Chapter XVI

Managing Multiple Projects

The best way to predict the future, is to invent it.

(Alan Kay)

Managing IT projects and being on an IT project team used to be simpler. PMs typically had one project to manage, and team members were on only one team. All the team members were located in close geographic proximity, and the work was all done at the workplace. Currently the project landscape has become much more complex, where everyone is concerned with multiple projects and teams may be spread out all over the world. The business needs of cutting costs and being quicker to market have increased the pressures on project teams and their managers.

According to the "Chaos Report" from the Standish Group (2004), unqualified IT project success only occurs in about one third of IT projects,. To improve this success rate, many associations (such as the IT Governance Institute) and companies are investigating broad IT governance issues. In regard to project management, these broad issues include such matters as project portfolio management, corporate-wide comprehensive standard project policies and procedures, and project knowledge management. As a vehicle for such consolidation and standardization and to deal with the complexities of project teams, companies have started to establish a Project management office (PMO). The PMO, its key current functions, and the future role of the PMO in global projects, project management maturity, Web portals, and strategic planning are discussed further in this chapter.

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The Project Management Office

The *program office* has been a common organizational construct in governments and companies for decades. A *program* is a group of projects managed in a coordinated way to obtain benefits not available from managing them individually (PMI, 2000). Program offices typically have some operational responsibility as well. Within a program office, the projects are all related in some way, typically advancing the goals of the overall program. For example, in the United States, a government agency would have program offices devoted to particular specific efforts generally funded by a specific source.

However, the *project management office* is an umbrella organization for all the projects in an organization and does not have any operational responsibility. The organization in question may be the entire corporation or one division, such as the IT division. In 2003, about two thirds of organizations with IT departments had PMOs, either inside or outside of the IT department (Hoffman, 2003). PMOs are sometimes called "project management support offices" (Powell & Young, 2004), and they are usually set up in one of two manners: with administrative authority or with a consultancy role. There may, however, be PMOs that have combinations of these basic roles. One definition of a PMO is that "a project office is a corporate management organization that evaluates, measures, and essentially enforces the performance and interaction of the implementation of IT project processes across a company's business units" (Elkins, 2003). Whether a PMO is an administrative function or purely a consulting function, a common goal of the PMO is to foster the *discipline of project management* within the organization. As state in the *PM Network*: "The project office's long-term vision is to transform project management knowledge throughout the organization so that it becomes part of the culture" (Block, 1999). According to Computerworld the roles of the PMO are as follows (Elkins, 2003):

- Eliminate project redundancies (across different departments or even divisions)
- Standardize the delivery process
- Access project ROI (both upon proposal and after project completion)
- Avoid the "latest and greatest" syndrome

CIO Magazine also itemized the roles for a PMO (Santosus, 2003):

- Project support: project management guidance
- Project management process/methodology
- Provide training
- Provide a "home" for project managers
- Provide internal consulting and mentoring
- Project management software tools (evaluate, select, configure, maintain)
- Project portfolio management

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In addition to the lists provided by leading IT publications, other (and more specific) roles often given to or assumed by PMO's include:

- Making sure projects are in line with the organization's strategy and goals
- Aiding in the project selection process
- Helping develop a project WBS, schedule, and cost plan
- Helping with software engineering methodologies, standards, and reuse
- Doing or checking estimation at both the task level and at the project deliverable level
- Doing or checking the risk analysis
- Developing detail policies and procedures
- Developing detail templates, forms, spreadsheets, and so forth.
- Reviewing all project plans (communications, risk, human resource, procurement, etc.)
- Coordinating the use (or acquisition) of scarce resources (including key personnel)
- Performing EVA and other performance analysis on projects
- Checking verification and validation efforts
- Being involved with project change control boards
- Performing or checking stage gate analysis
- Keeping project managers focused on priorities
- Integrating performance information for all projects as a part of executive level reporting
- Coordination of interacting or dependent projects in terms of business issues, technical issues, and corporate politics
- Coordination of diverse projects such as global efforts involving different time zones, currencies, measures, languages, cultures, and so forth
- Troubleshooting and proposing remedies for projects that run into schedule, cost or other difficulties
- Managing common key stakeholders
- Serve as a repository for project lessons learned
- Facilitating effective and consistent use of PM tools
- Making sure projects (and contracts) are properly closed out
- Being an advocate for project managers
- Guiding the organization in the improvement of PM (PM maturity)
- Helping project managers in their career development

PMOs established within the IT division often encompass more than just the project management discipline and may also include the software engineering discipline. For

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example, software engineering and architectural services which in the past may have been centralized in a chief technology officer (CTO) may be migrated into an IT PMO. PMOs may also include IT integration expertise and services that are often consolidated in an integration competency center (ICC).

In theory, the successful execution of all these roles will result in improved organizational performance, including reduced overall project costs, reduced lead time in implementing solutions, increased quality of delivered products, increased overall business benefit of project implementations, reduced risks of carrying out projects, and ability of the organization to handle bigger and more complex projects. The Sarbanes-Oxley Act (SOX)[1] now requires organizations to disclose large investments, including large projects; PMOs can facilitate compliance with this act.

A PMO requires extra overhead costs, and the benefits of the PMO must exceed these overhead costs. *CIO Magazine* reported that about one half of the companies it surveyed with PMOs indicated overall success, 16% saw no improvement, and 22% did not know yet (Santosus, 2003). However, *Computerworld* reported that 16% to 33% of organizations (depending upon industry) feel that their PMO is ineffective, and only 12% to 19% feel that their PMO is very effective (Hoffman, 2003). It is still often felt that PMOs spend too much time compiling reports for upper management and too little time ensuring that projects are running smoothly (Hoffman, 2003). Some "secrets" for PMOs to get off to a quick successful start and still follow their long-term vision were listed in *PM Network* (Block, 1999):

- Rein in runaway projects
- Assist project startups
- Establish risk management
- Establish portfolio management
- Conduct reviews and audits
- Organize and manage the resource pool
- Identify and develop potential PMs
- Establish and enforce a project management process

The last item in the above list is of paramount importance, and earlier in this book the concepts of critical success criteria and the dual stage gate review process were developed. Completion criteria are monitored by management stage gates primarily using earned value analysis (EVA), and satisfaction criteria are monitored by quality stage gates primarily via stakeholder opinions of preliminary product manifestations (risk and financial metric status are also part of these stage gate reviews). This process is illustrated again in Figure 16.1.

How to measure the success of the PMO can be a difficult issue, and different organizations have different approaches. Some look at the cumulative success rates of the projects and see if the PMO is responsible for improving that overall rate (for projects

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that produce products that are actually put into use). Some look only at the improvement of estimated time and cost versus actual time and cost for the projects. Some base PMO success on the opinion of stakeholders for all of the projects. Project closeout was also discussed in an earlier chapter and that closeout would go through a final stage gate review with a form such as that in Figure 16.2. The metrics shown in that closeout form could be aggregated for all projects and used to clearly quantify the success of the PMO.

As mentioned earlier, there are two basic ways that PMOs may be set up within an organization. The first way is without any administrative authority, where the PMO staff act as consultants, mentors, and trainers. Here the PMO may have many of the same roles as the authoritative PMO such as developing standard PM policies, procedures, forms, templates, and so forth, but it has no direct authority to enforce any of its suggestions. In this role the PMO observes and reports on what is going on and may or may not try to influence it, but has no direct authority to change anything. On the other hand, the authoritative PMO can enforce its policies and procedures, and often the project managers report to the PMO directly. For some IT divisions the PMO office is simply a staff position or positions to the CIO or CTO, and its authority comes through the CIO. In either case, the PMO should be kept separate from project teams so it can maintain its objectivity. *CIO Magazine* observed that the creation of an authoritative PMO which has the power to approve or kill projects and the power to audit projects for strict compliance with policies and procedures may be too bureaucratic and not work well in many organizations (Santosus, 2003). Some PMs resent PMO staff and consider them as paper shufflers or know-it-alls. In today's knowledge-worker–based world, a PMO with primarily a consultancy role may be a better fit in most IT organizations. Thus, when a project is in trouble, and if its PM did not follow the recommended PMO policies and procedures, then that PM would have "a lot of explaining to do" to the CIO.

The nature of the people that staff a PMO typically include project management specialists, subject matter experts, and project analysts. The PM specialists have gained their PM expertise through specialized training (such as through PMI certified training organizations) and/or years of experience. Subject matter experts are usually IT experts from a software engineering perspective and/or expertise in the specific type of IT applications involved. The project analysts are experienced in working with project information and specific tools. PMO staff members are usually well versed in both the business and technical aspects of IT projects, and it is not uncommon for some PMO staff to be outside consultants. The process of creating a PMO should be carried out like any project, and a part of that process is the evaluation of the effectiveness of the PMO. This is illustrated in Figure 16.3. That figure also indicates the main concepts that an IT PMO must develop, evaluate, and update including the organizational structure of the PMO, the roles and responsibilities of its staff, the office infrastructure, the PM methodology and software engineering methodology, the communications, and the tools and systems. For a PMO to be successful, it may take several years. *CIO Magazine* reported that 37% of PMOs were successful within 1 year, but that the success rate went rose to 65% for PMOs over 4 years old.

PM Solutions (www.pmsolutions.com) has identified the top 10 critical success factors for a PMO:

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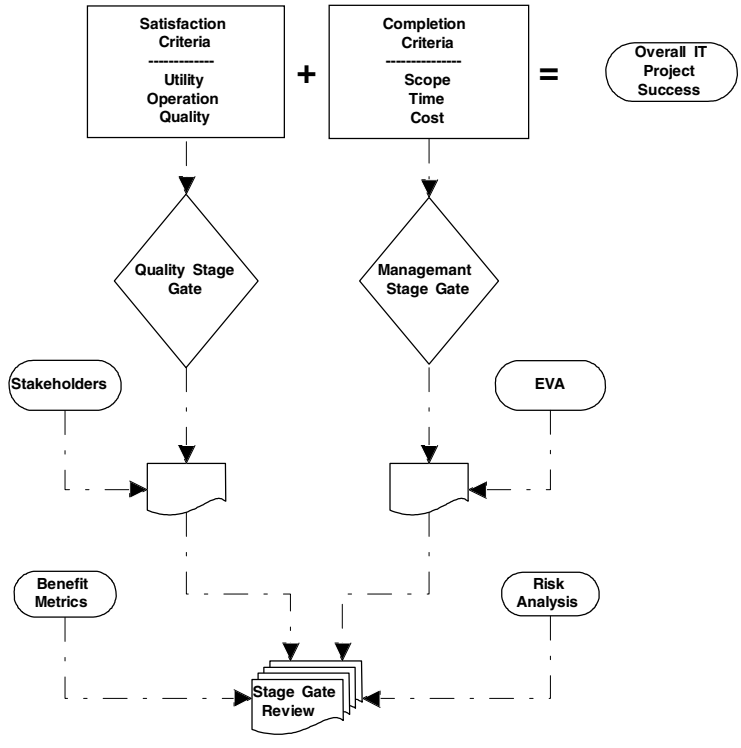
Figure 16.1. Dual stage gates



- The PMO has senior executive-level support.
- A superior process for selecting project managers and teams has been established.
- Project teams include participants from multiple business functions and disciplines.
- A high standard of truthfulness and integrity exists within the PMO.
- The PMO serves as an ambassador, communicating with all internal and external stakeholders.
- Training of project managers is competency-based (rather than purely academic).
- Project management methodologies, tools and templates are standardized.
- A useful knowledge library of best practices is maintained as part of the PMO.
- The PMO is involved in all projects from start to finish.
- The organization's project portfolio is managed by the PMO.

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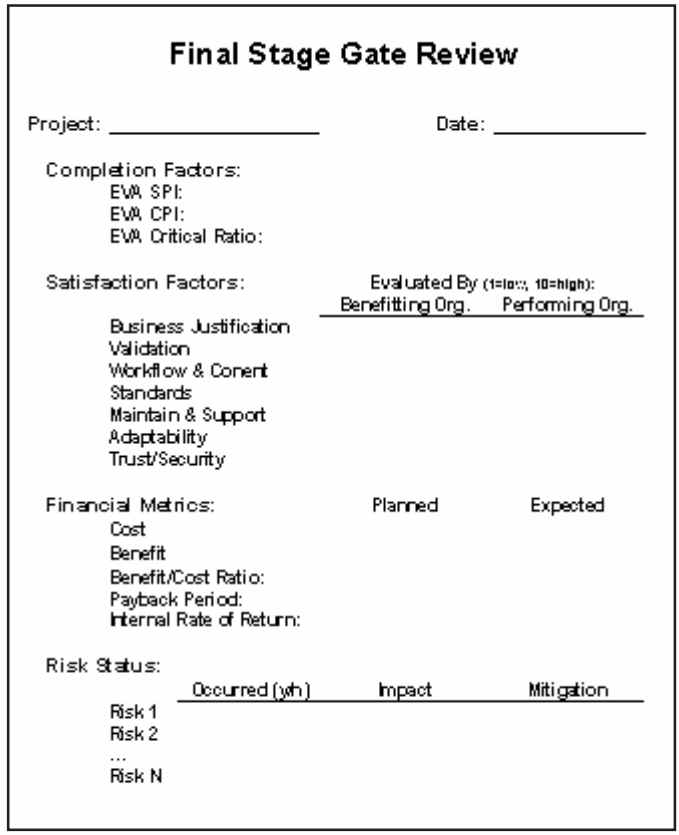
Figure 16.2. Final stage gate review form



Final Stage Gate Review

Project: _____ Date: _____

Completion Factors:
EVA SPI:
EVA CPI:
EVA Critical Ratio:

Satisfaction Factors:	Evaluated By (1=low; 10=high): Benefitting Org.	Performing Org.
Business Justification		
Validation		
Workflow & Conent		
Standards		
Maintain & Support		
Adaptability		
Trust/Security		

Financial Metrics:	Planned	Expected
Cost		
Benefit		
Benefit/Cost Ratio:		
Payback Period:		
Internal Rate of Return:		

Risk Status:	Occurred (y/n)	Impact	Mitigation
Risk 1			
Risk 2			
...			
Risk N			

Portfolio Management

An organization's project portfolio is the set of projects currently underway as well as projects that have been proposed. IT management has to be concerned not only with doing projects correctly but also that the correct projects are being done. Projects are normally prioritized based on the three R's: reward, risk, and resources. IT projects generally fall into several categories: mandatory, sustaining, and strategic. Mandatory projects are those that have to be done to remain in compliance with regulations of governing bodies or perhaps due to other legal or security issues. Sustaining projects are those that maintain the integrity of the IT infrastructure. Strategic projects are those which promise to improve the competitive position of the organization. IT portfolio management is the process of assessing the portfolio of projects to make sure that priority is given to the projects that are expected to add the greatest value to the organization

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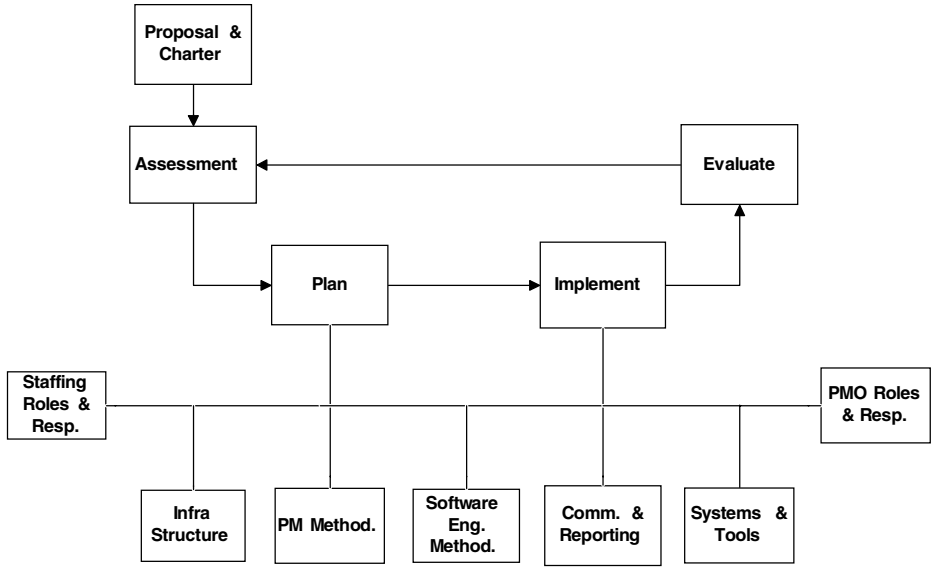
within acceptable levels of risk. Projects that duplicate effort, are too risky, or produce smaller benefits are not done, canceled, or placed on hold. Unfortunately 75% of companies do not do formal project portfolio management; most CIOs "steer project funding with little thought for the entire investment picture" (Stone, 2004). "Often the only hard information an organization can collect about its projects is how much they're spending—which is like trying to steer an airplane by looking at the fuel gauge" (Wayne, 2004). CIO Magazine lists the benefits to an organization via project portfolio management (Stone, 2004):

- Fairer decisions about funding (not just the political muscle of the sponsor)
- Optimal mix of risk and reward
- Better communication between IS and business leaders due to a common financial model
- Greater understanding and cooperation over funding allocation
- Greater business accountability for investment decisions
- Strengthened alignment between IS and business
- More efficient use of resources
- Fewer project and effort overlaps

Figure 16.3. PMO processes



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PortfolioStep lists the value of PMO portfolio management as (PortfolioStep, 2004):

- Improved resource allocation
- Improved scrutiny of work
- More openness of the authorization process
- Less ambiguity in work authorization
- Improved alignment of work (IT versus business units)
- Improved balance of work (type of work and risks involved)
- Changed focus from cost to investment
- Increased collaboration
- Enhanced communication
- Increased focus on when to "sell" (bail out)

A serendipitous beauty of project portfolio management is that it's actually impossible to do it without being aligned with the business, because creating a portfolio requires close collaboration with the business. It will elevate the CIO in other executives' eyes because he (finally) will be speaking in their native tongue (Berinato, 2004).

A portfolio must be "balanced" to make sure that potential rewards are weighed against risk levels. One might undertake a few very risky projects if the rewards are quite high, but one would not engage in many very risky projects. The process is similar to maximizing the returns from a portfolio of investments subject to risk constraints. In addition to maximizing returns and minimizing risks, the optimization of the project portfolio also needs to consider the availability and allocation of key resources and the time phasing of resource usage. Consider Figure 16.4, which shows several projects in a graph of risk versus reward.

Projects in quadrant A are no-brainers and are always to be done if resources permit. Projects in quadrant D are to be avoided, unless they are "must do" because of some compliance issue. Projects in quadrants B and C would be balanced off against each other to match the risk tolerance of the stakeholders. Some software systems might show the projects with different size circles, so that the absolute size of the projects was part of the above visualization. Suppose the estimated annual cost (in thousands of dollars) for the eight projects in that figure were as shown in the following list:

- P1 – 350
- P2 – 150
- P3 – 350
- P4 – 250
- P5 – 200

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- P6 – 300
- P7 – 150
- P8 – 150

If our total annual budget for the period was $1,000,000, we would likely choose P1 and P2 because they are in quadrant A, then chose P3 and P7 to balance high-risk and low-risk projects. The total of these four project budgets is $1,000,000.

Spreadsheet models in conjunction with integer linear programming (LP) can also be used to find the optimal mix of projects. Consider the eight projects shown in Figure 16.5. For each project the internal rate of return (IRR), cost, and risk factor has been tabulated. The risk factor translates to a money amount of contingency (factor times cost) that is estimated for each project.

Figure 16.6 shows the spreadsheet after calculated columns have been added to determine the total investment (investment % times cost), total return (cost times IRR), and dollars at risk (cost times risk factor). The LP solution involves maximizing the return with constraints such that the dollars invested does not exceed the budget ($3,000 in this example), such that the dollars at risk does not exceed the total contingency (20% in this example, $600), and that the investment % are between zero and 1 and also must be integers (i.e., zero for not doing a project and 1 for doing a project):

Max: Return = $X_i * IRR_i * Cost_i$

Subject to:

$X_i * Cost_i <= Budget$

$X_i * Cost_i * Risk_i <$ = Contingency (Overall Risk Factor * Budget)

$0 <= X_i <= 1$ and X_i is integer

These formulae are also shown in Figure 16.6 in the Excel Solver window.

Figure 16.7 shows the solution; again, the 1s in the investment % column indicate the chosen projects. Projects 1,2,6,7, and 8 would be done with our budget of $3,000 and overall risk factor of 20%.

A number of financial benefit metrics were discussed and detailed in Chapter III. In addition to (or instead of) risk versus reward or one of these financial benefit metrics, projects can be scored and ranked using "holistic" techniques that include both quantitative and qualitative metrics. Most of these methods define a list of metrics with a corporate weighting assigned to each metric. A score, such as a value between 1 and 10 (not all methods use a linear scale), is then given to each metric. The definition of each metric is usually worded so that a high score is good and a low score is bad. As part of the definition of each metric, examples of the meaning of high and low scores should be specified. For example, in considering technical feasibility, a score of 10 may mean that "this type of project has been done in this organization successfully in the recent past"; a score of 5 may mean that "this type of project has been done in similar types of

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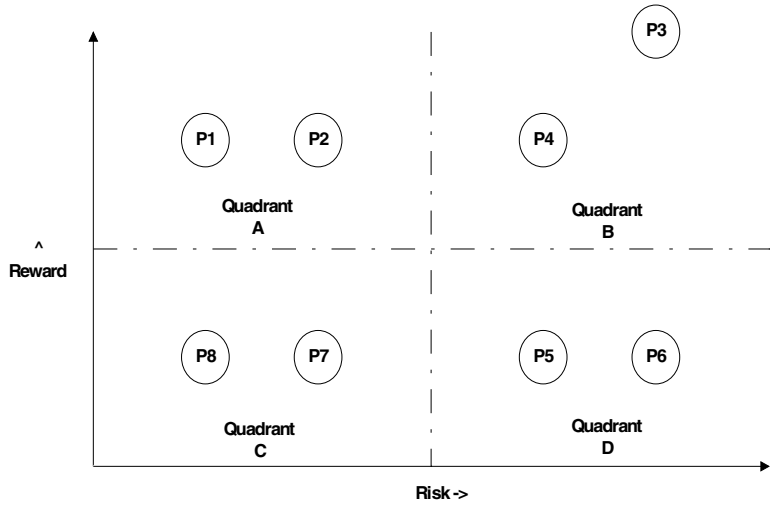
organizations with success"; and a score of 1 may mean that "we have not seen it done successfully anywhere yet." Statistically it is best if the metrics do not interact too much, but in reality many metrics are going to indirectly affect other metrics. Figure 16.8 is an example of such project scoring.

After projects are scored, they are ranked by the score and a cut-off line is drawn when the sum of project budgets (for the period in question, such as the fiscal year) matches the period budget limit; a limit point on resources could also be used. Many organizations have some type of project review board made up of executive members from both IT and business units. This board periodically reviews both the scoring and ranking process as well as other issues that may be involved with the selection and cancellation of projects.

CIO Magazine discusses the process of building a portfolio and breaks it down into five levels (Berinato, 2004):

1. Put all projects into one database; include such information as name, description, purpose, estimated time and costs, benefit metric (i.e., ROI or IRR), and key resources. This step alone will let IT management see the whole project landscape and allow pruning of duplicated efforts.
2. Prioritize the projects based on either the reward/risk or a scoring/ranking method.
3. Divide projects into two (mandatory versus discretional) or three budgets (mandatory, infrastructure, or strategic) based on the type of investment.
4. Automate the repository – reexamine key parameters regularly.
5. Apply modern portfolio theory (i.e., Markowitz methods).

Figure 16.4. Project risk vs.reward



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For large organizations, step 1 may be a bit overly ambitious to do for all projects, and the old 80/20 rule should be applied at first; concentrate on the 20% that make up the dollar bulk of your projects. For step 3, an organization has to decide how much of its total budget to place in each of the two or three investment categories, such as 60% into infrastructure and 40% into strategic projects once the funding for mandatory projects is set aside. The last step requires a lot of data and discipline and many argue that it is not worth the cost of the effort. *On this point* CIO Magazine *presents a quote from Douglas Hubbard: "The cancellation rate of IT projects exceeds the default rate on the worst junk bonds; and the worst junk bonds have a lot [of formal portfolio management] applied to them" (Berinato, 2004).*

Tools for project portfolio management range from simple spreadsheets to complex software utilizing the very detailed math and economics of Markowitz modern portfolio theory. Spreadsheets and simple databases are good starting points. A number of specialized software products for portfolio management are available and evolving, including those based on simulation techniques (i.e., Monte Carlo) such as Crystal Ball Pro. Other notable products are PlanView (www.planview.com), ProSight's Portfolios (www.prosight.com), Artemis International Solutions' PortfolioDirector (www.artemisintl.com), Niku's Clarity (www.niku.com), Pacific Edge's Portfolio Edge (www.pacificedge.com), SystemCorp's PMOffice (www.systemcorp.com), ChangePoint's ChangePoint 8 (www.changepoint.com), Deltek Systems' Project Planner (www.sema4.com), and SystemCorp's PMOffice (www.systemcorp.com). Many of these products combine portfolio management with other PMO functions discussed later in this chapter including knowledge management and performance report consolidation with dashboards. Most of the IT portfolio software products do not include risk assessment or life-cycle cost of IT assets (Hoffman, 2004).

However, WiseTechnology suggests that "before you're ready to go shopping for software to help you manage your project portfolio, you need to be sure that your organization is ready for portfolio management" (Glick, 2004). There are many models for "project management maturity," but none of them puts portfolio management at the basic levels. Without basic sound project management skills and processes, any amount of expensive portfolio management software will not help much.

Figure 16.5. Project risk/reward

B	C	D	E
Project	**IRR**	**Risk Factor**	**Cost ($)**
1	0.35	0.15	200
2	0.25	0.05	500
3	0.3	0.5	700
4	0.15	0.3	300
5	0.28	0.25	400
6	0.25	0.3	900
7	0.2	0.2	600
8	0.3	0.1	800

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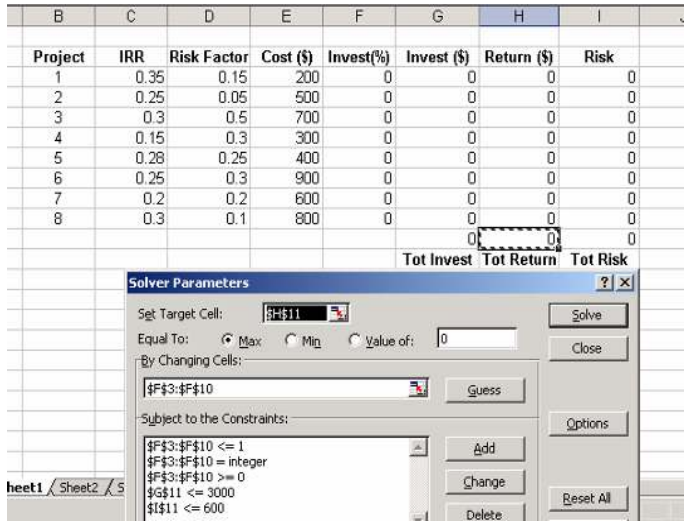
Figure 16.6. Project risk/reward spreadsheet



Mark Jeffery, of the Kellogg School of Management at Northwestern University, has developed a formal IT Portfolio Management Maturity Model (Melymuka, 2004a):

Level 1—"ad hoc":

- Random projects
- Uncoordinated decisions

Level 2—"defined":

- Standard methods for evaluating and prioritizing project proposals
- Central project management office
- Central budget oversight
- Central database of projects, with rough estimates of costs and benefits
- Basic understanding of financial metrics used to make investment decisions
- No consistent organization wide compliance
- No links into budgeting cycles
- No assessment of results or feedback into decision making

Level 3—"managed":

- Links to budgetary cycle
- Financial metrics such as ROI and net present value consistently calculated and used in annual reviews with business leaders

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Figure 16.7. Project risk/reward spreadsheet (answers)

	B	C	D	E	F	G	H	I
	Project	IRR	Risk Factor	Cost ($)	Invest(%)	Invest ($)	Return ($)	Risk
	1	0.35	0.15	200	1	200	70	30
	2	0.25	0.05	500	1	500	125	25
	3	0.3	0.5	700	0	0	0	0
	4	0.15	0.3	300	0	0	0	0
	5	0.28	0.25	400	0	0	0	0
	6	0.25	0.3	900	1	900	225	270
	7	0.2	0.2	600	1	600	120	120
	8	0.3	0.1	800	1	800	240	80
						3000	780	525
						Tot Invest	Tot Return	Tot Risk

Level 4—"synchronized":

Professional project management processes

Use of evolving metrics to measure project value through its life cycle

Frequent reviews to realign projects and weed out underperformers

Assessment of both project and portfolio risks

Assessment of future opportunities the project enables

Disciplined feedback from business

Results feed decision making

Figure 16.8. Project scoring

Project Scoring

	Factor	Weight	Project 1	...	Project N
1	Consistency with Mission (1 = low, 10 = high consistency)	9			
2	Technical Feasibility (1 = low, 10 = high)	7			
3	Operational Feasibility (1 = low, 10 = high)	7			
4	Economic Feasibility (1 = low, 10 = high)	7			
5	External Risk (1 = high, 10 = negligible)	6			
6	Internal Risk (1 = high, 10 = negligible)	6			
7	Risk of Not Doing this Project (1 = high, 10 = low)	5			
8	Internal Rate of Return (1 = low, 10 = high)	6			
9	Capital Investment (1 = very significant, 10 = little)	4			
10	Payback Period (1 = long, 10 = short)	4			
11	Degree of Contracting/Outsourcing (1 = much, 10 = little)	4			
12	Development Time (1 = long, 10 = short)	4			
13	Geographical Dispersion of Team (1 = much, 10 = little)	3			
14	Impact on Customer Base (1 = little, 10 = much)	5			
15	Impact on Organization (1 = little, 10 = much)	4			
16	Socio-Political Impact (1 = little, 10 = much)	3			
17	Legal and Ethical Issues (1 = many, 10 = none)	5			
18	Environmental & Safety Issues (1 = many, 10 = little)	3			
19	Increase in Org. Knowledge (1 = little, 10 = much)	4			
20	Increase in Org. Competitiveness (1 = little, 10 = much)	4			
	Totals:	100	0	0	0

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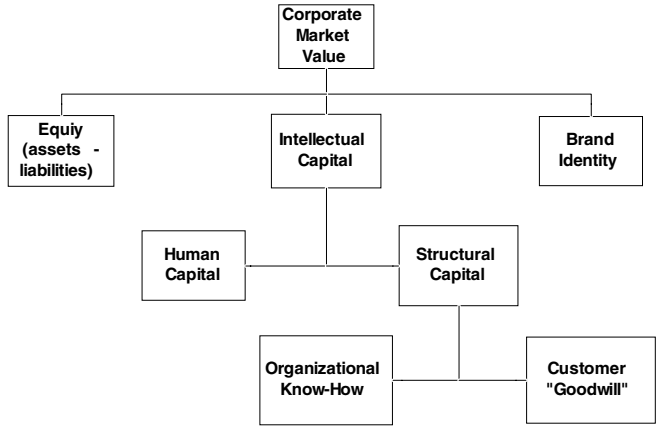
In his survey of 130 Fortune 1,000 IT groups he found the following distribution:

- Level 1—4.5%
- Level 2—24.5%
- Level 3—54%
- Level 4—17%

Knowledge Management

Another key function of a modern project management office is to be the focal point for corporate knowledge management or at least of knowledge management with respect to projects and project management. Information is data endowed with relevance and purpose, but knowledge is distinct from information and provides a higher level of meaning. The ability to act is an integral part of being knowledgeable. Having knowledge implies that it can be exercised to solve a problem, whereas having information does not. Knowledge management (KM) is a process that helps organizations identify, select, organize, and transfer important knowledge and expertise that are part of the organization's memory.

Figure 16.9. Organizational value



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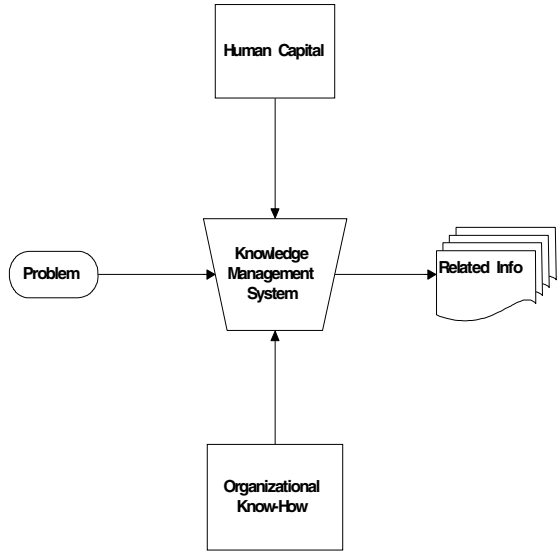
The PMO fosters knowledge management by sponsoring and/or undertaking initiatives to:

- Identifying knowledge
- Share knowledge in a formal manner
- Leverage the value of knowledge through reuse

Knowledge management promotes organizational learning and is used to help solve problems. Knowledge is a main ingredient in the value of a modern organization. Figure 16.9 shows a breakdown of an organization's value.

Historically, the main value was a business's equity, and the three factors thereof—land, labor, and capital—were the key to economic success. Today, knowledge is the fourth factor and is becoming the most important factor in many industries. From the industrial revolution until about 1980, the business landscape was mainly product driven. From about 1980 until 2000, most business was primarily market driven. Today, business is becoming knowledge driven; customers need an additional reason to buy, and a company's knowledge about how best to use/deploy the product or service is becoming of paramount importance. Thus, intellectual capital, which is made up of human capital and structural capital, is becoming the driver of business valuation. Information and knowledge have become the fields in which businesses compete. Ultimately, an organization's only sustainable competitive advantage lies in how its employees apply knowledge to business problems.

Figure 16.10. Knowledge management system



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There are two kinds of knowledge: explicit and tacit. Explicit knowledge is easily collected, organized, and communicated. *Tacit knowledge* is "knowing more than one can tell," such as how to ride a bicycle; it is personal, context specific, and very hard to formalize and communicate. Human capital embodies tacit knowledge whereas structural capital is mostly explicit knowledge. Modern knowledge management systems can contain and make available both types of knowledge, as is illustrated in Figure 16.10. Explicit knowledge matches *problems with solutions* in the form of facts (including historical data), procedures, best practices, recipes, standards, and the like. Tacit knowledge matches *problems with people* who have encountered or solved such problems in the past; this approach builds social environments to facilitate the sharing of such understanding.

A functioning knowledge system follows six steps to develop an effective knowledge base:

- Create knowledge
- Capture knowledge
- Refine knowledge
- Store knowledge
- Manage knowledge
- Disseminate knowledge

A state-of-the-art dissemination process makes knowledge visible through maps, directories (yellow pages), hypertext linkage, and search techniques.

For knowledge management to be effective in a company, however, organizational culture must change; employees must be willing to contribute knowledge and use knowledge. Thus there must be strongly committed top leadership, clearly expressed and communicated goals, and end users involved in the implementation process. A direct or indirect reward structure for contributing and using knowledge should also be included.

Lessons Learned

Lessons learned (LL) is the most common form of project knowledge management. As was discussed earlier in this book, a key part of the closeout of each project is a formal post-mortem meeting. This should be conducted preferably by the PMO. In such as meeting the discussion would involve general evaluating questions such as:

- Was the business justification realized (or does it appear that it will be realized); if not, why not?
- What risks events occurred and how they were handled?

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- What risks events did not occur, and perhaps why not?
- What in general should be done differently on the next such project?

The discussion would also involve process-specific questions, such as:

- What methods, tools, techniques, resources worked well?
- What methods, tools, techniques, resources did not worked well?
- What artifacts and components can be reused?

Each PMI project management process group (scope, time, cost, risk, quality, etc.) as well as each project deliverable, should be revisited in regard to these questions.

There are a number of formal management techniques that can be used for the LL process. Two commonly used techniques are structured walkthroughs and the external, internal, self-assessment (EISA) approach used in ISO, TQM, and CMM appraisals. In a structured walkthrough, the project team selects the participants and agenda and runs the meeting. No upper management personnel attend these meetings, so team members are not hesitant to be open and honest (Yourdon, 1988). In the EISA approach, an internal self-appraisal is followed up first by an appraisal using independent auditors from the same organization, then by an appraisal using external auditors (Wilson, 1995).

The intent of LL is not only to capture problems and related events, but to initiate solutions for use in future projects. This may involve formal processes (such as fishbone diagrams) to identify "root causes," as was covered earlier in the book. This LL process is a leading indicator of the maturity of an organization with respect to project management. Ewusi-Mensah (2003) systematically analyzed software development failures. *He*

Figure 16.11. NASA lessons learned Web site

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found it most distressing that companies continue to make the same mistakes over and over again on projects. Most of these companies did some type of post-mortem analysis, including lessons learned, but most either did not keep those records or make any use of that archived information.

Like any information knowledge repository, a formal LL information system gathers information, stores it, organizes and indexes it, makes it available, and monitors the usage thereof. The major uses of lessons learned knowledge is:

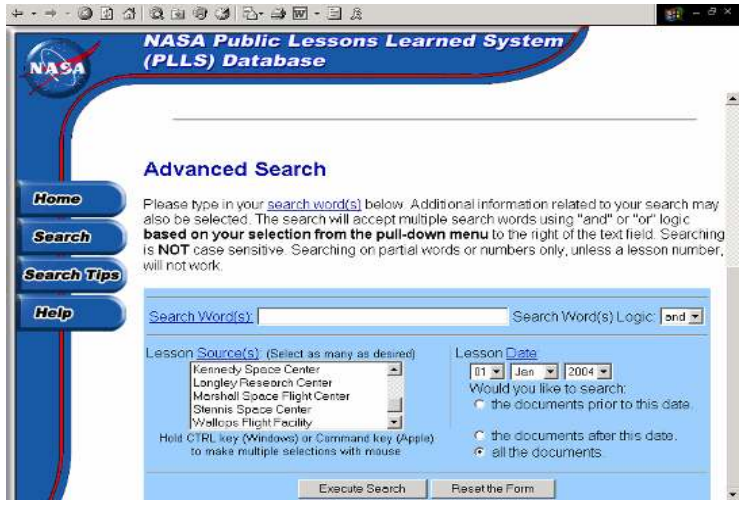
- Changing organization policies, procedures, methodologies, techniques, and tools
- Improving cost and time estimation methods and parametric data
- Improving risk assessment methods and parametric data
- Correlating problems with solutions (and/or those who may how to solve such problems)

Figure 16.11 shows the gateway screen for the NASA LL system.

NASA's described their LL information system as follows (Smith, 2004):

The NASA LLIS is an on-line, automated database system designed to collect and make available for use the NASA lessons learned from over forty years in the aeronautics and space business. The LLIS enables the knowledge gained from past experience to be applied to current and future projects. Its intent is to avoid the repetition of past failures and mishaps, as well as the ability to share observations and best practices. Through this resource, NASA seeks to facilitate the early incorporation of safety, reliability,

Figure 16.12. NASA lessons learned search



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maintainability, and quality into the design of flight and ground support hardware, software, facilities, and procedures.

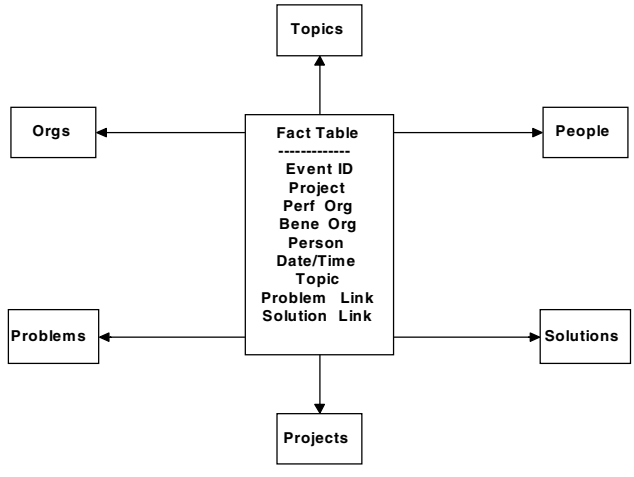
Figure 16.12 shows the search screen for the NASA LL Web-based system, which searches for keywords within date range for all or a particular space center.

Today, large, effective LL systems can be built using modern data warehouse information technology. A central fact table is constructed and a star topology (related tables) is typically used, as illustrated in Figure 16.13. Relational database technology and/or multidimensional technology (online analytical processing, or OLAP) can be incorporated. Using this approach, topics and/or problems are easily related to solutions and/or people.

Project management lessons learned type of information is not only obtained at the corporate level but also at the trade organization level. A number of IT project management organizations from time to time publish general lessons learned across their industry area, such as the project management organizations (e.g., PMI), software engineering organizations (e.g., IEEE or SEI), and trade publications. For example, InfoWorld's 2004 top 20 IT mistakes were (Dickerson, 2004)

- Botching your outsourcing strategy
- Dismissing open source or bowing to it
- Offshoring with blinders on
- Discounting internal security threats
- Failing to secure a fluid perimeter
- Ignoring security for handhelds

Figure 16.13. Lessons learned as OLAP system



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- Promoting the wrong people
- Mishandling change management
- Mismanaging software development
- Letting engineers do their own QA
- Developing web applications for IE only
- Relying on a single network performance indicator
- Throwing bandwidth at a problem
- Permitting weak passwords
- Never sweating the small stuff
- Clinging to prior solutions
- Falling behind on emerging technologies
- Underestimating PHP
- Violating the kiss principle
- Being a slave to vendor marketing strategies

Most of these issues have been discussed in prior chapters of this book as they relate to IT project management.

Figure 16.14. Forms and templates in this book

Process Group	Forms/Templates	Chapter
Initiation	Project Proposal	3
	Project Business Plan	3
Planning	Project Charter	6
	Overall Project Plan	6
	Methodology & SE	5
	Software Management Plan	6
	Communications Plan	6, 13
	Requirements Document	6
	Security Plan	6, 13
	WBS	7
	Schedule	7
	HR Plan	7, 13
	Cost Plan	7
	Procurement Plan	12
	Risk Plan	8
	Quality Plan & Standards	10
	Change Control Plan	11
Exec & Control	Management Stage Gate	3, 9, 11, 14, 15
	Quality Stage Gate	9,10
	Status Report	9
	Change Order	11
Closing	Project Close Out	11
	Final Stage Gate	11, 16
	Lessons Learned	11, 16

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Standard Forms and Templates

Another key function of a modern project management office is to develop standard polices and procedures relevant to the initiation, approval, management, and closeout of projects. A closely related responsibility is the creation and distribution of standard forms and templates based on those procedures. Policies, procedures, forms, and templates may be paper based, but in a modern organization these will all be in an electronic format, and some may be embedded in project management software tools, as was discussed in Chapter XV. Figure 16.14 is a recap of sample forms and templates that have been illustrated in this book. This recap can also be used as a checklist for an IT project life cycle.

Global Projects

Ever since the end of the Cold War, the world has been rushing toward international convergence of capital markets, business regulation, trade policies, and the like. More than 95% of world population lives outside of the United States, and for most countries the majority of their potential market for goods and services is outside of their borders. In addition, more than 60% of the world's *online* population resides outside of the United States, with the average Web site getting 30% of its hits from foreign surfers (Brandon, 2002). Business needs today are forcing organizations to manage projects outside of their home countries and often in multiple countries. In the last decade, domestic profits of U.S. companies increased about 20% while profits of their foreign subsidiaries increased almost 200%. Because the PMO is the corporate focal point for managing multiple projects, it makes sense for the modern PMO to coordinate foreign and multicountry projects.

Obviously, the spoken language is a major issue for managing projects on a global scale. English is the native language to only 8% of the world, and more than 70% of the 1 billion Web users around the world are non-English speakers. Most users in foreign countries prefer document content in their own language; it was found that visitors spend twice as long and are three times more likely to buy from a Web site presented in their native language (Brandon, 2002). Multiple languages are used in many areas. Belgium uses both French and Dutch. In Switzerland, German, French, and Italian are used. One has also to take into account differing dialects across various countries speaking the same language. One cannot use "classic German" in Germany, Austria, or Belgium because all those countries speak a different form of German. The combination of language and dialect is called a "locale," and the ISO has established a coding system for such locales.

Language, however, is just one of the many difficult issues in managing projects on a global scale. Other problem areas include cultural diversity, political, legal, logistic, regulatory, monetary, measures, standards, technical, and geographical. For example, an organization's contract may stipulate that it get paid in dollars, but the expenses may be incurred in foreign countries under a different currency; thus, the actual costs may vary

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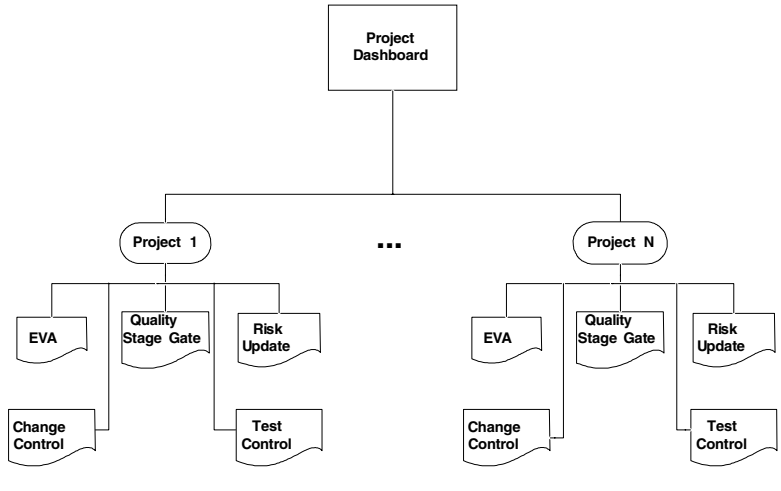
Figure 16.15. Project global issues by success factor

Global Issues by Success Factor

Success Criteria	Global Issues
Completion Factors	
Project Management	
Schedule (Time)	Foreign holidays, vacations, time zones
Cost	Foreign currency; multiple currencies, conversion costs
	Exchange rate fluctuations
	Need for foreign "on-site" manager
	Travel expense
	Long distance voice costs
	Tax issues (VAT, duties, import/export, etc.)
	Additional legal costs for contracts
Progress	Delays in getting progress info
Stakeholders/Communication	Language/culture communication difficulties
	24 hour communication needs (time zones)
	Email, network, internet outages
	Need virtual "war room"; can't use collocation
	Foreign labor laws
	Knowledge retention
	Employee performance evaluation difficulties
Risk	More risk factors and mitigation plans
	Political uncertainties
	Legal uncertainties & different judicial systems
Methodology	Cultural differences
Commitment to Perform	Authority overlaps and gaps
Ability to Perform	Cultural differences including work ethics
Verification	Differing quality standards
Technology	Differing units of measure (English vs Metric)
Satisfaction Factors	
Business Justification	Offshore outsourcing issues
Validation	Distance/Time factors complicate customer involvement
Workflow & Content	Developing/maintaining content for multiple locales
Standards	Differing national standards & conventions
	Compromise of certifications (CMM, ISO, etc.)
Maintainability & Support	24 hour support requirements
	Version control for multiple locales
Adaptability	Differing OO implementation languages/methods
Trust/Security	Political differences
	Difficulty of background checks
	Information privacy

Figure 16.16. Multiple project dashboard



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widely with the exchange rate. To effectively identify and thus manage all these global issues, one can relate such issues to the project's critical success factors; this type of analysis is shown in Figure 16.15.

The PMO Portal

In a move to reduce the overhead costs of the PMO yet still obtain many benefits thereof, some organizations are starting to develop *virtual PMOs*, or a *PMO portal.* With a virtual PMO, many of the functions of that office are provided online to project managers, project team members, and line management. Thus, the expertise of the PMO staff is leveraged to provide support to more people in more locations even on a global scale. Today's model for the virtual PMO is a Web-based system with central information repositories. For example, one component of the virtual PMO is typically a project dashboard, as is illustrated in Figure 16.16.

The dashboard provides current status information on all projects that may include earned value ratios, risk status, change control status, defect introduction and correction status, and quality stage gate stakeholder input. Because earned values are quantitative numbers expressed in currency (i.e., dollars) for both cost and schedule deviations, these

Figure 16.17. Project dashboard indicators

Vital Sign	Variance	Points
Schedule Delay	< 10%	0
	10% to 20%	1
	> 20%	2
Milestone Delay	< 10%	0
	10% to 20%	1
	> 20%	2
Deliverable Delay	< 10%	0
	10% to 20%	2
	> 20%	4
Unresolved issues	No issues	0
	< deliverables	1
	> deliverables	2
Cost Over Budget	< 10%	0
	10% to 20%	1
	> 20%	2
Resource Shortage	< 10%	0
	10% to 15%	2
	> 15%	4
High Probability, High Impact Risk Events	1 – 3 risks	1
	4 - 5 risks	3
	6 – 7 risks	5
Disposition of Team	Good	0
	Fair	2
	Poor	4
Sponsor's Commitment	Good	0
	Fair	3
	Poor	6

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Figure 16.18. Instrument gauge analogy of project dashboard

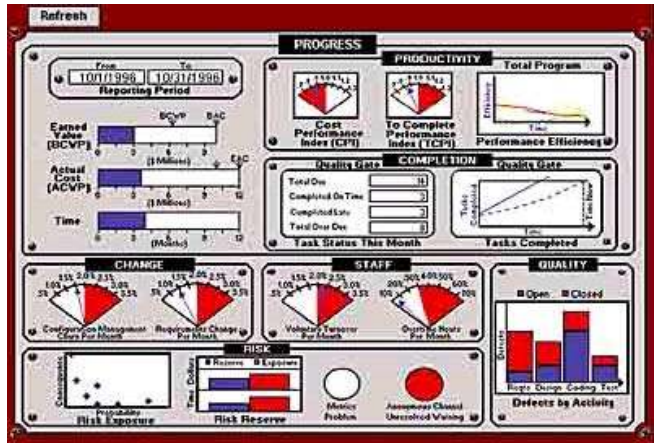
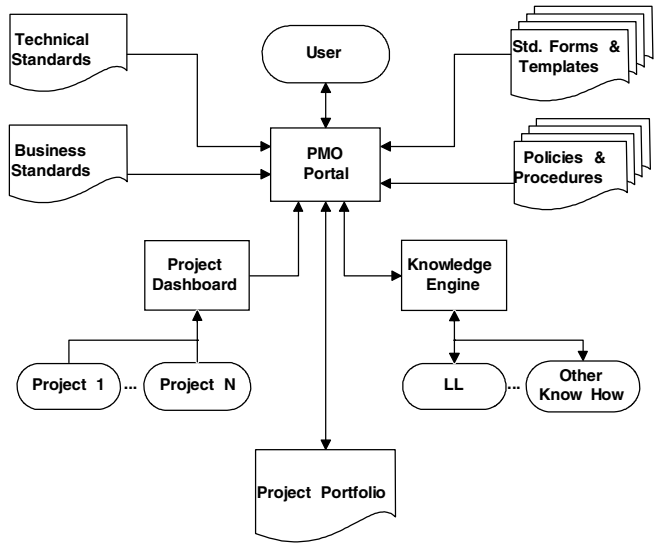


Figure 16.19. PMO portal



numbers can be rolled up along an OBS for example, to give a picture of how all projects are performing in an organization. Some dashboards use vital signs based upon a point system. An example from *Computerworld* is shown in Figure 16.17 (Melymuka, 2004b). If the total number of points is below 9, then the project is considered *healthy*; 9 to 15 is rated as *caution*, and over 16 is rated as *danger*. The recommended approach herein is to make vital signs correlate with project critical success factors (using the metrics for each success factor as was discussed earlier in this book).

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Some organizations use software tools that show the dashboard concept visually, with gauges and charts. One example of this is the Project Control Panel developed as an Excel add-on by the Software Program Managers Network (www.spmn.com/pcpanel.html) as illustrated in Figure 16.18. While the dashboard concept is quite useful for keeping upper management informed, a physical dashboard analogy may only appeal to pilots; most PMs likely prefer information displayed in a more common format such as tables, spreadsheets, and Gantt charts.

Figure 16.19 illustrates the conceptual organization of a comprehensive virtual PMO portal. The user of the system can view or download policies and procedures as well as standard forms and templates. The project portfolio can be viewed or even updated if the user has the authority to do so. A knowledge engine provides the user with solutions to problems from the lessons learned, puts the user in touch with people who have dealt with that problem previously, and provides training information via documents, slide shows, or videos. Chat rooms, bulletin boards, blogs, and wikis can be added to this virtual PMO so that physical meetings of various "boards" can be replaced with virtual meetings; for example, the project approval board, the change control board, or the stage gate board could go virtual. Intelligent software agents can also be added to the virtual PMO; these agents watch all the information available in the system and report exceptions and trends to upper management.

Project Management Maturity

Just as the SEI develops maturity models for software engineering, a number of project management organizations have been developing project management maturity models. The purpose of these models, just like the SEI models, is twofold:

- **Internally:** Companies access their maturity to find ways to improve
- **Externally:** Companies use their maturity rating to sell their project management services and other services that utilize project management (such as building things like IT systems)

PMI has been working on such a model for a number of years and has just recently introduced the organizational project maturity (OPM3). More than 30 other earlier maturity models were part of the research that PMI did for its model using over 800 volunteers (Cooke-Davies, 2004). The PMI model defines three domains to project management (portfolio management, program management, and project management) and four levels (stages) of maturity for each (standardize, measure, control, and continuously improve). Within each domain there are the five PMI process groups (initiating, planning, executing, control, and closing). Process within the process groups are described in terms of five entities: best practices, capabilities, outcomes, key performance indicators (KPI), and pathways. A practice is a component of a process or process group. A combination of certain capabilities result in a particular best practice through

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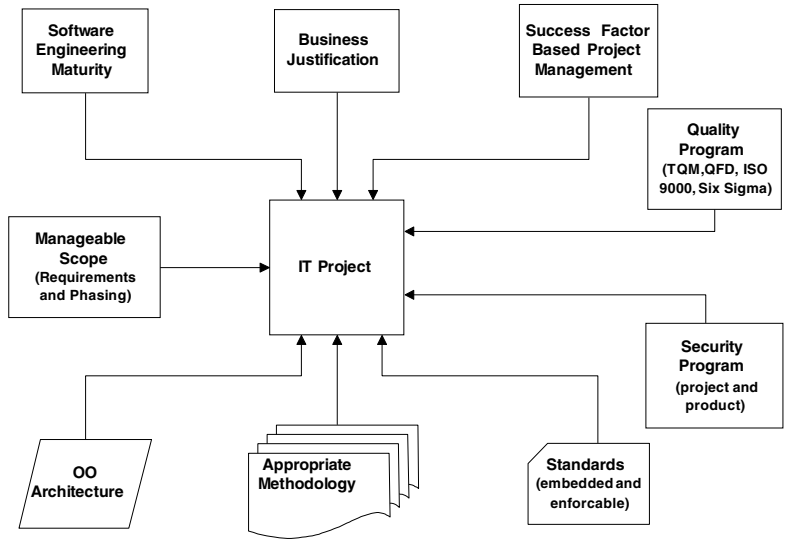
a defined pathway, and the outcomes signify the attainment of a capability via KPI metrics. There are one or more outcomes and corresponding KPIs for each capability.

The office of government commerce (OGC) in the United Kingdom has also released a comprehensive maturity model called project management maturity model (PMMM). Like the SEI CMM, PMMM defines five levels of maturity (Initial, Repeatable, Defined, Managed, and Optimized) with specific processes at each level. Like CMM, maturity is typically assessed by questionnaires that determine if those key processes are being carried out. PMMM is considerably less complex that OPM3 and may be more appropriate for many companies. However, PMMM does not include program or portfolio management.

The responsibility for project management maturity in an organization is typically logically housed with the PMO. Thus the PMO would determine the organization's initial maturity, take steps to raise the maturity level, and re-access the maturity as needed. Our model for IT project management maturity (at the single-project level) has been developed throughout this book and is summarized again in Figure 16.20. This model is a combination of best software engineering and project management principles and practices, and the project management practices and metrics thereof are based on identified critical IT project success factors.

Figure 16.20. IT project management maturity



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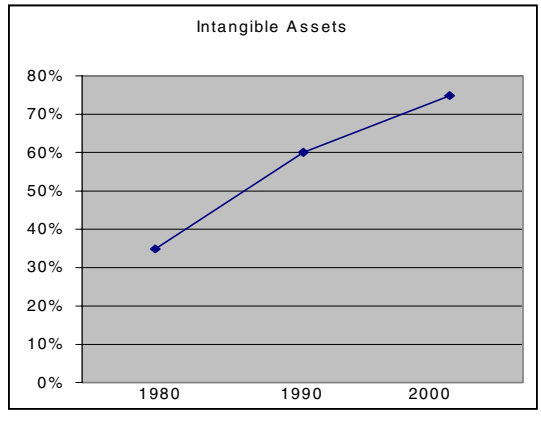
Project Management and Strategic Planning

EVA and other stage gate methods provide management key information to take corrective action primarily at the operational level for a particular project. When EVA metrics from all projects in a program are rolled-up and combined, then management has a greater visibility to examine issues across multiple projects and take actions some of which may be tactical as well as operational. Many project management techniques are often criticized as being too short-sighted and limited to control tactics that may not be in the best interest of the long-term success of an organization (Brandon, 2004). Certainly we understand (and most of us have seen cases) where employees are pushed too hard for success on one project only to become demoralized for performance on future projects.

One of the main responsibilities of a PMO is to implement an overall corporate project management strategy. Implementing such strategy involves the development and/or adoption of some type of strategic foundation upon which to translate corporate vision and goals into winning strategies with effective tactics. Long-term winning strategies must address both the quality and satisfaction dimensions as well as the financial and temporal dimensions (Brandon, 2004).

A number of strategic foundations have been used by organizations in the past, but the modern balanced scorecard (BSC) approach seems most successful and relevant in today's global and fast-paced economic setting. The BSC is a modern approach to strategic management that was originally proposed in 1992 by Robert Kaplan and David Norton (Kaplan & Norton, 1992). They recognized the shortcomings of traditional management approaches which have an overemphasis on metrics that are strictly financial based and looking for the most part at the results of past actions and plans. This rear-facing approach is becoming obsolete in today's fast moving, global, and technology-based economy. The balanced scorecard approach provides definitive procedures

Figure 16.21. Intangible assets



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as to what companies should measure in order to balance that traditional prime focus on solely a financial perspective.

While the processes of modern business have changed dramatically over the past several decades (especially with the growth of the Internet), the methods of performance measurement have stayed much the same. Past measurement methods are well suited to asset-based, slow changing manufacturing organizations. But past-performance measurement systems are no longer as relevant to capture the value creating mechanisms of today's modern business organizations (Kaplan & Norton, 1996). Today, intangible assets such as employee knowledge, customer base and relations, supplier base and relations, and access to innovation are the key to creating value; Figure 16.21 shows this shift for U.S. companies. When financial statements (profit/loss, balance sheet, cash flow), Gantt charts, or even EVA analysis are reviewed, the results of those reports reflect actions and decisions that occurred in the past. Some of the past actions and decisions that determine an organizations present financial state may have taken place a month ago, a year ago, or a decade ago (Brandon, 2004).

The balanced scorecard does not ignore financial matters but changes the perspective from a reactive to a proactive involvement. The balanced scorecard approach takes a look at the key management actions (including metrics) that will most likely affect a company's future financial state; these are termed *leading indicators* (Eickelmann, 2003). The balanced scorecard is a management system**,** not only a system of metrics. Using BSC, organizations first clarify and quantify their vision and strategy and then turn them into actions. BSC provides feedback around both the internal business processes and external outcomes to continuously improve overall performance. When appropriately implemented, a BSC approach transforms strategic planning from an academic exercise into the primary control mechanism of an organization (Averson, 2002; Niven, 2002).

In the language of the founders of BSC:

The balanced scorecard retains traditional financial measures. But financial measures tell the story of past events, an adequate story for industrial age companies for which investments in long-term capabilities and customer relationships were not critical for success. These financial measures are inadequate, however, for guiding and evaluating the journey that information age companies must make to create future value through investment in customers, suppliers, employees. (Kaplan & Norton, 1996)

BCS has been successfully implemented in thousands of organizations around the world, both for profit and nonprofit; success ratios (success in the last major change effort) are reported as (Averson, 2002)

- Non-measurement Managed organizations (55%)
- Measurement Managed Organizations (97%)

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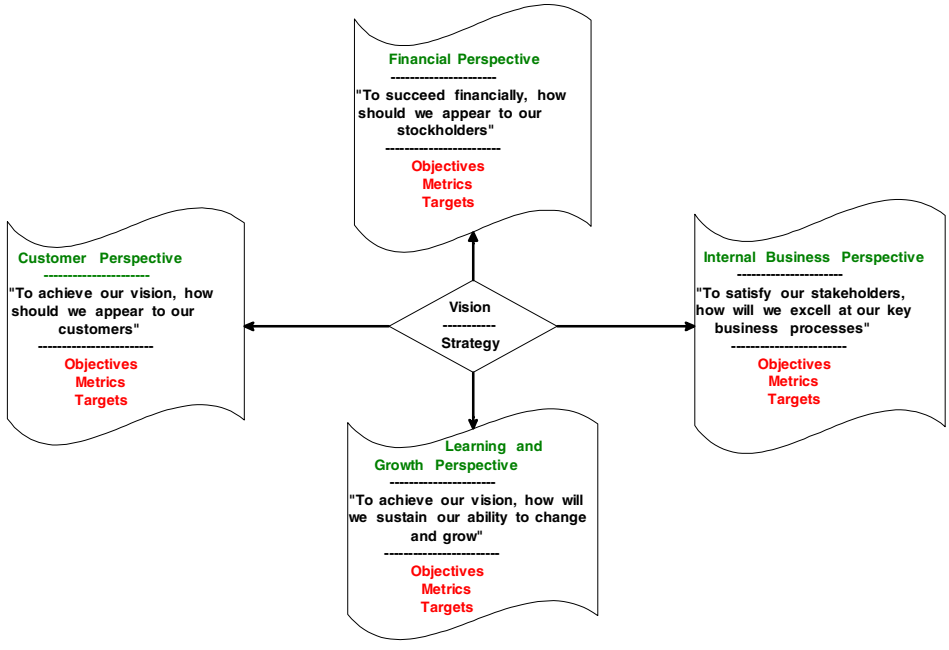
Figure 16.22. BSC perspectives



The BSC approach defines four perspectives from which an organization is viewed. Metrics are developed then data is collected and analyzed relative to each of these perspectives. This is illustrated in Figure 16.22 (Brandon, 2004).

The first perspective is the learning and growth perspective. It involves the investment in human capital through activities like positive feedback, motivational techniques, setting up mentors, communications facilitation, employee training, and the development of a company-cultural and code of ethics. Chapter XIII discussed many of these issues from an operational perspective. In the current climate of rapid technological change, it is becoming necessary for knowledge workers to be in a continuous learning mode. Organizations often find themselves unable to hire new technical workers and at the same time allow a decline in training of existing employees. This is a leading indicator of "brain drain" that will ultimately kill an organization. Metrics can be put into place to guide managers in focusing personnel development funds where they can help the most. This perspective is the foundation for long-term success of an organization. From a project team perspective, short-term learning and growth perspectives are already included in the metrics for our quality stage gates. However, for long-term success, long-term actions and metrics need to be established.

The next perspective is the business (or internal) process perspective. This perspective relates to the internal business processes. Metrics based on this perspective allow the managers to know how well their business is running, and whether its products and services conform to customer-stated requirements and unstated expectations. These metrics have to be carefully designed by those who know these processes best. There

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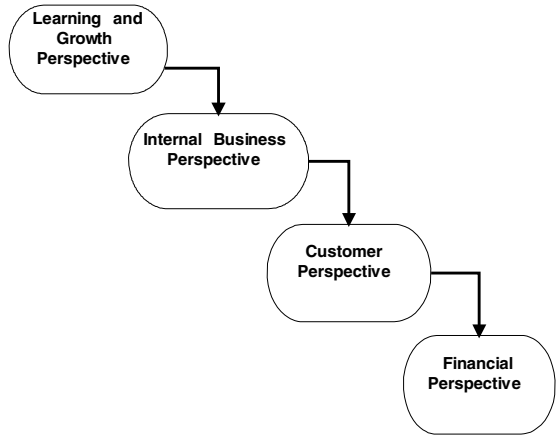
Figure 16.23. BSC perspectives cause and effect



are two kinds of business processes in an organization's value chain. Primary (mission-oriented processes) are the special functions of an organization often used for competitive advantage, and support processes (i.e., accounting, legal, procurement, HR, etc.) which are more repetitive in nature, and hence easier to measure and benchmark using classical metrics. From a project perspective, business process metrics are included in the metrics for both our management and quality stage gates.

The next perspective is the customer perspective. Recent management philosophy and IT products as customer relations management systems (CRMs) and sales force automation systems (SFAs) have shown an increasing realization of the importance of customer focus and customer satisfaction in any business. If customers are not satisfied, they will eventually find other suppliers that will meet their needs. Poor performance from this perspective is thus a leading indicator of future decline, even though the current financial picture may look good. From a project perspective, customer relations are included in the metrics for our quality stage gates.

The last perspective is the financial perspective. Kaplan and Norton do not disregard the traditional need for financial data. Timely and accurate funding data will always be important. Their point is that the current emphasis on financials leads to the unbalanced situation with regard to other perspectives. There is also a need to include additional financial-related data, such as risk assessment and cost-benefit data, in this category. Again, from a PM perspective, financial data is a key metric of our management stage gate, including EVA and risk analysis.

Figure 16.23 shows the perspectives in a waterfall, long-term, strategic cause-and-effect scenario. Motivation, skills, and satisfaction of employees are the foundation for all improvements. Motivated, skilled and empowered employees will improve the ways they work and also improve the work processes. Improved work processes will lead to improved products/services, which will mean increased customer satisfaction. Increased

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Figure 16.24. PMO BSC metrics

Perspective	Activities	Metrics
Learning & Growth	Effective Communications	Communication Problems
	Management Team Building & Motivation	PM and Employee Feedback
	Project Manager Development	Training Funding
	Motivation	PM Incentive Packages
	PM Forum	Sharing of "Lessons Learned"
		Use of "Lessons Learned"
Customer	Customer Relations	Customer Satisfaction
	Customer Involvement	Customer Feedback (about PM, and line management)
Internal	Planning	Rollup of EVA Time
	Process Standardization	Standard Forms & Procedures
	PM Support (from line management)	PM Feedback
Financial	Use of Resources	Rollup of EVA Cost
	Contracting/Procurement	Procurement Problems

customer satisfaction will in turn lead to long-term improved financial performance (Brandon, 2004).

In the early industrial revolution in order to shield the customer from receiving poor-quality products, aggressive efforts were focused on inspection and testing at the end of the production line. The problem with this approach, as pointed out by Deming (as cited in Walton, 1991), is that the true causes of defects could never be identified, and there would always be inefficiencies due to the rejection of defects. What Deming saw was that variation is created at every step in a production process, and the causes of variation need to be identified and fixed. Deming emphasized that all business processes should be part of a system with feedback loops. The feedback data should be examined by managers to determine the causes of variation, and then attention could be focused on fixing those particular problems. These aspects of quality management were discussed in detail earlier in this book. BSC emphasizes *feedback control from each of the four perspectives in each major business process*; that is, each perspective for each key process should have objectives, metrics, and targets for proper feedback control.

The successful concepts of BSC can be integrated into the project management context. Considering a project as a key business project, one needs to establish metrics for each of the four perspectives at the individual project level and also at the PMO level. BSC performance metrics at the project level have already been included in our dual stage gate methodology and comprehensively discussed earlier in the book. For example, EVA would be a key metric for the project level BSC financial perspective. Success factors from the completion perspective are used in the BSC internal perspectives, and success factors from the satisfaction perspective are used in the BSC customer perspective.

An BSC scorecard defines the key activities for each perspective and the metrics that are going to be used to monitor the performance of that activity. One possible very simple score card at the PMO level is shown in Figure 16.24 (Brandon, 2004). For example, at the BSC customer perspective, we would measure not only the customer's satisfaction with our projects, but how involved our project team, project manager, and line management was with customer personnel. *Thus, using the combined principles of dual critical*

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success factor-based stage gates, and BSC, a PMO office can more effectively manage all project work across an organization from a strategic perspective.

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Endnote

[1] The Sarbanes-Oxley Act was signed into U.S. law on July 30, 2002, and introduced highly significant legislative changes to financial practice and corporate governance regulation. It introduced stringent new rules with the stated objective: "to protect investors by improving the accuracy and reliability of corporate disclosures made pursuant to the securities laws."

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