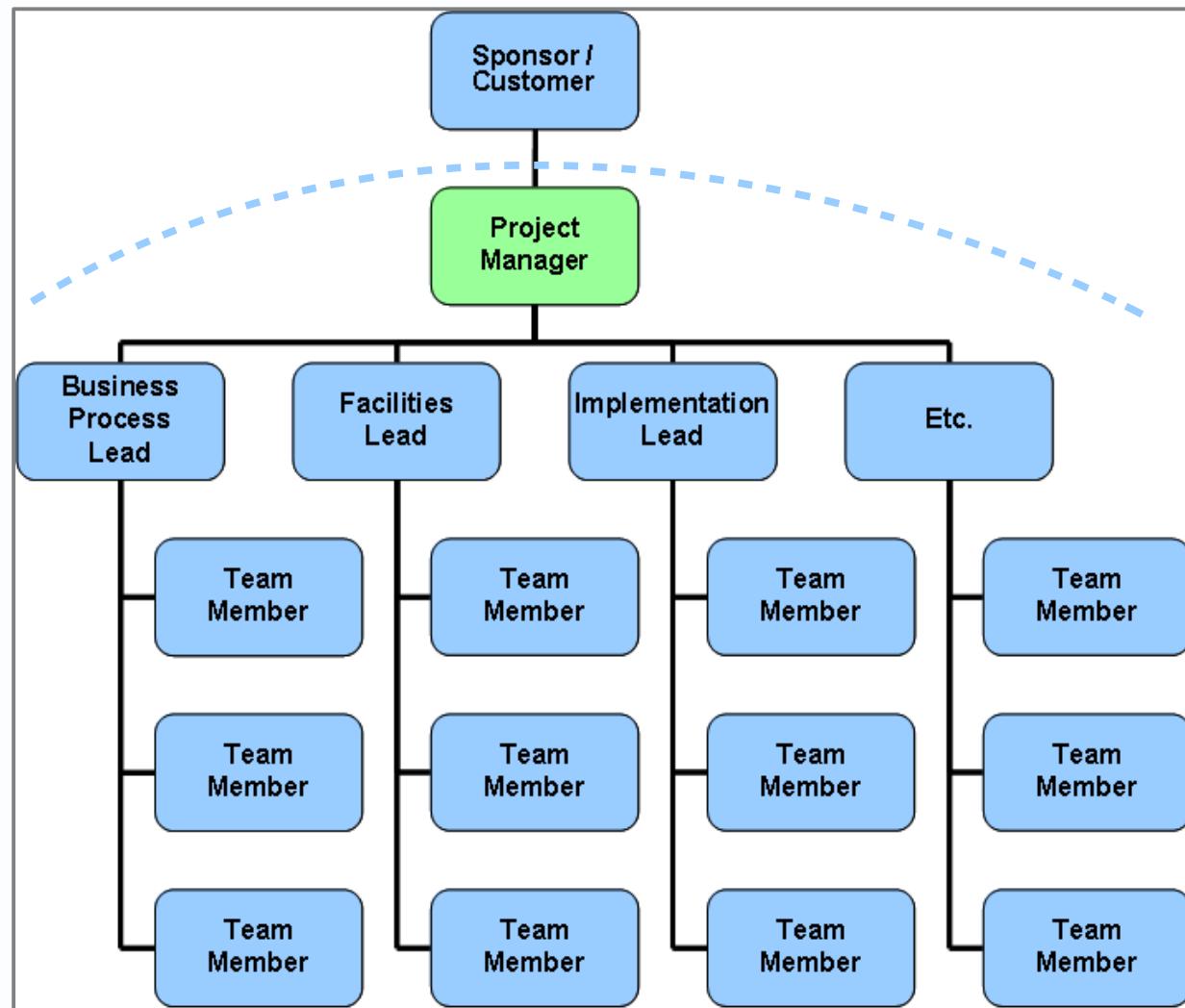
Role Of Project Manager

“If we want this project to be successful, then I need ...”

- Statement only the accountable project manager can make with authority.

The project manager must be one person, with both the accountability and authority to plan and manage the project and ensure all the best practices are implemented.

Not Project Coordinator or Project Director or Project Lead – only “Project Manager” conveys accountability and authority internal and external to the organization.



When there is one project manager with accountability that will be asked what went wrong if there are problems, they will have the courage to ask for resources and take the actions necessary to work towards the project success.

They must have direct access to the sponsor / customer.

The sponsor should publicly assign the project manager accountability and authority in the project charter (see next chapter).

Project Manager Requirements



Organization. The project manager should have basic organization skills:

- Most importantly, keep an action (todo) list, re-prioritize it once a day, and then work on the most important item first, until finished or waiting.

Project Management. Should have PM training, skills, and experience:

- A great way is to serve as a Deputy Project Manager (DPM) and do as much of the regular PM's job as you can.

Domain Expertise. Should have expertise in the project domain – e.g. business process, IT, financial, construction, manufacturing, etc.

- Or a domain lead with great experience in the area, and then rely on them wherever required.

Soft Skills. And should have soft-skills – “PM is a communications job”:

- Communications.
- Team Management.
- Negotiation.
- Leadership.

People do projects – so these are make or break items for any significant effort.

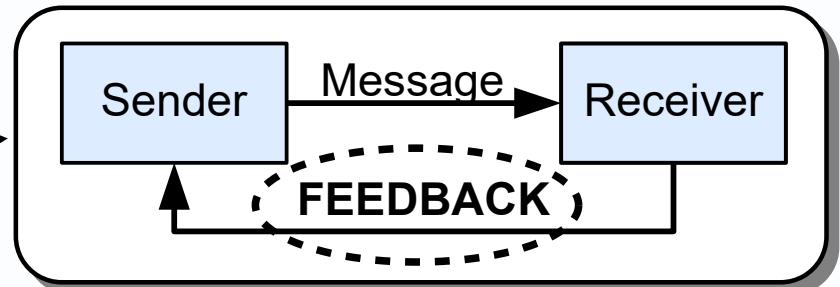
Communications Essentials



Active Listening. At some early meeting, give your team this tool ([references](#)):

- Listening is an active, energetic process.
- Grab the information and pull it in.
- Repeat it internally to leave a mark.

Communications Confirmation:



- Confirm messages you send:
 - “Let's make sure we are on the same page / wavelength / song-sheet, can you give that back to me in your own words?”
- Confirm messages you hear:
 - “Let me make sure I got that, so you are saying...?”

Communication Overhead. Understand the rapid rise in communications overhead – the number of channels in a team of size N is $(N*(N-1)/2)$ which increases at $O(N^2)$:

- For a team of 5 there are 10 channels; for a team of 20 there are 190 channels.
- Therefore smaller teams are better – size 5 is optimal when it fits the job:
 - Large enough to get things done, small enough there is not too much communications overhead, and an odd number so less deadlock.
- Adding people to a team that needs help can actually slow them down.
- Instead, add one extremely skilled person that has just done the same job.

Team Formation



The project manager should understand the [Tuckman Model](#) of team formation:

- All new teams go through four stages:
Forming → Storming → Norming → Performing
- You can't skip these stages.
- So recognize and be sensitive to which stage your team is in.
- Accelerate the movement through the stages with more meetings rather than less early on.
- Communicate to the team important Norms you should all display:
 - ➔ Active listening.
 - ➔ Communication confirmation.
 - ➔ No interruptions.
 - ➔ Honesty, integrity, and trust.
 - ➔ Open conflict of differing views.
 - ➔ Mutual accountability.
 - ➔ Write down your actions.



Team Foundations

“It's OK to admit our mistakes, that's how we learn.”
– Barack Obama, 2009.

Remove Interruptions. Brief your team on the need to let everyone finish their thoughts:

- Until the team has a culture of non-interruption, it will function at partial productivity.
- Interrupters usually are trying to help, they just can't stop themselves.
- Tell your team the simple three step technique to stop interruptions:
 - Open hand + “I want to hear your input” + “First let me get my full thought out”.
- If a member of your team can't do this, you must step in when needed.

Trust. The greatest accelerator of a high performing team:

- Be honest, or you can lose your team in seconds.
- Admit your own mistakes – it makes taking risk for success by others OK:
 - Never beat yourself up in front of the team, address and then say “let's move on”.
- Delegate and be tolerant of errors, a learning experience – meet, status, and mentor and train, but don't do the work.
- Use simple team building exercises at the start of a couple early meetings:
 - Tell us your childhood dream job, not what you are doing now.
 - Tell us a hobby or interest you have that we don't know about.
- Encourage opportunities for non-work related interaction – offsite events, coffee breaks, pizza Fridays – the key being to find areas of common interest.



Rotating Leadership:

- Everyone can lead, whoever is most experienced in an area, regardless of seniority, and then everyone else supports them on that item.

Open Conflict (of ideas):

- Encourage the team to raise any concerns, about anything, at any time.
- For very important items, go around the room and ask the team one by one if they have “any other comments or concerns” before closing it.
- Smooth the way with three useful language patterns:
 - ➔ Reflect back what you heard before disagreeing. “So you are saying ABC?”
 - ➔ Avoid the word “you”, choose “I” or “we” – less attacking.
 - ➔ Say “however” instead of “but” – signals you heard instead of ignored.

Mutual Accountability – the highest level of team performance:

- “The success of the entire project depends on all team members meeting the commitments they make to each other.”
- “If you make a commitment to someone else, make sure you meet it.”
- “If a commitment genuinely cannot be met for some reason, provide notice as far in advance as possible, so everyone can replan when it’s easiest.”
- “Hold each other accountable – status, follow-up, make sure others meet their commitments to you, before taking an issue to management as a last resort.”

Negotiation Essentials



Enter the negotiation believing win-wins are possible:

- The world is full of them – e.g. sports teams trade offense for defense.

Know four things before you begin:

- Your top line – what you will ask for as your best case.
- Your bottom line – your minimum acceptable outcome, without which you will at least pause the negotiation to consider the situation further.
- A set of items you can give up along the way and add to the discussion to “widen the pie” to try and achieve a mutually acceptable outcome.
- Your Best Alternative To a Negotiated Agreement (BATNA) – sometimes negotiations don’t work out, so always have a plan B.

State that you want a successful agreement – both are really on the same side.

Then get into these kinds of conversations, the essence of negotiation speak, exploring different options to find creative solutions:

- “If I did this, could you do that?”
- “If you did that, I could do this”.

From a non-smiling labor union negotiator for the US Teamsters trucker's union.

Agree easier issues first to simplify the negotiation and establish momentum.

“Look for 55% / 45% wins, where the other side wins too, or the deal won’t be sustainable after you shake hands”.

Leadership Essentials



“Ultimately, leadership is about keeping your team focused on a goal and motivated to do their best, laying the groundwork for others' success, and then standing back and letting them shine.”

– Chris Hadfield, *An Astronaut's Guide to Life*, 2016.

Leadership can be learned – start with four essentials:

- Goal Clarity. Make sure the goals are correct and clear – the team does the work, but the boss makes sure it's the right work.
- Motivation. Motivate the team – let them know what the project is achieving, and why it is important and worthwhile.
- Trust. Set a personal example of honesty, integrity, and accountability, and work constantly to increase the level of team trust.
- Support. Solve the problems the team cannot – get them the resources they need to do their work, and resolve any issues above their level.

Especially high value resources – brief and content rich:

- Colin Powell's Leadership Presentation – [Google](#).
- The Fun Standard – [FunStandard.org](#).

Exercise – Project Manager Development



In what areas important to the project manager role could you most improve?

- *Organization?*
- *Communications?*
- *Team building?*
- *Negotiation?*
- *Leadership?*

Prioritize the top three areas. What courses and mentorship experiences will help you meet these goals? How can you make those happen?



Chapter Summary

- The main value of project management is that it helps you easily plan the effort before you start, and then smoothly status and manage it once underway.
- Project management can help any kind of effort in any domain, small or large, in industry, government, or non-profit.
- Project management processes can be used by anyone in any role or position, and help the whole organization function as one integrated team.
- All projects should come from a documented “need”, a problem or opportunity that provides a good reason to carry them out instead of doing something else.
- If there is not enough information available to initiate a project, first conduct a “Feasibility Study” or “Needs Assessment”.
- Project management applies to small projects by not skipping any steps, but only spending 5% of the project effort in the planning stage.
- Documented processes are valuable because they capture best practices so our limited human capacity doesn’t have to remember or re-invent them.
- The Project Management Institute (PMI)[®] PMBOK[®] collects the world-wide standard PM best practices refined by projects over the last century.
- A PMI PMP or CAPM certification is usually required just for large or contracted projects, but is worthwhile at any level and respected around the world.
- Projects are temporary and unique – that's when PM processes are really useful.

Chapter Summary (Cont'd)



- Programs are collections of inter-related projects that interact monthly or less, and are managed as a group to optimize a program level objective.
- The five project management stages are Initiation, Planning, Execution, Monitoring & Control, and Closing, and can repeat across multiple project phases.
- The ten project management knowledge areas are Integration, Scope, Time, Cost, Risk, Quality, Human Resources, Stakeholders, Communications, and Procurement.
- Project management uses two key techniques: (1) breaking down complex items into simpler pieces, solving the pieces, and rolling them up to solve the whole; and (2) doing one thing at a time to lay down a baseline and avoid thrashing.
- Several powerful automated software applications support various parts of the project management process, most importantly the Gantt chart tool, with free open source options available.
- All optional programs and projects should flow from the strategic plan, to optimize organization achievement and maximize senior management support.
- The most important concept in project management is the triple constraint, that scope, time, and cost are fundamentally inter-related, and whenever one changes the other two must be rebalanced – the project manager's main job.
- The top three drivers of project success are (1) define the scope first, (2) manage scope changes, and (3) obtain user feedback as early as possible throughout the project to find the items inevitably missed when they are easiest to manage.



Chapter Summary (Cont'd)

- The project manager must have the title “Project Manager”, with their accountability and authority to ensure project success publicly assigned by the sponsor in the charter, and have direct access to the customer whenever required.
- Project managers need organization skills, project management skills, domain experience, and soft-skills since project teams are human systems.
- The essentials of good team communications are active listening, confirming communications, and being aware that communications overhead increases exponentially as the size of teams rise.
- All teams go through the stages of forming, storming, norming, and then performing, so be aware of the progression, hasten it with more team interaction early, and communicate the norms you want the team to adopt to help establish their identity.
- The essentials of a good team foundation are removal of interruptions, and establishing a culture of mutual trust through honesty, delegation, and formal and informal team building.
- The foundations of good team dynamics are rotating leadership, open conflict of ideas, and mutual accountability – the sign of a maximum performance team.
- The essentials of negotiation are: be optimistic and look for win-wins; know your top-line, bottom line, what you can add and give up along the way, and your BATNA; have conversations like “if I did this, could you do that” and “if you did that, I could do this”; agree the easiest items first; and aim for sustainable 55%/45% wins.
- The essentials of leadership are: ensure the goals are correct and clear; motivate the team; work constantly on increasing the level of trust; and provide the resources the team needs and solve the problems they cannot.



Stage 1 – Initiation

The First Gate

*“We succeed only as we identify in life, or in war, or in anything else, a single overriding **objective**, and make all other considerations bend to that one objective.”*

– President Dwight D. Eisenhower, *Speech To Nation*, April 2, 1957

Stage 1 – Project Initiation



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Purpose Of Initiation

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Sponsor And Customer

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Charter

Project Charter

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Chapter Summary



Purpose Of Initiation

The initiation stage documents in the project charter the key information the project manager requires to conduct efficient planning:

- The need that led to the project.
- The sponsor paying for it, and the customer that will use it.
- The stakeholders, all those affected by and can affect the project, along with their required commitments and support.
- The ultimate project outcome and benefit in a single sentence objective, along with any assumptions and constraints.
- The conceptual solution that will fulfill the objective.
- The initiation business case, typically estimated to about +/- 100% accuracy, including the budget, schedule, and benefits.
- The project manager that will prepare a project plan with a much improved accuracy of about +/- 10% for sponsor review before proceeding to execution.
- Mandate language that empowers the project manager and communicates to the organization they should support the PM during planning.
- A budget for the planning stage, typically 5% of the initiation estimate, along with a date for delivery of the plan to the sponsor.

Sign-off of the initiation charter only authorizes the start of planning, not execution: the project should never be approved until the subsequent planning stage provides a +/- 10% estimate for final sponsor decision making.



Project Manager Role

Often the project manager does not come on board until the end of the initiation stage, after the sponsor has prepared the charter, and the PM is then given some budget and schedule to prepare the real plan.

However, the recommended best practice is for the project manager to be included from the beginning of initiation, and take the lead on as much of the preparation of the charter as possible, providing the most continuity with the rest of the project:

- First, if the project “need” – a real problem or opportunity – has not already been established, the project manager should make sure it is identified and documented before anything else proceeds.
- The project manager can help avoid the main initiation risk – doing too much work so the charter looks so large and impressive the organization skips planning, resulting in approval of the project before planning produces a reliable budget and schedule estimate.
- The PM can help ensure the best practice is followed, for example that all stakeholders are included in finalizing the objective, so everyone is heard and they will support the project as needed.
- Can start thinking about the best personnel for the core project team (CPT) of leads that will be needed during planning to help figure out how to actually do the project.



The first players project initiation needs to identify are the sponsor and customer, with a single representative for each.

Sponsor:

- Provide the project funding, and approve or deny any budget changes – if building a school, probably someone from the school board.
- Select the project manager, and is their main boss.
- Sign off the initiation charter and send it to the stakeholders.
- Approve the final project plan, and authorize proceeding to execution.
- Chair the monthly reviews once the project is underway.
- Maintain organization level support for the project.
- Lead solution of any problems the project manager can't resolve.

Customer:

- The end-user with the need, that actually touches the project output – if building a school, someone that represents the teachers (the children are stakeholders).
- Help define the project scope, and approve any changes.
- Sometimes also must approve any schedule changes.
- Attend all monthly reviews.
- Coordinate user input and reviews throughout the project.

Project Stakeholders



Beyond the sponsor and customer, initiation should identify all the project stakeholders, those that are affected by the project or can affect the project – they are involved one way or another:

- You want to involve them and keep their support from beginning to end.
- Include a list in the charter, along with identification of any required support they must provide to the project, with one representative from each group as the formal point of contact.
- Also include those that oppose the project – you might be able to address some of their issues and reduce their opposition as time goes by.

Role of the stakeholders:

- First and most importantly, include them in setting the project objective, to obtain their involvement and buy-in from the very beginning.
- Ideally during initiation, at latest during planning, obtain commitment from those stakeholders whose assistance is required to successfully carry out the project, e.g. for provision of resources.
- Interview them during preparation of the requirements.
- Communicate with them regularly during the project to ensure they understand the progress, and let them know about problems early.



Stakeholder Analysis

For larger projects, stakeholder analysis can be quite extensive, involving preparation of profiles including their career history, likes and dislikes, etc.

For any size project, record at least this basic information in a stakeholder Register:

- Key need: One sentence defining project success from their point of view.
- Priorities: What is most important to them if the project ever becomes stressed and trade-offs need to be made among scope, time, and cost – ranked in order.
- Communications: The level of communication they required – inclusion in monthly reviews, changes to the scope, schedule, cost, etc.

Stakeholder Register				
Departmental Process Improvement Project (DPIP)				
Name	Role	Key Need	Priorities	Communications
David Smith	CEO	Improved efficiency.	Scope, Time, Cost.	Plan approval, plan changes, final report.
Anne Baker	Department Head	Minimal disruption.	Time, Scope, Cost.	Plan approval, plan changes, monthly review, final report.
Carol Fraser	Director Facilities	Minimize purchasing.	Cost, Time, Scope.	Core team member – everything.
Staff	Users	Fast implementation.	Time, Scope, Cost.	Schedule, review of changes to processes and floor plans.
:	:	:	:	:



Exercise – Stakeholders

List the stakeholders for your project:

- *Those who are affected by the project.*
- *And can affect the project.*

For each stakeholder:

- *What commitments of support to the project are required?*
- *In one sentence, what defines project success from their point of view?*
- *What priority do they place on scope, time, and cost?*
- *What level of communications do they require – inclusion in monthly reviews, reviews of work in progress, notification of changes to the scope, schedule, cost?*



Project Objective

The objective documents two critically important things required by the stakeholders in one clear sentence: the project ultimate outcome and key benefit.

- Popularized by [Peter Drucker](#) in book The Practice of Management (1954).
- A single sentence identifying what is needed, without any confusion with how.
- Plus the all important benefit, why the outcome is important and worthwhile.

The SMART model can be a helpful guide:

- Specific, Measurable, Agreed, Realistic, Time-Bound.
- Although the time is often put in the constraints section, along with any budget targets, to keep the objective sentence simpler and more targeted.

Example objectives:

- Reduce the time for repair approvals to less than 24 hours, to provide a timely response to user requests and minimize impacts on productivity.
- Provide a plan, schedule, and budget for delivery of the ABC service to the XYZ organization, to win business with a new customer with a 25% profit.
- Establish a soccer league with a governing organization, referees, playing fields, equipment, and eight team rosters, to provide community children ages 5 through 20 with a local sporting opportunity.

Overheard during planning: “*That's a great idea! However, it's not in the objective, and we aren't going to do that.*”
Scope creep stopped before project even started!



Objective Process

Convene a meeting of all stakeholders, ideally in one room, or in a teleconference or video conference if required.

Use a laptop and projector, or a shared document if online, to halve the time and double the effectiveness (too troublesome to keep “reading it back” from paper):

- Participants can then see the variations, and provide feedback as it develops.

Start by typing “Objective:” on the first line for the eventually agreed result:

- Ask the senior stakeholder, usually the sponsor or customer, to provide a full sentence that defines the “ultimate project outcome and benefit from your point of view”, and type that sentence on the second line of the document.
- Ask the next senior stakeholder for their view, type that sentence on a third line.
- Ask if anyone has any other suggestions – if so type those sentences as well.

Then state “we have enough to work with, let's see if we can come to agreement on one sentence, so we can fix the project outcome and benefit”:

- As discussion proceeds and agreement is reached on parts of the objective, type those parts on the first line (leave the second and later lines unchanged for reference back to the initial suggestions).
- The sponsor has the final call on any disagreements on wording.
- Make the outcome as specific as possible, ideally with numbers to size the result.

This is where you solve the “differing stakeholder expectations” problem, before planning even begins, and the most important step in any project.



Assumptions And Constraints

Assumptions and constraints are provided along with the objective, the three elements together providing the first definition of the project scope.

Assumptions and constraints are documented in separate sections, so the objective remains a single stand-alone sentence focused on the top-level outcome and benefit.

Assumptions:

- Elements to assume will be true, and so simplify planning.
- E.g: internal resources have all the skills required; office space will be available for consultants; the previous project ABC will finish in time.
- If there is concern they might turn out not to be true, review and consider whether to include them in the risk planning.

Constraints:

- Are known to be true for sure, and so must be built into planning.
- Any budget or schedule constraints are typically included in this section.
- Can include project level policies, standards, geographic limitations, etc.
- By restricting options, constraints can actually make planning simpler.

Conceptual Solution



Often during initiation there is a draft understanding of how to meet the objective called the “conceptual solution”, sometimes identified by a previous feasibility study, sometimes an option selected during preparation of the business case.

It should be top-level, and is sometimes called just “major deliverables”, avoiding prescribing unnecessary details before the planning team can apply their creativity and expertise.

Examples:

- Automated workflow software that can reduce approval time.
- Trend and alert reports that compile timing and rating data.
- A plan, schedule, and budget to deliver the ABC service.
- Online information campaigns targeted to South America.
- Soccer governing organization, referees, playing fields, equipment, eight team rosters.

Exercise – Scope



Baseline your project's scope so the team will be able to conduct productive planning:

- *Get your stakeholders together and baseline a single sentence objective for your project – documenting the ultimate outcome, and the key benefit.*
- *What are the assumptions – project-level items to assume are true to simplify planning?*
- *What are the constraints – project-level limitations such as schedule, budget, policies, or standards?*
- *What is the conceptual solution – top-level definition of what the project will produce to meet the objective?*



Business Case

“The question should be ‘is it worth trying to do?’ – not ‘can it be done?’”

– Allard Lowenstein, O Magazine, Sep. 2002.

The business case lets us know if we should even proceed to planning, and, if yes, provides a budget guesstimate so we can put aside 5% as the planning budget.

Sometimes the business case is easy, because the project is mandatory:

- There are legal, health, or safety issues requiring the project be done.
- It has already been done at a higher level, e.g. at the program level.

When the project is optional, there are three common business case calculation methods:

- Benefit Cost Ratio (BCR) = Benefits / Costs [most common]
- Return On Investment (ROI) = (Benefits – Costs) / Costs [% return on expenditure]
- Net Present Value = Benefits – Costs [normalized to the current year]

The business case estimates during initiation are usually around +/- 100% accuracy:

- Therefore they are sometimes called a “rough order of magnitude” (ROM).
- Only need to be accurate enough to decide whether to proceed to planning, and to allocate 5% of the initiation estimate as the planning budget.
- Only at the end of planning will the estimates be reliable enough, about +/- 10% accuracy, for final decision making to be made about whether the revised business case is good enough for the project to proceed to execution.



Benefit Cost Ratio

The most common and simplest business case method is the Benefits Cost Ratio (BCR).

Costs are relatively easy to estimate to +/– 100% accuracy:

- An “analogous” estimate is great – compare it to a similar project.
- Or just guesstimate: (People x Time x Rates) + Material + Services.

Estimating benefits in monetary terms is often less straightforward, but can often be made simpler by calculating: # Years x (Benefits / Year) x (\$ / Benefit):

- For construction projects like roads and buildings the time period can be decades, but for process projects we usually assume no more than 3 to 5 years maximum, since the world will change after that and the benefits might not continue.
- Then calculate the number of benefits per year: number of items sold, number of times cost is decreased, annual hours of time savings, annual hours of productivity increases, number of times cost is avoided, etc.
- Then calculate the monetary advantage of each benefit – profit per item, savings per cost decrease, cost of each hour saved, rate of return on each additional productivity hour, cost avoided for each incident, etc.

If you really can't express the benefits in monetary terms for an extremely subjective project, at least list the areas of benefits in the business case – what are the good reasons for expending effort on this project instead of others?

Also consider the “payback period”, the time to break-even on the expenditure: as a rule of thumb more than two years for process projects is a warning bell, since it will likely only get longer instead of shorter, and risk rises disproportionately as schedule extends.



Business Case Examples

Hold wine and cheese tasting event:

- Cost = \$20K facility rental + \$10K advertising + \$10K personnel costs = \$40K
- Benefits = 2500 tickets @ \$20 + 25 vendors @ \$1000 / booth = \$75K
- BCR = $75 / 40 = 1.875$ & ROI = $(75 - 40) / 40 = 87.5\%$

Implement automated purchase order system to save personnel time:

- Cost = \$25K software + \$50K personnel implementation costs = \$75K
- Benefits = Save 15 minutes for each purchase order
= 3 yrs x 5K purchase orders x \$20 time
= \$300K
- BCR = $300 / 75 = 4$ & ROI = $(300 - 75) / 75 = 300\%$

Upgrade computers from old operating system to new:

- Cost = \$400K software + \$100K implementation costs = \$500K
- Benefits = Avoid \$400K/year increased support costs
= 3 yrs x \$400K = \$1.2M
- BCR = $1.2 / 0.5 = 2.4$ & ROI = $(1.2 - 0.5) / 0.5 = 140\%$

Information package to help cities clean up toxic dumps:

- Cost = 2 people x 50 days @ wrapped rate \$500 / day = \$50K
- Benefits = infrastructure and land protection, less health spending
= 3 yrs x (0.05% x 50K dumps = 25) x
(\$100K benefit per cleanup) = \$7.5M
- BCR = $7.5 / 0.05 = 150$
ROI = $(7.5 - 0.05) / 0.05 = 14,900\%$!

Real examples.

Exercise – Business Case



What is the initiation business case for your project?

Either compare your project to another with known information, or do your best to itemize the costs and benefits, and estimate the monetary amounts:

- *What are the benefits?*
- *What are the costs?*
- *What is the Benefit Cost Ratio = Benefits / Costs?*



Project Manager & Mandate

“Project management assigns complete responsibility for the task and resources needed for its accomplishment to one project manager.”

– Executive Sciences Institute, 1964.

The charter formally identifies the project manager for preparation of the project plan and subsequent execution if the plan is approved.

The charter also includes a mandate empowering the project manager:

- “The project manager shall prepare a plan to carry out the project documenting the scope, schedule, budget, and risks for sponsor review”.
- “The project manager may call on internal and external resources as required to prepare a complete and accurate plan.”

The charter should also provide the PM with a budget and schedule for planning:

- The planning budget is typically 5% of the initiation estimate of the project cost – although it can be as little as 2.5% for simple projects in well known domains, or very rarely as much as 7.5% for the most complex projects in new domains requiring significant requirements analysis.
- A date is provided by which the plan must be ready for review.



Project Charter

The information from initiation is documented in the project charter, providing the key information the project manager needs to conduct a productive planning stage, and signed off by the sponsor and sent to all the stakeholders.

Typical charter table of contents:

1. Introduction (especially the need – the problem or opportunity)
2. Customer
3. Sponsor
4. Scope
 - 4.1 Objective
 - 4.2 Assumptions
 - 4.3 Constraints
5. Conceptual Solution
6. Business Case
7. Stakeholders (especially key commitments and required support)
8. Project Manager (with mandate and authority)
9. Planning Schedule And Budget

First top-level baseline
of the project scope.

Exercise – Charter



Complete the charter for your project:

1. *Introduction (especially the need – the problem or opportunity)*
2. *Customer*
3. *Sponsor*
4. *Scope*
 - 4.1 *Objective*
 - 4.2 *Assumptions*
 - 4.3 *Constraints*
5. *Conceptual Solution*
6. *Business Case*
7. *Stakeholders*
8. *Project Manager (with mandate and authority)*
9. *Planning Schedule And Budget*

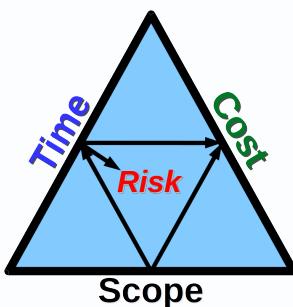


Chapter Summary

- The purpose of initiation is to baseline the key information the project manager needs to conduct effective planning, especially the project objective, and determine how much effort to spend in planning.
- Best practice recommends the prospective project manager lead the initiation stage and production of the charter, in order to ensure the process is implemented properly and to provide continuity through planning.
- The first items to identify are the sponsor that will provide the budget, and the customer with the need that will use the project result.
- The next people to identify are rest of the stakeholders, all those that will be affected by or can affect the project, and whose support you need to maintain.
- The most important step in scope definition is to get the stakeholders to agree a single sentence objective identifying the ultimate project outcome and benefit, along with any assumptions and constraints.
- The conceptual solution provides the top-level understanding of how to meet the objective, and is sometimes just a list of the major end deliverables.
- The initiation business case estimates the costs and benefits around +/- 100% accuracy, providing a gate to stop projects that make no sense, or, if it looks reasonable, putting 5% of the estimate aside for the planning budget.
- The charter also identifies the project manager, publicly empowers them with a mandate to prepare a project plan, and provides a planning budget and schedule.

Stage 2 – Planning

The Second Gate



He was exaggerating
to make the point.

His point.

*“Plans are worthless, but **planning** is everything.”*

– President Dwight D. Eisenhower, *Speech*, Nov. 14 1957.

Stage 2 – Project Planning



Introduction

Purpose Of Planning

Planning Process Flow

Core Project Team

Exercise – Core Project Team

Requirements

Objective To Requirements

Requirements – A Long Time Challenge

Requirements Example

Importance Of Requirements

Gathering Requirements

Requirements Attributes

Requirements Key Points

Requirements Document & Approval

Example – Buying Chairs

Exercise – Requirements

Solution

Solution Definition

Exercise – Solution

Deliverables

Work Breakdown Structure

WBS Example – An Aircraft

WBS Example – Shed

WBS Example – Supper

WBS Example – Standards

WBS Example – Process Improvement

WBS Process

WBS Key Points

WBS Hierarchical Decomposition

WBS Phasing & Combined Methods

Example – Hierarchical Decomposition

Example – Project Phasing

Breaking Down By Responsibility

Breaking Out Waiting Time

Breaking Out Interim Deliveries

Breaking Down By Duration

Relationship Of WBS & Requirements

WBS Dictionary

Deliverables → Work Packages → Activities

WBS Drawing Tool

Exercise – Work Breakdown Structure

Logic

Precedence Diagram

Kinds Of Precedence Links

Stage 2 – Project Planning (Cont'd)



Leads And Lags
Generic Example
Shed Example
Supper Example
Standards Development Example
Process Improvement Example
Precedence Diagram Process
Precedence Diagram Patterns
Precedence Diagram Tool
Exercise – Precedence Diagram
Estimating
Exercise – Power Of Estimation
Estimating Methods
Statistical Power Of Multiple Estimates
Activity Breakdown
Fine-Tuning
Productivity & Availability
Estimating Spreadsheet
PERT & 3-Point Techniques
PERT & 3-Point Example

Delphi Technique
Handling Estimating Error
Exercise – Estimating
Schedule
Gantt Chart
Gantt Chart Example
Gantt Chart With Work Packages
Gantt Chart With Activities
Critical Path
Critical Path Process
Critical Path Example
Forward Pass
Backward Pass
Critical Path With Float
Exercise – Schedule
Schedule Milestones
Exercise – Milestones
Resources
Resource Leveling
Resource Planning

Stage 2 – Project Planning (Cont'd)



Exercise – Resources

Cost

Estimating Cost

Cost Breakdown

Cost Accounts

Cost Baseline

Exercise – Cost

Procurement

Build Or Buy

Procurement Documents

Contract Types

Selecting The Winner

Exercise – Procurement

Risk

Risk Management

Risk Management Process

Risk Management Planning

Risk Identification

Standard Risk Statement Form

Risk Qualification

Risk Quantification

Response Planning

Other Risk Elements

Risk Register

Critical Chain Management

Risk Buffer Allocation

Risk Reserve & Management Reserve

Opportunity Risks

Opportunity Planning

Exercise – Risk

Communications

Communications Planning

Exercise – Communications Plan

Project Management Plan

Project Management Plan

Final Plan Review

Exercise – Project Management Plan

Chapter Summary

Purpose Of Planning



The purpose of the planning stage is to:

- Prepare an optimized plan to carry out the project, documenting the project scope, schedule, budget, and risks with an accuracy of +/- 10%, for review and final decision-making by the sponsor before proceeding.
- Provide enough information so the project manager can easily monitor and control the progress once underway.

To achieve this, the planning stage baselines:

- Requirements. The quantities, functions, features, and standards the project output needs to meet the objective.
- Solution definition. A description of the project output sufficient to plan what it will take to produce it.
- Deliverables. The end deliverables handed to the customer, plus all the interim work products the team needs to create just to get the project done, collected in a “work breakdown structure”.
- Precedence Diagram. A flowchart of showing how the deliverables come together.
- Estimates. Breakdowns of the resources, material, services, time, and cost required for each deliverable.
- Gantt Chart. A mapping of the deliverables across the calendar, including identification of the critical path that drives the end date.
- Budget. The cost by deliverable, sometimes also graphed across time.
- Risk Register. Baseline of the risks and their likely cost and schedule impact.



Planning Process Flow

Prepared by customer
if commercial RFP.

Response if commercial RFP.

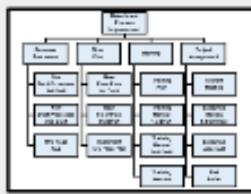
Requirements

Complete
Consistent
Feasible
Demonstrable

Needs not wants
What not how
Q: "Why, why..."
Q: "What else..."
Use cases, scenarios

Work Breakdown Structure

Deliverables only.
Documents, material,
services, facilities.

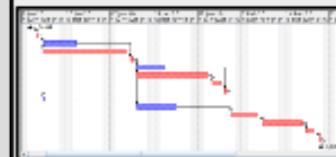


Precedence Diagram

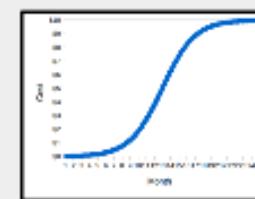
Flowchart of the
deliverables.
Just the logic,
no numbers.



Schedule



Cost Curve



Project Plan

Scope = WBS
Time = Gantt Chart
Cost = Cost Curve
Risk = Risk Register

Precedence Diagram
Requirements
HR Plan
Comms Plan
Procurement Plan
Quality Plan

Risk Register

Risk	P%	T	\$	P x T	P x \$	Response
Procurement delays	20%	10 d	\$50 K	2 d	\$10 K	Avoid
Approval delays	30%	15 d	\$75 K	4.5 d	\$23 K	Mitigate
Regulation change	40%	20 d	\$100 K	8 d	\$40 K	Accept
Team turnover	30%	30 d	\$150 K	9 d	\$45 K	Mitigate
Vendor performance	50%	20 d	\$100 K	10 d	\$50 K	Mitigate
Final inspection problems	60%	25 d	\$125 K	15 d	\$75 K	Mitigate
Risk budget:				48.5 d	\$243 K	

Estimation

Activity breakdown

Resources
Material
Services
Time
Cost

±100% Spend only 5% of the estimated project budget – you are not doing detailed planning, only producing a project-level plan that is within ± 10% of the likely outcome.

Each step can be reviewed with the sponsor to get interim direction – e.g. if scope is too large.

±10%

Core Project Team



“There is no wider gulf in the universe than yawns between those on the hither and thither side of vital experience.”
– Rebecca West, Black Lamb and Grey Falcon, 1941.

The first thing the project manager needs for the planning stage is the core project team (CPT):

- One subject matter area lead from each domain area – e.g. business, technical, financial, facilities, procurement, training, support, etc.
- Each lead is responsible for planning their part of the project – defining the deliverables, preparing cost and time estimates, identifying risks, etc.
- Critically important for continuity that these leads be the same people that will go on to implement the project, so they take the planning seriously, and will feel responsibility to meet their own plan later during execution.
- Can be very helpful for the CPT to start by reviewing any final reports and lessons learned from similar past projects.



Exercise – Core Project Team

What core project team (CPT) do you need to help plan the effort?

- *Recruit one lead from each domain area – e.g. business, technical, financial, facilities, procurement, training, support, etc.*
- *Ensure these leads will be the same people that will go on to implement the project, so they take the planning seriously, and will feel responsibility to meet their own plan later during execution.*



Objective to Requirements

Be Complete!

The most common mistake is missing a requirement essential to the objective:

"It was a classic case of not getting the requirements sufficiently defined from the beginning. And so it required a continuous redefinition of requirements that had a cascading effect on what had already been designed and produced."

– FBI Inspector General Glenn Fine, Failure of \$170M Virtual Case File project.

Gathering the project requirements is the first step of planning.

Objective

Ultimate project outcome and benefit.



Requirements

- Functions
- Features
- Quantities
- Standards
- Etc.

But Don't Gold-Plate!

However, the nice -to-haves and while-we-are-at-it's that aren't essential to the objective will first blow up your project, and then sink it.

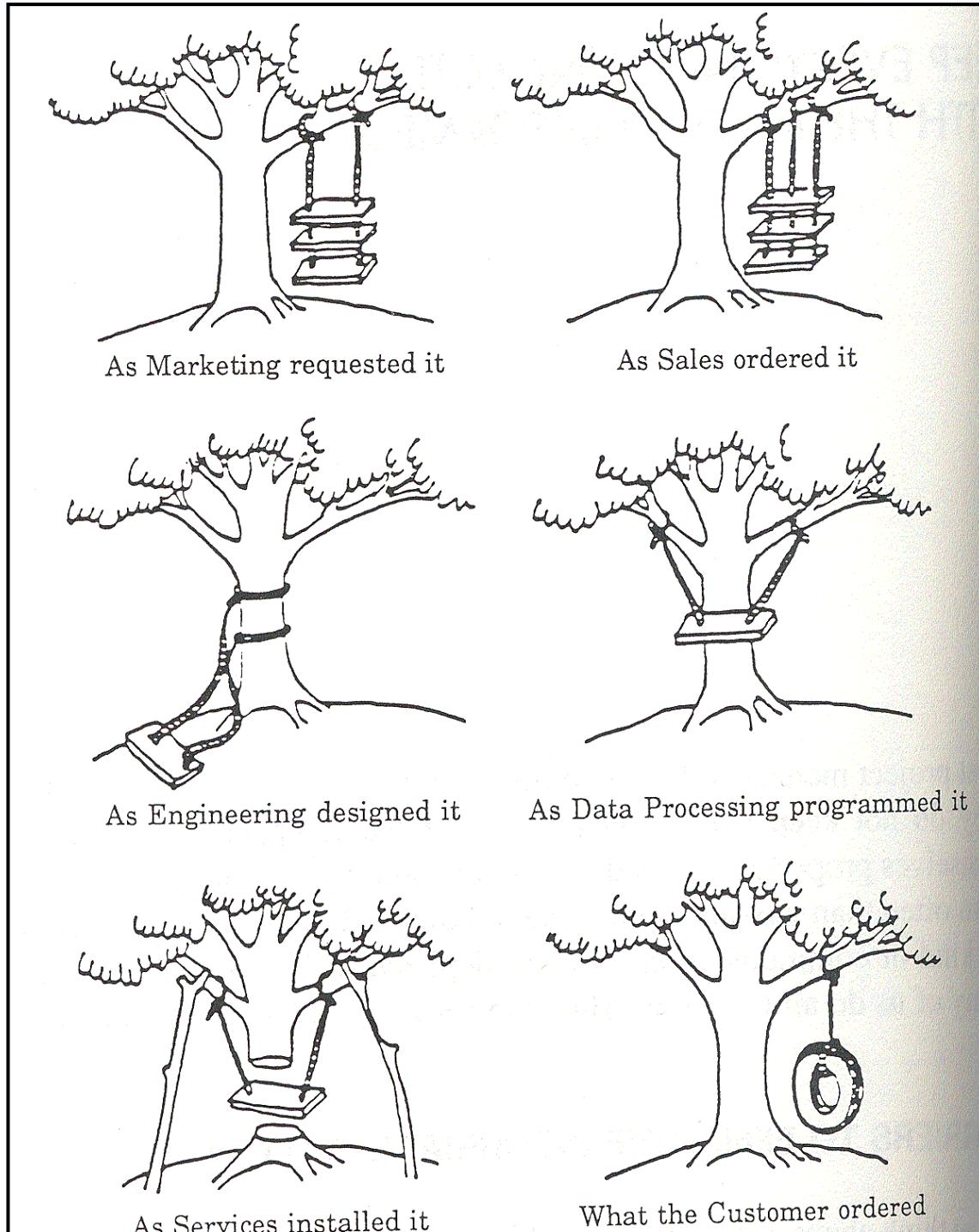
"We started with a big bang approach and put every possible requirement into the program, which made it very large and very complex."

– Elizabeth McGrath, US Air Force Deputy Chief Management Officer, Failure of \$1B Expeditionary Combat Support System project.



Requirements – A Long Time Challenge

From 1973.



[University of London Computer Center Newsletter](#), March 1973



Requirements Example

Extract from a
Health Information System project
(1,200 requirements total)

Req ID	Function	Requirement
CFHIS1.1	Identify Patient	Patient identification views shall have ability to update the information within the Master Patient Index.
CFHIS1.2.1	Verify Appointment	Shall have ability to verify the existing appointment within the scheduler.
CFHIS1.2.2	Verify Appointment	Patient demographics shall be accessible.
CFHIS1.3.1	Register Patient	Shall have the ability to place a patient on the active list.
CFHIS1.3.2	Register Patient	Access to the Medical Chart shall be available.
CFHIS1.3.3	Register Patient	Reception screening shall be available to reception staff while placing patients on the active list.
CFHIS1.3.4	Register Patient	The active list shall be annotated with the provider identity and location.
CFHIS1.3.5	Register Patient	Shall have the ability to establish templates for registration of the standard types of appointments by provider.
CFHIS1.3.6	Register Patient	Shall provide the provider schedule at a glance, with ability to search for open appointments by clinic and enterprise-wide.
:	:	:



Importance Of Requirements

Standish Group Chaos Report (1995) – main causes of project failure:

- 1 – Incomplete requirements.
- 6 – Changing requirements.

KPMG Canada Survey (1997) – main causes of project failure:

- 1 – Unclear / change of requirements.

Dean Liffingwell, *Return on Investment from More Effective Requirements Management*, American Programmer, 1997, 10(4) 13–16:

- “Requirements errors account for
- 70% to 85% of rework”.

Robert Grady, *Insights into Software Project Management*, Proc. of the Applications of Software Measurement Conference, 1999, 227–239:

- “Poor requirements account for 71% of project failures”.

True Stories

- A hospital builds a new wing. On opening it is discovered that the elevator doors are not wide enough to admit stretchers without having to lower the safety rails.
- A different hospital builds a new wing. On opening it is discovered the elevators are 4 inches too short, and cannot fit in a stretcher at all.



Gathering Requirements



Business Analysts are the professional requirements experts, and should lead the process whenever they are available:

- Sometimes work for the customer and give the requirements to the PM.
- However, ideally they work under the supervision of the PM, who can help the B.A. avoid the common mistake of “making the customer happy” by including much more than required by the project objective, thereby avoiding scope creep before the project even starts.

Interview all the stakeholders – don't miss anyone, especially support groups like operations, privacy, legal, contracts, regulatory agencies, etc.:

- “What is needed to meet the objective”.
- Go through a list of prepared questions.
- “Why? Why? Why?”
- “What else do I need to know?”
- Document any key scenarios / workflows / use cases needed to understand the amount of work that will be required.

B.A.'s have their own professional organization: The International Institute of Business Analysis –
IIBA.org

If there are no Business Analysts available – just do it yourself!



Requirements Attributes

“You can't always get what you **want**, but if you try sometimes, well you just might find, you get what you **need**.”

– Rolling Stones, *Let It Bleed*, 1969.

Project requirements identify what not how:

- E.g. how many students the school must support, not the color of the classrooms.
- The detailed “design requirements”, how the project level requirements will be achieved, are defined later as the first step in execution.

Identify the needs not the wants:

- “Users know what they *want*, not what they *need*.”
- Keep asking “why” until they tell you the real need.

Define the boundary, what is in and what is out:

- Geography, departments, training, support, etc.
- What is out of scope helps define what is in.

Key attributes of a good requirements set:

- Complete.
- Consistent.
- Provable – by demonstration, test, or analysis.

“I need a Rolls Royce.”

“Why?”

“I have to have one.”

“Why?”

“Well, I need to travel.”

“Why?”

“Well, I need to attend a meeting across town once a month.”

That's the requirement.

Requirements Key Points



Long time convention is that each requirement includes the word “shall”:

- “The ABC shall do XYZ...” (sometimes use “must” instead, but pick one!)

Can collect related requirements into sections – whatever makes sense:

- Functions, facilities, interfaces, documents, training, support, etc.

Use a maximum of two priority levels: Mandatory and Desirable:

- But just one priority is best – just the mandatory requirements.
- If two levels, be prepared to get only the Mandatory – usually hard enough.
- A second priority can be used to include non-essential requirements when a stakeholder demands they be included, but they inevitably confuse the team.

Need an automated tool if there are more than a few dozen requirements:

- A spreadsheet can work up to a few hundred, and then you likely need a database or software application if there are more.
- You typically trace (index or cross-reference) each requirement to the deliverables that satisfy it, tests and verifications, related documentation, etc.
- Specialized requirements applications include Doors, Jira (R4J/RMsis), Rational.
- However, databases like Microsoft Access or [LibreOffice Base](#) (open source) work well if you have someone that can run it and understands requirements management – less expensive and more flexible, especially for forms & reports.

Requirements Document & Approval



How much detail goes into the requirements document?

- More:
 - ➔ If you have any doubt, perform additional investigation, since the most common project problem is missing essential requirements during planning.
- Less:
 - ➔ However, don't include anything not essential to the objective, no nice-to-haves and while-we-are-at-its that will complicate the main goal.
 - ➔ Stop above the level of "how" – design is too costly for planning, too much information, and too restrictive on work once the project starts.

Put all requirements in a formal document and circulate to the stakeholders:

- Common name: Project Requirements Document (PRD).

Essential to have the customer review and approve the PRD in writing:

- Hold review meetings with all the relevant users from the customer organization, walk through every requirement to obtain any changes or agreement, and keep holding these meetings until the requirements stabilize.
- State more than once: "Any missed requirement will be five to ten times more disruptive and costly if it needs to be added once the project is underway."
- Very helpful if you can say: "Any additions later will come out of your budget!"

Example – Buying Chairs



It does not matter how small the project, if you don't have a good set of requirements gathered from everyone, there will be problems!

Example: you are buying chairs – if you don't get a list like the following collected, written down, reviewed with the stakeholders, updated if needed, and approved before ordering, you will likely end up with the wrong chairs:

#	Requirement
1	The chairs shall roll on castor wheels suitable for use on carpets.
2	The chairs shall have arm rests.
3	The chairs shall have padded seats and net backs.
4	The chairs shall be adjustable up and down with one hand.
5	The chair backs shall be adjustable back and forth with one hand.
6	The chairs shall be a uniform dark blue color.

For any project, even something as small as buying chairs, the return on investment for the effort spent on gathering a good set of requirements is many times over in savings of time and cost later.

Exercise – Requirements



Using a Business Analyst, or just doing it yourself if required, gather the requirements for your project:

- *Interview everybody – all stakeholders, users, domain leads, and especially operations, support, security, procurement, and legal if applicable.*
- *Ask “what is needed” to achieve the objective?*
- *Get all the quantities, standards, functions, features, etc.*
- *Ask any prepared questions.*
- *Keep asking why, why, why until they tell you the real need behind a requirement.*
- *Finish by asking “what else should I / would it be helpful to know”?*
- *Consolidate the requirements, obtain feedback one-on-one, and then hold group meetings to finalize the complete set.*

Solution Definition



In order to provide the core project team with enough information to plan the project, it is helpful to define a top-level solution definition, often based on the conceptual solution from the charter:

- E.g. an architecture diagram, floor plan layout, building model in software, physical mock-up, etc.
- Otherwise just a listing, e.g. the subject areas that must be covered in a policy manual, or list of the major deliverables to be delivered to the customer.
- This is not the detailed design – the purpose of planning is only to estimate the project +/- 10% to obtain stakeholder feedback and approval, so the detailed work should be done by the full team only after the plan is approved.

Integrated health information system project example:

- A top-level system architecture diagram, showing the major components of hardware, system software, applications, networks, and messaging.

Department process improvement project example:

- A list of the required major deliverables: updated process documents, updated floor plans, any new furniture and equipment.

New local soccer league:

- A list of the required major deliverables: governing procedures, playing fields, equipment, referees, and initial teams.



Document the solution definition so the core project team has enough information about what will be delivered to the customer to plan the project:

- *Wherever possible, provide a diagram, graphic, or other visual representation.*

- *Otherwise, provide a list of the major required deliverables – e.g. subject areas that must be included in a policy manual, or major elements of hardware, software, facilities, and documentation.*

Work Breakdown Structure



*“A **deliverable**-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives.”*

– PMBOK® Guide.

The work breakdown structure (WBS) is a collection of all the deliverables – both the end deliverables handed to the customer as well as all the interim work outputs that need to be produced by the project as it goes along:

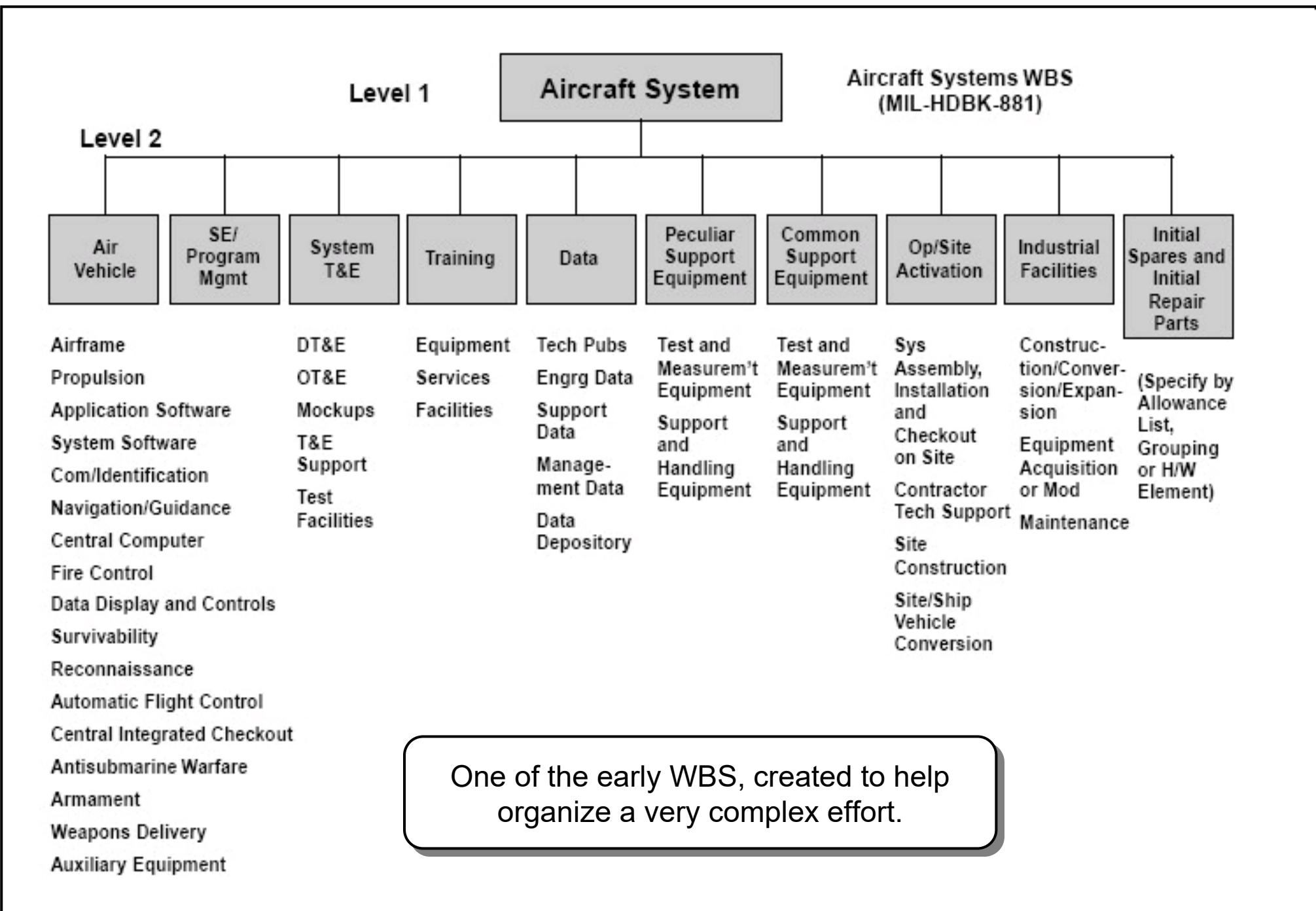
- Each deliverable has a single owner.
- When a deliverable is finished it is passed on to others, who then use it as input to produce their own deliverables.
- They can be material, software, part of a facility, or a document, as long as it is a tangible work output that is finished and passed on to others.

The work breakdown structure of deliverables is the official scope baseline, because it includes all the work of the project:

- Deliverables passed on to the customer at the end of the project.
- Plus all the internal deliverables needed just to move the project along – the plans, designs, reviews, approvals, contracts, inspections, tests, training, support documentation, etc.

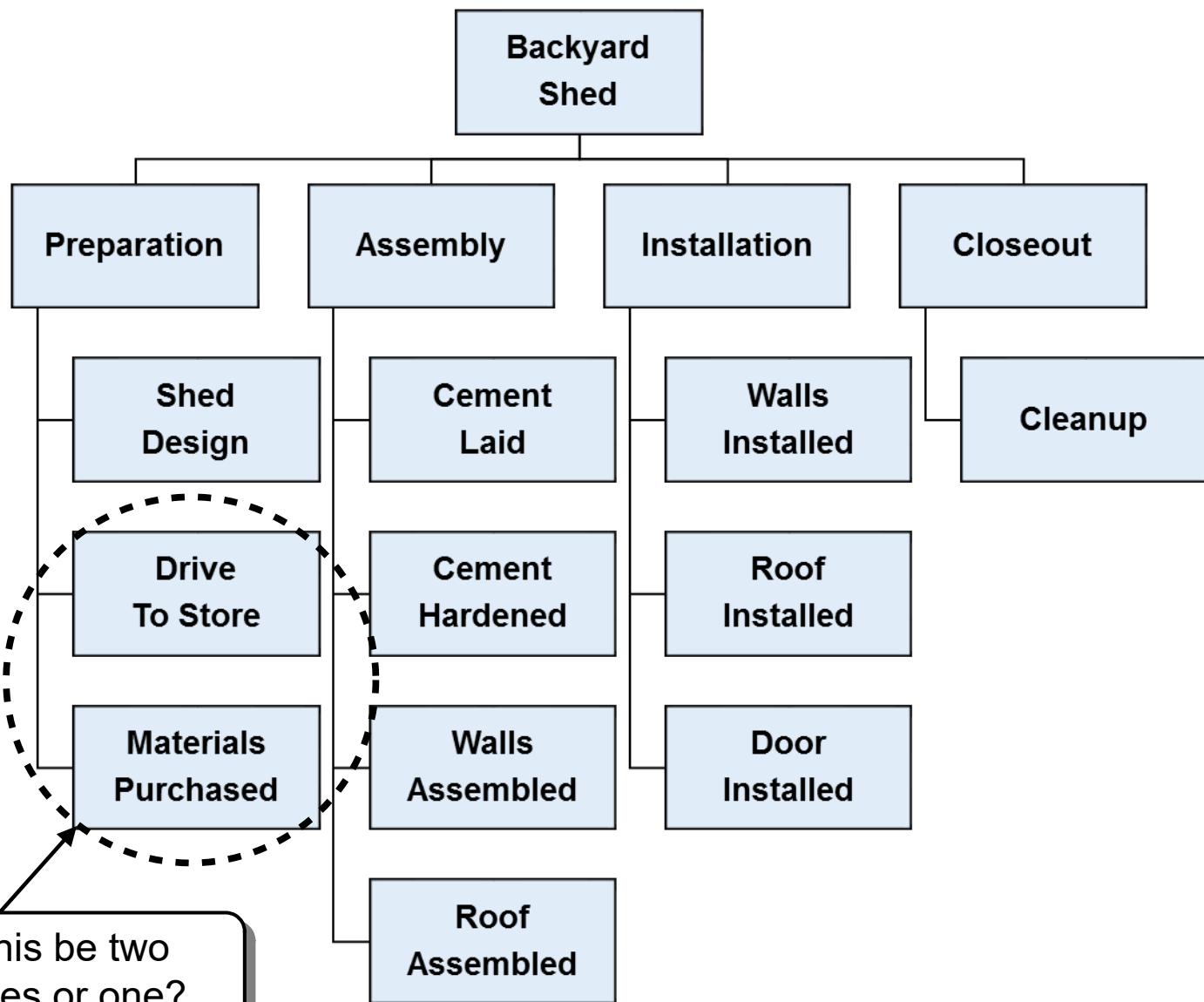
“If it’s in the work breakdown structure then it’s in the scope of the project; if it’s not in the WBS then it’s not in the scope of the project”.

WBS Example – An Aircraft





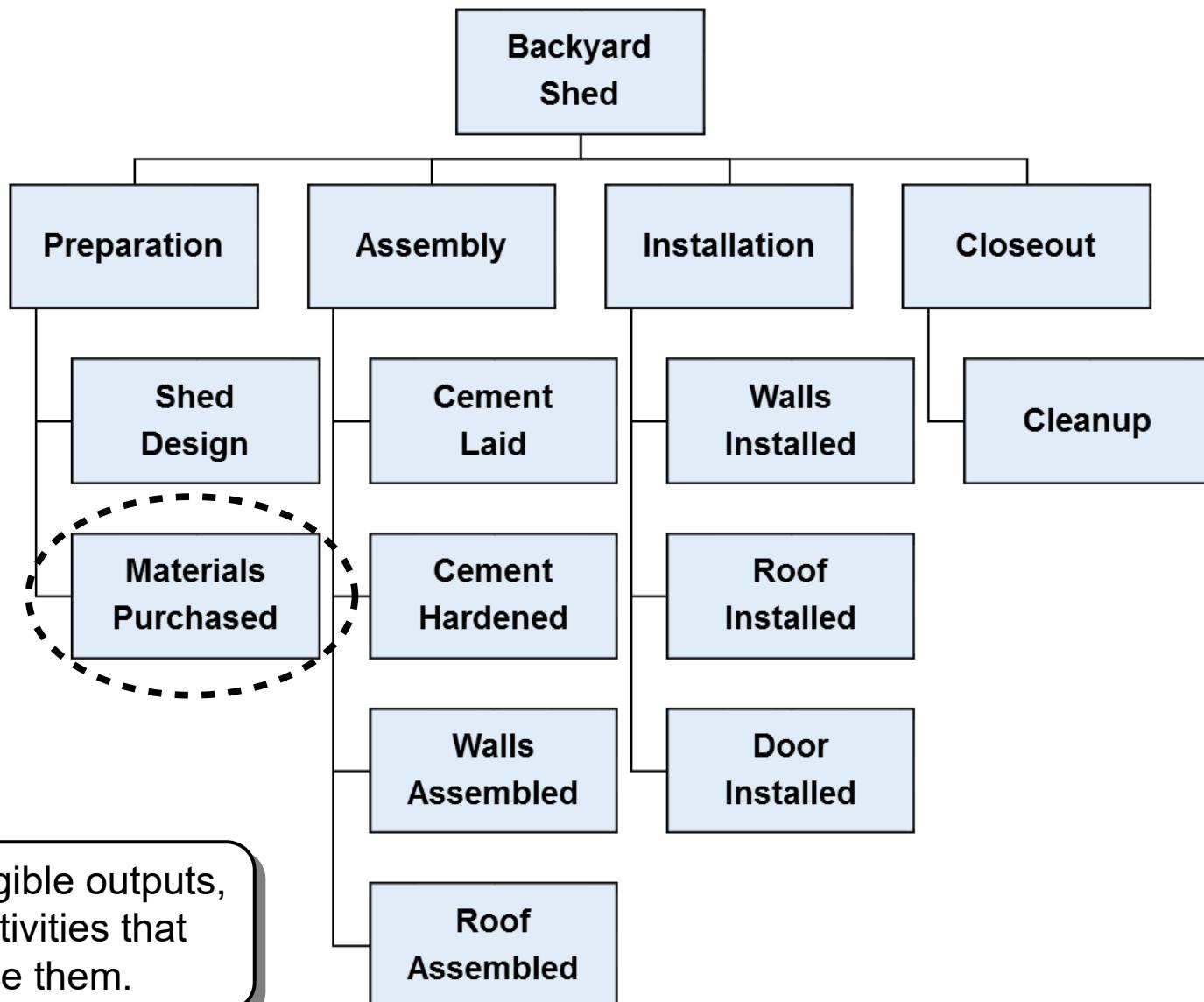
WBS Example – Shed



Should this be two
deliverables or one?

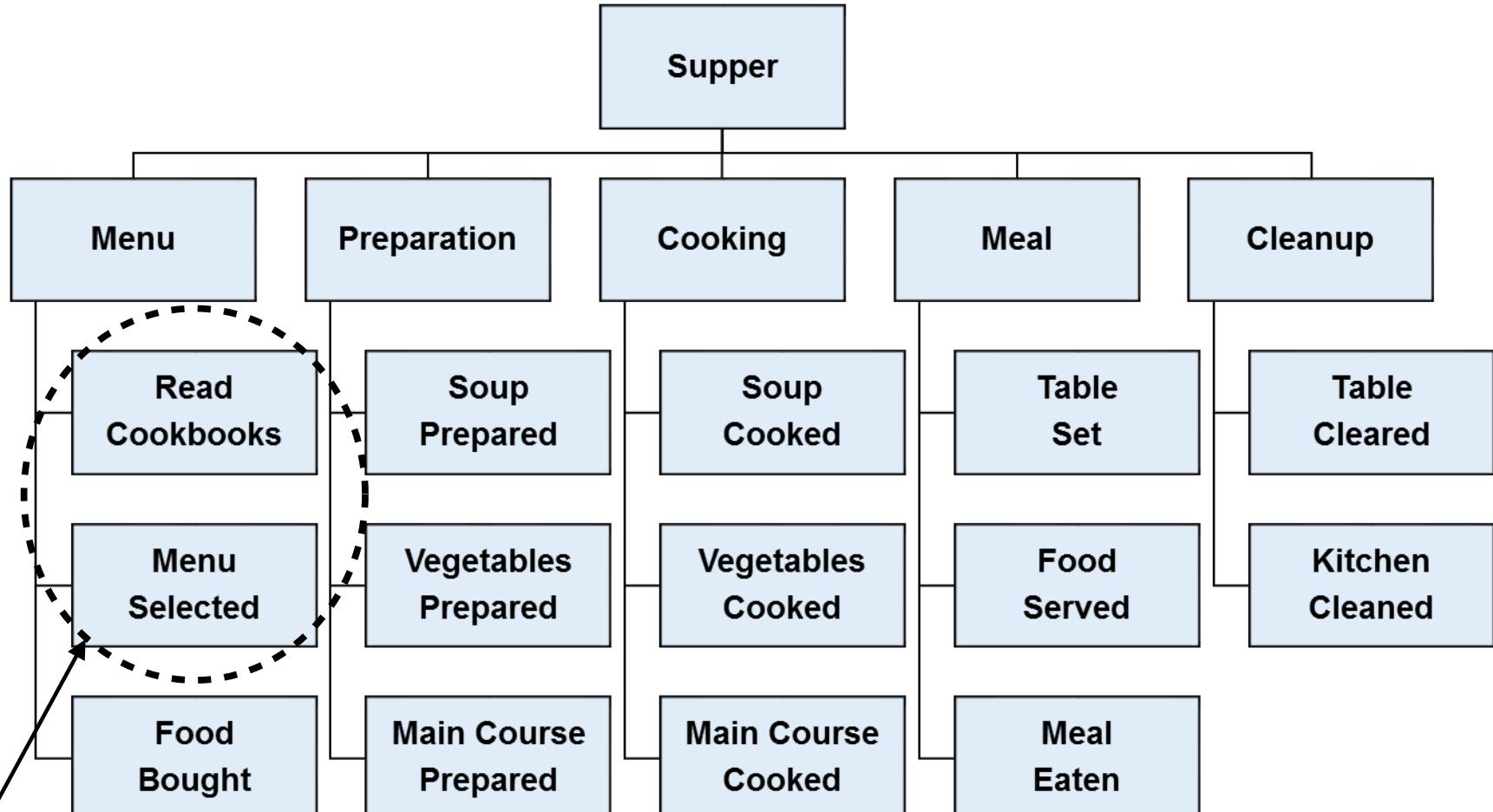


WBS Example – Shed





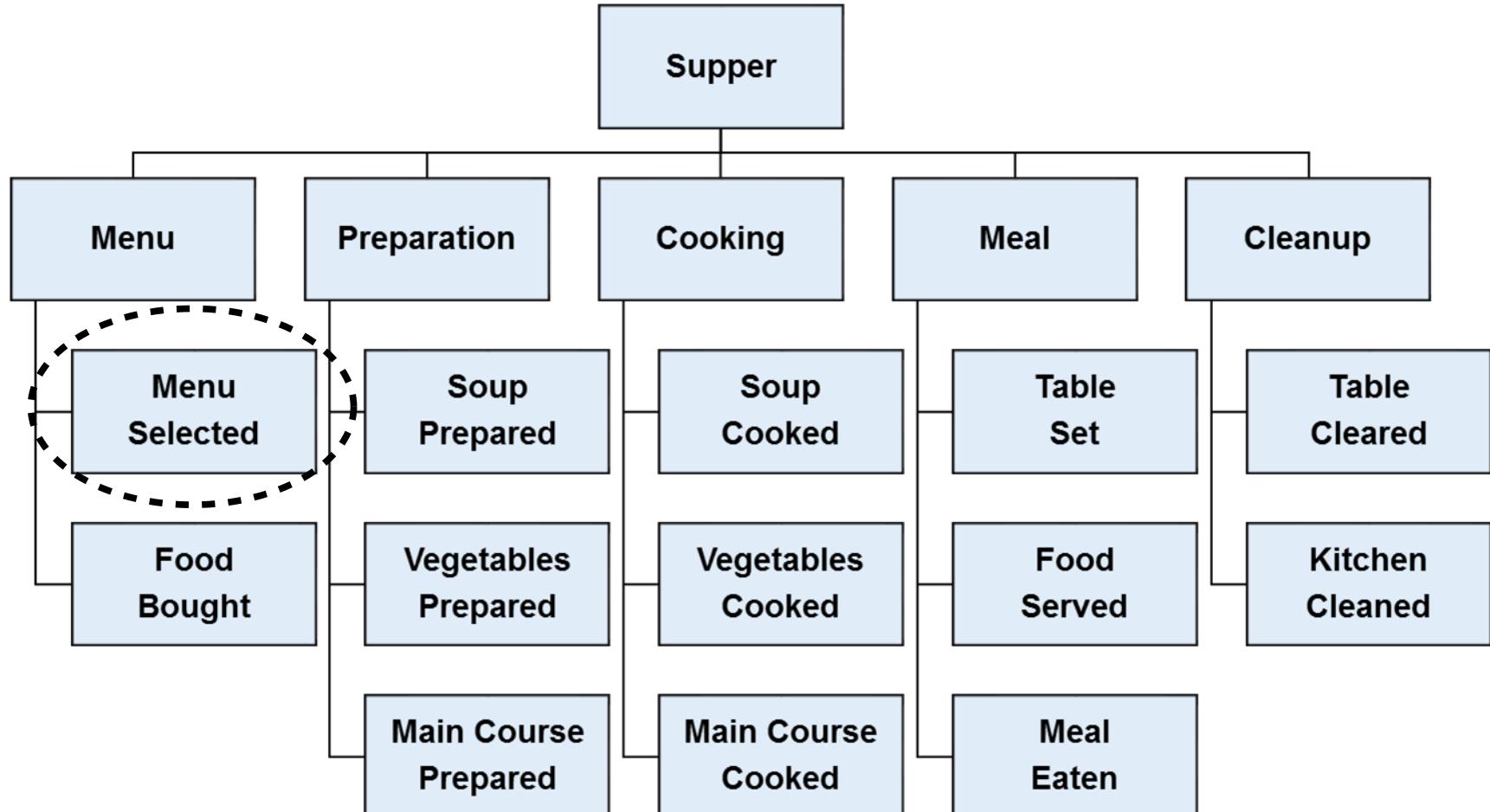
WBS Example – Supper



Should this be two
deliverables or one?

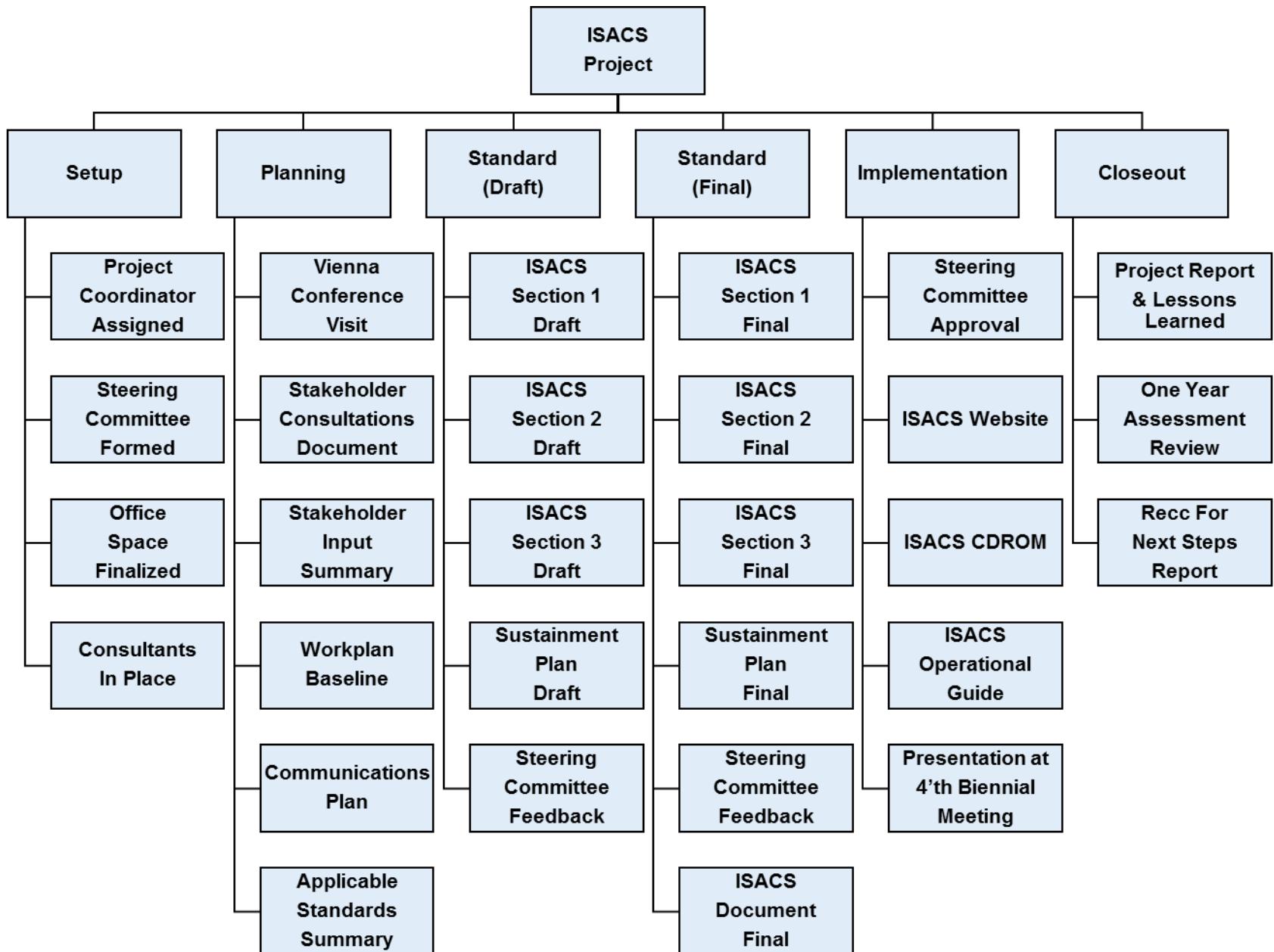


WBS Example – Supper



Just the tangible outputs,
not the activities that
produce them.

WBS Example – Standards Development



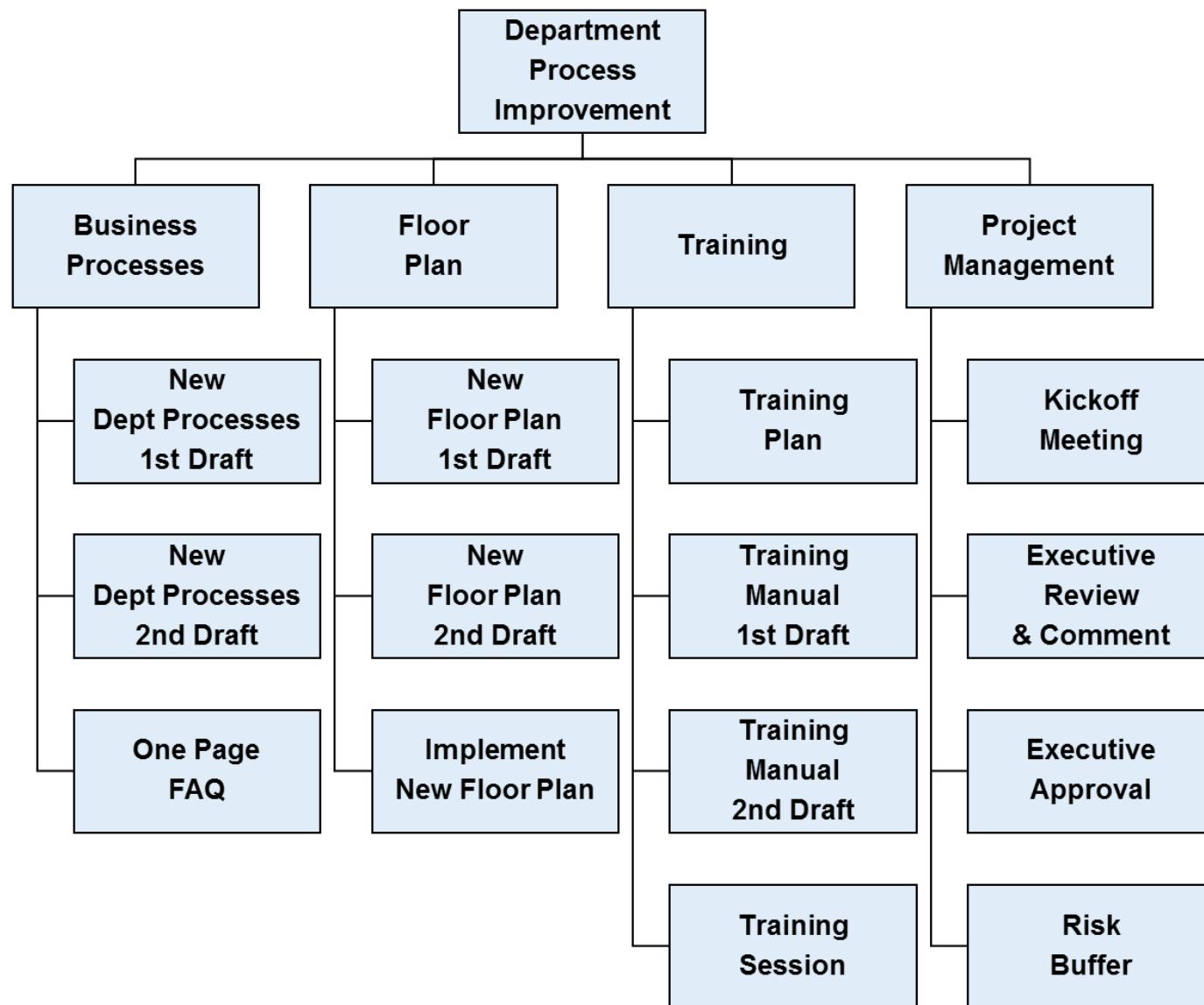
WBS Example – Process Improvement



Project: Department Process Improvement Project (DPIP)

Objective: Develop more efficient department processes and improved floor plan to increase productivity by 20%.

Used later
in course.





“Once the what is decided, the how always follows.”

– Pearl S. Buck, 1892-1973

Meet with the core project team, with copies of the requirements and solution definition available, and a stack of post-it notes:

- Expect at least three meetings before the WBS starts to stabilize, even for small projects.

For the first meeting:

- Walk through the project from beginning to end.
- Cover each area of the project – analysis, process, design, training, support, etc.
- Identify the deliverables required to get the work done.
- Write their names on post-it notes, and stick them on a draft WBS on a flip-chart.
- Move the deliverables around to collect them into any logical grouping that is convenient – never get hung up on the categories, they can always change later.
- After the first meeting, draw up the WBS with any organization chart app, such as the Microsoft Office “SmartArt Hierarchy” tool, which does all alignment of the boxes automatically.

For subsequent meetings:

- Make redlines to a printout of the WBS, and update the soft-copy afterwards.
- Keep holding meetings until changes subside and the WBS stabilizes.

Once the deliverables are identified, the project is broken into manageable pieces, and everything gets easy: assignment to team members, estimating, scheduling, management in monitoring and control, etc.

WBS Key Points



Name deliverables to reflect the work output, a noun if possible.

When in doubt, just add the word document to the end:

- Analyze Regulations → Analyze Regulations Document (Better)
- Analyze Regulations → Applicable Regulations (Best)

Make sure you understand the full process required and identify all the deliverables needed to get an area of work done:

- Plans, designs, draft versions, final versions, user reviews, executive reviews, procurement documents, inspection lists, test procedures, certifications, user documentation, reports, etc.

For larger projects, add a Project Management category to capture the cost and time that doesn't fit elsewhere, often including at least:

- Project Management Plan – for the project manager's time and salary.
- Risk Budget – the cost and time in the risk reserve.

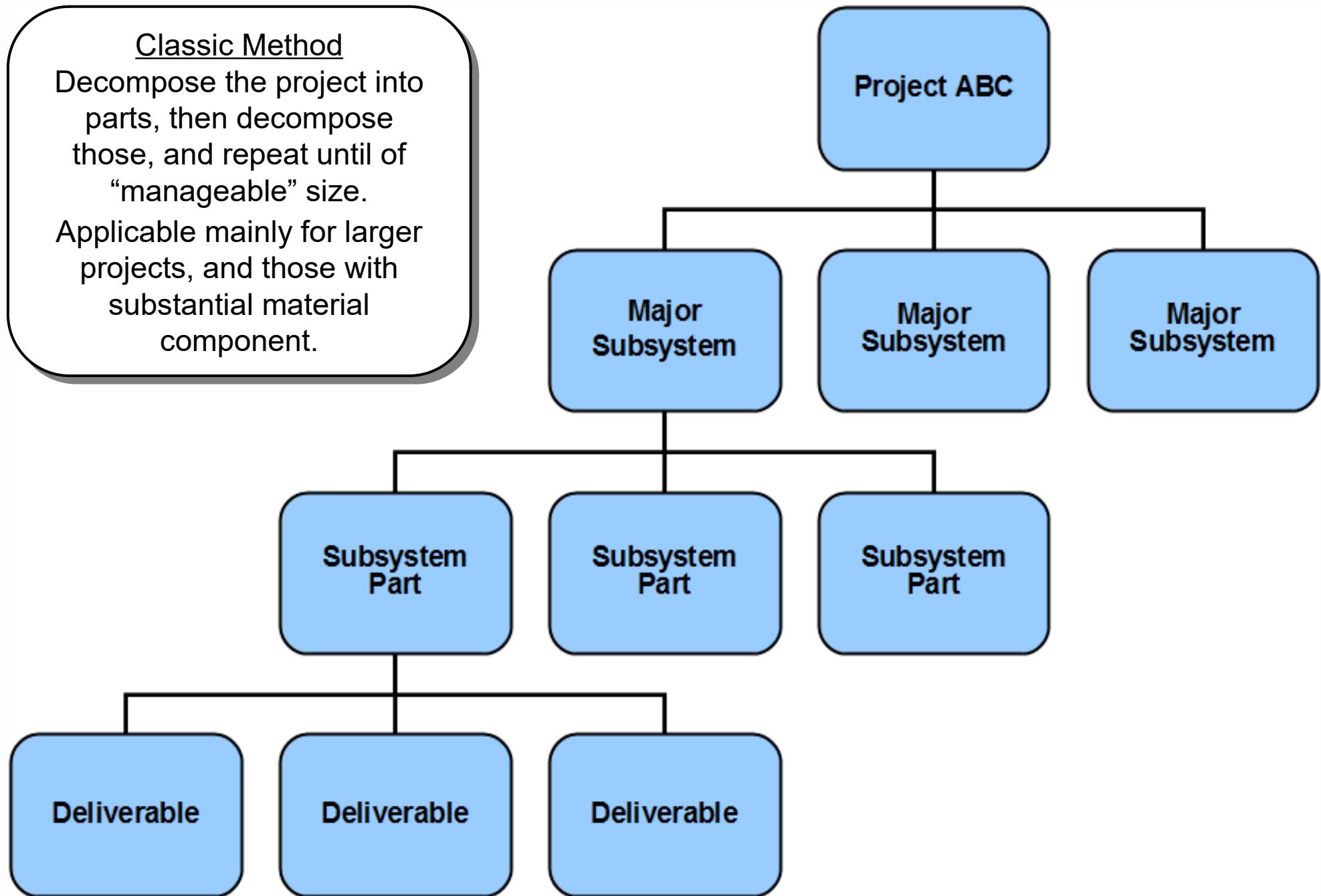


WBS Hierarchical Decomposition

Classic Method

Decompose the project into parts, then decompose those, and repeat until of “manageable” size.

Applicable mainly for larger projects, and those with substantial material component.



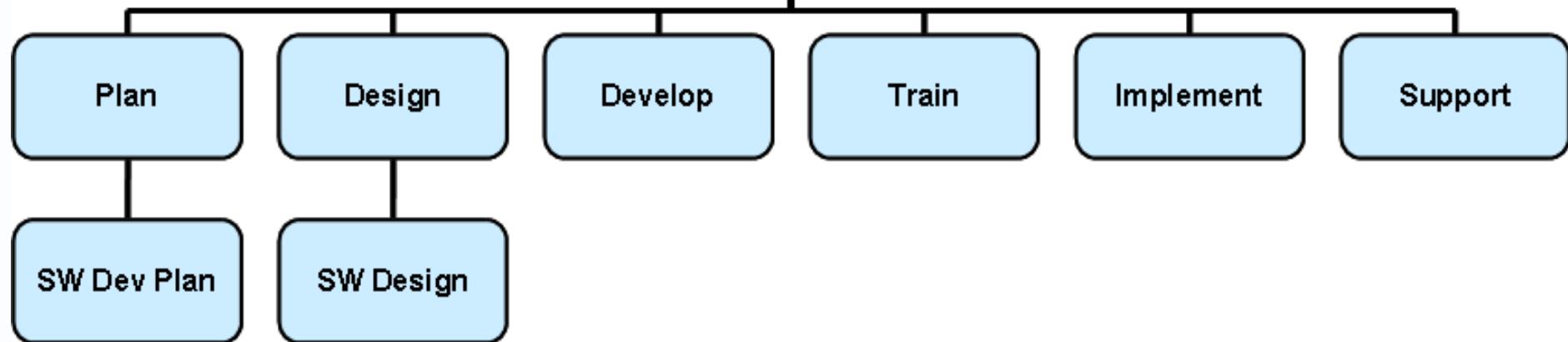


WBS Phasing & Combined Methods

Phasing

Good for projects where phases are a major characteristic.

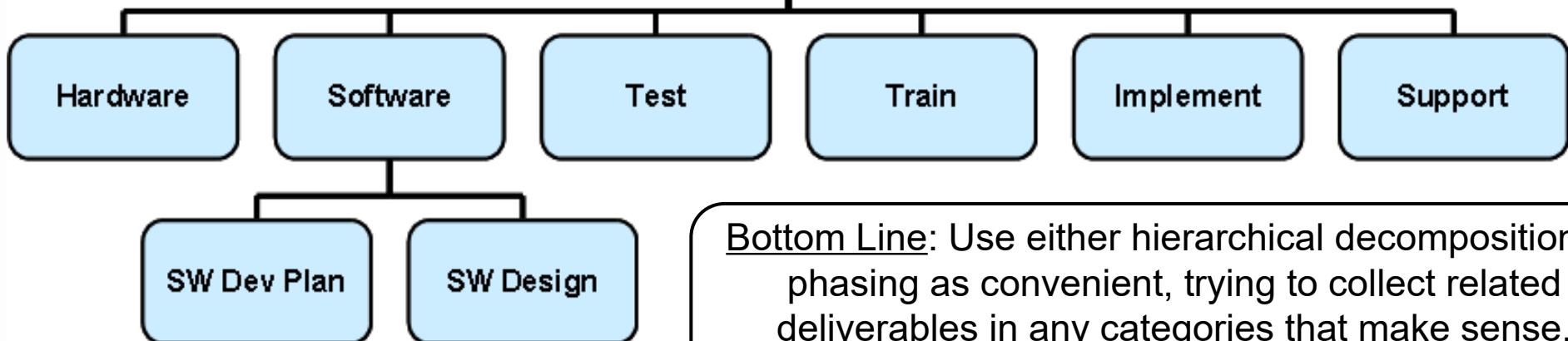
Project ABC



Combined

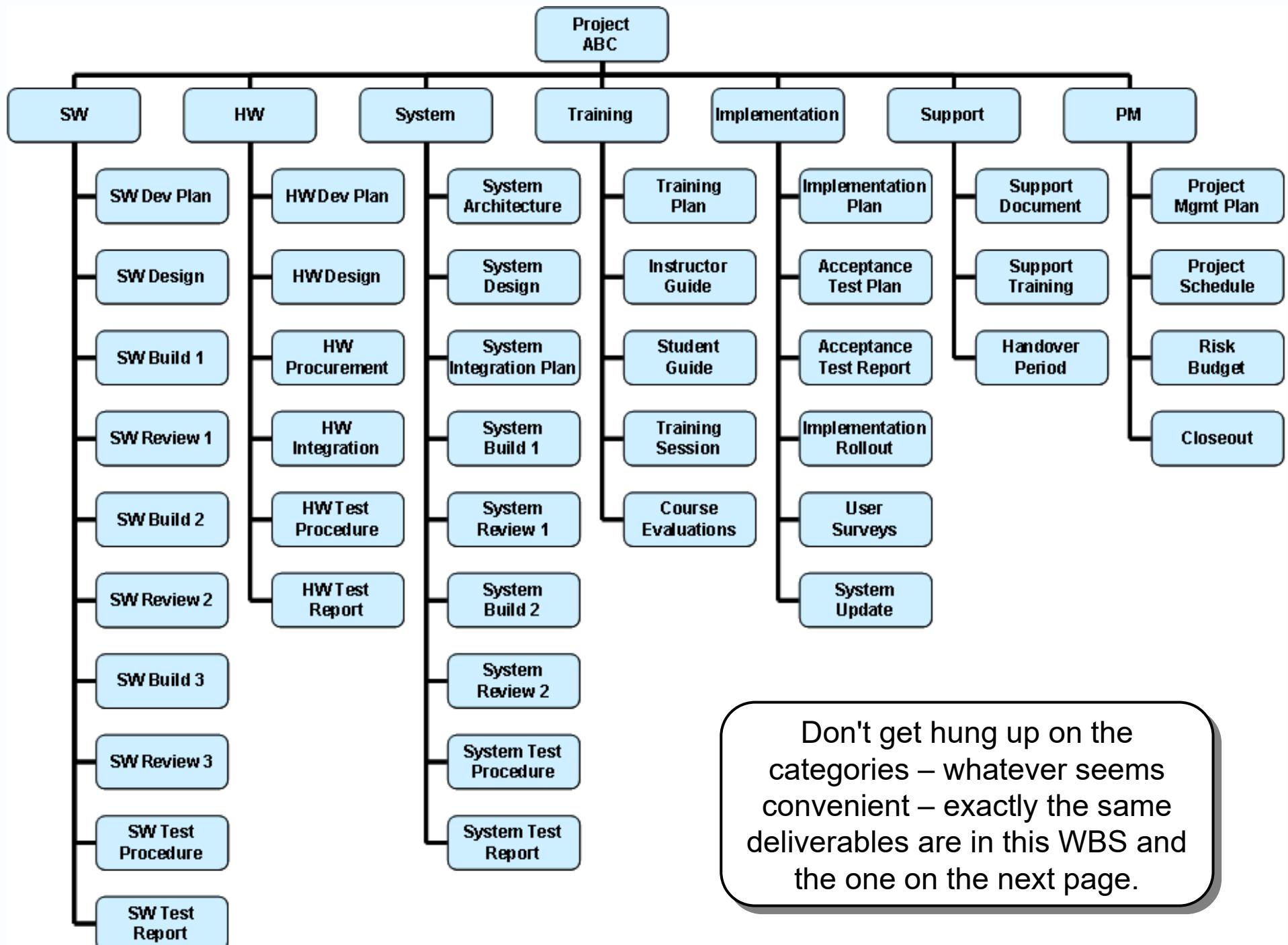
Good when project has some product, some phases.

Project ABC



Bottom Line: Use either hierarchical decomposition or phasing as convenient, trying to collect related deliverables in any categories that make sense, whatever seems most clear – you cannot get it wrong.

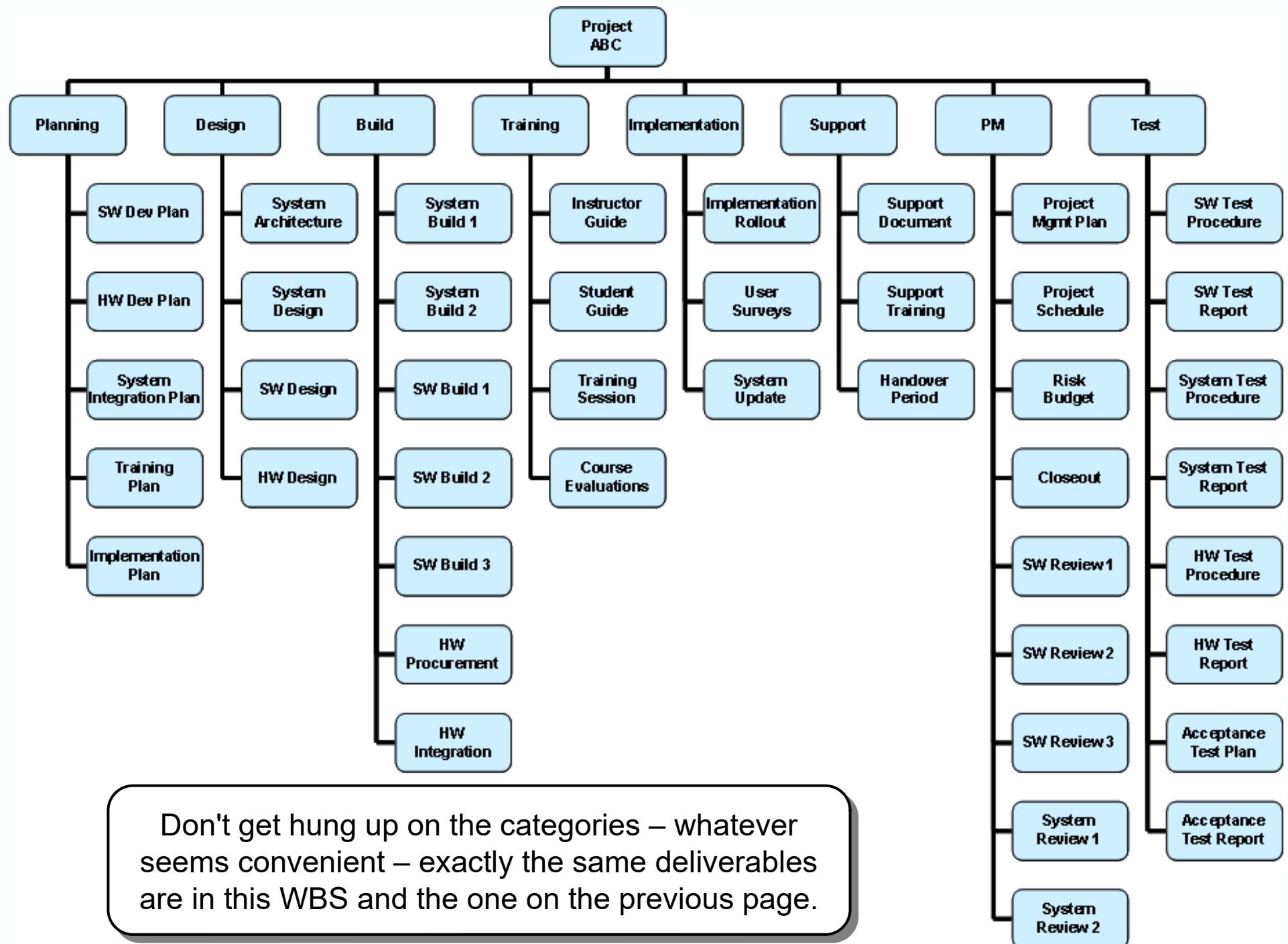
Example – Hierarchical Decomposition



Don't get hung up on the categories – whatever seems convenient – exactly the same deliverables are in this WBS and the one on the next page.



Example – Project Phasing



Breaking Down By Responsibility

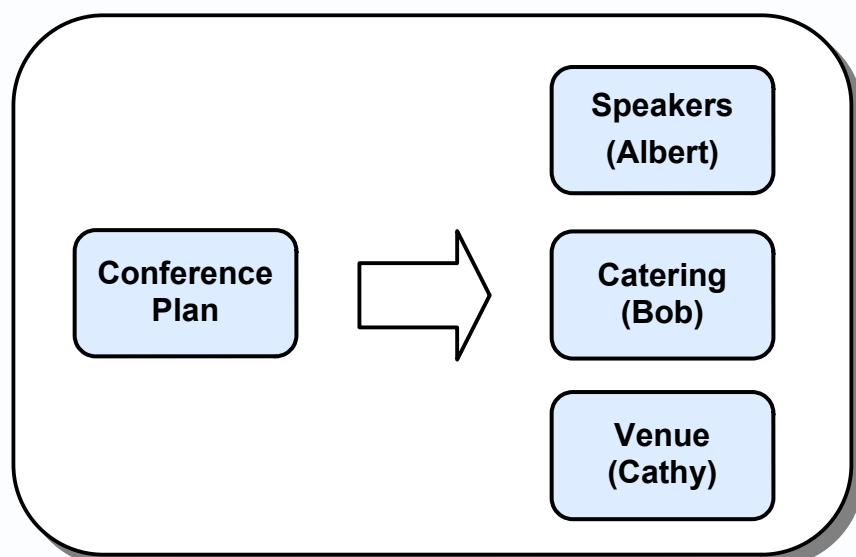


There are four reasons to break down a deliverable into smaller pieces: (1) Differing responsibility, (2) Separating out waiting time, (3) Creating interim deliverables, and (4) Duration longer than two weeks.

Breaking Down By Responsibility. If different project team members are responsible for different parts of a deliverable, it should be divided into separate parts each led by a single person:

- The project needs one person accountable for each deliverable.
- However this is not needed if several people work on several pieces as part of one functional team, and a single lead represents them all at the project level:
 - Then keep the deliverable as one output with one representative at the project level, and that team can then create their own WBS internally at their level.
 - They may have their own precedence diagram for the deliverable as well – the project management process can nest to as many levels as needed!

Example: If a conference plan has three sections each led by different team members, then break up the plan into different deliverables that can be managed individually – they also likely have different inputs and outputs and are done at different times.



Breaking Out Waiting Time

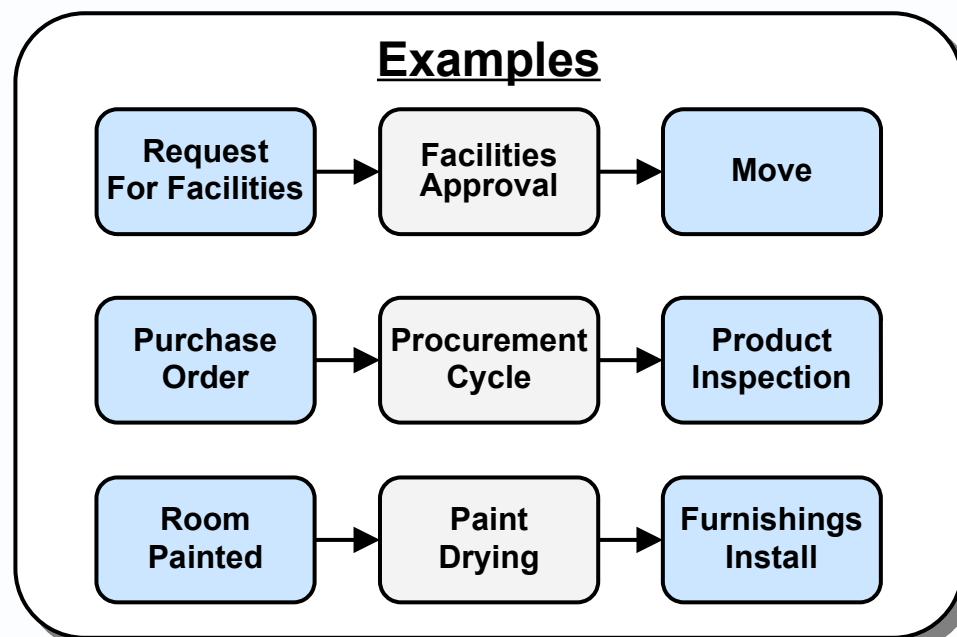


Deliverables that contain waiting time for an external reason or event should break the waiting time out into a separate deliverable:

- E.g.: approvals, procurement time, delivery time, paint drying, etc.
- The waiting deliverable has time, but usually no resources or cost.

Separate the deliverable into one for what comes before the waiting time, one for the waiting time itself, and one for what comes after the waiting time:

- Much easier to plan and manage.
- Highlights the waiting time on the precedence diagram and Gantt chart so it does not get lost inside a project deliverable.



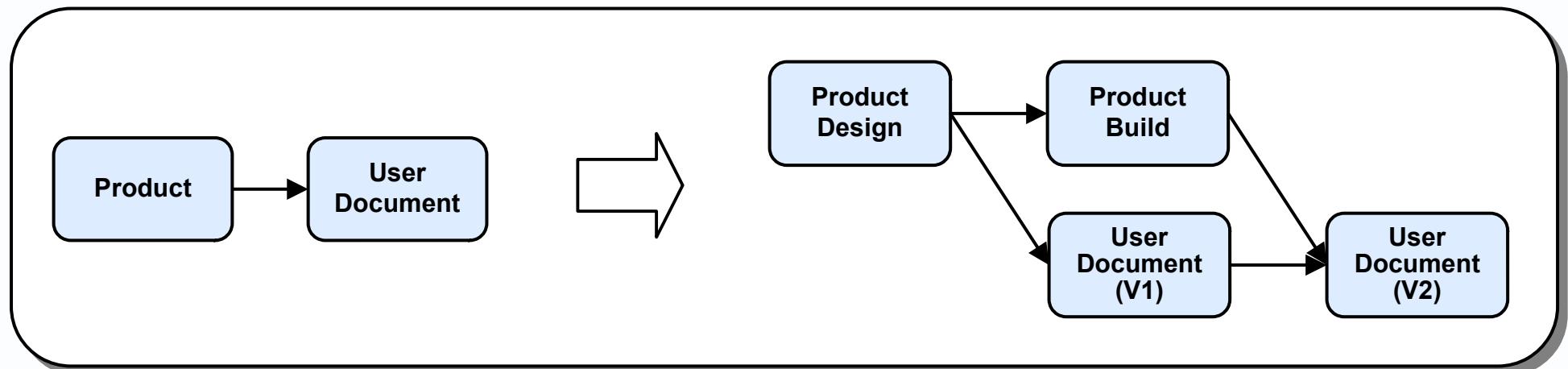
Breaking Out Interim Deliveries



Often a deliverable cannot be completed until later in a project, but can be started earlier:

- Then can be useful to break it into two parts, with the earlier part starting as soon as possible, and the final part completing when all the required input is available.
- Enables clearer presentation of the logic in the precedence diagram.
- Results in a faster schedule by starting some work as soon as possible.

Example: Often a user manual (or other documentation) can be started as soon as the design is ready, but only finished when the build is complete:



This often becomes apparent when creating the precedence diagram – keep in mind whenever something “can start earlier, but not be finished until later”.

Breaking Down By Duration



Any deliverable longer than two weeks must be decomposed into “work packages” of maximum two weeks duration, so it can be tracked later:

- These don't go on the WBS, but do go on the Gantt chart, so every month when you status a long deliverable you can tell how it's doing based on the progress of the individual work packages.
- Avoids the “everything is going great” answer from your leads on longer deliverables until the very end when it's too late to react, since you will have checkpoints to accurately determine status as you go along.

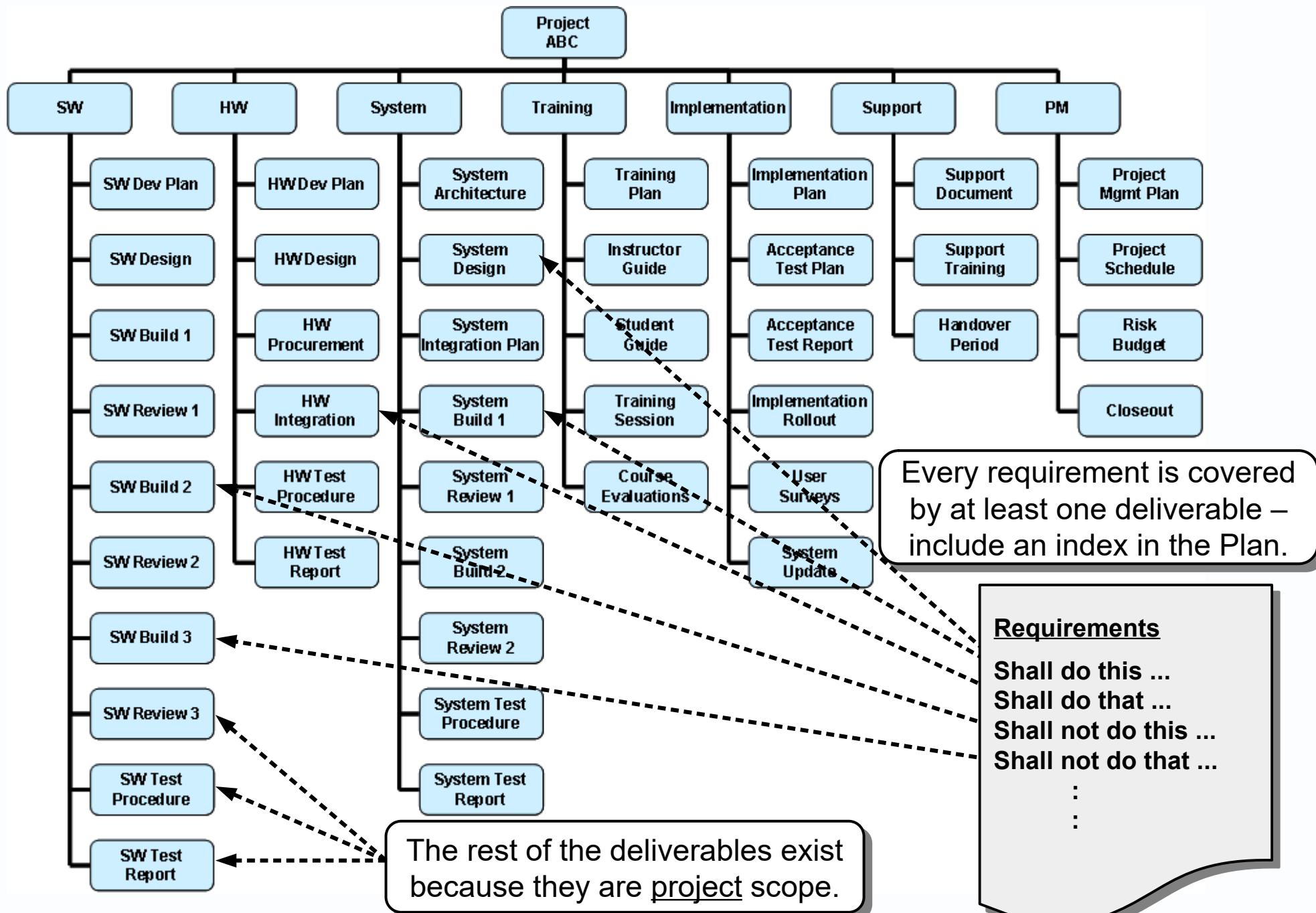
For example, say preparation of a document will take more than two weeks:

- Based on the owner's activity breakdown (see Estimating section) the deliverable could be divided into the following smaller, more manageable work packages that can be individually tracked to obtain accurate status later, thereby ensuring you have early warning if there are any schedule problems.





Requirements cover the product / service / result, while the WBS includes the entire project.





WBS Dictionary

The WBS dictionary contains basic information about each deliverable:

- Unique deliverable ID.
- Name.
- Text description.
- Lead.
- Cost account.

Prepare any way that works, as long as it is unique for each deliverable:
1, 2, 3...
1010, 1020, 1030...
AAAAA, AAAAB, AAAAC...

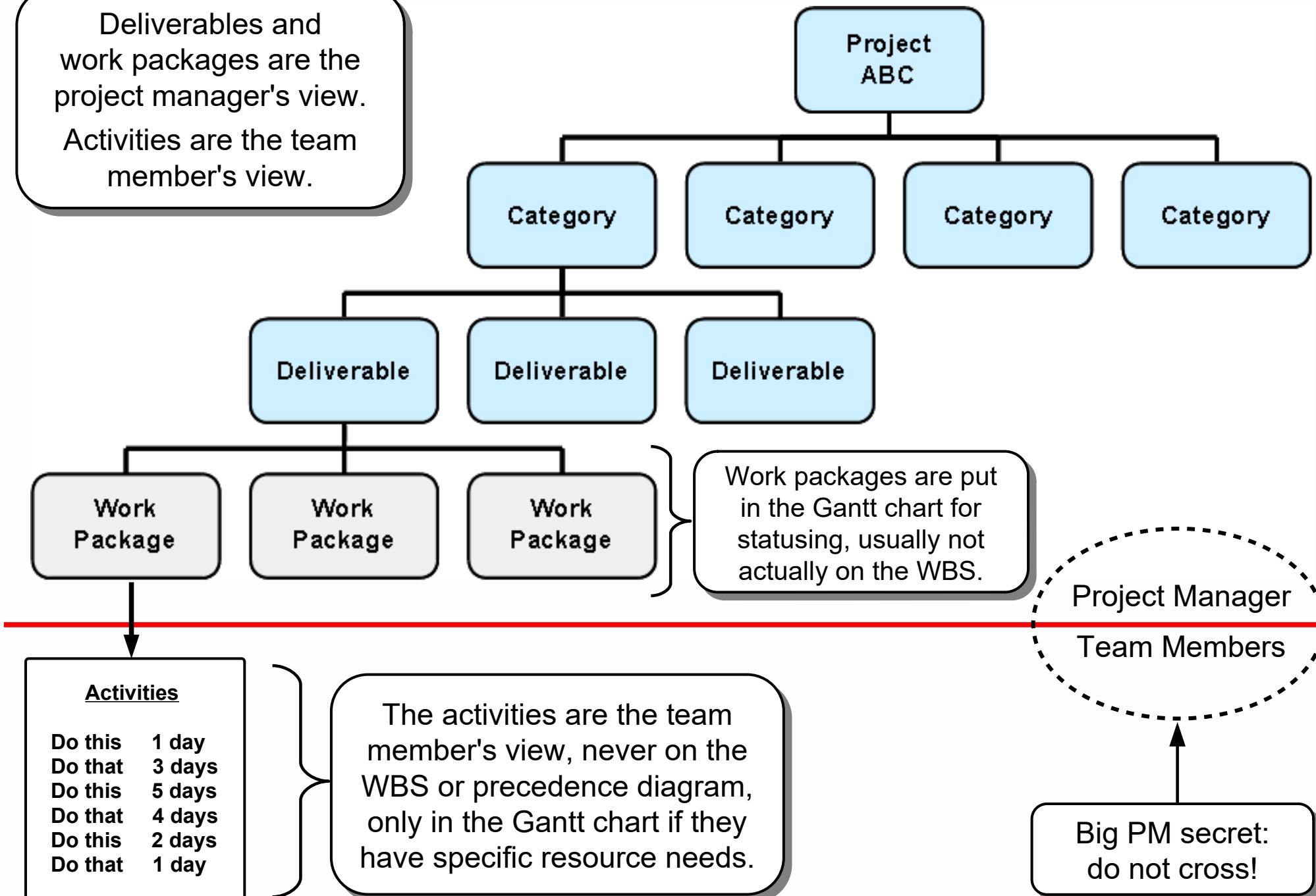
WBS ID	Name	Description	Lead	Cost Acct
1020	Updated Processes	Improved processes to remove duplicate and unnecessary steps.	J. Smith	51230
1025	Floor Plan Update	Seating plan that maps to improved processes and increases efficiency.	C. Brooks	51245
1030	Training Plan	Training plan to bring staff up to speed on more efficient processes	A. Doucet	51280
:	:	:	:	:

Financial code for capture of costs – can bundle more than one deliverable if convenient.

Deliverables → Work Packages → Activities



Deliverables and work packages are the project manager's view.
Activities are the team member's view.



WBS Drawing Tool



Can use the Microsoft Office
“SmartArt / Hierarchy” tool.

Can also use Org Plus, or a mind mapping
application like [FreePlane](#) (free open
source software).

Choose a SmartArt Graphic

?

X

All

List

Process

Cycle

Hierarchy

Relationship

Matrix

Pyramid

Picture

Office.com

Organization Chart

Use to show hierarchical information or reporting relationships in an organization. The assistant shape and the Org Chart hanging layouts are available with this layout.

OK

Cancel

Why Not Use The Gantt Tool To Draw The WBS?



Many Gantt tools can manage the WBS as well, and keep the WBS and schedule synchronized. This sounds like the perfect solution. However, in practice, this is the rare case where the control you gain is usually worth the effort of keeping some information in two different tools.

- As projects get medium size and larger, you will have nesting in the WBS. So the top-level WBS used as the primary means of communication will go down a few levels, and then more detailed breakouts will be developed by individual teams as required.
- You want to lay out the top-level diagram as clearly as possible, including the ordering of branches and deliverables.
- And you don't want the Gantt tool to redraw your WBS according to some canned algorithm every time the Gantt chart is updated.

Therefore, to get the layout and detail you want, duplication of some data in a second drawing tool that gives you complete control of the structure is usually worth it, and more so the larger the project gets.

Exercise – Work Breakdown Structure



Work with your core team to document your project's work breakdown structure:

- *Start with a flip-chart or white-board, and a stack of square post-it notes.*
- *Post a top-level note with the name of your project, and a row of second level notes for the various domain areas of the project:*
 - *However do not waste time arguing about what domain area a deliverable falls into, as they can all be moved around later.*
- *Identify the end deliverables to be provided to the customer.*
- *And the real point of the process – identify all the internal deliverables required by the project process just to get the work done: the plans, designs, reviews, inspections, tests, approvals, certifications, reports etc.*
- *The WBS is not chronological or organizational – any order or grouping that is convenient is fine.*
- *Draw up after the meeting, and keep holding meetings to update it until it stabilizes.*

Precedence Diagram



“Arriving at one goal is the starting point to another.”

– Fyodor Dostoevsky, Russian novelist, 1821-1881.

The precedence diagram is your most important project management tool:

- Flowcharts how the deliverables flow together.
- Shows the fundamental logic of the project.
- You can see the project, explain it to others, and manage it.

It shows the precedence relationships between deliverables:

- Which deliverables need to be done first?
- Which deliverables are needed to start others?
- Which deliverables can be started after others are finished?

Strive for parallelism – start deliverables as early as possible:

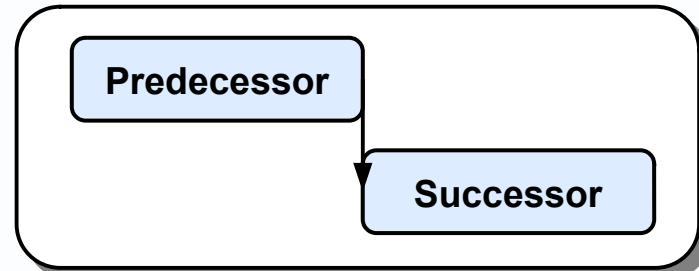
- There are often several parallel paths that can be streamed independently.
- Assume infinite people and resources at this stage – realistic resource constraints will be taken into account once the schedule starts to stabilize.

Kinds Of Precedence Links

There are four kinds of precedence links you can use, but only the finish-to-start link is practical in the vast majority of situations.

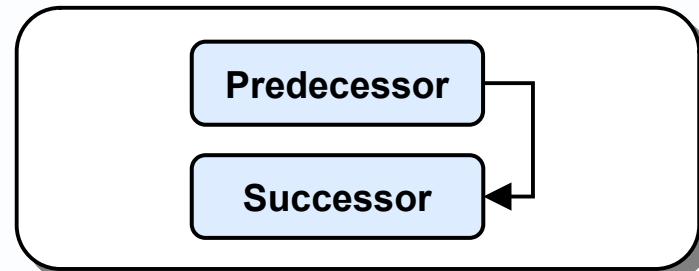
Finish-to-Start:

- Predecessor must finish, then the successor can start.



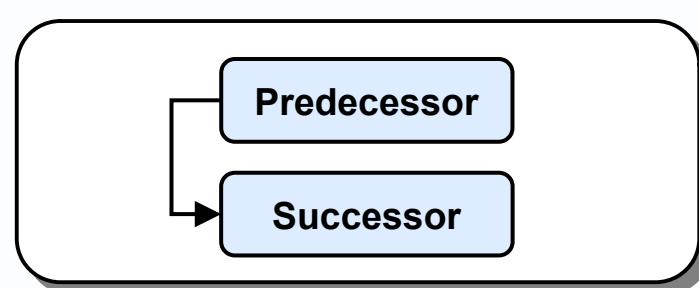
Finish-to-Finish:

- Successor must finish at the same time as the predecessor.



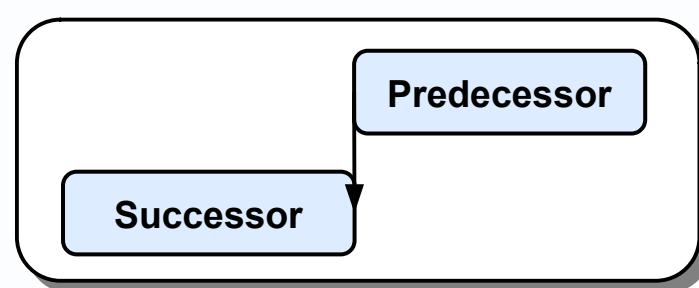
Start-to-Start:

- Successor must start at the same time as the predecessor.



Start-to-Finish:

- Successor must finish when the predecessor starts.



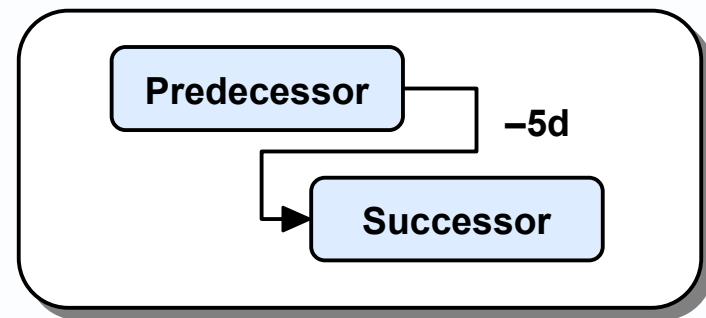


Leads And Lags

Finish-to-start links can also be used to show leads and lags, usually when entering them into the Gantt chart tool (see schedule section).

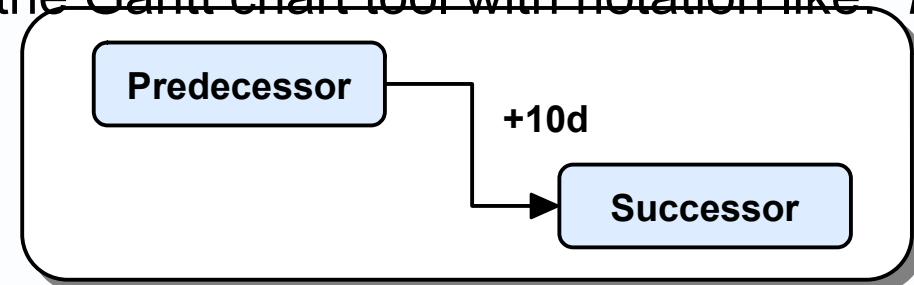
Leads:

- Show overlapping deliverables, typically used only for fast-tracking.
- Specified in the Gantt chart tool with notation like: $FS - 5d$



Lags:

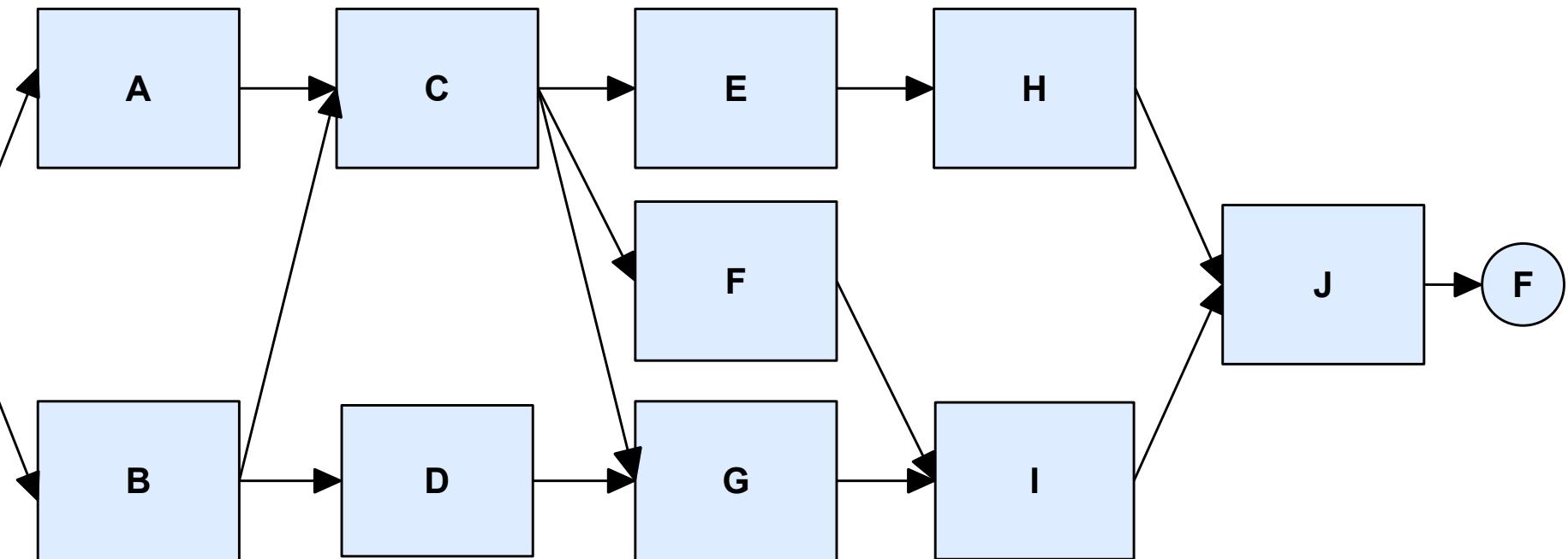
- Show a delay between deliverables, typically used for empty waiting time.
- Specified in the Gantt chart tool with notation like: $FS + 10d$



Generic Example

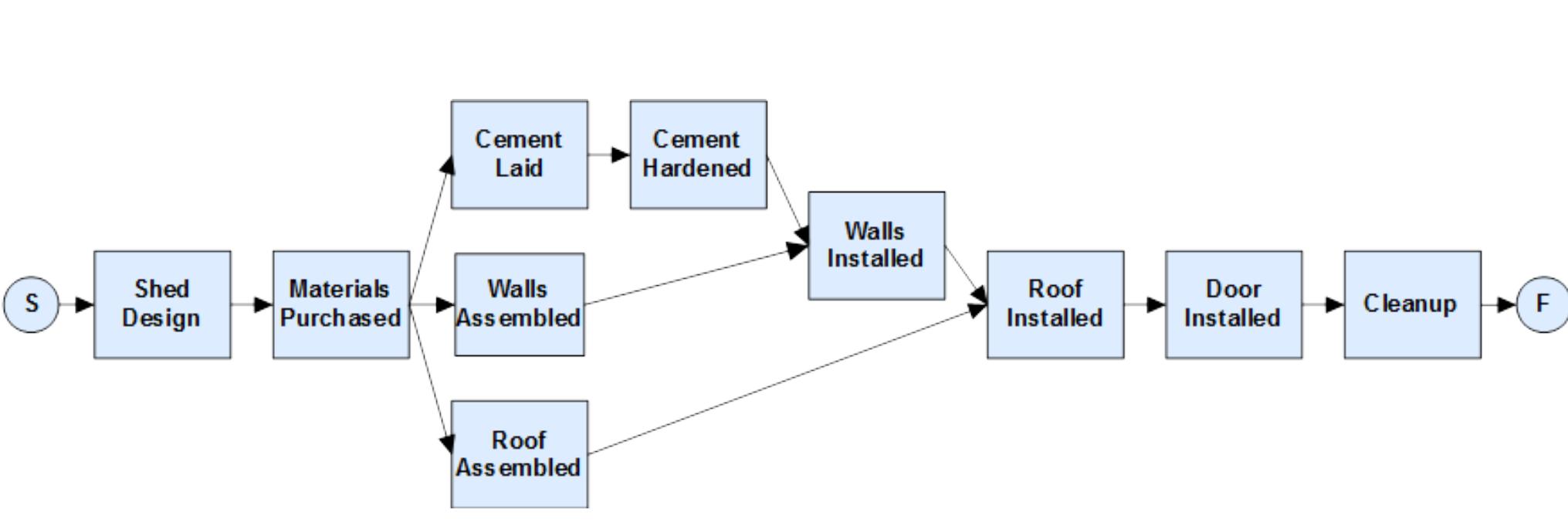
“The real key to effective project management is the project precedence chart. No amount of bells and whistles can compensate for an inefficiently constructed project precedence.”

– Lee Harris, *InfoWorld*, 1986.





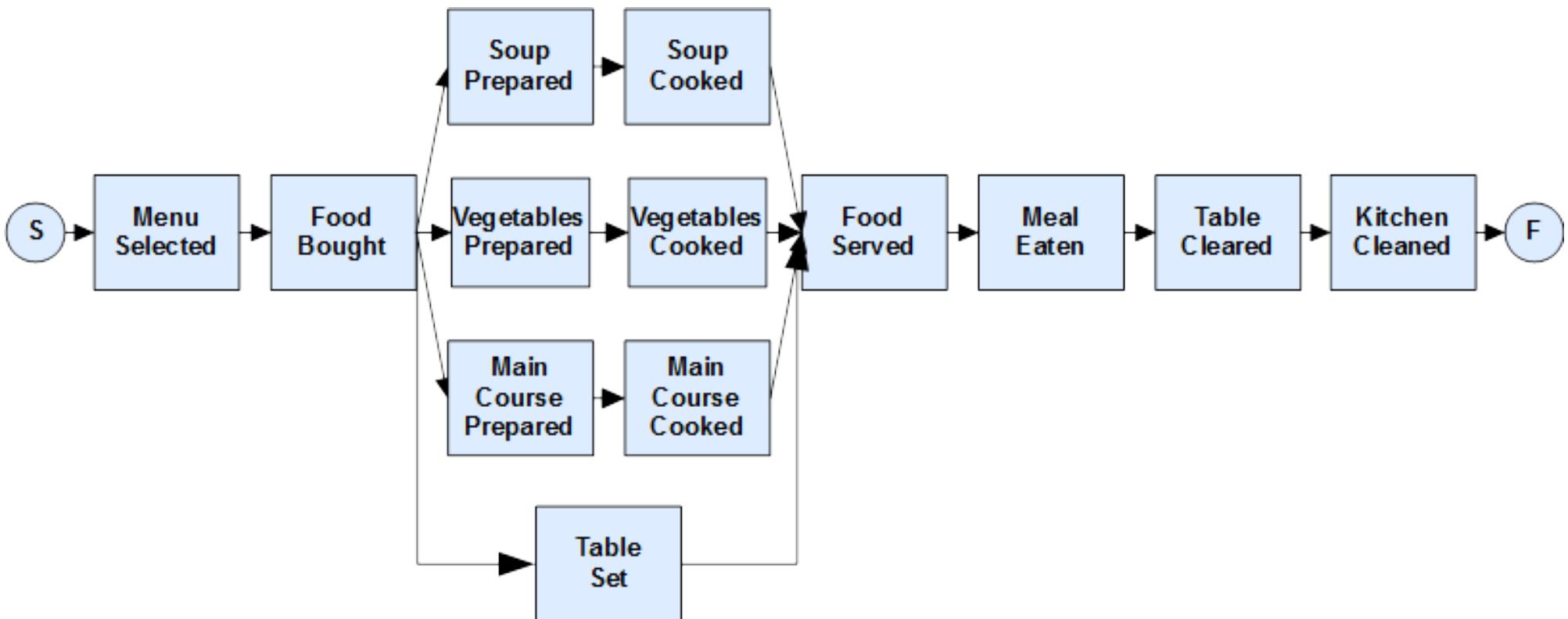
Shed Example



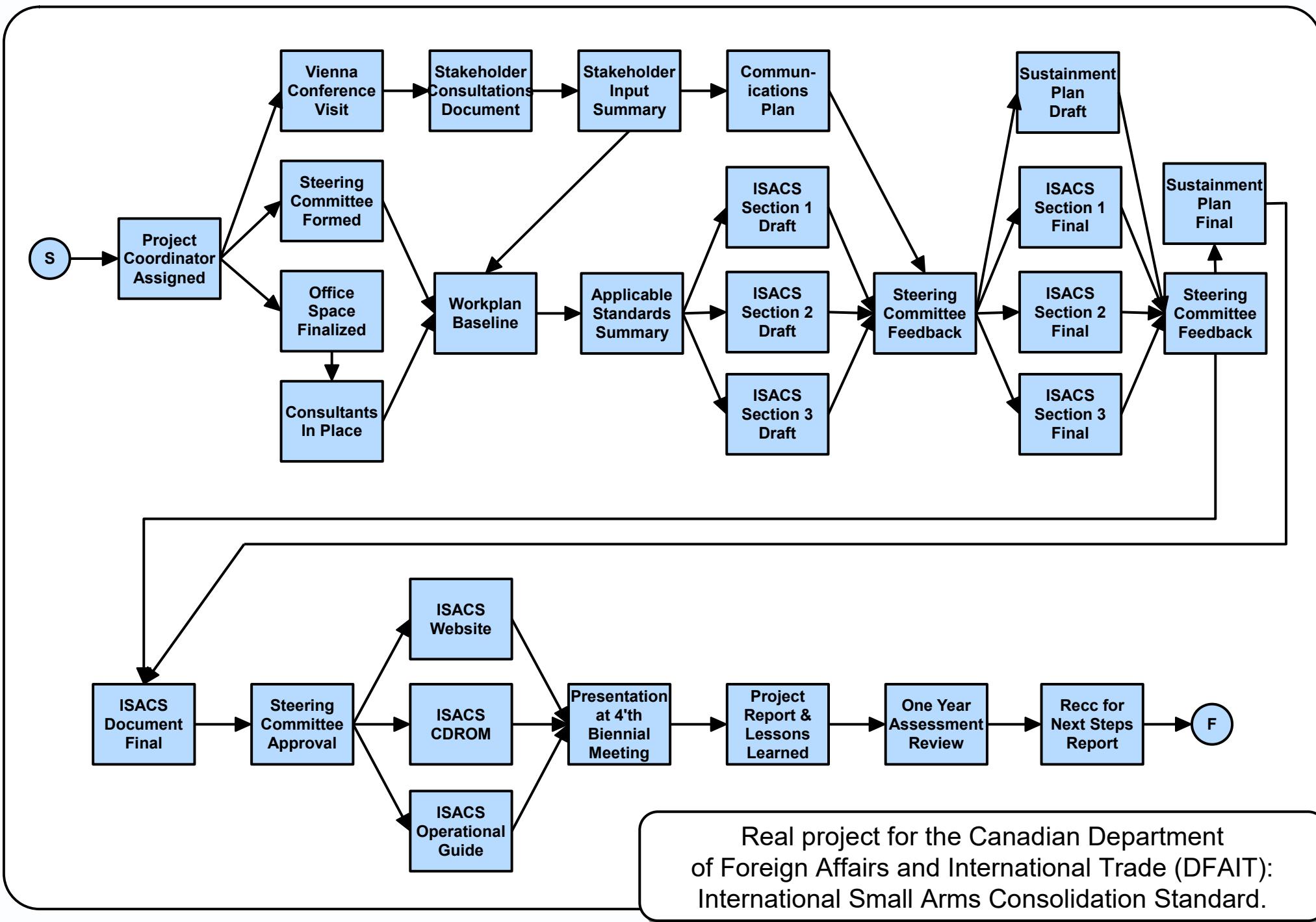
We are just working out the logic at this point, so assume infinite resources. If logically it can be done in parallel, show it that way.



Supper Example



Standards Development Example



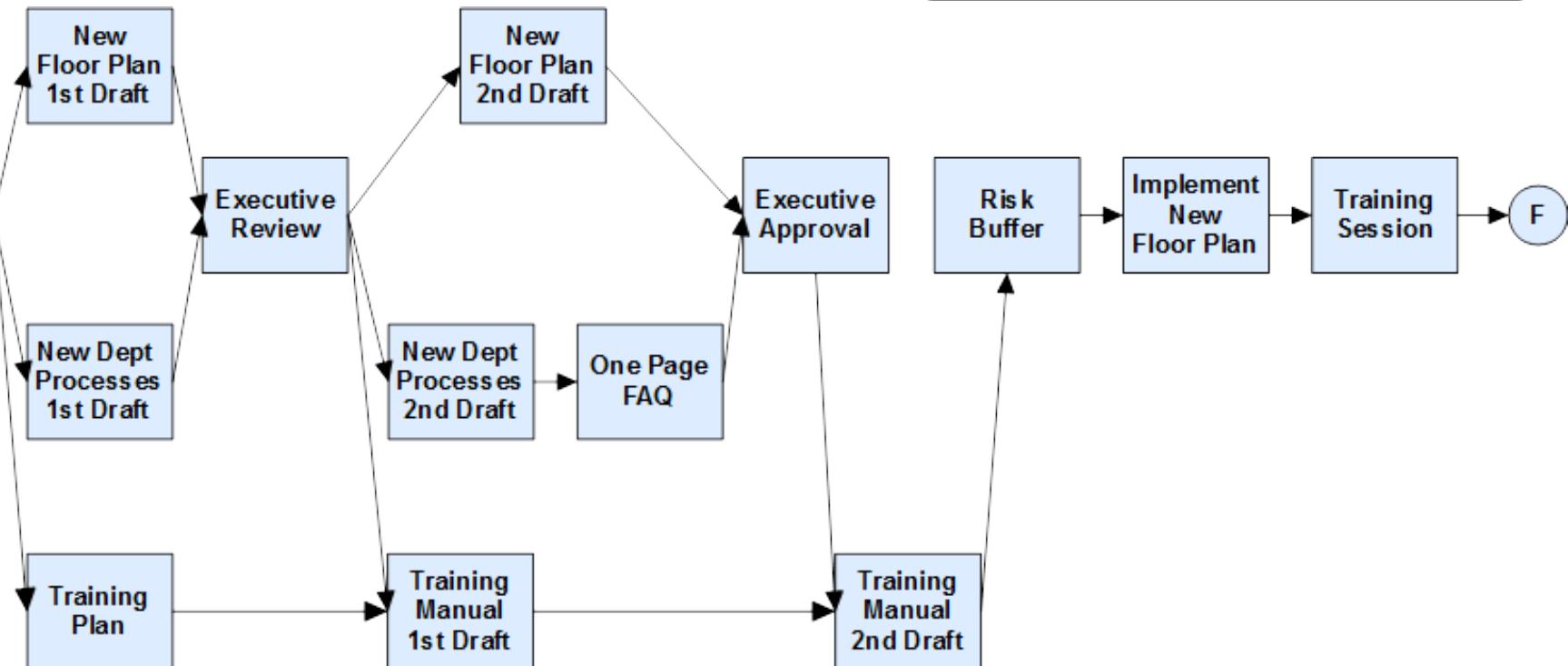


Process Improvement Example

Project: Department Process Improvement Project (DPIP)

Objective: Develop more efficient department processes and improved floor plan to increase productivity by 20%.

We built a WBS for this project in the previous section.





Precedence Diagram Process

Meet with the core project team, with the WBS in hand:

- Expect at least three meetings, a day apart, before it begins to stabilize.

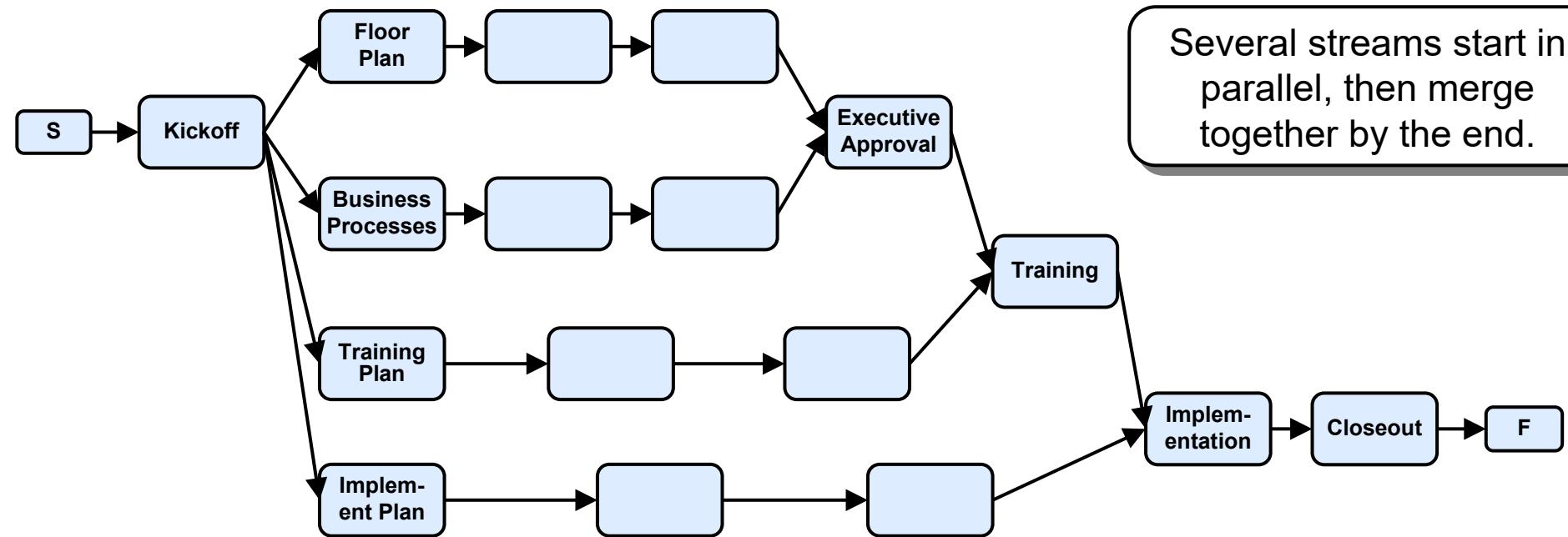
First meeting:

- Tape sheets of flip-chart paper horizontally along a wall to create a working area.
- Write the deliverables onto post-it notes.
- Post a Start box at the beginning and a Finish box at the end.
- Brainstorm moving the deliverables around to find the precedence relationships.
- Key questions: “What do we need to start this deliverable”, and “What can we start once this deliverable is done?”
- Add arrows only for hard dependencies – where the predecessor is needed as input.
- Ensure no dangling deliverables – everything has a predecessor and successor.
- It’s very common to add newly discovered deliverables as necessary – a key value of the process: plans, reviews, drafts, finals, contracts, approvals, etc.
- Critically important – draw arrows in pencil first, then in marker only when the first draft is complete, and the entire team agrees all the arrows in pencil are correct.
- After the first meeting, draw up with any tool with “connector” lines that move with the boxes, e.g. PowerPoint, Visio, [LibreOffice Draw](#) (free open source software).

Subsequent meetings:

- Make redlines to a printout of the precedence diagram, and update the soft-copy after.
- Keep holding meetings until the changes subside and the diagram stabilizes.

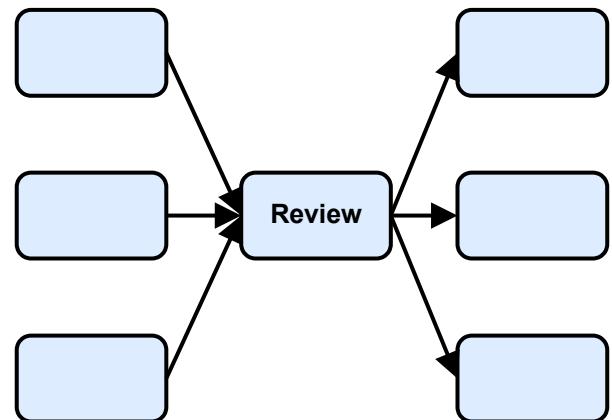
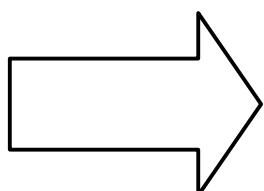
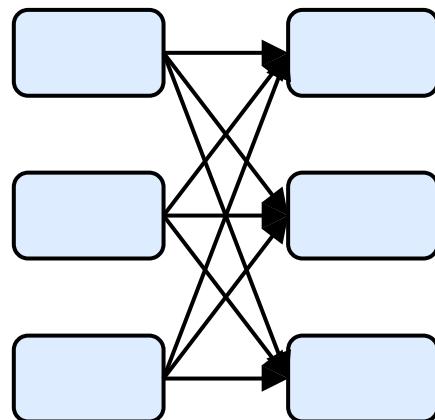
Precedence Diagram Patterns



Complex situation,
high risk of mistakes

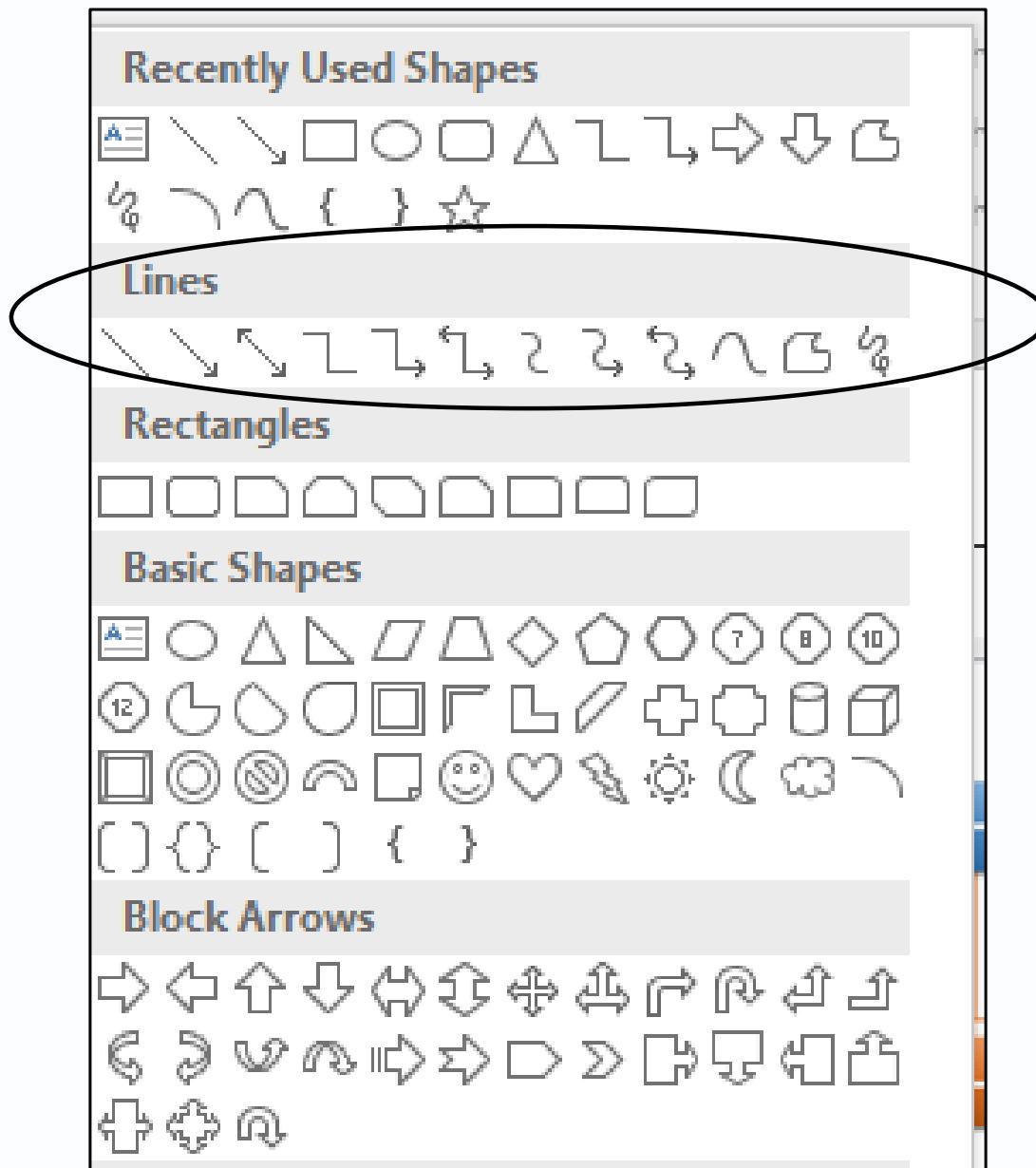
Simplifying
Complexity

More organized,
less risk





Precedence Diagram Tool



Can use Microsoft Office “connector” lines.

Can also use any other drawing tool, e.g. MS Visio or [LibreOffice Draw](#) (free open source software).



Many Gantt tools can manage the precedence diagram as well, and keep the precedence diagram and schedule synchronized. This sounds like the perfect solution. However, in practice, this is the rare case where the control you gain is usually worth the effort of keeping some information in two different tools.

- As projects get medium size and larger, you will have nesting in your precedence diagram. So the top-level precedence diagram used as the primary means of communication will show all the top-level interactions on one page, and there will be more detailed precedence diagrams inside some of the top-level boxes.
- You want to lay out the top level diagram as clearly as possible, including uncrossing as many lines as possible by moving deliverables around to lay the diagram out as flat as possible.
- For clarity you want separate arrows for each link, without melding of line segments as done by most Gantt tools.
- And you don't want the Gantt tool to redraw your top-level precedence diagram according to a canned algorithm every time there is an update to the Gantt chart.

Therefore, to get the layout and detail you want, duplication of some data in a second drawing tool is usually worth the effort, and more so the larger the project gets..

Exercise – Precedence Diagram



Work with your core team to document your project's precedence diagram:

- Start with sheets of flip-chart paper taped together along the wall or a white-board, and a stack of square post-it notes.
- Copy the deliverables onto the post-it notes.
- For each deliverable, ask: what deliverables do we need to start this, and what deliverables can we start once it is done?
- Add new deliverables wherever required – a key value of the process – you can just update the WBS later.
- Make sure every deliverable has a predecessor and a successor, even if only the kick-off and closeout.
- Use a separate arrow for every dependency – this will make things much simpler to follow and understand.
- Critically important: use a pencil or pen first, and get complete agreement from your planning team on all the arrows before drawing them in with marker!
- Draw up the diagram after the meeting, and iterate the process until the diagram stabilizes.

Exercise – Power Of Estimation



This exercise demonstrates that an estimate with any analysis behind it at all can come surprisingly close.

Example – estimate the number of piano tuners in the city you live in:

- *You have no input information at all, no consulting the Internet!*
- *How can you break down the analysis, what is the estimate based on?*
- *Now that you have structured the estimate, how close do you think it actually is?*
- *Imagine if you were able to research the estimate and base it on some hard data – can you see that estimates with any analysis behind them can get very close?*

Estimating Methods



There are five basic methods of estimating:

- Analogous. Comparison to something similar, commonly used for the +/- 100% estimate in initiation – e.g. this project is about twice as complex as that project, so we estimate twice as much time and cost for this one.
- Historical. Use hard estimating data from past experience – it costs \$X to paint 100 square meters, so it will cost about 80 times as much to paint 8,000 square meters.
- PERT / 3-Point. Estimate the best case, most likely, and worst case, and then average – much better than a single point guess (see later slides).
- Delphi. Ask several experts, have them compare their responses and discuss the reasons for their different estimates, and iterate until consensus is reached – used most often for estimating risk % and time (see later slides).
- Activity Breakdown. Break a deliverable down into the activities required, estimate them individually, and roll them up (see later slides).

Activity breakdown is by far the best estimating method for deliverables, and is really required for any project where a final planning accuracy of +/- 10% is desired:

- Only by thinking through the activities required to create the deliverable can the true cost and time be identified.
- You benefit from a magic property of statistics – the sum of the estimates of the activities at the deliverable level is more accurate than the estimate of any single activity because some of the error cancels out.

Statistical Power Of Multiple Estimates



Over many estimates some of the individual error cancels out:

- Any one estimate may have considerable error.
- However, the sum of multiple estimates converges close to the correct value.

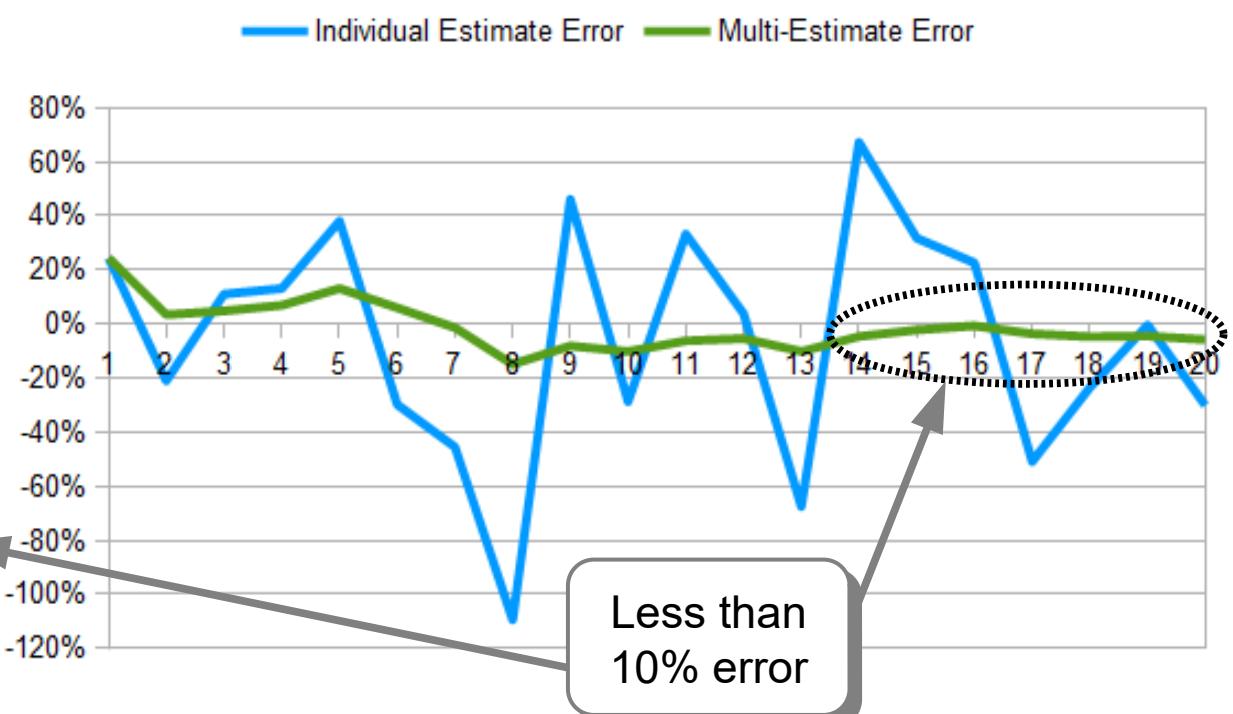
This helps the accuracy of the project-level estimate twice: we estimate the sum of multiple deliverables, and we estimate the deliverables as the sum of multiple activities:

- This is the key reason the project estimate will have an accuracy of +/– 10%.

Number of Estimates	Individual Estimate	Individual Estimate Error	Multi-Estimate	Multi-Estimate Error
1	124.4	24%	124.4	24%
2	79.0	-21%	101.7	3%
3	111.0	11%	104.8	5%
4	113.1	13%	106.9	7%
5	138.1	38%	113.1	13%
6	70.2	-30%	106.0	6%
7	54.5	-46%	98.6	-1%
8	-9.4	-109%	85.1	-15%
9	146.1	46%	91.9	-8%
10	71.2	-29%	89.8	-10%
11	133.3	33%	93.8	-6%
12	103.8	4%	94.6	-5%
13	32.5	-68%	89.8	-10%
14	167.2	67%	95.4	-5%
15	131.7	32%	97.8	-2%
16	122.6	23%	99.3	-1%
17	49.1	-51%	96.4	-4%
18	76.6	-23%	95.3	-5%
19	99.6	0%	95.5	-4%
20	69.9	-30%	94.2	-6%

Example From A Normal Distribution

Here the correct value is 100. Individual estimates vary widely, but the sum over many estimates will be close.



Activity Breakdown



“Whoever wants to reach a distant goal must take small steps.” – Saul Bellow, 1915-2005.

Implementation Plan		Personnel (hours)			Material & Services	
	<u>Activity</u>	Sr	Jr	QA	Item	Cost
Prep	Review requirements	16	8	4	VR Conference	\$60
	Review best prior plans	24	16			
	Prepare plan outline	16	8			
Three versions	First draft	80	60		Software	\$400
	Peer review	8	4		Transportation	\$80
	Second draft	60	40			
Two reviews	QA review			8	You can be wrong later... as long as you have a Basis Of Estimate (BOE).	
	Final update	32	16			
Total		236	152	12		\$540

The person that will create the deliverable when the project is underway must be the same person that estimates it in planning, to ensure accuracy in planning, and commitment during execution.

Decide the deliverable team composition and expertise before estimating, since the duration of work cannot be factored linearly by changing the people later.

Then breakdown the activities required to produce the deliverable, estimate the time in hours not days (sometimes there are 1 hour activities), and include any required material and services.

Look for the common patterns of some kind of preparation work to kick off the effort, more than one version, at least one internal peer review, and a final review before completion.

Fine-Tuning



Fine-tuning significantly improves the estimate, since the first cut is usually too large, because you estimate each activity a bit high in case you are missing something.

Implementation Plan		Personnel (hours)			Material & Services	
<u>Activity</u>		Sr	Jr	QA	Item	Cost
Review requirements		8 -8	4 -4	4	VR Conference	\$60
Review best prior plans		16 -8	16			
Prepare plan outline		16	8			
First draft		60 -20	50 -10		Software	\$400
Peer review		8	4		Transportation	\$80
Second draft		50 -10	30 -10			
QA review				8		
Final update		32	16			
Total		190 -46	128 -24	8		\$540

Then take a look at the total, do a gut check based on past experience, and if it seems too large then cut back the estimate a bit, or if it seems too low then increase it a bit or look for more activities you might have missed. Then fine-tune it again until it seems right.

This critically important step about doubles the accuracy – i.e. if it was 20% off after the first estimate, it is probably only about 10% off after the fine-tuning adjustment.

Productivity & Availability



“You may con a person into committing to an unreasonable deadline, but you cannot bully them into meeting it.”

– Edwards, Butler, Hill & Russell, 1997.

The raw estimate from the deliverable lead is pure “effort” time, and must be factored by productivity and availability to obtain the actual “duration” time:

- Duration = Effort / Productivity / Availability.

Productivity. First factor the raw effort estimate by a productivity percentage:

- No human being sustains 100% productivity – they need breaks, receive telephone calls, must take care of admin issues, etc.
- The productivity factor usually takes into account annual vacation time as well.
- Every organization (sometimes each department) should have a standard productivity factor, typically between 70% and 85%.
- Construction companies typically factor estimates for work done outside in the winter at 60% productivity – people move more slowly all dressed up in the cold.
- Each human resource estimate must be divided by their productivity factor to get their realistic costed time, before entering into the Gantt chart tool.

Availability. Then, if personnel are part-time, also factor by availability percentage:

- Availability is usually entered into and factored by the Gantt chart tool.
- If a resource is available 50% of the time the tool will double the duration time, if only available 33% of the time it will triple the duration, etc.



Estimating Spreadsheet

A full estimating spreadsheet that takes productivity and availability into account:

Deliverable:	Process Update Draft 1				Material & services cost:			\$2,680
Owner:	A. Allen				Resources cost:			\$36,800
Duration (days):	59.6				Total cost			\$39,480
Resource:	Proc. Lead	Bus. Analyst	System Analyst	User Rep.				
Hours a day:	8.0	8.0	8.0	8.0				
Productivity:	85%	85%	85%	85%				
Availability:	100%	50%	33%	50%				
Rate / hour:	\$100	\$80	\$80	\$60	Totals (Hours)	Max Dur. (Days)	Material & Services	
Kick-off	4	4	4	4	16.0	1.8	Food	4 \$20 \$80
Requirements review	4	4	4	4	16.0	1.8		
Best practices review	4	2	2		8.0	0.9		
Readiness review	4	2	2		8.0	0.9		
Review existing processes	16	16	16	8	56.0	7.1		
Identify update processes	8	8	4	4	24.0	2.4		
Analyze efficiency updates	16	16	8	4	44.0	4.7		
Flowchart processes	4	8	16		28.0	7.1	Software	1 \$400 \$400
Document new processes	8	16	24	2	50.0	10.7	Colour printing	1 \$850 \$850
Peer review	4	8	8		20.0	3.6	Video rental	2 \$250 \$500
Update processes	4	8	8	1	21.0	3.6		
User review	4	4	4	4	16.0	1.8		
Update processes	8	12	16		36.0	7.1		
User approval	2	2	2	2	8.0	0.9		
Final document	4	8	12	1	25.0	5.3	Colour printing	1 \$850 \$850
Effort hours	94.0	118.0	130.0	34.0	376.0	59.6	Material & services cost:	\$2,680
Effort days	11.8	14.8	16.3	4.3	47.0	Could incr. effort:	1. Unavailability of matrixed team or user representative. 2. Interfaces with external elements.	
Productive hours	110.6	138.8	152.9	40.0	442.4			
Productive days	13.8	17.4	19.1	5.0	55.3	Could decr. effort:	1. Authorization of User Rep to call on resources whenever required. 2. PM course for entire team :-)	
Duration hours	110.6	277.6	463.5	80.0	931.7			
Duration days	13.8	34.7	57.9	10.0	116.5			
Costs	\$11,059	\$11,106	\$12,235	\$2,400	\$36,800			

PERT & 3-Point Techniques



PERT. The Program Evaluation Review Technique is faster and a lot better than a single-point guess, about +/- 50% accuracy, but not as good as activity breakdown:

- PERT is driven by the observation that most people produce low estimates because they are afraid of looking incompetent.
- So the key value of the technique is it factors in the worst-case.

The method estimates three numbers – optimistic case (O), most likely case (M), and pessimistic case (P) – and then calculates the statistical likelihood:

- $\text{PERT} = (O + 4*M + P) / 6$.
- M is multiplied by 4 to approximate a normal statistical distribution, where numbers are more likely to fall in the middle, so the average must divide by 6.
- Since people usually estimate P much larger than M, the PERT average provides a larger and therefore more realistic estimate.

3-Point. However, experience shows PERT often still underestimates in practice, so a “straight 3-point” average, with no weighting, is often recommended today:

- $\text{3-Point} = (O + M + P) / 3$.

Standard Deviation. You can also pad the estimate with the $SD = (P - O) / 6$:

- Add one SD, and the actual result should be \leq the estimate 84% of the time.
- Add two SD's, and the actual result should be \leq the estimate 98% of the time.
- Add three SD's, the actual result should be \leq the estimate 99.9% of the time.



PERT & 3-Point Example

Let's say a deliverable owner estimates that their work will most likely take 15 days to complete, could take 10 days if all goes perfectly, or as much as 30 days if there are significant problems:

- PERT = $(10 + 4 \cdot 15 + 30) / 6 = 16.7$
- 3-Point = $(10 + 15 + 30) / 3 = 18.3$

The standard deviation is $(30 - 10) / 6 = 3.3$, therefore padding the PERT estimate indicates that, if this estimate is drawn from a normal distribution:

- Adding one SD means that 84% of the time $(16.7 + 3.3) = 20$ days should be enough.
- Adding two SD's means that 98% of the time $(16.7 + 3.3 + 3.3) = 23.3$ days should be enough.
- Adding three SD's means that 99.9% of the time $(16.7 + 3.3 + 3.3 + 3.3) = 26.6$ days should be enough.
- You can also use statistical formulas to determine how many SD's to add to obtain any given % confidence you want, e.g. 60%, 70%, 80%, etc.

These are faster techniques than activity breakdown, however not as accurate:

- Because the larger the item being estimated, the less accurate any estimating technique will be, and PERT and 3-Point typically estimate large items.
- If the project and an accurate estimate are important, instead break the project into individual deliverables, then the deliverables into activities.

Delphi Technique



“Know thyself.”

– Carved above the entrance to the Oracle of Delphi.

Delphi estimation can be used for deliverable time and cost, however is primarily used for risk probability and time, where there is often little information to go by:

- Gather your core project team, or a group of subject matter experts if assessing a domain specific item, and provide them with all relevant information.
- Each member writes down their first estimate on a piece of paper.
- Everyone reveals their estimate at the same time, removing the influence of early estimates on later ones if instead you had gone around the table.
- Each member then discusses the reasoning behind their estimate.
- Then iterate – each member writes down their next estimate, reveals them all at once, and each member discusses the reasons for their updated number.
- Usually less than five rounds are needed to get a consensus estimate – can average the results if within 10% or after five rounds.
- If the team is new to the technique, brief them on the process before beginning, emphasizing the goal is not to win by talking the others into your estimate, but to share knowledge and factor it into your updated estimates for each round.

Produces a much better and more defensible estimate than an individual guess:

- Rule of thumb, about $+/- 33\%$ accuracy.

Handling Estimating Error



Start by implementing the best practices to minimize estimating error:

- Have the person who will do the job in execution define the deliverables and perform the estimating during planning, so they will feel responsible for producing the most accurate result.
- Have the owner provide an activity breakdown for each deliverable, so they can think through the detail and provide the most realistic results.

However, what if that doesn't happen for reasons outside your control, or some team members are junior or have not done this kind of work before, or you have other reasons to be concerned estimates could be significantly in error?

- Check the estimates by finding an independent comparison, such as a standard industry metric, or results from a past project.
- Obtain one to three independent estimates from other parties, preferably from a different department, group, or contractor to ensure objectivity.

If you are still concerned the estimate is too low, the risk budget is your last resort safety net, and can be used to acknowledge the estimating problem:

- Add a line to the risk register called something like “Estimating uncertainty” and Delphi an appropriate probability, time, and cost (see Risk section) to cover the estimating shortfalls.

Exercise – Estimating



Have the owners of the deliverables provide you with a basis of estimate for each deliverable:

- *Use historical information if available, otherwise use activity breakdown.*
- *Use a standard spreadsheet format provided to all the owners.*
- *Ask the deliverable owners to identify all the human resources, material, and services.*

Gantt Chart



The Gantt chart maps the precedence diagram onto the calendar, and is the formal baseline for the project time.

For a project of any complexity, we need the help of a Gantt chart application, e.g. Microsoft Project, Primavera, GanttProject (open source), to do all the date calculations:

- Start by entering the project start date.
- Enter the number of hours in the work day (by resource if it differs).
- Enter the deliverables, their durations from the estimates, and the links between them from the precedence diagram.
- The tool skips weekends and any specified holidays and lays the deliverables across the calendar.
- The tool calculates the critical path driving the schedule end date.

Creating the precedence diagram first, then entering the structure into the Gantt tool, makes building the schedule easy, and provides several other advantages:

- The top-level schedule includes only deliverables, not activities.
- The number of precedence links is minimized to just what is needed.
- The Gantt chart is as simple as possible, easily maintainable, and actually useful throughout the project!
- Avoid the built-in precedence diagram function in the Gantt software since it redraws the diagram after every update, and instead maintain the precedence diagram in a separate drawing tool – the need to make updates in two tools is more than outweighed by the control you retain over the diagram layout.

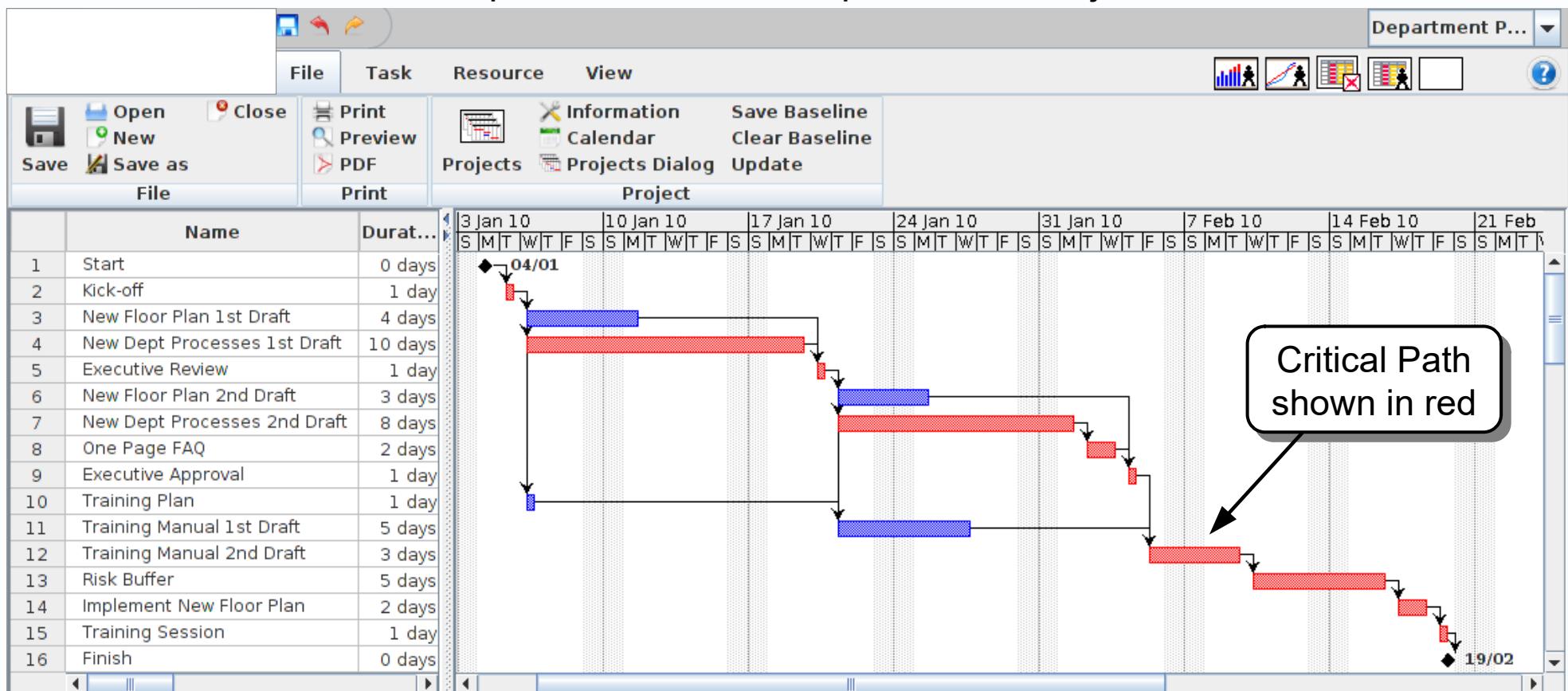
Gantt Chart Example



“Time is the scarcest resource, and unless it is managed, nothing else can be managed.”

– [Peter Drucker](#), management consultant.

Department Process Improvement Project



The Gantt chart is one-to-one with the precedence diagram:

- The deliverables are the bars.
- The precedence arrows are the links.

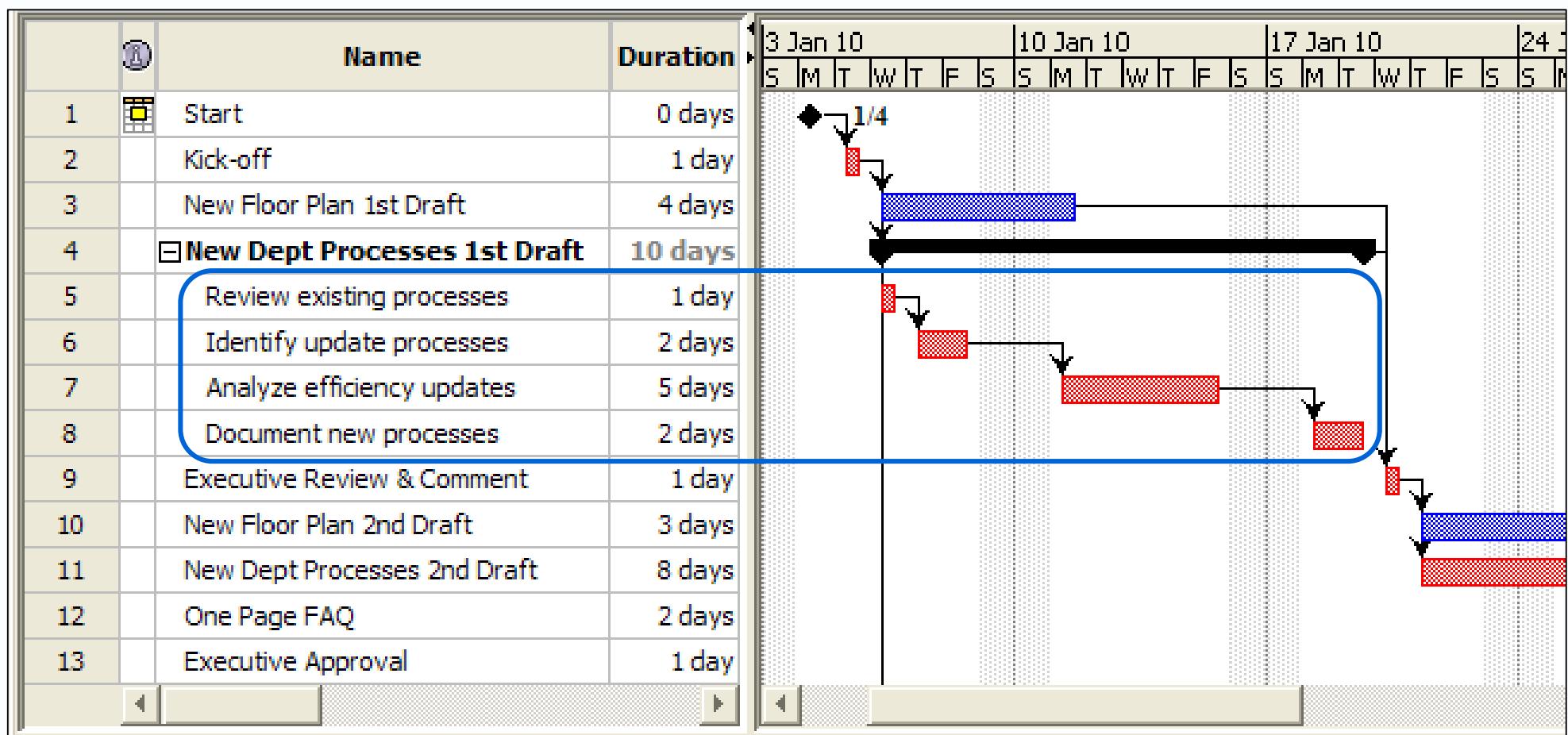
Gantt Chart With Work Packages



Work packages, the max two-week subdivisions of longer deliverables, don't go on the WBS or precedence diagram since they would just obscure the deliverable focus of those tools.

Work packages do go on the Gantt chart to enable later monitoring and control, so you will know the real status every month.

Simply indent them underneath their deliverable for easy management.



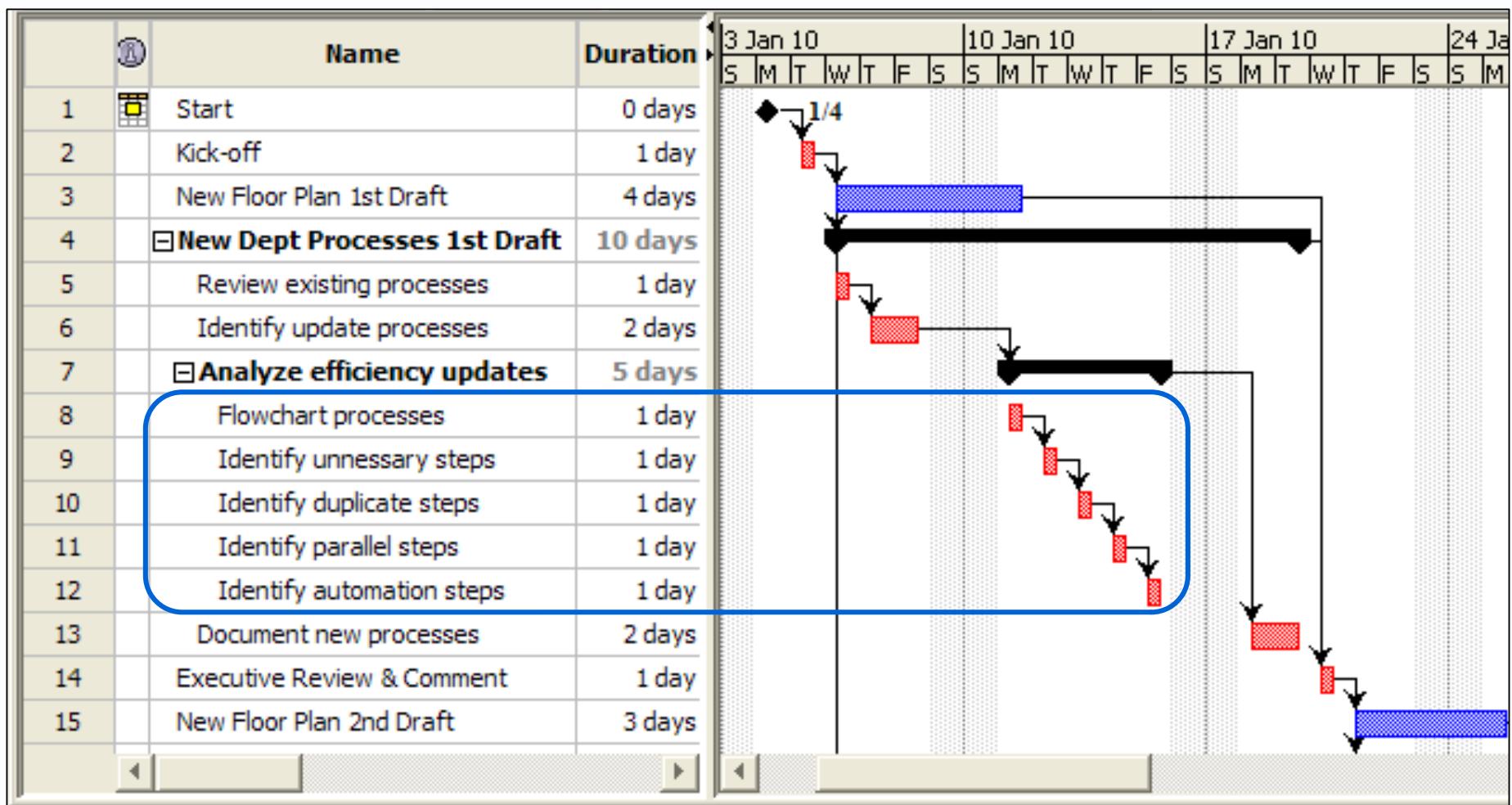
Gantt Chart With Activities



We sometimes also add activities to the Gantt Chart, when they have very different resource requirements, and we want to record the exact time the resources are required:

- Later in planning we will look at using resource usage reports across the calendar.

We can indent the activities under the deliverable or work package, and collapse or expand them as needed.



Critical Path



“A project without a critical path is like a ship without a rudder.”

– D. Meyer, Illinois Construction Law.

The critical path can be defined three ways:

- The longest path of back-to-back deliverables driving the schedule.
- The shortest amount of time in which the project can be done (since it can't be done in any less time than the longest path).
- If any deliverables on the critical path delay, the end date will slip.

The rest of the deliverables have some “float”, sometimes also called “slack”:

- The amount of time the deliverable can delay before it becomes critical and starts pushing out the end date.
- By definition, all deliverables on the critical path have zero float.

Knowing the critical path is enormously useful for the project manager:

- The PM can focus most of their attention on the critical path, since delays there drive increases in schedule, cost, and brand new risks.
- If the project is having schedule difficulties, the PM can move resources from non-critical path deliverables to help with critical path deliverables (assuming there is a skills match).

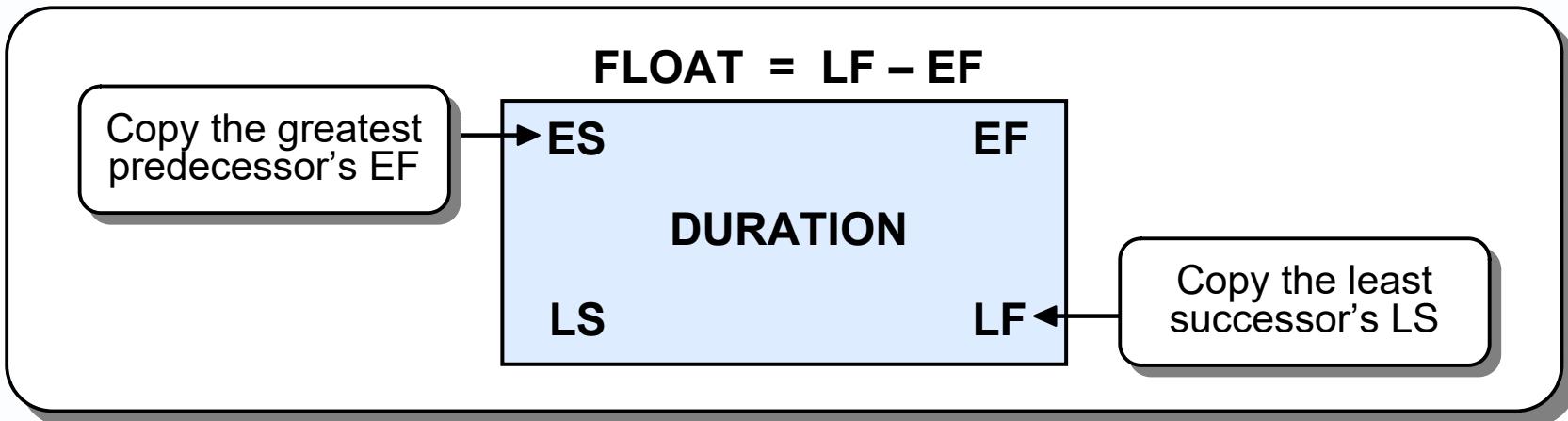
Critical Path Process



Let's look at how the critical path is calculated by the Gantt chart tool under the hood, so we will understand it in our bones, beyond simply that it is “important”.

1. *Forward pass:* scan the project from the beginning to the end, and find each deliverable’s earliest start (ES) and earliest finish (EF):

- Copy the *greatest* predecessor’s EF to the successor’s ES.
- *Add* (ES + Duration) to get the EF.

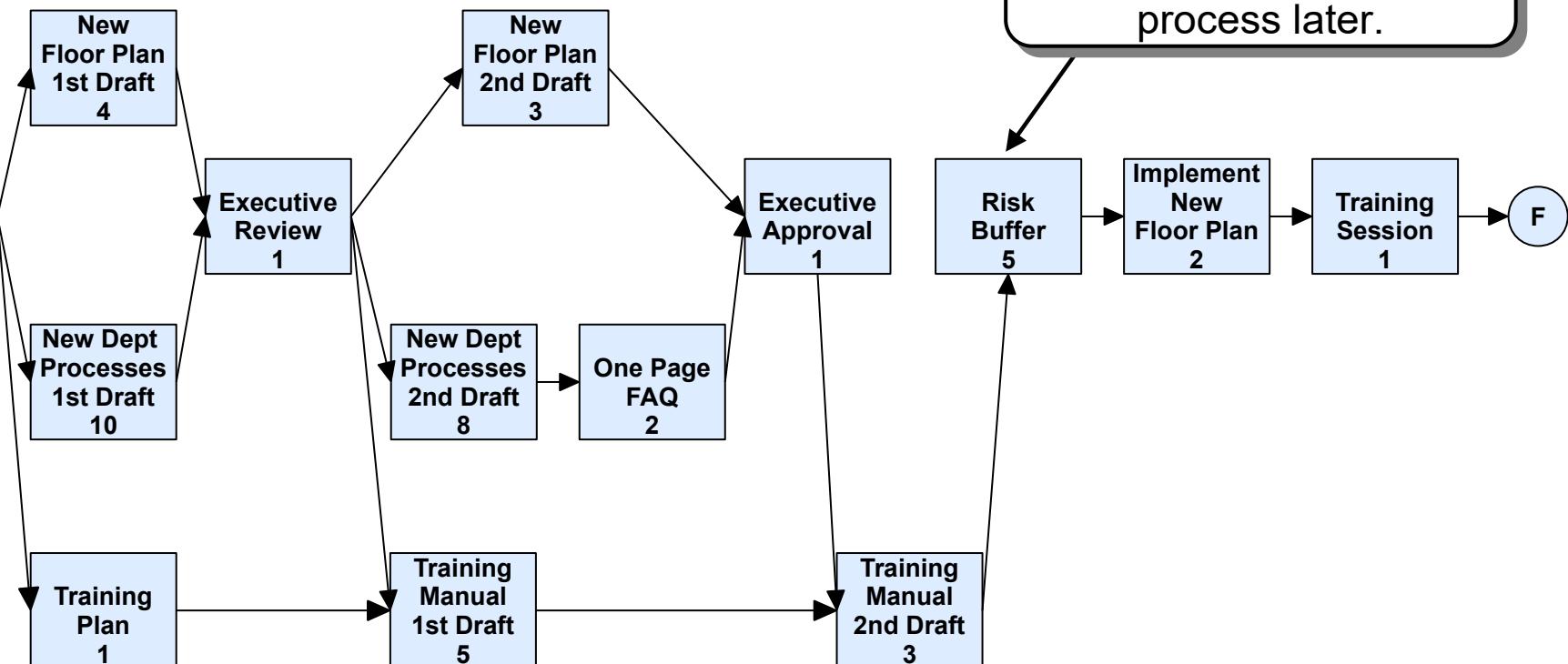


2. *Backward pass:* scan the project from the end to the beginning, and find each deliverable’s latest start (LS) and latest finish (LF):
- Copy the *least* successor’s LS to the predecessor’s LF.
- *Subtract* (LF – Duration) to get the LS.
3. Calculate each deliverable’s float as the difference between the latest finish and earliest finish, or (LF – EF).

Critical Path Example

Here's the Department Process Improvement Project again, with durations shown for each deliverable just for this exercise (usually you never put numbers on the precedence diagram which is just for showing the logic – numbers go only in the Gantt chart tool).

Let's perform a forward pass, backwards pass, calculate float, and determine the critical path.



Risk buffer is defined by the Risk Management process later.

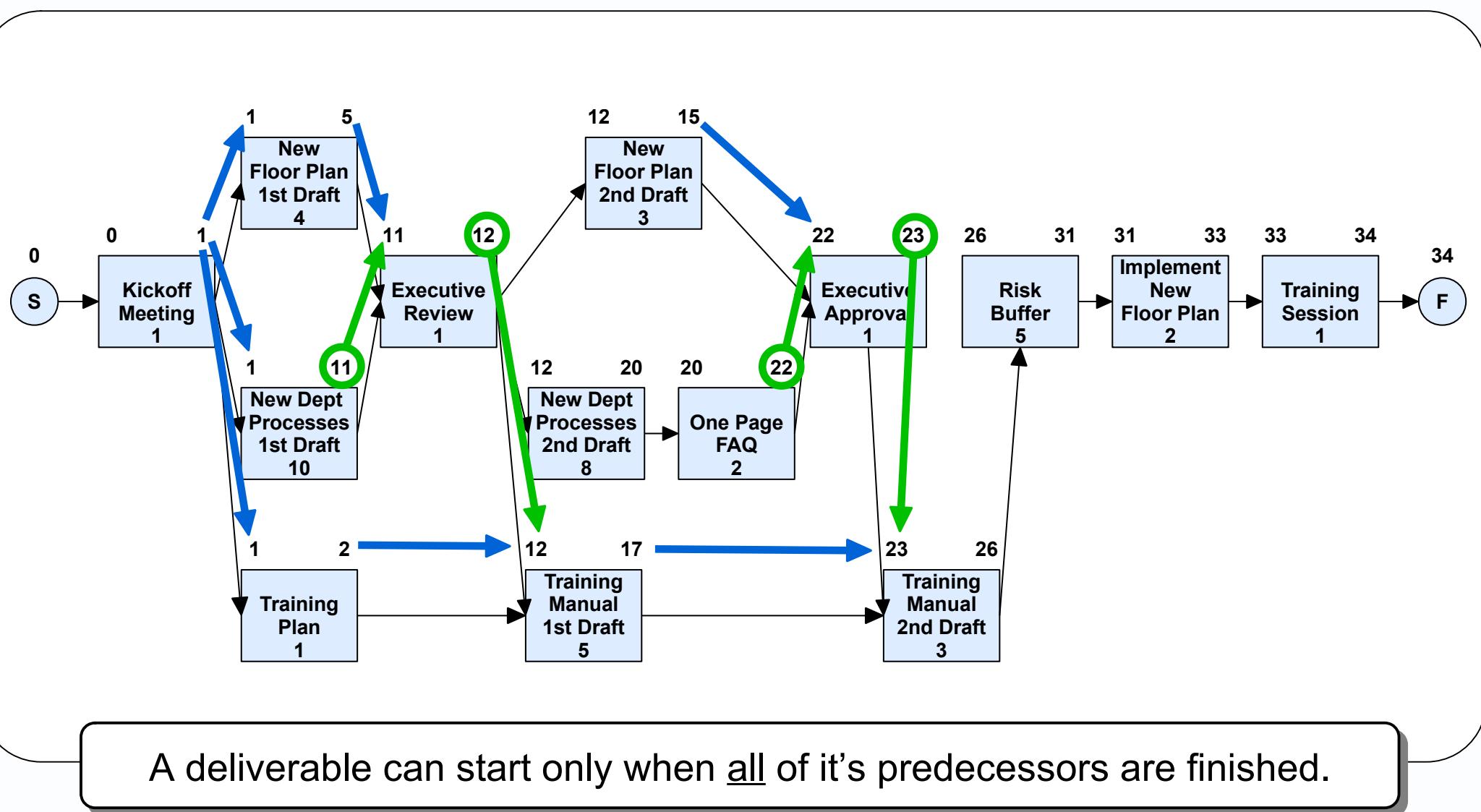
Same project for which we built a WBS in the earlier section.

Forward Pass



Copy the predecessors' greatest earliest finish (EF) to the next deliverable's earliest start (ES).

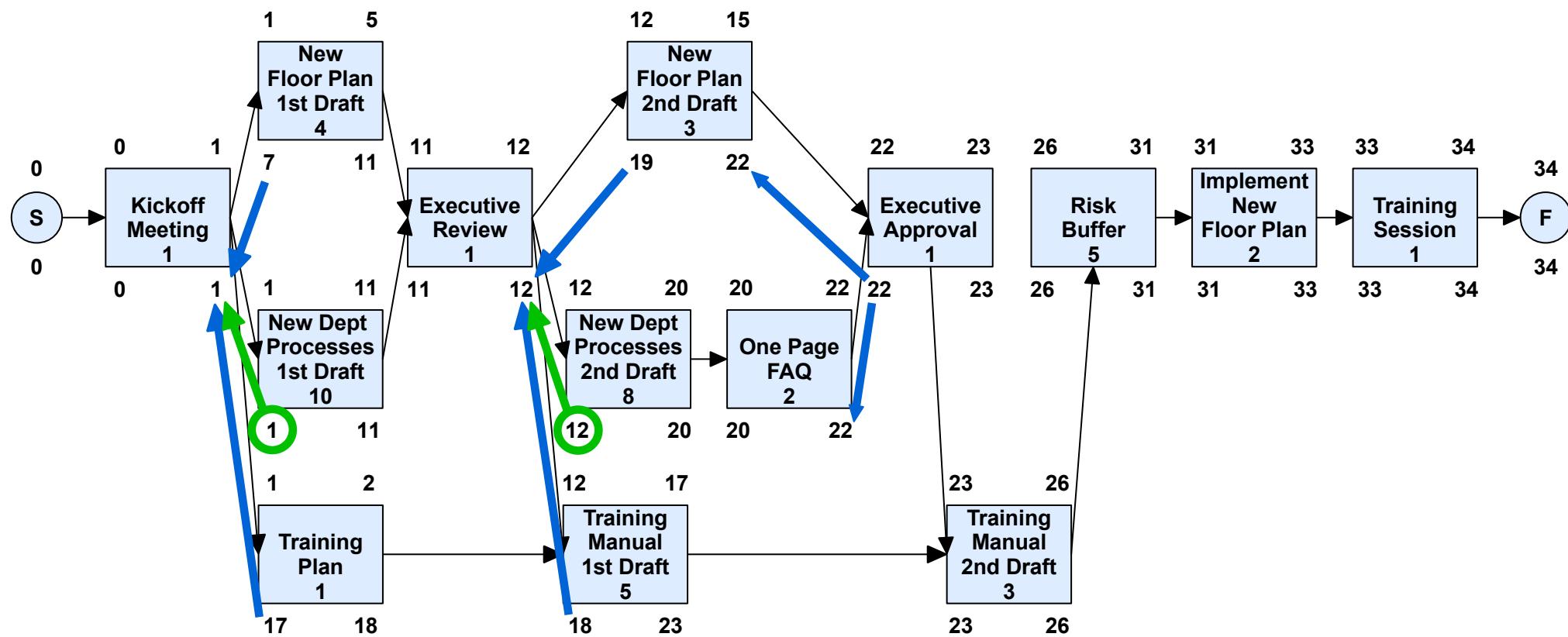
Simply add earliest start (ES) + duration to get the deliverable's earliest finish (EF).



Backward Pass

Copy the successors' least latest start (LS) to the previous deliverable's latest finish (LF).

Simply subtract latest finish (LF) – duration to get the deliverable's latest start (LS).

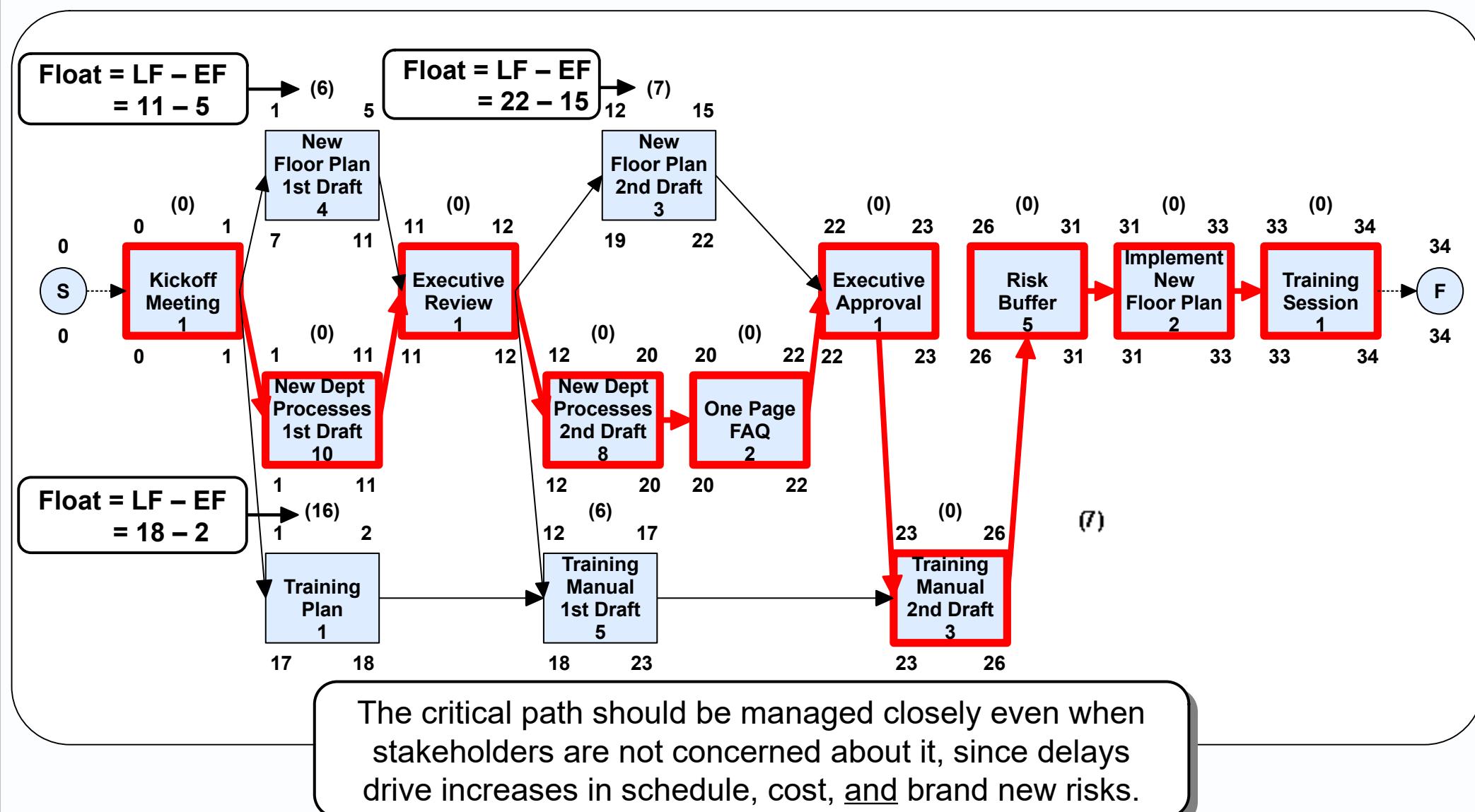


A deliverable can finish no later than its earliest successors' latest start.

Critical Path With Float

Float = Latest Finish – Earliest Finish

Where the float is zero, then the deliverable cannot be even one day late without pushing out the deliverables in front of it and extending the end date, which means it's on the critical path.



Exercise – Schedule



Determine your project schedule and critical path:

- Load the precedence diagram into a Gantt chart tool.
- Provide the project with a start date.
- Load the durations of each deliverable, either by direct entry for smaller projects, or including the work packages and possibly activities for more complex projects that need to precisely identify when different resources are required.
- Have the software tool determine the critical path that drives the end date.
- Consider the results and consult with your team. Calculation of the critical path provides so much useful information, it is often a trigger for making significant changes to the project, e.g. to shorten the schedule to fit within a sponsor constraint.
- Make any adjustments to the plan you deem necessary, including changes to the WBS, precedence diagram, resource allocations, or other items, and then recalculate the schedule and consider again.

Schedule Milestones



“Once you define the deliverables, everything gets easy”:

- Milestones are simply a subset of the existing deliverables that are important to stakeholders because they show significant achievement towards project completion.

Purpose of milestones:

- Reduce the set of deliverables to a manageable number for reporting each month to the stakeholders – e.g. usually not initial drafts.
- Provide enough to ensure the stakeholders have a good understanding of the project status every month and can do their job of providing oversight.
- If the project is contractual, milestones can provide agreed checkpoints for interim payments – e.g. all the material has been purchased.

Rule of thumb – at least one every 2 months:

- Ensures enough granularity for stakeholder oversight – not too much time goes by without an official reporting milestone.
- But very flexible – two milestones can be on the same day if they are important enough to the stakeholders.
- When you present the project plan you sometimes receive input from the stakeholders to add more deliverables for milestone reporting.

Exercise – Milestones



Select the set of milestones you will use for reporting to stakeholders:

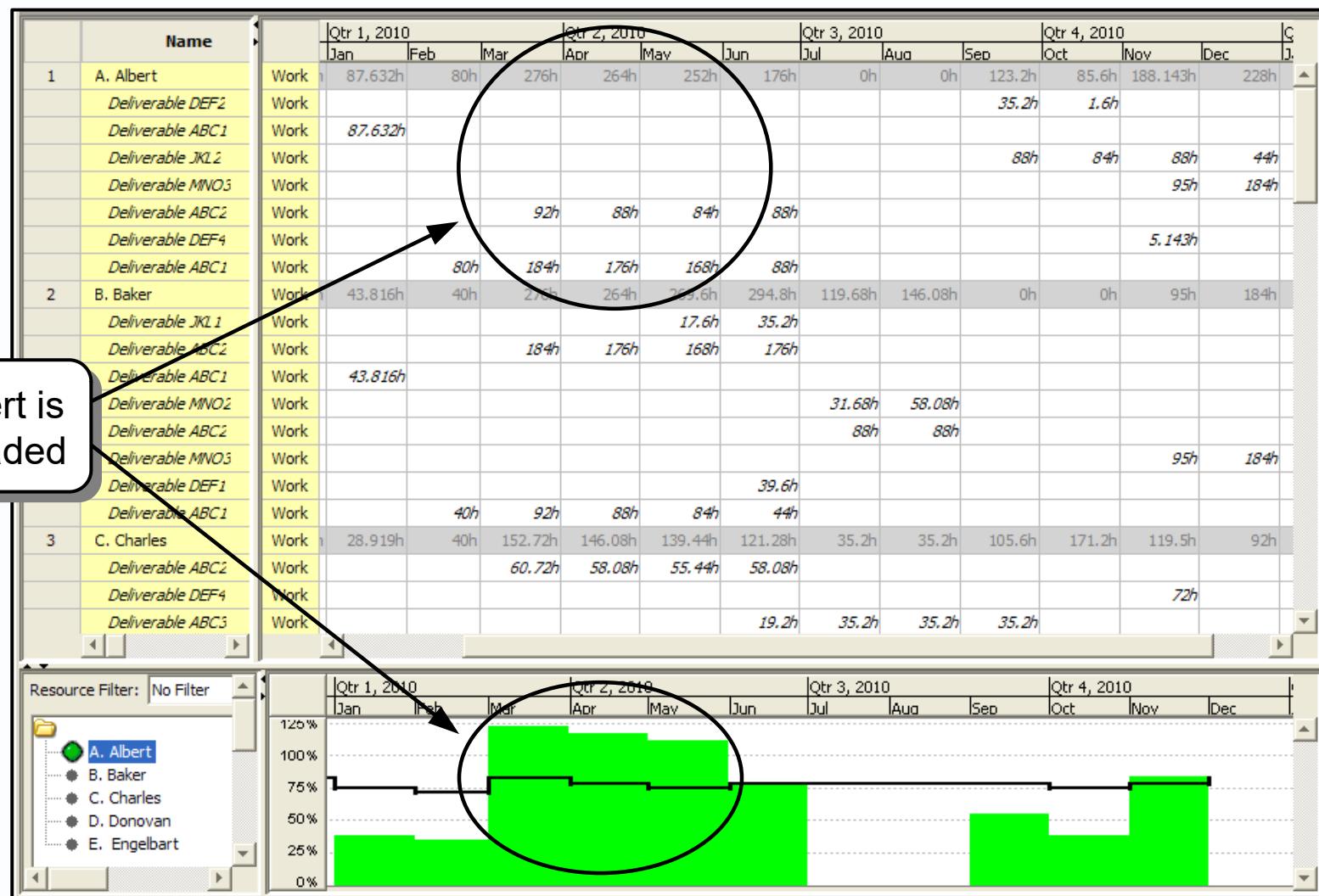
- Select a subset of the deliverables that are likely of interest to the stakeholders and show significant project achievement.
- They can be close together in time, but should be no more than two months apart.
- Although usually on the critical path, they do not have to be.
- Document the milestones as appropriate, e.g. in Microsoft Project by adding a zero day task to the end of the deliverable, by putting "(MS)" at the end of the deliverable name, or just including a list of the milestone deliverables in the schedule section of the project plan.



Resource Leveling

Load all resources for each deliverable into the Gantt tool, obtain a loading report, and solve any over-allocations or shortages, moving from the beginning forward:

1. If the project is schedule constrained:
 - Use float to move deliverables forward.
 - If not possible, find more resources.
2. If the project is resource constrained:
 - Use float to move deliverables forward.
 - If not possible, extend the schedule.



Resource Planning



Include a resource planning section in the project plan, or a prepare a separate document for very large projects:

- Include a project organization chart showing the PM, area leads, and any other members of the team known at this point – but put the customer at the top to keep the team focused on the real purpose of the work.
- Include a cross-reference of team members to their deliverables.
- Describe where you will get team members – internal, hire, contract.
- Describe how you will replenish team members if they leave the project.
- Describe the potential uses of any training budget within the project.

Include a section on “critical resources” if you have any:

- List the most important resources that are critical to the project success and hard to find – people, equipment, facilities, etc.
- Describe how you will get them, and replenish them if needed.
- If the booking dates for critical resources cannot be missed because you will not be able to get them again for some time, add enough time buffer within the schedule to ensure the project will be ready for them when needed (this is the only case of internal buffer, usually bundled all together at the end – see Risk section).



Perform resource leveling on your project:

- *Identify all over-allocations and solve them by using float, adding resources, or extending schedule as appropriate.*
- *Re-examine the critical path, consult with your team, and iterate the planning process to make any changes to the project required.*

Prepare a resource plan for your project, either a section of the project plan or a separate document:

- *Include a human resources section, with an organization chart, and a cross-reference of team members to deliverables.*
- *Describe where you will get team members, how you will replenish them, and the uses of any training budget.*
- *Include a section on any critical resources, including where you will get and replenish them.*



Estimating Cost

Cost estimates are obtained from the deliverable activity breakdowns, a sum of the personnel costs and any material and services.

Direct Cost. Make sure the activity breakdowns include all the direct costs:

- All variable costs – dependent on the amount of effort:
 - ➔ People * time * rates.
 - ➔ Equipment rental * time.
 - ➔ Printing * copies.
 - ➔ Travel * trips.
 - ➔ Paint * square feet.
- All fixed costs – one time expenditures per deliverable:
 - ➔ Computers, equipment, furniture, etc.

Indirect Cost. Deliverable estimates should not include any overhead or “indirect” costs, because they are already included in the rates for the direct costs:

- All the costs that would be too much trouble to calculate and track individually, including items like office rent, electricity, and office supplies, and support from departments like IT, QA, contracts, legal, shipping and receiving, etc.
- Instead they are calculated once a year, organization wide, and included in the cost of direct items – this is why “rates” are so much higher than salary.



Cost Breakdown

Cost is based on people rates (often ~2x salary) plus material and services.

Deliverable:	Process Update Draft 1				Material & services cost:			\$2,680					
Owner:	A. Allen				Resources cost:			\$36,800					
Duration (days):	59.6				Total cost			\$39,480					
Resource:	Proc. Lead	Bus. Analyst	System Analyst	User Rep.	Totals (Hours)	Max Dur. (Days)	Material & Services						
Hours a day:	8.0	8.0	8.0	8.0			Item	Qty	Cost	Subtotal			
Productivity:	85%	85%	85%	85%									
Availability:	100%	50%	33%	50%									
Rate / hour:	\$100	\$80	\$80	\$60									
Kick-off	4	4	4	4	16.0	1.8	Food	4	\$20	\$80			
Requirements review	4	4	4	4	16.0	1.8				\$0			
Best practices review	4	2	2		8.0	0.9				\$0			
Readiness review	4	2	2		8.0	0.9				\$0			
Review existing processes	16	16	16	8	56.0	7.1				\$0			
Identify update processes	8	8	4	4	24.0	2.4				\$0			
Analyze efficiency updates	16	16	8	4	44.0	4.7				\$0			
Flowchart processes	4	8	16		28.0	7.1	Software	1	\$400	\$400			
Document new processes	8	16	24	2	50.0	10.7	Colour printing	1	\$850	\$850			
Peer review	4	8	8		20.0	3.6	Video rental	2	\$250	\$500			
Update processes	4	8	8	1	21.0	3.6				\$0			
User review	4	4	4	4	16.0	1.8				\$0			
Update processes	8	12	16		36.0	7.1				\$0			
User approval	2	2	2	2	8.0	0.9				\$0			
Final document	4	8	12	1	25.0	5.3	Colour printing	1	\$850	\$850			
Effort hours	94.0	118.0	130.0	34.0	376.0	59.6	Material & services cost:	\$2,680					
Effort days	11.8	14.8	16.3	4.3	47.0	Could incr. effort:	1. Unavailability of matrixed team or user representative. 2. Interfaces with external elements.						
Productive hours	110.6	138.8	152.9	40.0	442.4		1. Authorization of User Rep to call on resources whenever required. 2. PM course for entire team :-)						
Productive days	13.8	17.4	19.1	5.0	55.3	Could decr. effort:	1. Authorization of User Rep to call on resources whenever required. 2. PM course for entire team :-)						
Duration hours	110.6	277.6	463.5	80.0	931.7		1. Authorization of User Rep to call on resources whenever required. 2. PM course for entire team :-)						
Duration days	13.8	34.7	57.9	10.0	116.5								
Costs	\$11,059	\$11,106	\$12,235	\$2,400	\$36,800								



We typically set up financial codes called “cost accounts” during planning against which all expenditures will be recorded so we can track the costs later during execution:

- Personnel will enter their time by cost account on timesheets.
- All purchased material and services will be allocated to a cost account.

Cost accounts can be assigned to an individual work package, a deliverable, or a set of deliverables, depending on the desired level of tracking:

- Very important elements of work might get a single cost account, even if the effort is relatively small – e.g. for a key piece of equipment.
- Several consecutive short duration deliverables all done by one person might be grouped under a single cost account.

The number of cost accounts is usually negotiated between the PM and the finance department, depending on how much granularity is needed for tracking and reporting:

- The finance department usually wants less cost accounts, however too few won't provide enough visibility for the cost tracking.
- On the other hand, too many accounts will drive the team crazy, e.g. if they have to enter several accounts on their timesheets every day.

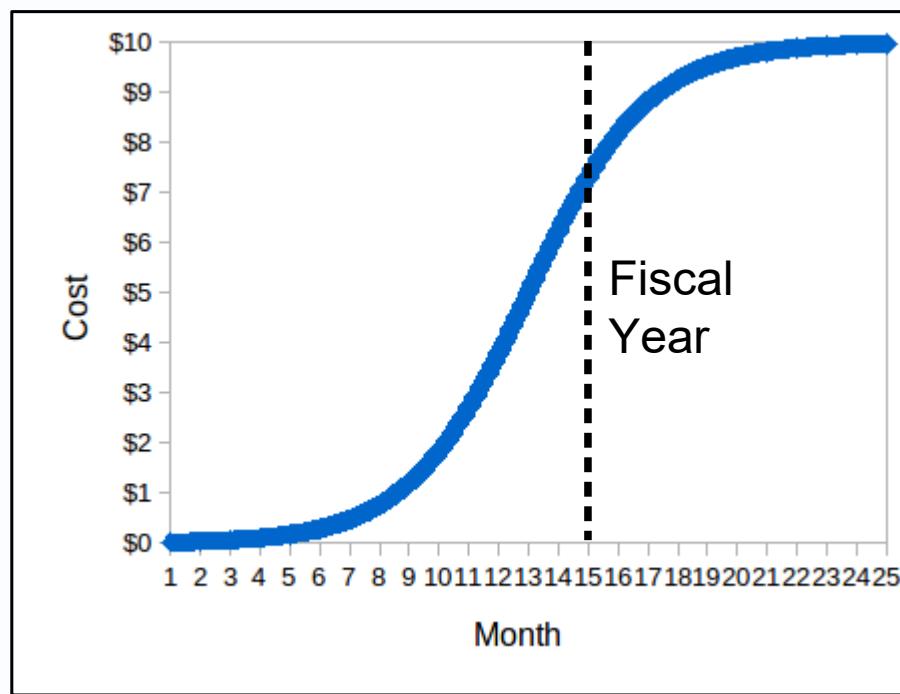


Cost Baseline

For a small project the cost baseline is just the total cost, e.g. \$25K, usually broken down by deliverable.

For a larger project the baseline is the “Cumulative Cost Curve”:

- A graph of the planned spending across time, usually prepared by the finance department by combining the deliverable costs and the schedule – some Gantt chart tools can do this automatically.
- Helps everyone understand the rate of spending and manage cash flow.
- Enables identification of what costs fall in which fiscal year (F/Y).
- Basis of Earned Value Management (see monitoring and control).



Sometimes called an “S-curve” since it is often in the shape of a flat letter S.

Exercise – Cost



Roll up the total cost for your project:

- *Add up the costs of all the deliverable estimates.*
- *Define a set of cost accounts for later tracking of cost performance, bundling multiple consecutive small deliverables if appropriate.*
- *For larger projects, graph the planned spending across time in a cost curve.*



During planning you need to decide which deliverables will be done in-house and which should be procured from external contractors.

Building. Decision criteria for building deliverables internal to your organization:

- You have the people, skills, and tools to do it faster, better, and cheaper.
- You need to retain the expertise to maintain the deliverable or build more.
- Ensure you include the “total cost of ownership” with long-term support costs.
- “Customizing” an existing solution can easily become a complete rebuild.

Buying. Decision criteria for buying deliverables from an external source:

- You don't have the people, skills, and tools internally.
- A contractor is a specialist and can do it faster, better, and cheaper.
- A bought product includes value from long customer feedback.
- A bought product can be configured to match your needs.
- Never buy based on a presentation or demo, and trial the solution first whenever possible.
- Talk to a minimum of three references to get feedback from others that have used any product you are seriously considering.
- And remember that if you are the only customer for a product, it is not really “off-the-shelf”, and you will have to pay the contractor for any later support.



There are three types of procurement documents you might use during planning.

Request For Quote (RFQ):

- When you need something straightforward – chairs, computers, service rates.
- You provide a specification and request a price from several vendors.
- Usually you choose the least expensive option that meets the specs.

Request For Information (RFI):

- When you are looking for industry input on what is currently available.
- Describe the need and requirements as best as you currently understand them.
- Industry provides information on how their company can help, in the hope their input will be included in the requirements for any future procurement.

Request For Proposal (RFP):

- You need something that doesn't yet exist and will need to be developed, so requires companies to send you a project plan as their proposal.
- Includes a full set of requirements for whatever you need.
- Often includes a Statement of Work (SOW) describing how you will work together, identifying mutual points of contact, required reviews, mandatory processes, and related information.
- For competitive bids, includes an evaluation approach for how the contract will be awarded, e.g. least cost or best value (see later slides).

Contract Types



Fixed Price:

- Are best for contracts where the scope is very well defined and unlikely to change.
- The parties agree on a price, then the contractor can make or lose money without impacting the buyer:
- But also fixes the scope, so any changes are usually much more expensive.
- Smaller companies will not be able to proceed if losing money – “pay me or sue me”.
- If the scope does change, whenever possible offset any additional work by removing some existing scope to balance off the impact – a win-win solution for everyone.

Cost Plus:

- Best for larger value and more complex efforts where the scope will probably change, and arguing over changes in the price will likely cause many problems.
- Start by obtaining the best possible estimate of the work from the contractor based on the requirements, often a full project plan, with as many assumptions as needed.
- You agree to pay the contractor's costs plus some pre-set profit percentage, often based on their bid rates for the various resources and materials.
- You need to do more project management of the contractor:
 - Integrate your and the contractor teams when possible, perhaps even colocate.
 - Implement rigorous change control so you can actively manage scope changes.
 - Obtain written weekly and monthly reports on their progress.
 - Put in checkpoints for formal notification on spending, e.g. 25%, 50%, 75%, 90%.

Selecting The Winner



The PM is responsible for selecting each contract type and award procedure:

- The procurement department may prefer fixed price with lowest price awards, even for projects where the scope is likely to change, since they sound good.
- However the PM is accountable for project performance, so you can negotiate with procurement personnel to choose the best type and award procedure.

There are two main approaches to selecting the winner on competitive contracts:

- Lowest Price. Easy, but dangerous for all but the simplest procurements:
 - Filter the set of bidders that meet the requirements, then choose lowest price.
 - Can easily get gamed on the requirements, get the lowest possible quality, and then pay much more later for changes to get what you really need.
- Best Value. More complicated, but much better for work of any complexity:
 - The project manager first establishes the bid evaluation criteria – e.g. 15% for experience of the team leads, 20% for experience of the firm in this domain, 50% for their response to the requirements, 15% for their support solution.
 - The team scores each contractor's proposal, divides by their price to get their bid value, and then awards the contract to the one with the greatest number.
 - Each contractor will now bid the best solution and team they can, since they know they will get credit to offset any higher price.
 - Usually provides the genuine “best value” winner, and in reality the least cost.

Exercise – Procurement



Plan your procurement strategy:

- *Which deliverables should your project obtain externally from a contractor?*
- *Should each contract be cost-plus or fixed price?*
- *Should the winner be selected by lowest price or best value?*



“Project Risk is an uncertain event or condition.”

– PMBOK® Guide

A realistic project plan considers problems that might occur, minimizes them before starting, and reserves time and money to deal with them if they do happen.

Risks differ from issues because they are uncertain – they might not happen:

- Best practice says risks must have a probability of 80% or less.
- At 90% and above, there is not enough likelihood of heading them off and they should be treated as issues – put the time and money to deal with them directly in the plan – if they don't happen you got lucky.

For small projects, perhaps under about \$20K, you can allocate a risk budget simply by setting aside time and money as a percentage of the rest of the project, most commonly 15% – e.g. for a 40 day \$20K project, add 6 days and \$3K to the risk budget.

For larger projects, it is very worthwhile to conduct the full risk planning process:

- You will be able to justify whatever amount of time and money you put in the risk budget, commonly between 5% and 15%, but could be more or less.
- The process is actually useful, and can significantly reduce the risks before you start - “planning is a project improvement exercise”.

Always remember: management wants to know the risks – never, ever minimize them.

Risk Management Process



There are six steps in the standard PMBOK® risk management process.

Risk Planning:

- Should follow a standard process document, basically this section.

Identification:

- Brainstorm with your core project team, use a historical risk checklist to jog the memory, review lessons learned reports, list every risk the team can think of.

Qualitative Analysis:

- Score the risks 1 to 5 for probability and impact, rank them by probability x impact, and shortlist to the most significant, 5 minimum to 10 maximum.

Quantitative Analysis:

- Put real numbers on the shortlisted risks by estimating probability, time, and cost, and calculating the expected (probability x cost) and (probability x time).

Response Planning:

- Assign an owner closest to the risk to manage it, plan what you can do to avoid or mitigate the risk, and baseline the risk register in the project plan.

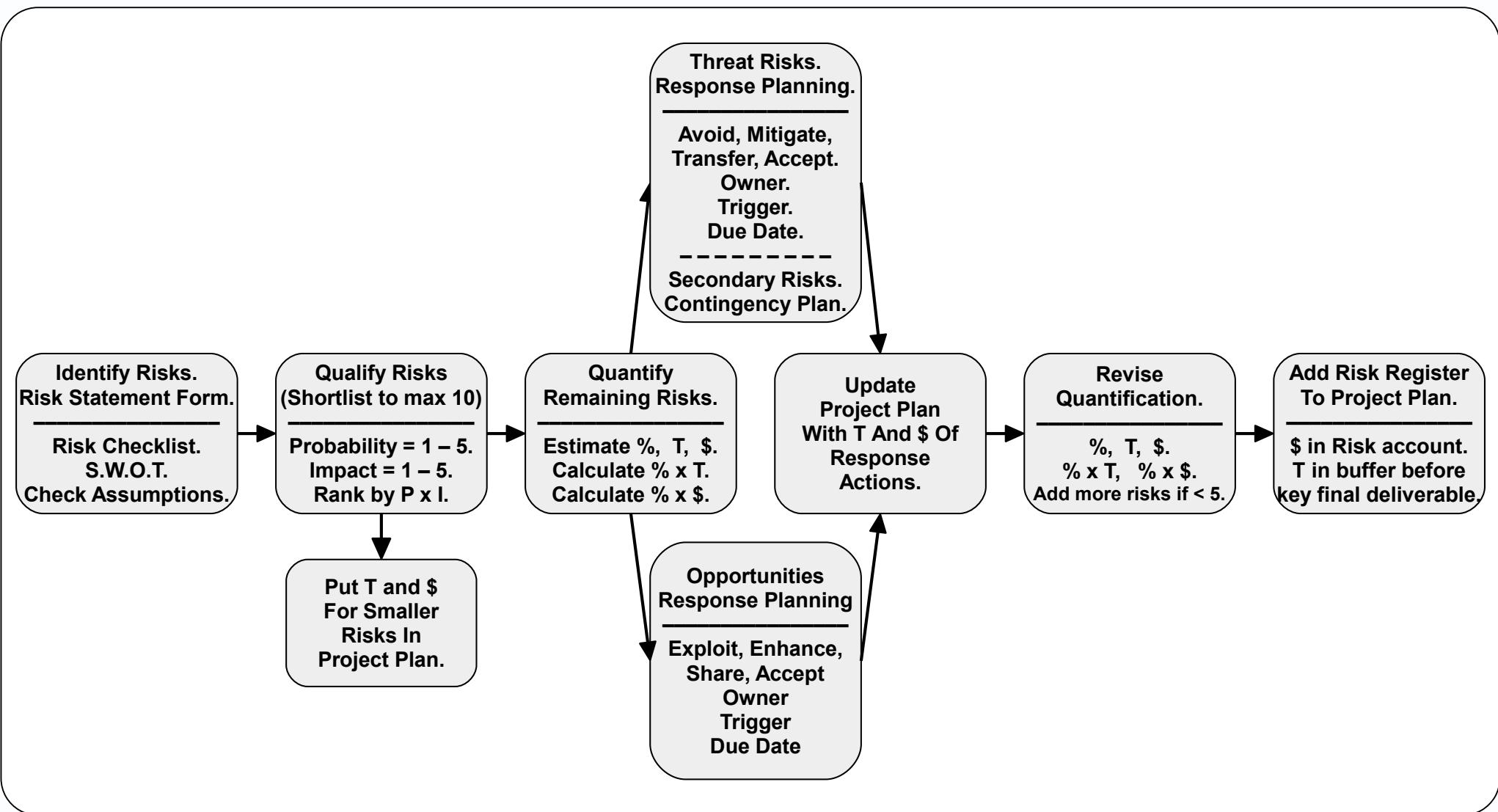
Monitoring And Control:

- Manage the risks as you progress through the project, take action and use risk budget as necessary, and formally review and report status at least monthly.



Risk Management Planning

You can often avoid risks, or at least reduce their probability and/or impact, during planning before starting the project.



Risk Identification



“Risk is our business!”

– Captain Kirk, [Star Trek](#), 1969.

Start by identifying as many risks as possible:

- Brainstorm with your core project team and write down a long list.
- Review the risk registers and lessons learned reports from past projects.
- Double-check the project assumptions, ask if they might turn out not to be true.
- For larger projects, hold several identification meetings through planning.

Two key tools help the team during risk identification meetings:

- Risk Checklist. To help jog the memory, your organization, department, or group should have a standard list, periodically updated, of all the risks that have occurred to past projects (see many [Internet templates](#)).
- SWOT. Strengths, weaknesses, opportunities, threats:
 - ➔ First identify weaknesses of the project and organization, which makes it easier to then identify threats that could arise from those weaknesses.
 - ➔ Identify strengths of the project and organization first, which makes it easier to then identify opportunities that could arise from those strengths – opportunities can be hard to find, this is the main value of SWOT.

Standard Risk Statement Form



It is very helpful to write the risks in “standard risk statement form”:

- If Cause then there could be Risk causing Consequence.

Advantages:

- Provides a standard format that everyone becomes familiar with.
- Identifies the three different components of the risk.
- Provides useful information to help manage the risk, since the cause is what we can do something about, and is often otherwise buried.

Examples:

- If the fence has holes then foxes could get in and eat all the chickens.
- If the morale is not good then team members could leave for other jobs causing schedule, cost, and quality problems.
- If the parts procurement is delayed we won't be able to build the product in time causing the customer to reject it.
- If the distributed team doesn't coordinate efficiently there will be missed work and schedule delays causing the project to miss the deadline.

Keep asking yourself “why might the risk we’re worried about happen” until you have identified the underlying cause that can actually be addressed.

Risk Qualification



Qualification orders the risks from worst to least, so we can short-list to the maximum top ten:

- In practice, management of ten risks is enough even on large projects, since any beyond the top ten are always relatively small.
- Smaller risks are addressed by putting time and money to deal with them directly into the project – if they don't happen you get lucky.

Score	Probability	Impact
5	Very Likely (80% to 100%).	Very High (prevents achievement of the project objective).
4	Likely (60% to 80%).	High (requires large amounts of time and money to address).
3	Possible (40% to 60%).	Medium (requires significant time and money to address).
2	Unlikely (20% to 40%).	Low (manageable impact).
1	Very Unlikely (0% to 20%).	Very Low (easy to work around).

Estimate probability and impact for each risk from a look-up table like above:

- Multiply probability and impact to get a ranking from 1 to 25 for each risk.
- Shortlist to the top ten risks maximum for the next step in the process.

Risk Quantification



Quantification puts specific numbers on the probability, time, and cost of each risk, enabling you to calculate a probable time and probable cost to put aside in the risk budget.

Probability. The likelihood of the risk happening:

- Use historical information if available, or input it into a Delphi estimation.
- For Delphi estimation (see Estimating section), choose probability in steps of 10% to 80% max – assume 90% probable risks will happen and put the full time and cost in the project, if they don't happen you get lucky.

Time. The impact on the project if the risk actually does happen:

- Use historical information if available, or do a Delphi estimation.

Cost. The impact on the project if the risk actually does happen:

- Can use historical information or Delphi if appropriate, but often cost is a calculation based on the time impact and any other impacts – e.g. the costs for all personnel, material, and services needed to address the risk.

For each risk put (probability * time) and (probability * cost) in the risk budget:

- This probabilistic calculation provides the most accurate assessment of the likely amount we will need, since some risks will happen and some won't.
- Need at least 5 risks for this to work – consult your risk checklist if needed.

Response Planning



“A stitch in time saves nine.”

Before baselining the risk budget, do some proactive response planning:

- You can often eliminate or substantially decrease risks, either before you start or once underway, if you just think about them a bit beforehand – one of the key values of risk planning.

First assign owners, the person closest to each risk and best able to manage it.

Then identify which of the standard response approaches best applies to each risk:

- Avoid. The best approach – see if you can prevent the risk completely by changing the project plan before you start, or put in place plans to try and avoid it once underway.
- Mitigate. Make the risk less bad by reducing the probability and/or impact by changing the project plan before you start, or put in place plans to mitigate it once underway – e.g. move the risky event earlier in the schedule, increase the monitoring so you can see the problem coming earlier, highlight the cause for senior management action, identify a backup vendor, etc.
- Transfer. Really only feasible for financial risks, e.g. buy insurance so you get reimbursed appropriately if the risk happens.
- Accept. The probable impact of the risk is too low, or there is nothing you can do about it, so simply track it and pay the time and money if it happens.

Other Risk Elements



“I've come to believe the biggest risk is being too cautious.”

– David Spiegelhalter, [Cambridge Ideas](#), 2009.

Other elements commonly identified for each risk during risk planning:

- Trigger. The earliest warning sign the risk is happening, an indication you should take immediate action to avoid or mitigate the risk.
- Secondary Risks. Any problems created by the response plan itself – e.g. bonusing key personnel to keep them through the end of the project could cause dissatisfaction with the rest of the team.
- Backup Plan. The plan B, what you will do if the response plan fails and the risk happens anyway – e.g. if you can't ensure the office building is ready in time, then you will rent temporary space.

Record all the data either in the risk register or in a separate risk management plan on larger projects.

Finally, redo the quantification step to reassess the residual risk remaining after the effects of the response planning, and baseline the final risk budget:

- You should be able to reduce some of the probabilities, time, and cost, but be realistic, make sure you keep as much reserve as you need.

Risk Register



Record all the risk information in a “risk register”, typically a spreadsheet (see the downloadable template).

Risk	P%	T	\$	P x T	P x \$	Response
Procurement delays	20%	10 d	\$50 K	2 d	\$10 K	Avoid
Approval delays	30%	15 d	\$75 K	4.5 d	\$23 K	Mitigate
Regulation change	40%	20 d	\$100 K	8 d	\$40 K	Accept
Team turnover	30%	30 d	\$150 K	9 d	\$45 K	Mitigate
Vendor performance	50%	20 d	\$100 K	10 d	\$50 K	Mitigate
Final inspection problems	60%	25 d	\$125 K	15 d	\$75 K	Mitigate
Risk budget:				48.5 d	\$243 K	

Review the total time and cost, and do a gut check – it should be a minimum of 5% of the project, 10%-15% is common, and higher if the project is very risky:

- If the budget seems too high or too low, add or adjust risks, and reconvene the team to revisit the estimates and assumptions as needed.

Cost goes into a special account controlled by the finance department:

- To access the budget you need to fill out a form and explain why, but no other approvals are necessary, it's the PM's budget – use it when needed.

Time goes just before the “key customer event” at the end of the project, so the risk buffer takes the hits from schedule slips, not the customer – see next slide.

Critical Chain Management



“Work expands so as to fill the time available.”
– C. Northcote Parkinson, Parkinson's Law, 1957.

Critical Chain Management (CCM) is the most efficient method for managing the risk budget, greatly improving schedule performance over the old style of adding buffer throughout the project.

First, ensure all deliverables have unpadded estimates without any internal buffer:

- Specifically ask the leads to “(a) make the deliverable estimates realistic, (b) but please scrub the estimates to make sure there is no padding within the deliverables, since we will have an overall buffer to deal with anything that happens on the whole project and don't want to double-count”.

Then the key feature of CCM is to place the entire risk time buffer at the end of the project, just before the “key customer event” whose schedule dates you want to protect:

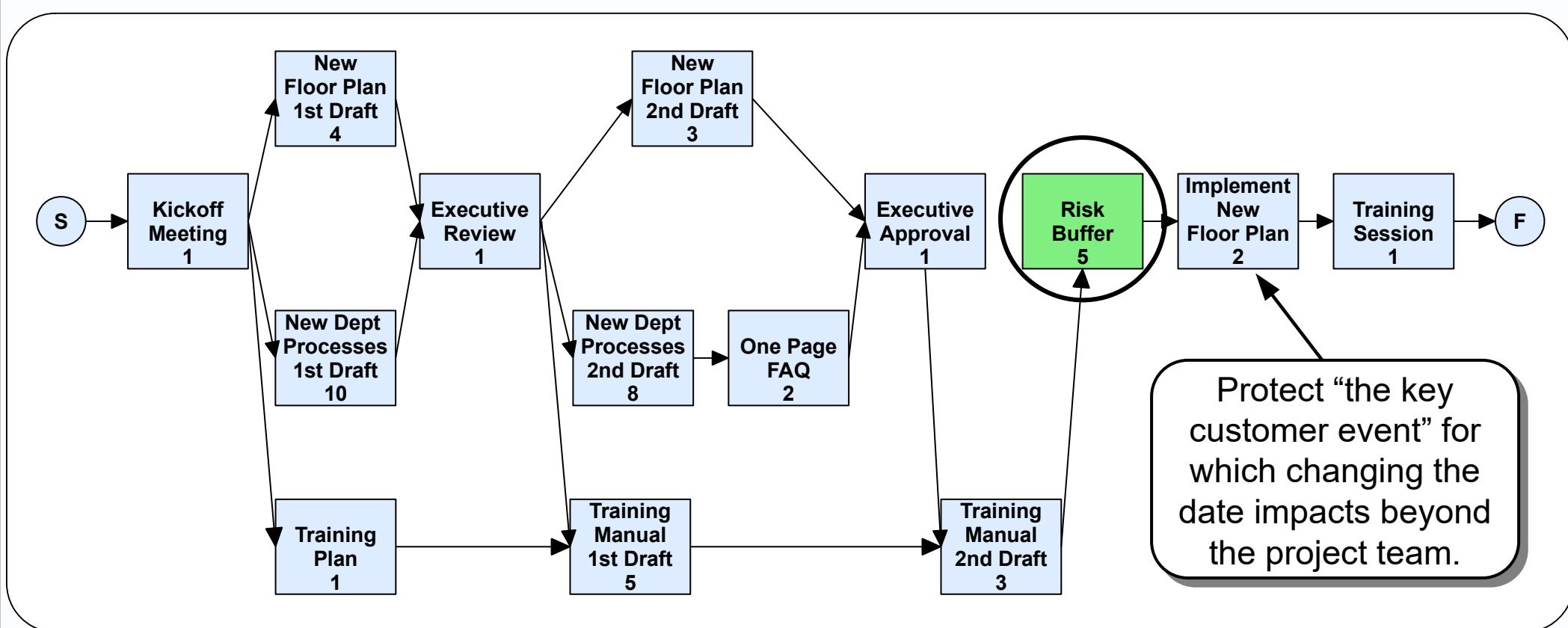
- Now the entire time buffer can be used for any schedule problems at any point earlier in the project, not only for the risks on the risk register.
- And if a risk does not happen, its time buffer is not built into the schedule and guaranteed to be used, and is still available for any other problems on the project.

Having said that, rarely, only when really necessary, you do add some time buffer earlier in the project schedule just before very critical dates:

- Before externally scheduled events that cannot be missed, e.g. a trade show.
- Before critical resource bookings that, if missed, you won't be able to get the resource again for some time – e.g. a high demand analyst or piece of equipment.

Risk Buffer Allocation

For our Department Process Improvement Project, the “key customer event” is the new floor plan implementation, since once scheduled and in everyone’s calendar, moving it will cause major disruption outside the project team, so that’s the event the risk buffer should protect.



The question now is not how much the project will inevitably be late, but how little of the risk buffer you can use – a much more realistic and motivating game to play.

The project manager must also make an important cultural change from the old style approach:

- Provide the project leads with fair accountability: “Please do your very best to meet the estimates you planned, and let me know right away if anything will prevent you from making schedule.”
- But also understand that some slippage will inevitably happen because the schedule had unpadded estimates, so being upset would be unfair and demotivating – use the overall buffer to deal with delays.



“A project plan without a sufficient risk reserve is already over budget.”

– Ancient PM expression.

There should actually be two risk budgets for each project.

Risk Reserve. The regular project risk budget or “contingency reserve”, as calculated in the previous slides, under the control of the project manager.

Management Reserve. Each project should also have a second reserve:

- Despite the name, this is not managed by the project manager, but instead controlled by the next level up – usually the sponsor or program manager.
- It's intended for risks outside the control of the project, such as program level delays, a recession, mergers, political changes, or other problems that exceed the ability of the project to manage.
- The standard recommended size for the management reserve is 10% of the project budget, or as decided by the organization.
- The most important point is the project manager should never count on the management reserve, mention it, or even admit they know it exists – they should always strive to manage project performance within their own risk reserve.

Opportunity Risks



“My friends, as I have discovered myself, there are no disasters, only opportunities. And, indeed, opportunities for fresh disasters.”

– Boris Johnson, 2004.

Risk management also considers positive risks or “opportunities” – uncertain events that could improve the project outcome or otherwise help the organization:

- Opportunities are managed by the risk process since the machinery is the same, with each opportunity having a probability and time and cost advantages.
- For example, they could be the potential to capture more business, or to solve more than one problem at once – e.g. budget share with another department.
- They are often identified with the SWOT tool, since opportunities are easier to find once you have identified the strengths of your project or organization.

The process is a good idea, since if you don't look for opportunities, keep a list, track them, and do something when you can, they are much less likely to happen:

- However, management will often challenge you to try and find enough opportunity time and cost to balance off the negative risk budget – this is almost never possible in practice, and the negative risk budget should never be reduced based on the opportunity risks – they should not be counted on.
- The team should never chase opportunities at the expense of the project performance, since their main job is to get the project done and protect it against the negative risks – try to get someone else in the organization to take the lead on opportunities whenever possible and then support them.

Opportunity Planning



Assign an owner for each opportunity:

- However, unlike negative risks where owners should be at the lowest level possible closest to the risk, opportunity owners should be assigned at the highest level possible to not distract the team – often the PM or senior leads.
- Whenever possible, assign owners completely outside the project team and offer to support, especially for business development opportunities.

Identify the most appropriate opportunity response category – the flip sides of the threat categories:

- Exploit. The opportunity is so good, you'll work to make it happen for sure.
- Enhance. Find ways to improve the opportunity by increasing the probability or time or cost advantage.
- Share. Provide to another organization or group and then share the benefit, for example by licensing the project output to another firm to market and sell.
- Accept. Just track it, since the benefit is low or there is nothing you can do.

Usually there are not enough opportunities to require qualification shortlisting, however you should always perform a quantitative analysis to estimate the probabilities and time and cost advantages, and create an opportunity register.

Then monitor and manage the opportunities appropriately once underway – just don't get distracted from your main job of protecting the main project performance.

Exercise – Risk



Baseline your project risk budget:

- *Identify the risks.*
- *Assign owners, and express the risks in standard risk statement form.*
- *Quantify the probability, time, cost, probable time, and probable cost.*
- *Conduct response planning, for action now during planning or later during execution.*
- *Revisit the quantifications to see if they can be reduced due to the response plans.*
- *Document the triggers, secondary risks, and plan B's.*
- *Add the entire time risk buffer to the schedule just before the key customer event.*

Conduct opportunity planning and create an opportunity register.

Communications Planning



“Project Management is a communications job.”

– Ancient PM expression.

Every project plan should include a section, or reference to a separate plan, explaining how communications will be managed.

Include descriptions of at least the following core communications (see later chapters):

- Issue Status Meetings. The leads discuss project-level issues and risks each week, and coordinate steps for further action where required.
- Project Review Meetings. Scope, schedule, cost, and risk status are reviewed with the sponsor and other stakeholders each month, assistance and direction are requested as needed, and plans made for further attention where required.
- Change Control Board Meetings. The project leads and other stakeholders consider proposed changes to scope, along with their schedule, cost, and risk impacts, and disposition as needed – yes, no, for sponsor review.

Include any other planned communications with a description of who will be involved, what will be communicated, when they will occur, and how they will take place.

Remember the project manager's communications essentials:

- Communicate the project's achievements widely – success deserves publicity.
- Communicate problems early, with solutions wherever possible.
- If you need assistance, ask for it as early as possible when stakeholders can be most helpful since the problem has the most time to resolve.

Exercise – Communications Plan



Prepare a communications plan, as a section of the project plan or a separate document:

- *Describe at least the weekly issue status meeting, monthly project review meeting, and change control board meetings.*

- *Include any other planned communications with a description of who will be involved, what will be communicated, when they will occur, and how they will take place.*



Project Management Plan

“A goal without a plan is just a wish.”

– Antoine de Saint-Exupéry, 1900-1944.

The Project Management Plan documents the essentials – background, scope, schedule, budget, risks, and issues – plus any other required information, for stakeholder review, final adjustment, and approval before project execution begins.

Typical PMP Table Of Contents

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 1. <u>Background</u> <ul style="list-style-type: none"> 1.1 <u>Need</u> 1.2 <u>Sponsor</u> 1.3 <u>Customer</u> 1.4 <u>Business Case</u> | 4. <u>Budget</u> <ul style="list-style-type: none"> 4.1 <u>Deliverable Costing</u> 4.2 <u>Cost Curve</u> |
| 2. <u>Scope</u> <ul style="list-style-type: none"> 2.1 <u>Objective</u> 2.2 <u>Requirements</u> 2.3 <u>Solution</u> 2.4 <u>Work Breakdown Structure</u> | 5. <u>Risks</u> |
| 3. <u>Schedule</u> <ul style="list-style-type: none"> 3.1 <u>Precedence Diagram</u> 3.2 <u>Gantt Chart</u> | 6. <u>Issues</u> |
| | 7. <u>Stakeholders</u> |
| | 8. <u>Resources</u> |
| | 9. <u>Communications</u> |
| | 10. <u>Quality</u> |
| | 11. <u>Procurement</u> |
| | 12. <u>Change Control Process</u> |
| | A. <u>Appendices</u> |

More info in Monitoring And Control and Closing chapters.

Final Plan Review



Once the Project Management Plan is ready, hold a meeting with the stakeholders to review the plan and obtain redirection or final approval to proceed:

- Sponsor attendance is essential to provide any required budget input.
- Customer attendance is essential to provide any required scope or schedule input.

Walk through the plan, answer any questions, and if any changes are requested, request time with the team to coordinate the updates, and then bring back a feasible plan for another review:

- To implement any requested changes, give stakeholders options whenever possible, especially among scope, time, and cost trade-offs.
- Always remember: “The ethical project manager has a professional responsibility to never propose a project plan that does not have enough time and cost to achieve the planned scope”.
- “A project without a sufficient risk reserve is already over budget”.
- Protect the sponsor, customer, and team, always T3: “Tell The Truth”.



Keep it balanced!

Exercise – Project Management Plan



Prepare a Project Management Plan for your project:

- *Include as many of the sections described in the example table of contents as appropriate for your project.*

- *Review the plan with the stakeholders, obtain their feedback, update the plan as appropriate, and iterate review until the plan is approved or shelved.*

Chapter Summary



- Planning is the most important project stage, where we put together an execution strategy that can get the job done and be easily monitored and controlled, and determine the scope, schedule, budget, and risks with an accuracy of +/-10% so we know what we are getting into before we start.
- Planning needs a core project team of subject matter experts from each project area to prepare their part of the plan, and lead the work later during execution.
- The main solution to the most common cause of project failure – incomplete scope definition – is to take the time to interview everyone and baseline the requirements, the needs not wants, what not how, complete, consistent, and provable.
- A top-level solution definition is required to plan the project, sometimes a diagram or just a list of major deliverables, not too detailed, enough to prepare a plan +/- 10%.
- The work breakdown structure identifies all the deliverables, both passed to the customer at the end of the project as well as all the interim outputs produced during the project just to get it done, and make everything else in planning easy.
- The WBS can be organized either hierarchically or by phases or in a combination, whatever is clearest for human communication, with categories being merely a convenience, and identification of the deliverables being what really matters.
- Deliverables must be broken into smaller pieces when: (a) there are different leads responsible for different parts; (b) there is waiting time within the deliverable; (c) it can be started earlier but not completed until later; (d) it is longer than two weeks so must be divided into “work packages” for later monitoring and control.

Chapter Summary (Cont'd)



- Every requirement is traced to at least one deliverable that meets it, while some deliverables have no requirements because they are just project work.
- The precedence diagram flowcharts how the deliverables come together, showing the fundamental logic of the project, and is the most important practical tool for planning, communicating, and managing the project.
- Estimating deliverable time, cost, and resources is most accurately done by an activity breakdown performed by the person that will be responsible for the work, and is the key step that results in an overall project plan estimate with +/- 10% accuracy.
- Estimation with the PERT or 3-Point technique is not as good as activity breakdown, but is better than just a single point guess, providing about +/- 50% accuracy.
- Estimation with the Delphi technique is not as good as activity breakdown, but is better than just a single point guess, providing about +/- 33% accuracy, and is used mainly for estimating risk probability and time.
- Estimating can be also done with the analogous method, by comparing to something similar, particularly useful for the +/- 100% initiation project estimate, and by using historical data when comparable information is available.
- All estimates must be factored by a productivity ratio, often between 70% and 85%, to take account of realistic human efficiency, and then factored again by an availability percentage if resources are only available part-time.
- The precedence diagram and deliverable estimates are loaded into a Gantt chart tool, given a start date, and the tool maps the work across the calendar, and determines the critical path of back-to-back deliverables driving the schedule end date.

Chapter Summary (Cont'd)



- Work packages are entered underneath the deliverables in the Gantt chart for later tracking, and activities can be added underneath the work packages if different activities have different resource requirements.
- After scope, the critical path is the most important project item to baseline during planning, enabling you to prioritize later monitoring and control on the deliverables driving the end date, and because schedule delays also drive increases in cost and risk.
- Milestones are not new items, but rather simply a subset of the existing deliverables that show significant achievement and are of interest to the stakeholders, and whose status will be reported each month – as a rule of thumb about one every two months.
- Use the Gantt tool to determine the resource loading and resolve any over-allocations using float if possible, adding resources if schedule constrained, extending schedule if resource constrained.
- Include a resource plan with an organization chart, cross-reference of the team members to their deliverables, and plans for management of any critical resources.
- Costs are easily rolled up from the deliverable activity breakdowns, including all direct fixed and variable costs, and for larger projects graphed across time in a “cumulative cost curve”.
- Cost accounts are assigned to the deliverables for later tracking, and sometimes bundle several consecutive short duration deliverables when all done by one person.
- Create deliverables in-house when you can do them better, faster, and less expensively, or need to maintain them or build more, and procure deliverables from contractors when they can do it better, faster, and less expensively, or the product has significantly benefited from long use by others.

Chapter Summary (Cont'd)



- Fixed price contracts are best when the scope is very well defined and will not change, while cost plus contracts are best when the scope will likely change, however require you to exercise closer project management oversight.
- Select contract winners on lowest price only for the simplest procurements, and for more complex work use best value scoring to get the best proposals from all bidders.
- Risk planning adds time and money into the project to take account of uncertain events (80% or less probability) that could negatively impact the project.
- Risks are most commonly identified by brainstorming by the core project team with a standard risk checklist, and are baselined in standard risk statement form.
- Risk probability, time, and cost can be estimated with historical information, the Delphi technique, or a bottom up calculation, and then probable time and probable cost are calculated for each risk and rolled up to determine the whole risk budget.
- Risk response planning assigns an owner closest to the risk, a trigger, identifies secondary risks, and develops a plan to avoid or mitigate the risk now during planning, or later during the project if required.
- The risk register should include at least 5 risks, maximum 10, typically amounting to 5% to 15% of the project time and cost, and more or less depending on the project.
- The risk cost goes into a controlled account requiring justification to draw down, and all the time is bundled into a buffer that goes at the end of the project before the “key customer event” to take the hits from schedule slips instead of the customer, and so it can be used for anything that goes wrong anywhere on the project.

Chapter Summary (Cont'd)



- Risk upside, also called opportunities, are identified and their time and cost advantages estimated, although they are usually not factored into the budget and schedule, and usually should be given second priority to the primary job of managing the negative risks and protecting the main project.
- Prepare a communications plan describing at least the weekly issue status meeting, monthly project review meeting, and change control board meetings, plus any other planned communications with a description of who will be involved, what will be communicated, when they will occur, and how they will take place.
- Prepare a project management plan documenting the scope, time, cost, and risk baselines, and sections or separate plans as required for stakeholders, resources, communications, quality, procurement, change control, and the requirements usually with a cross-reference to deliverables that meet them.
- Review the plan with the sponsor, customer, and other relevant stakeholders, request time to work in any changes, provide options wherever possible, and make absolutely sure scope, time, cost, and risk are properly balanced and truthfully communicated before proceeding to execution.



Stage 3 – Execution

The Real Work Begins

*“Take time to deliberate, but when the time for action has arrived,
stop thinking and go in.”*

– Napoleon Bonaparte, 1769-1821.



Introduction

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Building The Project Team

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Projectized Organizations

Matrix Organizations

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Managing People Conflict

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Communication Modes

First Steps

Kickoff Meetings

Project Requirements Review

Exercise – First Steps

Design & Build

Design Before Build

Exercise – Design & Build

Problem Identification

Finding Root Causes

Chapter Summary



Purpose Of Execution

“The coach should keep out of the way. Matches are won by players.”

– Romário de Souza Faria, Brazilian football player.

The purpose of the execution stage is to carry out the plan, design and build the project output, and prepare for delivery and handover.

The team does most of the work in execution, so the project manager's job is to:

- Build the full team starting with keeping the planning team, then adding the best people possible for each role.
- Completely delegate responsibility for how the work is done.
- Motivate the team – find ways to describe why the work is worthwhile.
- Maximize trust, the largest contributor to team performance.
- Ensure the customer stays involved, including a formal user representative.
- Constantly ensure the priorities stay clear – especially quality and schedule.

The project manager should practice MBWA (Management By Walking Around):

- Obtain unfiltered information from personnel that don't report directly to you.
- Ask questions but never direct solutions – pass any issues of concern through their regular manager to maintain their trust.

And then provide the resources needed and solve the problems the team cannot.

Building The Project Team



“A person does not need to be rounded, but a team does.”

– Ancient team building maxim.

People will get the project done, so build the best team possible:

- Keep the planning leads to ensure continuity and accountability.
- Whether you or the leads are staffing the team, negotiate across the organization and interview widely to get the best personnel.
- Look for four key attributes: skills, energy, team temperament, and ethics.

Look to build diverse teams, since it's proven to produce better results:

- E.g. if all strategic thinkers, you'll have great plans, but little work done, if all analytic thinkers, you'll get lots of work done, but in the wrong direction.
- Diversity of gender, ethnicity, age, background, experience, etc. will result in better problem identification, more creative solutions, and more fun.
- Most importantly, never bring on people just because they are like you.
- The best way to obtain diversity is to interview as widely as you can, look for the best match for the jobs, and diversity will follow naturally.

“I can't tell you that if you bring in weird and different people, then good things will happen. But I can tell you that if you hire similar people, and promote only the ones who are most similar, bad things are likely to happen.” – Adam Grant, NY Times, 2016-02-07.

Project Team Key Points



Key project manager responsibility is to help build the team identity:

- A team with a cohesive identity will perform at a much higher level.
- Hold off-site team-building sessions – lunches, dinners, bowling, pool, etc.
- Include as much of the team as possible in training sessions – e.g. project management, communications, negotiating, domain skills, etc.
- Hold pizza Fridays where everyone contributes a few dollars and gathers in the largest meeting room, with only one rule – no talking about work.
- Have someone with artistic abilities design a project logo, put it on all the project documents, and maybe coffee cups, baseball caps, warm-up jackets.
- Conduct trust building discussions at the start of early team meetings – e.g. what was your dream job as a kid, your hobbies, etc. (see Overview chapter).

Colocation of the team is critical for important projects:

- Electronic communications have much higher risk of misunderstandings.
- A project schedule can multiply several times over just due to delays between communications in a distributed team.

Ensure the team includes a user representative from the customer organization:

- Someone that completely understands the user's real needs.
- Ideally with customer trust, so they can champion the project internally.

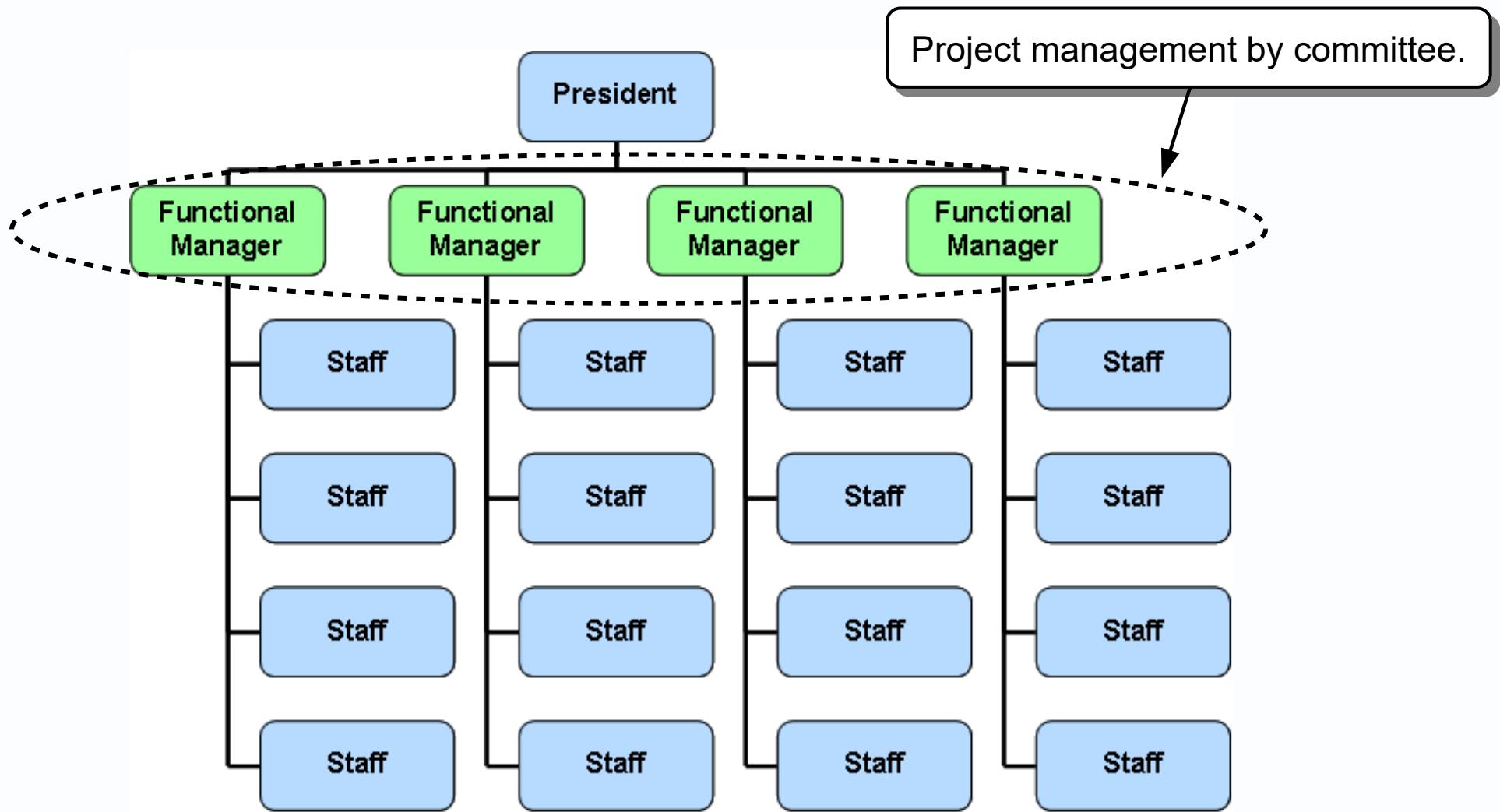


Functional Organizations

In smaller less mature organizations, there are no project managers.

The functional managers coordinate the projects as a committee.

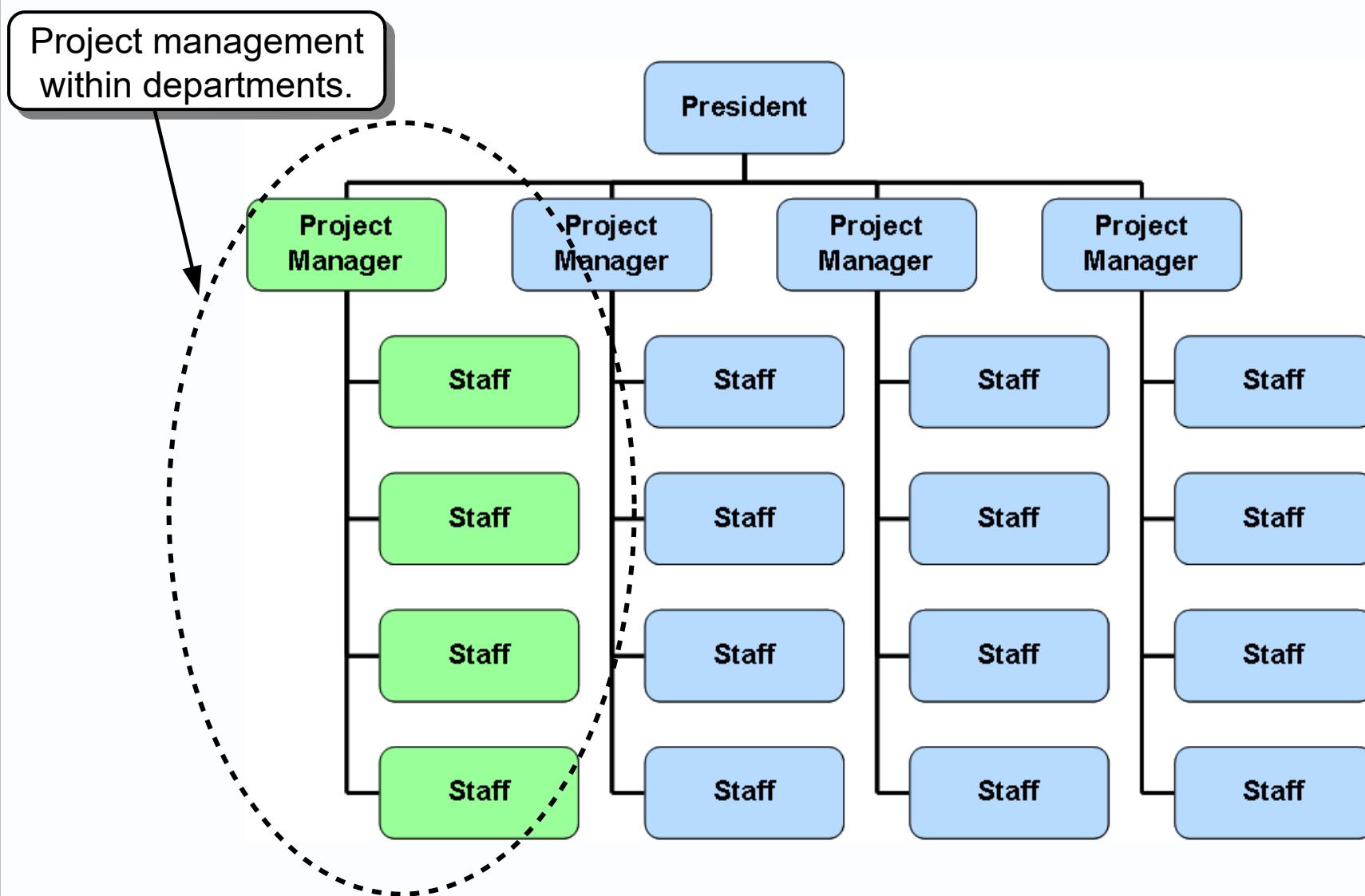
Without a dedicated project manager, project performance is a second priority.





Projectized Organizations

Each department head runs their own projects, with no sharing of personnel.
Great for control by the department heads, dual hatted as the project managers.
However, does not get the best team for each project from across the organization.
Not great for personnel development, since they are limited to department projects.





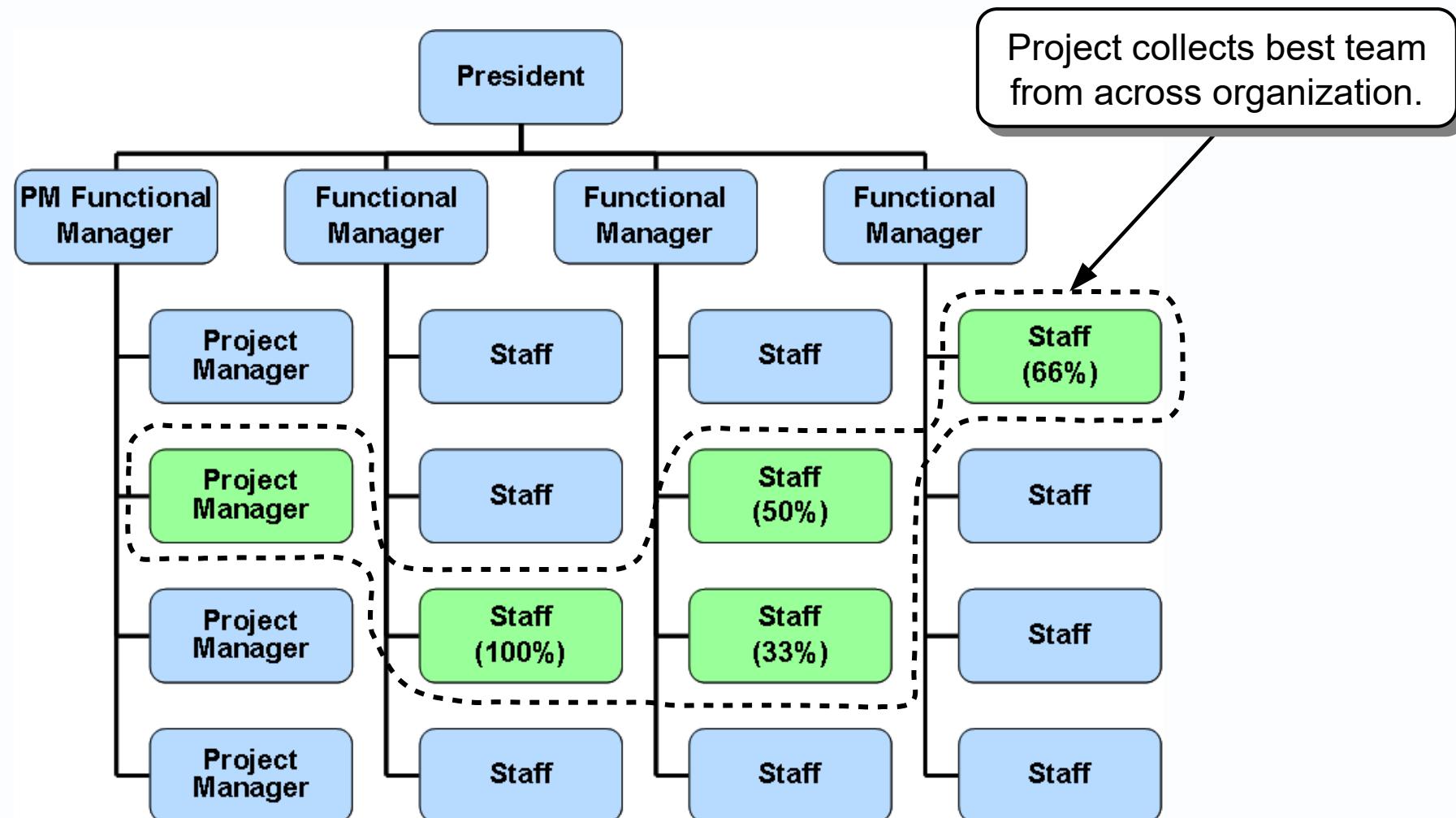
Matrix Organizations

Functional managers train and mentor the personnel, building their skills and taking care of their career development, and then allocate them to the projects as needed.

PM's have no career development responsibilities, so can focus purely on the projects.

PM's and FM's must work well together, deciding who manages staff performance, and if the FM wishes to retain day to day control, they must join the project as a lead.

Although this structure has challenges, it is usually the best compromise for everyone.



Management Of Matrix Organizations



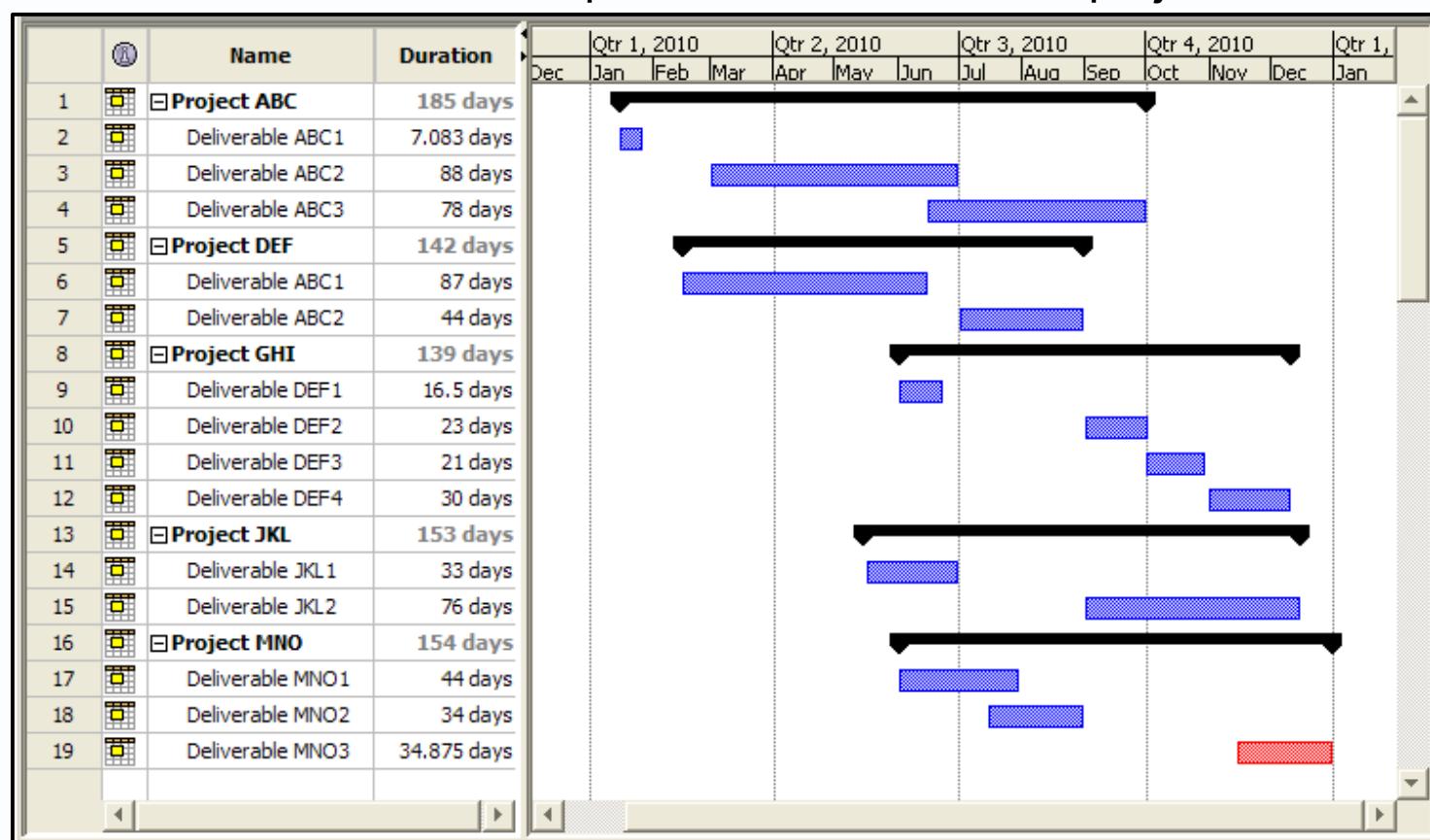
“Office workers are interrupted or self-interrupt roughly every three minutes. Once thrown off track, it can take some 23 minutes for a worker to return to the original task.”

– Gloria Mark, Rachel Silverman, [Wall Street Journal](#), 2012-12-11.

Remember human complexity constraints (Overview chapter) – the maximum number of items humans can keep in mind simultaneously is 3 to 4:

- Working more than one project at a time incurs a rapidly rising cognitive cost.

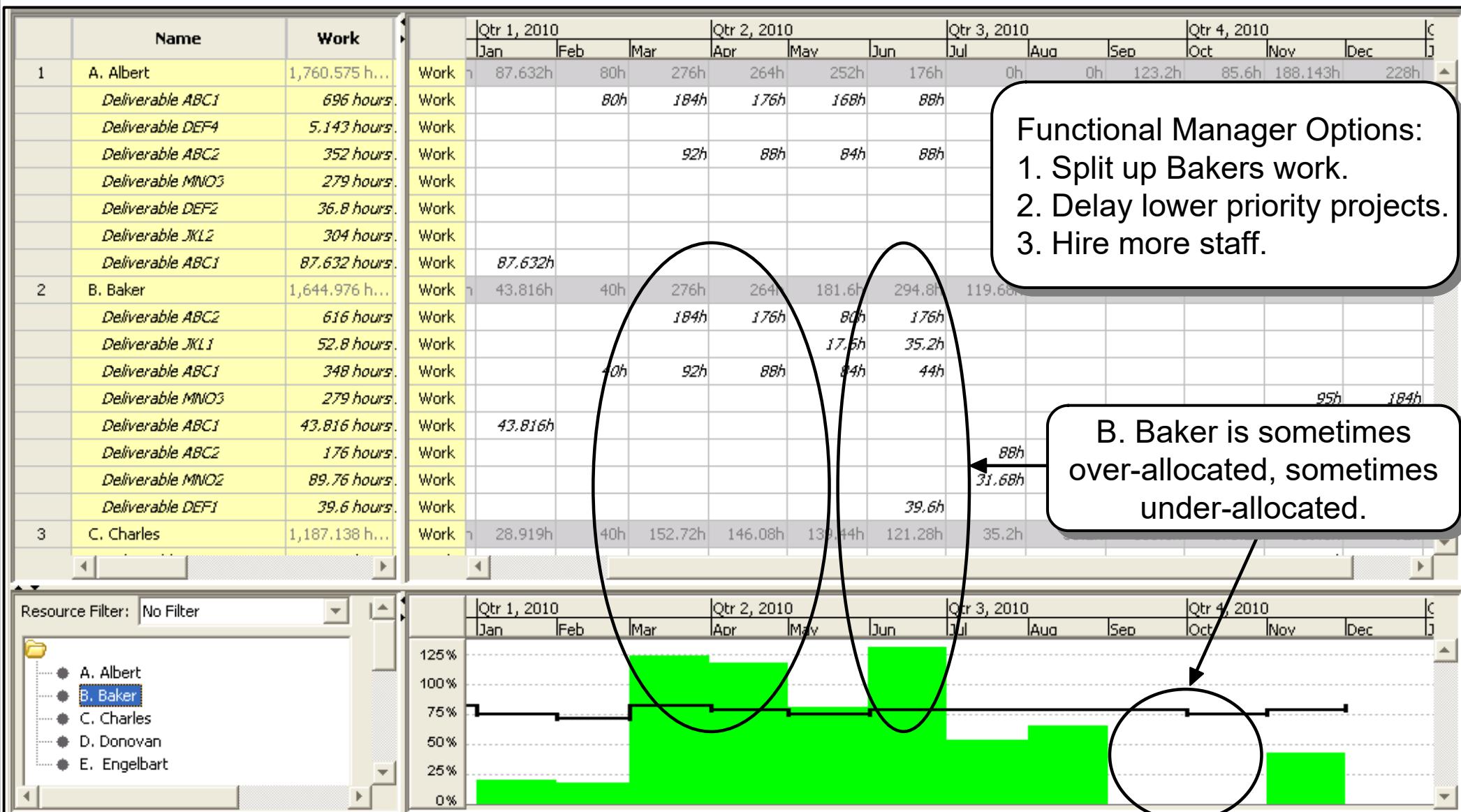
Therefore functional managers need to use a Gantt scheduling tool to track and manage a realistic allocation of their personnel across all the projects.



Matrix Personnel Allocation



The functional manager obtains resource loading reports from the Gantt tool to determine where their personnel are over-allocated and under-allocated, enabling them to avoid chaos by allocating personnel first to the highest priority projects.



Delegation



The project manager's job is to ensure everyone knows what needs to be done, whereas the team's job is to manage how it is done:

- The PM always retains accountability, and so must status and followup.
- But the responsibility for deliverable performance is delegated to the team.

The project manager's job is to make sure the project leads understand they must:

- Inform you early if there are any problems.
- Ask for help with anything they cannot resolve.

Then the project manager must accept that normal projects will have:

- Risks taken by the team to achieve better performance that sometimes fail.
- Team members taking longer and not doing as good a job as their leaders could – the normal way how people learn and get better.

Grow your team wherever possible, and delegate credit – e.g. have them present to customers and senior management on subjects in their area.

Every member of the team should have a “sign-off level”, an amount of money they can expend without authorization to save costly administration:

- The sign-off level for senior leads may be in the thousands of dollars to enable them to obtain material or services rapidly when required.
- The level for junior workers may only be \$100, but should never be zero.

Team Motivation



When the project manager motivates the team to believe the project is worthwhile, they work faster, less expensively, and produce higher quality results.

Start with the project need and the business case – why the project is being done:

- We are making the organization more productive.
- We are helping the organization break into a brand new market.
- We are creating a new local soccer league that will last for years.
- We are helping people get better health care when they will need it most.

Wherever appropriate, let the team know how the work is benefiting them:

- You are learning a new domain and gaining more skills.
- You are improving your career development and future prospects.

Sincere appreciation is the most meaningful motivator:

- Never institute an award that must be given to someone, e.g. every month.
- Provide thanks for good work publicly whenever possible – in a team meeting, in front of the customer.
- Give thanks privately too, such as when just passing in a hallway – then it is obviously sincere.
- Tell their regular boss or functional manager about their great work.
- Tell your own boss – sponsor, program manager, director – about their great work, and then have them pass on congratulations.

Managing People Conflict



There are four common causes of personal conflict among members of a team:

- Perceived lack of respect – e.g. knowledge, experience, seniority, gender.
- Poor communication – e.g. interruptions, lack of acknowledgment.
- Fear a new team member will take an existing team member's place.
- Fear of project / organization / business failure – puts everyone in a bad mood.

Try to solve the underlying problem, then, when needed, address the people directly:

- Call the conflicting parties together into a room.
- Ask each in turn to express all of their grievances to get them out on the table.
- Then insist each provide at least one positive comment about the other party.
- Make clear the negative impact of the conflict on the team and project.
- Demand the parties go away and figure out how to resolve themselves.
- Make clear if it is not resolved then “other solutions” will need to be taken.

If appropriate and helpful, make organization changes:

- Move people into a role better fitted to their skills and temperament.
- Separate conflicting people into different teams and physical locations.

Finally, if you have to replace a team member, remember the Star Trek principle:

- *“The needs of the many outweigh the needs of the one”.*
- Protect the project and team – do not risk failure due to inability to deal with one.

Exercise – The Project Team



Build your project team:

- *Keep the planning team, and add the best people for each role, negotiating with functional managers and interviewing widely as required.*
- *Look for skills first, then energy, a team temperament, and ethics.*
- *Conduct lots of team-building as early as possible to help form a cohesive team identity.*
- *Ensure a user representative is a core member of the team.*
- *Ensure everyone knows they are empowered to make decisions and take actions in their areas of responsibility.*
- *Figure out your motivation strategy – how to sincerely make the case the project is worthwhile, and the team should put in their very best effort.*

Communication Modes



"We instructed workers truly urgent messages and complex issues merited phone calls or in-person conversations, while email was reserved for messages that could wait."

– Rachel Silverman, [Wall Street Journal](#), 2012-12-11.

Usually, favor face-to-face, then phone, then written communications.

Verbal communication is best for:

- Issues that are not yet well defined – you need to talk it through.
- Problem resolution and negotiating – requiring a lot of back and forth.
- Face-to-face is better than phone – a much wider communication channel.

Email / written communication is best for:

- Transmission of data – numbers, documents, spreadsheets, flowcharts, etc.
- Followup record of verbal agreements – “As discussed...”
- Formal approvals and transmission of contractual information.

Meetings are best for:

- Regular team statusing – one hour max.
- Brainstorming – subjects needing wide input.
- Problem solving – requiring dynamic creativity.
- Reviews requiring presentations and walkthroughs.

Kickoff Meetings



After lessons learned meetings, kick-off meetings are the highest ROI events you can hold, usually saving days or weeks of time later in the project, so always hold them even when you think everyone already knows everything.

Internal Kick-Off: On the first day of project execution, invite the entire project team, contractors, and representatives from all supporting departments – procurement, IT, legal, QA, shipping and receiving, etc.

- Walk-through the essentials of the project plan, focusing on the need, business case (briefly), objective, solution, WBS, precedence diagram, Gantt chart, project team organization, risks, and issues.
- Invite questions at any time during the meeting, and answer those you can on the spot.
- Collect a list of the questions you cannot answer immediately, and then followup with answers after the meeting.

External Kick-Off: For contracted projects with an external customer, during the first week of the project hold a second very similar kick-off meeting attended by the leads from the project team and the leads from the customer organization – their business, domain, contracts, legal, QA, etc.



Project Requirements Review

The most important protection of your project is getting all the requirements – what is needed to meet the objective – during planning before execution starts.

However, sometimes the requirements come from the customer or are otherwise given to the PM as “finished”, but clearly have problems – are incomplete, inconsistent, or too vague to be implemented or proved.

Whether the requirements have issues or are “perfect”, great value can come from holding a Project Requirements Review (PRR) in the first week of execution:

- Assemble all the relevant stakeholders – customer, team, key contractors.
- Project the requirements on a screen, with a clarification column.
- Review every requirement, and add clarifications to remove any issues.
- Distribute the clarifications along with the requirements in all documentation.
- This is legal even for competitive, fixed price contracts, since the requirement language is not changed, only clarified with separate text.

ID	Requirement	Clarification
002	The room shall be 10m wide x 20m long x 2.5m high.	None.
001	The room shall be secure.	The room door shall have a certified Category 1 lock.
003	The software shall be user-friendly.	There shall be pop-up help information available for each text entry field.

“The PRR was the #1 factor in success of this project.” – Common customer & contractor comment.

Exercise – First Steps



Get your project underway:

- *Hold a kick-off meeting, invite everyone, brief the plan, answer any questions you can, and follow-up later on the rest. Also hold an external kickoff meeting if working with an external customer.*

- *Hold an internal Project Requirements Review, plus an external one if working with an external customer. Then make sure the clarifications are always distributed with the requirements from that point forward.*



“All things are created twice; first mentally; then physically.”

– Stephen Covey, 1932-2012.

The project requirements – what is needed – were identified during planning.

The first work of execution is to baseline the “design requirements” – how to meet the top-level project requirements – before creating the deliverables:

- Baseline a document table of contents, before writing the content.
- Prepare a new floor plan diagram, before construction or moving anything.
- Define a detailed architecture diagram, before working on any components.

Prototypes mock-up a deliverable’s basic functionality to help obtain design feedback at little cost:

- A building in modeling software that enables virtual walkthroughs.
- A cardboard or 3D printed piece of furniture, toy, or tool.
- A set of software screens showing how they would work and interact, without any working programming behind them.

It is critically important to obtain a user review of the design to find anything important that was missed before committing significant resources on building it:

- At least two iterations of the design are usually required to get it right.
- See the user review process and tool in the Monitoring And Control chapter.

Exercise – Design & Build



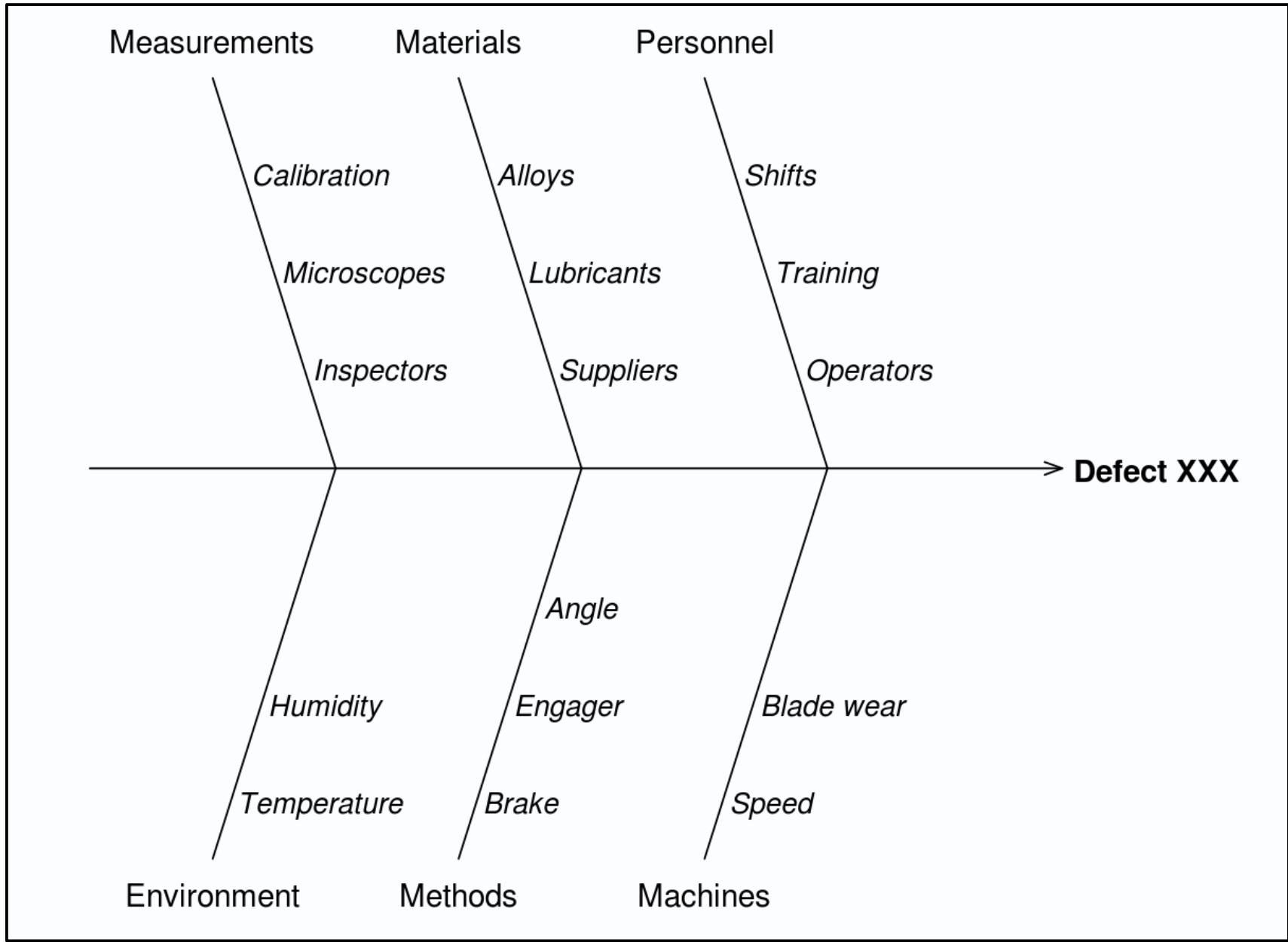
Design and build the project output:

- *Prepare at least one design of anything that is delivered to the customer.*
- *Obtain user reviews (see Monitoring And Control chapter) of each design to find anything important that was missed.*
- *If significant issues are discovered, conduct additional design rounds to ensure the eventual build will produce the correct result.*
- *Then create / build / produce the actual deliverable.*



Finding Root Causes

Part of execution is solving problems – the Ishikawa or “fishbone” diagram helps you dig behind symptoms and find the root causes.



Daniel Penfield, [Ishikawa Diagram](#), Creative Commons Attribution-Share Alike 3.0

Chapter Summary



- The purpose of execution is to assemble the best possible team, design and build the project output, and prepare for delivery and handover.
- Keep the planning leads to ensure continuity and accountability, select the rest of the team based on skills, energy, team temperament, and ethics, choose from the widest set of candidates to maximize diversity and therefore creativity and performance, and include a user representative in as much of the project work as possible.
- Build a cohesive team identity with off-site sessions, team training, and team meals, and work continually to maximize team trust since it's the largest contributor to scope, cost, and schedule performance.
- The more important the project, the more important it is to colocate the team in one building / floor / room to minimize mistakes and communication delays.
- Matrix organizations are usually the best compromise, providing the best availability of skills and allowing the project manager to focus on project performance, however the functional manager must use a scheduling tool to manage a realistic loading of their personnel across projects, ideally allocating people to one project at a time until that work is complete.
- Completely delegate responsibility to the team for how the work is done so they feel empowered and can grow and learn, accept that mistakes will be made, make sure the team knows they should ask for assistance when needed, and always status and follow-up since you retain overall accountability for success.

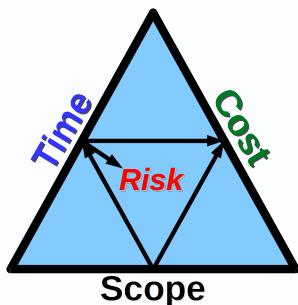
Chapter Summary (Cont'd)



- Motivate the team do to their best by communicating the project need, business case benefits, and personal career advantages, and provide credit and sincere appreciation publicly, privately, and to the team's functional managers.
- Manage people conflict by first addressing any underlying causes, then bring the parties together and clearly communicate the responsibility for resolution by the parties themselves, and then replace personnel if required to protect the overall project.
- Prefer verbal communications, face-to-face over phone, reserving email and written communication for data transmission, record of agreements, formal approvals, and contract communications, and hold meetings for regular statusing, brainstorming, problem solving, and reviews.
- Always hold an internal kick-off meeting for the whole organization even when you think everyone already knows everything, brief the project plan essentials, answer any questions you can and followup with answers to the rest, and repeat with the customer for contracted projects.
- Even when the requirements are “perfect” and legally locked, hold a requirements review the first week of execution and add clarifications wherever needed, saving many multiples of time and rework later.
- Prepare one or more designs of all deliverables, and obtain user reviews to obtain critically important feedback and find out what was missed, before expensively locking in the actual creation.
- When problems arise, the Ishikawa or fish-bone diagram provides a very useful structured tool to help investigate behind symptoms and find the root causes.

Stage 4 – Monitoring & Control

Status, Manage, Report



“Have no fear of perfection: you'll never reach it.”

– Salvador Dali, painter, 1904-1989.

Stage 4 – Monitoring & Control



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Weekly Status Meeting

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Chapter Summary



The purpose of monitoring and control is to keep track of how the project is doing, and take action to keep performance as close as possible to the original plan:

- Status the issues and risks with the project leads in a one hour max meeting at the start of each week.
- Ensure scope changes are never made without a full impact analysis and a considered decision, and try to trade out existing scope to balance off any new work – solve the number two cause of project failure, scope creep.
- Ensure all designs are reviewed by the users to provide critically important feedback and find anything missed before creating the full deliverables – solve the number three cause of project failure – insufficient user reviews.
- Ensure the risks are tracked and response plans proactively implemented, and use the risk budget as needed to protect the plan.
- Formally status the scope, schedule, budget, and risks once a month and review with the stakeholders.
- Take action wherever you can to redirect the performance back to the plan.
- Ask the stakeholders for assistance wherever they can be useful.
- If the performance cannot be brought back inline with the plan, ask the stakeholders which of scope, schedule, or budget is most important to them, and then do whatever is needed to rebalance the triple constraint.



Managing Expectations

“Under promise, and over deliver.”

– First principle of expectations management.

Project management is a communications job – actively manage stakeholder expectations so they remain realistic.

- Let stakeholders know about any significant developments as soon as they happen, and provide a full status review at least once a month.
- Never over-commit, especially under pressure, since you will quickly lose stakeholder trust about everything you communicate after that.
- If for any reason a commitment or expectation cannot be met, let people know well in advance, communicate the updated plan, and make sure you can meet it.

Know what is most important to each of your stakeholders:

- Sponsor – usually cost.
- Customer – often scope, then schedule.
- Program manager – often schedule due to impact on other projects, then cost.
- Functional managers – usually schedule due to impact on their resources.
- Senior management – the project benefits, external perceptions.
- Contractors & partners – schedule, inclusion in communication and planning.
- Project team – achievement, recognition, career development.

Weekly Status Meeting



Your most basic and important monitoring and control event is the weekly status meeting:

- Usually every Monday morning, at latest Tuesday morning, to set up the week.
- With the project manager and leads, not all hands – each project lead should hold their own status meeting afterwards with their own team.
- Usually don't formally status scope, schedule, cost – just the project-level issues to ensure they are being managed or assistance can be escalated if required, and any new issues are raised, plus review the risk register.
- Keep to one hour maximum – spin off side meetings on specific issues if needed.

Keep the issues list in a word processor table or spreadsheet so everyone can read it:

- Re-prioritize the list after each update with *Layout / Sort* (Word) or *Data / Sort* (Excel) for your preferred ordering – usually either Lead / Due or Due / Lead.

An absolute imperative – **never** cancel this meeting “to get work done instead”.

Project Issues List

Lead	Issue	Status	Due
A. Albert	Office Space Shortage	Converting meeting room 5 to a working area	2010-01-10
B. Baker	Printing of Manuals	Have told printer need copies by Fri or must switch suppliers.	2010-01-12
C. Charles	Software Schedule	Descoping the management functions until next phase	2010-02-14
:	:	:	:

A one hour meeting is only 2.5% of a 40 hour week – very inexpensive insurance!



Establish the weekly status meeting:

- *Schedule a repeating meeting for the duration of the project, ideally Monday morning, inviting all the project leads.*
- *Prepare a Project Issues List in the most convenient tool, usually Microsoft Word or Excel.*
- *Hold the meeting every week, one hour max, never canceling it, delegating the chair of the meeting if for some reason you can't attend.*



Change Control

“Because things are the way they are, things will not stay the way they are.”
– Bertolt Brecht, 1898-1956.

Ensure you manage “scope creep”, making the project result better and better and better, the second most common cause of project failure:

- The best solution is the same as the solution to the number one cause of project failure – get all the scope up front during planning.

Then make sure the project has a rigorous change control process:

- Any change, no matter how minor, must be written down on a change control form and submitted through the project manager.

Convene a Change Control Board (CCB) meeting to evaluate the change:

- Wide membership, any possibly affected party, all core and support functions.
- The primary purpose of the first meeting is just to identify all the areas of potential impacts – design, build, documentation, certifications, etc.

Then whoever is closest to the change follows up after the meeting to complete an impact analysis and determine the full time and cost required:

- Simply iterate the planning process – prepare requirements, a WBS, precedence diagram, deliverable estimates, Gantt chart, and risk analysis.
- Particularly make sure any additional costs due purely to increased schedule are included in the impact – any management, rentals, etc. needed for longer.

Impact Analysis



Example change: add an outdoor pool to a hotel already under construction.

Iterate the planning process to determine the scope, time, cost, and risks:

- Requirements. Interview everybody and baseline everything the pool will need – size, shape, depths, heating, drainage, fencing, signage, safety, zoning, bathrooms / changing area, etc.
- WBS. Identify all the deliverables required to do the work – draft design, user review, final design, zoning approval, material, construction, QA, test, inspection, procurement documents, etc.
- Precedence Diagram. Flowchart the logic of the work to determine how the deliverables come together and what can be done in parallel.
- Estimates. Have the owner of each deliverable provide an activity breakdown to identify the required resources, time, and costs.
- Schedule. Include the new work in the existing Gantt chart to determine when it can be done and any effect on the critical path – then add the costs for any management personnel or other resources required for longer due just to the schedule extension.
- Risks. Identify any risks, quantify them, do response planning, and then add any time and cost to the change impact.

Change Approval



“Don't do anything you don't have to do.”

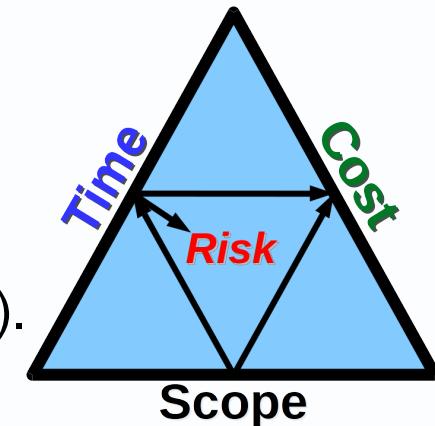
– Louis Fried, VP SRI International, 1992.

The PM can approve changes purely internal to the project that don't affect the customer scope, schedule, or budget.

Otherwise the change must be submitted to the sponsor for approval:

- Always include a recommendation:
 - ➔ Yes / No / Next phase (lean towards no or next phase).
- Never start implementing until formal approval with full knowledge of the additional time and cost is provided in writing!

Keep it balanced!



There should always be an “emergency approval” process for changes affecting health, safety, legal, or having catastrophic effect on project success:

- The project manager can then approve emergency changes immediately with a full impact analysis following up as soon as possible.

Whenever possible, offset any additional scope by removing some existing scope or moving it to a future phase – don't fall into the second most common cause of project failure and make the project better and better until it collapses!

Exercise – Change Control



Establish and implement a rigorous change control process:

- *Obtain or create a standard change request form, or use the template accompanying this course.*
- *Establish the Change Control Board (CCB) with membership from the project leads and all supporting groups that might be impacted by any change, such as business, development, implementation, training, procurement, security, support, QA, legal, etc.*
- *Ensure all members of the project team and the customer know that any change to anything already decided or approved, including requirements, deliverables, and documentation, must go through the change control process.*
- *As you proceed through the project, reinforce the importance of rigorous use of this process for even the most minor change.*



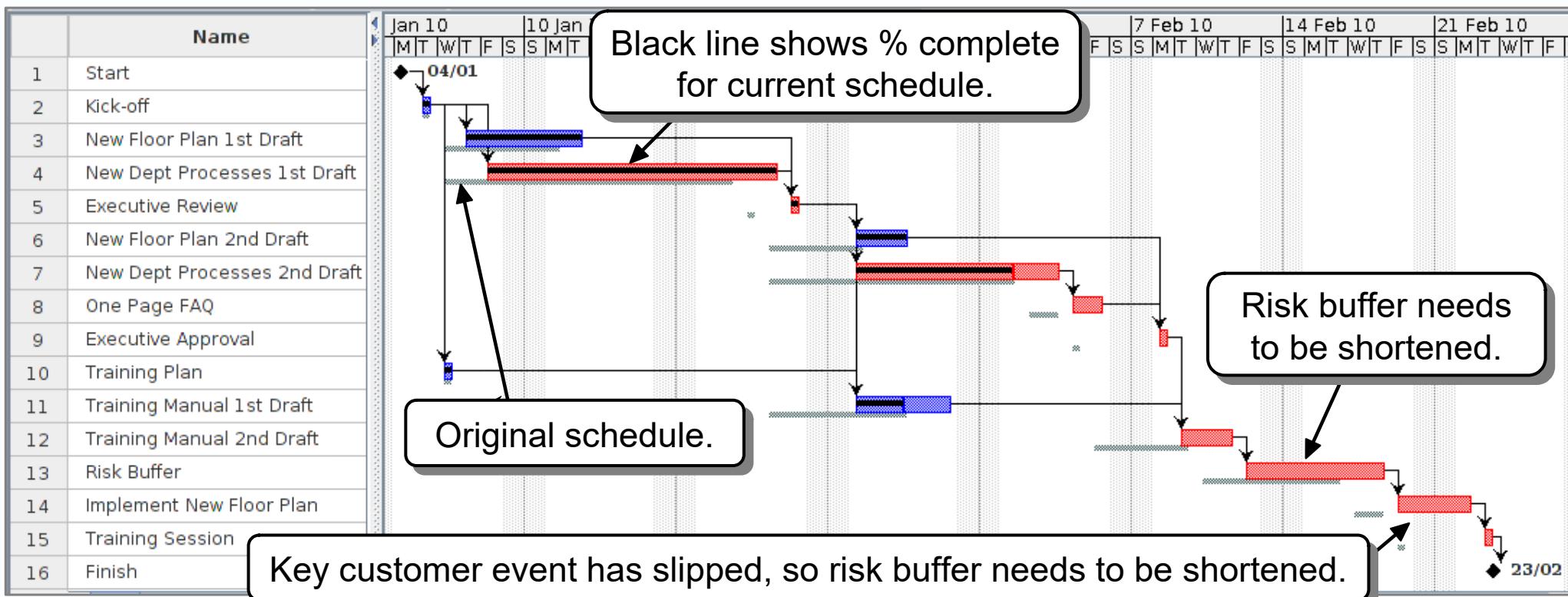
Schedule Status

Know the schedule performance compared to the plan by obtaining status from the leads:

- Usually the first of each month, more often for shorter, schedule critical projects.
- Status the work package level for deliverables longer than two weeks (see Planning).
- For completed work, ask the leads for the actual finish date.
- For unfinished work, ask the leads for the percentage complete.

Enter the status information into the Gantt tool to obtain the forecasted performance:

- The tool recalculates the critical path and finish date, and compares to the baseline.
- Shows how much risk buffer has been used, so how much it must be decreased.



Managing Schedule



The best way to manage schedule is to make sure there is enough to start with during planning, and then, during monitoring and control, focus on the essentials:

- Ensure everyone knows exactly what they need to do, has the resources required, and the skills needed or training and mentorship to acquire them.
- Ensure everyone is empowered to make the decisions they need to make, and is fully motivated – understanding why the project is worthwhile and their work is important.
- Ensure everyone understands that, after quality, schedule is the most important priority, since delays drive both cost and the emergence of brand new risks.
- Manage the critical path first – the rest of the deliverables are second priority.

The more critical the schedule, the more you need to make sure you have timely visibility by increasing the number of monitoring checkpoints:

- For shorter projects and towards the end of schedule critical projects, hold the usual monthly formal statusing bi-weekly or even weekly if needed.

To produce the greatest schedule performance, hold a maximum 15 minute standup meeting with the leads every morning, go around the room, and cover four essentials:

- What did you do yesterday?
- What are you going to do today?
- Is there anything preventing you from doing it?
- Let me know immediately if anything blocks you from progress.

Crashing & Fast-Tracking



If the project has serious schedule problems and the risk buffer will not be enough to address them, there are two basic ways of compressing schedule: crashing and fast-tracking.

Crashing. Adds people, resources, and money to get work done faster:

- Examples: larger teams, better tools, faster computers, dual monitors, etc.
- However, keep in mind that adding more people to a team can actually slow them down – instead add the fewest people possible, with the most experience, *that have just done the exact same job* – this can be very effective.

Fast-Tracking. Overlaps deliverables on the critical path, starting successor work early before the predecessor is completely finished, what the precedence diagram section called a “lead”:

- The most potential savings are where long duration deliverables are back-to-back, since there is the most potential for overlap.
- Three common types to look for:
 - ➔ Only Handle It Once (OHIO) – e.g. visit a site once for interviews and the site survey.
 - ➔ Staggering – the plumbing team starts on the first floor, then moves to the second floor and the electrical team starts on the first floor, then both move up a level and the painters come in to work on the first floor, then they all move up, etc.
 - ➔ Documentation – tell the team at the beginning of the project to get a start on any end documentation whenever they have any waiting time.
- But be careful – fast-tracking can often look good on paper, but might also need more resources, and can easily end up requiring rework when the predecessor work finishes and end up actually taking longer – only implement where really practical and low risk.

Exercise – Fast-Tracking



How tight is your project schedule?

- *At the very beginning of execution, assume your stakeholders suddenly ask you to reduce the schedule by 20% without adding funds – so you need to try fast tracking.*
- *Using fast tracking alone (no crashing to simply reduce deliverable time) determine if there are deliverables which you can practically overlap on the critical path to compress the schedule.*
- *What is the art of the possible?*
 - *Can you compress the schedule 20% with just fast tracking, and, if not, what is the maximum you can practically obtain?*
 - *How risky are the fast-tracking changes you made – the chances that you will end up with rework once the predecessor is finished and actually end up needing more time after all?*

Cost Status



Cost management starts with knowing where you are with cost reports, typically provided monthly by the finance department, ordered by cost account, and usually showing the previous month, costs to date, planned budget, and remaining budget.

Project: ABC		Month: Jan		This month		To Date		Budgeted		Remaining	
Cost Account	Item	Hours	Cost	Hours	Cost	Hours	Cost	Hours	Cost	Hours	Cost
51025	Smith, R.	4.00	\$200	8.50	\$425	12.00	\$600	3.50	\$175		
	Anderson, B.	148.50	\$5,940	223.60	\$8,944	250.00	\$10,000	26.40	\$1,056		
	Brown, M.	43.20	\$1,512	63.80	\$2,233	30.00	\$1,050	(33.80)	(\$1,183)		
	Morton, G.	65.30	\$1,959	85.90	\$2,577	80.00	\$2,400	(5.90)	(\$177)		
	PrintsRUs	N/A	\$625	N/A	\$1,250	N/A	\$1,875	N/A	\$625		
	Total		\$10,236		\$15,429		\$15,925		\$496		
51036	Smith, R.	4.00	\$200	1.00	\$50	4.00	\$200	3.00	\$150		
	Crowley, D.	12.00	\$540	20.00	\$900	12.00	\$540	(8.00)	(\$360)		
	Grant, P.	23.00	\$805	15.00	\$525	23.00	\$805	8.00	\$280		
	Johnson Construction	N/A	\$12,275	N/A	\$18,550	N/A	\$16,250	N/A	(\$2,300)		
	Total		\$13,820		\$20,025		\$17,795		(\$2,230)		
51048	C. Macintosh	65.50	\$3,275	92.00	\$4,600	110.00	\$5,500	18.00	\$900	:	:
	:	:	:	:	:	:	:	:	:	:	:
Total			\$132,744		\$164,528		\$185,341		\$20,813		

Cost management responsibility should always be delegated to the lowest level possible, to the person best able to manage the cost.

The project manager reviews all cost reports to retain oversight and accountability.

If costs are greater than planned, the risk budget cannot cover the overrun, and the stakeholders direct the budget must be brought back in-line, the only alternative is to reduce scope – if so, do it as early as possible to maximize the savings.

Managing Cost



Once a project is planned, you cannot manage cost directly by reducing salaries or contract payments, and cutting quality to try and reduce cost can quickly make the entire project a waste of time.

Therefore, you can only effectively manage cost indirectly, through what drives it:

- Scope. Find it all during planning, and get the owners to provide an activity breakdown so the budget will be accurate, and then manage change control rigorously so you will never be surprised by the additions.
- Schedule. Every extra day the schedule extends adds to the costs, so manage the critical path like a hawk.
- Risks. Manage them proactively, and mitigate them as early as possible when effective action will be least expensive.

Then make sure you always know the status by ensuring all costs are tracked and reviewed at least once a month:

- So all material and service costs must be allocated on purchase orders and in contracts to the appropriate cost account.
- All personnel hours must be tracked through timesheets:
 - ➔ An administrative burden, but the only way to ensure the project costs don't silently balloon, and personnel don't get unrealistically allocated to much more work than they can do – it actually protects them too.
 - ➔ A project management fundamental – personnel estimates only become useful, and more realistic over time, if they are tracked during the project.

Managing Risk



Review the risk register with the leads at the end of each weekly status meeting.

Watch for the triggers, the early warning signs the risk is coming true:

- Investigate, communicate, collect data, understand the drivers of the risk.
- Use risk budget funds proactively to reduce the probability and/or impact.
- Make sure you have a backup plan in case the risk happens anyway.

The money in the risk budget is controlled, so to draw on it you have to fill out a form and either specify the risk the money is for, or that it's needed to manage a new risk:

- Do not hesitate to draw on the risk budget if needed, that is what it is for.
- Spending funds from the risk budget is a PM decision – you are accountable for performance – so fill out the form and simply explain at the monthly review.

Formally update the risk register for the monthly review:

- Decrease or increase %, T, and \$ as appropriate.
- Add any new risks, quantifications, and response plans.
- Remove risks that are gone – cautiously, never too early.
- Don't use the risk budget for scope creep!

Extrapolate risk budget usage based on the current trend:

- If the risk budget is being consumed too fast, ask the stakeholders for assistance wherever they can help, and if needed obtain direction on what is most important – scope, schedule, or cost – then rebalance the project.

“Mr. VP Finance, I cannot give up much of the risk budget now, as most of the surprises will likely happen at the end of the project.”

Earned Value Overview



“Whilst you can practice good project management without EVM, you cannot practice EVM effectively without good project management.”

– Steve Crowther, British Aerospace Head Of Project Management.

Earned value management (EVM) is a very useful technique that measures the amount of work actually done compared to the amount of work planned to be done, in monetary terms, providing objective numerical metrics for cost and schedule status:

- Should be used only on projects above a certain size, e.g. \$1M and one year, as the admin overhead may not be worth it for smaller efforts.

Start by assigning each deliverable a Deliverable Value (DV) equal to the original estimated cost from the project plan:

- The original cost estimate is the best measure we have of the deliverable's value relative to other deliverables.

Then on any given status date:

- The Planned Value (PV) of each deliverable is the % of the Deliverable Value that was planned to be complete on that date – if a \$100K deliverable should be 50% done, then its planned value on that date is \$50K.
- The Earned Value (EV) of each deliverable is the % of the Deliverable Value actually completed on that date – if only 30% of the same \$100K deliverable is complete, then its earned value is \$30K, and it is \$20K behind schedule.
- The Actual Cost (AC) of each deliverable is the actual amount spent on the status date, whatever that might be, \$10K or \$200K.

Earned Value Metrics



On a given status date, typically the start of each month, calculate the following cost and schedule metrics.

Cost status compares actual spending to what you'd planned *for the work done*:

- Cost Variance (CV) is the difference between the total earned value for all deliverables and the actual costs for that work:
 - $CV = EV - AC$
- Cost Performance Index (CPI) is the ratio of the total earned value for all deliverables and the actual costs for that work:
 - $CPI = EV / AC$ ← Simply change minus to divide.

Schedule status provides an objective numerical measure in monetary terms of how much work has been done compared to what had *planned to be done*:

- Schedule Variance (SV) is the difference between the total earned value and how much work was planned to get done by this date:
 - $SV = EV - PV$
- Schedule Performance Index (SPI) is the ratio between the total earned value and how much work was planned to get done by this date:
 - $SPI = EV / PV$ ← Simply change minus to divide.

Cost Projections



You can use the cost variance (CV) and cost performance index (CPI) to provide objective cost projections.

Start with the baseline, the Budget At Completion (BAC), the total planned cost from the project plan.

Then calculate the Estimate At Completion (EAC), how much the project will end up costing based on the performance so far:

- $EAC = BAC / CPI$

Then calculate the Variance At Completion (VAC), how much the projected cost will differ from the original planned cost:

- $VAC = BAC - EAC$

Then calculate the Estimate To Completion (ETC), how much the project will cost and how much budget you will need from this point to the end:

- $ETC = (BAC - EV) / CPI$

You can also calculate the To Complete Performance Index (TCPI), or how efficient your spending must be from this point forward to meet the original planned budget, by dividing the work left to do by the budget remaining:

- $TCPI = (BAC - EV) / (BAC - AC)$

Schedule Projections



You can also use earned value to provide objective metrics for schedule projections:

- However, schedule projections are less reliably predictive, since the project might be doing well overall, but not on the critical path where it really counts.
- Therefore, earned value schedule projections must always be considered along with the usual critical path status to provide a complete picture.

Start with the baseline, the Schedule Days (SD), the original number of days in the project schedule, excluding the risk buffer.

Then calculate the Schedule Estimate At Completion (SEAC), the number of days the project will likely take based on the performance so far:

- $SEAC = SD / SPI$

Then calculate the Schedule Variance At Completion (SVAC), how many days longer the schedule will likely be from the original plan:

- $SVAC = SD - SEAC$

You can then calculate the Risk Schedule Variance (RSV) by comparing the SVAC to the number of days in the Remaining Risk Buffer (RRB), and see if the projected schedule will be covered by the risk buffer or if there is a shortfall:

- $RSV = RRB + SVAC$

Even if the RSV is positive, keep in mind that most schedule problems usually occur at the end of projects, so consider the specifics of your particular project.

Earned Value Meaning



The meaning of the EV metrics is naturally intuitive:

- Cost Variance (CV), Variance At Completion (VAC), Schedule Variance (SV), Schedule Variance At Completion (SVAC), and Risk Schedule Variance (RSV) greater than zero mean the project is ahead of the original plan, while less than zero mean it is behind the original plan.
- Cost Performance Index (CPI) and Schedule Performance Index (SPI) greater than 1.00 mean the project is ahead of the original plan, while less than 1.00 mean it is behind the original plan.

If your projects use color coding of status, the standards for CPI and SPI are:

- Green. Above 0.95, all is well.
- Yellow. From 0.90 to 0.95, needs corrective action.
- Red. Below 0.90, needs serious attention.

At the same time, a CPI or SPI that is too high, say > 1.05 , requires investigation to ensure the team is not getting great numbers by cutting corners or jeopardizing quality:

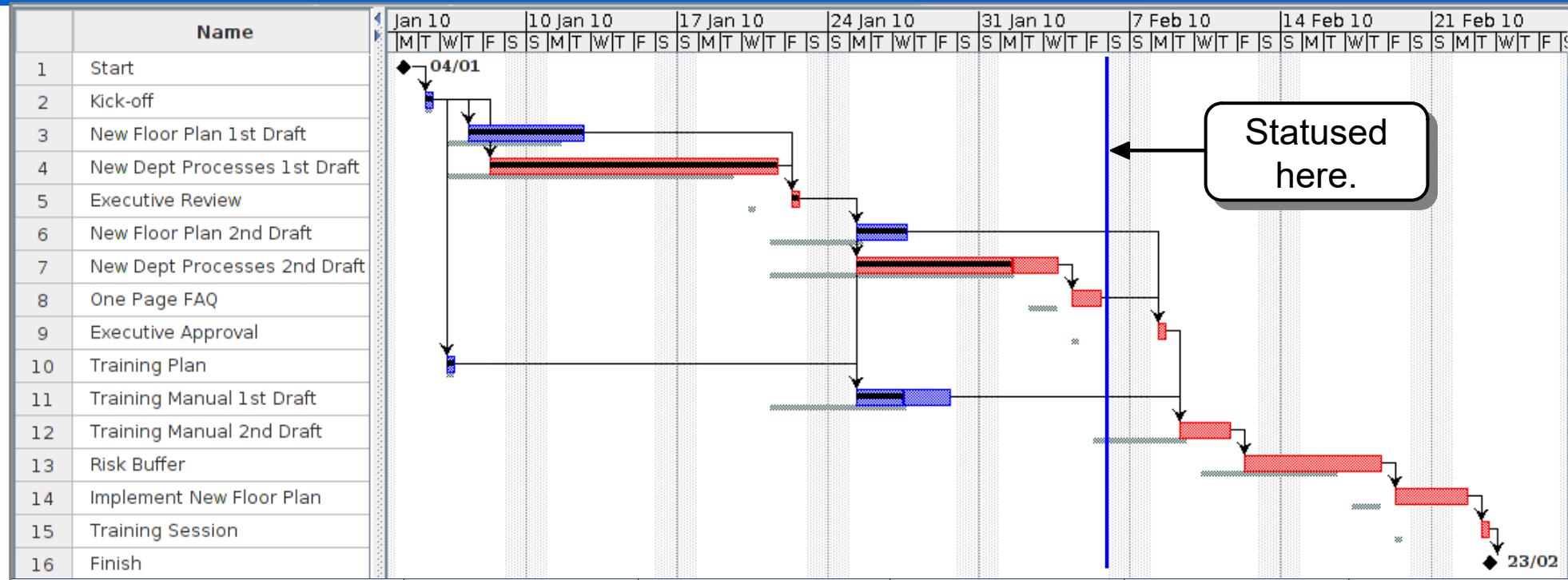
- If after investigation everything is OK, then the best message to stakeholders is “It turns out the team is performing better than originally estimated” – a true statement and better than saying the estimates were just too high.

The great advantage of earned value management is the *objective* numerical status it provides for the monthly reporting:

- If the numbers are good, the stakeholders will have much greater confidence in all the rest of the information you present.



Earned Value Example



12% ahead on cost, 26% behind schedule for the work done.

Deliverable	DV Estimate Cost	AC Actual Cost	Planned Percent Complete	Actual Percent Complete	PV Planned Value	EV Earned Value	Cost		Schedule	
	= EV-AC	= EV/AC	SV = EV-PV	SPI = EV/PV						
Kick-off	\$800	\$600	100%	100%	\$800	\$800	\$200	1.33	\$0	1
New Floor Plan 1st Draft	\$3,200	\$3,600	100%	100%	\$3,200	\$3,200	-\$400	0.89	\$0	1
New Dept Processes 1st Draft	\$8,000	\$7,200	100%	100%	\$8,000	\$8,000	\$800	1.11	\$0	1
Executive Review & Comment	\$800	\$700	100%	100%	\$800	\$800	\$100	1.14	\$0	1
New Floor Plan 2nd Draft	\$3,200	\$3,400	100%	100%	\$3,200	\$3,200	-\$200	0.94	\$0	1
New Dept Processes 2nd Draft	\$8,000	\$3,600	100%	60%	\$8,000	\$4,800	\$1,200	1.33	-\$3,200	0.6
One Page FAQ	\$1,600		100%	0%	\$1,600	\$0	\$0	1.00	-\$1,600	0
Executive Approval	\$800		100%	0%	\$800	\$0	\$0	1.00	-\$800	0
Training Plan	\$1,600	\$1,200	100%	100%	\$1,600	\$1,600	\$400	1.33	\$0	1
Training Manual 1st Draft	\$4,000	\$1,400	100%	50%	\$4,000	\$2,000	\$600	1.43	-\$2,000	0.5
Training Manual 2nd Draft	\$3,200		25%	0%	\$800	\$0	\$0	1.00	-\$800	0
Risk Buffer	\$5,600									
Implement New Floor Plan	\$800									
Training Session	\$1,600									
Project	\$43,200	\$21,700			\$32,800	\$24,400	\$2,700	1.12	-\$8,400	0.74
Projections	EAC =	\$38,420	VAC =	\$4,780	ETC =	\$16,720	SEAC =	39	SVAC =	(10)

What should the PM do with this project?



“No one has a greater asset for his business than a man's pride in his work.”
– Hosea Ballou, 1771-1852.

Modern quality processes come from Total Quality Management (TQM), developed by [W. Edwards Deming](#), whose key quality observations are:

- “Quality must be planned in, not inspected in” – i.e. inspection and test after a deliverable is finished is necessary, but can only catch problems at the end – real quality must be embedded in the work as it's being done.
- Quality parts and processes actually reduce cost and schedule, since they increase efficiency, and reduce both the amount of testing required and customer acceptance issues and returns.
- Strive for continuous incremental improvement – most great advances are made of many small improvements that add up to very large results.

The project's main quality responsibility is to ensure the output is “fit for purpose”:

- This is a long-time legal requirement in common law, meaning a product must have the features necessary for actual use, e.g. a car needs to have brakes even if it is not specifically listed on the sales documentation.
- From the project manager's perspective, this means the project must not only meet the requirements, it must genuinely be able to do the intended job.
- The most effective tools to make sure the project is fit for purpose are peer reviews within deliverables, and user reviews of work in progress.



During planning, ask each lead: “How will you ensure quality is built-in to your deliverables while you are working on them?”

- If the answer is only to inspect them when finished, then make sure they have a better method while the work is actually being done, at a minimum including peer reviews.

Peer reviews are a long time best practice to significantly improve quality:

- Used since the 1700's to improve scientific papers before publication in journals.
- In software development, studies have shown they can reduce bugs by 80%.
- Can be used for any kind of deliverable – documents, designs, prototypes...

Formal Peer Reviews. Required for health, safety, and legal sensitive deliverables:

- Official records are kept of all comments, with formal follow-up by the QA organization.

Informal Peer Reviews. Much easier to implement, and much better accepted by the team:

- Can be used for anything that is not health, safety, or legal sensitive.
- No formal records are kept, other than a meeting notice the review happens.
- Structured so it takes one hour max for each reviewer to review the work – split up the deliverable into multiple pieces and reviews if needed.
- Hold a one hour max consolidation meeting to gather all the reviewer comments.
- The owner goes around the table, listens, records, and never wastes time defending – the formal process for informal peer reviews (basically this description) mandates the owner must say “thank you” after each comment.
- Then the owner can accept or ignore any comment as they see fit, without costly and time-consuming formal followup, and will naturally implement the best input.



User reviews also make an invaluable contribution to quality by helping ensure the project result is fit for purpose – can actually do the job it's intended for.

They are the solution to managing the third most common cause of project failure, insufficient early user feedback:

- All too often at the end of the project the user says: “That’s exactly what I said I wanted, but now that I see it, I realize it’s not what I need”.

The solution is to have users review and provide feedback on everything they can – draft designs, table of contents, first mockups, initial prototypes, every build, etc.

Manage the danger of falling into scope creep with an organized prioritization process:

- First, have the users prioritize the comments with 1 = “Essential to the project objective”, 2 = “Good idea but next project or phase”, and 3 = “For later investigation” – this minimizes most of the unnecessary scope increases.
- Then have the project team prioritize the comments, since they have the best sense of how much work each item will require, often recommending some user priority 1 items be priority 2 to minimize the cost and schedule increase.
- Both the user and project priorities are then provided to the sponsor, who usually meets with the users to discuss, and then provides a final prioritization.
- Any items the sponsor designates priority 1 are then entered into the change control process, the time and cost impact determined and provided back to the sponsor, who then makes a final decision on which items to add to the project.

Try very hard to trade out other scope equal in time and cost to balance off any new work.



User Review Disposition Tool

Here is a simple tool to disposition comments from a user review to help make sure you find the most important items while avoiding scope creep.

Many users can be involved in a review, however there must be a lead user who can make the final decision on the prioritization of each comment.

Enter their comments into a table or spreadsheet during the review, and make sure the users agree on the wording of each item.

Order the comments by user priority with *Layout / Sort* (Word) or *Data / Sort* (Excel).

After the meeting, have the project team enter their prioritization in a second column.

Provide the document to the sponsor for entry of their final decision in a third column.

User Review Disposition Table

"We prototype each new 'postal outlet' with cardboard first, then only after a user walk-through, and their comments are worked in, do we build the real thing."

– PM at Canadian Post Office

Issue	User Priority	Project Priority	Sponsor Decision
Add this...	1	1	1
Remove that...	1	2	1
Change this...	1	1	2
Enhance that...	1	1	1
Add this...	2	2	2
Remove that...	2	2	2
Add that...	2	2	3
Change this...	3	3	3
Enhance that...	3	3	3
:	:	:	:

1 – Essential to objective, run through Change Control.

2 – For the next project.

3 – For later investigation.

Solution Options



Some common project problems and potential resolutions.

Problem	Resolution
Cost or Schedule	Crashing – add resources, people, better tools, or one very highly skilled person that has just successfully done the exact same job.
Cost or Schedule	Descope – remove non-essential scope, move to later project or phase.
Quality	Peer reviews – ask 3 to 5 colleagues to review each deliverable prior to completion to find issues the owner is too close to see.
Quality	User reviews – have users review everything early, then disposition comments into “essential”, “next project”, and “later investigation”.
Schedule	Fast tracking – start some deliverables early based on partial completion of preceding work (but be careful you won't need rework).
Schedule	Stand ups – meet each morning max 15 min without chairs: “What did you do yesterday, what are you going to do today, is there anything preventing you from doing it, let me know right away if blocked.”
Scope Creep	Requirements trading – trade out some non-essential requirements equal to the new scope to balance off the cost and schedule growth.
Scope Difficulty	Subcontract – transfer the work to an organization, company, or group that is an expert in the type of work required.
User Acceptance	Piloting, phasing, scenarios – deploy parts of the solution to parts of the organization, using scenario based verification testing (see Closing).
Vendor Management	Onsite statusing – go to the vendor's site to obtain status updates, at least monthly, and every week if required – this gets their full attention.



The project manager sometimes has to persuade people to address a problem.

Start with understanding, by finding out what is most important to them:

- Simply ask them – then reflect it back and clarify to make sure you understand.
- Then communicate how addressing the problem helps their priorities.

Find an independent person or organization they respect that supports your position.

Key trick: it is always very helpful to put your position on a single piece of paper:

- A subjective disagreement can go on forever – you need to depersonalize it.
- A piece of paper summarizing the best presentation of your position makes the data the issue, not the people involved.
- Include as many numbers and objective third-party information as possible.

Then, if needed, establish they are “standing on a burning platform”:

- Human beings are twice as motivated to avoid failure as to obtain success.
- Identify the large downsides to their current position – legal, reputation, etc.
- Demonstrate that their movement is urgently required to avoid the downside.

Unless it is a make or break issue, look for a win-win compromise by using negotiating techniques (see Overview chapter).

However, if it is really make or break, and you’ve tried everything you can one-on-one, then you must appeal up the chain of command and do whatever is necessary.

Monthly Status



"Eventually a young manager displayed the first red chart. I stood up and clapped. That's when everyone understood the key became identifying the problems, and helping each other find solutions."

– Alan Mulally, Ford CEO, [How to turn around a business losing \\$17B](#).

You need to regularly gather formal status on the project progress to help you monitor and control, and to review with the stakeholders so they are kept up to date:

- Typically monthly, since that is when financial info is updated, however high risk and schedule critical projects can require formal updates bi-weekly or even weekly.

Collect the latest status on the big five – scope, schedule, cost, risks, and issues – and document them in a one page report (see template on the next slide):

- One page is a manageable amount of work, and should be sufficient for stakeholder review of even \$B projects if you are providing status every month.
- One page ensures the items of most importance to you don't get lost – risks, issues, and request for help with problems you cannot resolve, such as support from internal departments and external organizations, addition of resources, etc.

If your organization uses color coding – a short-hand method to help understand quickly how the project is doing – the standard is the same as used for earned value:

- Green. Within 5% of plan, the project is doing well.
- Yellow. From 5%–10% off plan, action is required to get back on track.
- Red. More than 10% off plan, major action is required to address the issues.
- Colors can be assigned to scope, schedule, and cost individually.

One Page Report



Standard one page template used by many organizations for \$K to \$B projects.

<u>Scope & Schedule</u>			<u>Earned Value</u>				
Name			Milestone	CPI	SPI		
Start			Milestone 1	0.92	0.98		
Kick-off			Milestone 2	0.94	0.96		
New Floor Plan 1st Draft			Milestone 3	0.86	0.94		
New Dept Processes 1st Draft			Or whatever cost status available.				
Executive Review			Project	0.87	0.93		
New Floor Plan 2nd Draft			BAC = \$8.5M, EAC = \$8.9M, ETC = \$4.4M				
New Dept Processes 2nd Draft							
One Page FAQ							
Executive Approval							
Training Manual 2nd Draft							
Risk Buffer							
<u>Issues</u>			<u>Customer</u>				
<ul style="list-style-type: none"> Top three. <ul style="list-style-type: none"> • • • 			<ul style="list-style-type: none"> So important they get a quadrant of their own – anything on their mind. <ul style="list-style-type: none"> • Happy, unhappy. • Want more, want less. • Organizational changes, etc. • • • 				
<u>Risks</u>							
<ul style="list-style-type: none"> Top three. <ul style="list-style-type: none"> • • • 							

Monthly Review



*"We offer three kinds of service: (1) Good – won't be cheap or fast;
(2) Fast – won't be good or cheap; (3) Cheap – won't be fast or good."*
– Sign In A Garage

Meet with the sponsor and other relevant stakeholders to review the status:

- The goal is to make sure they always have an accurate and timely understanding of the progress, and are never surprised by problems.
- But remember stakeholders are also there to help the project – so if you need assistance, ask for it as early as possible when they will be most responsive since there is the most time to help, and will often feel useful and part of the project success.

If the risk budget is being used faster than expected, and you cannot bring the project back on plan, then tell the truth, and perform your most important job:

- Ask for direction, phrased positively as “We can do the very best possible from here, what is most important to you at this point – scope, schedule, or cost?”
- They usually pick two of the constraints, in which case your job is to protect those two, and let the other one go to the least extent possible.
- The stakeholders will then remember the project as successful, since the decision was made as early as possible, they provided timely direction, and the project was as *successful as it could have been in the circumstances*.

Exercise – Monthly Review



Establish and implement a monthly status review:

- *Set up the monthly review board, typically including the sponsor, customer, and senior representatives of any key stakeholders, especially those whose support is required by the project.*
- *Establish a standard one-page report format, such as the template just described.*
- *At the start of each month, gather status on the scope, schedule, cost, risks, issues, and customer, and review the project progress with the review board.*
- *Make sure you treat the review as a two-way communication, and ask the stakeholders for help with anything you need assistance with.*
- *If the risk budget is being consumed too fast, tell the truth, then ask the stakeholders what is most important to them – scope, schedule, or cost – and then rebalance the constraints as needed to obtain the best possible outcome in the circumstances.*

Chapter Summary



- The purpose of monitoring and control is to track the status of scope, schedule, cost, and risks, and take action to keep performance as close to the plan as possible.
- Know what is important to each stakeholder, actively manage their expectations, never over commit, and give them a full status update at least once a month.
- The most basic and important project control is the weekly maximum one hour status meeting with the leads to update the issues list and risk register – never cancel this meeting to get work done instead, and keep it going until the end of the project.
- Solve scope creep, the second most common cause of project failure, by instituting a rigorous change control process, and try hard to implement any new scope in the next project or phase, or trade out other scope equivalent in impact to balance it off.
- Maximize schedule performance by ensuring the team has the skills and resources required, are fully empowered and motivated, understand schedule delays drive both cost and new risks, and then manage the critical path like a hawk.
- For critical schedules, hold a stand-up 15 minute meeting each morning, ask each lead what they did yesterday, what they will do today, if there is anything preventing them from accomplishing it, and to let you know immediately if anything blocks them from progress.
- Compress schedule by crashing – adding more resources such as better tools or a very experienced person that has just done the same job, and fast tracking – starting deliverables before their predecessors are completely finished where really practical and no rework will be needed.



Chapter Summary (Cont'd)

- Obtain cost reports at least once a month, ordered by cost account that collect all material, services, and personnel time, delegate management to the person best able to manage the cost, and review the reports yourself to maintain oversight.
- Cost cannot be arbitrarily reduced once planned, and can only be effectively managed by controlling the drivers – scope, schedule, and risks.
- If costs must be reduced the only option is to reduce scope, a decision that should be made as early as possible to maximize the benefits.
- “Quality must be planned in, not inspected in”; quality parts and processes reduce time and cost by increasing efficiency and reducing required testing and customer acceptance issues; and continuous small improvements add up to big results.
- The highest quality goal is for the project output to be “fit for purpose”, and is greatly assisted by peer reviews to find issues the deliverable owners cannot see, and user reviews of all draft work in progress to find requirements that were missed – only working in items essential for project success, and trading out other scope to balance off the impact of new work wherever possible.
- Delegate ownership of risks to the lowest level possible, watch for the triggers, spend money to manage risks early when they are least expensive, add new risks to the register whenever they arise, and reduce and remove risks very cautiously.
- When the project is large enough to support the administration, use earned value management to provide objective numerical metrics and projections of cost and schedule performance, based on the amount of work done compared to what was planned to be done, greatly aiding the confidence of stakeholders in project reporting.



Chapter Summary (Cont'd)

- You can help persuade people to resolve an issue by understanding what is important to them and putting it in their interest, depersonalizing the issue and strengthening your position by putting supporting data on a single piece of paper, when needed establishing they are “standing on a burning platform”, and then, if necessary to protect the project, escalating resolution up the chain of command.
- Formally status the project scope, schedule, cost, risks, and issues monthly to obtain solid information to help you monitor and control, and to review progress with the sponsor and stakeholders so they are kept fully informed and never surprised:
 - Use a one page report format to keep the reporting manageable, and to ensure the information you need to discuss does not get lost.
 - Ask the stakeholders for assistance with anything they can help with.
 - If the risk budget is being consumed too fast, tell the truth, then ask the stakeholders for direction on what is most important to them – scope, schedule, or cost – and after they pick two, let the third one go as little as possible to manage the project to the best outcome possible in the circumstances.



Stage 5 – Closing

Finalize Everything

“Begin at the beginning, and go on till you come to the end, then stop.”

– Lewis Carroll, *Alice in Wonderland*, 1865.



Stage 5 – Closing

Introduction

Purpose Of Closing

Procurement

Contract Closure

Acceptance

Change Management

Scope Verification

Scenario Based Verification

Delivery Criteria

Transition To Operations

Exercise – Scope Closure

Lessons Learned

Lessons Learned

Team Closure

People Transition

Project Celebration

Exercise – People Closure

Final Report

Final Report

Exercise – Final Report

Chapter Summary

Note: Acceptance In Closing



For reasons of simplicity and practicality, there is one difference from the PMBOK in the description provided in this reference. The PMBOK puts Scope Verification in the Monitoring and Control stage, so that closing only starts once all the deliverables have been verified, to protect closing from starting when there is really a lot more work left than we realize. This is a good idea. For example, never pay a contractor all of the final invoice when there is still work outstanding.

However, in many organizations there is a significant difference between the build and the scope verification parts of the project, with scope verification involving changes in the team, participation from contract personnel, and conduct of very formal processes, and so scope verification is often practically categorized as a closing process. This reference takes this approach, and so includes best practices for scope verification in a single Acceptance section here in the closing stage, while also emphasizing the best practice is to carry out scope verification and acceptance all the way through the project as portions of the scope complete.

Purpose Of Closing



The purpose of closing is to wrap up the project in an organized manner and make sure nothing gets forgotten:

- Ensure all procurements are complete, everything has been delivered, and all contracts are formally closed.
- Ensure change management has been well planned, and the customer truly believes the project result will be useful to them and will accept it.
- Verify all the scope has been completed, the project output is “fit for purpose”, and everything required has been delivered.
- Ensure the group responsible for maintaining the project output – support, operations, sustainment – has all the information and training they need.
- Ensure project lessons learned are gathered, documented, and made available to others in the organization.
- Provide performance feedback to team members, and help them transition back to their functional organizations or to other projects.
- Hold some kind of celebration to acknowledge the effort of the team and provide a human closure point for the project.
- Prepare a final report for the stakeholders documenting whatever happened compared to the original plan, describing major risks and lessons learned, and providing recommendations for what should happen next.

Contract Closure



The project should conduct scope verification with contractors the same way the project does with the customer (see next section):

- Hold scope verification events throughout the project as elements are completed to sign off work as you go.
- Conduct scenario based verification wherever possible.
- Ensure all requirements are met, material and services delivered, documentation received, and required training held before closing contracts.

It's a very useful best practice to hold three-party verification events, where contractors verify their scope with the project at the same time the customer signs off the scope or communicates any concerns:

- A single scope verification event is much more efficient than two.
- A combined verification event avoids the risk of approving scope from a contractor that the customer will not accept from the project, while ensuring the contractor hears about any issues from the customer directly.
- To make this work, customer requirements must have been passed down to contractors without modification to ensure back-to-back compliance.

On conclusion of the scope verification, the PM authorizes payment of any final invoices, since they know best if the contractor's work was successfully done.

Ensure the procurement lead sends a formal closure notification to each contractor to prevent any unnecessary further work and invoicing (it can happen).

Change Management



Projects that introduce significant changes to an organization require careful “change management” to avoid resistance by users and ensure successful adoption.

Most importantly, during planning, or at latest the beginning of execution, identify a user “internal champion” with credibility inside the customer organization:

- Include the champion in the project planning, design, development, and implementation, and ensure you have their support for everything you do.
- Provide the champion with everything they need to sell their organization on the project value – briefing packages, demonstrations, metrics, etc.
- The goal is for the champion to get to the point they feel confident in saying to their organization: “This project is well worth it, and will really help us.”

Then do everything possible to ensure the delivery is successful:

- All required training is provided “just in time” the day before delivery.
- Ensure the project team and all required support personnel are available to assist immediately with any problems that arise.
- Conduct user surveys so you can identify any issues and fix them right away, and to obtain objective metrics to show most users like the project result.
- Whenever possible, pilot the project in part of the organization, and phase in the easiest parts first, to learn from the feedback, fix anything required, and obtain interim successes that you can build on.

Scope Verification



One of the key steps in closing is scope verification – formally proving to the customer that the project output is correctly produced:

- All requirements are met – proved by inspection, demonstration, analysis, or test.
- All material and services are delivered.
- All documentation is delivered.
- All training is provided.

Wherever possible, it's best to hold several verification events incrementally through the project as portions of the scope are finished, e.g.:

- The building foundation is complete, then superstructure is built, then facade is finished, then electrical is done, then plumbing is complete, then interior is finished, then safety systems are in, then landscaping is done, then maintenance documentation is finished, etc.
- The clinical software works, then laboratory software works, then radiology software works, then pharmacy software works, then dental software works, then integrated system passing information back and forth works, then data warehousing functions work, etc.

The over-arching goal of scope verification is to prove the project output is “fit for purpose” – that it can actually do the job it was intended for.

Scenario Based Verification

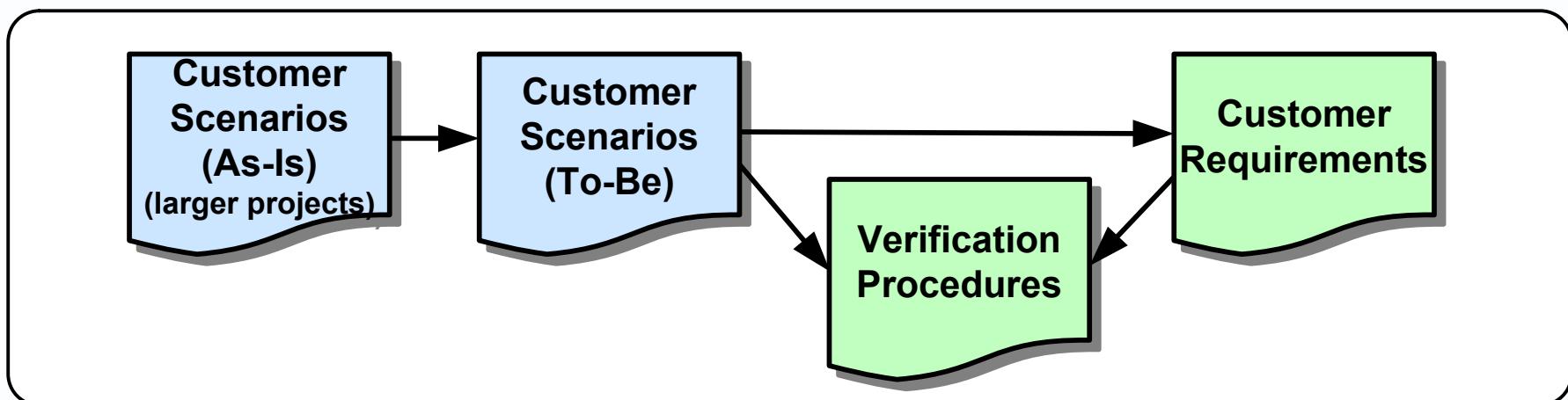


Scenario based verification is a great way to prove the project output is “fit for purpose”:

- Business analysts prepare a set of scenarios (also called use cases, workflows, or operational procedures) reflecting how the customer needs to use the project output.
- The project requirements are then derived from the scenarios.
- However, if scenarios were not prepared up front, it is very helpful to prepare them anyway, as early as possible during execution, to assist with scope verification.

Then structure the verification procedures to show the project output being used as described in the scenarios:

- Trace the requirements to scenarios that demonstrate the requirements being met.
- Work with the customer to obtain agreement the verification procedures reflect their scenarios and will prove the traced requirements are met – make changes as needed to obtain their buy-in.
- Then run the verification procedures in formal events to prove to the customer the project output is fully fit for purpose and satisfies the requirements at the same time.



Delivery Criteria



Some project outputs are complex enough that delivery to the customer cannot practically wait for resolution of every non-critical issue that would be better fixed during the support or warranty period, e.g.:

- For delivery of a building, last minute discovery of a few missing finishings can be resolved after move-in, without holding up opening the facility.
- For delivery of software, last minute discovery of formatting or spelling issues can be fixed after rollout, without holding up rollout of the system.

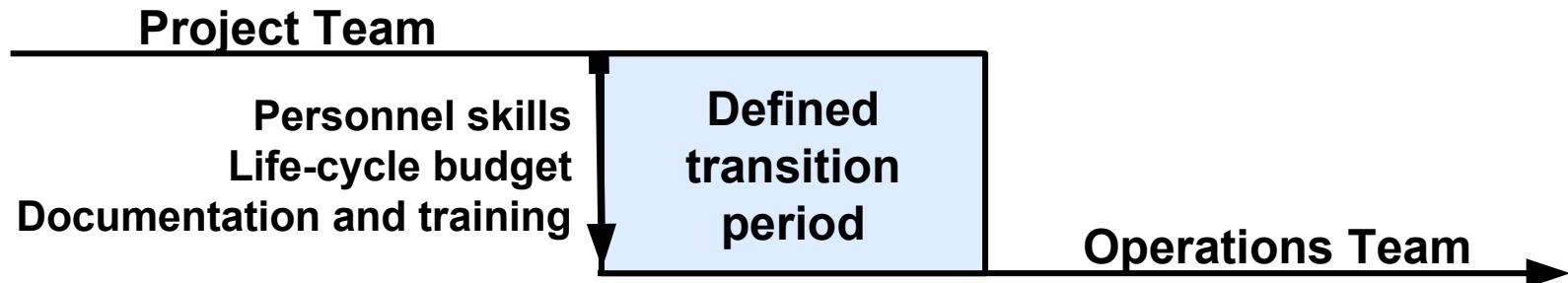
The win-win solution is to agree delivery criteria with three categories:

- There must be zero priority 1 issues – affecting core functionality.
- There must be less than N (e.g. 3) priority 2 issues – a workaround exists:
 - E.g. an electrical outlet is not wired, a text field is a couple characters short.
- There must be less than M (e.g. 5) priority 3 issues – minor usability:
 - E.g. some floor mats are not yet delivered, a field title is misspelled.

Agreement on these criteria provides the customer with assurance that delivery will not begin with anything really important outstanding (zero priority 1 issues), and that everything will be fixed soon during the support period, while enabling delivery to proceed at a reasonable point without holding it up for minor issues.

The handover criteria should be agreed with the customer ideally during the planning stage, or, if needed, as early in execution as possible.

Transition To Operations



The project output often needs to be sustained by a different group than the project team, sometimes called the “operations”, “support”, or “sustainment” group, e.g.:

- Facilities will be cleaned, insured, and repaired.
- Software will be maintained, patched, and licenses renewed.
- Policies will be updated to reflect any changes in regulations.

The project team must provide the operations team with everything they need to maintain the project output:

- The required personnel skills are identified.
- The life-cycle budget is known.
- The required training and documentation is provided.

During the transition, some project personnel must remain available for a defined period to help bridge the handover and assist with any issues that might arise – this is often called the “warranty” or “support” period.

Exercise – Scope Closure



Close the project scope:

- *Close all procurements, ensure everything has been delivered, and use three-party verification events including the customer wherever possible.*
- *Plan for change management to ensure the customer likes and accepts the project output, ideally with the assistance of a user champion.*
- *Wherever possible, hold scope verification events as you proceed as parts of the project are completed.*
- *Wherever possible, use scenario based verification to demonstrate the project output is fit for purpose.*
- *Provide the operations, support, or sustainment team with everything they need to maintain the project output after the project team disbands.*



Lessons Learned

*“Experience is not what happens to a man.
It is what a man does with what happens to him.”*
– Aldous Huxley, Texts and Pretexts, 1932.

Capturing lessons learned is the most valuable process in the whole project life-cycle.

To ensure maximum usefulness, brief the team first on the purpose of the process:

- Capture what did not go well to be improved, and also what did go well to repeat.
- To help us all get better, so never focus on the people – “no names, no blame”.

Wherever possible, collect lessons learned as you proceed during the project:

- Hold lessons learned meetings after each significant project phase.
- And / or collect them with a Wiki or shared document accessible to the whole team.
- You get greatest participation when lessons gathered are useful during the project.

When holding lessons learned gathering events:

- Invite all available project personnel, everyone that participated.
- Walk through the time-line and review all project domain areas.
- Review the issues lists and risk register.
- Display the lessons learned document on a screen for maximum participation.

Most importantly, make sure the lessons learned documentation is available to others, e.g.:

- On a Wiki, document management system, or standard location in a shared folder.
- Filed with the organization’s document management group.

People Transition



“The discipline you learn and character you build from setting and achieving a goal can be more valuable than the achievement of the goal itself.”

– Bo Bennett, Year To Success, 2004.

There will eventually be a point the project is over, and you can disband the team.

And not too early – watch for team morale issues as you get close to the end:

- The more enjoyable the project, the more there can be a real sense of let down.
- So emphasize the project is not finished until completely delivered, and that doing the best possible job during the final stretch is what ensures the success of all the previous effort.
- Keep holding the weekly status meetings and monthly project reviews – they can get shorter, but never cancel them.
- Maintain the team identity, e.g. keep the Friday pizza lunches going.

Do right by your team by providing appropriate performance feedback:

- For leads borrowed from matrix organizations, complete their annual review as though they were your permanent staff and provide it to their functional manager.
- Ask your leads to do the same for their personnel.
- Provide written feedback to the management of any leads from contractors or external organizations.

Bring good performing personnel onto your next project wherever possible:

- Or help them find positions on other projects by making recommendations to other project managers.

Project Celebration



“The first responsibility of a leader is to define reality. The last is to say thank you. In between, the leader is a servant.”

– Max de Pree, CEO Herman Miller.

The project manager must hold some kind of meeting to provide a tangible closure point for the team – every effort needs a defined finish line.

Hold some kind of “project celebration”:

- Ensure everyone that participated in the project is invited – never miss anyone – include all personnel from supporting departments.
- Have some food available, even if just pizza or muffins.
- Once everyone has gathered, give a very brief speech: “We did it, great job, you created this success, thank you, I’d love to work with you again, my very best wishes for whatever you do next.”
- If there are remote sites, hold a telecon, and ask them to bring food locally, and go around the sites and ask each local lead if they wish to say anything.

Does not have to be fancy – a small, short celebration is much better than none.

It is never too late to hold the event – it could be well after the project ends.

Exercise – People Closure



Close the people side of the project:

- *Hold a final lessons learned event, organize all the lessons learned documentation, and make sure it will be available to others.*
- *Don't disband the team too early, and keep the weekly issues meeting and monthly project review going until the scope is successfully delivered and handover complete.*
- *Provide performance feedback for your direct reports, and help the team members transition to their next jobs.*
- *Hold some kind of project celebration to provide a human closure point for the team.*

Final Report



The last step in wrapping up the project is to write a final report for the stakeholders.

A typical final report table of contents:

1. Introduction (Usual background information, especially the project need and objective.)
2. Results (Whatever happened compared to the original plan.)
 - 2.1 Scope
 - 2.2 Schedule
 - 2.3 Cost
3. Business Case Status (Whatever is known at the end of the project about the extent to which it was realized.)
4. Major Risks (Most significant items and how they were handled.)
5. Major Lessons Learned (Most valuable.)
6. Recommendations For Next Steps (Such as suggested future work, often including items from change control and user reviews not done during the project and best implemented in future projects or phases.)

For larger projects, also hold a meeting with the stakeholders to review the report.

And then flow any actions implied by the report to the appropriate parts of the organization, e.g. suggested updates to any policies or procedures.

Exercise – Final Report



Wrap up your project:

- *Write a final report documenting what happened to the project scope, schedule, and budget compared to the plan, the status of the business case to the extent known, major risks, major lessons learned, and recommendations for next steps.*
- *Send the report to the stakeholders, and for larger projects hold a review meeting to walk through and discuss.*
- *Flow any suggested actions to the appropriate parts of the organization.*
- *Take some rest and relaxation time, and move on to your next challenge!*

Chapter Summary



- The purpose of closing is to deliver and handover the project result, close contracts, capture lessons learned, transition the team, hold a project celebration, and write a final report.
- Close all contracts, wherever possible using scenario-based scope verification and three-party verification events including the customer, and provide formal written notification of contract closure to prevent any further invoicing.
- Successful change management requires a respected user champion to sell the project internally to the customer, just-in-time training, user surveys to find problems early, and piloting and phasing wherever possible to build on success.
- Hold formal scope verification events throughout the project to prove to the customer that the project output was correctly produced – that all requirements, material, services, documentation, and training has been provided.
- Scenario based verification is the best way to demonstrate to the customer the project output is fit for purpose and sign-off the requirements at the same time.
- For complex projects, establish agreed delivery criteria up front with thresholds that assure the customer the solution will be solid but don't unreasonably hold up delivery over minor issues that can be easily fixed post delivery.
- Ensure the operations group has all the documentation, training, budget identification, and other information required to maintain the project result.

Chapter Summary (Cont'd)



- Document lessons learned, both those to avoid as well as to repeat, with no names or blame, ideally as you go during the project using a Wiki or shared document or after each phase, displayed on a screen in group reviews for maximum participation, and then make sure they are available to others.
- Watch for team morale issues towards the end of the project, emphasize the importance of the final stages to ensure the whole project is successful, and keep the weekly meetings, monthly reviews, and team building going.
- Provide performance feedback for all direct reports and ensure they do likewise for their teams, and bring good performing personnel to your next project or help them transition to other projects.
- Hold some kind of celebration to bring the project to a human closure point, invite everyone, have food, and give a very brief speech acknowledging the effort of the team, thanking them, and wishing them well in their next challenge.
- Write a final report documenting whatever happened with scope, schedule, and cost, the business case status to the extent known, major risks, most valuable lessons learned, and recommendations for next steps, then review the report with the stakeholders, and flow required actions to the organization.

Notes



Notes

