![Innate - The Resource Management Software Company logo]

Resource Management Seminar:

Optimizing the utilisation of multi-disciplinary resources

-Matching skills capacity with demand-

This is the first in a series of seminars that is being delivered by Innate under the auspices of the Association of Consulting Engineers. Innate has 20 years of experience of implementing resource management software for professional services organizations. Reference will be made to two recent assignments:

- The Engineering services division of Petrofac, the oil and gas facilities provider
- Atkins Intelligent Transport Systems.

1 The challenge

As the Engineering Director of Petrofac International, the oil and gas facilities provider, Steve Major is responsible for the effective utilization of more than 3,500 engineers. He describes his primary challenge as being:

To continuously optimize the utilization of a geographically dispersed engineering workforce, where each project has its own timeline, priority and competency requirements.

This succinct definition highlights the tension between two conflicting objectives. To achieve high levels of utilization, staff numbers should be kept to a minimum, but in order to effectively staff up projects, sufficient levels with the right mix of skills must be available …. and this in an environment of constant flux, where project changes arise unexpectedly, estimates are shown to have been over optimistic and, on the supply side, key staff decide to move on.

1.1 Striking the right balance

The consequences of too much or too little spare resource are equally unpalatable:
1. Staff sitting on the bench is wasted resource; incurring costs that cannot be billed will significantly affect the operational profit.
2. Yet without sufficient spare resource, inappropriate staff will be assigned to key projects, risking re work, delay and damage to the corporate reputation.

To strike the right balance, a number of objectives start to emerge:

1. Multi-skilled staff will improve the flexibility of the resource pool. The more flexible the resource pool the easier it will be to staff new projects appropriately, without having to recruit or use contractors.

2. To meet the profit targets for the business, there must be a constant drive to improve productivity. The Association of Consulting Engineers undertakes an annual benchmarking exercise that draws on metrics from their 600 member organizations. The Profitability section of the 2011 report states:

    'If fee earners could increase their billable time by 10 minutes a day, the average company would generate 2.3% extra revenue. Assuming the extra 10 minutes a day could be carried out without increasing either staff costs or overheads, that could raise profits by 33% from the current level'.

    For 'extra revenue per day' read 'increase in productivity', and productivity as a key profit driver is confirmed.

Having management information that is current, pertinent and reliable is the key. Good forecasting will identify pockets of resource bottlenecks and underutilization in time for corrective action, but sound business processes and reliable system support are necessary to deliver this.

1.2   Common symptoms

Before we discuss the information requirements, let us look at some common symptoms that will confirm the challenge should not be ignored:

- Managers retain favourite staff on their projects 'just in case they are needed'
- Limited visibility of suitable alternatives if preferred person is busy
- Resource conflicts are difficult to see and resolve
- Utilization against targets is difficult to measure
- The impact of successful bids on the skills capacity to deliver is difficult to visualize

We have a (regrettably un-attributable) quote from one of the larger members of ACE:

'If we were a manufacturing business with assets of the value of our 3,000 staff, we would have invested heavily in an efficient stock control system by now. Struggling with regional spreadsheets is just not good enough'.

2   Management Information

There are a number of key reports:

- Forecast demand v capacity
  - Where are the bottlenecks and under-utilization?
  - Scenarios that show the impact of project awards

- Productivity & Utilization
  - How effectively are our teams working?

- Track outstanding requests for resource.
  - Managing the resource allocation process

- Resource performance on each project
  - to see the impact of poor performance

2.1 Forecast demand vs capacity

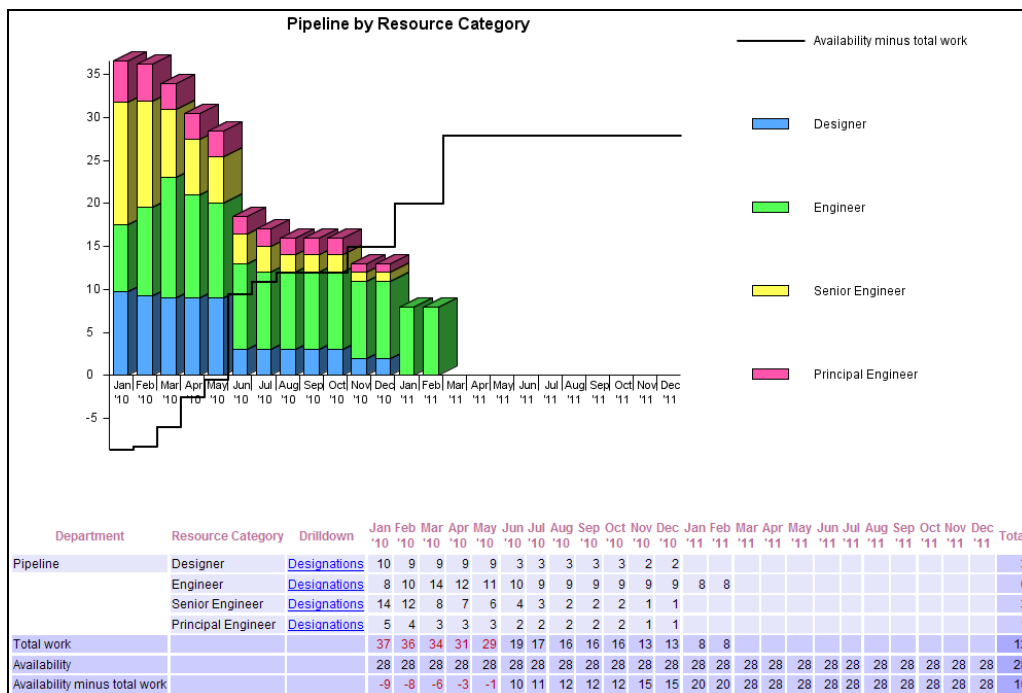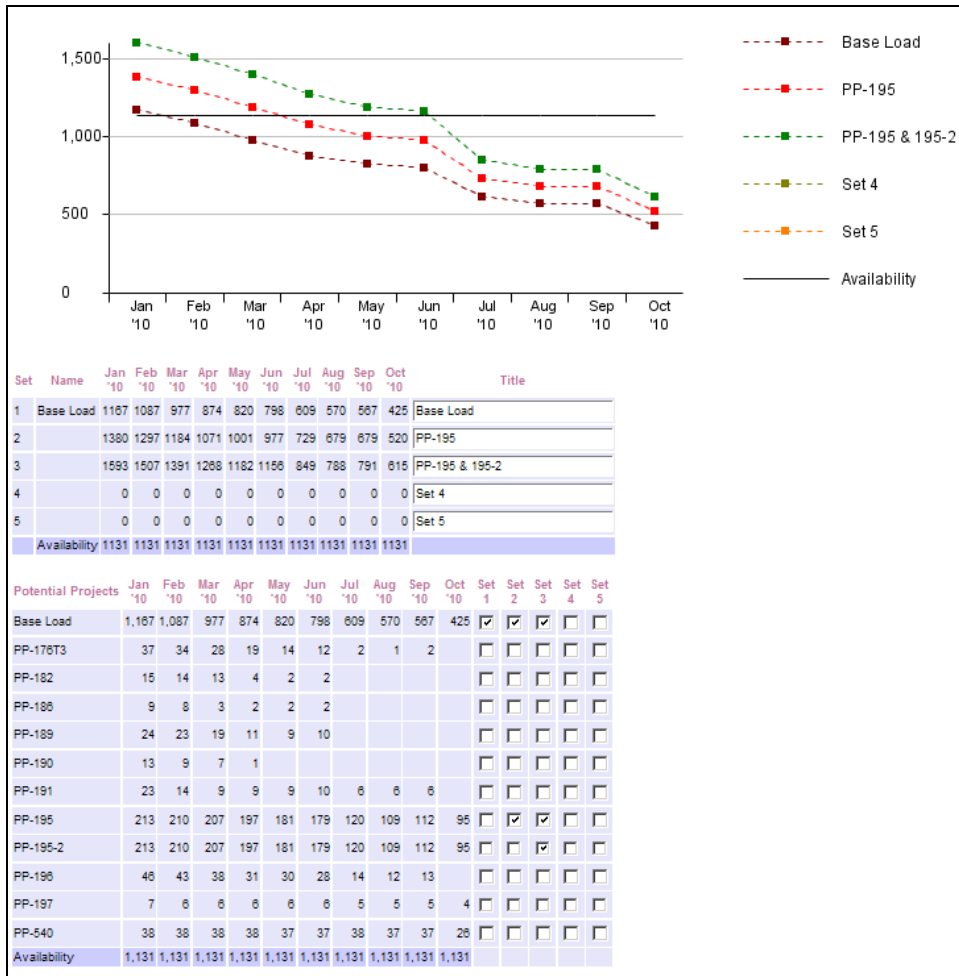| Department	Jan '10	Feb '10	Mar '10	Apr '10	May '10	Jun '10	Jul '10	Aug '10	Sep '10	Oct '10	Nov '10	Dec '10	Jan '11	Feb '11	Mar '11	Apr '11	May '11	Jun '11	Jul '11	Aug '11	Sep '11	Oct '11	Nov '11	Dec '11	Total
Civil / Structural	224	226	220	218	205	219	217	203	211	196	159	147	26	18	14	10	2	2							105
Electrical	114	107	92	77	76	80	51	53	54	43	41	38	30	26	16	10									38
HSE Design	38	40	40	43	42	38	23	13	9	9	8	4	4	3	1	0	0	0							13
Instrument	173	155	144	125	119	118	85	84	82	26	24	18	14	14	6	6									49
Mechanical	168	162	150	139	126	127	62	61	61	16	13	11	9	6	3	2	1	1							46
Metallurgy and Corrosion	9	11	13	13	13	13	9	9	7	6	6	2	2	2											5
Pipeline	37	36	34	31	29	19	17	16	16	16	13	13	8	8											12
Piping	242	213	188	170	161	144	114	104	102	95	42	19	19	17	1	1	1	1							68
Process	141	123	93	61	48	38	9	8	6	2	2	1	1	1	1	1	1	1							22
TeleCom	30	27	25	21	19	21	19	17	17	15	15	10	4	4											10
Total work	1,175	1,102	1,000	897	838	817	608	568	565	424	323	263	117	99	42	31	5	5							368
Availability	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126
Availability minus total work	-49	24	126	230	288	309	518	558	561	702	803	863	1,009	1,027	1,084	1,096	1,121	1,121	1,126	1,126	1,126	1,126	1,126	1,126	758

This forecast compares the committed workload for each department against the spare capacity. Numbers in red indicate resource bottlenecks, so that managers can easily drill down through the organization structure to identify particular skills shortages.
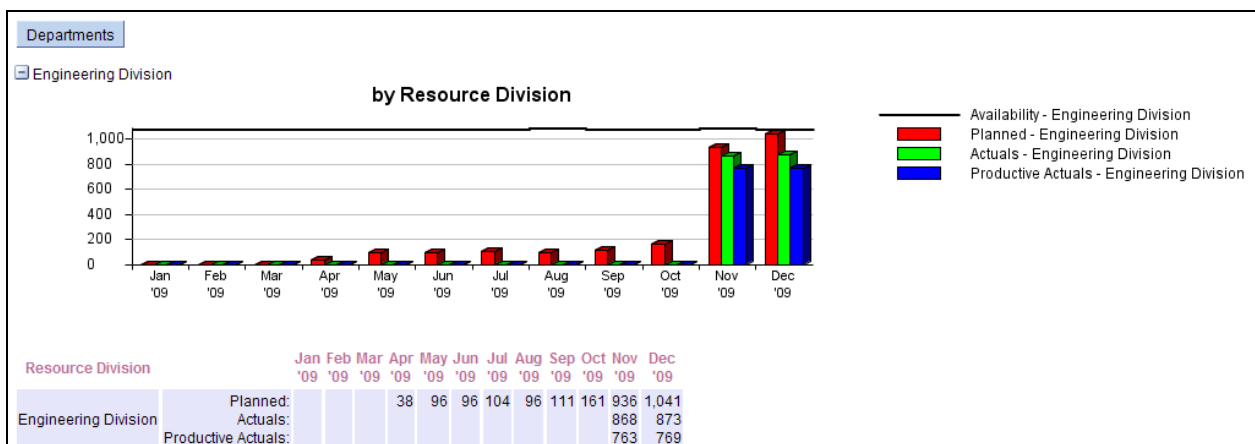

Department	Resource Category	Drilldown	Jan '10	Feb '10	Mar '10	Apr '10	May '10	Jun '10	Jul '10	Aug '10	Sep '10	Oct '10	Nov '10	Dec '10	Jan '11	Feb '11	Mar '11	Apr '11	May '11	Jun '11	Jul '11	Aug '11	Sep '11	Oct '11	Nov '11	Dec '11	Total
Pipeline	Designer	Designations	10	9	9	9	9	3	3	3	3	3	2	2													3
	Engineer	Designations	8	10	14	12	11	10	9	9	9	9	9	9	8	8											6
	Senior Engineer	Designations	14	12	8	7	6	4	3	2	2	2	1	1													3
	Principal Engineer	Designations	5	4	3	3	3	2	2	2	2	2	1	1													1
Total work			37	36	34	31	29	19	17	16	16	16	13	13	8	8											12
Availability			28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
Availability minus total work			-9	-8	-6	-3	-1	10	11	12	12	12	15	15	20	20	28	28	28	28	28	28	28	28	28	28	16

Scenario comparisons

[Line chart: Scenario comparisons]

Legend:
- Base Load
- PP-195
- PP-195 & 195-2
- Set 4
- Set 5
- Availability

Set	Name	Jan '10	Feb '10	Mar '10	Apr '10	May '10	Jun '10	Jul '10	Aug '10	Sep '10	Oct '10	Title
1	Base Load	1167	1087	977	874	820	798	609	570	567	425	Base Load
2		1380	1297	1184	1071	1001	977	729	679	679	520	PP-195
3		1593	1507	1391	1268	1182	1156	849	788	791	615	PP-195 & 195-2
4		0	0	0	0	0	0	0	0	0	0	Set 4
5		0	0	0	0	0	0	0	0	0	0	Set 5
	Availability	1131	1131	1131	1131	1131	1131	1131	1131	1131	1131	

Potential Projects	Jan '10	Feb '10	Mar '10	Apr '10	May '10	Jun '10	Jul '10	Aug '10	Sep '10	Oct '10	Set 1	Set 2	Set 3	Set 4	Set 5
Base Load	1,167	1,087	977	874	820	798	609	570	567	425	☑	☑	☑	☐	☐
PP-176T3		37	34	28	19	14	12	2	1	2	☐	☐	☐	☐	☐
PP-182		15	14	13	4	2	2				☐	☐	☐	☐	☐
PP-186		9	8	3	2	2	2				☐	☐	☐	☐	☐
PP-189		24	23	19	11	9	10				☐	☐	☐	☐	☐
PP-190		13	9	7	1						☐	☐	☐	☐	☐
PP-191		23	14	9	9	9	10	6	6	6	☐	☐	☐	☐	☐
PP-195		213	210	207	197	181	179	120	109	112	95	☐	☑	☑	☐	☐
PP-195-2		213	210	207	197	181	179	120	109	112	95	☐	☐	☑	☐	☐
PP-196		46	43	38	31	30	28	14	12	13	☐	☐	☐	☐	☐
PP-197		7	6	6	6	6	6	5	5	5	4	☐	☐	☐	☐	☐
PP-540		38	38	38	38	37	37	38	37	37	26	☐	☐	☐	☐	☐
Availability	1,131	1,131	1,131	1,131	1,131	1,131	1,131	1,131	1,131	1,131					

This interactive report enables up to 5 scenarios to be defined, by selecting a mix of potential projects to layer on top of the Base Load, which is the live projects. As potential projects are included/excluded with the checkboxes, the loading profile and line charts are updated. This can be used to look at the impact overall, or on individual departments or teams.

2.2   Productivity and utilization

[Bar chart: by Resource Division — Departments / Engineering Division]

Legend:
- Availability - Engineering Division
- Planned - Engineering Division
- Actuals - Engineering Division
- Productive Actuals - Engineering Division

Resource Division		Jan '09	Feb '09	Mar '09	Apr '09	May '09	Jun '09	Jul '09	Aug '09	Sep '09	Oct '09	Nov '09	Dec '09
Engineering Division	Planned:				38	96	96	104	96	111	161	936	1,041
	Actuals:											868	873
	Productive Actuals:											763	769

This historical reprt, which only shows two months, indicates productivity and utilzation achievements by comparing the following, for each month:

1. Availability
2. Planned work
3. Actual effort recorded
4. Productive effort recorded, by counting just the effort spent on projects and proposals.

Drilling down to each department provides useful comparison of utilization and productivity:
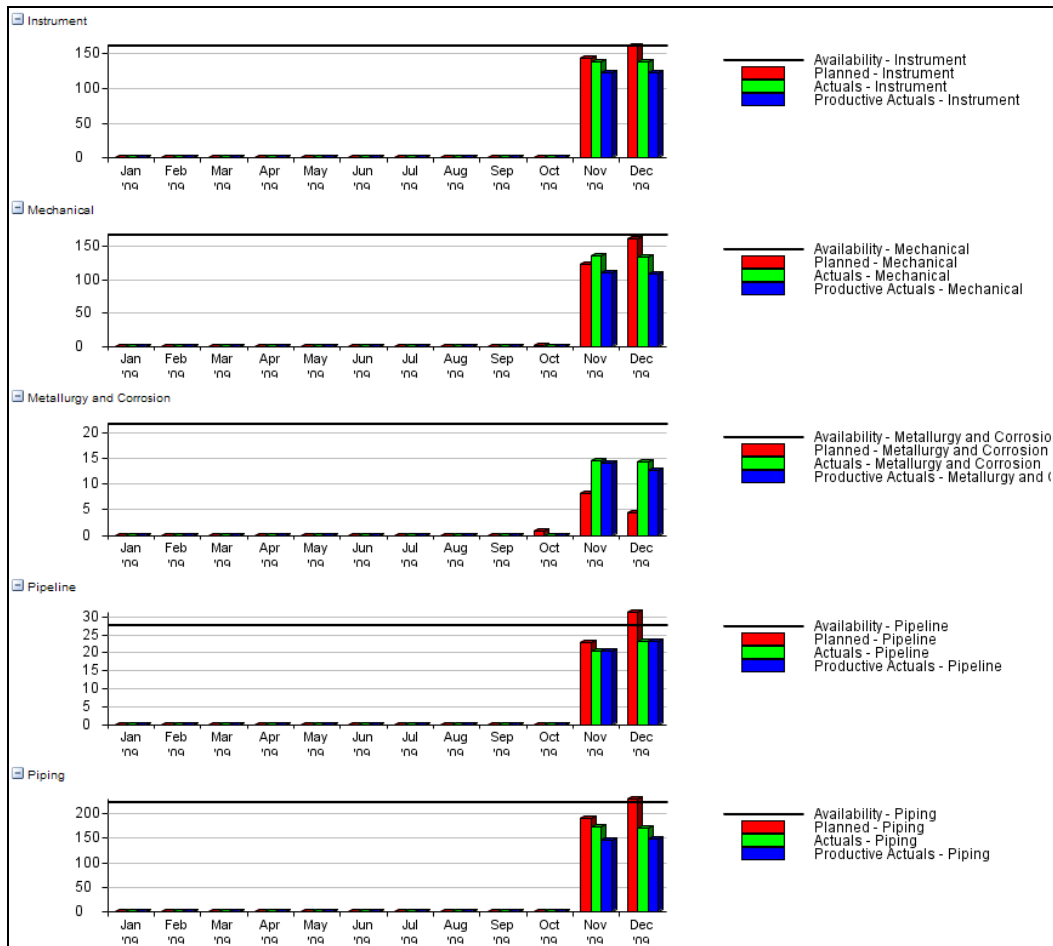
As the historic data builds, you can see how the productivity trends for each department will become highly visible. Here is the source for productivity improvement; if the less well performing departments can start to match the best performers, significant improvement in productivity can be achieved.

2.3   Outstanding requests for resource

Project Job No.	Drilldown	Dec 28	Jan 4	Jan 11	Jan 18	Jan 25	Feb 1	Feb 8	Feb 15	Feb 22	Mar 1	Mar 8	Mar 15	Mar 22	Mar 29	Apr 5	Apr 12	Apr 19	Apr 26	May 3	May 10
F-03030	Departments	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
F-03037	Departments	1	0																		
F-03040	Departments	1	1	1	1	1															
F-03041	Departments	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
F-03043	Departments	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
J - 142	Departments	9	34	34	34	34	50	50	50	50	64	64	64	64	69	78	78	78	79	83	83
J - 143	Departments	9	34	34	34	34	50	50	50	50	64	64	64	64	69	78	78	78	79	83	83
J-1312E	Departments		53	53	53	53	53	27													
J-131O	Departments	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
J-132	Departments	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
New Proposal	Departments	3	10	10	10	10	17	17	17	17	27	27	27	27	27	28	28	28	26	22	22
PI-09001	Departments	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Page total		43	148	148	148	148	185	159	132	132	169	169	169	169	180	196	196	196	197	201	201

This highlights the risk of delays to projects because named resources have yet to be allocated. Project J-1312E requires 53 staff to be assigned within the next 7 days! Drill down shows the offending departments:

Project Job No.	Resource Department	Drilldown	Dec 28	Jan 4	Jan 11	Jan 18	Jan 25	Feb 1	Feb 8	Feb 15	Feb 22	Mar 1	Mar 8	Mar 15	Mar 22
J-1312E	Civil / Structural	Categories		9	9	9	9	9	5						
	Electrical	Categories		9	9	9	9	9	5						
	Instrument	Categories		9	9	9	9	9	5						
	Metallurgy and Corrosion	Categories		1	1	1	1	1	0						
	Pipeline	Categories		4	4	4	4	4	2						
	Piping	Categories		8	8	8	8	8	4						
	Process	Categories		9	9	9	9	9	5						
	TeleCom	Categories		5	5	5	5	5	2						
Page total				53	53	53	53	53	27						

2.4   Resource performance on individual projects

	1	2	3	4	5	6	7	8	9	10	11	12	13
Budget	5	12.5	25	30	40	45	50	60	65	75	80	85	
Actual Effort	5	15	30	35	45								
Earned Value	5	12.5	25	30	35								
Forecast					45	55	66	74	88	96	110	118	125

Months
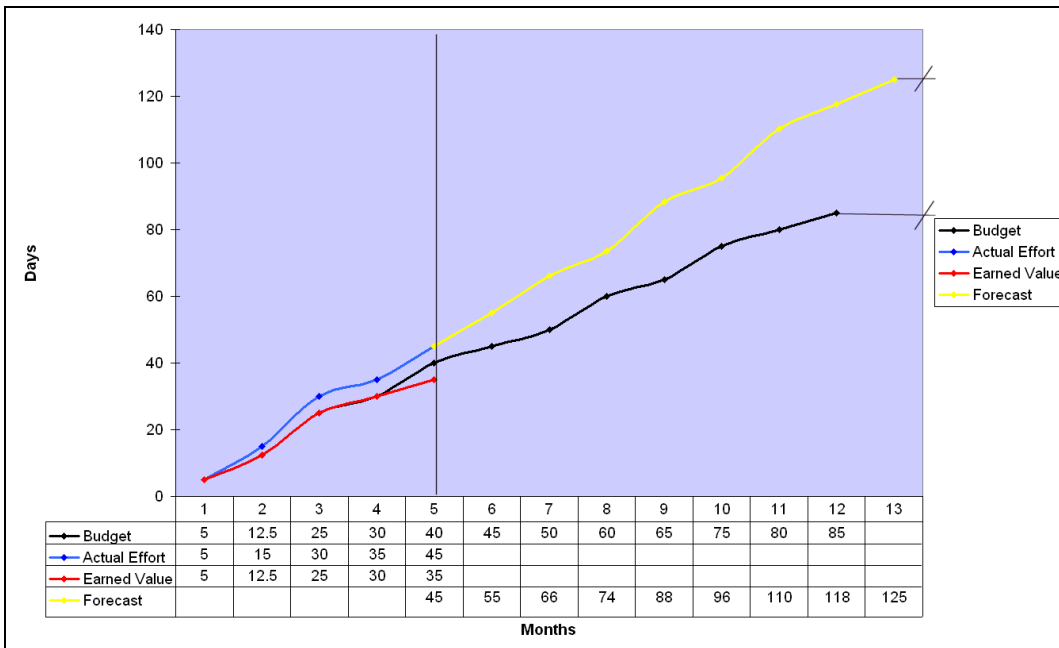
Whilst the previous reports have focused on resource utilization, the of tracking effort and progress on individual projects is equally important. Measuring the performance of the allocated resource will test the credibility of the estimate to complete. If this has to change, it will impact the resource planning and destabilise the previous reports.

The report above show that, although the value of work achieved (Earned Value) has been in line with the plan until the previous month, the actual effort has consistently exceeded that planned. This causes unfavourable cost and schedule variances to date (more on this later), so that the forecast to completion has the potential to dramatically overrun, unless corrective action can be taken.

Without this detailed performance measurement of the resources on individual projects, there can be little confidence that projects are proceeding according to plan, and the credibility of the resource forecast report will be undermined.

3   Core business processes

For the information produced in these reports to be credible, the underlying resource management processes must be both sound and enforced.

3.1   The key roles

Most organizations operate a matrix organization with three key roles in the resource management process:

3.1.1   Line Managers – maintaining the supply

- Maintain details of skills & competencies
- Hire & termination dates, impact of holidays
- Identify skills shortages in good time for recruitment by HR
- Provide career paths
- Set aside sufficient resource for BAU & departmental projects
- Ensure balanced workload for their team and that everyone reaches their utilization targets

3.1.2   Project managers – defining the demand

- Resource planning at generic skill level, using templates
- Stipulate experience and competency requirements
- Visibility of spare capacity so plans will be feasible
- New plans generate resource requests, updated plans create change requests.
- Search for appropriate staff and request individuals

3.1.3   Senior management – assign priorities and resolve disputes

- There will be excess demand for some skills and insufficient demand for others
- Prioritise each piece of new work - how far down the list can you get?
- When one team gets overloaded, are there similar skills elsewhere?
- Looking at the longer term trends in demand, do you have the right skills mix going forward?

3.2   Demand management

Each Line manager has a capacity profile for their team. As project managers create new demand with their resource planning, these should be issued to relevant line managers as requests for resource
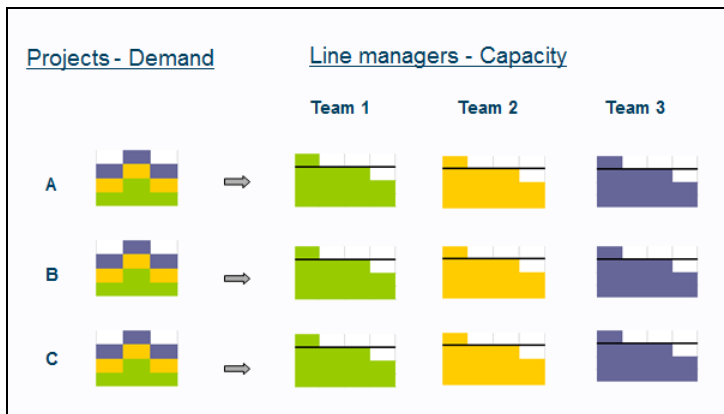
It is an ever changing scenario. Changes in demand and capacity constantly arise from:

  ⊙ New projects and proposals
  ⊙ Client delays free up resources unexpectedly
  ⊙ Changes in project scope, or the realisation of poor estimating
  ⊙ Key resources resign

Being able to quickly assess the impact of changes in demand (new work, project delay, poor estimating, etc.) and supply (key staff resignations, delay in hiring programmes) is crucial. The Resource management software must provide scenario comparisons so that:

  ⊙ The impact of change is immediately visible
  ⊙ 'What If…' scenarios support the evaluation of alternative courses of action.

Business planning must include longer term forecast of skills demand, to trigger necessary retraining or hiring programmes.

Maintaining a realistic resource plan for each project

Implicit in this is the need to maintain realistic resource plans for each and every project. As scope changes are agreed, or poor estimating is acknowledged, Change control must be applied to maintain realistic resource plans

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Original	5	12.5	25	30	40	45	50	60	65	75	80	85			
Change 1	5	12.5	25	35	47	55	60	70	75	85	90	95	100		
Change 2	5	12.5	25	35	47	55	70	85	90	100	110	115	120	125	
Change 3	5	12.5	25	35	47	55	70	85	90	110	125	130	135	140	150

Months
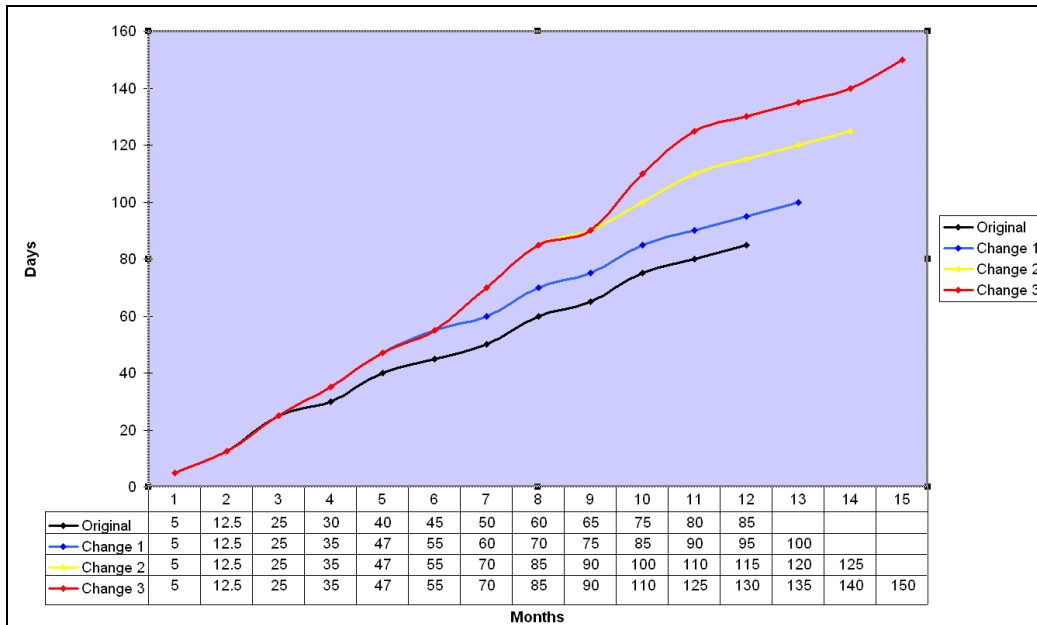
Prior to making these changes, individual project baselines or snapshots should be taken, so that there is a reference preserved for comparative reporting and analysis. Why has this project started to overrun so dramatically within the last two months?

It is important to acknowledge such changes to the project baseline as soon as they become apparent. The credibility of the forecasting report relies heavily on each project's resource plan being realistic. Senior managers need to promote a culture that responds openly to poor project performance.

Resource allocation

Requests for resource will need to stipulate skill and competency requirements as well as preferences. It is likely that the resource allocation will need to be tracked through its stages, which typically are:

- ⊙ Requested – project manager requests resources as a time phased demand profile
- ⊙ Proposed – Line manager proposes an individual
- ⊙ Accepted/declined – by the project manager
- ⊙ Confirmed – by the line manager
- ⊙ Date change – reconfirm resource's availability as task dates change.

Line managers need good system support when searching for suitable resources. This screen shot shows how search criteria can be entered to produce a list of staff that are available.

Enter criteria for the replacement resource in the boxes below.

Resource: (any) ▾   Skill: Prefer ▾ ANALYST ▾
Location: Prefer ▾ (any) ▾   Role: Prefer ▾ (any) ▾
Languages: Prefer ▾ (any) ▾   Grade: Prefer ▾ (any) ▾
Include: Available and busy resources ▾

Use the boxes in the first column below to change which resources are assigned to the task and then click Save or modify the criteria and click Check Availability.
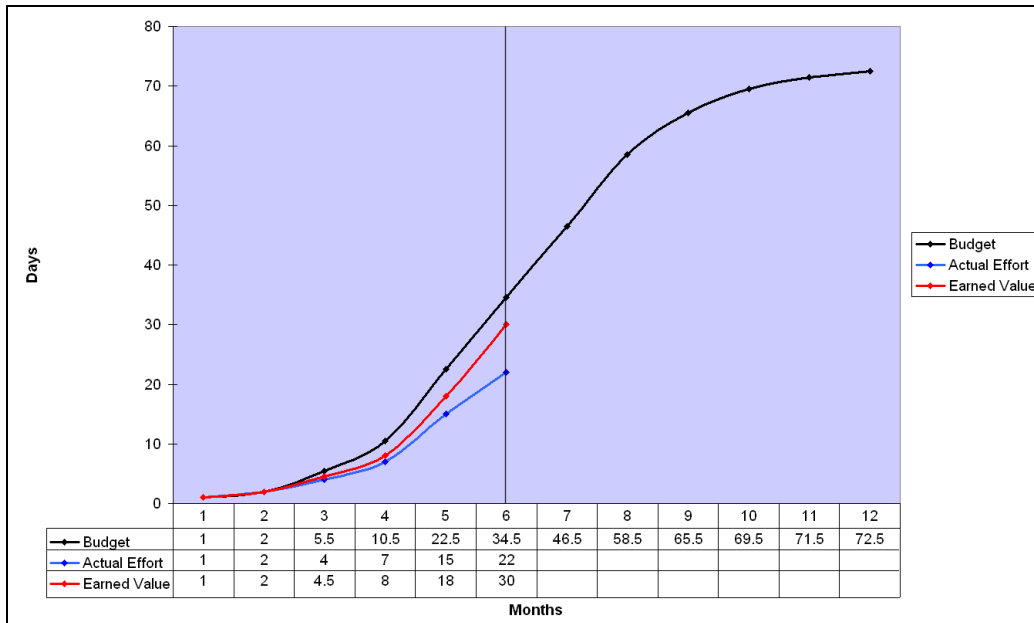
I want to: Transfer all of the work to a single resource ▾

Assigned	State	Resource	Skill	Other Skills	Start	Finish	Work	Max	Show...
⦿	Overloaded	ANALYST	ANALYST		18/01/2010	25/03/2010	320	8	Assignments

The resource above is currently assigned to this task. The resources below are suitable replacements matching the search criteria.

Assigned	State	Resource	Skill	Other Skills	Start	Finish	Work	Max	Show...
○	Available	Gary Graham	PROGRAMMER	ANALYST, TECHNICIAN	18/01/2010	25/03/2010	320	8	Assignments
○	Available	Dan Black	TECHNICIAN	TESTER, ANALYST	18/01/2010	25/03/2010	320	8	Assignments
○	Available	Sam Smith	PROGRAMMER	TECHNICIAN, ANALYST	18/01/2010	25/03/2010	320	8	Assignments
○	Busy	Kris King	ANALYST	ACCOUNTANT, TECHNICIAN	18/01/2010	25/03/2010	320	8	Assignments
○	Busy	Larry Lamb	ANALYST	ACCOUNTANT, TECHNICIAN	18/01/2010	25/03/2010	320	8	Assignments
○	Busy	Nat Nolan	ANALYST	TESTER, TECHNICIAN	18/01/2010	25/03/2010	320	8	Assignments
○	Busy	Pat Pringle	ANALYST	DOCUMENTER, TECHNICIAN	18/01/2010	25/03/2010	320	8	Assignments
○	Busy	Fran Gold	TESTER	ANALYST, TECHNICIAN	18/01/2010	25/03/2010	320	8	Assignments
○	Busy	Ann Brown	DOCUMENTER	TESTER, ANALYST, PROGRAMMER	18/01/2010	25/03/2010	320	8	Assignments
○	Busy	Bill Green	TECHNICIAN	PROGRAMMER, ANALYST	18/01/2010	25/03/2010	320	8	Assignments
○	Busy	Reg Ring	PROJECT MANAGER	DOCUMENTER, ANALYST	18/01/2010	25/03/2010	320	8	Assignments
○	Busy	Terry Turner	PROGRAMMER	TECHNICIAN, ANALYST	18/01/2010	25/03/2010	320	8	Assignments

Where suitable staff could be available in several teams or departments a 'dating agency' approach is suitable. Details of the resource requirements are posted on a Vacancy board and line managers, driven by their utilisation targets, will propose their most suitable candidates, from which the project manager can make his choice. This approach is used by Atkins Intelligent transport systems.

Details of new assignments and any subsequent date changes should be emailed to the allocated resource, with an option to add it to their personal outlook calendar.

Tracking effort and progress

As previously discussed, the actual performance of resources on individual projects will affect the resource plan, so it is important to measure the performance of resource effort using Earned Value for each reporting period, as shown in the chart below:
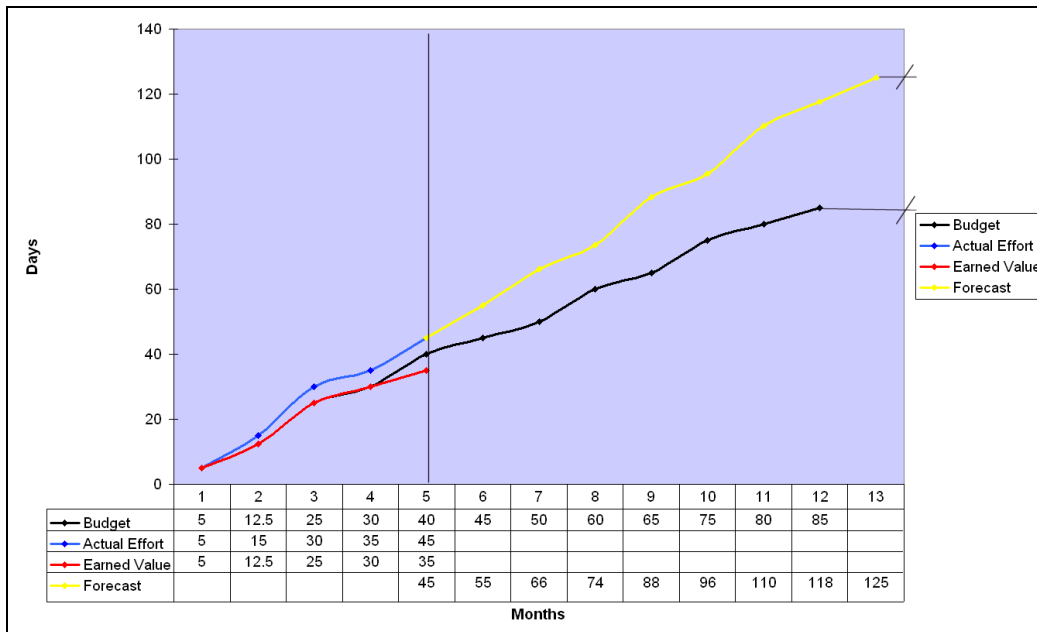
	1	2	3	4	5	6	7	8	9	10	11	12
Budget	1	2	5.5	10.5	22.5	34.5	46.5	58.5	65.5	69.5	71.5	72.5
Actual Effort	1	2	4	7	15	22						
Earned Value	1	2	4.5	8	18	30						

Months

- Establish performance baseline – the project budget
- Track actual effort – timesheets
- Assess progress – value of work done

Cost and schedule variances at month 6 are:
- The schedule variance is budget minus earned value, i.e. 4.5 days negative
- The cost variance is earned value minus actual effort, i.e. 6 days negative

This information must be used to trigger a re-estimate of the performance baseline. Unless there are good reasons for believing that the project will magically recover, corrective action will need to be taken and the outstanding work independently re-estimated.

If no corrective action is taken and the current cost and schedule variances reflect the performance throughout the project, then an overrun of 40 days, 50% of the budget, can be predicted. You can see how poor the Forecast report will be if such poor performance on individual projects is ignored!

	1	2	3	4	5	6	7	8	9	10	11	12	13
Budget	5	12.5	25	30	40	45	50	60	65	75	80	85	
Actual Effort	5	15	30	35	45								
Earned Value	5	12.5	25	30	35								
Forecast					45	55	66	74	88	96	110	118	125

Months

4 How well do you score?

Most professional service organizations have a patchwork of reports, processes and system support in place. Unless a major (and potentially highly disruptive) investment has been made in an ERP or PPM system, a typical profile would be:

- Projects are generally centrally registered, with sufficient financial parameters defined.
- Multiple spreadsheets are in widespread use for resource planning and these are often department or regionally based, making it difficult to consolidate for forecast reporting that is current, consistent and complete.
- The resource allocation process is often poorly defined, with inconsistent procedures & communication
- Roles and responsibilities can be inconsistent in large organizations
- Whilst the tracking of effort on individual projects is often done, measuring the progress achieved is much less common.

So how can the gap be bridged?

Evolutionary change is much less disruptive than more radical system changes, so minimise the risk, costs and disruption by building on what's in place. In order to produce information that is pertinent, credible and current:

- Review business processes, as previously discussed
- Appropriate software tools

When reviewing software tools, we recommend:

- Spreadsheet style resource planning interface for user acceptance
- Configure screens and navigation to reflect your process steps
- Resource management software that integrates effectively with corporate systems

5   *The potential rewards*

If we return to the Association of Consultant's conclusion that a 2% increase in billable earners productivity could increase current member's profits by a third, then we can start to quantify the benefits.

I suspect that most professional services organizations will accept the feasibility of a 2% increase in productivity if the reports, processes and system support that we have discussed where in place. Assuming an average billing target per resource of only £100k a year, an increase of 2 per cent would realize an additional £2,000 in income, per resource. Depending on your number of billable resources, this soon translates into real money:

- For 100 resources, £200k
- For 500 resources, £1 million
- For 1,000 resources, £2 million

What impact would this extra revenue have on your current profit?

The first next step

Innate is pleased to offer at no cost and no obligation, a half day audit and report on your current resource management reports, processes and systems. The report will provide an estimate of the likely costs in bridging the gap and an estimate of the potential benefits that could be expected from such an investment.