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Project Portfolio Management

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INTRODUCTION

According to the CHAOS Report of the Standish Group, unqualified IT project success only occurs in about one-third of IT projects (The Standish Group, 2004). To improve this success rate, many organizations are investigating broad IT governance and project management issues such as "project portfolio management". Often as an organizational home for such issues, organizations have started to establish a "Project Management Office" (PMO). CIO Magazine has itemized the key 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

In its most basic form, project portfolio management is concerned with the quantification of project benefits, costs, and other business and technical issues to provide for the optimal selection of which projects to initiate, which to hold, and which to cancel. Careful selection of which projects to initiate is vital to the success of an organization. Project initiation represents a future and perhaps long term commitment of resources and management attention; if a choice is careless or inappropriate, then the consequences may be severe (Brandon, 2006). In this paper, modern methods for the proper selection of which IT projects to initiate are discussed along with ways to manage and optimize a group of project possibilities from a business benefit perspective.

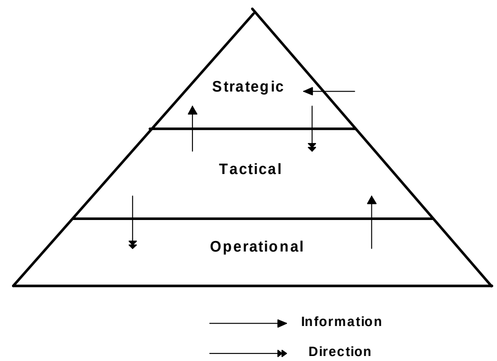
ORGANIZATIONAL PLANNING AND PROJECT PROPOSALS

Organizational project planning and the associated decision processes occur at several levels of the company including the operational level, the tactical level, and the strategic level; this is illustrated in Figure 1. The operational level is concerned with day to day activities in operating the business including running the current projects. The management focus at this level is on efficiency, productivity, and quality: managers make sure that "things are done right". The tactical level is concerned with short term planning, and the management focus at this level is on effectiveness, consistency, and accuracy; here managers make sure the "right things are being done". The strategic level is concerned with long term planning, and the focus is on organizational values, goals, and competitiveness. Project selection is typically performed at the tactical level based upon the values and overall goals set at the strategic level.

Projects are initiated from the recognition that there is a problem to be addressed, and that this problem can be addressed through a project to implement some solution. Problem needs must be quantified (eventually in terms of requirements for IT projects) and the solution thereto "justified" for a project to be formally initiated. The general process of refining "needs" into a problem statement is shown in Figure 2.

According to common "IT folklore", IT projects are typically justified on one or more of the three F's: fear, faith, or facts. The "fear" approach uses rational such as:

Figure 1. Organizational management levels (Brandon, 2006)



Our competitors are already developing such a system!

Upper management and shareholders will consider us behind the technology curve if we do not do this!

The "faith" approach uses rational like:

Our competitors have done this and it is working for them!

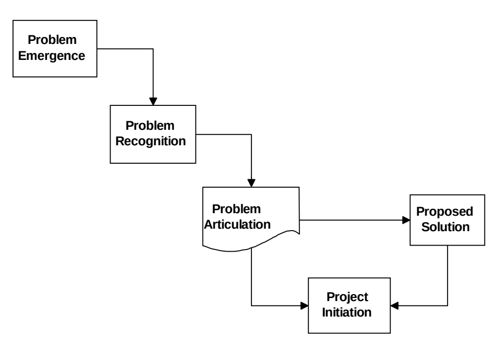
This type of system is part of our IT infrastructure and we cannot quantitatively justify it like we could an additional factory capital equipment item!

A "facts based" project proposal would identify and quantify the specific benefits of a project, the rough costs for developing the associated product, business and technical risks, and relevant issues. Assuming one takes such a facts based approach, the next question becomes "how to use these facts to best select which projects to undertake", and that is where formal portfolio management steps in.

PORTFOLIO MANAGEMENT

An organization's "project portfolio" is the set of projects currently underway as well as projects that have been proposed. Projects are

Figure 2. Project initiation (Brandon, 2006)



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 within acceptable levels of risk. Projects that duplicate effort, are too risky, or produce smaller benefits are not done, canceled, or placed on hold (Brandon, 2006).

Unfortunately seventy-five percent of companies do not do formal project portfolio management; most CIO's "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

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

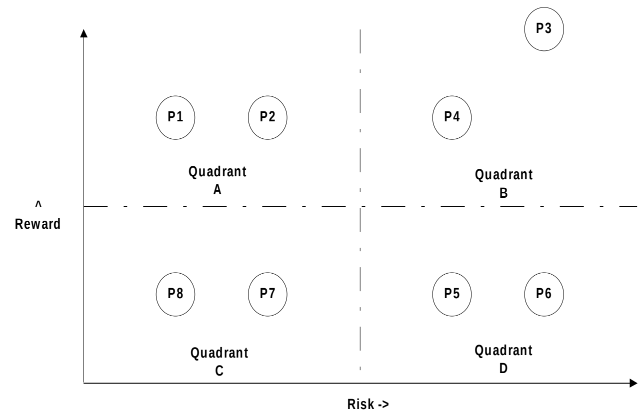
Enhanced communication

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 financial investments subject to risk constraints. As well as maximizing returns and minimizing risks, the optimization of the

Figure 16 – 4. Project risk vs. reward (Brandon, 2006)



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" 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 (P1 thru P8) in that figure were as shown below:

P1 – 350 P2 – 150 P3 – 350 P4 – 250 P5 – 200 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 since they are in quadrant A, then chose P3 and P7 to balance high risk and low risk projects. The total of these 4 project budgets is $ 1,000,000.

SCORING OR DETERMINING "REWARD"

Determining a project's potential reward (often called scoring) can be accomplished solely on the basis of financial metrics, or done on the basis of a more "holistic" set of measures. There are a number of techniques used to evaluate the financial benefit of a project, and most rely on future estimates of revenues and costs. The most elementary technique is the simple ***cost-benefit analysis*** which compares the cost to do a project versus the benefit to be realized. A simple static ROI (return on investment) calculation can also be made as the ratio of the benefit minus cost divided by the cost, and "***payback periods***" can also be similarly determined. Information Week recently performed a study of payback periods on IT projects for US companies and results were (D'Antoni, 2005):

Under six months - about 30% of projects

Within one year - about 35% of projects

Within two years - about 20% of projects

Within three years - about 15% of projects

However, these basic financial metrics do not consider the absolute size of the investment nor benefit, and they also suffer from the problem that

Figure 3. NPV cost/benefit analysis

Year	Benefit	Cost	B-C	Discounted B-C
1	$0.00	$175,000.00	-$175,000.00	-$159,090.91
2	$0.00	$175,000.00	-$175,000.00	-$144,628.10
3	$50,000.00	$25,000.00	$25,000.00	$18,782.87
4	$100,000.00	$10,000.00	$90,000.00	$61,471.21
5	$100,000.00	$10,000.00	$90,000.00	$55,882.92
6	$100,000.00	$10,000.00	$90,000.00	$50,802.65
7	$100,000.00	$10,000.00	$90,000.00	$46,184.23
8	$100,000.00	$10,000.00	$90,000.00	$41,985.66
9	$100,000.00	$10,000.00	$90,000.00	$38,168.79
10	$100,000.00	$10,000.00	$90,000.00	$34,698.90
Total	$750,000.00	$445,000.00	$305,000.00	$44,258.22
		Interest =	0.1	

Figure 4. IRR calculation

Year	Benefit	Cost	B-C	Discounted B-C
1	$0.00	$175,000.00	-$175,000.00	-$154,728.74
2	$0.00	$175,000.00	-$175,000.00	-$136,805.61
3	$50,000.00	$25,000.00	$25,000.00	$17,279.80
4	$100,000.00	$10,000.00	$90,000.00	$55,001.46
5	$100,000.00	$10,000.00	$90,000.00	$48,630.33
6	$100,000.00	$10,000.00	$90,000.00	$42,997.19
7	$100,000.00	$10,000.00	$90,000.00	$38,016.58
8	$100,000.00	$10,000.00	$90,000.00	$33,612.90
9	$100,000.00	$10,000.00	$90,000.00	$29,719.32
10	$100,000.00	$10,000.00	$90,000.00	$26,276.76
Total	$750,000.00	$445,000.00	$305,000.00	$0.00
		Interest =	0.131011619	

the time value of money is ignored. When interest rates are low and short projects are under consideration, this may not be a serious shortcoming. But when interest rates are high and the projects under consideration are long, then ***net present value*** (NPV) techniques should be used. The formula for NPV (or discounted cash flow) is:

$$NPV = \sum (B - C)_t/(1+i)^t$$

Where $(B\text{-}C)_t$ is the benefit minus the cost for period t, and i is the interest rate (cost of borrowing money or opportunity cost for other uses of cash). For NPV, benefit minus cost is more formally revenue (cash in) minus expenditures (cash out). Figure 3 is an example of a NPV calculation done in a spreadsheet program. The cost column includes development and long term "***total cost of ownership***" (TCO) values. TCO includes the incremental ongoing cost of support, operations, and maintenance (above the status quo). The column for "discounted benefit minus cost" is calculated from the application of the above formula. Even though the total benefit minus the total cost is $305,000.00, the NPV is only about $44,000 at an interest rate of 10%.

Another similar project financial evaluation technique is called the ***internal rate of return*** (IRR). This metric is better than NPV since it is not as sensitive to the uncertainties of future benefits and costs and to the future interest rates. The internal rate of return is the value of the interest rate that yields a zero value for NPV; this is sometimes called the "***time based return on investment***". This can be calculated in spreadsheet programs by using built-in "solver" tools. Since in reality a quadratic equation is being solved, multiple IRR values could be found. Thus one must impose additional constraints on the solution (such as IRR is positive, or in a given range). Figure 4 shows the spreadsheet calculation for IRR on the previous example; the IRR here is about 13%.

Projects with the same net present value may have different internal rates of return. Consider the two cases shown in the spreadsheet of Figure 5. This is another reason the IRR is a better way to compare competing projects.

The financial evaluation methods (as discussed above) rely on future estimates of revenues and costs, either including uncertainty or not. Other methods of scoring that do not rely on entirely future financial estimates can be used in addition to or in replacement of the financial models. These other methods may consider purely strategic considerations or may involve a number of criteria including risk factors, environmental factors, sociological factors, etc. Stix and Reiner (2004) classified a number of IT project selection methods as represented in Figure 6:

B's – Bedell's Method	BSC – Balanced Scorecard
CBA – Cost Benefit Analysis	CSF – Critical Success Factors
DCF – Discounted Cash Flow	DT – Decision Trees
IE – Information Economics	IM – Investment Mapping
IP – Investment Portfolio	KU – Kobler Unit Framework
OT – Option Theory	ROI – Return on Investment
ROM – Return on Margins	SIESTA – "Siesta" Method
SP – Scenario Planning	SWOT – Strengths/Weaknesses
TCO – Total Cost of Ownership	

Although less than twenty methods are illustrated in the above figure, over 100 such methods currently exists (Stix, 2004). Each of these methods has pros and cons, and each method is more applicable for certain types of IT projects and less applicable for other types of projects.

In an attempt to develop more "holistic" methods, many different "scoring and ranking" methods have been proposed which include less quantitative and more qualitative metrics for evaluating proposed

Figure 5. IRR vs. NPV

Case 1

Period	Benefit	Cost	B-C	Discounted B-C
1	0	70	-70	-$60.87
2	0	50	-50	-$37.81
3	20	30	-10	-$6.58
4	90	0	90	$51.46
5	120	0	120	$59.66
			NPV:	$5.87
		Interest:	0.15	
		IRR:	0.17	

Case 2

Period	Benefit	Cost	B-C	Discounted B-C
1	0	20	-20	-$17.39
2	0	40	-40	-$30.25
3	20	50	-30	-$19.73
4	90	55	35	$20.01
5	120	12.95	107.05	$53.22
			NPV:	$5.87
		Interest:	0.15	
		IRR:	0.19	

Figure 6. Project scoring methods

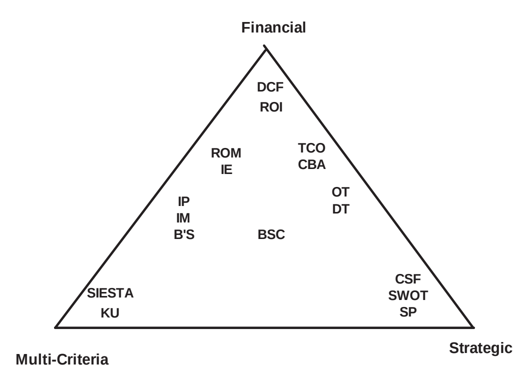


Figure 7. Project scoring (Brandon, 2006)

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

projects. Most of these methods define a list of metrics with a corporate weighting assigned to each metric; the weightings sum to 100%. Then a score is given to each metric such as a value between 1 and 10 (not all methods use a linear scale). This is illustrated in Figure 7.

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 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, however in reality many metrics are going to indirectly affect other metrics.

In Figure 7, external risks involve factors outside of the performing organization such as market factors, regulatory factors, and the risk of working with a particular customer or benefiting organization (including the risks that the project is inappropriate for the customer's desired business objective). Internal risks involve the project team, the chosen technology, and other factors inside of the performing organization. If one ignores risk, then after projects are scored, they can be ranked by the score and a "cut-off" line 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 use this simple approach, since the project selection process gets more complicated when risk is quantified and included in the selection process.

CALCULATION OF RISK VS REWARD

A number of specialized software packages can be used for project selection when both reward and risk can be quantified. However simple spreadsheet models can also be used since integer linear programming (LP) is generally now available in these tools. Consider the eight projects shown in Figure 8. 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 9 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 (3000 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

Figure 8. 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

one and also must be integers (i.e. zero for not doing a project and 1 for doing a project):

Max: Return = $\sum X_i * IRR_i * Cost_i$

Subject to:

$\sum X_i * Cost_i <= Budget$

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

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

These formulae are also shown in Figure 9 in the Excel Solver window.

Figure 10 shows the solution; again the 1's in the investment % column indicate the chosen projects. Here projects 1,2,6,7, and 8 would be done with our budget of 3000 and overall risk factor of 20%.

SPECIALIZED PROJECT PORTFOLIO SOFTWARE

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's 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 project management (or PMO) functions including performance reporting (Hoffman, 2005). This makes it easier to continually evaluate project ROI on a comparative basis with other projects as estimate-at-completion (EAC) costs as well as estimated benefits may change during a project's execution; a recent article in CIO

Figure 9. Project risk/reward spreadsheet

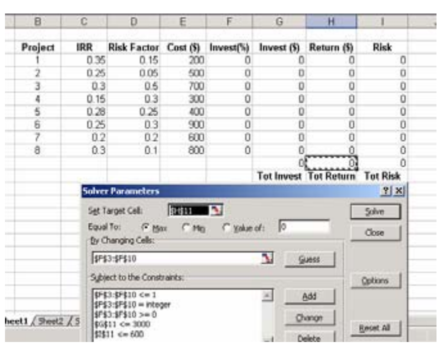


Figure 10. Project risk/reward spreadsheet (answers)

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

magazine illustrates this approach as implemented at Lowes (Waxer, 2005). However, many of the current IT portfolio software products do not include risk assessment nor life cycle cost of IT assets (Hoffman, 2004).

CONCLUSIONS

WiseTechnology suggests "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. CIO 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)

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 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).***

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