PROJECT MANAGEMENT PROCESS - PROJECT MANAGEMENT STEPS

1. Agree to precise specification for the project - 'Terms of Reference'
2. Plan the project - time, team, activities, resources, financials - using suitable project management tools.
3. Communicate the project plan to your project team - and to any other interested people and groups.
4. Agree and delegate project actions.
5. Manage and motivate - inform, encourage, enable the project team.
6. Check, measure, monitor, review project progress - adjust project plans, and inform the project team and others.
7. Complete project - review and report on project performance; give praise and thanks to the project team.
8. Project follow-up - train, support, measure and report results and benefits. [1]

1 - AGREE ON PRECISE SPECIFICATIONS (TERMS OF REFERENCE) FOR THE PROJECT

Often called the project 'terms of reference', the project specification should be an accurate description of what the project aims to achieve, and the criteria and flexibilities involved, its parameters, scope, range, outputs, sources, participants, budgets and timescales (beware - see note below about planning timescales).

Usually the project manager must consult with others and then agree the project specification with superiors, or with relevant authorities. The specification may involve several drafts before it is agreed. A project specification is essential in that it creates a measurable accountability for anyone wishing at any time to assess how the project is going, or its success on completion. Project terms of reference also provide an essential discipline and framework to keep the project on track, and concerned with the original agreed aims and parameters. A properly formulated and agreed project specification also protects the project manager from being held to account for issues that are outside the original scope of the project or beyond the project manager's control.

This is the stage to agree special conditions or exceptions with those in authority. Once you've published the terms of reference you have created a very firm set of expectations by which you will be judged. So if you have any concerns, or want to renegotiate, now's the time to do it.

The largest projects can require several weeks to produce and agree project terms of reference. Most normal business projects however require a few days thinking and consulting to produce

[1] *Acknowledgement: Alan Chapman Businessballs.com*

a suitable project specification. Establishing and agreeing a project specification is an important process even if your task is simple one.

A template for a project specification:

1. Describe purpose, aims and deliverables.
2. State parameters (timescales, budgets, range, scope, territory, authority).
3. State people involved and the way the team will work (frequency of meetings, decision-making process).
4. Establish 'break-points' at which to review and check progress, and how progress and results will be measured.

Separately the acronym BOSCARDET provides a useful example structure for Terms of Reference headings/sections: Background, Objectives, Scope, Constraints, Assumptions, Reporting, Dependencies, Estimates, Timescales. This structure contains no specific heading for costs/budgets - these considerations can be included within 'Constraints' or 'Estimates'.

Since projects (and other activities requiring Terms of Reference (TOR) vary considerably there is no standard universal structure for a TOR document. The responsibility lies with the project manager or leader to ensure all relevant and necessary issues are included, and this local interpretation tends to imply TOR headings and document structure. Brainstorming Brainstorming can be a helpful process by which all relevant (TOR) criteria can be indentified and structured.

Organizations may have standard TOR structures, such as the BOSCARDET example, which it is sensible to use where applicable, mindful of risks of omission or over-complication that can arise when following standard practice.

2 - PLAN THE PROJECT

Plan the various stages and activities of the project. Where possible (and certainly where necessary) involve your team in the planning. A useful tip is to work backwards from the end aim, identifying all the things that need to be put in place and done, in reverse order. Additionally, from the bare beginnings of the project, use brainstorming (noting ideas and points at random - typically with a project team), to help gather points and issues and to explore innovations and ideas. Fishbone diagrams are also useful for brainstorming and identifying causal factors which might otherwise be forgotten. For complex projects, or when you lack experience of the issues, involve others in the brainstorming process. Thereafter it's a question of putting the issues in the right order, and establishing relationships and links between each issue. Complex projects will have a number of activities running in parallel. Some parts of the project will need other parts of the project to be completed before they can begin or progress. Such 'interdependent' parts of a project need particularly careful consideration and planning. Some projects will require a feasibility stage before the completion of a detailed plan. Gantt Charts and Critical Path Analysis Flow Diagrams are two commonly used tools for detailed project management planning, enabling scheduling, costing and budgeting and other financials, and project management and reporting.

Project Timescales and Costs

Most projects come in late - that's just the way it is - so don't plan a timescale that is over-ambitious. Ideally plan for some slippage. If you have been given a fixed deadline, plan to meet it earlier, and work back from that earlier date. Build some slippage or leeway into each phase of the project. Err on the side of caution where you can. Projects which slip back and are delivered late, or which run over budget or fail to meet other financial requirements often cause significant problems. Many planners are put under pressure to deliver projects sooner and more cost-effectively than is realistic. Ambition and aiming high are good attitudes, but planning without proper prudence and responsibility is daft. Investors and executives tend rarely to question an over-ambitious plan, but they will quickly make very ruthless decisions when any overly ambitious project starts to fail. Exercising a little realism at the outset of a project regarding financials and timescales can save an enormous amount of trouble later.

The Project Team

Another important part of the planning stage is picking your team. Take great care, especially if you have team-members imposed on you by the project brief. Selecting and gaining commitment from the best team members - whether directly employed, freelance, contractors, suppliers, consultants or other partners - is crucial to the quality of the project, and the ease with which you are able to manage it. Generally try to establish your team as soon as possible. Identifying or appointing one or two people even during the terms of reference stage is possible sometimes. Appointing the team early maximises their ownership and buy-in to the project, and maximises what they can contribute. But be very wary of appointing people before you are sure how good they are, and not until they have committed themselves to the project upon terms that are clearly understood and acceptable. Don't imagine that teams need to be full of paid and official project team members. Some of the most valuable team members are informal advisors, mentors, advisers, who want nothing other than to be involved and a few words of thanks. Project management on a tight budget can be a lonely business - get some help from good people you can trust, whatever the budget.

To plan and manage large complex projects with various parallel and dependent activities you will need to put together a 'Critical Path Analysis' and a spreadsheet on MS Excel, Primavera or equivalent. Critical Path Analysis will show you the order in which tasks must be performed, and the relative importance of tasks. Some tasks can appear small and insignificant when they might actually be hugely influential in enabling much larger activities to proceed or give best results. A Gantt chart is a useful way of showing blocks of activities over time and at a given cost and for managing the project and its costs along the way.

Various project management software is available, much of which is useful, but before trying it you should understand and concentrate on developing the pure project management skills, which are described in this process. However, the project manager should not rely solely on the project management system, or “black – box” to monitor the pulse or status of the project. The project management system should be utilized as a tool , which augments the project management team’s overall skills and application of it’s experience.

Project Management Tools

Here are examples and explanations of four commonly used tools in project planning and project management, namely: Brainstorming, Fishbone Diagrams, Critical Path Analysis Flow Diagrams, and Gantt Charts. The tools here each have their strengths and particular purposes, summarised as a basic guide in the matrix below.

Matrix key:

B = Brainstorming
F = Fishbone/Ishikawa Diagrams
C = Critical Path Analysis Flow Diagrams
G = Gantt Charts

*** - main tool
** - optional/secondary tool
* - sometimes useful

	B	F	C	G
Project brainstorming and initial concepts, ideas, structures, aims, etc	***	**		
Gathering and identifying all elements, especially causal and hidden factors	*	***	**	
Scheduling and timescales			**	***
Identifying and sequencing parallel and interdependent activities and stages	*		***	*
Financials - costings, budgets, revenues, profits, variances, etc	*	*	**	***
Monitoring, forecasting, reporting		*	**	***
Troubleshooting, problem identification, diagnosis and solutions	**	***	**	*
'Snapshot' or 'map' overview - non-sequential, non-scheduled	**	***		
Format for communications, presentations, updates, progress reports, etc		*	*	***

Brainstorming

Brainstorming is usually the first crucial creative stage of the project management and project planning process. See the brainstorming method in detail and explained separately, because it many other useful applications outside of project management.

Unlike most project management skills and methods, the first stages of the brainstorming process is ideally a free-thinking and random technique. Consequently it can be overlooked or under-utilized because it not a natural approach for many people whose mains strengths are in systems and processes. Consequently this stage of the project planning process can benefit from being facilitated by a team member able to manage such a session, specifically to help very organised people to think randomly and creatively.

Fishbone Diagrams

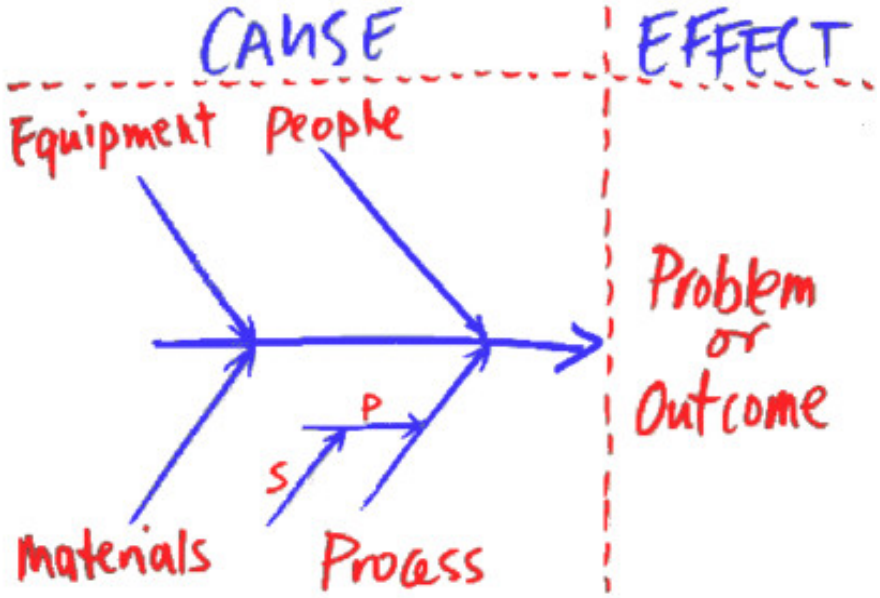
Fishbone diagrams are chiefly used in quality management fault-detection, and in business process improvement, especially in manufacturing and production, but the model is also very useful in project management planning and task management generally.

Within project management fishbone diagrams are useful for early planning, notably when gathering and organising factors, for example during brainstorming.

Fishbone diagrams are very good for identifying hidden factors which can be significant in enabling larger activities, resources areas, or parts of a process.

Fishbone diagrams are not good for scheduling or showing interdependent time-critical factors.

Fishbone diagrams are also called 'cause and effect diagrams' and Ishikawa diagrams, after Kaoru Ishikawa (1915-89), a Japanese professor specialising in industrial quality management and engineering who devised the technique in the 1960s. Ishikawa's diagram became known as a fishbone diagram, obviously, because it looks like a fishbone:



A fishbone diagram has a central spine running left to right, around which is built a map of factors which contribute to the final result (or problem).

For each project the main categories of factors are identified and shown as the main 'bones' leading to the spine.

Into each category can be drawn 'primary' elements or factors (shown as P in the diagram), and into these can be drawn secondary elements or factors (shown as S). This is done for every category, and can be extended to third or fourth level factors if necessary.

The diagram above is a very simple one. Typically fishbone diagrams have six or more main bones feeding into the spine. Other main category factors can include Environment, Management, Systems, Training, Legal, etc.

The categories used in a fishbone diagram should be whatever makes sense for the project. Various standard category sets exist for different industrial applications, however it is important that your chosen structure is right for your own situation, rather than taking a standard set of category headings and hoping that it fits.

At a simple level the fishbone diagram is a very effective planning model and tool - especially for 'mapping' an entire operation.

Where a fishbone diagram is used for project planning of course the 'Effect' is shown as an aim or outcome or result, not a problem.

The 'Problem' term is used in fault diagnosis and in quality management problem-solving. Some fishbone diagrams can become very complex indeed, which is common in specialized quality management areas, especially where systems are computerized.

This model, and the critical path analysis diagram are similar to the even more complex diagrams used on business process modeling within areas of business planning and and business process improvement.

Project critical path analysis (flow diagram or chart)

'Critical Path Analysis' sounds very complicated, but it's a very logical and effective method for planning and managing complex projects. A critical path analysis is normally shown as a flow diagram, whose format is linear (organised in a line), and specifically a time-line.

Critical Path Analysis is also called Critical Path Method - it's the same thing - and the terms are commonly abbreviated, to CPA and CPM.

A commonly used tool within Critical Path Analysis is Program, Evaluation and Review Technique (PERT), which is a specialised method for identifying related and interdependent activities and events, especially where a big project may contain hundreds or thousands of connected elements. PERT is not normally relevant in simple projects, but any project of considerable size and complexity, particularly when timings and interdependency issues are crucial, can benefit from the detailed analysis enabled by PERT methods. PERT analysis commonly feeds into Critical Path Analysis and to other broader project management systems, such as those mentioned here.

Critical Path Analysis flow diagrams are very good for showing interdependent factors whose timings overlap or coincide. They also enable a plan to be scheduled according to a timescale. Critical Path Analysis flow diagrams also enable costings and budgeting, although not quite as easily as Gantt charts (below), and they also help planners to identify causal elements, although not quite so easily as fishbone diagrams (below).

This is how to create a Critical Path Analysis. As an example, the project is a simple one - making a fried breakfast.

First note down all the issues (resources and activities in a rough order), again for example:

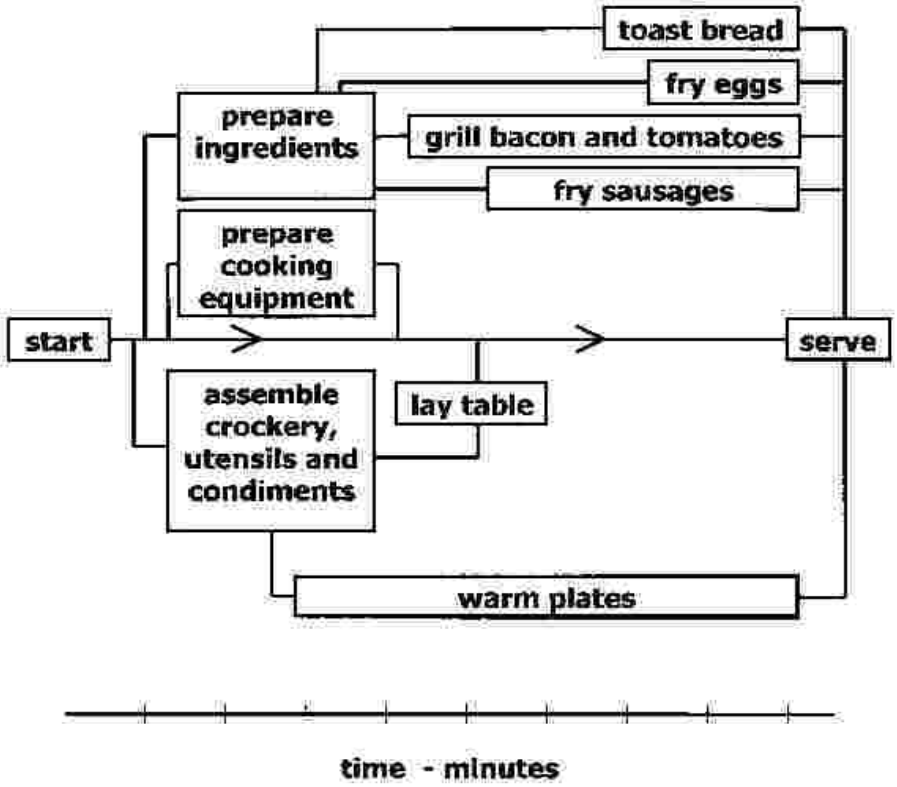
Assemble crockery and utensils, assemble ingredients, prepare equipment, make toast, fry sausages and eggs, grill bacon and tomatoes, lay table, warm plates, serve.

Note that some of these activities must happen in parallel - and crucially they are interdependent. That is to say, if you tried to make a fried breakfast by doing one task at a time, and one after the other, things would go wrong. Certain tasks must be started before others, and certain tasks must be completed in order for others to begin. The plates need to be warming while other activities are going on. The toast needs to be toasting while the sausages are frying, and at the same time the bacon and sausages are under the grill. The eggs need to be fried last.

A Critical Path Analysis is a diagrammatical representation of what needs done and when. Timescales and costs can be applied to each activity and resource. Here's the Critical Path Analysis for making a fried breakfast:

This Critical Path Analysis example below shows just a few activities over a few minutes. Normal business projects would see the analysis extending several times wider than this example, and the time line would be based on weeks or months. It is possible to use MS Excel or a similar spreadsheet to create a Critical Path Analysis, which allows financial totals and time totals to be planned and tracked. Various specialised project management software enable the same thing. Beware however of spending weeks on the intricacies of computer modelling, when in the early stages especially, a carefully hand drawn diagram - which requires no computer training at all - can put 90% of the thinking and structure in place. (See the details about the most incredible planning and communications tool ever invented, and available for just a tiny fraction of the price of all the alternatives.)

PROJECT CRITICAL PATH ANALYSIS FLOW DIAGRAM EXAMPLE



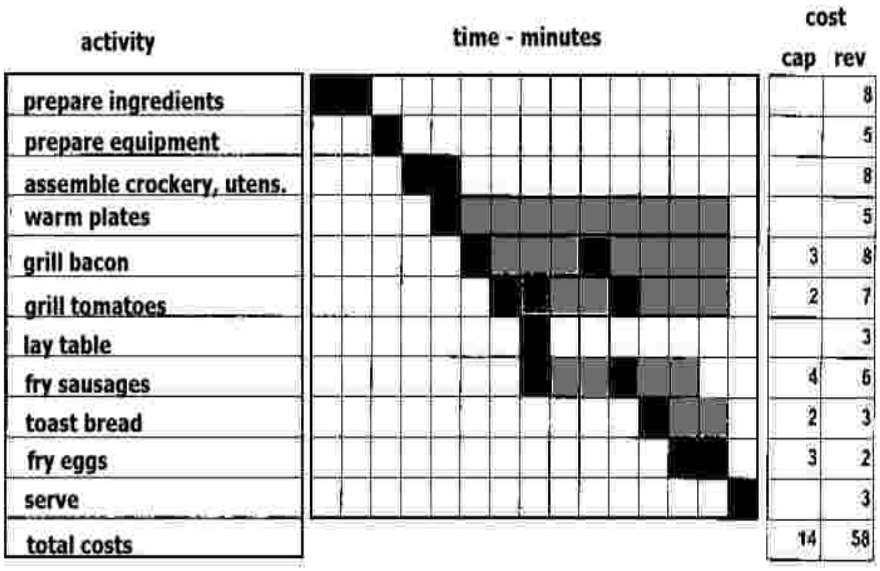
GANTT CHARTS

Gantt Charts (commonly wrongly called gant charts) are extremely useful project management tools. The Gantt Chart is named after US engineer and consultant Henry Gantt (1861-1919) who devised the technique in the 1910s.

Gantt charts are excellent models for scheduling and for budgeting, and for reporting and presenting and communicating project plans and progress easily and quickly, but as a rule Gantt Charts are not as good as a Critical Path Analysis Flow Diagram for identifying and showing interdependent factors, or for 'mapping' a plan from and/or into all of its detailed causal or contributing elements.

You can construct a Gantt Chart using MSExcel, Primavera or a similar spreadsheet. Every activity has a separate line. Create a time-line for the duration of the project (the breakfast example shows minutes, but normally you would use weeks, or for very big long-term projects, months). You can color code the time blocks to denote type of activity (for example, intense, watching brief, directly managed, delegated and left-to-run, etc.) You can schedule review and insert break points. At the end of each line you can show as many cost columns for the activities as you need. The breakfast example shows just the capital cost of the consumable items and a revenue cost for labor and fuel. A Gantt chart like this can be used to keep track of progress for each activity and how the costs are running. You can move the time blocks around to report on actuals versus planned, and to re-schedule, and to create new plan updates. Costs columns can show plan and actuals and variances, and calculate whatever totals, averages, ratios, etc., that you need. Gantt Charts are probably the most flexible and useful of all project management tools, but remember they do not very easily or obviously show the importance and inter-dependence of related parallel activities, and they won't obviously show the necessity to complete one task before another can begin, as a Critical Path Analysis will do, so you may need both tools, especially at the planning stage, and almost certainly for large complex projects.

GANTT CHART EXAMPLE



A wide range of computerised systems/software now exists for project management and planning, and new methods continue to be developed. It is an area of high innovation, with lots of scope for improvement and development. Many organizations develop or specify particular computerised tools, so it's a good idea to seek local relevant advice and examples of best practice before deciding the best computerised project management system(s) for your own situation.

Project planning tools naturally become used also for subsequent project reporting, presentations, etc., and you will make life easier for everyone if you use formats that people recognize and find familiar.

Project financial planning and reporting

For projects involving more than petty cash you'll probably need a spreadsheet to plan and report planned and actual expenditure. Use MSExcel or similar spreadsheet systems for recording and monitoring the financial accounting for small projects. Large projects are likely to require some sort of require dedicated accounting system, although conceivably Gantt Charts and financial management accounts can easily be administered within a spreadsheet system given sufficient expertise. If you don't know how to put together a basic financial plan, get some help from someone who does, and make sure you bring a good friendly, flexible financial person into your team - it's a key function of project management, and if you can't manage the financial processes your self you need to be able to rely completely on whoever does it for you. The spreadsheet must enable you to plan, administer and report the detailed finances of your project. Create a cost line for main expenditure activity, and break this down into individual elements. Create a system for allocating incoming invoices to the correct activities (your bought-ledger people won't know unless you tell them), and showing when the costs hit the project account. Establish clear payment terms with all suppliers and stick to them. Projects develop problems when team members get dissatisfied; rest assured, non- or late-payment is a primary cause of dissatisfaction.

Remember to set some budget aside for 'contingencies' - you will almost certainly need it.

Project contingency planning

Planning for and anticipating the unforeseen, or the possibility that things may not go as expected, is called 'contingency planning'. Contingency planning is vital in any task when results and outcomes cannot be absolutely guaranteed. Often a contingency budget needs to be planned as there are usually costs associated. Contingency planning is about preparing fall-back actions, and making sure that leeway for time, activity and resource exists to rectify or replace first-choice plans. A simple contingency plan for the fried breakfast would be to plan for the possibility of breaking the yolk of an egg, in which case spare resource (eggs) should be budgeted for and available if needed. Another might be to prepare some hash-browns and mushrooms in the event that any of the diners are vegetarian. It may be difficult to anticipate precisely what contingency to plan for in complex long-term projects, in which case simply a contingency budget is provided, to be allocated later when and if required.

3 - COMMUNICATE THE PROJECT PLAN TO YOUR TEAM

This serves two purposes: it informs people what's happening, and it obtains essential support, agreement and commitment. If your project is complex and involves a team, then you should involve the team in the planning process to maximise buy-in, ownership, and thereby accountability. Your project will also benefit from input and consultation from relevant people at an early stage.

Also consider how best to communicate the aims and approach of your project to others in your organization and wider network.

Your project 'team' can extend more widely than you might first imagine. Consider all the possible 'stakeholders' - those who have an interest in your project and the areas it touches and needs to attract support or tolerance.

Involvement and communication are vital for cooperation and support. Failing to communicate to people (who might have no great input, but whose cooperation is crucial) is a common reason for arousing suspicion and objections, defensiveness or resistance.

4 - AGREE AND DELEGATE PROJECT ACTIONS

Your plan will have identified those responsible for each activity. Activities need to be very clearly described, including all relevant parameters, timescales, costs, and deliverables. Use the SMART acronym to help you delegate tasks properly. See the delegation tips and processes. Using proper delegation methods is vital for successful project management involving teams. When delegated tasks fail this is typically because they have not been explained clearly, agreed with the other person, or supported and checked while in progress. So publish the full plan to all in the team, and consider carefully how to delegate medium-to-long-term tasks in light of team members' forward-planning capabilities. Long-term complex projects need to be planned in more detail, and great care must be taken in delegating and supporting them. Only delegate tasks which pass the SMART test. Other useful materials to help understand team delegation are the Tannenbaum and Schmidt Continuum, and Tuckman's group forming/performing model. The Johari Window model is also an excellent review framework for quickly checking or reminding about mutual awareness among team members in large complex projects, where there is often a risk of project fragmentation and people 'doing their own thing' in blissful isolation - which seriously undermines even the best planned projects.

5 - MANAGE, MOTIVATE, INFORM, ENCOURAGE, ENABLE THE PROJECT TEAM

Manage the team and activities in meetings, communicating, supporting, and helping with decisions (but not making them for people who can make them for themselves). 'Praise loudly; blame softly. One of the big challenges for a project manager is deciding how much freedom to give for each delegated activity. Tight parameters and lots of checking are necessary for inexperienced people who like clear instructions, but this approach is the kiss of death to experienced, entrepreneurial and creative people. They need a wider brief, more freedom, and less checking. Manage these people by the results they get - not how they get them. Look out for

differences in personality and working styles in your team. Misunderstanding personal styles can get in the way of team cooperation. Your role here is to enable and translate. Face to face meetings, when you can bring team members together, are generally the best way to avoid issues and relationships becoming personalised and emotional. Communicate progress and successes regularly to everyone. Give the people in your team the plaudits, particularly when someone high up expresses satisfaction - never, never accept plaudits yourself. Conversely - you must take the blame for anything that goes wrong - never 'dump' (your problems or stresses) on anyone in your team. As project manager any problem is always ultimately down to you anyway. Use empathy and conflict handling techniques, and look out for signs of stress and manage it accordingly. A happy positive team with a basic plan will outperform a miserable team with a brilliant plan, every time.

6 - CHECK, MEASURE, AND REVIEW PROJECT PERFORMANCE; ADJUST PROJECT PLANS; INFORM PROJECT TEAM AND OTHERS

Check the progress of activities against the plan. Review performance regularly and at the stipulated review points, and confirm the validity and relevance of the remainder of the plan. Adjust the plan if necessary in light of performance, changing circumstances, and new information, but remain on track and within the original terms of reference. Be sure to use transparent, pre-agreed measurements when judging performance. (Which shows how essential it is to have these measures in place and clearly agreed before the task begins.) Identify, agree and delegate new actions as appropriate. Inform team members and those in authority about developments, clearly, concisely and in writing. Plan team review meetings. Stick to the monitoring systems you established. Probe the apparent situations to get at the real facts and figures. Analyse causes and learn from mistakes. Identify reliable advisors and experts in the team and use them. Keep talking to people, and make yourself available to all.

7 - COMPLETE PROJECT; REVIEW AND REPORT ON PROJECT; GIVE PRAISE AND THANKS TO THE PROJECT TEAM

At the end of your successful project hold a review with the team. Ensure you understand what happened and why. Reflect on any failures and mistakes positively, objectively, and without allocating personal blame. Reflect on successes gratefully and realistically. Write a review report, and make observations and recommendations about follow up issues and priorities - there will be plenty.

8 - FOLLOW UP - TRAIN, SUPPORT, MEASURE AND REPORT PROJECT RESULTS AND BENEFITS

Traditionally this stage would be considered part of the project completion, but increasingly an emphasised additional stage of project follow-up is appropriate.

This is particularly so in very political environments, and/or where projects benefits have relatively low visibility and meaning to stakeholders (staff, customers, investors, etc), especially if the project also has very high costs, as ICT projects tend to do.

ICT (information and communications technology) projects often are like this - low visibility of benefits but very high costs, and also very high stress and risk levels too.

Project management almost always involves change management too, within which it's very important to consider the effects of the project on people who have to adapt to the change. There is often a training or education need. There will almost certainly be an explanation need, in which for example methods like team briefing have prove very useful.

Whatever, when you are focused on project management it is easy to forget or ignore that many people are affected in some way by the results of the project. Change is difficult, even when it is good and for right reasons. Remembering this during and at the end of your project will help you achieve a project that is well received, as well as successful purely in project management terms.

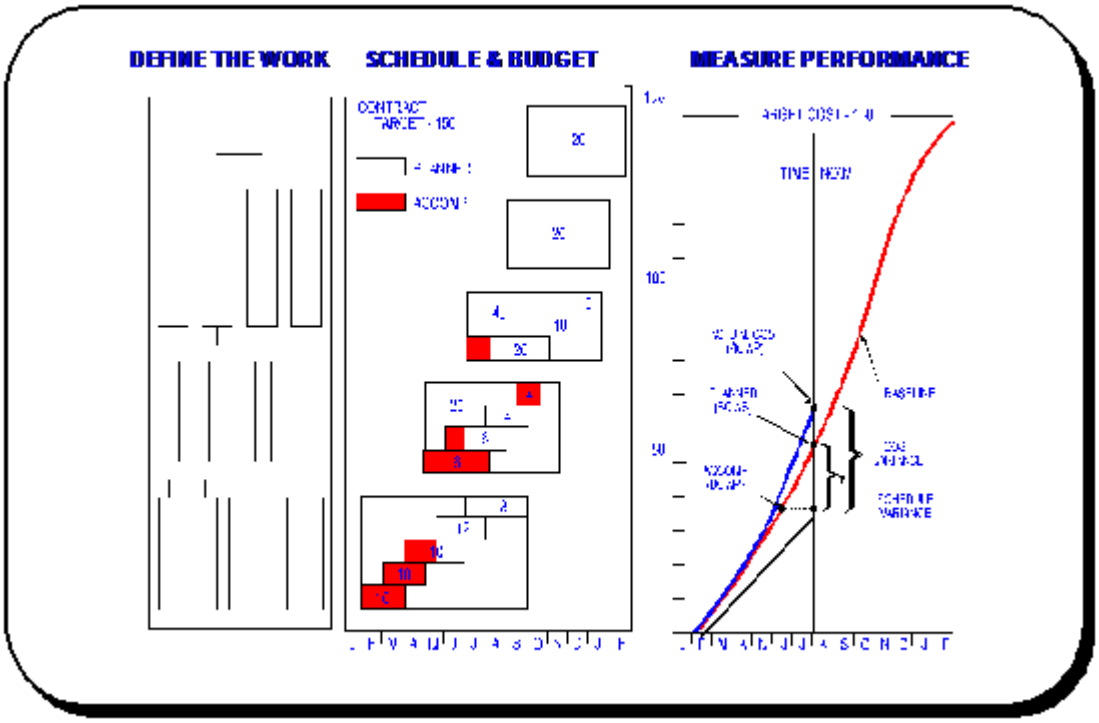
CONSTRUCTION PERFORMANCE MONITORING

To support the oversight and management of a large coal fired power plant construction project, one must select a measurement and management system. One such system is the Earned Value Management technique. Earned Value Management (EVM) is an industry standard, integrated system of project management and control that enabled KCP&L and the various contractors to monitor the progress of a project in terms of integrated cost, schedule, and technical performance measures.

Earned value project management involves planning work to a manageable level of detail such that it is feasible to allocate a portion of the budget to each planned work unit (work package), and then tracking progress by the accumulated "value" of completed work units. As work is performed, it is "earned" on the same basis as it was planned, in dollars or other quantifiable units. As the work units are completed, the project earns the budgeted value associated with those work units. This method associates a dollar value with work completed so that it can be compared with the actual spending (to determine cost variance – potential cost overruns), and the planned spending (to determine schedule variance – potential schedule slippage). In this manner, planned and actual spending is integrated with actual work performed. The integration provides greater visibility into the real project status for all stakeholders and thus creates a scenario for better management of risks, for early determination of whether a project is in trouble, and for estimating what will be needed to complete it.

Although tracking earned value occurs during project execution, it cannot be accomplished if appropriate project planning and budget allocation has not occurred up front. The figure below depicts, at a high level, the activities that are necessary in order to effectively implement the principles of earned value management.[2]

[2] *Acknowledgement: Quentin Fleming, Primavera Systems Inc.*



Earned Value Activities

Define the Work: The Project Manager must decompose the project into distinct discrete manageable tasks or groups of tasks (work packages) with decisive outputs and specific measurable entry and exit criteria. Each work package has a short duration, or can be divided into a series of milestones whose status can be objectively measured. Each work package can be assigned a start and finish date, a budget value, and can be integrated with higher-level schedules. This activity is often referred to as developing the Work Breakdown Structure (WBS). It is important to balance the level of detail in the WBS with the needs of the project, with the ultimate goal being the ability to realistically estimate the cost of accomplishing each task (earned value). Providing too much detail creates an overload of data, creating a tracking nightmare, and stifling the creativity of developers; lack of detail may mask vital information.

Schedule and Budget: Once the effort is identified through the WBS, the project manager must prepare a budget and schedule for accomplishing the work. This is in contrast to "backing into a schedule" based on an arbitrary fixed dollar amount. Details of budgeting and scheduling are beyond the scope of this document, but essentially involve identifying what resources are needed and how much effort will be required in what time frame to complete each of the tasks in the WBS. What is critical to being able to track earned value is that a portion of the budget is allocated for each work package that comprises the WBS and that the WBS adequately defines all work necessary to meet the agreed-upon requirements for the project.

Measure performance: This activity focuses on performance, not just planned vs. actual spending. It involves tracking a number of measures starting very early in the project, and analyzing the data to determine real project status. Important measures are:

Primary Metrics

Budget Cost of Work Scheduled (BCWS): The dollars (or hours) planned for the effort. The cumulative planned expenditures would equal the total dollars budgeted for the effort for the specified time period. With EVM, the spending plan serves as a performance baseline for making predictions about cost and schedule variance and estimates of completion (The spending plan).

Actual Cost of Work Performed (ACWP): The cumulative actual expenditures on the effort viewed at regular intervals within the project duration (Actual spending).

Budgeted Cost of Work Performed (BCWP): The cumulative budgeted value (dollars or hours) of work actually completed. It may be calculated as the sum of the values budgeted for the work packages actually completed, or calculated as the percent work complete multiplied by the planned cost of the project (Earned value, the measure of technical accomplishment).

Derived/Calculated Measures

From the above three primary measures it is possible to derive measures that can be used to accurately assess the status of the project and predict its future state.

- **Cost Variance (CV):** The numerical difference between the earned value (BCWP) and the actual cost (ACWP). CV = BCWP – ACWP. (Another way of thinking of this is the difference between the planned and actual costs of work completed.)
- **Schedule Variance (SV):** An indicator of how much a program is ahead of or behind schedule. SV = BCWP – BCWS. (Another way of thinking of this: earned value – planned budget, or the difference between the value of work accomplished for a given period and the value of the work planned). Schedule variance is presented well in chart format.
- **Cost Performance Index (CPI):** The cost efficiency factor representing the relationship between the actual cost expended and the earned value. CPI = BCWP/ACWP. A CPI ≥ 1 suggests a relatively efficient cost factor, while a CPI <1 may be cause for concern.
- **Schedule Performance Index (SPI):** The planned schedule efficiency factor representing the relationship between the earned value and the initial planned schedule. SPI = BCWP/BCWS. A SPI ≥ 1 is good. SPI < 1 suggests actual work is falling behind the planned schedule.
- **Budget at Completion (BAC):** The sum total of the time-phased budget. Synonymous with "Performance Measurement Baseline".

- **Estimate to Complete (ETC):** A calculated value, in dollars or hours, that represents the cost of work required to complete remaining project tasks. ETC = BAC – BCWP.
- **Estimate at Complete (EAC):** A calculated value, in dollars or hours, that represents the projected total final costs of work when completed. EAC = ACWP + ETC.

In looking at the list of important measures earned value (BCWP) is one of the three basic measures from which the other measures are derived. Without it, the other measures are not possible. A significant commitment to the quality and size of the project management staff is required to support the development, accuracy and timeliness of the metric.

Earned value credit should be binary, with 0 percent being given before task completion and 100 percent given when completion of each work unit is validated. Establishing specific measurable exit criteria for each task makes it easier to track task completion, and thus credit the earned value of the task to the project so that the earned value of the project at any given point in time is obtained by "simple math" rather than by subjective assessment.

Communication of Performance Status

Tracking earned value is of little value if the estimating and analysis capability that it provides is not used to manage the project. Although originally required for reporting project status to the acquirer, in recent years there has been a migration of focus. EVM is now viewed as a project management technique, as well. Its usefulness is broader than simply reporting project status up the management chain. There are some important reasons to communicate the project status (represented in terms of earned value) to all stakeholders.

- Promote Accountability: When developers understand how their individual work (or lack thereof) influences the project, they tend to be more focused on their specific work goals. They also better understand the significance of estimating the amount of work needed to complete specific tasks. There exists a mindset among some project managers that they should "protect" their developers from the distraction of project metrics. In reality, communicating project status to the development staff tends to establish a sense of accountability for their assigned pieces of the project and often results in more realistic estimates for completion of future tasks.

- Status Reporting: Reporting real project status, including earned value, at regular intervals provides an opportunity to address potential problems early in the project when it is still possible to resolve problems and avoid cost overruns and schedule slippage. The project team takes a proactive approach to prevent problems from occurring. The project management team uses the information to resolve issues that are beyond the control of the project team. The time interval should be at least monthly, regardless of the size and duration of a project, and more frequent for some projects. Many practitioners experienced with earned value management indicate that the project team should review project earned value weekly, because it can alert the team to specific problem areas before they develop into major problems.

COMMON CONSTRUCTION PERFORMANCE TERMS

- **Schedule Compression:** occurs when a schedule slips and more work than was originally planned is required in a remaining work period. Schedule compression is the shortening of the project schedule without affecting the project scope. It alleviates bottlenecks without sacrificing the project schedule.
- **Congestion:** is the result of needing to employ an increased number of workers in a given area than originally planned, either because of compression ort low worker productivity.
- **Re-sequencing:** occurs when it is necessary to change the planned order of work in a given area. This can cause claims by other contractors who have to change their scheduled plans.
- **Actual Man Hours:** are hours needed to achieve the scheduled activity.
- **Earned Man Hours:** are the hours achieved for a given scheduled activity. This differs from Actual Man Hours.
- **Planned Value:** the work scheduled for a particular point in a project and the budget earmarked for that work.
- **Actual Costs:** the actual cost charged to that scheduled activity.
- **Earned Value:** the work actually accomplished at any point in time and the budget devoted to that work.
- **Cost Performance Index (CPI):** a measurement that expresses the ratio of Earned Value to Actual Costs in percent.
- **Schedule Performance Index (SPI):** a measurement that expresses the ratio of Earned Value to Planned Value in percent.