PROJECT MANAGEMENT IN PRACTICE

BOSTON UNIVERSITY
METROPOLITAN COLLEGE

THE 2006 PROJECT RISK AND COST MANAGEMENT CONFERENCE

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Repeatable Risk Identification: A Practical Approach

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Abstract

Two approaches of Risk Identification (checklist *vs.* non-checklist) are compared and recommendations are made about the suitability of both. Fewer risk assessments could expose the project to the impact of a risk item not identified due to changes in the project environment. The standardized questionnaire or checklist can expose the project to the impact of an unidentified risk item not included in the checklist. With a check list that is well managed by the project management group, the benefits of regular repeated risk assessments will outweigh fewer assessments using other methods. With an immature or unmanaged check list many candidate risk events can be missed with possibly disastrous impact to the project. Smaller projects are more suitable to checklist risk assessments where the impact of unidentified risk items is relatively small. A prudent project manager will use traditional non-checklist methods to identify risks as the impact of unidentified risks will be large.

Project Risk Management Process

Project Risk Management consists of four basic phases: Identify, Assess, develop Responses to the risk events, and Control the risk process through a feedback loop. This basic process is depicted in Exhibit 1 (adapted from PMBOK, Ackermann 2002):

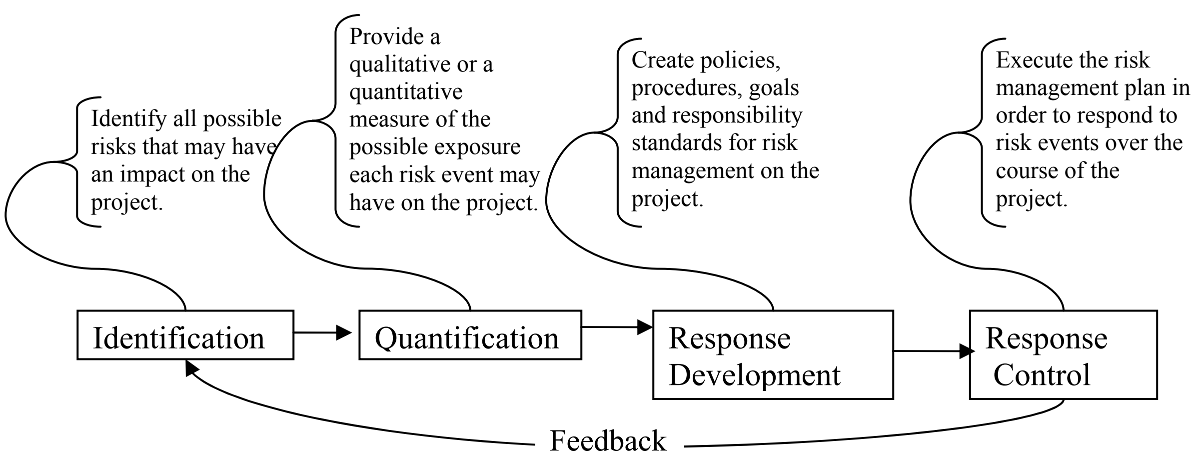

Exhibit 1: Project Risk Management

Various authors have documented variances of the basic process. Wideman (1992) has an additional phase, Documentation, where he suggests “a database of reliable data for the continuing evaluation of risk on the current project, as well as for improving the data base for all subsequent projects.” Implied in that statement is a recognition that risk management is a continual process, and that the same risk events may occur in future projects and should be documented.

Smith & Merritt (2002) suggest a five step process that consists of Identification, Analysis, Prioritization, Resolution and Monitoring of the risks on a project. The Monitoring phase is defined as "Assess status and closure of targeted risks; identify new risks." This shows a need to assess risks throughout the life of the project.

The Office of Naval Acquisition Support Pamphlet (ONAS P) 4855-X defines a process for identifying technical risks at the appropriate functional level – Functional, Sub-system and Middle/Upper Management. The emphasis is on identification of events that may have an impact on the project.

The common factor between the mechanisms described above is that the risk items must initially be identified and then continuously identified throughout the duration of the project. If they are not identified correctly, or not identified at all, they will not be known to the project and it will not be possible to create methods to defend the project against the risks if or when they occur. It is thus absolutely imperative that risk events are identified.

The tools and techniques for identifying risk items in a project can be any of the following and a combination of these techniques can be used (PMBOK 2004):

- Documentation Reviews
- Information Gathering Techniques
  - Brainstorming
  - Delphi
  - Interviewing / Expert Judgment
  - Root Cause Analysis
  - Strengths Weaknesses Opportunities Threats (SWOT) Analysis
- Checklist Analysis
- Assumptions Analysis
- Diagramming Techniques
  - Cause and Affect Diagrams
  - System and Process Flow Charts
  - Influence Diagrams

The outcome of identifying the possible risk events that may impact the project is the risk register for the project.

The identification techniques are time consuming and in many cases the size of the project does not warrant a detailed identification of the possible risk events for the project. Kanabar (2006, Pg.105) suggests that typically 2-4% of project costs are invested in the risk management process.

This is a small investment considering the possible return if a risk event is foreseen and the resultant impact on the project minimized. It is however a small amount of money for travel and accommodation to enable the stakeholders to be present at regular collaborative risk identification sessions. Most of the techniques used for identifying possible risk events are collaborative in nature and labor intensive, and will quickly destroy a relatively small budget.

In most cases a formal risk assessment is done at the beginning of the project, but formally identifying new risk items while the project executes, is not common. This all reduces the project manager's ability to predict a successful outcome of the project during execution. Carr *et al* (1993, pg.21) support the need for repeating the risk identification and follow-up processes periodically during the project life cycle because "Project risks change over time in both characteristics (probability, impact, time frame) and contents – i.e., the risk of yesterday could be the problem of today or cease to be a risk altogether, and new risks could arise."

Checklist Approach
Establishing the risk profile of a project using checklists is a recognized technique that lends itself to profiling a project for known risk items rapidly and with little effort. The key with a checklist approach is that the risk items were previously identified and compiled in the questionnaire for easy completion and rapid analysis using standard computer spreadsheet software.

A standard checklist of previously identified risk items are distributed to the project stakeholders and after completion the results from all the questionnaires/checklists are aggregated to provide a risk profile of the project. The risk checklist can be distributed at regular intervals during execution of the project and the risk profile of the project can be tracked against a baseline. Changes in the profile will be immediately apparent and the project manager can take the appropriate action to take advantage of the change in profile. An example of checklist analysis is available in the Appendix.

Discussion of Checklist Approaches

Adaptation from Ernst & Young
The Risk Assessment questionnaire adapted from Ernst & Young consists of risk events grouped into three categories (Project Size, Structure and Technology), each with sub-categories to refine the data further. Each sub-category has a number of questions with cued responses corresponding to Low, Medium or High risk impact to the project. The premise for this compilation of possible risk items is an organization with an established project management library of projects from which the risk events and parameters can be established.

Analysis of the responses consists of data counts and simple aggregation of the raw data to provide graphical representations of the project risk profile.

An extract from a questionnaire adapted from Ernst & Young is shown in Exhibit 2.

Category – Project Structure		
Subcategory: Definition		
Project Scope	The project scope is: • Well-defined • Defined, but at high level • Vague	☐ - Low ☐ - Medium ☐ - High
Project Deliverables	The project deliverables are: • Well-defined • Defined in name but not content • Not defined	☐ - Low ☐ - Medium ☐ - High

Exhibit 2: Extract from Ernst & Young Questionnaire

Taxonomy-Based Risk Identification
In their report on Taxonomy-Based Risk Identification, Carr *et al* (1993) propose a questionnaire where the risk items are classified into three levels – Class, Element, and Attribute. Questions under each taxonomic attribute are designed to elicit the range of risks and concerns potentially

affecting the project or the product of the project. The Taxonomy-Based Questionnaire from the report is specifically geared towards software development, but the concepts can be applied to other project types with adaptations. The taxonomy questionnaire was based on three sources of information:

- Published literature of software development risks
- Experience of people beyond what is published
- Analysis of field data

A master questionnaire will be created for the organization and will contain all possible risk events as identified. The questionnaire used on the individual projects may contain a subset of the applicable set of events for the project.

Although the method proposed in Taxonomy-Based risk identification does not quantify the responses, it would be a small task to apply cued Likert scale responses to the questions. The responses can then be dealt with in a mathematical model as proposed in the adaptation of the Ernst & Young example.

Alternative from Wideman
Wideman (2002) suggested sources of possible risk events and these are listed here:

- External Unpredictable

Regulatory, Natural hazards, Postulated events, Side effects, Completion

- External Predictable

Market risks, Operational, Environmental impacts, Social impacts, Currency changes, Inflation, Taxation

- Non-technical

Management, Schedule, Cost, Cash flow.

- Technical

Changes in technology, Performance, Risks specific to technology, Design, Size and complexity of project.

- Legal

Licenses, Patent rights, Contractual, Outsider suit, Insider suit, *Force Majeur.*

A generic checklist can be created from the sources and can be classified or taxonomized with categories of "External Unpredictable," "External Predictable" and so forth with associated sub-categories and the risk factors that will define the individual questions. The specific questions for each sub-category will then be analyzed using standard count and mathematical methods.

Comparison
In all three cases the risk events are classified on three levels and this provides an opportunity to create reports of lesser or greater granularity at the Category, Sub-category or Risk factor level, or as with Carr *et al* at the Class, Element or Attribute levels.

The master questionnaires will in all cases be developed by using known risk items for the project type, practical experience of the contributors and continual renewal based on input from the practitioners using the checklists.

Standard Response Development
Standard responses to the risk items can be created and brought into play during execution of the project. These standard responses will reduce the effort, but will be generic and will not capture the uniqueness of the specific project environment – a danger that non-optimal risk responses will be applied to the project.

A sample risk response based on the Ernst & Young adaptation is shown in Exhibit 3. Each risk event in the questionnaire is described and specific strategies to reduce the impact if the risk event occurs are shown.

Risk Factor Description	Risk Management Strategies
Project Size Risks	
Man hours: Projects involving a large number of man hours may cause project team members to lose enthusiasm, become complacent about producing high-quality work or burned out. Managing projects with a large number of man hours can be very time consuming	• Perform formal project planning and monitoring, supported by an automated project management tool. • Submit regular status reports to both IS and user management • Obtain user acceptance of a well-defined change management procedure at the beginning of the project • Break the effort into separate projects on the phase boundaries • Rely on team leaders to help manage the effort • Provide for additional quality review points • Recognize the individual needs of team members

Exhibit 3: Risk Event Standard Responses

Application

Creation of such a standard questionnaire and the associated responses will typically be the task of the Project Management Office (PMO) who will monitor the effectiveness of the questionnaire through continual audits. The PMO will own the questionnaire and will make adjustments as it identifies risk items that should be removed, added or changed.

The questionnaire will be used by the project manager to get a baseline risk profile at the beginning of the project and at any other stage as he or she sees fit. This could be time based (e.g., weekly), or it could be based on the product or system development cycle, phases of the project life cycle, or any sampling period appropriate for the project. It is important that all risk identification participants complete the questionnaire consistently to obtain valid statistical results between the samples. Results can be obtained rapidly and with little effort using previously created models in spreadsheet software. The data can be presented in graphical format for inclusion in management progress reports, but the data is of sufficient granularity to assist the project manager finding issues in the project risk environment.

This checklist based risk process can be repeated with relatively little time, effort and cost overhead, and the project team will be more inclined to follow the process on a regular basis at appropriate times. The repeated risk analysis will increase the probability of a successful project.

The biggest disadvantage of the checklist approach is that it does not give the project an opportunity to identify risk events that are unique to the project and the environment in which it executes. This seemingly myopic approach can be an extremely dangerous for the project where risks with possible catastrophic impact can be missed and not included in the project risk management plan. It will behoove the project manager to be on the lookout for additional items that could impact the project.

Comparison of Approaches

In this section we compare the approaches and attempt to make unbiased recommendations when using any of the tools. Both the checklist and the non-checklist approaches, if executed properly, will provide the desired results. It is however important to understand the benefits and limitations of the methods. This will allow the practitioner to better decide which approach will be the most beneficial to a specific project.

Checklist Approach
Benefits
Standardized across projects:- All the projects within an organization can be compared and rated against one another. **Repeatable**:- The same risk identification and related assessments can be done on a regular basis during the execution of the project. **Comparable**:- The results from the identification and associated assessments can be compared during the project life cycle and risk trends can be analyzed. **Rapid**:- It is an easy task to distribute the questionnaire to the project stakeholders and then to collate and analyze the information. **Cost efficient**:- E-Mail systems are ubiquitous and the electronic nature of the questionnaire lends itself to easy distribution and collection of the material.
Limitations
Risk events missed: Risk items not identified in the checklist can be missed if the project team does not understand this limitation and keep their eyes open for additional items that may impact the project. **Large project suitability:** Larger projects will by their nature operate in a more diverse project environment and a standard checklist will not be able to cover the more varied sources of risks.

Exhibit 4: Checklist Approach: Benefits and Limitations

Non-Checklist Approach
Benefits
Risk events unique to the project environment: If done correctly all risk events that could impact the project will be identified. The general items, but also those that are unique to the specific project environment will be identified and included in the identification. **Team building exercise**: The collaborative nature of the risk identification process is an ideal opportunity for building the project team. **Appropriate for larger more elaborate projects**: Smaller projects do not have sufficient budget to spend the appropriate resources on risk management processes. Larger projects should have sufficient resources to do regular risk assessments using the more thorough approach.

Limitations
Time consuming: The traditional methods for identifying risks are time consuming and therefore there may be a tendency to limit the time spent on identifying risks. **No comparison to show trends**: The approach is not repeatable and the results from the various identification occurrences can not be compared. **Not repeatable**: The risk identification and associated assessment can be done multiple times, but not repeated in an exact manner to identify trends. **Resource intensive:** Risk Identification methods are collaborative in nature and lengthy. When the project stakeholders are distributed the cost to identify risk items can be prohibitive.

Exhibit 5: Non Checklist Approach: Benefits and Limitations

Conclusions

Both the checklist and non-checklist approaches for risk identification have a place in establishing which items could impact a project. The project operates in a changing environment and the items that could adversely affect the project will change as well. The checklist approach allows for cost effective identification and analysis of the risks at regular intervals during execution of the project, but the project could be compromised if the checklist ignores items that may have an impact on the project.

The non-checklist approach, on the other hand, is time consuming and will use project resources to the extent that it may not be possible to identify risks regularly during the execution of a smaller project where the project budget is limited. New risk items during the execution of the project may not be identified and this could impact the project.

The project practitioner can use a checklist approach entirely for smaller projects where the organization has created checklists for similar types of projects. Larger, more diverse projects with sufficient budget can use the non-checklist approach, but can benefit from base-lining the project using a checklist. Additional risk events can be identified using non-checklist methods.

The ability to repeat the risk identification process using few project resources will provide the project manager with regular insight into changes in the risk profile of the project. This will allow for an increased potential to predict the outcome of the project.

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Appendix - Sample Analysis

Category	Subcategory	Risk Factor	Responses (Count)		
			L	M	H
Project Size	Project Size	Man hours	3		
		Calendar Time	1	2	
		Team Size	1	1	1
		Sites	1	2	
		Interfaces to Existing Systems	3		
		Organizations to Coordinate		1	2
Project Structure	Project Definition	Project Scope	1	2	
		Project Deliverables	3		
		Benefits of New System		2	1
		Complexity of Requirements	1	1	1
		User Knowledge	1	2	
		Business Knowledge of Project Team	2	1	
		Availability of Documentation	1	2	
		Dependence on Other Projects	3		
		Dependence of Other Systems on this Project	1	1	1
	Sponsorship & Commitment	Project Sponsorship	1	2	
		Commitment of User Management	1	2	
		Commitment of User Organizations	1	2	
		Relation to Strategic System Plan	1	1	1
	Effect on User Organization	Replacement or New System			3
		Effect on Computer Operations		3	
		Procedural Changes Imposed by the New System	1	1	1
		Changes to Organizational Structure	1	2	
		Policy Changes		1	2
	Staffing	Project Manager Experience	3		
		Full-time Project Manager		3	
		Full-time Project Team	2	1	
		Experience as a Team	1	1	1
		Team's Experience with Application	1	1	1
		Team Location	2	1	
	Project Management Structure	Methodology Used	1	2	
		Change Management Procedures	3		
		Quality Management Procedures	3		
		Knowledge Coordination Procedures	2	1	
Project Technology	Hardware & Software	New or Nonstandard Hardware or System Software	1	2	
		Availability of Hardware for Development and Testing	1	1	1
	Development Approach	New Tools and Techniques	1	2	
		New Language	1	2	
		New DBMS	1	2	
	System Complexity	Type of Processing	1	2	
		Response Time as Critical Requirement	1	1	1
		Requirements for System Availability	1	1	1
		Technology Mix			3
		Data Complexity			3
		Data Quality	1	2	
	Software Package	Knowledge of Package	1		
		IS Prior Work With Vendor	1		
		Functional Match to System Requirements	1		
		IS Involvement in Package Selection	1		
		Vendor Reputation	1		

Exhibit 6: Detail Analysis Worksheet

Category	Subcategory	Subcategory			Category			TOTAL		
		Low	Med	Hi	Low	Med	Hi	Low	Med	Hi
Project Size	Project Size	50%	33%	16%	50%	33%	16%	42%	40%	17%
Project Structure	Project Definition	48%	40%	11%	44%	41%	14%			
	Sponsorship & Commitment	33%	58%	83%						
	Effect on User Organization	13%	46%	40%						
	Staffing	50%	38%	11%						
	Project Management Structure	75%	25%	0%						
Project Technology	Hardware & Software	33%	50%	16%	36%	39%	23%			
	Development Approach	33%	66%	0%						
	System Complexity	22%	33%	44%						
	Software Package	100%	0%	0%						

Exhibit 7: Summary Table -- An aggregation of the individual responses grouped by Sub-category, Category and Project.

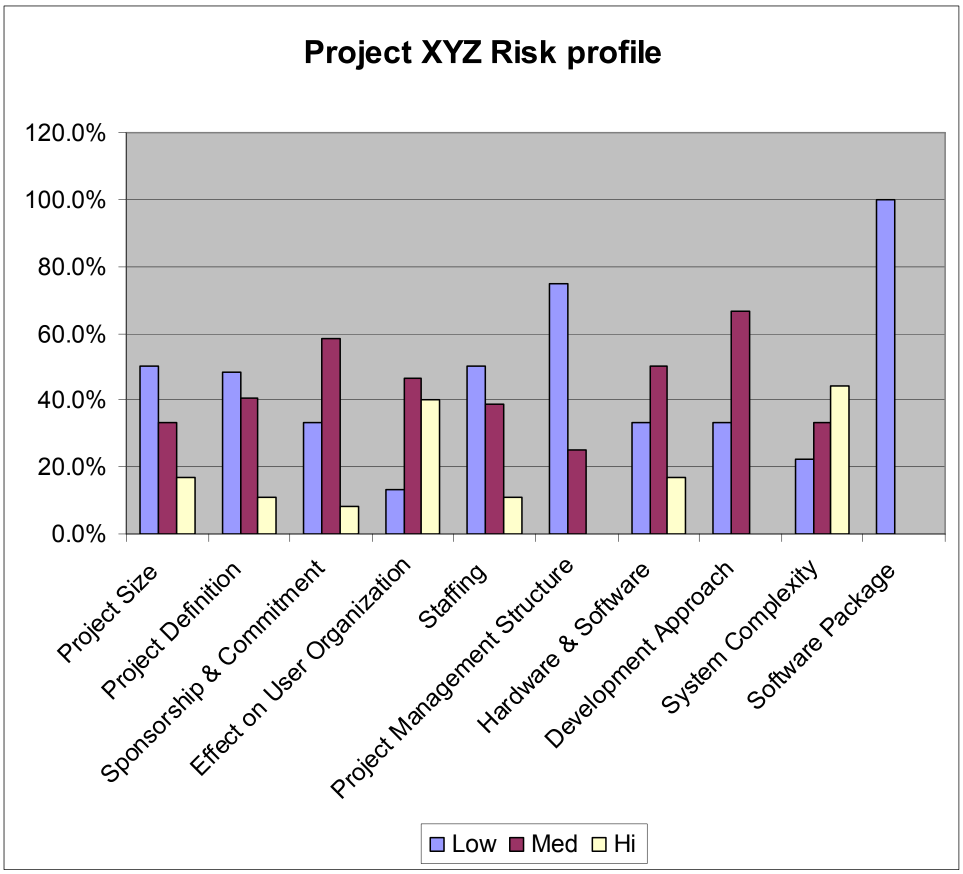

Exhibit 8: The summary table in pictorial format:

Technology Readiness Level: An Alternative Risk Mitigation Technique

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Abstract

The key to achieving concept-to-market targets and realizing a corporation's competitive edge is for technology programs to realize their goals of implementing technological breakthroughs into mainstream products. The process of converting engineering opportunities into economic realities in an environment characterized by fast pace, highly volatile processes, emerging technologies, and high degree of uncertainty faces multiple, overlapping and unique risks. This paper focuses on developing risk mitigation plans and contingency scenarios, including scheduling of decision points, exit criteria, work around alternatives, trade-offs, risk de-escalation, and fall-back strategies based on the concept of the Technology Readiness Level (TRL). TRL is applied to aerospace products, particularly jet engines, with incursions into space and defense products.

Introduction

Technology programs and technical risks

Technological programs aim at technology insertion into products ranging from space, aerospace, and defense; IT and software engineering; medical, transportation, energy; and so on. Technology insertion leading to new products is a process carried out through projects during the product development cycle and the transition to production.

Paraphrasing Heisenberg's theory on uncertainty in sub-atomic physics, "for any project we may identify three major variables: performance, cost and schedule. The specification of any two will cause variation in the third." (Kujawski 2001)

Any project with ambitious-aggressive requirements, schedule and budget constraints incurs risks that the product "will not reach its performance goals, development will not be within the specified timeframe and / or will cost more than estimated due to technical developmental and maturity risks" (Smith et al 2004). Ambitious-aggressive requirements are the quintessence of market leaders, and risk-taking is within their core values. In this context, new product development rationale evolved from physical assets utilization to opportunities exploitation (O'Marah 2004).

The quandary is how to achieve a reasonable balance between opportunity and risk, as the Chinese recognized so early in creating the character for Risk by blending of characters for Danger and Opportunity (Githens 2005).

Technology Readiness concept

Technology Risk Assessment (TRA) concentrates on the underpinning technologies critical to the product / system capability generally assessed at the sub-system level. Technology Readiness is the status of an underlying technology "with respect to its feasibility and maturity for operational use" (Smith et al 2004). Technology Readiness Level (TRL) is the scale used for technology's level of maturity (Pratt & Whitney 2006). Technology penetration to a certain level within the readiness range is a subjective quantification of its maturity (Valerdi et al 2004).

TRL aims at defining and tracking the risk de-escalation process by using a "common currency" measurement and a consistent approach for all technical risks associated with the product / system. TRL evolves during the project's lifetime from a filter for assessing technology readiness of new technologies or novel applications of learned-out technologies in the initial phases to a tracking tool for the transition from development to production in the late phases.

Context

Good risk management practices make the aggressive risk-taking possible by bounding the level of uncertainty through risk mitigation plans and actions (Martinelli et al 2004). TRL is a risk mitigation tool that reduces the monetary impact of technical risk (Kanabar 2005) by

- exhaustive testing of sub-systems and systems to lower the probability of occurrence below an accepted threshold
- building in technical "safety nets" and redundancies to contain the risk event value.

The key to a successful risk mitigation plan is to identify the most significant contributors to the program variability (Mavris et al 2001). TRL aims to address these significant contributors early in the project life cycle.

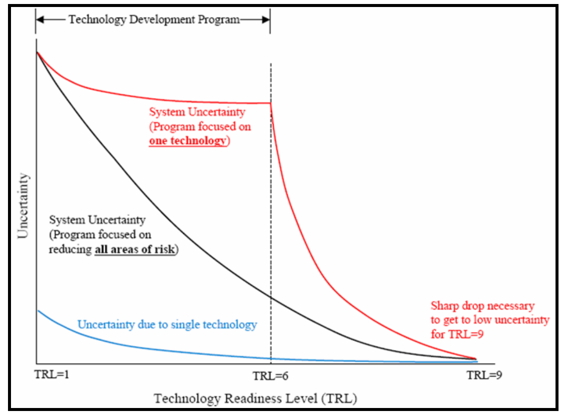

Exhibit 1: Uncertainty vs TRL

Testing is performed in a sequence of analytical models, scaled physical models, and full-scale prototypes (Exhibits 8 and 9). Many of these tests are subject to regulatory oversight and integral to product certification for revenue service. Residual risk is subject to contingency measures using dedicated techniques like Failure Modes and Effect Analysis (FMEA) that are incorporated into the product / system documentation and operators' training material.

Historical perspective

The TRL concept was developed by NASA in the 1980's by Sadin et al (Nolte et al 2003), originally as a seven level system later expanded to nine levels by J.C. Mankins (Mankins 1995). The United States Air Force adopted the use of TRL in the 1990's. In 1999, the United States General Accounting Office produced an influential report GAO/NSIAD-99-162 (GAO 1999) that concluded that use of immature technology increased overall program risk and recommended that the DoD adopt the use of NASA's Technology Readiness Levels as a means of assessing technology maturity prior to transition from development to production (GAO 1999).

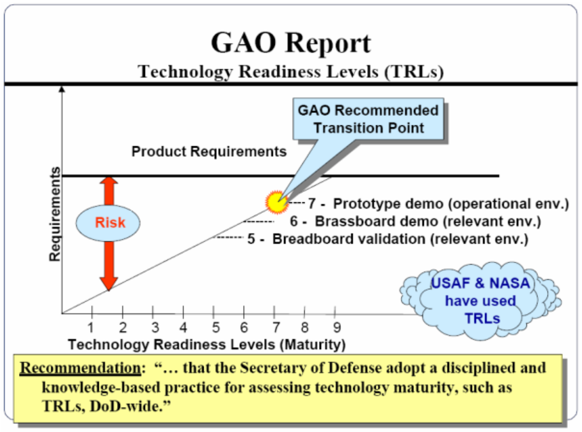

Exhibit 2: GAO conclusion

In 2001, the Deputy Under Secretary of Defense for Science and Technology issued a memorandum that endorsed the use of TRLs in new major programs (Graettinger 2002). Guidance for assessing technology maturity was incorporated into the Defense Acquisition Guidebook (Defense Acquisition University 2004). Subsequently, the DOD developed detailed guidance for using TRLs in the DoD Technology Readiness Assessment Deskbook (DoD 2005).

TRL became the technique of choice for Canadian, British (AMS 2006) and Australian (Moon et al 2005, Smith et al 2004) defense establishments' acquisition procedures. In the same time, major defense suppliers in the private sector began implementation of the TRL concept tailored for their specific industries and needs.

<u>Application Of TRL</u>

TRL and project life cycle
TRA and TRL are part of the Risk Management Plan and are initiated at program launch. TRL is a waterfall process that encompasses the product / system development and the transition from development to production. Unlike the hype associated with new technology (Gartner Group's five-stage hype cycle), technological knowledge and risk follow steady trends (Exhibit 3).

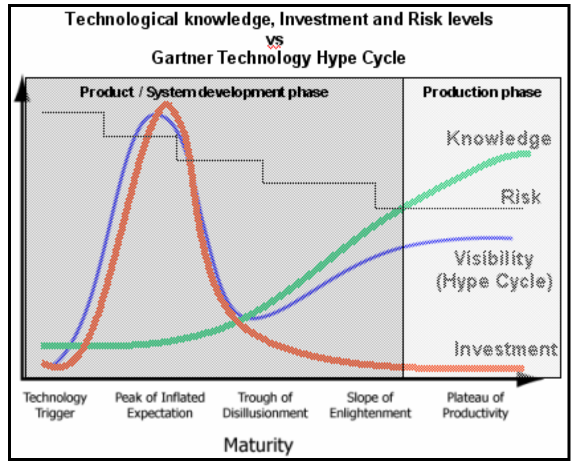

Exhibit 3: Technology hype

Project life cycles for space, defense and aerospace products / systems have similar phases (Exhibit 4), but different milestones (triangles) and gates (diamonds). The major differences between DoD / P&W and NASA project life cycles are:

- most NASA projects do not enter into multiple item production cycles
- most NASA produced flight items do not require service and retrofit with the notable exception of the Space Shuttle.

Nonetheless project cost risk is most likely significantly reduced for NASA and DoD / P&W if technologies are well developed prior to transition to production (milestone C for DoD and gate P3 for P&W).

The primary goal of the product / system development phase is risk reduction through increase in knowledge (Exhibits 1 and 3).

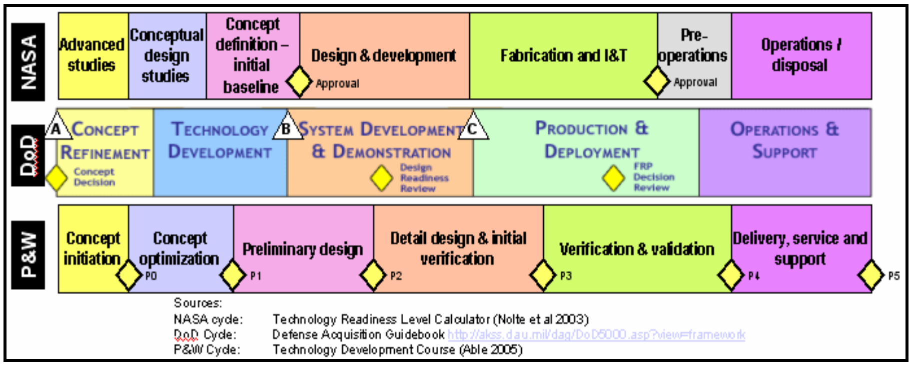

Exhibit 4: Comparative life cycles NASA - DoD – Pratt & Whitney)

The new technology comes with assumptions that all its elements are feasible and it will provide a boost to the product / system in terms of performance and/or cost. These assumptions add uncertainty (risk) and require enabling testing (analysis, experiments, tests, simulators) to determine the feasibility and specific details of elements in order to reduce uncertainty and variability (Mavris et al 2001).

Risk mitigation via TRL process uses exhaustive testing of sub-systems / systems to verify technology assumptions and capabilities, and doing so lower probability of occurrence below an accepted threshold.

Method and Tools

TRL gages and levels definitions

Parallel definitions of TRL by NASA, DoD and P&W tailor the concept for specific needs and conditions (Exhibits 5).

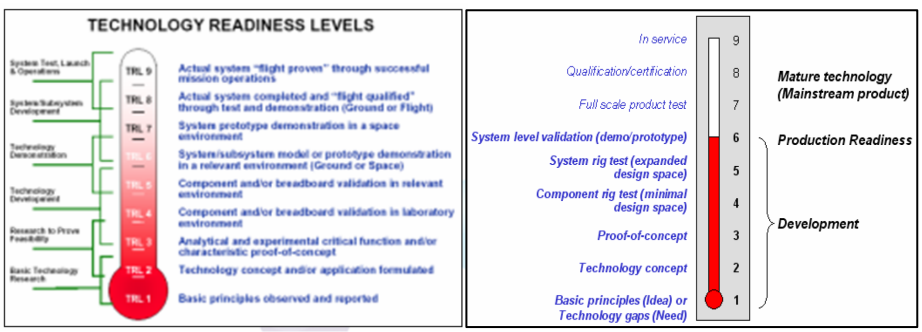

Exhibit 5: NASA and P&W TRL gages

TRL level 6 is the crucial demarcation point that defines the boundary between developmental technology and a production-ready technology.

A two-scale Technology Readiness model was developed by MITRE Corp. (Chambliss (2001) for the Federal Aviation Administration (FAA) traffic flow management project to combine TRL with Implementation Readiness Level (IRL). It is rolled out against a four-phase R&D process that is a variation of the life cycles outlined in Exhibit 4.

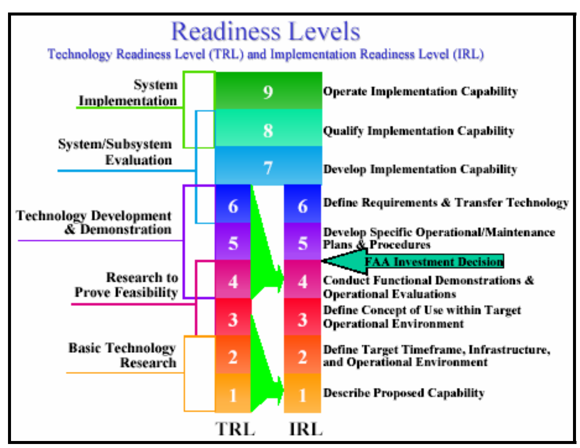

Exhibit 6: TRL and IRL relationship

The MITRE model separates the pure research and Development & Implementation for the particular project where pure research is performed by an independent entity and will eventually be incorporated into FAA's operational system.

Exit criteria

NASA's TRL definitions are accompanied by project exit phases, associated risk reduction activities and exit criteria (Kujawski 2001).

Description of Technology Readiness Levels

Technology Readiness Level	Exit Project Phase	Risk Reduction Activities	Exit Criteria Next Level and Phase
Level 1: Basic principles observed and reported.	Advanced Studies	Basic technology research.	- Basic principles observed and reported
Level 2: Technology concept and/or application formulated. Level 3: Analytical and experimental critical function and/or characteristic proof of concept.	Advanced Studies Conceptual Design	Research to prove technical feasibility. Active R&D initiated with analytical and laboratory studies.	- Technology concept and/or application formulated - Analytical and experimental critical function and/or characteristic proof-of-concept
Level 4: Component and/or breadboard validation in laboratory environment.	Conceptual Design	Technology development. "Low-fidelity" prototype implemented and tested.	- Demonstration of technical feasibility using breadboard in laboratory environment - Conceptual Design Report (CDR) - Systems Requirement Review (SRR)
Level 5: Component and/or breadboard validation in relevant environment.	Preliminary Design Detailed Design	Technology demonstration. Significant increase in level of fidelity. Basic technology elements integrated with reasonably realistic supporting elements. Prototype implementation conforms to target environment and interfaces.	- Component and/or brassboard validation in relevant environment. - Preliminary Design Review (PDR) at end of Phase B - Final/Critical Design Review (FDR) at end of Phase C
Level 6: System/subsystem model or prototype in a relevant environment.	Detailed Design Development	Major increase in level of fidelity. Prototype implemented on full-scale realistic problems. Partially integrated with existing systems. Engineering feasibility fully demonstrated in actual system application.	- System/subsystem model or production prototype demonstration in a relevant end-to-end environment (ground or space) - Not implemented for all technologies
Level 7: System prototype demonstration in a space environment.	Development	Fully integrated with operational hardware and software systems. All functionality tested in simulated and operational scenarios. End of system development.	- Actual system completed and "flight qualified" through test and demonstration (ground or space).
Level 8/9	Development Operations		- Actual system "flight proven" through successful mission operations

Exhibit 7: NASA's TRL system details

P&W employs a similar set where project phases are delimited by "passport gates" (P0 through P5 in Exhibit 4), while exit criteria are embedded into the Engineering Standard Work.

<u>P&W implementation of TRL</u>

Drivers

- Technology Readiness Levels and associated processes defined and mandated by internal company procedures
- Company goal is for all high-risk technologies attaining TRL=P6 by Verification and Validation gate
- Experience proves that projects achieving TRL=P6 prior to gate P3 stay within a predicted and tolerable margins of baseline cost and schedule estimates
- The line between "technology risk factor" and the "design and engineering risk factor" is somewhat fuzzy since both involve development. The former focuses on research and developing the technology, while the latter focuses on detailed implementation of the technology (Kujawski 2001)

Scope

P&W definition of technology for the purpose of TRL application is restricted to "activities going beyond present Engineering Standard Work". While the TRL concept is universally valid, internal company procedures make it mandatory for certain technology categories:

P&W Technologies categorization

Technology category	Definition
Critical	Technology with TRL < P6 in a launched program
Key	Enabling or significant benefit for future programs
Market discriminator	Enhancement for future programs
Emerging	Under exploratory development

Process and tools for single-track projects

1. Inputs (entry form questionnaire)
    a. Risk Probability and Consequence (P-C) at project start and target for project completion
    b. Risk details (description, owner, potential impact, initial TRL, etc.)
    c. Contingency plan
    d. Dated, step-by-step risk abatement plan with predicted de-escalation step
2. Methods and tools
    a. Risk Template spreadsheet (Microsoft *Excel*™) with built-in macros to compute initial and final risk based on P-C inputs
    b. Risk Template spreadsheet (Microsoft *Excel*™) applies TRL standards in line with application procedure (Pratt & Whitney 2006)
    c. Exit criteria for each risk abatement step are defined by Engineering Standard Work
3. Output(s)

A composite chart (Exhibit 8) consisting of

- Details of technical risk (description, owner, potential impact, etc.)

- Contingency Plan
- Quantitative assessment of TRL status with a color-coded qualitative assessment (high, medium, low risk)
- Step-by-step, dated risk abatement plan
- TRL waterfall plotted against project timeline
- P-C risk chart displaying the initial and target risk levels

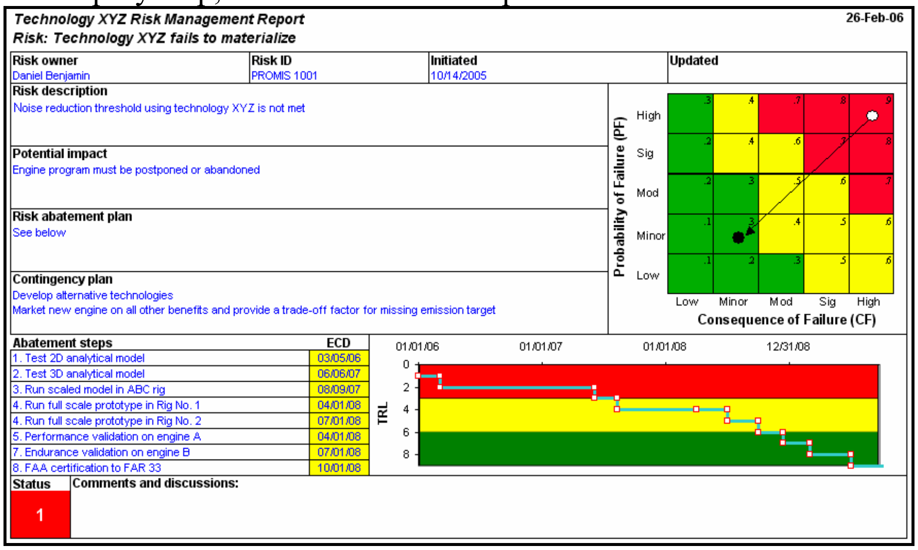

Exhibit 8: P&W's TRL Composite Report for single track project

Process and tools for multi-track projects

The process is similar to the one described for single-track projects, but trades-off project details in favor of details for the sub-system / sub-product. The output is a chart (Exhibit 9) with TRL waterfalls for each subsystem / sub-product.

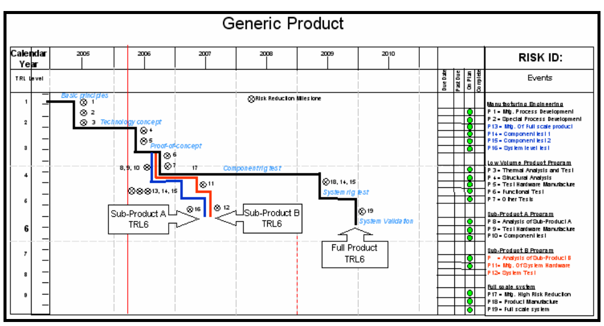

Exhibit 9: P&W's multi-track waterfall

System / product level TRL

System / product level status is evaluated based on the status of its constituents (Exhibit 10) and an overall TRL Overview (Exhibit 11) that measures program achievements along 10 swim lanes.

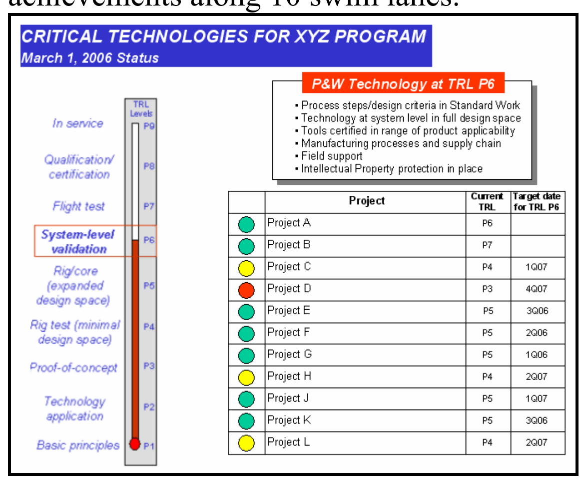

Exhibit 10: P&W's Program TRL review

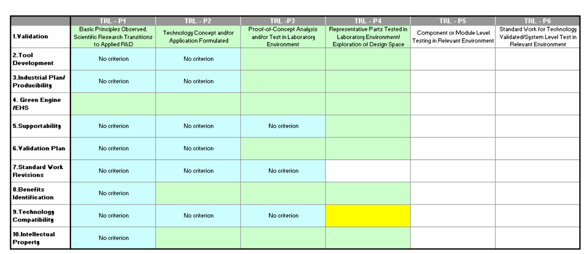

Exhibit 11: Program TRL overview

Other available tools

A Technology Readiness Level Calculator was developed by the United States Air Force (Nolte et al. 2003). This tool using standard set of questions implemented in Microsoft *Excel*™ that outputs a graphical display of the TRLs achieved is intended to provide a snapshot of technology maturity at a given time point.

Alternative methodologies

A multitude of alternative approaches are available to address the multiple dimensions of technical risk.

R&D^3 concept

Mankins proposes TRL enhancement with a complementary measurement of Research and Development Degree of Difficulty R&D^3 (Mankins 1998).

R&D^3 – I	A very low degree of difficulty is anticipated in achieving research and development objectives for this technology. Probability of Success in "Normal" R&D Effort 99%
R&D^3 – II	A moderate degree of difficulty should be anticipated in achieving R&D objectives for this technology. Probability of Success in "Normal" R&D Effort 90%
R&D^3 – III	A high degree of difficulty anticipated in achieving R&D objectives for this technology. Probability of Success in "Normal" R&D Effort 80%
R&D^3 – IV	A very high degree of difficulty anticipated in achieving R&D objectives for this technology. Probability of Success in "Normal" R&D Effort 50%
R&D^3 – V	The degree of difficulty anticipated in achieving R&D objectives for this technology is so high that a fundamental breakthrough is required. Probability of Success in "Normal" R&D Effort 20%

Exhibit 12: R&D^3 levels

COSYSMO Technology Risk Driver

The Constructive Systems Engineering Cost Model COSYSMO (Valerdi et al 2004) is rooted in the cost modeling for large-scale systems. The Technology Risk Driver combines the positive aspects highlighted in the TRL concept with negative aspects that immature technologies can introduce to the product / system, for a more comprehensive technology risk measure.

Valerdi et al 2004 challenge the postulate that technology risk and maturity are inversely related as overly simplistic since it ignores new risk factors surfacing as technologies attain a high maturity level. These factors include the obsolescing of a given technology ('retiring' factor) and the leapfrogging of newer technologies over a given high maturity technology (emerging new technologies that provide nearly equivalent or better capabilities).

The rating scale for Technology Risk Driver shown in Exhibit 13 is based on three viewpoints in assessing technology readiness: lack of maturity, lack of readiness and obsolescence.

Viewpoint	Very Low	Low	Nominal	High	Very High
Lack of Maturity	Technology proven and widely used throughout industry	Proven through actual use and ready for widespread adoption	Proven on pilot projects and ready to roll-out for production jobs	Ready for pilot use	Still in the laboratory
Lack of Readiness	Mission proven (TRL 9)	Concept qualified (TRL 8)	Concept has been demonstrated (TRL 7)	Proof of concept validated (TRL 5 & 6)	Concept defined (TRL 3 & 4)
Obsolescence	(Obsolescence not an issue)	(Obsolescence not an issue)	Technology is the state-of-the-practice; emerging technology could compete in future	Technology is stale; new and better technology is on the horizon in the near-term	Technology is outdated and use should be avoided in new systems; spare parts supply is scarce
Cost multiplier	0.68	0.82	1.0	1.32	1.75

Exhibit 13: COSYSMO rating scale for Technology Risk Driver

Valerdi et al claim that high maturity technologies can actually take new risks due to the type of 'dampening' factors and this rapid TRL decay (Exhibit 14) should be considered in any selection criteria.

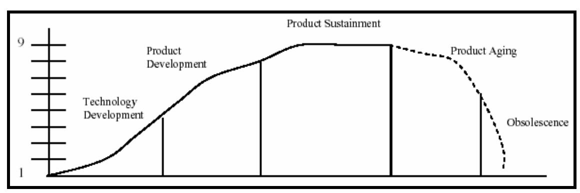

Exhibit 14: TRL profile over life cycle

COSYSMO perspective is derived from fast turnaround - short life-cycle technologies like integrated circuits, computer storage, but its potential implication should not be overlooked on any technology risk analysis.

TIES method

Technology Identification, Evaluation and Selection (TIES) is a potent "on the fly" technology evaluation method focused on benefits/penalties and prioritization of candidate technologies, rather than a readiness status indicator (Mavris 2001 and Roth et al 2004). It is tied into General Electric Aircraft Engines (GEAE) processes and it combines physics based analysis tools, expert experience, statistical analysis and Six Sigma methods (design of experiments DOE and response surface equations RSE).

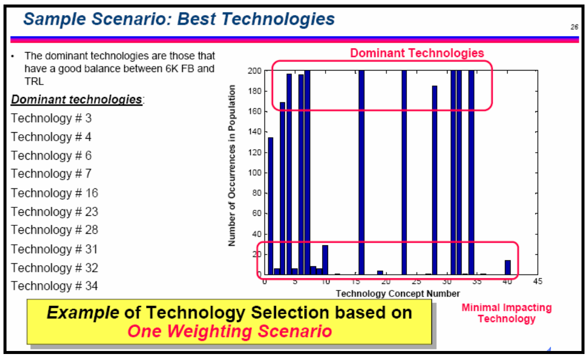

Exhibit 15: TIES sample for fuel burn (FB) technologies

The impact of technology is quantified via "technology dials" (k-factors) and analytical relationships between technology metrics and product performance that measure technology capability (Mavris 2001). In the context of TIES, TRL is just one of the many variables.

TMAT

Technology Metrics Assessment and Tracking (TMAT) is a physics based process developed for NASA's UEET (Ultra Efficient Engine Technology) program in which P&W is a partner. It relies on quantifiable program metrics identified and tracked as a function of performance progression, time and monetary expenditures to determine the optimal investment strategies and high payoff technologies to advance the state-of-the-art (Mavris et al 2001).

TMAT is geared more toward comparative analysis of technology mixes, while TRL assumes the technology selection was already made.

RAND Technology Risk Metric

RAND National Defense Research Institute devised a technology risk metric that captures the difficulty in transitioning from one TRL level to the next (Gordon et al 2005 pp. 21).

The metric consists of technical risk estimates for each major sub-system and an overall assessment of the technical challenge by the capability to meet the key requirements (payload and range for RAND's assessment for Navy's Heavy-Lift Helicopter). It is well suited at product / system / program level, but questionable for any levels below (sub-product / sub-system / project / module / component).

The metric targets large-scale systems integration and fills in the product / system TRL rating that is missing from P&W Program TRL (Exhibit 10).
It is noteworthy that the overall ranking of options using Technology Risk Metric and TRL are similar except for order reversal of the bottom-of-the-list two options.

RAND Technology Risk metric is also adding one extra layer of subjectivity by introducing a weighing scale that differs with the sub-system (0 to 3 for payload and range and –1 to +1 for engine) and creates room for manipulation of results.

Conclusions

<u>TRL system strengths</u>

- Robust and reliable within the context of relatively long life cycle technological programs
- Consistent approach across dissimilar technologies

- Common understanding of technology status
- Compatible with and embedded into Risk Management planning
- Decision making tool for technology funding and transition from development to production
- Common platform with regulatory agencies (USAF, NASA, FAA, etc.)

TRL system weaknesses

- TRL scale assesses only the technology's state-of-the-art in a snapshot with a rigid time stamp and ignores the difficulty of developing the technology to an actual production item
- Current TRL concept ignores systems engineering risks (integration, environmental, inter-operability, compatibility between technologies, regulatory issues and dependence on technologies yet untested)
- Technology obsolescence, leapfrogging and other negative factors are omitted
- TRL adds another set of reports, paperwork and reviews (Technology Development Review TDR)
- TRL's associated with transition from development to production are susceptible to bias toward either side
- Comparison of dissimilar technologies using TRL alone is misleading as value added to product is not accounted for.

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Avian Flu Risk Management

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Abstract

This paper will discuss the possibility of an avian flu pandemic. Topics to be addressed include what is the avian flu, the history of the flu, and the devastating consequences of a pandemic. The paper will assess some of the risks and costs associated with a pandemic. As the topic of the bird flu is very large topic, this paper will be narrowed to Retirement Systems in the United States.

Not a day of the 2005-2006 Winter went by without the media mentioning new facts or incidents regarding the 'bird flu'. Early February, 2006, the CBS morning news was about the deteriorating health of two women in South Asia, while CNN reported new cases of the bird flu in Nigeria. As I sat for a class in Risk Management, the idea of a research paper on the bird flu became quite obvious. My goal became to find out what kind of risks we could face.

What I learnt is that most organizations are not prepared for an avian flu pandemic. Most organizations limit the focus of their Disaster Recovery Planning to fires, bombs or events that do not have a long duration.

When people think of a disaster, they think of a one time event that ends within a short period, and that is specific to a limited and defined location.

We assume help and resources can be brought in, as needed. Think about the 2004 Asian tsunami that killed thousands. It was localized and it did not last more than a few hours. Help was brought in from different countries. Now, imagine a tsunami that would hit all the corners of the world at the same time. Imagine that every day the tsunami keeps hitting the shorelines. Imagine that it happens 6 months per year. Imagine you have 'this' happen 3 or 4 years in a row.

Now, you have an idea of the type of event we might be dealing with. It is a different type of disaster than what most companies are planning for.

What I believe is that most companies refuse to address the risk of the avian flu, because acknowledging the risk would require starting a huge project. The result would impact the way employees work, how the organization is structured, address sensitive subjects like tele-commuting and potentially conflict with certain legislations.

With many new regulations like Sarbanes Oxley (SOX) or the Patriot act, CIO's are spending bigger portions of their budgets on compliance. It is very possible that many CIO's prefer to 'not do anything' hoping that no disaster will happen, rather then be the ones to increase the IT budget for … nothing.

Since resources are scarce and certain projects are legislative mandated, priorities do not match the business requirements of many organizations. As an example, many companies scrambling to be SOX compliant. Being SOX complaint could go against the interest of your business.

- SOX requires to keep records of all communication. How do you track communications during a true disaster?

It appears obvious to me, that the cost of a system that fits regulatory standards would be extremely expensive.

What expense would be considered too much to prevent a disaster?

Unless the question is "why develop a system that does not have a high probability of occurrence?" My answer is simple: Developing a comprehensive flu plan is preparing for most disaster types and preparing the organization for the challenges of 21st century operations.

In the worst case scenario, if bird flu does not become pandemic, organizations will be ready for the next pandemic. Those organizations will be able to deal with most natural catastrophes. And maybe better, the organization will be able to provide its employees with desirable perks such as telecommuting. Let's not forget that a dollar spent on employees generally returns 6 times.

A cost? Or an investment for the future?

Refusing to acknowledge the risk of the bird flu when all specialists are scrambling to find antidotes is an even more surprising approach. Historians will remind us of the many pandemics that have ravaged the earth. Think about the plague during the middle ages in Europe. Think about the 1918 Spanish flu, which killed over 25 million people. So many pandemics have hit the face of the earth that it is stunning that this type of disaster is not a top priority.

Knowing that pandemics have happened again and again since the dawn of time, I investigated the probability of an occurrence. To my surprise, many specialists give the probability of an avian flu pandemic a virtual 100% before 2010.

It is scary to see that the organizations publishing those numbers are 'serious'. These are major organizations that are not used to blowing the whistle for nothing. Some of these include the Center for Disease Control (CDC), the World Health Organization (WHO), the World Bank and the American embassy web sites from different European countries.

What is the Flu?

The flu is an infectious disease, often confused by patients with a cold. It is a potentially serious disease that can have some of the following symptoms:

'Fever, headache, fatigue/sore joints (can be extreme), dry cough, sore throat, nasal congestion, sneezing, irritated eyes, body aches, extreme coldness' according to the Wikipedia website.

How do you get the bird flu?
Currently, the possibilities are extremely limited. A human would need to have direct physical contact with domesticated poultry. And those birds would need to have been in contact with infected wild birds. Also, a human could get sick from a contact with infected animal feces, or by living in extremely close proximity with poultry. Indications currently demonstrate that the amount of human-bird interaction was very high for those that died from the Avian flu.

The second way of getting infected is through consumption of poultry meat that is not cooked thoroughly enough. Current research appears to indicate that properly cooked meat is safe for consumption.

For those who are wondering about how you know if you have the bird flu, the symptoms are: fever, sore throat, muscle aches, headache, lethargy, conjunctivitis (eye infections), breathing problems and chest pains.

What is a pandemic?
A pandemic is a serious and potentially lethal new disease that can spread quickly and widely throughout the world from human to human. This definition is relatively broad, but one scary fact is that two out of those three conditions are already in place. The only element left is an easily transmissible virus from human to human.

As an example of a pandemic, the 1918 Spanish flu pandemic took less then a year to become global. It is particularly scary to realize that this event occurred at a time when people did not travel much.

Here is the prevailing scenario:
- Possible recurring infection cycles for up to five years.
- Up to 50% absenteeism (at work) for up to six month per year.
- Up to 30% of population infected.
- A minimum 4% Gross Domestic Product (GDP) loss,
  - This could translate into $200 billion in United States.
  - Worldwide loss could be around $800 billion per year.
- Human behaviors similar to the SARS events in Asia in 2003-2004:
  - Crippled economy, specially for the travel & entertainment industries.
  - People walking in the street with gloves and surgical face masks, etc.
  - Fear of contact with others: humans or animals.
  - Mandatory quarantines.
- Crippled poultry industry.
  - Across Europe, poultry consumption went down 20-70%.
  - Massive destruction of poultry worldwide.
- Possible quarantine of cities or regions:
  - President Bush mentioned that he would use quarantines to prevent viral outbreaks.
- Unprecedented medical demand.
  - Could doctors process the resulting medical demand?
  - Can hospital host bird flu patients?
  - 'Tamiflu'. Would it truly work?
  - Black market for medicines? 'Tamiflu' is already reported to sell for $100.
- Possible scenes of panic resulting from the lack of treatments.
- Disruption of services: food chain, schools, government services.
- Possible implementation of martial law.

What can be done?
Taking into account the PMBOK Risk Response Planning Process, we can either:

avoid, transfer, mitigate, exploit, share, enhance, accept, or have a contingent response planning. In practice, choices will be probably limited. A few companies might profit from a pandemic, but most organizations will be limited to mitigating, accepting, or having a contingent response planning.

I decided to look at Retirement Systems in the US and prepare a presentation for the board. Retirement systems have the property that they are quasi-government. They are hybrid entities in between governments and for profit organization.

I started by looking at some Retirement System core processes:

- Pay benefits
- Provide access to health care
- Pay administrative expenses
- Invest funds
- Support computer systems
- Pay associates
- Provide building support
- Maintain communications

Next, I started wondering about each core process. For example the ‘Pay administrative expenses’ could be decomposed into two sub core processes:

- Issue check and process invoices.
- Financial accounting: G/L, asset management, and budgeting.

How would issuing a check be affected by the avian flu? What is required to issue a check? The answer could include being physically present on-site, having access to a dedicated printer, having access to printable checks and having the permissions to create the check. And then of course you need to be able to mail and deliver the check to the recipient.

What would happen in the event that 50% of the staff is absent? It is possible that checks would not be cashed because the check cannot be produced and mailed. It is possible that the US Post Office would not distribute mail. It is possible that the mail not be for fear of germs. It is even possible that some mail be destroyed if presumed contaminated.

> ***My first conclusion was that all processes should be upgraded, based upon a priority matrix to allow for every process to be conducted remotely.***

One thing that could be done is to progressively increase electronic communication with members. Research could be done to investigate the impact of having a rule that “all none electronic communications will be processed based upon staff’s availability”. This could protect the system during a disaster, by having the member acknowledge that a request will be processed when possible.

This project would have a considerable cost. But the question should be what is the Return On Investment (ROI)?

In my opinion, not having paper documentation, should reduce costs. A retirement system would not need to keep millions of paper copies. Also, the IT storage volume of data keyed-in would be much lower then if the documents were scanned.

So, I took again the main Retirement System core processes and thought about the main processes that could be impacted.

- Pay benefits.
  - Run Pension. Should not be a major problem with remote access.
  - Problems might exist for members who receive paper checks.
  - The worst case scenario is that benefits cannot be provided to the member.
  - The System may not be able to process new applications, withdrawals, etc.

    - It may not be possible to send 1099's to the members.
    - The call center may be closed, because no staff member is present.

Develop a project to have all communications with the members done electronically.

- Provide health care benefits.
    - Paying benefits means paying health care premiums. This should not be an issue.
    - Health Care costs may be surging and causing a negative pressure on the system. It may become necessary to drop medical coverage.

Develop a project to have all communications with the members done electronically.

- Pay administrative expenses.
    - Issue checks and process invoices.
    - Financial accounting: G/L, Asset management and budgeting.
    - Both could be done by providing electronic access to the teams and training them.

Again an electronic system for vendors to key in invoices may be the solution.

- Invest funds.
    - This is probably one of the most sensitive subjects. The stock market could lose as much as 50% in less then 6 months depending on the severity of the crash.
    - With the risk of member contributions not coming in, the System could be forced to liquidate some positions and take the losses. This could have a negative impact for a number of years as the loss would be spread over several years.
- The system might need to study if using derivatives could allow the system to hedge itself against the risks.
- A system of triggers should be implemented to adjust investments in preparation for the disaster.
    - ▪ The system might be legally bound in its investments and not be able to short-sell stocks or use derivatives.
- Consider drafting a plan to increase active member's funding and decreasing benefits paid.
- A simulation should be conducted, where member contributions are not coming in, $1 billion in benefits have to be paid during the pandemic and the stock market loses 50%.
        - ▪ Options should be drafted.
        - ▪ Contacts with the legislature might be started based upon the findings.
- Establish contacts with all vendors to make sure that they could operate under this type of scenario.
- Support computer systems.
    - Increase technical infrastructure to allow for at least half of the staff to work from home using the internet.
    - Increase the number of phone lines for remote dial up communication with the mainframe.
    - Consider having a facility for a few IT staff members to stay on site (or at the DR site) to make sure the mainframe/servers are operating.
        - ▪ Select members based on family status.
        - ▪ Negotiate special pay rates for those employees for the duration of the outbreak.
    - Make sure that the DR sites are at least 100 miles away form the main office location.
    - Consider relocating the DR site, instead of creating a new one.

    - Consider meeting other public organizations with similar systems to pool resources into a systems only site:
        - The DR site could just have the infrastructure to resume operations. People would work form home, until a new recovery site location is found.
- Pay associates.
    - Acknowledge in advance the possibility that the organization or banks might not be able to transmit payroll on time, during a disaster.
    - Consider having a policy where the organization would pay a small interest, if salaries are not paid within one week of the due date.
    - Make it clear that sick people are not to go to work.
- Provide building support.
    - Train Support staff with Emergency/First Aid/Sanitation.
    - Enforce a very strict health policy for those members and make them monitor other people health.
    - Find a solution to sanitize the mail.
    - Make sure that the building could be evacuated for an extended period.
- Maintain communications.
    - An Instant Messaging system could be implemented.
    - Each employee would be pre-assigned a log in name as: Organization_my_name@XX.com
    - A call phone tree would be used to communicate with all employees.
        - Directors, Managers, Supervisors would gather personal information about employees, as personal email account, family status (kids), disaster experience, Red Cross training, etc.
    - The previous information would be used to determine which employees to use.

Note: The system would be highly dependant on the post office operating. In order to minimize risks, it might be necessary to:

- A lot will depend on the nature of the virus. Is it airborne, how long can the virus survive… Precautions such has installing an HVAC system or to sanitize mail, documents and offices need to be researched.
- Find a system to 'sanitize the mail' to prevent contamination. Putting the mail in ovens might be a solution. This would be used until all communications are done electronically.
- It might be necessary to study a plan to deliver the mail at employee's houses.
- Limit or restrict on-site counseling of members with retirement/benefit advisors.

Friends overseas (in Honk Kong) have told me about new work policies where they will be able to work from home for two months. One of them mentioned that his company was providing him with a two month supply of food and equipment so that he would not have to leave his house in case of a catastrophe. What I found while working on this paper does concern me. I think IT people are pulled in all different directions at the same time. In the world of Retirement Systems, projects are mostly compliance based.

Conclusions

I think they are many reasons to be pessimist about the bird flu. Only time will tell if we worried for nothing or if did not do everything in our power.

Some steps should be taken immediately. Organizations should probably stock up on masks, gloves and disinfecting products.

Usage of those products appears to cost around $1/person/day during a pandemic.

Also, it should be a become a priority to teach managers that it is less costly to send sick employees home, rather then have others get sick.

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Acknowledgements
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Risk Management: Avoid Project Derailment

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Abstract

The intent of this paper is to foster awareness of the elements in risk management that can lead a project to a successful path. The genesis of risk management is basically the human instinct to fight uncertainty; the more uncertain the terrain that a project encounters the higher its risk and degree of potential failure. Project mangers need to be able to identify signs of potential project derailment, which usually occurs when project dependencies (and their innate risks) are not well managed, are underestimated, or ignored. This paper expounds the value of implementing solid risk management ***methodologies*** while freely welcoming ***creative thinking,*** and managing a superlative ***communication*** plan.

Introduction

"This project was a disaster!" a client shouts frantically at the project manager during a project-closing meeting. Is this just a project manager's unsavory nightmare? Hardly. Project failure is endemic in the geo-spatial information systems (GIS) industry. Studies show that 53% of IS projects overrun their schedules and budgets, 31% are cancelled, and only 16% are completed on time and on budget (Clancy 2004.) Exhibit 1 depicts the percentage success, where:
Type 1, or project success: Completed on-time and on-budget, with all features and functionality as initially specified.
Type 2, or project challenged: Completed and operational, but over-budget, above schedule, and fewer features and functionality than originally specified.
Type 3, or project impaired: Canceled at some point during the development cycle.

Evidently, the nature of projects is risky, and the risk increases significantly with the degree of innovation of the project. Consequently, adopting a Pollyanna attitude concerning the success or failure of a project would actually be the biggest risk of all. One of the major mistakes made by inexperienced project managers is the inability to discuss the risky nature of their projects. They sometimes might go as far as to imply (to their client) that a risky project can be managed to achieve a minimum risk level, or no risk at all. Risk management needs to be accepted, assessed, and addressed by project manager and their organization in order to fight the relentless battle against project failure (Enterprise Risk Management 2003).

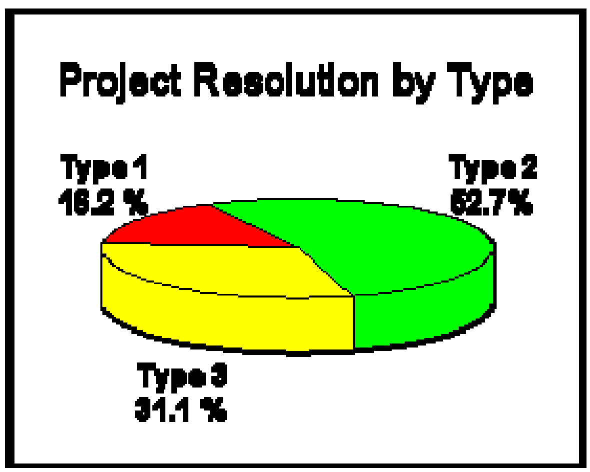

Exhibit 1. Project success rate

There is a myriad of risk factors that can derail a project and a similar amount of information to avoid *project derailment* (a "new-wave" option to indicate a lesser degree of project failure). Thus, when it comes to performing a risk analysis a project manager is avidly looking for a sliver-bullet (a cure all) that will indisputably take a project to the glorious path of success. So, how can we avoid project derailments? Unfortunately, as in the medical field, there is not such "cure." To successfully mitigate risks throughout a project's lifecycle project managers need to value the importance of implementing ***robust risk management methodologies***, ***solid communication***, *and* ***creative thinking***.

Success Driven Project Management (SDPM) is a methodology that fully integrates risk management, scope, resources and schedule. SDPM is based on the resource critical path approach (Goldratt 1997), which involves the assessment of financial constraints, resource activity floats, schedule constraints, contingency reserves, and success probabilities. A high level analysis of the effectiveness of SDPM is addressed in this paper.

It has been said that communication is the blood of a project's life cycle, and that neglecting to plan for effective communication processes is perhaps one of the biggest oversights of risk management. This document provides an approach to integrate communication as a major element of risk management by introducing best practices as it pertains to strengthening the link between risk management and successful communication.

Risks are usually assessed through a pre-defined and established business structure. However, fostering creative thinking is crucial to the identification of risks throughout the project's life cycle. A number of techniques to encourage creative thinking are discussed in this paper (e.g. Search and Reapply, Challenge Facts, and Role play.)

Success Driven Project Management

The planning and executing phases in the life of a project strongly need a solid methodology to address risk. SDPM is a project planning (and performance management) methodology widely used in the Ukraine and Russia. SDPM is supported by Russian project management software called Spider Project, which is based on a set of indicators for estimating project performance and a forecast of project success. The indicators include contingency and probability of achieving a project's goals. The success or failure probability trends are used to determine corrective actions. (Liberzon 1996.) The identified success probability trends show performance results, task dependencies and risks, the evolution of the project; and other widely used methods like Earned Value Analysis. Perhaps the biggest strength of the SDPM methodology is the support provided by software tools that supply project managers with the valuable information described in the following sections.

Planning stage

1. Project costs, dates, and material requirements that are likely to be achieved based on the requirements of the project.
2. Time, cost and contingencies that should be allocated throughout the Work Breakdown Structure (WBS.)
3. Probability of achieving user assigned project goals, (success probability.)

Executing and control

1. Contingency and probability of achieving goals.
2. Success probability to determine corrective actions.
3. Impact of any corrective action on success probability.

The SDPM methodology is mainly based on the *resource critical path* approach. The critical path is defined as: "activities with *float* less than or equal to a specified value, usually zero" (PMBOK 2004, p. 145). Float is the amount of time that a project's activity may be delayed from its early start without delaying the project finish date.

Critical path approach

1. The calculation of the critical path including all constraints (schedule, resource and financial.)
2. The calculation of resource constrained activity floats, assignment floats and identification of critical resources.
3. The calculation and management of project contingencies.
4. A project risk simulation.

Based on the above factors an assessment of the success probability can be produced, and which reports the current project status, success probability trends, and earned value data. This will allow the project manager to immediately act upon needed corrective action. Exhibit 2 shows a success probability analysis produced using the Spider Project software. The information shown on the upper half of the box is the data for a specific project. The lower half of the screen shows the success probability trends and the earned value analysis. Such data will allow the project manager to act accordingly to address the levels of risks (depending upon the information produced).

Tracking Risks

By observing the current values and trends of project success probability, project managers can obtain the needed decision tools for project planning and analysis (while integrating project scope, time, cost, resources and risk management.) Having success probability trends tracked via SDPM throughout all phases of a project should empower and motivate project managers to act immediately upon impending risks.

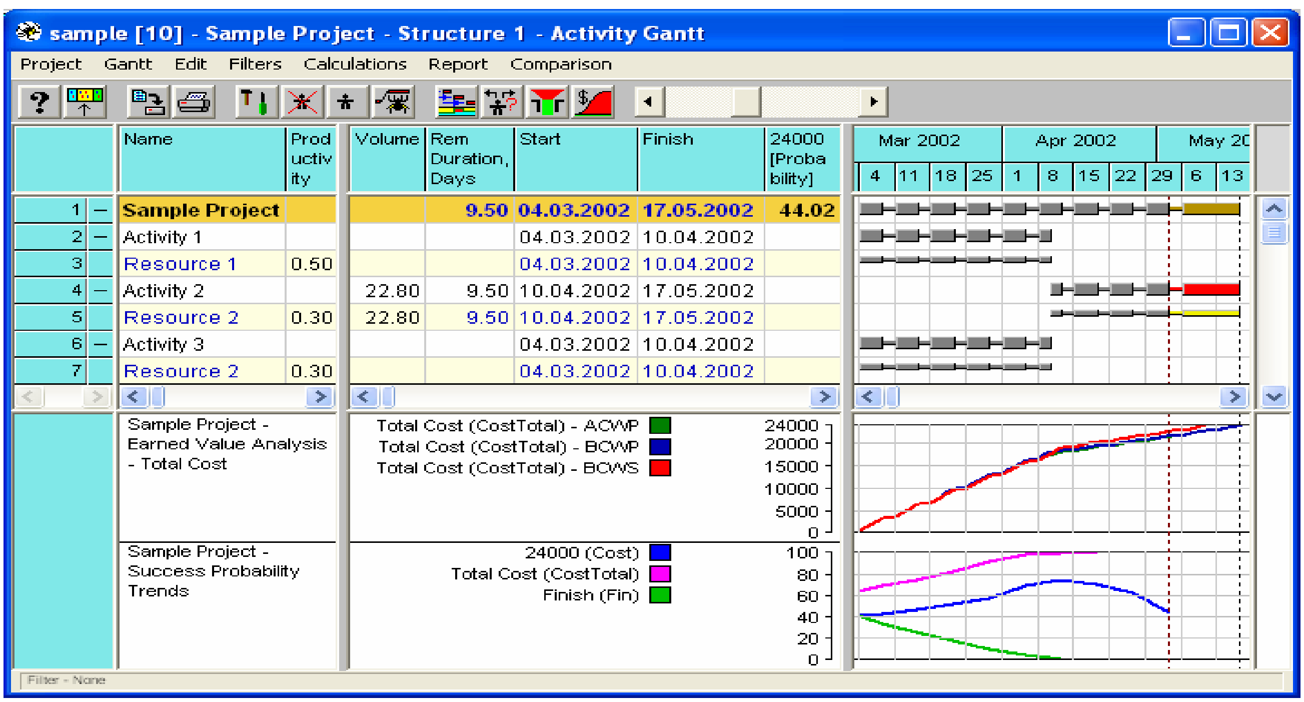

Exhibit 2. Success Probability Analysis

Communication

Achieving success in the field of project management entails an ability to mitigate risk through balancing the primary components of projects: time, cost, scope, quality, and stakeholders' risk tolerance and expectations. Exhibit 3 shows *the project diamond*, which depicts such a balance. The relationship among the elements of the project diamond is symbiotic. For instance, a change to a project's requirements would result in a scope change, which may impact cost, time and quality.

The challenge faced by project managers is to manage change while maintaining the shape of the project diamond. Given the fact that the business world is ever-changing, perhaps the most precious management tool that a project manger can have a *strong communication* plan.

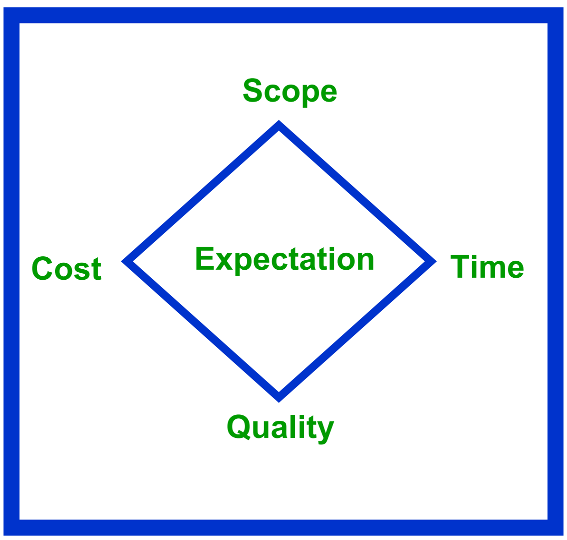

Exhibit 3. Project Diamond

Effective communication planning is not conducted in a vacuum. It must be coordinated with and carried out in cooperation with all appropriate stakeholders. The project manager must manage stakeholders' expectations throughout the phases of the project. While the details of project communication plans vary according to project complexity, size and duration, all communication plans *must* address the following:

Communication purpose: Objectives and goals of formal and informal communication activities.

Communication Method: Format and tools for the varying essentials of the communication process.

Communication frequency: Timing and frequency requirements for all formal and informal communication activities

A solid communication plan must identify and analyze all key *project variables* to suit a project's specific needs and internal capabilities. Theoretically, there is no such thing as too much communication. However, reality dictates that the complexity and size of the project will determine the amount and extent of communication provided throughout a project lifecycle. For instance, while managing a small and simple project, the implementation of an overly formal communication plan would cause administrative burden, productivity drain, and schedule over-run. Conversely, informal ad-hoc communication applied to a complex and large project would quickly damage the reputation and credibility of a project manager.

Communication Variables

To optimize the success of project communication plans, strategies must be implemented to suit the nature of a particular project and to address its special needs and circumstances. All communication plans must incorporate *four variables*:

1. Project requirements:
   In order to implement effective communication project managers must consider the project needs included in the following factors: A) Project type, size and risk. B) Technical complexity. C) Organizational reach. D) Cost and budget. E) Business value.

2. Communication requirements:
   Once the project factors have been identified and assessed, the communication's goals need to be

identified. Planning the *purpose* of the communication can be grouped as follows: A) Information flow. B) Status reporting. C) Meeting management. D) Decision and approval processing. E) Issues management. F) Feedback management. G) Change management (Lam 2003).

The needs and value of communication will intensify exponentially to the complexity and visibility of the project's factors. Exhibit 4 depicts this concept (Laufer & Hoffman 2000). It is important to understand a project's degree of necessary communication to achieve success; a very small project when exposed to a formal communication strategy would risk to unnecessary effort, wasting resources and time.

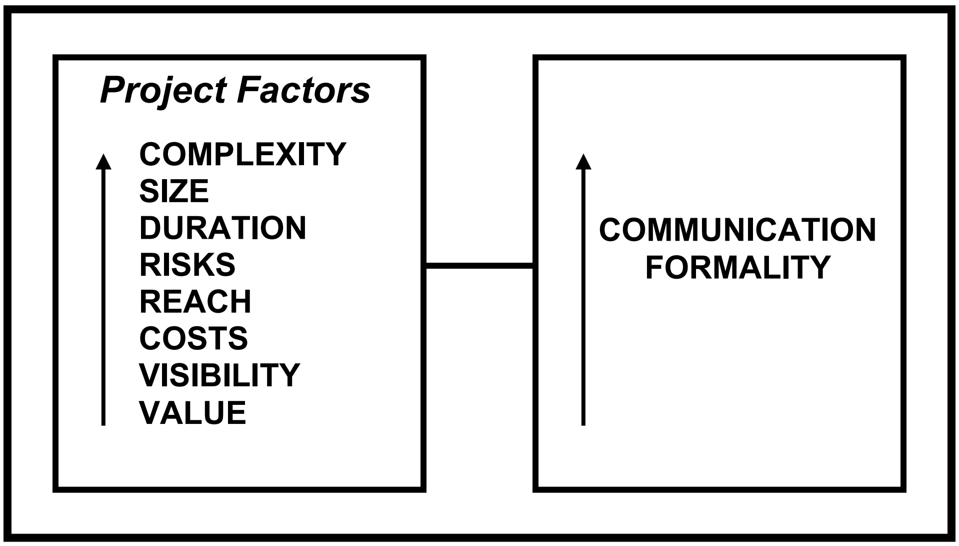

Exhibit 4. Communication formality increases exponentially to the degree of project factors

3. **.**Technical capabilities:
   Once the appropriate level of communication is identified, every available channel of communication must be gauged to assess the technical capabilities of delivering information to stakeholders (based of course, on the nature of the project.) To develop a strong communication system, project managers must understand the availability and the capabilities of each of the various communication systems offered at their business environment. The basic factors to consider are: A) Accessibility of the system by stakeholders. B) Associated usage cost. C) Training needs. D) System must cover project's needs.

4. Staffing considerations:
   Communication plans will always add "processing" overhead to the project; consequently, a project manager must be aware of staff availability when designing the plan. Meetings demand time from staff; status reports need to be prepared and distributed; presentations must be created and presented; etc. Consequently, communication strategies and activities must be implemented after the costs and benefits are weighed, scheduled demands are considered, and resource constrains are assessed. Attention must be given to the following factors: A) Balance information requirements against staff availability. B) Status reporting should not interfere with

actual project effort. C) Maintain control of the effort spent in meetings and reporting.

Communication's Strategy Guideline
Although effective communication plans will develop from a careful balance of project needs, communication requirements, technical capabilities and staff considerations, the *glue* of an effective communications plan is the tools available to cohesively maintain all of the discussed factors. *Appendix A* provides a detailed guideline of the essential tools necessary to achieve successful communication in project management. (The information is fictitious to provide a thorough example.)

Creative Thinking

When faced with risky situations during a project's lifecycle the innate tendency is to abide by what is *known*. That is, what have we done before to address a perilous situation like the one at hand? Most project mangers would argue that there is nothing wrong with following a proven solution. However, just because a process has been proven to work does not necessarily mean that such process is the *best* approach to resolve the particular issue a project might be facing. Successful project management fosters *creative thinking* to eliminate, or mitigate risk.

There is a NASA's anecdote that appropriately underlines the value of creative thinking in risk management. In the mid 1970's engineers at NASA were faced with the task of decreasing the weight of the Shuttle's external tank. Countless hours were spent studying the tank's design and trying to identify where to cut back on weight. Legions of PhD's in physics were brought-in to study the design and assess the options, to no avail. Then, during a lunch break one of the physicists went to the Shuttle's hangar to meditate on the issue. While there the physicist engaged in a conversation with a mechanic who was painting the Shuttle and commented on the weight issue, to which the mechanic replied: "That is not a problem, just stop painting the tank and you will take 700 pounds off this bird." (To this day this anecdote is, understandably, highly controversial, to the point that some might venture to classify it as an urban legend.) (Murnaw 2003)

Theoretically, creative thinking is concerned with merging two previously individual thoughts, products, or processes to stimulate the production of new ideas. However, in practice merging two unrelated thoughts to pursue new ideas (and consequently arrive to a solution of a concern) might not be as easy as the theory makes it appear. Thus, several creative thinking techniques have been developed to stimulate brainstorming (outpour of new ideas to be merged into a solution) (Archibald 2003).

Search and Replace Technique
This technique involves finding a stimulus by looking into another area of expertise (from that of the issue at hand), to find a process which has solved a similar concern. Once processes are identified one must discern how to reapply that solution to the specific issue at hand.

There are several questions that must be asked in order to stimulate new ideas using this technique, and below are the most commonly used:

- Who else has solved this issue?
- What similar area of expertise might have solved this issue?
- Is there anyone else in the company who knows how to solve this?
- What else could we use to solve the issue?
- Where else might this concern have been solved?

- What other companies might know how to solve this?
- What similar problems have been solved, and how?
- What other industries face the same concern and what do they do about it?

Participants applying this technique gather all of the answers to the above questions and select the most suitable to resolve the concerns at hand.

Challenge Facts Technique

This technique is based on the observation that facts are actually just the most reasonable, educated guess of an event, and based on what is known at the time of such event. Our world is in a constant state of change. Our views vary as we grow and gain knowledge concerning our environment. Goals, ambition, and morals change from one generation to the next. What seems impossible today will be plausible within a year and a common event shortly after that. Consequently, challenging what we know as facts today can stimulate the fabrication of new ideas which can ultimately serve as a vehicle to solve an issue or seize an opportunity.

The challenge facts technique asks for participants to consider what they believe to be facts and investigate what differences and advantages it would make if those facts were not truly facts. The following questions can help participant to challenge facts:

- What could happen if those facts are totally wrong?
- Can you modify the fact to seek improvement of the situation?
- If this fact were to change in the future, would it be better viewed?
- What new ideas would such new view of fact can be generated?
- Can you find new hypothetical facts to replace this fact?

The main point to remember is that one must view this technique as a tool not to prove someone wrong, or inaccurate, but a tool to investigate what might happen if the fact at hand were not true. Remember, one must use the challenged facts as a stimulus for new ideas, plain and simple. This technique is widely used in product improvement because of its powerful stimulation of new ideas, risk management, and product diversification (Active Risk Management 2006).

Role Play Technique

This technique fosters the ability to change a participants' perspective by getting them to role play a different individual and to assess how that individual would approach the issue at hand. In the business world is not surprising to obtain ten different views of a problem in a meeting attended by ten people. The best way to assess a situation is to see it from someone else's point of view. Why? Different people use different bits of information, knowledge and experiences to approach the same problem.

It is extremely valuable to view a task from different angles. There is no secret that project managers often appear to live in a different world than that of technologists, so imagine the ideas that can be generated as one takes the role of both occupations and plays around with the synergy of thought!

First, participants of this technique need to select an occupation to role play. Once an occupation is selected then individuals need to approach the issue, risk, or opportunity at hand in the way that the character being role-played would approach it. The following questions can be used to stimulate the role play and consequent generation of ideas:

- How would they think?
- What objects and items would they be using?
- Where would they be doing it?

- How would they see the problem?
- What action would they take?
- How would they explain the problem?
- How would they solve the problem?

This technique is widely used by project managers to resolve communication problems among internal groups (Archibald 2003).

Foster Creative thinking

It is often believed that by simply brainstorming, people would generate enough of a stimulus to prompt them to act differently upon a problem. To a certain extent such a belief is true, but it is normally enough to make a change or to aggressively approach a problem. Project managers need to foster creative thinking among the team and encourage them to challenge what is known, replace the current problem with a different value to obtain different results, and to view a problem from as many angles as they can possibly perceive.

Summary

This paper presents three essential factors that must be included in all projects regardless of complexity and size:

1. The implementation of a robust risk management methodology (such as SDMP.)
2. The implementation of a solid communication plan
3. Fostering of creative thinking as stimuli to generate ideas.

Through the implementation of these factors project managers should be able to support essential risk management processes and develop a risk control to avoid project derailment.

Conclusions

Delivering a successful project entails managing its risks by paving the path to its delivery with solid risk managing tools. The role of project management is to turn the uncertainty of an impending event into certain outcomes and assurance. Recognizing and accepting that uncertain events must be associated with risks is essential to the initial stages of developing a risk management methodology, a solid communication plan, and maintaining an open mind concerning the nature of the issues by fostering creative thinking.

Project derailment usually occurs when project dependencies (and their innate risks) are not well managed, are underestimated, or ignored. To excel at risk management, project managers need to accentuate the importance of evaluating and addressing risks throughout the project's lifecycle. They need to implement the necessary tools that will allow them to identify the interactions between risks across all phases of a project (Lam 2003).

The genesis of risk management is based on the need to avoid project derailment. Thus project mangers must utilize ***methodologies*** that provide effective risk identification, assessment and mitigation. The approach to risks must always allow for ***creative thinking*** (and creative initiatives) to address those risks, acknowledge them, and ***communicate*** their impact on the project.

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Communication Strategy Guideline

What	Target	Purpose	Frequency	Method	Date	Notes
Initiation Meeting	All stakeholders	Gather requirements Gather information for Initiation Plan.	▪ FIRST ▪ Before Project Start Date	Meeting		
Governance Meeting(s)	Governance Boards	Gather information for Initiation Plan.	▪ Before Project Start Date ▪ As required	Meeting		
Distribute Project Initiation Plan	All stakeholders	Distribute project plan to alert stakeholders of project scope and to gain buy in.	▪ Before Kick Off - Meeting ▪ Before Project Start Date	Document distributed via hardcopy or electronically.		
Project Kick Off	All stakeholders	Communicate plans and stakeholder roles and responsibilities. Encourage communication among stakeholders.	▪ At or near Project Start Date	Meeting		
Status Reports	All stakeholders and Project Management Office (PMO)	Update stakeholders on progress of the project.	▪ Regularly Scheduled ▪ Frequency based upon project size & priority ▪ Weekly is recommended for large/midsize projects	Distribute electronically		
Team Meetings	Entire project team. Individual meetings for sub-teams, technical team, and Functional teams as appropriate.	To review detailed plans (tasks, assignments, and action items).	▪ Regularly Scheduled. ▪ Weekly is recommended for entire team. ▪ Weekly or bi-weekly for sub-teams as appropriate.	Meeting		
Project Advisory Group Meetings (may apply only to larger projects)	Project Advisory Group and Project Manager	Update Project Advisory Group on status and discuss critical issues.	▪ Regularly Scheduled. ▪ Monthly is recommended.	Meeting		
Sponsor Meetings	Sponsor(s) and Project Manager	Update Sponsor(s) on status and discuss critical issues. Seek approval for changes to Project Plan.	▪ Regularly scheduled ▪ Recommended biweekly or monthly and as needed when issues cannot be resolved or changes needed to Project Plan.	Meeting		
Executive Sponsor Meetings (may apply only to larger projects)	Executive Sponsor(s) and Project Manager	Update Sponsor(s) on status and discuss critical issues. Seek approval for changes to Project Plan.	▪ Not regularly scheduled. ▪ As needed when issues cannot be resolved or changes needed to to Project Plan.	Meeting		
Post Project Review	PMO, Project Manager, key stakeholders, and sponsor(s).	Identify improvement plans, lessons learned, what worked and what didn't. Review accomplishments.	▪ End of Project, or end of major phase	Meeting/Report Project Manager will produce report.		

What Ancient History Can Teach Us about Modern Risk Management

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Abstract
In 221BC, Emperor Qin Shi Huangdi had a problem. He accomplished the unification of China from nine disparate states, standardized legal codes, language, character sets, coinage, and even weights and measures. He built a centralized government to replace the old feudalistic one and through ruthless means, silenced other schools of thought and philosophy to focus on legalism. Still, he faced his biggest risk: how to keep his loyal nationalists in the country while fending off attacks from neighboring barbarians. To mitigate this risk, he ordered fortifications originally built to protect the individual disparate states to be joined into a giant wall, later becoming The Great Wall of China.

The story of Qin Shi Huangdi's rule over China might seem an odd way to begin a discussion about modern project risk management. But it's not. By looking backward, it is possible to examine lessons learned and apply them to projects today.

Finding Analogous Projects Is Not Always Easy

If a project is defined by PMBOK (2004) as "a temporary endeavor undertaken to create a unique product, service, or result" (Project Management Institute, 2004) how is it possible for a project manager to find analogous projects to study for comparisons and understanding of potential risks faced by predecessors? After-action reviews and project archives on prior projects within your company may not be able to give you enough insight into the potential risks for your particular project.

Is it good enough to declare that the risks you may face on your project are things you cannot know about from the start? Or is deeper analysis required? By cracking the spine of your old history book, it is possible to discover inspiration and analysis. With a little creativity and imagination, ancient history can have more to teach us about project management and risk management than at first meets the eye.

How old is the concept of risk management? Did it just spring to life in the past few decades or has it been around for many millennia? Case studies abound of project managers using modern techniques to accept, avoid, mitigate, or transfer risks on their projects.

As Project Managers, we're taught to analyze risks and assign priority and costs to risks and to use tools and techniques to proactively control risks on our projects. So is this concept of managing potential risks, or threats, to projects new? Or has the term "risk management" been coined recently to raise awareness in business to the need to plan for and deal with risks on projects and in business in general?

Unlikely Sources Of Inspiration for Risk Analysis

Flipping through the pages of history, there are many examples of decisions that could qualify as risk management in practice. Perhaps the term is new, but risk management is not. Asking the question "what if this happens" and answering "then we will do this" has been happening for as long as there have been assets worth protecting. The old saying "an ounce of prevention is worth a pound of cure" defines risk management in terms anyone can understand.

A few hundred years ago, medieval castles in Europe were built to withstand the constant threat of invasion from warring armies and their arsenals of weaponry such as trebuchets and metal-tipped arrows. Building castle walls of stone and mortar thick enough to withstand an enemy's fire is clearly an example of proactive risk management.

Drawbridges, moats and turrets were all answers to the medieval question of "what if our enemies or their artillery come too close to our castle?" Castles may offer literal translations for the need to protect your modern project from a variety of risks, but how about studying ancient civilizations whose present-day ancestry is still benefiting from proactive decisions made to mitigate risk?

The Story of the Birth of China

Qin Shi Huangdi called himself the "First Emperor of China." Through a series of bloody wars, his army had finally accomplished the unification of nine disparate states into a single country in 221 BC (Emperor Qin Shihuang's Mausoleum). No sooner was Qin Shi Huangdi's triumph of unification celebrated when risks appeared to threaten to tear at the seams of the newly-named country of China.

Each of the nine states had their own legal codes and philosophies of government. Qin Shi Huangdi recognized this as one of his greatest risks and immediately established a standardized legal code (Xian History: The First Emperor of China - Qin Shi Huang). Similarly, he replaced the old forms of government with feudalism and silenced all schools of philosophy except legalism through ruthless means (Xian History: The First Emperor of China - Qin Shi Huang). Observing the tremendous risk of opposition to his new government Qin Shi Huangdi buried students of Confucianism alive in order to mitigate the risk of an uprising among philosophers (Emperor Qin Shihuang's Mausoleum).

Such brutality was commonplace in the early years of China, but the impact this had on the country cannot be denied, as the feudal form of government first established by Qin Shi Huangdi persisted for well over 2000 years (Xian History: The First Emperor of China - Qin Shi Huang).

Differing languages, character sets, coinage, weights and measures were seen as a threat to commerce in the burgeoning new country. Qin Shi Huangdi recognized this as a risk to commerce and prosperity so he quickly instituted a national language, a single character set, one type of coinage, and standardized weights and measures (Xian History: The First Emperor of China - Qin Shi Huang).

The mitigation of this risk early on in the country's inception allowed trade to exist where it had never existed before. To further minimize the risk of China's economic failure and to open up trade routes within his country, Qin Shi Huangdi mandated the construction of the equivalent of modern-day expressways (Emperor Qin Shihuang's Mausoleum).

Recognizing the risk of invasion from jealous neighbors as a constant threat, Qin Shi Huangdi knew he needed an army, much larger than his original army, to stave off attacks. To mitigate the risk of not having a large enough army to defend the country, Qin Shi Huangdi enacted a form of conscription, ensuring every male aged seventeen and sixty years spent at least one year in the army (Xian History: The First Emperor of China - Qin Shi Huang).

After pervasive attacks by bordering nations, Qin Shi Huangdi decided the risk to his young country was even greater than his army could handle. In an effort to mitigate the risk of an invasion and possibly the dissolution of the newly formed country, Qin Shi Huangdi expanded the fortifications built originally to protect the individual disparate states into a giant wall running the perimeter of the country (Xian History: The First Emperor of China - Qin Shi Huang). This giant wall, during the Ming Dynasty, became The Great Wall of China.

How to Use the Story of the Birth of China to Analyze Risks

By evaluating Qin Shi Huangdi's decisions while unifying China in 221BC in more modern terms of business, project and risk management, we can gain an understanding of how to use history to teach us how to mitigate risks on a project.

A very literal translation would be to use the lessons of Qin Shi Huangdi to manage a project to merge a number of smaller companies into a larger one. But with a little creativity and imagination, the lessons can apply to a number of different projects and mitigation strategies for risks.

By unifying the nine states into a single country, Qin Shi Huangdi fulfilled a vision set forth many years before of unification. The strategy to combine the nine states was one that had been in the minds of many in power long prior to Qin Shi Huangdi's ascent to the throne.

One of the greatest risks when small companies merge into one large company is lack of proper planning and strategizing. Due diligence prior to a merger is critical to mitigate this risk. Understanding the businesses, the cultures, the systems and the people comprising the merger is an incredibly complex undertaking that requiring many hours of deep analysis before strategies can be developed and decisions made.

Failure to plan for the nuances of combining multiple businesses into one can lead to disastrous consequences and may leave the fledgling company defenseless against further acquisition by predator companies seeking to gain from the misfortune of others.

Once Qin Shi Huangdi conquered the nine states, he enacted a series of strategies aimed at consolidating the country. A post-merger integration plan must be built after due diligence has been performed to ensure proper alignment to the newly formed company. Such decisions such as who will be in charge and what direction they will take the company in must be made to ensure success.

Sensitive decisions surrounding layoffs may be best left to a Change Agent to absorb any residual animosity. If clear management direction is not set swiftly after the merger, chaos will likely overrun the company and productivity will surely suffer. It is imperative for the employees of the smaller companies to realize their new corporate identity as quickly as possible and to see their new management as leaders who will grow the company and who will ultimately build prosperity for their employees.

After setting the tone of management for its employees, the next greatest risk to overcome is meshing together different computer platforms, accounting systems, human resource systems, and all of the processes and practices of each of the smaller companies. Included in the post-merger integration plan should be a separate plan dealing strictly with the integration of data. This must be done in order to facilitate the flow of business throughout the entire company and reduce the risk of people performing "business as usual." The goal is to unify the company in all aspects of daily work to propel the new business forward in the marketplace.

Standardization of office automation tools, practices, and procedures will mitigate the risk of poor performance. Employees must be taught how to do their jobs and must understand that doing them well increases the company's chances of succeeding in a competitive market. In addition, the corporate culture must be willing to embrace change and flourish under the new management.

Physical security isn't much different than cyber security

As part of a data integration plan, the risk of protecting the company's intellectual property must be mitigated. Without protection, there is a risk of employees splintering off in rebellion and taking intellectual property stemming from a sense of entitlement or even spite.

In addition, the risk of corporate espionage is likely because of the perception that the newly formed company is vulnerable and defenseless against attack from others, jealous of the company's larger status. Establishing corporate security and governance is imperative. Communicating the guidelines to all employees mitigates the risk of anyone pleading ignorance and limits the perception of susceptibility to corporate espionage.

Like The Great Wall of China, many companies today construct walls to protect curious or malicious corporate neighbors out while allowing the day-to-day commerce within the walls to progress. Also like The Great Wall of China, these walls – firewalls – are often favorite targets of barbaric invasion. Instead of armies of millions, today's barbarians send viruses and, borrowing from pages of history books, "Trojan Horses" to penetrate firewalls. Keeping a company's Great Firewall free from invasion may prove costly, and if not done properly, can actually fail. Even if it is done properly, the proliferation of small handheld devices such as iPods and thumb-nail memory sticks invites insiders within the company to stock up on company information all the while being silently untraceable.

Modern IT managers must think like the crafty enemy lurking at the gates or within the gates to ward off potential attacks on a company's cyber security. This is a risk that one set of gates cannot mitigate. As China found out more than once in history, a single wall is not impenetrable and is only as strong as those who serve to protect it.

Constant monitoring of the firewall, limiting personal devices permissible on the company's premises, and establishing groups of users allowed to plug in personal devices into the ports of corporate equipment can be helpful in mitigating the risk of an outside invasion or an inside job aimed at destroying or stealing sensitive intellectual property. Several layers of "walls" will certainly thwart an enemy's ill-willed intent.

However, it's not enough to simply build risk mitigation factors into a cyber security system and walk away. Frequent audits of the system must be performed to ensure its stability and expose any liabilities before they become known to the outside world. These audits are referred to as "attack and penetration" tests and are preferably conducted by an outside firm whose job it is to expose vulnerabilities. To mitigate the risks posed by the uncovered weaknesses in the cyber system, IT management must be committed to patching the holes before they have a chance to grow into breaches.

Using history to learn about modern risk management may seem like a stretch at first. We would all like to believe that modern technology sets us apart from our ancestors, but in reality, it becomes easier to draw comparisons. If you can think about the problems of yesterday's civilizations as some of the problems in today's corporate world, then you can begin to interpret what was done in the past to mitigate or avoid risks and apply those concepts to your own projects. With a little creativity and imagination, analogous project research is as easy as opening the pages of your history books.

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On-line Discussions to Mitigate Communications Risks in On-line Courses

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Abstract

The single greatest challenge in projects designing and delivering an on-line course is to duplicate, or replace, the classroom face-to-face interaction between students as well as between students and their instructor. Both channels of interaction were, and still are, required to facilitate the learning process. In those early days of on-line education when I was squarely and firmly on the traditional (live) side of the argument, I delighted when students denigrated on-line because courses of the lack of student interaction. Time, financial pressures and increases in technology have forced a greater adoption of on-line education. The interaction problem has not been dealt with or perhaps it would be fairer to say that it has not been solved. One possible solution is the reason for this paper.

Introduction

All of the usual project risks are present in on-line course design and delivery. As with any other project these risks must be mitigated and in this paper I plan to identify two communication risks and one grading risk as well as the tactics to mitigate those risks.

The two communication risks are; failure of student-to-student interaction and failure of student-to-instructor interaction. The grading risk is one of large on-line classes divided among numerous facilitators whose application of grading standards will vary.

The tactics to mitigate the student to student communication risks and risks to grading uniformity are the use of on-line discussions that are graded via a very specific set of grading rubrics. Instructor to student communication risks utilize a tactic of entertainment rich video/audio lectures that support the presentation tools and the written word used in the course.

I have designed and delivered numerous (perhaps one hundred) on-line courses and found that the course designer must concern them self with the “entertainment level” of the offering. The use of video/audio supporting the other tools in the course is a tried and true method of increasing the entertainment level and hence the interest level of a lecture.

This entertainment level can be increased simply by the designer insisting that the instructor present their lectures in some video format. The entertainment level, of course, increases with a more animated presentation of the lecture by the instructor. I have also found that the material covered in an audio/visual lecture is far more entertaining if it is presented in terms of the instructor’s personal experience versus “straight from the textbook.”

On-line discussions provide more opportunity for dialogue. I will be explaining the use of grading rubrics in more detail outside of this introductory section. For the purpose of introduction, however, it should be noted that all three risks; failure of student-to-student interaction, failure of student-to-instructor interaction as well as failure to grade uniformly across a large class with numerous facilitators are each mitigated, in part or in total, by the use of on-line discussions graded via detailed rubrics.

On-line Discussions

The following quote from the Catalyst Website of the University of Washington sums up current thinking regarding how on-line discussions should be handled. It was certainly my starting point when I developed on-line discussions graded via a very specific set of grading rubrics. "Choose technologies for your distance learning course – On-line discussions - An online message board is a great way for distance learning students to communicate with each other and you. A message board allows students to discuss course topics online, respond to each other's comments, and share ideas. As the message board administrator, you can designate the participants for your message board, suggest topics for discussion, and monitor the participation of individuals on the board."

The courses I design use the same technology and methods as above to facilitate discussions, with the following exceptions:

- Discussion questions are assigned via the syllabus.
- Discussions require three submissions.
  1. An initial submission answering the discussion question
  2. A rebuttal to another students Initial Submission
  3. A rebuttal to a second students Initial Submission
- Both Initial and Rebuttal Submissions are graded via the use of separate Initial and Rebuttal Rubrics.
- The output of the grading rubrics constitute 20% of the students' grade.
- There are three separate grades for each discussion assignment each having a weight of 33% to the combined grade.
- The use of both grading rubrics are two fold:
  1. To cause active participation in the discussion by explaining, through the rubrics, how the student can earn the maximum grade.
  2. To insure uniform grading across a wide cross section of facilitators, teaching assistants and or instructors.

The other major difference is one of intent. It is my intent to cause the students to interact with the instructors and classmates at least as much as they would in a traditional classroom. The fact that there are points to earn is the beginning of the student's motivation. As the students use the rubrics and become accustomed to the entire Discussion & Rebuttal process their motivation shifts from a good grade to the participation in a spirited debate.

I have seen students who have completely given up on class participation "virtual chatterboxes" given only the slightest exposure to the thrill of heated discussion/debate. This is not a situation where students who speak up in "live" class are replaced by those who find their voice on the keyboard. It is, rather, a broadening of the number of students who participate in classroom, live or virtual, discussions.

One view of why we have a higher rate of participation in class discussions, by those who would be silent in traditional classroom discussions, is that the new participants are students who crave (or require, or utilize) virtual anonymity before they risk participation. This may well be the case, however performance data has not, as yet, supported this hypothesis. In addition to lack of data, a casual observation of the occupations among the 500 plus students who have taken courses using this method show a profile of individuals who are required by their job function to have and hold strong opinions. The general make-up of previous classes is individuals who work in the insurance or banking industry. When looking at this combined group it does not generate an image of the pasty faced, tech weenie, closeted away in a basement office who speaks out only in an anonymous chat room.

How it Works

As seen by the students

Students receive the information in Exhibit 1 in their Syllabus regarding their Discussion Assignments.

An Evaluation Rubric will be provided for those elements of the course that are qualitative in nature e.g., Discussion Assignments. All other elements (Exams and Analysis Exams) will be will be tested via Multiple choice, True False, etc. methods and graded on a points earned basis

Participation (Discussion Assignments)	20%
Midterm Ops Mgt & Analysis Exam	40%
Final Ops Mgt & Analysis Exam	40%

Exhibit 1: Course Grading

Students receive the instructions shown in Appendix A for their Discussion Assignments. These instructions are for an actual assignment in a Project Management Teams and Communications on-line course. The first two paragraphs relate specifically to this assignment in this course. The remaining instructions are generic to all of my courses using a grading rubric.

Discussion Grading Rubric

Initial Submission

Criteria	Grades
Submission is approximately 250 words. Writing skills are excellent. Submission on/before day three. Arguments are logical and well thought out. Several other sources cited. Submission poses challenge to classmates for rebuttal.	90-100 points
Submission is approximately 150 words. Writing skills are adequate. Submission on/before day five. Arguments are adequate. One other source cited. Submission poses little challenge to classmates for rebuttal.	80-89 points
Submission is approximately 150 words. Writing skills are adequate. Submission on/before day seven. Arguments are few, but adequate. No other source cited. Submission is too late to allow for classmates' rebuttal.	70 – 79 points
Submission is less than 150 words. Writing skills are sub par. Submission is late. Arguments are few and do not support submission. No other source cited. Submission is too late to allow for classmates' rebuttal.	69 or less points

Exhibit 2: The Grading Rubrics for the Discussion Topic Submissions

Discussion Grading Rubric

Rebuttal Submissions

Criteria	Grades
Two submissions are each approximately 125 words. Writing skills are excellent. Submissions are received on/before day five. Rebuttals are logical and well thought out. Other sources cited. Submissions pose challenge to classmates further rebuttal.	90-100 points
Two submissions are each at least approximately 75 words. Writing skills are adequate. Submissions are received on/before day seven. Rebuttals are adequate. Other sources cited. Submissions pose challenge to classmates further rebuttal.	80-89 points
One submission of approximately 75 words. Writing skills are adequate. Submission is received on/before day seven. Rebuttals are adequate. Other sources cited. Submission poses challenge to classmates further rebuttal.	70 – 79 points
One or two submissions of less than 75 words. Writing skills are sub par. Submission is received late. Rebuttals are adequate. Other sources cited. Submission is too late to allow classmates further rebuttal.	69 or less points

Exhibit 3: The Grading Rubrics for the Discussion Topic Submissions

As seen by the Instructors and Facilitators

The principle contact with students is through the facilitators. It is the facilitators that grade the initial and rebuttal submissions, give feedback on the quality of that work as well as council the students on overall course performance.

Appendix B contains a list of frequently asked (and answered) questions. I have built this list over a half dozen courses utilizing the grading rubrics. The "FAQ" document is sent to all facilitators before the beginning of the course. Taken together they represent a "primer" for facilitator's use of the rubrics. Viewing the facilitators questions and resulting answers is another way of looking at the more detailed instructions that I, as instructor and course author, give to the group that will be grading these assignments in the hoped for uniform method. It should be noted that these questions are usually asked only the first time the facilitator works on a course using the rubrics. After their initiation they become tutors for the next batch of new facilitators.

What has been learned?

A template for results.

In their March 2000 study titled "*Content analysis of online discussion in an applied educational psychology course"* authors Noriko Hara - Indiana University, Curtis Jay Bonk - Indiana University and Charoula Angeli - University of Pittsburg analyzed discussion in an online conference using an instructional method called the starter-wrapper technique within a traditional graduate level educational psychology course. Although the starter-wrapper technique is very different from the use of a grading rubrics both method netted similar results. In the above study the following was noted:

> *"Transcript content analyses showed that, while students tended to post just the one required comment per week in*

the conference, their messages were lengthy, cognitively deep, embedded with peer references, and indicative of a student oriented environment. Moreover, students were using high level cognitive skills such as inferencing and judgment as well as meta-cognitive strategies related to reflecting on experience and self-awareness."

Rubric results.

I believe that the above study found exactly the metrics with which to measure success

Rubrics Results		
Average grade	258 Students	91.3 Ave. Grade
Number of words over required 250/125	150 Students	103 / 76 words over
Distribution showing larger inclusion of discussion participants.	Normal Distribution had Mean = 91.3	Shows approximately 75% of the curve within B+, A- & A grade ranges

Exhibit 3: Grading Results showing quality and quantity of interaction and uniformity across facilitators

I have recorded most of the 2000 graduate and graduate student grades. In most of my classes there are grades for "Participation," a.k.a. interaction between the student and their classmates. The average grade across traditional and on-line courses is a numeric grade of 88.7. As you can see from the above the average grade is 91.3, which given the dictates of the rubrics requires maximum participation to earn a 90 to 100 grade. Also in applying the direction of the rubrics we can reasonably assume that the initial and rebuttal submissions are "*cognitively deep, embedded with peer references, and indicative of a student oriented environment"* since these (worded differently) are requirement of the rubrics. The second measurement on the above table is on of answer length. Setting the rubrics standard at 250 for initial submissions and 150 for rebuttal is based on my personal experience. I have found, specifically on essay exam, that a student requires two blue book pages to include the right amount of content in their answers. The average student will fill two blue pages with 250 words. In the Rubrics Results chart above, we find that of the 150 students measured, on average, exceeded the minimum initial requirement of 250 words by 103 words and 76 words over the 150 rebuttal requirement. One may assume from these figures that students begin with the dictates of the rubrics for an excellent grade but soon find themselves exceeding the minimums to make their point or win their argument.

and would like to claim the same results as above when the grading rubrics is used. That is;

"*their messages were lengthy, cognitively deep, embedded with peer references, and indicative of a student oriented environment. Moreover, students were using high level cognitive skills such as inferencing and judgment as well as meta-cognitive strategies related to reflecting on experience and self-awareness."*

The last measurement claims that if you were to view the grade distribution curve that it would be normal and the mean equal to 91.3. This would indicate that once the numeric grades had been converted into letter grades (for Participation only) over 75% of the class would have earned a B+, A- or A. This is a much larger inclusion in the ranks of the higher grades than is normal. If you consider, per the dictates of the rubrics, what it takes to earn these high level grades, you may reasonably assume that students are using higher level skills as they are challenged by the task and their classmates.

All three of the above measurements, ultimately, lead to the assumption that grades falling into normal distribution are applied uniformly across a large number of instructors/facilitators.

Notable Quotes

Before leaving the "results" section, I wanted to share some feedback we have received on courses where "instructor entertainment level" and "the grading rubrics" were used to mitigate risks to communication.

I couldn't believe that I "talked" so much in the discussions and rebuttal! I usually do the minimum for a passing grade, but there was something in the interaction between the other students and my self that had me writing more than what was expected. I really got into it.

I thought that the lecture materials, particularly the videos and PowerPoints w/audios, really added to the course …they added variety to reading the lecture materials, and kept it more interesting.

I thought the lecture content/variety in this course were among the best…

The rubrics was great! Finally a grading tools that told us what was required to earn the grade you wanted to shoot for.

Overall, I think that BU has improved the overall quality of the online experience… I would recommend the program to others.

Exhibit 4: Notable Quotes

Conclusion

Using entertainment rich audio/visual lectures, by an animated instructor who adds the "personal touch" to his/her lectures with his or her own experiences, is an excellent way of adding to the instructor/student interaction. While it is true that this interaction is virtual its value manifests itself in the other elements of the course.

The risks of poor communication or no student to student interaction of non-uniform grading are mitigated by using class discussions that employ grading rubrics. Simply employing the rubric is not sufficient to completely remove all risks. You will, as designer or instructor, need to insure that students and facilitators are "schooled" in its use. You will also need to closely monitor the grading results and student evaluations. My results have proven, for me, that attending to the "entertainment value" of virtual lectures and the use of grading rubrics in class discussions has mitigated, if not obliterated the two risks to communication and one risk to grading uniformity. With close attention to course design, instructor performance, the installation, training and control of discussion grading rubrics, you too will see similar results.

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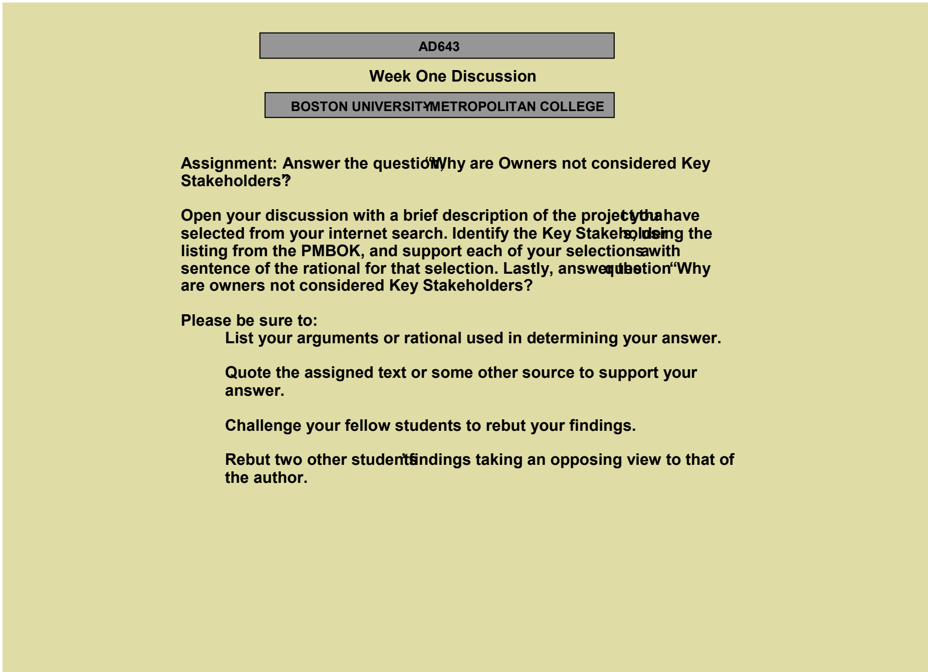
Appendix A: Discussion Assignment Instructions

"Open an internet search tool. I have used Google in the example shown here, but any tool will do. Do a search for a project. It would be a good idea to look for large projects as these will suit the assignment better and will yield the material more readily that is needed. If you have a project in mind, use your project and save your self this first step. For example, I have used Boston's "Big Dig" project. I'd like you to use another project because you will be doing some "detective work" and to just follow along with my example will not have any benefit to you. So open the search engine and either look for a big project or search of a project that you have some knowledge about. Once you have results on a specific project you are ready to begin the assignment tasks.

The assignment is to submit an initial discussion topic with a brief description of the project that you have selected from your internet search. Then, using the listing from the PMBOK, identify the Key Stakeholders and support each of your selections with a sentence describing your rational for that selection. Lastly, answer the question "Why are owners not considered Key Stakeholders?

"Your initial discussion submission should be at least 250 words. Try to be succinct and stay close to 250 words. I know this will sound illogical but most students tend to go well beyond this guideline. Your grade will not suffer if you have more than 250 words but it will make your submission more challenging to read and rebut. The point of this assignment is for you to find and display your finding for your classmates and their job is critique, in their rebuttals, those findings. So stay close to the guidelines and everyone will benefit.

Once you have found answers to all the requirements of the assignment go to the Discussion Area and submit your findings. Please be sure to, as the assignment suggests, list your arguments or rational used in determining your answer, quote the assigned text or some other source to support your answer and challenge your fellow students to rebut your findings. This is your "Initial Submission" and is now visible in the Discussion Area for your fellow students to rebut.



*** Note – Both the PowerPoint slide (visual) and audio voice-over from the course re-affirm the increasing point values that may be earned by adhering to the Rubrics.

Depending on when you submitted your Initial Submission, wait a day or two and then go back to the Discussion Area and rebut two Initial Submissions from two of your classmates. Rebuttals should be approximately 125 words each. As with Initial Submissions you will not be penalized for exceeding this guideline but being succinct is always better than being verbose. Also, try to find submissions with which you disagree. It is always easier to say "I totally agree with your findings," than to offer an opposing opinion or findings. These opposing views, however, are always better learning tools.

Once you have submitted your rebuttals the assignment is complete. You should now go to your initial submission and read the rebuttals submitted. If you have extra time in your study schedule, you are certainly free to carry-on the discussion or "rebut the rebuttals." This will further validate your findings and increase your knowledge on the topic. But, as I mentioned, this is on a "time available" basis and sadly most students will find their schedule "tight" to say the least.

Grading for the both Initial and Rebuttal submissions are based on the rubrics show (See Exhibits 1 and 2 below). This is a fairly straight forward method of allowing the student to tailor their submission to the grade they would like to receive.

If you spend a moment reviewing the criteria and grades you'll find that your grade is calculated on some very basic criteria; amount of content, quality of content and timeliness of submission. Many students find that they write the first few submissions to achieve the highest grade possible.

Then, after these first few submissions, they shift their focus to the educational intent of the assignment which is to practice the skill or test the knowledge gained in that section of the course. Regardless of whether you are targeting the highest grade or the maximum amount of knowledge, or both, you'll find that if you "write for grade" initially you will maximize the learning of the exercise."

Appendix B: Facilitator FAQ

Frequently asked, facilitator, questions:

Students seem to spending a great deal of time and energy on the Discussion Assignments. Should this be discouraged?
The discussion assignments are only 20% of the final grade. The main purpose of the discussion assignments is to motivate the students to actively participate in the course. Students should prioritize their efforts with a focus on the exams as they constitute 80% of the course grade.

Is there a "right" and expected answer?
There is no correct or perfect answer. Actually if you want to see some excellent answers check out this week's submissions. I did not see very many that I would not have awarded the full 100 points. This BTW is fine, if the students have stuck to rubric and their submissions are all "100 point" submissions, great! There does not have to be a normal distribution of discussion grades. Remember the main purpose of the discussion assignments is to motivate the students to actively participate in the course.

How do you determine 250 and 125 words?
As silly as it sounds, I actually cut and pasted them into a word document and used word count. I only did this until I felt comfortable estimating or someone was "short" of the required length. The "250 to 125" is meant to be a guideline and as long as the student gets close we should be happy.

In addition to the rubric I'm seeing these things that affect their grade; --don't put the project name in the title, --don't answer the question, --they do answer the question, but not explicitly
The phase "Arguments are adequate' in the rubric is ment to deal with the above. My rule has always been that if I can justify taking points away for things like those mentioned above, then the rubric supports these deductions.

There was some confusion in the rubric, a suggested alternative is: Submission on/before day three ---> Submission on/before due date.
The rubric was designed to impact the grade on a sliding scale of lateness and size of the answer. For instance, the student cannot get 100 points if the submission is on day five or only has 150 words. These are guidelines and I'd rather see individual interpretation (yours) of them on a case by case basis than to try to put single sentence in the rubric that would answer all the questions that all the students will have. This, need for interpretation, will be required in week four when there are two discussions. I will be issuing something on this prior to that week, but it will still need some sort of interpretation on your part.

Do you put your responses in the discussion thread for all to see or in the response when grading the student?
In the past I have made responses individual, not public as in the discussion thread. This has had some drawbacks, but they were far out weighed by positives.

Risk and Culture: A Sector-Based Exploration of Risk Tolerance

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Abstract

This paper is an attempt to stimulate new ways of thinking about risk tolerance and culture in organizations. For the most part the literature on this subject treats risk tolerance as a result of the set of values and beliefs that form the culture of an organization. Here, we first center our attention on the current thinking in the risk tolerance debate. This will enable us to position risk tolerance within the culture of an organization. Then we propose to add a sector based dimension to the debate, since it has so far gone undetected.

"When anyone asks me how I can best describe my experience in nearly forty years at sea, I merely say, uneventful." E. J. Smith, 1907, Captain, RMS Titanic.

Introduction

The inspiration for exploring the relationship that exists between an organization, its sector of economic activity, and risk culture stems in part from the fact that very little literature exists on this subject, and in part on the drive provided by the author's personal curiosity developed during various experiences in the corporate world in the US and Spain in recent years. The purpose of this research paper is to insert in the current debate on risk tolerance an initial framework of reference for further research in the direction of risk tolerance characterization by sector of economic activity.

The hope is that new research in this direction can help uncover trends that may be useful to project managers, as it provides them with additional tools and reference points ready for use in the cultural environment in which they operate. The research performed to support this effort will cover the following themes:

- Setting the stage by positioning the elusive risk tolerance concept within the cultural dimension of organizations.
- Reviewing current thinking in the field of risk tolerance behavior in an attempt to seek out the dimension that best suits the direction of our research.
- Making the case for adding a sector-based perspective of organizational culture and risk tolerance as a next step in furthering our understanding of risk culture.
- Illustrating one possible simple model for sector based risk tolerance analysis that we shall call Risk Tolerance Index (RTI)

The sectors of economic activity that were used for mock examples of sector based risk tolerance analysis were IT/Software, Construction, Healthcare and Financial.

It must be noted that, while sector specific literature exists on organizational risk, risk tolerance characterization in terms of project management by sector of activity is quite absent. This led us to assume mock data values for the purposes of illustrating the model. The implication is that as real data becomes available, the model of RTI should not vary substantially in its validity.

Culture and Project Management

On a general level, the study of the relationship between organizational culture and project management provides us with a set of ideas that may improve the success of project managers in taking on the complex challenges offered by operating in all sorts of different project environments. It is important to stress that the testing ground for this research topic is that of large organizations such as corporations. It is the author's hope that by doing so, we can focus on structures that are complex enough to be analyzed and categorized.

Defining risk culture

The literature on the subject of culture and risk (Deal & Kennedy 1982, Bernstein 1996, Brown 1995) abound with theories on how the environment in which projects take place is important because it conditions the ways in which a project manager can understand how to adapt to the culture in which he or she must operate during the time of the project. The impact of culture on projects is pervasive: from how to structure the communication plan to the way to effectively manage project teams; from building good project sponsor relationships to how to imbue projects with the concept of risk management.

All these aspects of project management are relevant in terms of their link to culture. In our case we are more interested in the link between culture and risk management as it affects the work of project management.

Maintaining the value of a project in a complex organization involves dealing with the uncertainty that will be associated with its delivery. As such, the role of the project manager is to steer uncertain events into certain outcomes. If this is the case, then the primary process associated with project management should be that of risk management (Patrick 2001). As we all accept the notion that risk is an integral part of any project, we must then plan, identify, qualify, quantify, develop options and monitor project risks (PMBOK Guide 2004).

While more recent concepts of risk management have come to include positive risks as well as negative ones, here we are concentrating on the negative ones because they normally carry a higher degree of concern both for the project manager and the top management. As the importance or risk management comes into focus, so does the need to transmit such concepts throughout the organizations. The literature reviewed on this point insists on the importance of injecting risk management practices at all levels in order for it to be effective, regardless of the kind of organization (Kwak & LaPlace 2005).

Understanding risk tolerance

An organization's risk tolerance and that of its key stakeholders must be understood, because both will influence and guide decision making (TBC 2001). Risk tolerance and performance expectations should be linked directly at the corporate level. Organizations should understand the correlation between the degree and duration of unfavorable variances from established performance expectations or targets and the level of risk exposure.

An organization's tolerance for risk varies with its culture and with evolving conditions in its internal and external environment, and management must determine which risks the organization should accept at which levels, then reevaluate these choices on an ongoing basis because circumstances change and so do risk likelihood and impact. According to the extensive review of its risk tolerance policies, the Board of Canada, (and similarly that of the U.K.) considers the following concepts helpful in identifying the organization's risk tolerance level and that of its key stakeholders:

- The operating policy framework, i.e. acts, regulations, and departmental policies, directives and guidelines, levels of delegation of authority,
- How the organization or stakeholders have reacted to past risk events and issues,
- Formal or informal mechanisms to track, report, and act on performance employees' understanding of the risks taken by themselves, their team or group and the department,
- Whether there is a common understanding of risk tolerance and risk management and how effectively it is communicated across the department and to its internal and external stakeholders,
- Employees' understanding of the risk tolerances of key stakeholder groups,
- Whether stakeholders have been consulted on risk tolerances and performance targets.

The importance of being risk tolerant

There are virtues associated with an organizational culture that promotes risk management as an integral part of its strategic process. It is also widely recognized that all sectors of the economy have focused on management of risk as the key to delivering their objectives while at the same time protecting the interests of their stakeholders (Hayton 2005).

An interesting trend taking place in risk management is that it is no longer only the concern of private enterprises. Governments and Public Organizations invested heavily in risk management over the past few years, providing the funding needed and the backing necessary to consolidate in organic bodies of work the major aspects of risk management, such as the Orange Book by the *HM Treasury*. Similar examples of Government driven initiatives collected in extensive documentation on risk management can be found in the Treasury Board Secretariat of Canada.

While these initiatives were done with the intention of injecting risk managing techniques into the public sector, it is widely applicable to large corporations as well. Large corporations and the public sector often share some the same problems in engaging the workforce to adopt a more risk taking and an entrepreneurial mindset. In fact, the goals stated by the HM Treasury in their "Risk Program" might closely resemble what is sought by a private organization: Risk is uncertainty of outcome, and good risk management allows an organisation to:

- Have increased confidence in achieving its desired outcomes;
- Effectively constrain threats to acceptable levels;
- Take informed decisions about exploiting opportunities (HM Treasury, 2004).

After briefly reviewing risk management and culture in general terms as it may apply across private or public sectors, we must turn now to decomposing these concepts into their key components (see Exhibit 1).

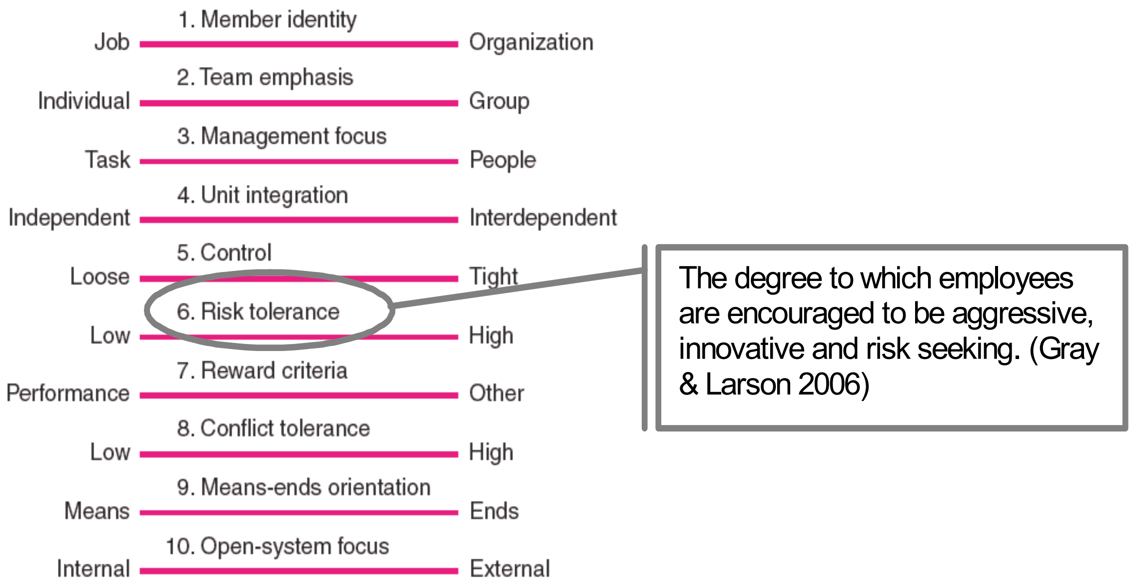

Exhibit 1: Characteristics of Organizational Culture

Culture is composed of objective processes that can be analyzed and quantified, but in order to capture its more elusive aspects we must also rely on a degree of interpretative process. As we are hoping to aid in the more interpretative side of this process, we can select our target from the correct set of cultural characteristics make sure that we maintain its framework of reference.

Focus on risk tolerance in corporations

After looking at ways to understand an organization's risk culture on a general level, we now turn to defining this dimension as it takes place in a specific type of organization, although its relevance remains intact for all types of complex organizations.

One way of describing risk tolerance in a corporation is in terms of the drive for innovation and the degree of entrepreneurship in the workforce. As firms mature, there is a greater need to structure incentives to promote innovation, and at the same time there should be more resources available for incentive pay based upon short-term inputs as opposed to long-run financial performance or other outcomes. The influence of life-cycle stages upon perceptions of risk is also likely to be related to firm strategy and environmental conditions in a complex way (Hayton, 2005).

Hayton also finds that in high technology industries the uncertainty surrounding the success of innovations is greater than in low technology industries, due to higher rates of change, faster pace of change and less certainty over technological trajectories. The relevance of this is that it shows how different levels of environmental risk are expected to influence both the degree and the way an organization institutes incentives for risk acceptance.

It is often said that in today's business environment it is not good enough to simply protect a business though a combination of good accounting practices and insurance policies. This is because the process of globalization has made pressure on margins too intense and the exposure to volatility too great for that to be an adequate strategy for most organizations, even small ones (Merna & Merna 2004).

Therefore, organizations have put increasing value on the far greater and far less tangible world of expectations and reputation to sustain shareholder value. This in turn has called for the rise of risk management and its current popularity in corporate boardrooms (Merna & Merna 2004). Such explanations for risk behavior and risk tolerance levels seem to be centered on the dimension of the organization as a participant in a process of ever increasing performance demands from customers and stakeholders, as much as from competition in a globalized marketplace.

Explaining and measuring risk analysis has also dealt with dynamics of personal human behavior. After all, organizations and the people that work in them form a bidirectional cultural exchange whereby human behavior has an impact on how far the organization goes in accepting risk and promoting it in its structures. However, the organization also can be said to have a long term cultural trait that doesn't change overnight and tends to mold its workforce. The result of this exchange produced the direction and speed at which each company moves to include risk culture and the desirable level of risk tolerance indicated by corporate management.

As we explore both the organization and the human level in search for clues as to how risk tolerance behaviour is shaped, we must also seek out the relevance of the sector of economic activity of such organizations in order to expand the list of dimensions or facets representing the same phenomenon.

Towards a Sector Based Approach to Risk Tolerance Identification

In this section we depart from the general debate already taking place in the published literature on risk tolerance, and begin to trace possible ways to characterize sectors of economic activity by risk tolerance parameters. This exercise deals primarily with cultural aspects of risk tolerance, and carefully avoids getting into the process of risk control for sake of focus.

The quest for sector characterization
We assume that a large number of project managers gain exposure to projects in more than one sector of economic activity. When project managers move from a project or series of projects in a specific business sector to a new one, and begin preparations for the planning phase, they will face uncertainty in, among other things, the culture of the organization they are operating in. Within the many preparations at the start of a project, the project manager will reasonably assess the culture of the organization, and the degree of risk tolerance present at the various levels of command.

The quest for sector based characterization of risk finds its reasons in that it may be developed into a useful tool for project managers to add to their "back pack" or "tool kit," commonly referred to as the essential list of necessary information or forms that should always accompany a project manager on a new endeavor. The extent to which this frame of reference is useful will depend on how much it helps project managers to maintain the value of their project. More specifically, it depends on how much it is able to advise and prepare the project manager in those cultural dimensions of risk tolerance that may affect the project preparation, execution and closure.

A Sector based risk tolerance scorecard
Part of the uncertainty about entering a new organizational environment could be diminished or mitigated if this information were collected and updated in a systematic fashion. Such a task could take the form of a

sector based survey of organizations, but it could also be implemented on a more practical level by any project manager by starting a record in the form of a risk tolerance template for each project that is closed.

One way of thinking about how to organize and record this information is illustrated in Exhibit 2. The questions that the scorecard tries to answer are related to the quantification of indicators such as whether an organization's culture is conducive to learning from mistakes, or is not a culture of blame, or if risk management processes are integrated in the culture of the organization.

By answering these questions and tagging each scorecard to the appropriate sector of economic activity we may obtain the following structure of information (see Exhibit 3).

Risk tolerance indicator by sector of economic activity of the organization: Generic Template

Risk Indicator	Scale 1-10	Weigth (%)	Weighted Average
Knowing when to stop innovation	8	5%	0,4
Learn from mistakes	10	10%	1
Culture avoids blame	7	15%	1,05
Culture that encourages risk identification	5	10%	0,5
Employee accountability linked to organisational objectives	8	10%	0,8
Personal ownership of own behavior	5	5%	0,25
Risk management processs integrated in culture	7	20%	1,4
Contribution of team-working	7	15%	1,05
Clearly defining the risk appetite	5	10%	0,5
Total Risk Tolerance Indicator	**62**	**1,00**	**6,95**

Exhibit 2: Risk Template Scorecard

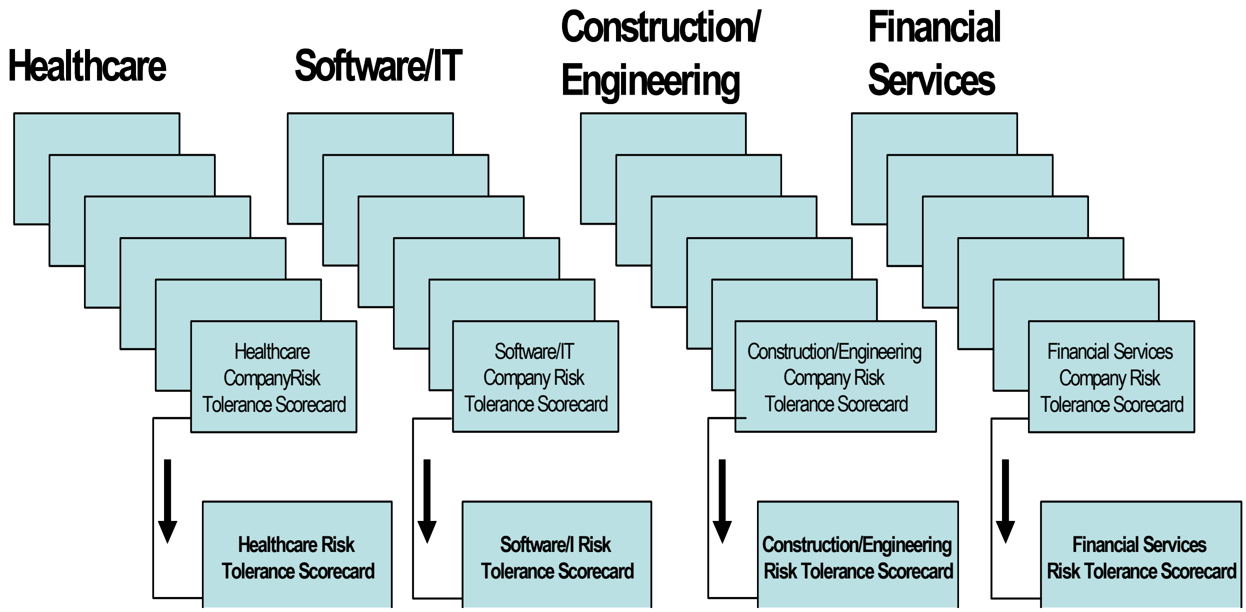

Exhibit 3: Building a Sector Based Scorecard File

Once we collect and organize the information this way, we can then begin to answer some of the following questions:

- What can we say about the culture of risk tolerance in organizations that are part of a same sector? What is the range or distance between maximum and minimum score? What is the mean?
- Is the scorecard indicator range among the sectors that we are considering wide or narrow?
- How can we qualitatively explain the quantitative differences that may result from this analysis?
- Are we able to provide information to answer questions that can make project managers work more efficiently if they had it?

Charting sector based risk tolerance

In this trial version with mock data that we devised, what counts is the idea and the process to follow to extract knowledge out of our experiences in project management. One useful application of this information relates to the possibilities that this data offers in correlating our Risk Tolerance Index with other indicators such as shareholder value (% variation over x period of time). The data values used in this exercise are shown in Exhibit 4):

In theory then, it is possible to see whether the assumption that higher shareholder value is enhanced by implementation of appropriate risk tolerance practices by management holds true. That is to say that we would be able to determine if this axiom is not only the expected result when looking at the organization per se (but that it also transfers to the sector in which it operates (see Exhibit 5).

	Healthcare	Construction/Engineering	Software/IT	Financial Services
Risk Tolerance Index	8	7	7	10
Sharholder Value increase (as % from previous year)	13	10	8	17
Population of Organizations	10	10	10	10

Exhibit 4: Data Table for Charting Risk Tolerance Indicator

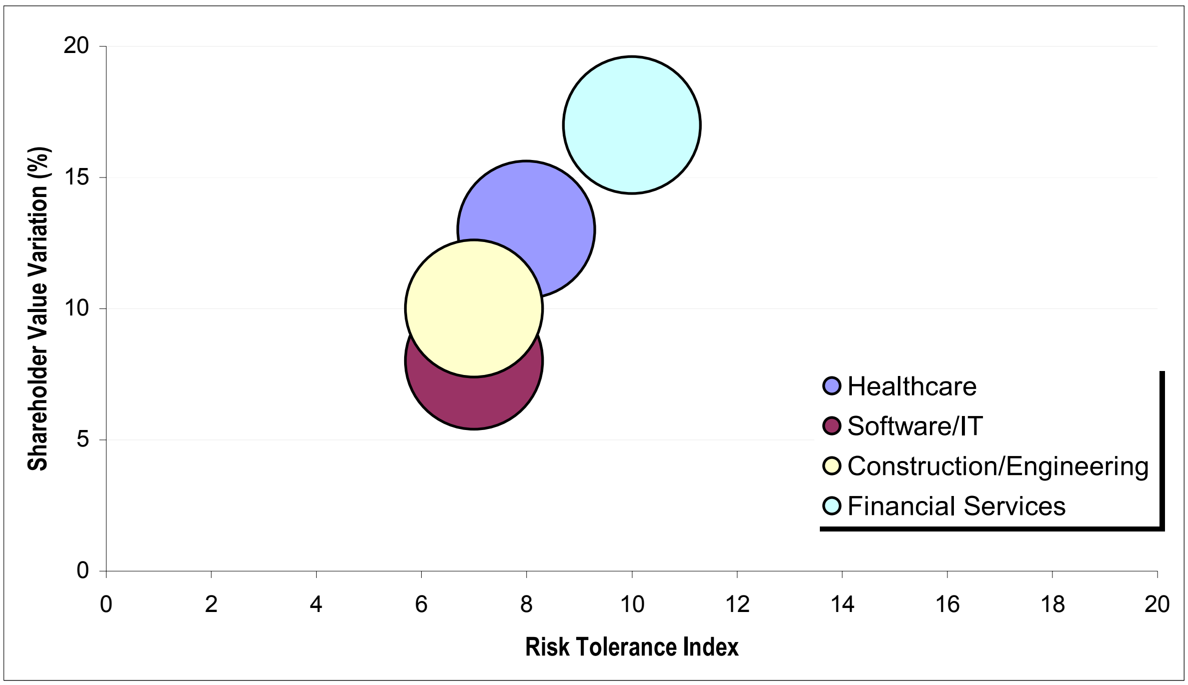

Exhibit 5: Correlating Risk Tolerance Index and Shareholder Value

In this example we can appreciate how the distribution of data that we derived from our Scorecard exercise with information on shareholder value can map an interesting correlation. (The size of the bubble here is given by the number of organizations per sector of activity considered that populate our data.) While this is only a high level exercise with mock data, we were able to show that indeed it is possible to trace a sector based analysis of risk tolerance that may be of some help to project managers in that it could provide them with a roadmap to follow as they begin to set up their planning phase in a new organization operating in a new sector from the one where he or she has accumulated most experience. In doing so, it became obvious that much more work need to be done in order to fill the gaps and provide it with live data.

Preliminary Conclusions

In summary, we first confronted the complex task of putting organizational culture and risk tolerance in perspective. These concepts tend to be somewhat elusive in our constant desire to catalog and quantify our thinking, mainly because they ultimately rest on the variability of human nature.

Then we conducted a high level review of risk tolerance as it pertains to the purpose of this paper. What we found is that it is often talked about in the literature but only in the human and organizational dimension, therefore lacking a sector based dimension.

We also advocated the utility of adding this dimension to the body of knowledge in this field of research, as it would be interesting to project managers and students of organizational behavior alike.

Finally, we used this particular framework of risk tolerance that we defined to devise a new way of portraying this idea, and a possible path to follow in the quantification and use of such data. In essence, we are far from being able to fully answer the question that we asked in our introduction. At best, we provided one possible way to shed some light on this new direction of research and come closer to an answer, being fully aware that in the process we opened many other questions.

We cannot close without restating that this exercise is meant to be a general and theoretical scenario, and admitting that to be valid should be put to test with field research, whether by statistical survey or *ad hoc* interviews with company managers across various sectors of economic activity.

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Risk Detection in Risk Management Planning: A Technology Transfer Perspective

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Abstract

The cost and time required to transfer technology in the pharmaceutical industry has risen partly due to unforeseen events, and too often due to inadequate risk management. While risk prevention constitutes the ultimate goal of risk management planning in the spectrum of global uncertainties, risk detection is rapidly becoming the alternate effective tool to counter threats. From the perspective of technology transfer in the pharmaceutical industry an attempt will be made to identify the risks (threats) associated with the analytical methodology transfer and to propose tools and techniques that can be utilized to detect identified risk events early. Risk detection is the systematic approach used to assign to risk events relevant symptomatic attributes that are capable of triggering the necessary alarms to signal the emergence of a treat. The ability to detect risks at its earlier stages can have tremendous effects on the strategic outcomes of risk response and risk control planning.

Introduction

The quality assurance of drug substances and products in the pharmaceutical industry depends strongly on the staff competence and the development of rugged manufacturing processes that facilitate consistent and predictable production of FDA regulated goods, in accordance with current Good Manufacturing Practices (cGMP). The decision to transfer technology to different sites may be based on a number of factors (ISPE 2003) including:

- The transfer from discovery laboratories, through scale-up and clinical development, to commercialization
- The need for additional capacity
- The strategic requirement to relocate business units because of economic advantages in different regions of the world
- The end results of corporate mergers and consolidations

The successful completion of technology transfer in any industry relies heavily on the ability of the organization or project team to identify, detect, and respond to foreseen risks at their earliest stages. From the perspective of technology transfer in the pharmaceutical industry an attempt will be made to identify the risks associated with the analytical methodology transfer (AMT) and to propose tools and techniques that can be utilized to detect these risks early during the execution of the project plan.

Analytical Methodology Transfer
ISPE (2003) defines technology transfer as the systematic procedure that is followed in order to pass the documented knowledge and experience gained during the development and commercialization to an appropriate, responsible, and authorized party. It embodies both the transfer of documentation and the demonstrated ability of a receiving site to effectively perform the critical elements of transferred technology to the satisfaction of all parties, including the regulatory agencies. The

success of technology transfer is based largely on documented evidence that a method, process, or product can be reproduced against a pre-defined set of specifications. Analytical testing is the tool used to determine success. Therefore, successful transfer of suitable analytical methodology is critical to the successful completion of technology transfer. The acceptable results of analytical testing validate that the receiving site is capable to implement qualified or validated processes, using available personnel and suitable equipment.

The sending site (SS) is the originating laboratory that has the responsibility for creating transfer protocols, training, providing test samples, assisting in analysis, establishing acceptance criteria, and providing data for comparison. The receiving site (RS) is the selected laboratory that is responsible for acquiring adequate instrumentation, training personnel, executing the protocol, and analyzing test samples.

The intricate nature of analytical methodology transfer underscores the necessity to develop a thorough plan to ensure proper execution. Laboratory managers need to determine cost, time schedule, and availability of resources (human and equipment) to cope with such activity. The risks linked to these aspects of the transfer are significant and can impact positively or negatively the outcome of the transfer. It may be wise for laboratory managers responsible for such projects to develop an adequate risk management plan to detect, respond to, and to control these risks.

Risk Detection in Risk Management Planning

Project risk management includes the processes concerned with conducting risk management planning, identification, analysis, responses, monitoring and control on a project (PMBOK (2004). In the context of AMT, Morris (2004) defines risk management as the continuing process of minimizing risks throughout a product's life cycle to optimize its benefits and balance its risk.

Project risk management planning is described by PMBOK (2004) as the process of deciding how to approach and conduct the risk management activities for a project. It's usually developed during the establishment of the project management plan and for the AMT consists mainly of a strategic competency and safety plan designed to decrease product risk by using appropriate interventions tools. For an AMT the primary risk factors or events are related to the scope, quality, time, resource, health/safety, and cost.

Risk management has often been compared with medical practice (Kanabar, Project Risk Management: A step-by-step guide to reducing project Risk). There are a lot of similarities between both professions. Kanabar continues by stating that: "As in medical practice risk prevention is more cost-effective than risk detection." However, in medical practice some medical conditions are impossible to prevent due to genetic predispositions. In risk management some risk events are very difficult to prevent due to the nature of the project. In both scenarios early detection becomes the next best approach to increase the chance of survival or to minimize the negative impact on the project.

Therefore, once the project team completes the risk events identification, it must also consider developing a risk detection plan which will be complementary to the risk response and control plan. A risk severity matrix can provide a basis for prioritizing which risk to address (Gray and Larson 2006). The risk (threats) events identified to have the greatest impact and the highest probability of occurrence are further evaluated to determine if applicable triggers can be implemented to detect them early before affecting significantly the project outcome. Risk detection planning is a preemptive measure aimed at improving the timing of the implementation of risk response plan and also reducing the cumulative impact of foreseen threats on the project. In this capacity, risk detection can only be secondary to risk prevention as a proactive and engaging tool in risk management planning.

Risk detection planning is the systematic approach used to assign to risk events relevant symptomatic attributes that are capable of triggering the necessary alarms to signal the eminence of a threat. The ability to detect risk at its earliest stage can have tremendous effects on the outcomes of risk response and risk control strategies. Identifying the symptomatic attributes relevant to a specific risk event is the first step in the risk detection process.

A qualitative approach: Tools and Techniques

The determination of symptomatic attributes involves the participation and complete involvement of all project team members and relies heavily on the accuracy and relevance of the risk events identified during the risk identification step. Therefore, expert opinions, lessons learned, and historical data must be taken into account.

To avoid false alarms, noise needs to be established for all the symptomatic attributes. Noise is the background information inherent to each attribute. It remains consistent throughout its phase and changes in intensity only by a triggered signal. Signal occurs when the flow of information coming from a symptomatic attribute increases significantly from the established noise level over a period of time. The signal triggers the detection of a threat. The sensitivity of the detection signal varies with the importance of the risk events to the project stakeholders, which emphasize the necessity of their direct participation in the stratification of the risk events.

Furthermore, between the noise and signal detection rests a buffer zone that is indicative of the acceptable tolerances of the noise (background information) relative to the criticality of the risk events. The wider the ranges for tolerances the longer it will take before the signal is triggered. Consequently, the longer it takes to differentiate the signal from the background noise, the more likely false alarms and false positives will emerge. It becomes imperative for the symptomatic attributes to be descriptively relevant to the risk events to reduce the lag time before a signal is triggered. Therefore, a direct relationship must exist among the symptomatic attribute, its related noise and detection signal.

Risk events generally vary in scope, exist in multiple dimensions, and must be examined in context; i.e., risks must be evaluated in relation to each other (Gorban and Townsend 2003). To reduce the rate of potential false positive results that can be caused by elevated background noise generated by overly estimated symptomatic attributes, a descriptive cross-calibration is introduced to this qualitative approach (Exhibit 1-6). The cross-calibration serves as a mean to standardize the process. The cross-calibration assigns a numeric qualifier (1 for low, 2 for moderate, and 3 for high) to each of the symptomatic attributes based on a comparative evaluation of the noise to signal detection. This evaluation is based on functional similarities and dependencies found between the noise and the detection signal.

The probability of catching a risk event becomes heavily dependent on the ability of the project team members to accurately define representative symptomatic attributes. A detectability rating is assigned to each risk event to help the project team determine the probability of detection. The rating system is based on calculating the average value obtained for each cross-calibration associated with the symptomatic attributes. This average value is rounded to the nearest whole number. The symptomatic attributes are assigned a detectability rating of likely, most likely, and highly likely to differentiate the risk event propensity for detection.

To assist in the characterization of symptomatic attributes a guideline is developed to minimize the subjectivity that is inherent to most descriptive and qualitative process. Symptomatic attributes are developed from the project scope statement using the established objectives, deliverables, key milestones and project product. From the different project attributes, pertinent indices called symptoms are linked to the risk events. The symptomatic attributes expose, with respect to the specific risk events, the concerns of the project key stakeholders and team members on the accomplishment of certain key milestones and deliverables or the delivery of the project product.

Noise and detection signal parameters are collected from the detailed level of work breakdown structures and work packages developed during the project plan for each task and activity. These parameters are evaluated for relevance with those of the risk breakdown structure developed during the risk events identification.

A case study: Company Zeta developed drug Beta in Europe. The results of clinical studies are promising and Zeta decided to manufacture the drug in the USA. A project team was assigned the task of transferring the technology to the USA in time to support full-scale commercialization. The team is composed of members from both sites. Some members of the team located in Europe composed the analytical methodology group of the sending site (SS) and some members of the team located in USA constituted the analytical methodology group of the receiving site (RS). Members of both sites through communications (teleconference and/or on site meeting) agreed on a timeline for a series of activities leading to the testing and successful release of batches of drug products manufactured at the RS.

These activities comprised identifying equipment needs, instruments applicability and suitability, training of personnel, safety assessment, and regulatory requirements. A level of risk was assigned to the execution of each of these activities. The team members from SS and RS working in concert were responsible for identifying the applicable risks events such as scope, quality, time, resource, health/safety, and cost. For each of the identified risk events the team members related symptomatic attributes (see Exhibit 1-6). A descriptive for noise and detection signal is given to each attribute to help in determining the detectability of the specific risk event.

For example: if senior management concerns about product integrity (see Exhibit 5) calls for an evaluation of safety data then an increase in the number of analytical methods to be transferred may result. Since preparations were already made to transfer other test methods then the cross-calibration qualifier is 1 for this symptomatic attribute. However, if there are no MSDS (Material Safety Data Sheets) at the receiving site for the chemical substances being used for the transfer, and employees expressed safety concerns, then the qualifying calibrator is 3 for this symptomatic attribute. The absence of MSDS can be correlated to the employee safety concerns.

A functional interdependence among symptomatic attributes, defined noise and detection signals increases the probability of detecting a risk event. Therefore, the detectability rating is directly proportional to the degree of functional relevance that exists among the symptomatic attributes, noise and detection signals. Symptomatic attributes can be listed for a risk event that requires cross-functional activities. Then, interdependence among the symptomatic attributes, noise and detection signal may become difficult to establish. However, the cross-calibration tool can be utilized to numerically express the level of importance of the relational dependence that exists between the noise and the detection signal in a cross-functional environment, hence balancing the overall symptomatic attributes by reporting the average of cross-calibration values to determine detectability rating.

This proposed qualitative approach to risk detection implies an interactive as well as a proactive engagement among the project team members to continuously assess the relevance of the symptomatic attributes and to assign detection signals. Since risk identification is a continuous process (Tchankova 2002) a dynamic approach must be maintained to effectively assess risk events and related attributes.

The Project Management Body of Knowledge (PMBOK) Perspective

Since the tools and techniques are explained, to remain compliant with (PMBOK, 2004) the inputs for risk detection can be summarized as follows:

1) Risk events identification
2) Risk breakdown structure
3) Work packages, work breakdown structure
4) Impact and probability analysis
5) Risk severity matrix
6) Organizational process assets (historical data, expert opinion)
7) Risk register (risk identification process, symptomatic attributes, project team members participation, accurate listing of risk events)
8) Risk management plan (budget, schedule, identified stakeholders, roles and responsibilities)
9) Project scope statement (risks associated with new technology, labor resources)
10) Approved changed requests
11) Work performance information
12) Performance report

The outputs for risk detection are listed as:

1) Risk register (risk identification process, project team members participation, accurate listing of risk events)
2) Symptomatic attributes
3) Noise
4) Triggers (detection signal)
5) Risk detectability rating
6) Risk events (project background information, lessons learned, expert opinion)
7) Risk audits
8) Results from qualitative and quantitative (variance and trend) analysis
9) Technical performance measurement
10) Status meetings

The qualitative approach to risk detection proposed in this article uses the AMT in the pharmaceutical industry. However, this technique can be implemented to fit other type of projects, especially when the amount of data available for statistical and mathematical treatment may restrict the utilization of a quantitative approach. This technique can lead directly into the risk response planning or into additional quantitative analysis if required.

Risk Events	Symptomatic Attributes	Noise	Detection Signal	Cross Calibr-ation	Detectab-ility Rating
Scope	Increase in #of analytical methods to transfer	Safety data evaluation	Senior management concerns about product integrity	1	Likely
	Change in analytical methodology	Analysts concerns	Expert opinion asked	1	
	Increase in # of samples to be tested	Request for more test samples	Request for change control	2	X≈1

Exhibit 1: Risk Event Detectability Rating for Scope: A qualitative approach

Risk Events	Symptomatic Attributes	Noise	Detection Signal	Cross Calibra-tion
Quality	Failure to meet transfer acceptance criteria	Difference in site requirements	Expressed Analyst concerns	3
	Failure to evaluate test methods for applicability at the receiving site	Compendia tests	No data collected	3
	Poor documentation (test methods not clear, inadequate validation documentation)	Request for clarification	Multiple interpretation among analysts	3
	Compliance and regulatory issues (significant difference between sites standard operating procedures, regulatory bodies, non-adherence to GLPs, and cGMP regulations, 21 CFR part 11)	Confusion	Audits results	3
	Technical failure (utilization of old technology/ methodology)	Evaluation of maintenance logs	Failing system suitability	3

Exhibit 2: Risk Event Detectability Rating for Quality: A qualitative approach

Risk Events	Symptomatic Attributes	Noise	Detection Signal	Cross-calibration	Detectability Rating
Time	Unreasonable time commitments	Test materials not yet available	Request for materials delayed	2	Most likely X≈2

Exhibit 3: Risk Event Detectability Rating for Time: A qualitative approach

Risk Events	Symptomatic Attributes	Noise	Detection Signal	Cross-calibration	Detectability Rating
Resource	Failure to evaluate site instrumentation for applicability, suitability	Different manufacturer of instruments	Failing performance verification	2	Most likely X≈2
	Personnel involved in concurrent multiple projects	No show at meetings	No scheduled update on progress	2	
	Inadequate knowledge transfer	Analysts frequently asking questions	Request for clarification	2	
	Inadequate training of personal	Not enough time on training	Multiple errors by analyst	2	
	Overworked staff	Complaints by personnel	Constant requests for overtime	3	

Exhibit 4: Risk Event Detectability Rating for Resource: A qualitative approach

Risk Events	Symptomatic Attributes	Noise	Detection Signal	Cross-calibration	Detectability Rating
Health and Safety	Failure to evaluate the health and safety hazards of chemical entities on employees	Employee concerns	No MSDS at the site for substances	3	Highly likely X≈3
	Failure to obtain environmental regulatory permits	No paper work in file	Internal Inspection	3	
	Inadequate training	Personnel not qualified	Minor cuts, lacerations	3	

Figure 5: Risk Event Detectability Rating for Health/Safety: A qualitative approach

Risk Events	Symptomatic Attributes	Noise	Detection Signal	Cross Calibr a-tion	Detectabilit y Rating
Cost	Budget overrun (capital equipment acquisition and qualification)	Instrument failure/brea kdown	Quote for replacement	2	Highly likely X≈3
	Labor (hired contractor)	Request for overtime	Multiple team members on overtime	3	

Exhibit 6: Risk Event Detectability Rating for Cost: A qualitative approach

The parameters (symptomatic attributes, noise, detection signal) developed from the qualitative approach can be inputted into subsequent quantitative data treatment. The principle of risk detectability rating, as a qualitative tool and technique, enunciated in this article also has its relevance and importance for risk detection in risk management planning.

Detection systems perform routine inspection on collected data for anomalies and raise an alert upon discovery of any significant deviations from the norm. For example, Fawcett and Provost (1997) detect cellular phone fraud by monitoring changes to a cell users' typical calling behavior. Kanabar (Project Risk Management: A step-by-step guide to reducing project Risk) compares risk management to the medical professions.

A further comparison can be made between risk detection in project management and early disease outbreak detection. One of the challenges for early disease outbreak detection is finding readily available data that contains a useful signal (Wong, Moore, Cooper and Wagner 2005). The principle of detection system is based on the reliance on tools used to differentiate anomalies from normal occurrences. These anomalies can be translated into symptomatic attributes, background noise and triggers if a qualitative approach is used. Mathematical modeling tools such as algorithms can serve the same purpose of detection mechanism when large sets of numeric data are available for quantitative analysis.

Many detection algorithms (Goldenberg et al. 2002; Buckeridge et al. (2005); Fawcett and Provost 1997) assume that the observed data consist of cases from background activity, which can be referred to as the baseline, plus any cases from irregular behavior. Under this assumption, detection algorithms operate by subtracting away the baseline from recent data and raising an alarm if the deviations from the baseline are significant. The estimation of the baseline distribution using historical data can be cumbersome due to the presence of different trends in surveillance data. The selection of incorrect baseline distribution can have dire consequences for an early detection system (Wong et al. 2005).

A literature search on the methodology of detecting risks yielded a research paper published by Wong et al. on bio-surveillance algorithms to detect early disease outbreak. The article contains a wealth of information related to quantitative tools and techniques such as algorithms (The Control Chart Algorithm**,** Moving Average Algorithm, ANOVA

Regression, and WSARE) that can be used to detect a risk in the process of becoming a threat based on symptomatic attributes. The WSARE approach is a technique used to detect early disease outbreak by means of a rule-based anomaly pattern. WSARE operates on discrete, multi-dimensional data sets with a temporal component. This algorithm compares recent data against a baseline distribution with the aim of finding rules that summarize significant patterns of anomalies.

It's recognized that these algorithms may not be suitable to detect risks for AMT related to technology transfer in the pharmaceutical industry due to the vast amount data these systems require to function properly. Nonetheless, algorithms certainly have their application in assessing data collected from drug clinical trials sponsored or developed by the pharmaceutical industry to detect early adverse effects.

Conclusions

If the ultimate goal of the pharmaceutical industry is to make drugs available to patients quickly, then risk detection tools and techniques can definitively be utilized to decrease the negative impacts associated with drugs development and commercialization. Pharmaceutical, biotech, life sciences, and R&D industries are quality and schedule driven sectors marked by strong competition to be the "first to market" (Nalewaik 2005). Reduced time-to-market is a competitive advantage and produces increased sales revenue. Therefore, the integration of adequate project management techniques in the product life cycle can yield tremendous benefits.

In industries where schedule is critical, and the advancement of technology continues to introduce new processes and concepts, application of risk management can reduce cost and schedule overruns. The utilization of risk management as a proactive project management tool can reduce the susceptibility to losses incurred during a course of actions, which can be followed by an auditable trail of changes (Nalewaik 2005).

To successfully minimize these losses a risk detection system must be developed to proactively respond to eventual threats. The risk detection plan is developed during risk management planning in concert with the risk identification, response, and control plans. Its primary role is to alert the project team members or organization on eminence of threats.

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The Importance of Identifying Risk during Project Planning

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Abstract

Often risks are not identified early enough in the project lifecycle. By the time the risk is identified, there is limited opportunity to conduct a careful risk analysis to determine the best approach to managing, resolving, or mitigating the risk. A risk discovered late in the project lifecycle becomes a fire to fight. In examining some real-world experiences, project managers faced project "fires" when risks were not identified during the planning phase. These fires often resulted in added costs or negative consequences. There is value for a project manager to determine risks early in a project lifecycle. Using proven tools and techniques, a project manager can identify, analyze, document, and communicate project risks during project planning. Finally, using a risk analysis tool will help ensure successful projects.

Introduction

We have all heard the saying, “Give a man a fish, and you feed him for a day. Teach a man to fish and you feed him for a lifetime.” Let me revise that from a risk management standpoint: “Put out a manager’s fires, and you help him for a day. Teach a manager fire prevention, and you help him for a career.” If a manager understands good risk management, he can worry about things other than firefighting.” (Glazewski 2005)

Addressing risk throughout the project lifecycle

Although it is most important to identify risks early, risk identification is not a task that is limited to one phase of a project. At the beginning of each new phase, the project team should work to identify new risks, look for triggers of previously identified risks, and examine current risks for changes in the risk or the response.

Why Spend Time and Money on Risk Management?

Changes happen quickly, and companies need to stay competitive. Understanding and managing risk is a way for companies to ensure greater project success. “When risk is managed and reduced, the results are not only internal financial and operational advantages, but a measurable competitive advantage that affects every area of the company, from the costs of risk in the marketplace, to employee morale and retention, to the company’s position in the marketplace.” (Morris 2005)

Risk response and control also take place throughout the project lifecycle. As soon as risks have been identified and analyzed, the project manager, along with the project team, will work on preparing responses for the risks with the highest impact and probability. Then the project manager will monitor the situation looking for triggers or signs of an impending risk. This cycle of risk identification, risk analysis, risk planning, risk monitoring, and risk control continues throughout the length of the project, however, the management of risk must begin in the earliest phases of the project in order to gain the highest return on investment.

The value of early risk identification

Identifying and planning for risks early in a project can save money as contrasted with identifying a risk at a later stage, or even at the end of a project. By identifying a risk early, there is time for analysis and preparation for the development of an appropriate risk response. If a risk is identified at the end of a project, or if a risk is only identified after it occurs, the costs to control or mitigate the risk will be much higher than if that same risk had been identified early in the project. See Exhibit 1.

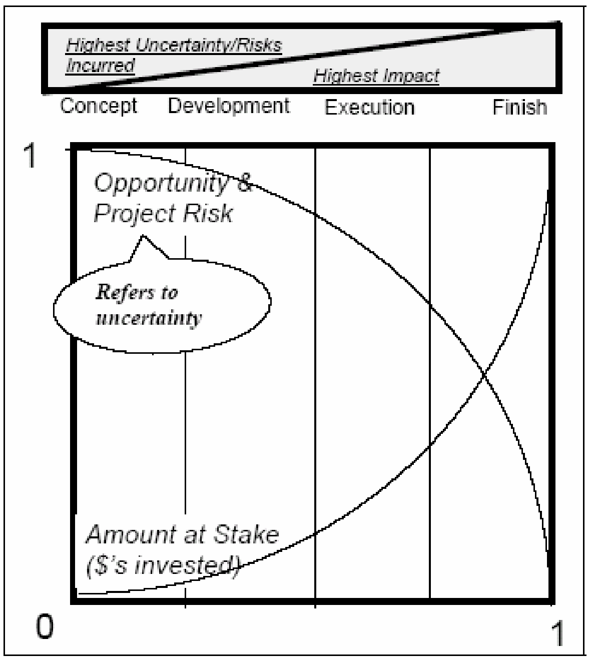

Exhibit 1: Risk vs. Project Life Cycle (Kanabar, p. 30)

Exhibit 1 reveals how the amount at stake rises abruptly toward the end of the project. A risk that may have had an impact of $100 at the beginning of a project, and may have an impact of $10,000 or greater if not identified until the end. “The cost and effort to prevent a fire is almost always far less than the cost and effort to rebuild after the fire is out.” (Glazewski 2005)

The worst case scenario is that a risk is not identified until after it occurs. The project team must prepare a quick response that may include a work around. A work around differs from a contingency plan, which is a separate course of action that was planned and implemented in order to avoid a risk. A work around may increase the time, cost, or scope of the project and may place the project in a jeopardy status.

What happens when risks are not identified early in the project?

In researching the topic of early risk identification, project managers were interviewed to gain a real-world perspective on what problems can result when risks are overlooked during early phases of the project. Each individual who participated in the interview process was asked to respond to the following question.

Have you ever experienced a situation where a risk was not identified early in the project lifecycle? If so, what was the result?

"It is important to make sure you are working with all the right people" says Karen Tate, owner of the Griffin Tate Group and member of the Project Management Institute (PMI) Board of Directors. Ms. Tate worked on a project involving a new design inside an existing manufacturing plant. "The instructions to the construction people were very accurate. The shutdown [for the upgrade] went smoothly." Following the upgrade, the project team received written notes from plant personnel complimenting their job well done. However, a later audit determined that the Drawing Standards Group had not been included in preparing the instructions for the construction, and the project was given a low rating by the auditors. Karen points out that a project manager needs to search for "hidden stakeholders" to avoid such a pitfall.

Scott Shippy is an Engagement Director with Convergys. He reports that there have been "many times" when a risk was not identified early in a project. "The most-often-missed risk is the loss of team members and lack of a backfill plan. On many occasions, I have seen major projects delay and fail because of an unexpected departure of a team member."

Sangeeta Kothari is a Solutions Analyst for Citigroup. She offered three risks that can have a major impact on a project, if they are not identified early. "Losing a key resource after three or four months can be very difficult." The farther into the project, the more difficult it is to recover when a key team member leaves the company.

A risk can occur if a project is dependant on a third party or a partner. "There is a risk to your project if the project becomes a lower priority for the third party or partner." When a third party, partner, or vendor is involved, their priorities and progress will impact the project. This is a risk because the project manager may have very little authority with the third party, partner, or vendor. Working in the banking industry can involve external risks too. "Compliance or regulatory changes can add risk to a project."

Common Risk Scenarios

These stories of unidentified risks are common among project managers. Losing a team member, failure to identify a stakeholder, limited control over vendors, and unexpected regulatory changes are common risks. The remainder of this paper will focus on ways that project managers and project teams can identify and plan for risks such as these.

Risk Identification

When to Identify Risks

Requirements-gathering sessions are an ideal place to begin risk identification. If the requirements are not complete, and accurate, the project will never be complete or accurate. "Requirements form the basis of project plans, since the purpose of the plans is to describe how the requirements can be met. If the requirements are deficient, then the project plan is flawed; and if the plan is flawed, then its implementation is defective." (Frame 1995 pp. 156,157)

Risk identification may be part of the requirements gathering session, or be conducted as a separate meeting. The Project Management Body of Knowledge (PMBOK) suggests that, “Project teams hold planning meetings to develop the risk management plan. Attendees at these meetings may include the project manager, selected project team members and stakeholders, anyone in the organization with responsibility to manage the risk planning and execution activities, and others, as needed.” (PMBOK 11.1.2.1)

The project manager should identify any team members, stakeholders, subject matter experts, or individuals who have worked on similar past projects to participate in the risk identification session. Past experience on a similar project means that these individuals will have experience with the types of risk that may be encountered on the current project.

The facilitator or project manager should come to the risk identification meeting with a planned agenda. One way to begin is by asking questions to help the project team begin to uncover risk factors.

Karten (1994 pp 91-2) suggests the following “starter questions”:
1. “What does the problem entail that is so new or different as to pose a risk?
2. What factors might reduce the level of risk that the problem poses?
3. What does past experience tell us about complications that might arise if we address this problem?
4. In what ways is the risk of addressing the problem less than the risk of leaving things as they are?”

Project Team Participation in Risk Identification
It is important for the Project Manager to engage all team members in the discussions on risk identification. As people participate, they are more likely to agree to the risk planning decisions.

The facilitator or project manager may have a difficult time engaging people in risk identification. People may not want to make comments they perceive as negative, or they may not be willing to admit that a portion of their work may lead to a project risk.

“Why is it so difficult for people to say what they need directly to the people who are involved? They’re simply avoiding something they fear: the consequences of talking directly. Usually, the immediate consequences are negative, even if the long-run effects turn out to be positive.” (Bernstein and Rozen 1992 p. 233)

If the project manager is in a situation where the team does not feel comfortable discussing risks, the Nominal Group Technique is an alternative to brainstorming that provides an excellent means of gathering input from a group. Each person has a chance to voice their input and document their concerns. This technique also works well if there is an individual who tends to dominant the conversation because it gives every person an equal opportunity to participate.

Procedures for using the Nominal Group Technique include: generating ideas individually, recording all ideas as a group, discussing each idea for clarification, and voting on the ideas (Dunham). The project manager may choose to use other tools or techniques for risk identification, some of which are outlined in the PMBOK.

PMBOK Tools for Risk Identification
The project manager should select the tools and techniques that will work best for the size and scope of each project. Multiple tools and techniques can be used for each project.

Conduct documentation reviews to ensure that there is consistency between requirements and assumptions in the project documents. (PMBOK, 11.2.2.1)

Information gathering techniques such as brainstorming help "obtain a comprehensive list of project risks." (PMBOK, 11.2.2.2)

The Delphi technique allows participants to reach a consensus anonymously. The facilitator circulates a questionnaire to the participants who respond back to the facilitator. The responses are summarized and sent out again for additional input. "The Delphi technique helps reduce bias in the data and keeps any one person from having undue influence on the outcome." (PMBOK, 11.2.2.2) One of the drawbacks of the Delphi technique is that is can take a long time to collect and summarize input. The Delphi technique works well with a project team who may not be located together or are spread across multiple time zones.

Interviewing others who have worked on similar projects can be informal, yet valuable. "Interviewing experienced project participants, stakeholders, and subject matter experts can identify risks. Interviews are one of the main sources of risk identification data gathering." (PMBOK, 11.2.2.2)

Root causes can be determined by asking the question "why" multiple times. Continue to ask "why" until the root cause of the risk is identified. This type of information gathering "sharpens the definition of the risk and allows grouping risks by causes. Effective risk responses can be developed if the root cause of the risk is addressed." (PMBOK, 11.2.2.2)

SWOT Analysis examines strengths, weaknesses, opportunities, and threats and "ensures examination of the project from each of the SWOT perspectives, to increase the breadth of considered risks." (PMBOK, 11.2.2.2)

Diagramming Techniques may include: "cause-and-effect diagrams, system or process flow charts, or influence diagrams." (PMBOK, 11.2.2.5) These types of charts or diagrams help the project team to pinpoint areas of risks, and risk thresholds.

Opportunity Risks
In addition to looking for risks that can negatively impact the project, the project team should also be looking for "opportunity risks". If these positive risks are identified early, then the team can be prepared to accept the opportunity should it occur. Throughout the project, the project manager should be looking for triggers to the opportunity risk.

Risk Analysis and Documentation
Once the initial risk identification is complete, the project manager and team can move on to risk analysis. It is important to remember that risk identification is not complete until the project is complete. There is a continuous cycle of risk identification and analysis throughout the project lifecycle.

Stakeholder Tolerances

Before performing risk analysis, it is important to determine the tolerance level of the key stakeholders. Stakeholders may have a low, medium, or high tolerance for risks. If cost is most important to the key stakeholders, they may be willing to accept risk associated with project timing or quality. If quality is most important, the stakeholders may be willing to accept risks associated with higher costs. It is important to involve the stakeholders in risk analysis so that they can assist in determining the priority and impact of the risks.

Qualitative Risk Analysis

Qualitative Risk Analysis uses the list of risks that have been identified and takes the process one step further by assigning an impact, a probability of occurrence, and a priority. By looking at the impact, the probability, and the priority of each risk, the team can focus on the most important risks and begin to plan for risk mitigation.

Joe Limanowski is a Project Manager with AMIG. He has 25 years of experience as a project manager and says, "The risk you ignore won't ignore you." Mr. Limanowski uses a simple probability and impact matrix if he has a small project with less than ten identified risks. It is a straight forward way to rank the risks and discover those that are in the "red zone" of high impact and high probability. See Exhibit 2

5		Risk #8		Risk #7	Risk #5
4			Risk #2		Risk #6
3	Risk #9			Risk #3	
2		Risk #1			
1				Risk #4	
	1	**2**	**3**	**4**	**5**

Exhibit 2: Probability Impact Matrix (Limanowski)

In Exhibit 2, the vertical axis is the level of impact of the risk. The horizontal axis is the range of probability of the risks. Each risk that has been identified is assigned a number based on the probability and impact of occurrence with 1 being a low probability or impact, and 5 being the highest probability or impact. For example, losing a team member halfway through the project may have a low probability (2) but a high impact (5). That risk would be numbered and placed in the matrix in Exhibit 2 (risk #8). The risks that fall into the upper right quadrant of the matrix are the most important as they have the highest probability and impact. These risks are in the "red zone", and they should be given the highest priority. Mid-range risks are documented in orange, and low level risks are documented in green. The project manager may decide to accept the risks that are in green, or further evaluate the risks in the orange zone.

For large projects with many risks, Mr. Limanowski suggests using a modified chart to quantify impact and probability. See Exhibit 3.

Risk	Impact	Probability	Product	Mitigation
Risk #1	9	8	72	Prepare a contingency plan
Risk #2	5	5	25	Re-evaluate this risk during project execution
Risk #3	2	4	8	Accept
Risk #n				

Exhibit 3: Risk Analysis Tool (Limanowski)

For each risk (Risk #1 through Risk #n), impact and probability values are assigned based on a scale of 1 being a minimal impact or minimal probability to 10 being very high impact or high probability. The Product is equal to the Impact times the Probability. The project team can then focus on mitigation or contingency planning for the risks with the highest product. Risks with a low product may be accepted. There is also a column for mitigation where ideas and plans are documented. Kepner and Tregoe (1965) describe this process as "assessing the probability of an event and the seriousness to the project if it occurs." Again, they multiply the factors to arrive at a means to assess and compare different risks.

It should be noted that re-visiting these risks, and adding to the list, must be part of the on-going management of any project. A risk which was originally determined to have a minimal impact on the project, may have both a higher impact and probability based on changes in the project environment, changes in the work breakdown requirements, or changes in the corporate/general environment.

Scott Shippy of Convergys shared a similar tool that was developed to help analyze, prioritize, and communicate project risks. See Exhibit 4.

Ref. #	Risk Description	Mitigation Plan	Responsible Party	Probability of Occurrence (1% - 100%)	Impact (1 – 10)	Exposure	Priority Ranking
1							
2							
3							

Exhibit 4: Risk Analysis Tool (Shippy)

This tool builds upon the tool in Exhibit 3 by adding the elements of responsibility and exposure. Such a tool can be used for documentation and prioritization, as well as for communication to the project team and stakeholders. The columns on the Risk Analysis Tool are used for:

- Risk Description: Document the risk that was identified.
- Mitigation Plan: Like the previous tool, this risk analysis tool places particular emphasis on documenting mitigation plans that will go into effect once the risk occurs.
- Responsible Party: For each risk, an owner is assigned. The owner will prepare the mitigation plan and watch for risk triggers.
- Probability of Occurrence: This is estimated from 1% to 100% for each risk. (If the probability is 0%, then it should not be listed here as a risk).
- Impact: The impact of each risk is estimated from 1 (low) to 10 (high).
- Exposure: Documenting the possible exposure will help to identify who will be impacted if the risk occurs. Exposure will answer questions such as: Which functional areas will be impacted? Will this risk impact the client or is it internal? Will the risk impact the cost, schedule, or quality of the deliverable?
- Priority Ranking: Based on the probability, impact and exposure, each risk should be assigned a priority ranking. The project team should spend the most time and effort on the risks with the highest priority ranking.

Which ever risk analysis tool is used by the project manager, it should be revisited on a regular basis. Regularly scheduled status meetings provide an opportunity for the project team to review the risk analysis tool. When risk is reviewed, the team should work to identify new risks, monitor the status of current risks, and reevaluate the priorities to make sure nothing has changed.

Quantitative Risk Analysis
"Quantitative Risk Analysis is performed on risks that have been prioritized by the Qualitative Risk Analysis process as potentially and substantially impacting the project's competing demands. The Quantitative Risk Analysis process analyzes the effect of those risk events and assigns a numerical rating to those risks" (PMBOK 11.4). Decision trees and Monte Carlo simulation are two of the tools that can be used for Quantitative Risk Analysis.

Risk Communication
The Risk Analysis tools shown in Exhibits 2 through 4 are excellent ways to communicate risk identification and analysis. Stakeholders and team members can see the list of risks along with the probability and impact for each. The highest priority risks can be listed at the top with the lower priority risks at the bottom. If a mitigation plan has been determined, it is also documented in Exhibits 3 and 4.

The risk analysis tool should be reviewed periodically to see if there are new risks to be added, or if triggers indicate an impending risk. If changes are made to the risk analysis tool, it should be sent to the project team and stakeholders.

Putting the Plan into Action

Interviews with project managers revealed some common project risks.
1. Failure to identify a stakeholder

2. Losing a key project resource
3. Low priority placed on the project by a third party, partner, or vendor
4. Unplanned compliance or regulatory changes

If these risks are identified early in the project, they can be analyzed, tracked, and mitigated. See Exhibit 5.

Ref. #	Risk Description	Mitigation Plan	Responsible Party	Probability of Occurrence (1% - 100%)	Impact (1 – 10)	Exposure	Priority Ranking
1	Failure to identify a stakeholder	Seek expert advice from people who have worked on a similar project	Project Manager	25%	6	May lead to missed requirements	#3
2	Lose a key project resource	Identify alternate resources from development and testing	Project Manager	20%	8	May impact the schedule or quality	#2
3	Low priority by 3rd party vendor	Identify alternate vendors, enlist the help of the Project Sponsor	Project Manager / Project Sponsor	50%	7	May impact the project schedule.	#1
4	Unplanned compliance or regulatory changes	Outline all regulatory changes that will take place during the project.	Project Manager and Legal resource	10%	10	This would impact the quality of the project.	#4

Exhibit 5: Completed Risk Analysis Tool

Conclusions

Early risk identification and planning will save money and time later in the project. As a result, a project with a solid risk management plan will be less likely to fail or be cancelled. Planning for the inevitable "fires" in advance will help the project team to stay focused on their work if the risks materialize.

On a football team, the Quarterback works from a play list. Based on the current score, down, and yards needed, he will call a play from the play book. When the Quarterback is faced with a risk, such as a looming defensive lineman, he needs to have a contingency plan. The contingency plan is not something made up on the fly, but rather an alternative course of action that has been documented and practiced. The Quarterback may call an audible, and his team will respond accordingly.

In a similar fashion, a project manager needs to understand, identify, document, and prioritize possible risks. When the risk occurs, and the contingency plan is put into action, the team should respond much the same as the football team. They react to a well thought out, rehearsed alternative plan. By using risk identification and risk analysis tools, the project manager is ensuring the best possible outcome for each project.

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Research Subjects

Kothari, Sangeeta *Citigroup*, February 15, 2006, Blue Ash, Ohio.
Limanowski, Joe *AMIG*, February 15, 2006, Blue Ash, Ohio.
Shippy, Scott *Convergys*, February 9, 2006, Denver, Colorado.
Tate, Karen *Griffin Tate Group*, February 14, 2006, Blue Ash, Ohio.

Project Cost Management and Long Term Organizational Goals

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Abstract

"Project Cost Management includes the processes involved in planning, estimating, budgeting, and controlling cost so that the project can be completed within the approved budget" (*PMI*, "A Guide to the Project Management Body of Knowledge", Third Edition, 157). However, project managers should understand long term growth goals of the organization while striving to reduce cost and contribute towards overall success. To gain competitive advantages in today's environment companies use strategic cost management. Cost management is a broad concept. It involves understanding the organization's current status, future goals and market conditions, collecting and analyzing data, and providing appropriate cost management information to the manager to manage the firm efficiently.

Introduction

For survival and growth of a company, strategic decision making in cost management is an essential element. This paper discusses cost management concepts that can be used by project managers to align their project decisions with company's goals and objectives.

Enterprise cost management is managing cost across the whole organization. This means that cost savings of an organization win over cost savings of a single project. Project managers play an important role in managing enterprise costs by effectively utilizing existing processes and improving current workflows.

Target Costing and Life cycle costing are used increasingly to compete in the global economy. Target costing is determined by understanding the desired cost for the product or service to gain and sustain competitive advantage. Life cycle costing concepts explain that to deliver cost effective, high quality products, solutions or services, cost efficiency should be applied in all phases. This includes planning, designing, developing, testing, manufacturing, logistics and maintenance. Project managers need to understand lifecycle concepts clearly or they may make decisions which might keep them within their project budget but will cost the organization more in the long term.

Design to cost begins by understanding the customer's affordability, feature needs, and market requirements and thus establishes a target cost. These requirements vary globally and from customer to customer. Project managers should use cost models to make proper decisions during the design and development phase to reduce total life cycle costs of the product or service.

Value management (VM) is an organized effort to come up with innovative ways to get more value for your money. It is important to foster creative ideas and to ensure that they are based on parameters that define success. VM principles should be applied to high cost areas of the project.

The 'Total' in **Total Quality Management** means that the whole organization is involved in the quality of the products and services. 'Quality' means that the product or service conforms to the requirements of the customer. 'Management' implies infrastructure and leadership to support the customer requirements. The following exhibit summarizes the tools, long term benefits to the organization, and recommendations to the project managers that are discussed in this paper.

Tools	**Long Term Organizational Benefit**	**Recommendations for Project Managers**
Enterprise cost management – *Procurement*	Contracts, content management, supplier selection and relationship help financial and supply assurance goals.	Use procurement tools and business processes to manage cost and supplier selection. Engage in make versus buy decisions and optimal use of supplier capabilities. Leverage corporate spends.
Asset management	Maximize return of investment to the owner.	Track and leverage whole organization's software, hardware, and equipment needs & utilization.
Financial management	Buy versus lease, payment terms, discount terms, cash flow	Understand current and future needs to minimize acquisition and financing costs.
Target costing and life cycle costing	Offer competitive products and services while remain closely linked with the profit expectations and product planning process.	Use innovation in design, processes and take advantage of new technologies earlier in the product life cycle. Over emphasis on cost management has a risk of lost opportunity or time to market. Consider total cost of ownership by the end user in achieving total customer satisfaction.
Design to cost	Understands customer needs and affordability. Help improve market share. Reduces redesign or rework costs.	Use cost modeling. Design issues may result in schedule and cost overrun.
Value management	Can be applied to development, production and manufacturing processes. Foster innovation and improves quality. Offer optimal value to the customer.	Break project into small functions, observe areas of improvements and remove constraints. Use cause and effect diagram for costing to increase value of the product or service. Generate alternatives through creative thinking.
Total quality management	Improves customer satisfaction. Lowers cost of poor quality.	Use six-sigma processes such as DMAIC [Define Measure Analyze Improve Control], SPC [Statistical Process Control]. Training, green belt and black belt certification.

Exhibit 1: Tools, Benefits and Recommendations

Enterprise Cost Management

It is important to manage costs of acquisition, costs of lifecycle management, and costs of financing throughout the enterprise. These elements are tightly linked set of activities, supported by software, services and business processes. Let's look at each of these components more closely.

Procurement

Procurement is not just following the business processes of sourcing components such as purchase orders, payments, etc., but more importantly it includes product content management, with efficient utilization of processes such as, requisition, budget control, approval, and decision support. An Enterprise Resource Planning (ERP) application may not be a solution for procurement processes as ERP workflow may be different from the way your company works. Moreover, ERP applications are expensive, lack content management, and mostly focus on costs and financial controls. I would recommend using component councils and change control boards to manage product content.

Strategic Sourcing
This is another important component that contributes significantly to the bottom line of a company. It involves deep understanding of the products and services and focuses more on supplier relationship management than on negotiations. In today's economic environment outsourcing has become necessary and a company should have expertise, processes and tools in place to find and manage appropriate suppliers. It is recommended that market intelligence and competitive data of good quality be provided to sourcing professionals for fact based negotiations with suppliers. Even if an organization has good systems and processes in place, it is recommended that project managers be proficient in procurement procedures, policies, and guidelines.

Asset Management
Asset Management can be defined as the process of overseeing property performance with the goal of enhancing value and maximizing return to the owners. Asset management does not consist of a single activity that takes place at a discrete moment in time, but rather over the life cycle of a property from acquisition to disposition (Glickman & Henry 2004). Project managers need to take a more holistic approach in creating and maintaining value consistent with ownership objectives.

The key elements of an asset management plan address the tracking and control of all warranty agreements, maintenance activities, disposal costs, upgrades, and any software licenses. In information technology areas, project managers have to buy, track and upgrade software licenses very frequently. I would recommend that project managers think about leveraging the organization as a whole instead of narrowly focusing only on their project. Strategic negotiations using cost analysis, good tracking systems and organizational asset management should be the key considerations of project managers while making these decisions.

Financial Management
Financial Management aims to minimize acquisition and financing costs. It involves decisions such as buy versus lease, payment terms, and discounts from suppliers. Each stage of financial management provides opportunity to save and improve cash flow.

Depending on the present and future business needs, companies need to develop acquisition strategies. For example a health care company can create a flow chart document of the current and future equipment needs that may help them negotiate a long term supply agreement with suppliers. Different financing strategies could be developed depending on size and scale of the project. For large capital projects that have lasting value, financing with tax-exempt bonds may be the best route. The most effective financing negotiations can be done when the business objective is stated clearly and each party considers each others interests.

Understanding these business objectives can help project managers make appropriate financing decisions. It is important to understand the risk tolerance of the organization while working on large or complex projects (ePlus 2003). The diagram below explains the three main components of enterprise cost management:

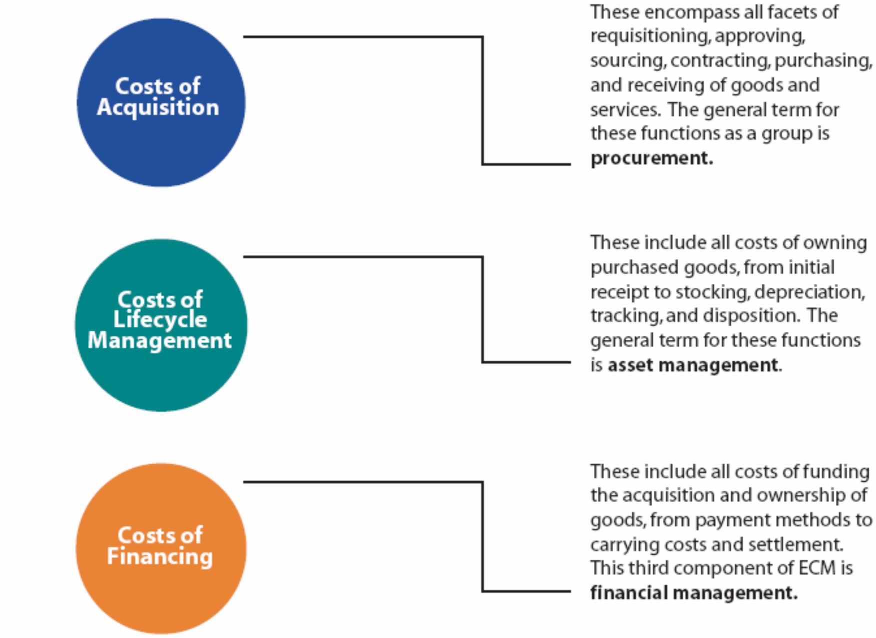

Exhibit 1: Enterprise Cost Management

Target Costing and Life Cycle Costing

Target Costing

Intel Corporation manufactures chips that are used in most of the personal computers worldwide. Intel's strategy has been to ignore low end computers and be the first to develop and deliver upgraded chips. The prices of Personal Computers (PCs), today, have gone down so much that Intel has had to develop a strategy to provide high-level chips and yet maintain desired profit margins. Intel also faces competition with other chip makers such as AMD. To be able to grow and be cost competitive, Intel is reducing costs by target costing, and is developing simplified versions of chip sets to meet the low-price computer demands.

Target Costing is used for managing costs, primarily by introducing new technology or by redesigning. It provides target cost for the product or service to earn a desired profit at a reasonable price:

Target Cost = Competitive price – Desired profit

While the personal computer costs have come down rapidly, how does Dell manage to outperform the competitors? Dell Computers focuses on reducing cost as well as adding value to the product. Its secret is also speed - speed in order taking, manufacturing, collections, and restocking. Speed reduces cost and adds value to the customer service.

Target Costing by introducing new technologies has been used by auto makers. According to Henry Ford in his book, 'My Life and My Work' "Our policy is to reduce price, extend the operations, and improve the article. You will notice that reduction of price comes first. We first reduce the price to the point where we believe more sales will result.

The new price forces the cost down" (Blocher, Chen, Lin 1999, 134). Ford used the following two strategies to reduce price:

- New manufacturing technology and advanced cost management techniques such as activity based costing.
- Total quality management and theory of constraints to further reduce cost.

I would recommend taking advantage of new technologies and processes to reduce cost. But, project managers need to be mindful of project delays and lost opportunities.

Life-cycle Costing

Life-cycle costing is used to minimize overall costs throughout the life of a product. The cost life cycle is the sequence of activities within the firm that begins with research and development, followed by design, manufacturing, marketing/distribution, and customer service (Blocher et al. 1999). The following diagram shows the stages of cost life cycle of product or service.

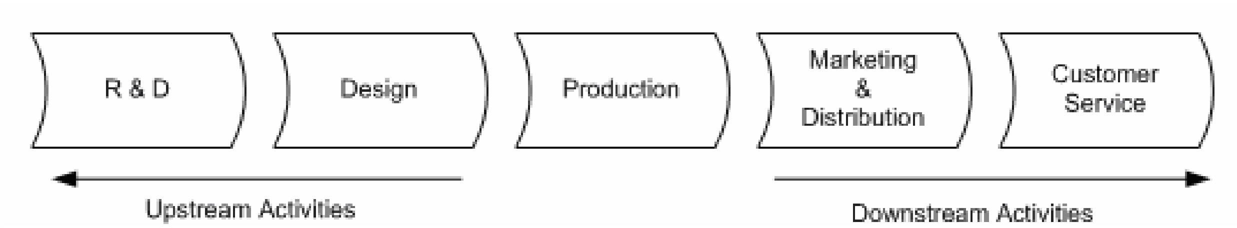

Exhibit 2: The Cost Life Cycle of Product or Service

To understand life cycle costing it is important to understand the basic product lifecycle which is simply the time the product exists from cradle to grave. A product's lifecycle can be looked from several viewpoints. *Marketing* is concerned with general sales patterns as the product or service passes through different stages. The figure below explains the general pattern from the marketing view point:

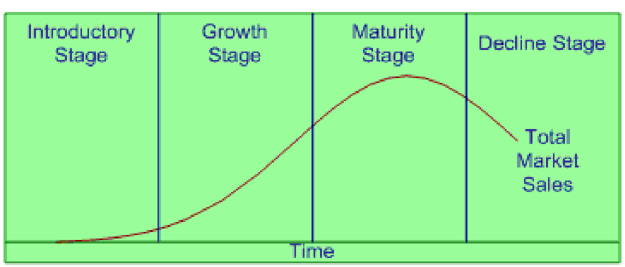

Exhibit 3: General Pattern of Product Life Cycle: Marketing View point

The Introductory stage is preproduction which is used to focus on understanding the market. There are very few sales during this period. During the growth phase sales increase quickly. Sales increase is slowed down during Maturity phase. Finally, the Decline phase is when the product or service looses market acceptance.

The *Production* view point is concerned with life cycle costs instead of sales revenue. The production life cycle is defined by activities such as research and development, production and logistics. It includes planning, designing, testing, advertising, distribution, warranty, and customer service.

From a *Customer* view point the product lifecycle is related to activities such as purchasing, operating, maintaining and ultimately disposing of the product. Product performance is emphasized, for the price, during the consumable life cycle of the product. The price here means the total cost of ownership. Customer satisfaction depends upon this price and the performance of the product. For example, the total cost of ownership of a car includes purchase price, gas, warranty, service, and maintenance.

The *Interactive* view point puts all of these viewpoints together and creates an integrated lifecycle cost management for the project manager.

Project managers make decisions that impact the life cycle costs of a product or a service. For example, should a project manager spend time to build a base functionality now that will make it easier to build extensions later? Should a project manager increase number of reviews to avoid defects in later phases? Should a project manager spend time to design software in such a way that it is easier to upgrade and support? Project managers should consider overall costs in all phases while making these decisions. Total customer satisfaction is very vital and life cycle costs should include post purchase costs that a consumer considers.

Design to Cost

Customers worldwide are demanding more performance at less cost and at the same time American companies are facing fierce competition from European and Asian competitors. Companies are reducing research and development budgets, downsizing, cutting back on general administrative costs, and locking down the design process. Decisions made after the product moves into production account for only ten to fifteen percent of the product's costs reduction (Crow 2000). A cost reduction or profitability program has to start with the design of the product at the very beginning of the development cycle.

Design to cost begins with understanding the customer's affordability requirements and feature needs, thus establishing a target cost. Then there is a need to understand production volume and non- recurring costs of development and tooling. If the development cost is significant compared to the recurring cost of production, then efforts should be made to reduce non-recurring cost. The process or technology used should not get too far ahead of feature needs and affordability of the customer.

In a typical product life cycle, the design teams consider subjective cost estimates of design alternatives during the planning phase. During the design of both products and processes, cost models of various alternatives are evaluated. In the early development cycle product cost models (e.g., parametric estimating) are based on design parameters with little consideration of the manufacturing process. Later in the development cycle, manufacturing processes are added in the product cost model. If a new manufacturing process is needed then instead of relying on existing cost data, new data is collected from suppliers, engineers and other users of this manufacturing process. Later, more complex cost model such as design for manufacturability (DFM) or design for assembly (DFA) may be used. Once the product design is essentially complete, tools and methods such as computer-aided and manual process planning would be used to develop even more refined cost estimates. Finally, as the product moves into production, cost accounting systems would collect costs by product, assembly, part, and operation. These costing tools are illustrated below (Crow 2000).

It is recommended that project managers pull together various functions as described above and make informed decisions by using cost model tools to minimize the total cost of product or service.

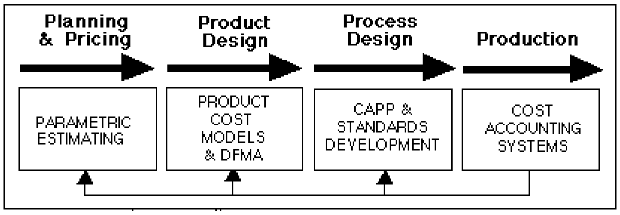

Exhibit 4: Costing Tools

Value Management

In 1947, term "value analysis" was coined at the General Electric (GE) plant. Harry Erlicher, Purchasing Vice-President, realized that after the war there was pressure to reduce costs without loosing functionality. He thought GE should strive to reduce costs in an organized approach. He implemented a value improvement program that assimilated the work done by each department, drove cost reduction, and provided low cost products with high quality (Brown 1994).

The purpose of a company is not to minimize costs, rather it is to improve profit and shareholder value. Value is a marketing term which is the price for goods or services that a customer is willing to pay when the sale is profitable. Value Management is not just a tool but a methodology that incorporates a proven set of disciplines to solve management issues. This process interacts with engineering and marketing, and considers target costing, lifecycle costing, quality, and time to market. It evaluates a range of alternatives including innovation, reconfiguration, eliminating, simplifying, improving and changing processes or procedures (Kaufman 1998).

The figure below illustrates how Value Management, Value Engineering and Value Analysis are linked together.

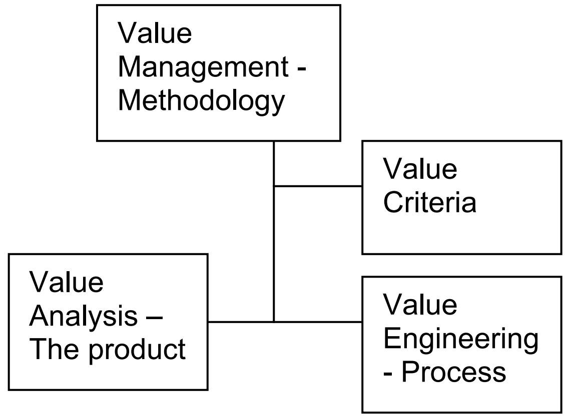

Exhibit 5: Value Management

"*Value Engineering* is an organized effort to get more for your money. It applies recognized techniques and tests to measure value and thus eliminate unnecessary costs of designing, developing, and manufacturing. It differs from cost control because it is directed toward analyzing value, not costs" (Brown 1994 pp. 20). Value analysis (VA) and Value engineering (VE) are used interchangeably but Value Engineering has broader scope. Value Engineering is applied during design phase but Value Analysis is applied in later phases. In the VE technique, five questions are asked:

1) What is the part?
2) What does it do?
3) What does it cost?
4) What else will do the job?
5) What would that cost?

Pareto's principle states that 80% of problems are caused by 20% of issues. The same principle is applied in VE to figure out areas that will result in maximum cost reduction.

Project managers have to make tough decisions regarding outsourcing of a function. They need to be sure that by outsourcing the ultimate functionality is not going to be altered. This is when the value engineering concept comes into play as its main objective is to provide the same value at lower cost.

Value Analysis or VA uses same tools as value engineering and is usually performed after the design phase but it is not required to do so. Project managers can work with developers to address three things that might have been missed. First, due to time pressure, has R&D not looked at alternative approaches? Second, have designers considered innovation? Fear of failure is usually the roadblock to creativity. Third, has transformation occurred by simplifying, altering, eliminating or by using other cost saving approaches?

VE, VA and VM principles should be applied by project managers to look at areas that require high cost. They clearly need to understand the requirements and evaluate alternative approaches to increase profitability and provide value to the customer.

Total Quality Management

In the 1980s U.S. firms had reputation of producing low quality and defective products. During that period Motorola management realized that Total Quality Management or TQM is vital to survival. Motorola completely changed its philosophy on quality and was a pioneer among U.S. companies in introducing TQM concepts such as six-sigma quality (less than 3.4 defects per million) and 10X quality improvement every year.

It focused on quality built into the product and daily practices. Due to these actions Motorola was the first company to receive the Malcolm Baldrige award in 1988 for manufacturing excellence. Even today TQM is a culture in Motorola and management considers it to be a top priority. Total customer satisfaction teams work to make sure the voice of the customer is heard and thus focuses on building better products. Motorola also focuses on achieving quality success by continuous training of its people in quality improvement techniques. U.S. managers have realized the importance of quality management in redefining their competitive advantage. New products, modern equipment and technologies can be readily copied by competitors and as such are just temporary advantages.

There is a cost associated with quality control but it has been proven that the benefits outweigh the cost of poor quality. The total cost of quality includes *prevention costs, appraisal costs* and *failure costs*. Prevention costs include all activities performed to prevent poor quality such as quality planning meetings, process evaluations and quality education. Appraisal costs are associated with measuring and auditing products or services to make sure it conforms to requirements, such as, inspection, and calibration of testing equipment, etc. The last cost is failure cost which is due to nonconformance. Failure cost could be external which occurs after delivery of product, such as customer returns and product recalls or could be internal, such as scrap and rework (Shim and Siegel 2000).

TQM has been defined in different ways. Some define it as meeting or exceeding the customer's requirement and some as providing the customer with right product at the right place. Based on the studies performed on many companies, the following most common primary strategies for TQM are recommended for project managers (Kerzner 2000, 1134):

- Employees input for improvement
- Teams to identify and solve problems
- Encourage participative leadership
- Benchmark major activities in the organization to make sure that it is being done in most efficient way
- Reduce cycle time and improve customer satisfaction by using process management techniques
- Employee training in TQM, DMAIC, DFM, and SPC, etc.
- ISO 9000 training and certification

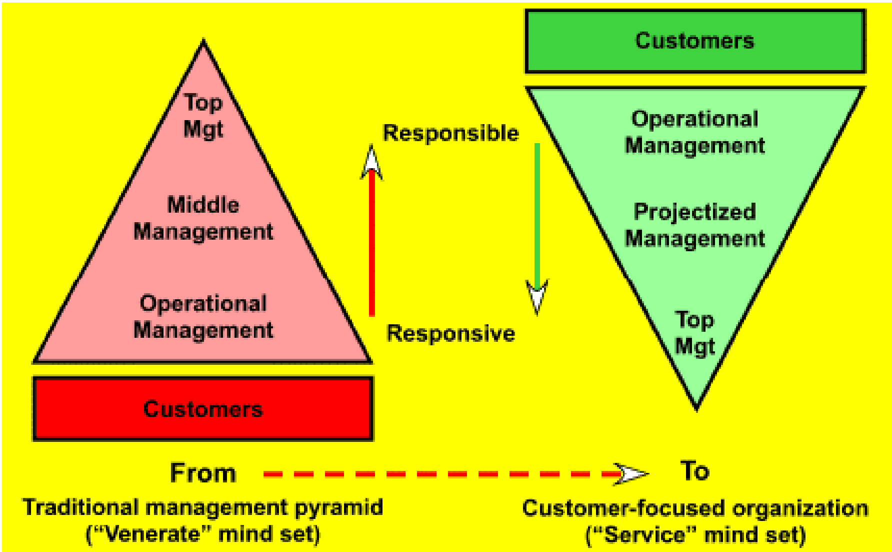

Exhibit 6 – Changing the Approach: Total Quality Management

The above diagram explains the change of approach from a traditional management focus to a customer focused organization. Elements of TQM focus on the customer satisfaction, long term commitment, top management support, full employee participation, effective vertical and horizontal communication, reliance on standards and measurements, commitment to continuous training, and lastly, giving importance to rewards and recognition. Project managers can apply 'traditional' quality management thinking to a series of projects, or management by projects. In each project they need to focus on understanding customer requirements and make sure top management and other functional areas support is there for financing and staffing. TQM requires increased teamwork as well as individual responsibility.

Conclusions

By understanding different cost management techniques project managers can contribute towards an organization's cost management and not just focus on completing project within their approved budget. Enterprise cost management explains the standards, processes and systems in place for the employees to follow. Project managers should not try to cut corners to get quick approvals for their project as eventually it is going to affect the organization. Target costing and life cycle costing concepts help project managers realize that to deliver a cost effective, high quality product, solution or service, cost efficiency should be applied in all phases of the product life cycle.

Design to cost is important for optimizing the cost of the product. Cost models can be used to make design decisions. Value management techniques are used to get a better return on investment (ROI) for the customer and the shareholders of the company. Total quality management should be initiated by top management in order for it to be adopted by everybody in the organization. TQM focuses on minimizing defects by statistical process control and ensures total customer satisfaction and good business relationships. In the end decisions made by project managers affect the total cost of the product or service. All the above concepts and recommendations tie in together for efficient cost control and long term growth for the whole organization.

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Failure Mode and Effect Analysis as Project Risk Management Tool

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Abstract

"Failure Mode and Effect Analysis*"* is a methodology use the automotive, aerospace and healthcare industry for analyzing potential failures during the product and process development processes. This methodology is a pro-active approach that attempts to identify what potential failures have the highest probability to occur, what will be their potential effects and what have to be done to reduce this probability; all this using a quantitative technique. The intent of this paper is to develop a pro-active *"Project Risk Management Tool"* based on the *"Failure Mode and Effect Analysis"* methodology. Any stakeholder would be able to identify the highest potential risks, the impact of the risk, what would trigger the risk and the action plans aimed to mitigate or contain this risk. This tool will also be using a quantitative technique to determine risk priorities.

Introduction

If anything can go wrong, it will.

One of the biggest reason why projects failed, along with the lack of a solid change management plan, is because lack of identification, mitigation, and contingency risk plans. Conversely, projects where risks are identified, mitigated or/and contained, and where a control and monitoring system is instituted, leave less opportunity for failures due to identified or unidentified risks.

Although, risk could have positive or negative impact on projects, the importance of a well defined risk management system is imperative for any project, regardless its nature. Several case studies show that neglecting this could generate several issues throughout the life of the project, which, in the some cases, could jeopardize its successful completion. (PMBOK® guide 2004)

Based on the arguments previously mentioned, the Project Management Institute (PMI) considers project risk as a key element for a successful project completion, and has therefore identified Project Risk Management as one the nine Knowledge Areas Processes on its Project Management Body of Knowledge (PMBOK). (PMBOK® guide, 2004)

This paper will focus on the utilization of the Failure Mode Effect Analysis Methodology (FMEA) as a tool that covers all the aspects that have been considered to identify risks, mitigate them and if needed, contain them; shrouding by a control and monitory system. All this based on the Project Management Body of Knowledge principles.

History of FMEA

Failure Mode and Effect Analysis is a methodology initially developed by the United Stated Department of Defense and stated on the military standard 1629, *"Procedures for Performing a Failure Mode and Criticality Analysis."* FMEA was used as analysis tool on the early design process of system functional assemblies. His purpose was to assess high risks items

and define the action plans needed to minimize failures. (United States Department of Defense, 1980).
National Aeronautics and Space Administration (NASA) also used FMEA during the 60's on the Apollo mission. To this day, NASA still uses this tool on his Process Based Mission Assurance as *"tabular technique that explores the modes in which each system element can fail and assesses consequences of this failures."* (NASA Process Based Mission Assurance Knowledge Management System, 2006)

In attempt to increase their products reliability, Chrysler, Ford and General Motors, in a jointly effort, developed in 1993 a FMEA manual which has been published on the SAE-j1739 and QS9000/TS16949 standards. QS9000/TS16949 requested FMEA compliance for the development of every single car component and every production process as mandatory requirement. (FMEA Reference Manual, 2001).

Most recently, the healthcare industry has adopted FMEA as a process improvement tool in the design of healthcare facilities aimed to reduce the fatalities caused by preventable medical errors. (i.e. Reiling, Knutzen & Stoecklein, 2003).

The paper presented here will begin with a brief explanation of the typical FMEA application, followed by a description of how FMEA can be used as a risk management tool based on PMI principles. The description will include modified FMEA concepts, their application, how to quantify and qualify them; as well as how to state mitigation and reaction plans. The paper will conclude with arguments on how FMEA, used as a risk management tool, can fulfill the six different Risk Management processes specified by the PMBOK.

Typical FMEA application

FMEA, as previously described, has been used for different type of industries as a tool aimed to identify potential product and process failures, his potential effects and his potential causes. FMEA, in order to identify the failure with the highest probability to occur and the highest impact, uses a quantitative and qualitative method. This method is based on scores given to the severity of the failure, the probability of occurrence and the capability of detection for each individual potential failure.

The multiplication of these scores equal to a Risk Priority Number (RPN). The highest Risk Priority Numbers (RPN's) will be the potential failures that would have the most impact, the major probability of occurrence and the less level of detection once they had occurred. Following the identification of the highest RPN's, an action plan is defined. In this plan, all the action aimed to reduce the initial RPN has to be depicted. Also, new scores are assigned to the specific failure mode, but now, based on the outcome of the actions before stated. (FMEA Reference Manual, 2001).

Finally cyclic reviews are scheduled to update the FMEA with the most recent RPN status and the addition of new failure modes, if this is needed. This action, gives to FMEA a live document status, where continuous updates are made in an attempt to account for any potential risk throughout the development of products or processes. (FMEA Reference Manual, 2001).

How to use FMEA as risk management tool based on PIM principles.

How the original FMEA concepts will change based on the PMI concept

FMEA, to describe the potential failures and its repercussion takes into consideration the following concepts:

- *Item/Function*: Describes the function of the product or process being analyzed.
- *Potential Failure Mode*: Describes how the product or process could potentially fails.
- *Potential Effect of Failure*: Define the effects of the failure
- *Potential Cause*: Define how the failure could occur
- *Classification*: Describe any special product or process characteristic.
- *Current Controls*: Describe mechanism to either prevent or detect the potential failure mode.

To compute the RPN's, the following concepts have to be scored within a scale that ranges from 1 to 10:

- *Severity*: Score given based on the most serious effect for a given failure mode.
- *Occurrence*: The likelihood that a specific potential cause will occur
- *Detection*: Score associated to the best selection control.

To be able to use FMEA as a risk management tool, the concepts described above have been changed into concepts more adequate to project management. The exhibit 1 illustrates these changes.

How these new concepts would be applied to the tool.

The concepts describe on the exhibit 1 will be used as based to build the Risk Management Tool, therefore, following are the definition of the concept related to risk identification.

Work Packages/Sub-deliverable: Specify the Work Packages(s) and Sub-deliverable(s) that could be affected by the risk.

Risk: Concise description of the uncertain event or condition (risk) being quantified (PMBOK® guide, 2004).

Typical FMEA application	Used as Risk Management Tool
Item/function	Work Package/Sub-deliverable
Potential failure mode	Risk
Potential Effect of Failure	Risk Impact
N/A	Project Objective Impacted
Potential cause	Root Cause
Classification	Classification
N/A	Risk Category
Current Controls	Risk Detection Method
N/A	Risk Response Plan
Severity	Impact
Occurrence	Probability
Detection	Status

Exhibit 1: FMEA concepts and PMI concepts

Risk Impact: Describe the impact of the risk in terms of what would happen if the risk occurs.

Project Objective Impacted: Describes what would the risk impact; cost, time, scope and/or quality. (PMBOK® guide, 2004).

Classification: Describe if the effect of the risk would have a negative (N) or positive (P) impact. (PMBOK® guide, 2004).

Root Cause: Define the event(s) that generated the risk. The root cause will be described based on (a) *Risk Category* and (b) *Risk Trigger.*

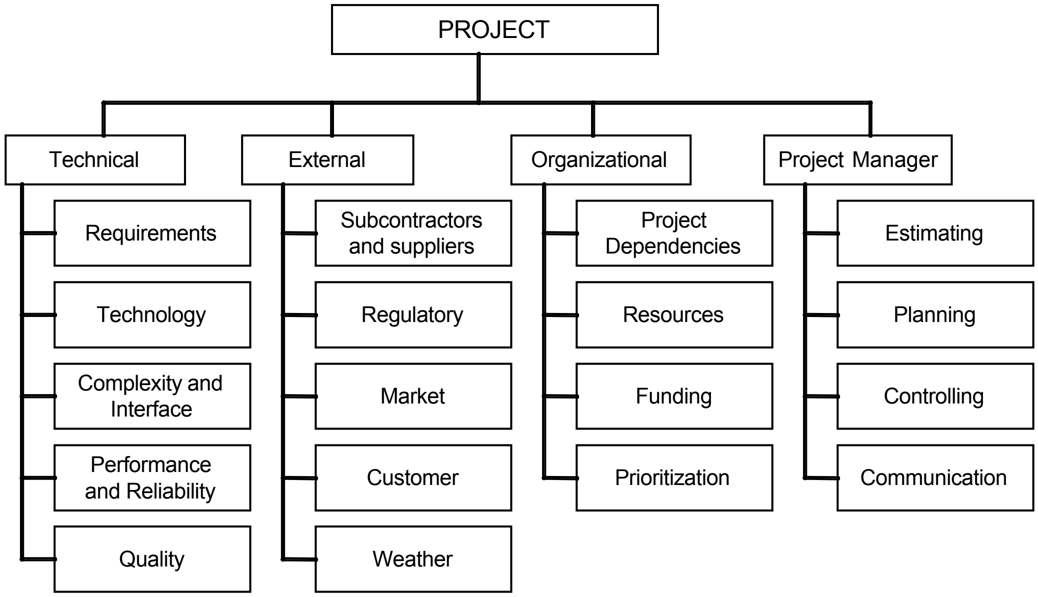

Exhibit 2: Sample of the organization Risk Breakdown Structure (RBS).

a) *Risk Category*: Describes the category of the risk based on the organization Risk Breakdown Structure (RBS). It also helps identify where the root cause of the risk is. Exhibit 2 shows an example of a RBS. However, it maybe modified based on the project or organization. (PMBOK® guide, 2004).

b) *Risk Trigger:* The mechanism(s) that would generate the occurrence of the risk. (Grey & Larson, 2006).

Risk Detection Method: Brief description of the event(s) that would indicate that the risk has become real. (PMBOK® guide, 2004).

How to qualify and quantify the risk

To qualify the risk and obtain its RPN, three different concepts will be scored: Impact Probability and Detection. Following is a recommendation of how these concepts could be scored. These are simply guidelines and maybe modified depending on the project at hand. (PMBOK® guide, 2004).

Impact: Score given based on the objective affected and its implication on the project if the risk becomes real. Exhibit 3 proposes a criterion to score the impact of the risk under different variables. (PMBOK® guide, 2004).

Probability: Score given based on the likelihood that a specific risk will occur. Exhibit 4 presents a guideline of how the probability could be scored. (PMBOK® guide, 2004). The scores assigned to the Impact, and Probability are multiplied to obtain the RPN. The risk will be prioritized as high, moderate or low based on its RPN value. RPN < 5 will be considered Low level risks. 6 < RPN < 10 are considered Moderate level risks, while RPN > 12 represent High level risks.

Project Objective Affected	Numerical Scales Very low / 1	Low / 2	Moderate / 3	High / 4	Very High / 5
Cost	Insignificant cost increase	<10% cost increase	10-20% cost increase	20-40% cost increase	> 40% cost increase
Time	Insignificant time increase	< 5% time increase	5-10% time increase	10-20% time increase	> 20% time increase
Scope	Scope increase barely noticeable	Minor areas of the scope affected	Major areas of the scope affected	Scope reduction unacceptable to sponsor	Project end item is effectively useless
Quality	Quality duration barely noticeable	Only very demanding applications are affected	Quality reduction requires sponsor approval	Quality reduction unacceptable to sponsor	Project end item is effectively useless

Exhibit 3: Risk impact depending on the Project Objective Affected.

Probability	Score
Very unlikely	1
Unlikely	2
Moderate	3
High	4
Very high	5

Exhibit 4: Probability Scores.

Probability □	RPM Results				
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5
Impact □	**1**	**2**	**3**	**4**	**5**

Exhibit 5: RPM Level

Risk ID	Work Package/ Sub-deliverable Affected	Risk Description	Class	Project Objective Affected	Risk Impact Description	Impact	Root Cause: Risk Category	Root Cause: Risk Trigger	Prob	Risk Detection Method	RPN
1	New Image/ 1.2	Late delivery of new logo	N	Time Money	Delay in the Restaurant opening	4	External subcontractor/ suppliers	No enough information during update meetings	4	Weekly face to face meeting to review job execution	16

Exhibit 6: First part of the Risk Management Tool.

Exhibit 6 shows the first part of the Risk Management Tool. All the concepts mentioned previously would be interacting on this lay out.

How to state the mitigation and/or contingency plans

Up to this point, a tool that describes the risk, its impact, and response plan has been discussed. Additionally, a system has been defined to prioritize the risk. Nonetheless, this risk has to be managed and controlled; hence, the next step is to define the mitigation, contingency, and response risk plans. These will be incorporated into the Risk Management Tool by adding the columns shown in Exhibit 7.

Risk Response Plan	Actions	Responsible/ Completion Date	Status	Action Res		
				Prob	Dete	RPN
Transfer	Define a fix price contract including monetary penalties in case of delays.	Project Manager/ August 7th	Open	4	3	12

Exhibit 7: Second part of the Risk Management Tool.

Risk Response Plan: Describe the risk response strategy to follow based on negative risk or threats; positive risk or opportunities, and contingency response. Exhibit 8 describes how these strategies are classified. (PMBOK® guide, 2003).

Responsible/Completion Date: Define the person responsible for completing the action, and the completion date.

Action Results: Re-score Impact, Probability and Detection based on the risk response plan outcome. Refer to Exhibits 3, 4 and 5.

Status: Reflect the status of the Risk Response Plan. It could be open or close depending on the work performed and the completion date.

How the Risk Management Tool will look using PMI concepts

The identified and evaluated risks, along with the response plans will populate a layout, which is the combination of the first and second parts presented in exhibit 6 and 7. It will encompass all the project information. Exhibit 9 shows this layout, a *"Risk Management Tool."*

Strategies for Negative risk or Threats	**Avoid:** Changes the project management plan to eliminate the threat posed by the risk
	Transfer: Shifting the negative impact of the threat, along with the ownership of the response to a third party.
	Mitigate: Reduction in the probability or impact to an adverse risk event to an acceptable threshold.
Strategies for Positive Risk or Opportunities	**Exploit:** Ensure that the opportunity is realized.
	Share: Allocate ownership to a third party who is best able to capture the opportunity for the benefit of the project.
	Enhance: Modify the size of the opportunity increasing the probability and/or positive impact.
Strategies for Threats and Opportunities	**Acceptance:** Indicates that the project team has decided not to change the project management plan to deal with this risk
Contingency response	**Contained:** It is appropriate fore the project team to make a response plan that will be execute under certain conditions,

Exhibit 8: Risk Response Plan strategies.

How frequently the tool would be updated

Risk control is conceder the last face in a risk management cycle (Kanabar, 1997). Although the risk management tool present here is able to provide a well rounded view of the project risks, its implications, and priority levels; it will not be complete without a monitoring and control system.

To take care of this aspect, a periodic risk reassessment will be performed throughout the life of the project. During these events, the effectiveness of the risk response plans will be evaluated and updated, and the RPN's rescored, if that is needed. Other factor to conceder is the appearance of unexpected risks or the sudden increase of current risk RPM's due to unforeseen events.

Project Number/Latest Change Level: IDE Rev -A-	Project Manager: Ginamaria Espinoza	Customer Approval Date (If Req'd.):	
Project Name/Description: Renewal of LaCasa restaurant	Core Team: Axel Gonzalez, Victor Gonzalez, Ma De La Luz Padilla	Other Approval/Date (If Req'd.):	
FMEA Number: 0001/0010	Key Contact/Phone: 679 345 2354	Date (Orig.): July 8th, 2006	Date (Current Rev): August 1st, 2006

Risk No	Work Package/ Sub-deliverable Affected	Risk Description	Class	Project Objective Affected	Risk Impact Description	Impact	Root Cause		Prob	Risk Detection Method	RPN	Risk Response Plan	Actions	Responsible/ Completion Date	Status	Action Res		
							Risk Category	Risk Trigger								Impa	Prob	RPN
1	New decoration/ 1.2	late delivery of new logo	N	Time Money	Delay in the Restaurant opening	4	External subcontractor/ suppliers	no enough information during update meetings	4	Weekly face to face meeting to review job execution	16	Transfer	Define a fix price contract including monetary penalties in case of delays.	Project Manager August 7th	Open	4	2	8

Exhibit 9: Risk Management Tool

In order to record the changes made, a separate log will be added. This log will state when the update was made and what was changed. It will also serve to record any unforeseen risk and RPN variations.

Communication Plan

A key factor of risk management is awareness (i.e. Kanabar, 1997). To keep the stakeholders aware in timely manner a communication plan has to be defined. Even when the tool presented can act as a risk performance report for the team members, it may not be adequate for a steering committee, sponsors or customers. Therefore an alternative method has to be use to convey the most crucial information. A Pareto chart will describe the highest RPN, also, it will give a concise description of the risk reaction plan. Exhibit 10 describes an example of a Risk Pareto chart. The Pareto charts will describe: (1) The risk with the highest RPN, (2) following the Pareto 80/20 rule, it will identified the 20% of the risks which could cause the 80% of the potential issues (Kenneth, 2005).

Conclusions

The PMI PMBOK, describes Project Risk Management as the processes concerned with conducting: (1) Risk Management Planning, (2) Risk Identification, (3) Qualitative Risk Analysis, (4) Quantitative Risk Analysis (5) Risk Response Planning, and (6) Risk Monitoring and Control. Following an expiation of how the Project Manager Tool presented can cover all these processes. (PMBOK® guide, 2003).

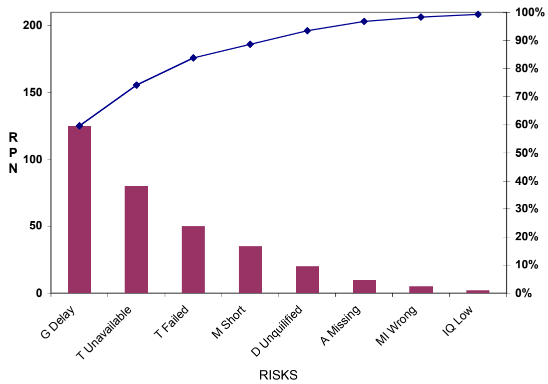

Exhibit 10: Risk Pareto chart

Risk Management Planning - Deciding How to approach and conduct the risk management activities for a project. Having a document where all the project risk will be listed classified and evaluated will cover this part. As shown during this paper, this tool fulfill all this different dimension, first, giving a number to the risk, secondly, by the identification of the Work Package and Sub-deliverables affected, followed by the description of risk and lastly by describing the risk classification. (PMBOK® guide, 2004).

Risk Identification - Determining which risk may affect the project and documents their characteristic. The section dedicated to the root cause and risk detection method will cover this process. A accurate description of the risk category and risk trigger will help to archive a narrow risk identification. Furthermore, the section dedicated to risk detection will indicate the controls aimed to detect when the risk has occur. (PMBOK® guide, 2004).

Qualitative Risk Analysis: *Method for prioritizing the identified risk*. Impact, probability and detection will act as the qualitative part of this tool. The RPN will be derived for these concepts and it will indicate what risks will be in the high level and therefore point where the effort should be concentrated. (PMBOK® guide, 2004).

Quantitative Risk Analysis: numerically analyzing the risk effects on the project. The RPN along with the Project Objective Affected and the Risk Impact Description will cover this process. (PMBOK® guide, 2004).

Risk Response Planning: *Process for developing options and determining actions.* The step where the response, mitigation, and contingency plans are define fulfill these processes. Furthermore, this section allows the reassessment of the risks based on the risk response plan outcomes. (PMBOK® guide, 2004).

Risk Monitoring and Control: Monitoring of new and changing risk. The log proposed where all the different changes will be captured will comply with process. The effectiveness of the risk response plans will be evaluated and updated, and the RPN's rescored. (PMBOK® guide, 2004).

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A Parametric Cost Model to Estimate Oracle-based Application Development Effort

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Abstract

Software cost estimation models play a key role in supporting project managers with their top down budgeting needs. In this paper we present twp parametric cost estimation models to estimate programming effort for software implementation. In particular our research focuses on Oracle based applications. Metrics data from four large oracle projects was used to create this simple model, which can be adapted to estimate total software development effort for different systems development life cycles.

Introduction

The importance of estimating the size of and the time required for software development cannot be over-emphasized. In the foreword to Tom DeMarco's *Controlling Software Projects*, Barry Boehm says the following:

> Better cost estimation methods help us to understand the relative costs and benefits of a proposed future system well enough to be able to reduce its scope or to eliminate portions whose benefits do not justify their estimated costs (De Marco 1982).

While, progress has been made towards measuring and estimating the effort of software applications using 3GLs (Boehm 1981; Kemerer 1988), very little research has been done to estimate effort of applications developed using fourth-generation tools or application software generators.

In this paper, we introduce two parametric models for this domain and describe our experience with them. Definitions and theoretical aspects of these tools are presented first, followed by experimentation, calibration, and related details.

Effort Estimation and Cost Models

There are several kinds of cost models in existence today. Software engineering and project management books usually describe such models in detail (Pressman 2002; Pfleeger 1991; Boehm 1981; Abdel-Hamid & Madnick 1991; Dreger 1989; Jones. 1986; De Marco 1982; Grady & Caswell 1987). They are available today for all kinds of applications. Warburton (1983) describes a model for predicting the costs of real-time software.

Cost models estimate software development effort by considering major cost factors such as the size and complexity of the application. In principle, such models function by defining a simple relationship between development effort and some early metric of software size that can be used to forecast project costs with greater accuracy and precision than traditional seat-of-the-pants guestimates (DeMarco & Lister 1990).

Cost models are generally very easy to use and novice project managers or estimators with little or no experience can benefit the most with them. Several cost models are commercially available. COCOMO is the most widely embedded model for applications using COBOL.

Fourth Generation Tools

Since this research paper pertains to effort estimation of projects developed using Fourth-Generation Tools (or techniques) (4GTs), it is worthwhile defining this term as it suggests the scope and purpose of the parametric model. Pressman (2002) and Damodaran (1987) use the term *Fourth-Generation Tools* as opposed to the term *Fourth Generation Languages*. Damodaran states that 'the reason the former is preferred is that the items in question are mostly tools rather than languages" (p. 157). We also prefer to use the term fourth-generation techniques for the same reasons - the products being researched (e.g., Oracle DBMS application generators) are tools not languages. So what are 4GTs? According to Pressman (1987):

> The term *fourth generation technique (4GT)* encompasses a broad array of tools that have one thing in common: each enables the software developer to specify some characteristic of software at a high level. The tool then automatically generates source code based on the developer's specification. There is little debate that the higher the level at which the software can be specified to a machine the faster a program can be built (p 24).

4GTs reduce the time and effort required to generate an application by a factor of at least 5 when compared with application development using 3GLs (Martin 1985; Bate & Vadhia 1986; Matos & Jalics 1989). 4GTs are likely to become an increasingly important part of software development during the next decade, and conventional methods and paradigms are likely to contribute less and less to all software developed" (p. 25). The focus of our cost model is the techniques used in small to medium business applications, tools such as: query facilitators, form generators, report generators, application generators, and related 'specification oriented' application packages.

Estimating the cost of application development during the early stage of a project is probably one of the toughest challenges an application developer faces today. Currently no simple approach or universally applicable formula exists for project sizing and cost estimation. Regardless, all project managers are required to submit a ballpark estimate, based on quantitative data in order to support financial justification for the development. The key stages of cost estimation covered by the 4GT model include the Conceptual phase and a detailed version of equations covers the Design phase.

The 4GT estimation model was designed and implemented on the basis of interviews with several practitioners, literature and research, product citations, and project data gathered over the past 10 years. In fourth generation environment, work effort can be attributed to functions that have to be implemented. In other words information system size can be represented by functions. A function can be classified into one of the following types: form, report, the data, and process. The Oracle DBMS generates forms, reports and applications, and of course it uses tables to store data.

Important characteristics of application development with 4GT's are:

- We generally specify what is to be accomplished
- Most of the specification effort is focused on and around screen fields.

The term 'screen field' refers to the input and output data elements of forms, reports, and related elements. Like most cost models, the 4GT model uses a predictor to estimate effort. Predictors play a crucial role in the estimation process, according to DeMarco(1982):

> Every metric falls into one of two categories: either a result or a predictor. A result is a metric of observed cost, scope or complexity of a completed system. Examples include total cost, total manpower, time, cost, etc. A predictor is an overtly noted metric that has a strong correlation to some latter results.

When facing an estimating task the estimator always has a model in mind. This intuitive model can be formally established as a cost model.

Effort = K * Predictor

Some popular predictors are lines of code (LOC), and function points (FP) (Boehm 1981; Albretch & Gaffney 1983). While the function points are suitable for estimating Oracle applications they are not easy to use.

LOC as a predictor has done well historically for 3GL applications such as COBOL. However, LOC is not a practical predictor for 4GT applications as a substantial amount of the code is automatically generated by Oracle tools. While 4GT applications certainly involve some SQL coding, and some PL/SQL coding, this code is more declarative in nature and is at a higher level.

Our detailed 4GT model uses a new predictor called a specification element (SE). The current specification element is a hybrid of the terms software specification and data element. An SE is formally defined as a specification task associated with implementing a data element. An example of SE is "Enter ZIP code. Test for numeric value only." Another example of an SE is "automatically retrieve name when ID is entered."

The philosophy behind the predictor SE can be viewed in terms of Connell & Shafer's (1989) software brick. That concept of a brick is explained as follows:

> If a brick wall is to be built, there are metrics available regarding the average amount of time required to lay one brick. Estimating the time required to build a wall is then reduced to simply calculating the number of bricks required from the wall's dimensions and multiplying that number by the current metric for brick-laying.

During the design stages the total number of data elements is known. The adjusted specification element ASEV is the count of the development effort for the whole form multiplied by the complexity of the specification.

ASEV = Number of data elements * Complexity of specification element.

Complexity of specification was researched further and is classified as follows:

Simple SE's.
These are simple screen elements that do not have any specification complexity. For example, a field call ZIP code but with no implied

complexity of doing a check for zip code or retrieving the town and state when a ZIP code is entered.

Basic SE's
While a few screen fields might require no further action, some require validation. For example: check the ZIP code for numeric value only.

Detailed SE's
Such screen fields require implementation of a trigger or a stored procedure. For example: when the ZIP code is entered, automatically populate the town, city and state fields.

Form-Function SE's
Such a specification is associated with programming within the context of the form entry and user exit.

Let us revisit the brick analogy within the context of the detailed 4GT model.

- The various categories of SE's presented above are equivalent to different sizes of bricks with different metric values (such as time required to lay each brick). If you're building a large wall with large rocks, the effort and scope of the project is larger than an equivalent implementation requiring a wall with smaller bricks.
- The total number of screen fields refers to the total number of bricks. Knowing the total number of bricks required and their corresponding metric values (such as the time required to lay each brick), we can begin to obtain an estimate of the development effort required to implement the form.

Case Study
To test the various models we used data from several applications that were developed, including some at Boston University. But the most comprehensive research was done on the Legal SYStem (LEGASY) project at Great West Life Assurance Company in Winnipeg. This large project has the following systems

- Automated Litigation Management: store information regarding issues, files.
- Automated calendar of events: keep track of scheduled events of each file.
- Automated time tracking: record in-house counsel time for each file.
- Implement key word document search: locate document on the system which contains a specific word or phrase.

Corporate executives examined the above requirements with a view to implementing the system. The system took 2,340 person hours to implement. We were given access to all project management data, which allowed us to calibrate and tune the model.

The results of the calibration resulted in the following values:

- Ball Park Programming Effort

  Effort = [(10.2* # of forms) + (7.9 * #. of reports) + (4.9 * # of entities)]

- Detailed Model: Specification Element based Programming Effort
  - Time to implement a simple SE = 10 person-hours
  - Time to implement a basic SE = 24 person-hours
  - Time to implement a detailed SE = 50 person-hours
  - Time to implement a form-function SE = 250 person-hours

- Ratio between different activities of the Systems Development Life Cycle for a traditional project:

- o Initiation & Requirements: 8% of total lifecycle 80 PM
- o Functional Design: 15% of total lifecycle 150 PM
- o Detail Design: 15% of total lifecycle 150 PM
- o Programming (+ unit test): 30% of total lifecycle 300 PM
- o System Testing: 13% of total lifecycle 130 PM
- o Acceptance Testing: 10% of total lifecycle 100 PM
- o Implementation: 7% of total lifecycle 70 PM
- o Wrap-Up: 2% of total lifecycle 20 PM

The 4GT model only estimates the Programming effort. This data leads us to use a multiplier of 3.1 in the 4GT Model.

Ball Park Model

The 4GT model (Fourth Generation Technology Model) On the basis of the available data from Great West Life we calibrated the ball park model for the 4GT model as follows:

Programming Effort = [(10.2* # of forms) + (7.9 * #. of reports) + (4.9 * # of entities)]

We now present an example of using the above model in real world projects: A proposed telephone system has 5 forms, 2 reports, and three tables. Implementation: Oracle RDBMS

Programming Effort = [10.2 * 5 + 7.9 * 2 + 4.9 * 3]
= 252 Person Hours (Approx. 2 Person Months)

Programming effort is calibrated to be a third of the total life cycle development effort. Therefore we multiply this by a factor of 3.1.

Total System Development Effort = 3.1 * Ball-Park Programming Effort

Therefore, Total effort = 252 Person Hours (Approx. 2 Person Months)

Detailed Model

Specification Element based Programming Effort is used when more design details are available. For example: You are implementing an Oracle application with 10 simple SE's, 5 basic SE's, and one Form-function SE.

Your application development effort is:

Effort = 10* 10 + 5 * 24 + 250 = 470 person-hrs.

Note: the above does not consider additional cost drivers. We describe the cost drivers that are common in Oracle applications below.

Limitations of the 4GT Model

Parametric models are stand-alone products. That is, they do not tap into a metrics database for estimation or planning purposes. As technology changes and improves, the accuracy of a parametric model may decline. A 4GT model is also open to such risks. A solution is to tightly couple the cost model with live and current project management metrics data. This way the data generated by the parametric model stays current.

Cost Drivers

Boss Corporation (2001) describes key cost drivers for packaged software implementations using Oracle. The cost, scope, and risk of an

ERP project are directly proportional to the following items:

- The degree of business complexity
- The number of applications to be implemented
- The amount of extensions to the package software
- The nature of the business processes

Boss corporation (2001) Corporation analyzed a complex project to determine what factors controlled the cost.

> Their work plan for this project was over 1,500 consulting workdays and 4,000 client workdays. They looked at each task in the work plan, the cost factors controlling the task, and the number of planned days to complete the task. Then, they weighted the results to determine which factors contributed the most to implemented cost. Because multiple factors might contribute to the cost of a single task, results add to more than 100%.

Factors Affecting Total Cost Factor

The data below shows factors affecting the total cost.

- Applications to be implemented: Impact is 45%
- Business complexity: Impact is 40%
- Customizations, interfaces, data conversion: Impact is 31%
- Business processes and reengineering: Impact is 13%

However they add that over the past seven years, consulting firms and Oracle have developed many techniques to control costs, project scope, and complexity, implying that such cost drivers can be mitigated today.

Project Factors

We have researched one category of cost drivers called project factors (PFs). PF's are a group of project parameters that influence team productivity and project cost. Examples of project factors include the skill-level or experience of the participants, methods or languages used, etc.

When planning a project, such factors must be identified and the level of their impact. Various PF's that play an important role in effort estimation are described here. Several researchers have identified and documented some of these PF's in their cost models (Albrecht 1979; Walston & Felix 1977; Boehm 1981; Jones 1986; Bailey & Basili 1981; Abdel-Hamid & Madnick 1991). Here is a list of some PF's

- The size of the project
- The size and experience of the project team
- The stability of the development environment
- The requirements and interface specifications
- Project factors.
- Mode of Development

Mode of Development

The mode of development will affect the 4GT Cost Models results in the following ways:

1) The extent of support available from various sources such as the Systems Center and the extent to which assistance with various aspects of application development is available from the data processing shop. If such support exists, then it serves the purpose of facilitating application development and eventually reducing effort and cost of software development.
2) The type of end user. Six categories of end users have been identified by Rockart & Flannery (1983).
   (a) Programmers

(b) End User Computing Support Personnel (Information centre staff members)
(c) Functional Support Personnel (power users who work in functional departments, outside of IS)
(d) End User Programmers (who can write code)
(e) Command Level End Users

Conclusions

In this paper we introduced two parametric equations of the 4GT model that can be used to estimate application programming effort for Oracle and related database systems. The model consists of a ballpark model that is used to estimate effort in the early stages of the life cycle and a detailed model that can be used to estimate effort during the design phase of the systems development life cycle. For traditional life cycles we used a calibration factor of 3.1, which is used as a multiplier to get total life cycle development effort. We briefly presented a few cost drivers that impact software development effort.

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Value Management Processes Provide Discipline for Risk Management

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Abstract

The practice of Risk Management has been proven in its ability to identify, analyze, mitigate, and control threats to a project plan. The use of opportunities in Risk Management may not be fully developed and understood for various reasons: a threat-driven risk management mindset, an inflexible, traditional corporate culture, and acknowledgement that developing good ideas in an enterprise requires an integrated, formalized process that can utilize the talents of a project team in a creative manner. Value Management has been around since the 1940's and is used in many different industries. It can be applied to products, services, processes, and projects. Its basic premise is to use functional analysis to generate and develop proposals to maximize value to the customer. By utilizing the best aspects of Value Management with Risk Management, risk opportunities would get the attention they deserve to have a positive impact on the goals of the project.

Introduction

This paper will show that the core set of processes that are integral to Value Management will add a disciplined approach to cultivating risk opportunities in Project Risk Management. The main purpose of Project Risk Management is to increase the probability and impact of positive events, and decrease the probability and impact of negative events. The Project Management Book of Knowledge (PMBOK) outlines the Project Risk Management processes as the following: risk management planning, risk identification, qualitative and quantitative risk analysis, risk response planning, and risk monitoring and control (p. 237).

Value Management methodology can expand on the functional building blocks of a project in order to develop opportunities that can benefit an organization. Risk Management has an analysis process step that is proven in its use to evaluate the probability and impact of the opportunities to project goals. Therefore, a combination of Value Management and Risk Management can provide more credible data to the stakeholders so that they can make better decisions on the opportunities that are laid out before them. Organizations that are set-up to use the approaches described in this paper will be able to show impressive returns on investment based on their ability to generate and implement project risk opportunities.

Value Management Overview

Value Management is an organized effort that uses interdisciplinary teams and a structured job plan. Kaufman (1990) describes how Value Management was developed during WW II by a General Electric Company electrical engineer Lawrence D. Miles. Larry Miles needed to find alternative materials in order to manufacture the high demand war equipment and trained purchasing buyers to ask the right questions of the design engineers in order to understand why materials were chosen before finding alternatives. The current definition for Value Management according to

Kaufman (1990) is “An organized effort directed at analyzing the functions of goods and services to achieve those necessary functions and essential characteristics in the most profitable manner” (p. 1.3). Companies should strive to improve product features in which the customers value. This could then help companies demand higher prices or improve sales. The value methodology has been integrated at many companies while SAVE (Society of American Value Engineers) is an organization that advances and promotes the value methodology (“SAVE International Website,” 2006).

Exhibit 1 illustrates the total time that should be allocated for a Value Management activity.

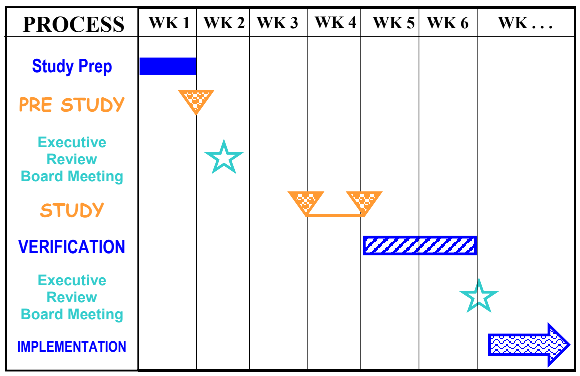

Exhibit 1. The Value Management Timeline

For a new product, process, or service, the process will take about five full days of full-time, dedicated team membership with an experienced facilitator. The pre-study takes about a day followed by an Executive review meeting. The time allocated for preparation, verification, and implementation is elapsed time based on the needs of the project. Exhibit 2 describes the 7 phases of Value Management, which is captured in the timeline. These phases are discussed in more detail (Pratt & Whitney value management event facilitator’s guide 2000).

Information Phase (Pre-Event)

Along with what is listed in Exhibit 2 as activities of the Information Phase, the team needs to identify the perceived barriers and select the appropriate management that will make up the Executive Review Board (ERB). Following the pre-event a status report is given to the ERB to gain approval to proceed with the study and to get help knocking down barriers that would prevent them from achieving their goals.

Phase Name	***Activities***
Information	Define Problem, Establish Goals, Define Attributes, Develop FAST Model
Speculation	Brainstorm Functions, Record Ideas
Evaluation	Champion and Score Ideas, Select To Ideas, Expand Surviving Ideas
Development	Develop Proposals, Evaluate Impact on Attributes, Create Implementation Plan
Verification	Audit Technical and Financial Assumptions, Verify Resource Availability
Reporting	Present Proposal to ERB, Obtain Go Ahead Approval & Funding
Implementation	Execute Plan, Verify Impact to Bottom Line

Exhibit 2: Phases of Value Management

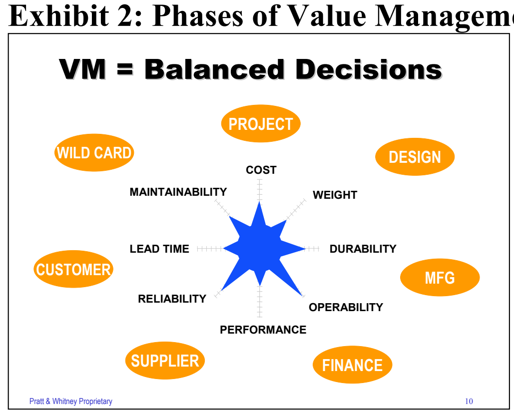

Exhibit 3: Product Performance Profile

An instrumental tool that is used in Value Management is the product performance profile depicted in Exhibit 3 as a star chart. From Exhibit 3, the attributes that are pertinent for this particular value study are cost, weight, durability, operability, performance, reliability, lead-time, and maintainability. They are weighted relative to each other in accordance with the contribution each makes to the product. The minimum acceptable value for each attribute is located at the inner circle of the base of the star. The maximum value is located at the farthest point out on the axis of each leg. The current value of each attribute is located at the tip of the star leg.

The star chart is created to provide a status of how balanced the current design is and helps determine where there are opportunities to trade between attributes. It is also used as a basis for improvement based on the scenarios that the team recommends as a result of the Value Management study. A single weighted score can be calculated. Usually the team members that participate in the study have a stake in one or two attributes and therefore have expertise in the particular functional area represented by that attribute. In the above figure, the team could be made up of a project leader, designer, manufacturing engineer, financial person, supplier, customer, and specialists in operability and/or durability. Also, wildcards are usually brought in who have little or no knowledge of the subject matter in order to get fresh ideas into the study.

Functional analysis is completed next - refer to Kaufman (1990) for a thorough explanation of FAST. Functions are defined in two words: an active verb and a measurable noun and should not be defined too specific. For example, the function of a pencil is to “Make Marks.” The fundamental point of functional analysis is to define basic and secondary functions that best describe a product or service. Basic functions describe the original intent of a product or service, operating in its normally prescribed manner. Secondary functions carry out or support the basic function. The basic function is typically 5% of the product cost while the secondary contributes 95% of the product cost. The basic function cannot alone sell a product; however, secondary functions cannot be sold without satisfying the basic function. And finally, the loss of the basic function causes a loss of market value/worth of the product or service.

Speculation Phase
The speculation phase is where all the ideas are generated or brainstormed. In order to encourage innovation brainstorming the focus is on functions, not process steps or hardware parts. One way to approach this is by thinking of the simplest, most elementary thing that would perform a given function, ignoring all other features. Also, it is important to generate alternatives that reduce, combine or eliminate secondary functions while still delivering the basic function.

Evaluation Phase
This is where the brainstormed ideas (by function) are evaluated and prioritized. There are several group judging techniques that can be used and after the ideas are evaluated, the top ideas are selected and further expanded. The most common evaluation technique is performed in three steps. The first step is for each team member to champion those ideas that they believe will contribute to achieving the study goals. The second step is to review each championed idea and then have team members draw on their knowledge and experience to simultaneously vote on the merits of the idea. The third step is to sort the ideas in descending order (of the score) and the team will be asked to determine the lowest acceptable score. All surviving ideas above the waterline need to be formally written up to include details of the proposed approach, investment required, drawbacks, probability of success, and impact to attributes.

Development Phase
In the development phase, scenarios are developed, the attribute impacts are evaluated, and business cases are created for the proposals the team feels most strongly about. The usual recommendation is to select a

primary and two back-up proposals. Some ideas may not contribute to the goals and will be dropped. The idea write-up sheets are entered in a computer toolset so the information can be used to create scenarios. Scenarios are sub-sets of ideas and are the basis for the team recommended proposals.

Verification Phase
The verification phase is important as facts and assumptions are checked, cost impact is audited, and implementation plans are created. It also provides the team a break from the value study to recharge and catch up on normal work.

Reporting Phase
As this is a post study activity, the Executive Review Board (ERB) presentation is put together, presented to the ERB, and the ERB is charged with making a decision on the main proposal. If the decision is a go, there may be more homework for the team to do before funds and resources are released to implement the project. It is important to note that the ERB must be made up of the key stakeholders of the project in order to maximize the results of the value study.

Implementation Phase
If the project is given the green light by the key stakeholders, the implementation plan can begin, progress reported and tracked in order to measure how the bottom line has been impacted. It is also important that all successes (and some failures) should be advertised throughout the company to promote the project, results, and the Value Management process.

Opportunity Risk Management

In the early 1990's, a pharmaceutical company had been researching a new drug to help men suffering from chest pains. The heart medication did not show promise and the studies for this drug was stopped. However, the company realized that the side effects could be used to treat a different medical condition. The pharmaceutical company re-evaluated the drug and the clinical trials were so effective that it only took the FDA six months to approve it. The pharmaceutical company is Pfizer, the drug is Viagra, and profitability from Viagra continues to grow (Viagra Overview and History 2004). While this is an extreme case of good fortune based on the unexpected development of a game-changing product, opportunities are abundant in companies that produce goods and services. Value Management has been demonstrated to spawn opportunities comparable to the Viagra example, which can provide significant impact to an organization's bottom line.

Risk Management has been used in many different organizations to mainly manage the uncertain negative issues that govern the particular organization's business. Therefore, there are misconceptions about Risk Management that are mainly due to how it's been applied. A lot of companies only view risks as factors that have a negative impact to objectives and will only spend time managing risks that could have adverse effects to a project's budget, schedule, and performance. Unfortunately, it appears that managing opportunities is not as important as managing threat-related risks - organizations will claim they don't have time to manage opportunities. Opportunities that are not realized can be as detrimental to the success of an organization as threats that have materialized. Especially in companies such as Pfizer where competition in the pharmaceutical industry requires that companies need to constantly develop new opportunities to create new markets to survive.

Opportunities, like threats, are evaluated based on likelihood of occurrence and impact. Impact exposure can be evaluated in terms of cost, time, performance, and quality. Scoring schemes can be developed for both qualitative and quantitative analysis. PMBOK shows and describes the Probability and Impact that can be applied for both threats and opportunities (p. 252). The left hand column shows the probability values based on five levels, where the lower-most row shows an impact scale for both threats and opportunities. For given probability and impact levels, a risk threat score can be calculated. Likewise, a risk opportunity score can be calculated. The Viagra product would score as a High Opportunity since the probability of success is high (it fills a popular need) and the impact on corporate goals is high (great financial and business success).

Once the opportunities and threats have been identified and analyzed, risk response strategies need to be developed. PMBOK outlines the responses for both threats and opportunities (pp. 261-263). Just as mitigation works well to outline the steps to reduce the probability and impact of the threat, enhancement is done to increase the probability and/or impact to amplify project benefits. Opportunities (or a proposal of opportunities) require a project plan for implementation.

Whether managing threats and opportunities, risk monitoring and control is an important process step. PMBOK describes that for opportunities, risk monitoring and control may identify new opportunities to add to the proposal, track the progress of the development of opportunities, monitor triggering conditions for contingency plans, and review the implementation of the risk responses and determine if they obtained the projected benefit (p.264).

Illustrated Example – Capital Appropriations

The Capital Equipment Program Office (CEPO) at Pratt & Whitney is involved in the forecasting of capital equipment, project planning, procurement of equipment, and equipment build and installation. The involvement of CEPO begins with the initial request to help a particular manufacturing business unit and is continuous until the equipment has been delivered and project validation is completed. For example, to complete the procurement and installation of a 5-axis milling machine with unique requirements for machining large aerospace parts, it has to be shown that the machine can operate and produce parts to the original specifications as defined by a manufacturing engineer.

A Value Management study was held at the request of CEPO in order to develop a standardized Capital Appropriations process, from the development of a capital plan through asset recovery. The purpose of the study was also to establish defined roles, responsibilities, and robust controls that support the Pratt & Whitney business plan, manufacturing, sourcing, and service strategies (Capital appropriations Value Management Study 2000).

The goals of the study were as follows:

- Develop a process definition that identifies the "customer" and CEPO roles and responsibilities
- Define the owner for each major step in the process
- Develop an effective sales pitch and communication plan.
- Identify robust control measures
- Define implementation plan

The attributes defined for this study were the following: Resources Required (manpower), Speed (in calendar days), Compatibility (with other business units), Management Control, User Friendly (based on number of process steps), and alignment (based on number of checkpoints in process). The attributes were defined quantitatively so that the results of the Value Study could be measured and compared to the baseline. Exhibit 4 shows the functions the team generated based on two purposes of Capital Appropriations: Manage Capital-Equipment and Define Execution-Plan.

Manage Capital-Equipment	**Define Execution-Plan**
Meet Schedule	Appropriate Funding
Coordinate Project	Negotiate Finances
Manage Plan	Establish Forecast
Implement Plan	Create Wish-List

Exhibit 4. Functional Analysis for Capital Appropriations Value Management Study

After the functional analysis phase was completed, the speculation, or brainstorming phase began. The team generated over 200 ideas in about a day of intense brainstorming. These were evaluated and developed into 39 ideas, or opportunities. From the 39 ideas, 14 were carried forward into a primary proposal. Exhibit 5 shows the list of the 14 opportunities.

The next step was to assess the opportunity and it's benefits. The higher the probability value is, the higher the probability that the opportunity will be successfully implemented. The higher the impact level, the higher the opportunity will benefit the project objectives. Exhibit A provides a list of the opportunities along with the probability and impact levels for each of them listed. Exhibit A also lists the threats (if applicable) that could hinder the chance of success of the opportunities and/or negatively impact project objectives. The exhibit also summarizes the probability and impact levels for each threat listed (as each threat corresponds to a particular opportunity).

The probability and impact levels for both the opportunities and threats are plotted on the Probability and Impact Matrix shown in Exhibit 5. A waterline needs to be established to define which opportunities are pursued and which response strategy will be carried out. For the sake of this paper, only opportunities in the red (High) region are above the waterline and require priority action and aggressive response strategies.

Opportunities #4, 5, 6, 8, and 12 meet these criteria. However, Opportunity number 4 has a high threat that may negate its benefits to the project. It may be determined that it must be dropped from the going-forward list. Investigating opportunity #4 – it states "Standardize and consolidate inputs and data and provide reports to the decision making body in order to construct a Capital plan." It appears that it has a good chance of success. However, the accompanying threat states that it "will be perceived as additional work. This will result in business units perceiving that they are losing control of the capital program."

This illustrates the fact that opportunities need to be assessed against any potential threats that could negatively affect the chance of success or positive impact to the project. Opportunities #8 and #12 are questionable and will need more extensive analysis of their respective threats. For all opportunities that obtain priority action, exposure can be calculated for both the opportunity and the threat utilizing numerical value impacts for the attributes that were defined in the study. For the Capital Appropriations study, Exhibit 5 could be expanded to include actual impact values for the attributes (resources required, speed, compatibility, management control, user friendliness, and alignment).

Probability and Impact Matrix										
Probability	Threats					Opportunities				
0.90		12				6				
0.70			8	4			4			
0.50			2	3			5, 8, 12	7		
0.30		5, 10	1, 6	7, 13			3, 10	1		
0.10			3			13	9, 14	2, 11		
	0.05	0.10	0.20	0.40	0.80	0.80	0.40	0.20	0.10	0.05
Impact (ratio scale) on an objective (e.g. cost, time, scope, or quality)										

Exhibit 5: Opportunities and Threat for Capital Appropriations Value Management Study

The method described above provides more credible data and decision-making ability to the team members and stakeholders in determining which opportunities get the funding and resources, especially if funds are limited and there are not infinite resources available. It is recommended that a probability and impact analysis for opportunities and threats be created for each proposal that is presented to the Executive Review Board. The next step would be to develop risk response strategies for the opportunities that get priority in a proposal. Of course the response strategy, along with the study results, would be presented to the Executive Review Board.

Combining the Processes

In practice, Value Management activities are usually carried out first in order to determine exactly what is meant to the business from delivery of the project. As the Value Management process generates opportunities, is recommended that the opportunities be identified together with the threats that are likely to occur if the proposal was implemented.

The project team would iterate on its means of defining value, opportunities and associated threats until an optimum balance of value and risk is obtained ("Achieving Excellence in Construction - risk and value management," 2003). Even though Risk Management and Value Management inherit separate origins, they share many characteristics and are gaining in popularity in their complementary uses ("The Institute of Value Management - What is value management"). Exhibit 6 highlights similarities in their methods throughout their respective processes.

Both processes entail a planning stage to define objectives and structure their utilization. Both processes are systematic in identifying opportunities (a Risk Management Structure is used in Project Risk Management and Functional Analysis is used in Value Management). Both are also good at providing methods to prioritize and develop plans and strategies (responses and implementation plans). It can be argued that Value Management is better at utilizing creativity and brainstorming to identify the opportunities that can benefit a Project's goals. However, the analysis process step of Risk Management provides a means to evaluate the probability and impact of opportunities to project goals. Both processes utilize the stakeholders to help review and monitor execution.

Value Management Phases	**Risk Management Process Steps**	**Similarities Between Processes**
Information	Risk Management Planning	Defines objectives and structure for application
Speculation	Risk Identification	Identifies opportunities
Evaluation	Risk Analysis	Evaluates and prioritizes opportunities
Development and Verification	Risk Response Planning	Develop strategies and plans for opportunities
Reporting and Implementation	Risk Monitoring and Control	Review with stakeholders, promote, and monitor implementati on

Exhibit 6: Comparison of Value Management Phases and Risk Management Process Steps

Conclusions

In an optimum setting, a culmination of Risk Management and Value Management would provide a powerful means to cultivate risk opportunities. The phases of Value Management can be used to augment the Risk Management Process steps. Value Management has established itself as an expansive and creative process that utilizes the talents of a diverse team to generate new opportunities that the customer values, and funnel them into proposals validated with business cases. Risk Management is strong in its planning stages, qualitative and quantification methods, and disciplined means to develop risk response strategies. The combined method of Value Management and Risk Management provides more credible data and decision-making ability to the team members and stakeholders in determining which opportunities get the funding and resources. Change Management may be required to get an organization to transform its culture to a state in which it could benefit from an integrated approach of Value Management and Risk Management. The rewards will be well worth the effort as organizations can focus on striving for the opportunities that will improve their business while effectively managing the threats.

Idea #	Opportunity (Ideas)	Opportunity Probability Level	Opportunity Impact Level	Threats	Threat Probability Level	Threat Impact Level
1	Capital Equipment Project Engineer and Manufacturing Engineer to select equipment suppliers from an approved list.	2	3	No perceived threats.	NA	NA
2	All purchase orders and supplements will require only 3 approvals.	1	3	Management may not approve of revised process as they want additional signatures to control spending.	3	3
3	Define process and procedures to standardize, leverage buys, accelerate deliveries by establishing a Capital Equipment Project Engineer focal point.	2	2	Create additional pressure on the availability of the resources (CEPO) and cause a perceived loss of control by customers.	3	4
4	Standardize and consolidate inputs and data and provide reports to the decision making body in order to construct a Capital plan.	4	2	Reduce autonomy on part of customers - This will result in business units perceiving that they are losing control of the capital program.	4	4
5	Electronic mailbox for Capital Appropriations Request (CAR) - review with electronic sign-off, tracking system, and status of CAR for customer inquiry.	3	2	Customers may not buy-in to electronic process which could negate the benefits.	2	2
6	Form Capital Council to review Manufacturing Departments wish lists for capital equipment. Standard tools and a ranking system will be used to prioritize wish list.	5	1	Percieved lack of ownership at the Manufacturing business unit level and the effort needed to implement plan may negate benefits.	2	3
7	Use standard form and content guidelines and proper business case structure to include financial evaluation, ROI, Payback and strategic importance of project to the enterprise.	3	3	Level of effort needed to formulate and implement plan may make it impractical.	2	4
8	Assess the expected benefit of a Capital Appropriations Request (CAR) after the asset is put into production using a random audit of executed projects on a quarterly basis.	3	2	Number of resources for this activity may not be available.	4	3
9	Identify the critical path of each project as part of the preparation of the project schedule.	1	2	No perceived threats.	NA	NA
10	Establish Manufacturing Engineering Manager in each of the business units who will manage their business unit's capital requirements.	2	2	Implementing changes to current business unit structure could cause confusion on this role for the Manufacturing Engineers.	2	2
11	Define a standard project template which identifies tasks that are generic to all capital equipment projects.	1	3	No perceived threats.	NA	NA
12	Establish on-line (Web-based) schedule library to track project.	3	2	A dedicated resource may not be available to constantly input data into database which could hinder the progress of the projects.	5	2

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Cost and Risk Management Critical in Offshoring

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Abstract

In most cases the offshore provider is not the issue in information technology (IT) outsourcing. Instead the problem is a lack of detailed risk management and an accurate cost estimate. A company gets in trouble when it only focuses on the promised low hourly rate. By the time all of the project costs are booked, the budget estimate is far exceeded and forecasted savings substantially reduced. To understand the upside to offshoring costs, we present lessons learned and a checklist of top-down risk categories. However, even with such a checklist, companies need to spend substantial time identifying offshoring risks and given these risks, the upside to cost. If done appropriately, the company will have an accurate cost estimate. If not done appropriately, the company will probably blame the offshore provider and terminate the relationship prematurely.

Introduction

Many companies begin their IT offshore experience with large, complex projects. "First-Time offshore customers often encounter a rash of unexpected difficulties, such as lower-than-anticipated cost savings and the need to send IT managers overseas for extended periods to resolve project problems" (Hoffman & Thibodeau 2005, 46). This methodology of beginning big and focusing on cost savings can result in decisions that are counterproductive for successful offshoring. Therefore, I propose that if companies begin offshoring with a small, simpler project, they can easily "correct" cost estimate shortfalls before the next offshore project begins. In fact, redefining the hourly rate used in the cost estimate is most important.

The offshore provider might in fact charge a low hourly rate. To this low rate, other offshoring costs need to be taken into consideration for the budget estimate. A company's budget of $15 per hour can substantially increase to $45 per hour when travel, zone differences, and project delays are factored in (Hoffman & Thibodeau 2005, 47). Here lies the crux of the problem. This narrow focus on an hourly rate can lead management to believe the offshore provider is the issue needing resolution instead of identifying what went wrong in cost and risk management.

Hierarchy of Risks

Within an offshoring project, the project team needs to decide how best to begin. In our opinion it does not matter if a company works on putting its house in order first and then begins the search for an offshore provider while writing the contract or visa versa. The choice will depend on what fits the company and its culture better. Our preference is to begin looking for the appropriate offshore provider while writing the contract.

"…It can take 18 months to set up a deal" (Simons 2005, 6). Within 18 months, a company should be able to craft the contract and find a provider as long as the appropriate levels of resources are assigned to the project. As explained under contract risk, an understanding of offshoring risks is required to successfully write a contract. This translates into a requirement for the project stakeholders to understand top-down risk categories and its corresponding risks along with the need for contingency plans, mitigation plans, and workarounds.

Top-Down Risk Categories

To understand the upside to cost, lessons learned are compiled under top-down risk categories. These lessons are real life examples from offshoring companies. The risk categories are contract risk; business continuity risk, “global delivery model” (Simons 2005, 6) risk; and cost, schedule, and scope risk. Each risk category supports the standardization of an offshore checklist. The checklist provides a tool to facilitate proper execution of risk and cost management.

Contract Risk

The first risk category to be examined is contract risk. When looking at contract risk, a company needs to focus on finding the appropriate offshore provider and completing the contract documentation.

- Does the contract documentation contain all relevant information?
- Has the company found the appropriate offshore provider?

When looking at contract risk, a company needs to focus on finding the appropriate, not the cheapest, provider. The search requires verification that the offshore provider has the capabilities and competencies required by the company (Valanju 2005, 5). Capabilities and competencies encompass many different areas of expertise though verification for this paper will focus on evidence of best practices, productivity gains, and partnering.

The importance of implementing best practices and productivity gains is to reduce development cycle time, hence cost (Margulius 2005, 15). Partnering makes sure the offshore provider “bring value and solutions to the relationship” not just a decrease in labor cost (Providers 2005, 36). Finally, the following question has to be answered: Will it be possible to create a long-term relationship with the offshore provider? (Management Week 2005, 44) If the answer is maybe or no, the project team has not completed this task in the project schedule.

As the contract is written, risks and the corresponding controls become very important. “Once risks are identified and understood, controls need to be defined to mitigate and manage the risks. These controls become incorporated into the contract by defining policies, roles and responsibilities, and possibly audits and penalties” (Twing 2005).

The contract also requires other information to be present to minimize vagueness. It is extremely important the contract has a dictionary to define critical words or phrases. For example, the company might demand “rigorous acceptance criteria for the code that’s produced” (Human 2005, 46). The company must make sure the provider understands what “rigorous acceptance criteria” is.

Furthermore, is there enough flexibility written into the contract to allow for incremental process improvements? (Margulius 2005, 14) Keep in mind incremental process improvements need to follow the company’s documented change control process. Also the contract needs to be written to “specify that you get the best-quality people working on your account and as much personnel continuity as possible. Develop incentives and penalties to ensure not only that they initially put a high-quality team on but [that] they keep it on” (Margullius 2005, 15).

Finally, it is very important to get knowledgeable people to write the offshoring contract. It is always better to benefit from other companies' best practices and lesson learned instead of learning them all the hard way yourself.

Business Continuity Risk

Before IT work can be offshored, ambiguity needs to be removed from the day to day business interactions. What must replace ambiguity are well documented roles and responsibilities that have to be followed so that all parties understand their part in this new relationship.

- Has the company documented the plan for transitional employees? How about employees that will remain with the company after the offshore model has been implemented? Does the company understand what skills are required within the company after implementing the offshore model? Do the employees have these skills or are there missing skills?
- Has the company documented current state (As-Is) as well as future state (To-Be).
- Are new standard templates, business processes, guidelines, and oversight mechanisms required?
- Are the current business processes under control?

"A review team should be established to analyze each business process that will be affected by the proposed outsourcing" (Twing 2005). One way to successfully analyze a business process is through "Failure Modes and Effects Analysis (FMEA)" which is part of "Six Sigma". If the business process requires corrective action, responsible individuals are identified along with tentative completion dates. The completion dates have to be established well in advance of offshoring.

Even if the current business processes work as required, it does not mean the company is ready to offshore. Instead new standard templates, business processes, guidelines, and oversight mechanisms maybe required. Does the company have: business processes for software quality management, software configuration management, and software development management; detailed guidelines explaining communications management, FMEA for risk, issues log, project constraints, project interdependencies, scope management, time management, and training documentation; documented process flows outlining how development is tracked and the integrated change control process; and oversight mechanisms?

Another important area within business continuity risk is organizational change management since a company is still responsible and "accountability is far more difficult to achieve" (Smith 2005, 6). An optimal tool to help facilitate the transition to an offshore model is documenting current state as well as future state of the business (Fest 2005, 22). Through this documentation the firm has one more opportunity to find "gaps" and implement corrective action.

As documentation requirements are being addressed, the company also needs to look at internal resource requirements. Two areas that need to be focused on are transitional resources and the ongoing resource requirements. For example, employees may retaliate during the transition period (Durfee 2005, 22) so employee impact given offshoring cannot be ignored. Furthermore, if the offshore model is stating the functional and technical aspect of development will be performed by the offshore provider, the company's employees will now support quality assurance. Do the selected employees have the skills to perform quality assurance or is training required?

Finally, the actual planning for the transition of work needs to be performed. Valanju (2005) references 4 critical areas that need to be focused on:

- List the risks you need to mitigate while shifting operations
- Plan how to maintain business continuity throughout the transition
- Decide how to transfer knowledge effectively to the offshore center
- Create adequate backup plans for remedial action.

“Global Delivery Model” Risk

When implementing a “global delivery model,” culture and skill demand comes into play. It cannot be ignored or minimized since it plays a leading role for a successful implementation.

- Can the company create a “mutually trusting relationship”? (Margulius 2005)
- Can the resources be secured short-term and long-term in the offshore model?
- Is there a cultural understanding of how business interactions occur?

For example, “Indian businesses have a reputation for being averse to saying no to any kind of business opportunities” (Valanju 2005). The downside of this behavior is an increased chance the service will not be delivered as promised due to lack of in-house expertise or training money.

Furthermore, if the provider does have in-house expertise or training money, it still faces a current environment of high employee turnover and skill shortages (Sawers 2005). The provider then must aggressively recruit from a pool of resources to meet employee resource levels. While recruiting, the offshore provider may find the need to reduce recruiting standards given the pool of resources which in turn can compromise the company’s security (Focus on Skills 2005).

Unfortunately, the skill shortage problem appears to be a long-term issue. McKinsey is forecasting a substantial growth in demand for Indian IT resources over the next five years (Outsourcers 2005). This means a company needs to find a means of securing enough skilled resources within the offshore model. Interestingly, enough relationship building is the optimal tool and technique to guarantee offshore resources are quality resources.

Only through a relationship will the company increase the chance of receiving high quality workers in an environment of over-commitment (Margulius 2005). One final point is that travel is required to properly build personal and business relationships with the provider. During these visits a company can learn critical information such as culturally acceptable ways to confront issues and create an atmosphere for team building (Margulius 2005).

Cost, Schedule and Scope Risk

Given the high demand for skilled offshore resources, it becomes essential for the company to require a formal scope baseline signoff and accurate business requirements. This helps to ensure the business and IT are in agreement with the level of development required for the project with no “gold plating”.

- What project schedule and budget estimate impacts are found in the top-down risk categories?
- Has the company spent time creating a standard template outlining what a complete business requirements document entails for each type of development such as interfaces and reports?
- Have travel requirements been considered?
- Has the company put a mitigation plan together outlining how to address word document confusion?

Business requirements are submitted via documents that promote confusion because of “company-specific terminology, ambiguous requirements, interpretation of understanding,

…and language differences" (Human 2005). A company can reduce the confusion by supplementing the document with other types of communication such as video conferencing, conference calls, and face to face.

Yes, face to face communication involves travel and travel should occur in both directions. For example, for new offshore providers, travel to the provider is advised to troubleshoot issues especially at the beginning of the project (Focus on Skills 2005). It also is advised to have the offshore provider travel to business location(s) to cultivate business understanding. By improving business understanding so too is quality output improved (Hoffman and Thibodeau 2005).

Even with a mitigation plan to reduce document confusion, "business owners often can't describe what they want until they've seen it." (Human 2005, 46) Unfortunately, this translates into incomplete business requirements documentation and the need for change of scope. With scope change, incremental costs are incurred offsetting some of the offshore cost benefit. (Human 2005). If the scope change is substantial enough, schedule too will be negatively impacted. Therefore, it is imperative a company creates a standard template outlining critical information required for a complete and accurate business requirements document.

Project Planning Phase

Even with a checklist, companies will have to spend a substantial amount of time and effort making sure that all risks are identified. Only through extensive work can a company understand at the start of the offshoring project the upside to cost. If done appropriately, the company will have better cost management and more realistic cost savings expectations when offshoring IT. If not done properly, the company will probably "terminate the outsourcing relationship prematurely" ("Providers" 2005, 36) without reaping the benefits that initiated the relationship in the first place.

To make sure the relationship is not prematurely terminated, internal and / or external experts are required to quantify risks for inclusion in the cost estimate. Once the cost estimate is complete, the next step is to establish a cost baseline. A cost baseline is part of the cost budgeting process as outlined in the PMBOK. "Cost budgeting involves aggregating the estimated costs of individual schedule activities or work packages to establish a total cost baseline for measuring project performance" ("PMBOK" 2004, 167). To measure project performance, the baseline cost detail has to match the level of detail tracked during the cost control phase.

Execution Phase of Project

A project moves from planning into the execution phase of the project with a work authorization. This phase requires the calculation of a variance between budget and actual costs. During this process, each variance should be researched and a variance explanation provided. Only through variance explanations can a company understand what was done correctly and what improvements are required. This step is important to execute so that appropriate incremental improvements can be implemented before the next offshoring project begins.

Conclusion

The importance of strictly following PMBOK methodology when offshoring projects cannot be stressed enough. No matter how small and simple the project, the offshore relationship adds complexities that can only be controlled through detailed project management control. By following the PMBOK, a company will be able to identify important lessons learned and document corrective action before the next offshoring of IT work. Offshoring is not going away. Therefore, it should be managed in a manner that allows all involved to succeed.

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The Importance of As Sold vs. As Executed Margin Variance Analysis

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Abstract

Successful project management depends on the job being sold with tactical intelligence and strategic wisdom. In the increasingly competitive market we work in today, an estimating miss on a budget line item can have huge impact on the as sold margin of the executed contract. By the same token, execution of a project out of sync with the way it was sold can lead to serious cost over runs. To survive today, there is an increased need for an organization to have a reliable and efficient model to cycle information between the commercial and project management organizations to avoid both lost sales opportunities and margin erosion during execution. This paper will look at practices that increase the likelihood of establishing meaningful proposal and execution costs. Bringing stakeholders together across the project life cycle to review and take action on margin variance analysis trends ensures that company strategy is competitive.

Introduction

One of the key factors inhibiting the long-term success and sustained competitiveness of many businesses is the failure to understand, monitor and correct project as sold versus as executed variances. These variances point to a major source for diagnosing estimating gaps and providing direction to drive improvement with the greatest cost benefit.

Often, profit margins estimated by the commercial team are considerably higher than the resulting as executed margin. Once the project is out of the sales stage and is handed off to the project management team, little is often done to validate the basis of the cost estimate. There is generally no closed loop cycling of information and lessons learned between the commercial staff, the project execution team, and stakeholders to provide insight into what the as sold versus as executed variances mean. The opportunity to refine the as sold cost to obtain maximum profit, ensure competitiveness, and yield minimum risk is missed.

Defining Variance Analysis

The statistician Ronald Fischer introduced the terms variance and variance analysis into statistics as it is commonly understood and practiced today. There are many statistics models and tools that can assist in calculation of variance. “Using basic definitions for the mean and variance, it can be shown that the weighted sum of independent random variables is a random variable whose mean and variance can be calculated. The variance formula for a portfolio of projects is shown below.” (Scheffe 1999).

As it relates to products and services, cost variance is described as the difference between the costs detailed in the plan and the actual costs. The term “variance analysis” refers to the study of the difference between planned and actual results from the sale of goods and services.

This analysis involves looking at trends and doing comparative analysis, assessing current assumptions, and developing corrective action plans for the future. There are many different focuses of variance analysis. For the purpose of focusing on as sold versus as executed margin variance, this paper will discuss estimate to planned, planned to actual and estimate to actual variance. These variances are primarily being related to material, labor and overhead.

Notation

n: Number of projects

μ_j: Mean net present worth for project j

v_j: Variance of net present worth for project j (σ_j^2)

$$x_j : \begin{cases} 1 \text{ if project } j \text{ is selected} \\ 0 \text{ if project } j \text{ is not selected} \end{cases}$$

Portfolio

$$\text{Mean NPW: } \sum_{j=1}^{n} x_j \mu_j$$

$$\text{Variance: } \sum_{j=1}^{n} (x_j)^2 v_j$$

$$\text{For } x_j = 0,1 : \text{Variance: } \sum_{j=1}^{n} x_j v_j$$

Exhibit 1: Formula for variance analysis across a portfolio.

Estimate to Planned is the difference between what was quoted and how we planned to execute the project.

Planned to Actual is the difference between how the work was planned and the way it was executed.

Estimate to Actual shows the difference between what was quoted and what was executed.

Each is reviewed at different stages of the project life cycle and will be discussed in further detail. When the estimate is sound, positive gross margin variance, the goal of business, indicates that the project is under-spending; signaling that we are selling the project at the right price, executing at the lowest cost, and taking care of our assets.

Both material positive and negative variances need to be explained adequately. In the case of consistent positive variances, analysis can lead to better accuracy in future estimating, which may lead to price reduction and thus make the product or service more competitive.

For trending purposes, variance is calculated both on tasks completed and partially completed. While many companies still limit analysis to actual performance results versus plan results at year-end against prior year's sales, quarterly and monthly portfolio trends during execution can serve as a warning signal to amend proposals in process and give light to ongoing quality or production issues.

Why Perform Margin Variance Analysis?

Margin Variance Analysis can be used to quantify the difference between the estimate, planned, and actual costs, at any level that is required – an individual line item, a single project, or a portfolio of projects for gross or net margin. Net margin incorporates fixed cost. Margin analysis is useful for examining the financial performance of products, market segments, and to budget for future operations.

Due to the limited amount of variance in fixed costs, most profit variance analysis focuses on gross margin. Examining changing gross margin ratios over time highlights problems and opportunities. Declining gross margin indicates problems with pricing, poor cost control, or productivity, and ultimately customer satisfaction - which eventually lead to insufficient revenue to support a company's infrastructure.

Materiality

When reviewing variance data, materiality should be considered. The following examples highlight different aspects of the relevance of materiality. The first example demonstrates how a small variance can have a huge impact on the gross margin.

Example 1
A firm generating $2MM of revenue a year might have a target operating profit margin of 30%. In a $2MM firm, this equates to a target of $600,000 in operating profit ($2MM x 30% = $600,000). If the firm's actual operating profit margin is 26%, however, their actual operating profit is $520,000 ($2MM x 26% =$520,000). So what appears to be a relatively small variance in operating profit margin (26% versus 30%) has a significant dollar impact in gross profit dollars ($600,000-520,000+80,000 financial impact)" (Pomering 2002)

The second example, speaks to focusing on the important exceptions.

Example 2
If you have a variance of $.25, that isn't a big deal if the quantity produced is very small. However, as the production run increases, then that variance can add up quickly. Most projects generate tons of variances every day. To avoid a tidal wave of numbers that are inconsequential, instead focus on the large variances. For example, it is far more important to find out why there is a $10,000 cost variance than to spend two days determining why an expense report was $75 over budget." (Spafford 2003)

Applying Variance Analysis
From a portfolio and project management perspective, a breakdown of total project variance from planned and actual results can be made by separating variances into two categories: variances caused by non-standard performance (planned to actual) and variance caused by inadequate planning (estimate to plan).

Inadequate planning would result from misses or changes on the commercial side that a project manager must either live with or mitigate. Non-standard performance results in variances occurring during project execution. Variance thresholds are set by management, and if exceeded, would require problem analysis and explanation. Further breakout of a project portfolio's gross margin analysis might be made to differentiate by product category, region, and customer.

If we were to use only planned and actual results on a total project portfolio basis in the analysis, the full picture of the effects resulting from planning and performance activities on the total variance cannot be determined. Areas where there were negative variances for budgeted line items are concealed by a positive variance in others. Therefore, variance analysis calls for further decomposition into significant budget line items. This variance analysis, when fed back to contributing functions and the management team, will make the case for future improvement. This improvement will not only impact project performance, but the entire proposal pricing process as well.

The margin variance may be calculated by comparing various margins. For example, forecasted gross margin is obtained by subtracting the forecasted direct costs from the forecasted revenue. The actual gross margin on closed jobs is derived by subtracting the actual direct costs on closed jobs from the actual revenue of closed jobs.

Finally, the Work in Progress (WIP) gross margin is found by subtracting the WIP direct costs from the WIP.

A margin variance indicator tells how profitable a project or portfolio is relative to the plan and if it is meeting, exceeding, or falling short of gross profit expectations. Figure 2 provides an "example comparing uncompleted jobs, completed jobs, all jobs, and the business plan target." Roper and Lin 2005)

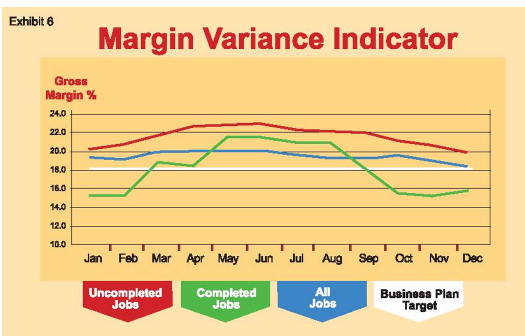

Exhibit 2: Margin Variance.

Other project related variance categories that impact gross margin include:

- Fixed-rate variance - the difference between actual and budgeted fixed costs
- Supplies variance - the difference between actual and budgeted cost of material
- Staffing-rate variance- the difference between actual and budgeted personnel wage rate, including overtime and registry wages
- Labor efficiency variance - the difference between actual and budgeted direct-labor hours
- Revenue quantity variance - the difference between actual and budgeted amount of revenue related to the efficiency of billing and collecting reimbursement, or the amount of reimbursement

Sales volume variance (and its components), while a significant contributor to total gross profit variance is not part of the project management equation. For the purpose of accurate comparison, variance must be broken down into a category of measurement to ensure we are measuring consistently. Generally that category of measurement is per unit. Variance analysis allows actual results to be matched against planned targets to enhance planning accuracy.

Project Life Cycle Identification of Variance

Variance Analysis takes place during each stage of the project life cycle. The stages of the project life cycle are: planning, initiation, and execution, controlling and close out.

Initiation

The commercial team reviews the end of year variance for insight into putting together the basis of the cost estimate for future sales. While the profit margin variance is attributed to a variety of factors, a deep dive is rarely performed to get to the root cause of the variance. Simply stated, the new unit price is based on marketplace conditions, historical data, cost estimating templates, cost estimating policies, expert knowledge and lessons learned, with an adjustment for the target margin established by the business. The allotment for gross margin variance is included in a contingency reserve to ensure the target profit margin is obtainable. In today's competitive market, the pressure of competition can result in estimates that are biased downward in order to win a project.

Another factor leading to inadequate planning is poor quality of historical data. If the data collection process has a low degree of confidence, inaccurate decisions can be made as a result.

Planning
Upon receipt of the project, the project manager reviews the as sold estimate to understand the basis of the cost estimate. The project manager is now looking for the estimate to planned variance. At the time the project kicks off technology, laws, vendors, processes, etc. may have changed.

A revised plan or project cost plan is put together to reflect the realistic performance levels given the actual operating environment during project execution. Once the management team approves the plan, it becomes the project baseline.

Also, the goal at this stage is to determine if inadequate planning was done on the part of the sales team. Inadequate planning can be caused by many factors, including:

- Lack of understanding of costs/risk associated of new technology
- Scope misses
- Market fluctuations (labor, material, war)
- Undocumented proposal risk

Clearly, if the execution team is involved in the planning, some of these risks may be eliminated.

Once the revised plan is completed the project manager obtains senior the management team approval to baseline the project against execution project variances. The as sold planned margin may prove to have been overstated and adjustment must be made. This initial review is important in distinguishing planning inadequacies from that caused by inadequate performance.
Execution and Control
During execution the project manager reviews planned versus actual results to see if the project is being executed on the same basis as the way it was sold. Changes may have resulted from the project team, the customer, vendors or a change in environment, such as new regulations.

During execution, financial reviews of margin performance with the executive team and/or operational managers give increased visibility into forecasted project profit margins. Financial reporting driven by finance can be too late, as it takes a backward look at data. It can also be too high level for a project manager's planning and control decisions. Use of a Work Breakdown Structure (WBS) facilitates capturing and identifying the source of change through work packages. Managerial accounting drives cost analysis to the project level, in a timely manner.

Tools
Activity Based Costing (ABC) and Earned Value (EV) are examples of cost monitoring techniques that link cost to project activities, identify cost variance trends, and can provide a graphical analysis.

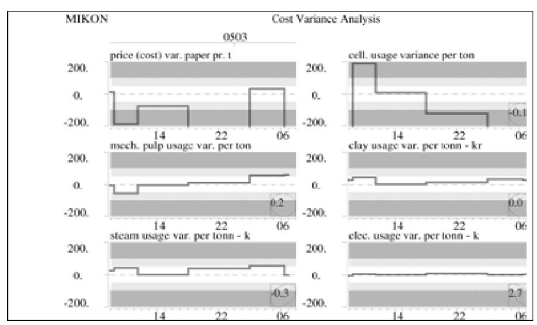

Exhibit 3: ABC Cost Variance Analysis Chart.

"The figure above shows a graphical analysis of cost variances. Top left shows the cost variance of paper cost per ton, which is a master signal. The other five graphs show the contribution from variances in different input resources."

Both methods use the Work Breakdown Structure (WBS) to segregate cost estimates into deliverables and their work packages. The WBS organizes the deliverables and defines the scope of the project. It enables the project team to allocate cost changes to the appropriate task or deliverable. Use of a WBS facilitates identification of the source of variance.

Project financial data collection in the same budget categories as used by the commercial team facilitates variance analysis. Storing data in one database from project planning through closeout also facilitates data collection.

The Project Management Institute (PMBOK) recognizes project management should:

- have the ability to monitor cost performance to detect and understand variances from the cost baseline, and…
- act to bring expected cost overruns within acceptable limits.

More On Earned Value

The Earned Value technique is used to measure project variance against the cost baseline. Earned valued calculations revolve around planned valued, earned value, and actual cost.

- Planned value (PV) is the budgeted cost for the work schedule to be completed on an activity of WBS component up to a given point in time.
- Earned valued (EV) is the budgeted amount for the work actually completed of the schedule activity or WBS component during a given time period.
- Actual cost (AC) is the total cost incurred in accomplishing work on the schedule activity or WBS component during a given time period. This AC must correspond in definition and coverage to whatever was budgeted for the PV and the EV.

EV for a task is the percent complete multiplied by its approved budget. From the PV, EV, and AC values a Cost Variance and Schedule Variance, along with other indicators, can be determined. For example, knowing the Budgeted at Completion (BAC) and Estimated at Completion (EAC) will give you the Variance at Completion (VAC), where VAC=BAC-EAC.

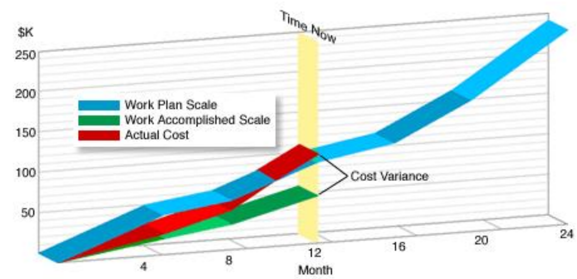

Exhibit 4: Cost Variance.(NASA)

In businesses where project maturity is less advanced, there may be challenges in establishing actual cost. Hundreds of hours can be spent on data retrieval and reconciliation if there is no system to capture financial data. The impact of budget changes cannot be easily seen at the project summary level.

Project Closeout

After project completion, the team looks at the total project plan to actual variances. They should also look at the project estimate to actual to compare what was quoted to what was finally executed. If there is a large variance in either, it is generally due to schedule overrun, scope misses, customer scope changes, cost of quality or a project being sold in a manner that operations cannot perform. This review allows the team to see where the variances are, why they occurred, and learn from the experience. In order to gain full benefit for the business, this information is cycled back to the commercial team as lessons learned.

These lessons learned and information from the finance department provide gross margin information to sales and marketing teams to help them understand their role in ensuring margin performance.

Cost of Quality
As cost variances are detected, associated quality issues and their related costs are brought to light. The management team has the role of transferring these lessons learned and best practices to the right stakeholders for correction to improve productivity and profit margin for the business as a whole.

Pitfalls of Margin Variance Analysis
What can be perceived as a major drawback to the variance analysis approach to project monitoring is the amount of time it takes to establish actual cost. On large projects, supported by a typical finance department, the cost data can have a lag time, limiting the ability to do an actual analysis based on real data.

Length of Monitoring Cycle
If the monitoring cycle is not timely, it may make the application of control impossible. By the time the problem is identified through variance analysis it is too late to take corrective action. This highlights the need for a monitoring system that is timely.

Poor Data Quality
If data is not collected properly, the cost of quality is rolled into the cost for a deliverable or WBS task. When this happens, the true cost of quality and resulting cost impact of the variance is not able to be determined. Also, assumptions and business decisions made on data with a low confidence level may be incorrect.

Insufficient Analysis
Insufficient analysis could lead to the incorrect conclusion. The root cause of a variance needs to be determined in order to shed light on its mitigation and application of lessons learned.

Conclusions

Variance Analysis is a key factor in highlighting risk and ensuring profitability. This technique is utilized at every stage of the project life cycle.

The management team plays a big role in following up in areas where as sold versus as executed variance analysis reveals negative margin impact. Where surprises pop up, a root cause analysis may be needed to determine the cause(s). If operational issues are found, management's role is to drive resolution of those issues – across departments or business units.

Resulting process improvements can ensure the cost variance information is applied consistently across the project portfolio. Action around understanding and reducing identified variance gets all departments motivated to work toward the common goal of a profitable business.

For businesses who rise to the challenge of putting this process in place, the payoff may be significant: improved return on equity, reduced volatility, enhanced customer satisfaction, and ultimately improved shareholder value.

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Doing Business with Japan: Cultural and Political Risks in International Projects

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Abstract

This article aims to identify risks often neglected by managers of projects involving Japan: those related to cultural and political differences. First, the corporate culture of this country is described, based on a survey of previous works. Second, we introduce the subject of political risks and provide some guidelines to their mitigation. We finally present an example of a U.S. firm managing projects with Japan.

Introduction

Many works in research have attempted to pinpoint the characteristics of the effective Multi-national Corporation (e.g., Erramilli, Agarwal and Kim 1997, Kristensen and Zeitlin 2004). A common conclusion from many of these works is that to succeed in the international market, a company must be able to adapt its management style to the local customs.

Employees' behavior is determined more by national culture than by organizational culture (Adler 1986). What Sir Patrick Geddes' remarked almost a century ago has become today's rule: "Think global, act local". (Stephen 2004) Unfortunately, managers in charge of projects with other countries do not always plan for cultural differences, which go beyond language. From that, many difficulties arise, including internal conflicts resulting from the imposition of an "imported" management culture, misinterpretation of guidelines by foreign project team members, failure to predict differences in local political, legal and economic environments and the difficulty to adapt its products or services to the taste of local customers.

These risks must be taken into consideration and prioritized depending on the type of project. A project manager who is not capable of analyzing the situation he is about to enter will not be able to identify important risks and prepare a plan to avoid or mitigate them.

As much as these difficulties are discussed in previous works, U.S. project managers and firms looking for information to help them plan their collaborations with foreign actors will often find impractical information on national cultures. In this paper we focus on some of the cultural and political risks to be aware of when working on projects in Japan, and try answering the following question:

> *Which cultural and political risks should project managers be aware of when planning projects in Japan, and how do they avoid or mitigate these risks?*

Most of the information in this article is based in academic works, and their pertinence in today's Japan was certified by interviews with Japanese living in the U.S.

and with North-Americans with work experience in Japan.

Japanese corporate culture
The western idea of Japanese culture is greatly influenced by accounts of ancient costumes, like the life style of the *samurai* and the *hara-kiri*. Although these practices are no longer common, Japanese culture is still built over strong moral values, such as honor, order, loyalty and tradition. It is also a culture of strong personal relationships and great concern for the individual's welfare. Whitley (1990) has identified the most prominent features of the Japanese large organization:

1. High degree of specialization. Most companies choose to concentrate on a limited range of business, outsourcing many segments of their work. This feature encourages identification of the employee with the industry and the product.
2. Strong commercial relations between firms. Due also to the high level of outsourcing, Japanese firms establish partnerships rather than simple buy-sell relations with their suppliers. Such relations are usually long-term and based on trust and obligation. This is valid also for the firms' relationship with banks and insurance companies.
3. Managerial autonomy from shareholders. Managers are a link between shareholders and employees, but it is to their employees that they feel most obliged. There is less pressure to increase shareholders' value than in U.S corporations.
4. Strong hierarchic structure. Employees respect the authority of higher positions.
5. Consultative decision making. Decisions take more time, as often every person affected participates in the decision-making process and a consensus is expected. As a result, there is not often one individual who carries the responsibility for the decision.
6. Close relationships between firms and government agencies.

Whitley's analysis can be used to explain other traits of the Japanese business culture. The lack of concern for shareholders' value doesn't mean growth and profit are not sought, it means only they become goals for different reasons. Each employee has a great sense of loyalty and obligation to the employer organization, *giri,* so he or she is willing to work hard for its success.

The *gambare*, the spirit to fight hard, is also built into the Japanese from their upbringing and usually by their corporate training. An individual is hired to be part of the firm rather than to perform a specific job. (Peterson 1993). The power and size of the employer is also a measure of status to the Japanese, and salaries are strongly correlated to firm's size (Kossek and Ozeki 1998). The sense of loyalty to the firm also results in the predomination of lifelong employment and little mobility between firms.

Loyalty is also seen in the firm's relationship to the employees, the earlier assuming an almost paternal role. Organizations often provide housing subsidies, medical assistance, paid transportation and even subsidized vacation packages, although vacations are less common than in the U.S. Managers make a point of remaining informed about their employees' personal life and are expected to participate in important events such as weddings or the birth of a child. The firm encourages these situations, often by providing funds for after-work socialization.

However, this degree of personal contact does not open doors for face-to-face work-related discussions. Confrontation at work is unusual, much due to their collective and cooperative work culture (Song and Perry 1992). Their respect for hierarchy also helps to explain this behavior.

In spite of the strong power distance, distinction between hierarchical levels is less obvious than in most western firms, in terms of earnings and status differentiators. As noted by Peterson (1993, 274), only managers in the high-end of the hierarchy are entitled to privileges, such as a company car or a luxurious office. That also helps us understand the decentralized decision-making process (Kagono et al 1985, 42), with all employees affected by the decision involved and searching for consensus.

Respect for the elderly is also part of the Japanese culture, and the stretching of the retirement age experienced in the past years has imposed delicate situations in the corporate environment, with more senior employees often being subordinate to younger managers (Peterson 1990). This situation is becoming more common and accepted by both parties. Still, reprimands, which are *per se* not usual, are even less encouraged in these cases.

The corporate environment has changed in the past several years, much through the influence of the West. One indicator of these changes is the rise in employment of women in management. Still, management is predominantly a male function in Japan, with women accounting for less than 5% of the positions with more than 10 subordinates, and this percentage decreases as we go up in the hierarchical scale (Basic Survey on Wage Structure 2004, Statistics and Information Department, Japan).

Another indicator is the rise in performance-related pay, although gender, seniority and family status remain the most important factors in defining earnings (Genda and Rebick 2000). A tendency to higher inter-firm mobility has been noticed in the past few years, especially among the young and in part-time jobs (Ono and Rebick 2002). Whether this tendency will reach the managerial level and whether it will prove permanent remains to be seen.

Managing projects with Japan

Having described some aspects of the corporate culture of Japan, we now turn to the main objective of this article: How do project managers avoid culture-related risks in projects with Japan?

First, all changes that involve disrupting relationships with suppliers must be carefully evaluated. In the U.S., projects that aim to restructure an organization tend to see such relationships merely in financial terms.

Changing a lifelong supplier for a better deal will not be seen with good eyes. If such changes prove necessary, take the time to explain to relevant employees why the decision has been made, making sure this explanation does not concentrate only in financial issues, but on the importance of such changes to the company’s growth.

This loyalty to suppliers must also be considered in projects of introduction in the market. Loyalty is not only part of corporate culture, but of Japanese culture, and customers are also loyal to their local stores, although that is changing, especially among the young. We later discuss the case of Toys “R” Us, where this cultural trait was an obstacle to entering the Japanese market. It was also a pleasant surprise, as loyalty proved weaker than the law of supply and demand.

The same concern for relationships exists on a personal level, with employees. The main indicator of the organization’s concern for the well-being of their workers is the fact that marital status and number of children are considered when defining salary. These rules for financial compensation should be considered when managing human resources in Japan.

This concern also makes lay-offs a serious subject in Japanese organizations. Should they prove inevitable, managers should take the time to explain why they are necessary. The choice of employees to be dismissed should consider seniority and family status. First because there is more mobility among the young, and second because laying off employers in delicate family situations may give the new American managers a reputation for heartlessness.

Good advice would be to involve unions in the decision. Differently than in the U.S., Japanese unions are firm, rather than class based, and are formed by both blue and white collar workers (Peterson 1993). It is not uncommon for high level managers to be also union managers, so involving them in the decision and getting them to agree to the terms of the lay-off may give it an official status. This, however, is not a universal solution, as the importance of unions is diminishing, with the number of unionized employees becoming lower every year, down to 21% today (Ono and Rebick 2002).
Another aspect of managing resources is that financial rewards for performance may not be the best choice. If chosen, make sure they are included in the bonus and not in the salary, for that is where gratification for performance is expected (Peterson 2003: 271).

Loyalty again changes the way to manage Japanese workers, as it can be used to motivate team members. A clear explanation of the benefits of the project to the company must be made at its kick-off, and the importance of team members to the success of the project should be stressed. When talking about benefits, place bets in values other than financial. Leadership of the market and satisfaction of customers are more encouraging than increase in profits and shareholders’ value.

Japanese are very rank-conscious, and the possibility of promotion can be used as an incentive, but only to a certain extent. Seniority remains the main force to push one up the ladder, and senior managers shouldn’t feel left behind. A project manager must also understand the importance of hierarchy.

Project managers of Matrix-style projects cannot expect their Japanese team members to neglect their department bosses. In these cases, establishing a good relationship with the department managers may be valuable, and explaining how the project will benefit the company can help establish common interests, and encourage cooperation.

Respect for hierarchy is supported by strong conflict avoidance. Japanese are non-confrontational, and reprimands and face-to-face feedback should be avoided. This aspect

should be considered when auditing or evaluating team member performance. Also when managing multi-national meetings or discussions.
Although hierarchical, organizations have great interaction between levels, this interaction should be encouraged, as it facilitates communication. This can be done by simply avoiding the introduction of status differentiators, of which the North American managers are so fond.

A down side to this interaction is that broad participation and search for consensus in the decisions-making process make it slow. Globalization and external influences are making it more dynamic, but changes take time, and project managers should allow more time than usual to obtain decisions by their Japanese counterparts. If time is short, one possibility to speed up decisions would be to include an American representative in the process, one introduced as a high-ranking manager, to be able to speak up without being considered offensive, and who knows and respects Japanese culture. Japanese are also risk-averse, which not only makes decisions lengthier, but also makes it more difficult to sell risky projects or tasks.

One big risk hidden in the assigning of team members is power conflict with women in top positions. Even if there is no reluctance in taking orders from a woman, employee's willingness to commit and trust her competence may be affected, especially with senior members. Women in these situations should consider nominating a male colleague to deal with their Japanese co-workers if there is reason to believe gender issues are in place.

Projects in market entry should also consider other cultural aspects when choosing entry mode. Takeovers are made difficult by the cultural stigma of selling a company and the close relationship between local firms. Joint ventures, if chosen, must be seen as an end rather than a means, as the transition to a wholly owned, or majority owned stage is problematic. The local partner may be unwilling to sell its stakes in a successful venture.

The workers' loyalty to their original employer is another obstacle. These reasons help explain European companies' "double-entry" in the Japanese market, first starting a joint venture with a local company and then going out on their own (Buckley 1998). Starting a subsidiary also poses some difficulties, like low labor-mobility and customers' loyalty to suppliers.

There was a time when failing to observe local habits and customs could offend and result in business catastrophe. In today's globalized world, Japanese managers dealing with westerners understand and forgive these faux-pas. Still, in a country where business is built on trust, earning the empathy of partners can make a big difference. So keep in mind that:

- When introduced to someone, bow. The younger bow lower than the older.
- Business cards should be handled facing the person by holding their borders with both hands. The person receiving the card must read it for a few seconds before putting it away.
- Drink is part of business. Many deals are closed amongst bottles of strong alcohol.
- Refusing food and drink is considered impolite.
- Nodding means "I hear you" and not "Yes."

- Exchanging gifts with visitors is common, even in business. Give it with both hands and, when receiving one, take it with both hands and don't open it in front of the presenter.

Last, but not least, communication deserves special attention. Lack of communication is an often neglected risk that has ruined many projects. Not a lot of Japanese speak fluent English, and usually have strong accents that can make telephone conversations difficult. Give preference to e-mail when putting together a communication plan. A good idea is to establish an interactive website and schedule daily inputs from members in both countries, as it will also solve the problem of time-difference.

Political, economical and legal Risks
In terms of the economy, Japan has been facing deflation and slow economic growth, a scenario darkened by the ageing of the population, which makes the already high public debt even more preoccupying.

Prime Minister Koizumi's first target was to increase public savings. His policies have shown good results, with an increase in employment and exports. His popularity and the strong presence of his party in the Diet should insure the continuity of his economic policies. IMF studies simulating gradual fiscal adjustment and productivity growth forecast strong economic recovery (Batini, Diaye and Rebucci 2005).

Historically, Japan's economic and political scenarios have proven fairly stable, considerably resisting even the Asian Crisis of 1997 with little impact. There is no evidence to believe this will change, which suggest that little attention be given to risks of instability.

Less certainty can be applied to the bank sector, as low profitability makes banks more vulnerable to shocks, especially regional banks. As the Japanese begin to invest in financial markets, this risk grows larger. When choosing a national bank, risks should be mitigated through a careful analysis of the institution's financial status, beginning with its ratings by international agencies.

One of the biggest legal risks faced by projects involving new business with Japan is impediment by bureaucracy. A project manager should account for long periods for all processes that require approval, registration or any kind of input by local authorities.

As an example, register of patents and trademarks take an average of six years, compared to thirteen months in the U.S (American Chamber of Commerce in Japan 1996). Improperly filing the requests may stretch this delay. For this and other reasons, the first step to avoid delays is to find a local attorney. This may prove a tricky task, as there are restrictions by local law associations on the number of lawyers accepted every year, and to their relationships to foreign firms. Time for procuring legal counseling must be planned for.

Local legal expertise is also vital due to constant changes in international business laws. The changes are positive, aimed to support foreign investment, including the signing of most international trade and investment agreements.

Japan is not a hospitable forum for international arbitrations and disputes (American Chamber of Commerce in Japan

1996). Foreign firms must be represented by local attorneys and documentation translated to Japanese. Japanese courts are extremely slow, with trials lasting up to ten years, and even arbitration proceedings are remarkably lengthy. Parties should try an informal negotiation by all means before starting legal procedures, a practice common in Japan, given their custom of looking at business relations as partnerships (Hinkelman et al 1994).

The second choice should be conciliation under court supervision, which is simpler and inexpensive. Still, it is advisable that contracts with Japanese firms indicate an U.S. or other international arbitration court to resolve conflicts when possible.

A popular way of doing business in Japan is to associate with a local partner. The partner should be chosen carefully. Due to the firms' strong ties to governmental agencies, having a reputable partner will greatly facilitate the U.S. firms' business.

The government tends to make things easier for their friends. In selecting a partner, look for records of previous legal and financial issues and other indicators of the firm's soundness. Second, search for means to be introduced by a trusted party, an U.S or Japanese firm within the potential partner's business circle, as trust is decisive in closing deals.

Finally, large projects should involve a multilateral credit agency, such as the U.S. Export-Import Bank, or the World Bank's International Finance Corporation. They often have influence with local agencies, and can be helpful in trying to protect project participants against the consequences of local government action. (Gersten 1999)

The Toys "R" Us example

Having enjoyed phenomenal success in the U.S. and Europe, Toys "R" Us (TRU) launched a project to enter the lucrative Japanese toy market at the end of the 1980's. The plan was to open 7 warehouse stores by the end of 1991, attracting costumers with low prices and broad choices.

At that time, the situation for large retailers was changing. The Ministry for International Trade and Investment (MITI) was reconsidering its law on Large Scale Retail, which posed obstacles to establishing any large store. The main force behind MITI's change of heart was the pressure by the younger generation. The rise in wealth had allowed young Japanese to travel, exposing them to western culture and making them question high prices and government regulations. The low stock of foreign direct investment also exercised pressure to open the market for foreign investors.

Realizing the delicate legal situation in Japan, TRU chose to look for a local partner. The strategy used by most foreign retailers entering Japan, to associate with a local retailer, did not work, as the chosen partner's traditional ways of doing business had conflicted with those of TRU. Luckily, the head of TRU International was introduced to Den Fujita by a common acquaintance, just after this first attempt had failed. Fujita was the president of Mc Donald's Japan and a profit-driven businessman with strong political influence.

The project faced its first impediments when applications for business permits in several cities were turned down one after the other.

With close ties to government agencies, and close relationships to each other, the owners of local toy shops gathered to delay or assure the refusal of permits by municipal authorities. Commercial laws were also not favorable, as they attempted to maintain the historical structure of retail, one formed of small local shops.

Another unforeseen problem was caused by the strong relationship between wholesalers and manufacturers. Toys "R" Us manages to sell at low prices by buying directly from manufacturers, but Japanese manufacturers refused to sell directly to the company, afraid that it would damage their relationship to wholesalers and lock them out of their distribution channels.

Obtaining land suitable for retailing was also a challenge, due to the density of population and lack of flat land, and so was finding local highly educated workers, due to almost full-employment and low labor mobility.

Fujita's experience with real estate and his contacts in the government were key factors in resolving these problems. He also pushed U.S. representatives to pressure MITI for changes in the law.

Finally, TRU opened its first store in December 1991. The publicity caused by the conflict with local shop owners brought 17,000 costumers to the store on its opening day (Barttlet, Ghoshal and Birkinshaw 2004; Kay 1996).

Conclusions

Differences between Japanese and American corporate cultures are important and numerous. They reflect the distinct national customs, history and values of these two countries. In today's globalized world, things are changing, and the Japanese have learned much from the American way of managing and vice-versa.

But differences are still important, and some features of the Japanese culture must be considered when planning a project, especially the respect for the elderly and for hierarchy. One must also respect their non-confrontational attitude and their loyalty towards business partners, employees and employer. Awareness of legal differences also plays an important role in the success of projects, as they can result in unforeseen delays caused by bureaucracy and legal disputes.

As the example of Toys "R" Us shows, loyalty in business relationships, low mobility and legal differences can impose great problems. The differences in business culture caused delays and the project to go over budget. It also shows the importance of carefully choosing a local partner, with good knowledge of Japanese culture and good relationships with local agencies.

Failing to observe local customs, such as proper handling of business cards, no longer have the potential to ruin a deal. However, a project could still jeopardize its results if managers fail to consider the aforementioned features of corporate culture.

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Changing and Temporary Museum Exhibit Financial Analysis

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Abstract

Museum operating expenses are paid by grants, private donors, memberships, and earned income through admissions. With tough economic times affecting many areas of the country, companies have less and less money to donate for the good of the community. This has caused museums to rethink how they do business, turning more to increasing earned income through ticket sales and other profitable ventures. To complicate matters, the science museum exhibit front is rapidly changing and technology is playing a key role. Explaining complex concepts is being made easier through computer simulation. The user can be in control and quickly see the effects of global warming, glacial erosion, and evolution in a matter of seconds. Because of technology the estimated life for a museum exhibit has dwindled, with life expectancy now of roughly ten years for a permanent exhibit.

Introduction

The goal of this analysis is to determine if temporary exhibits add value to the museum and, if so, what are the tools used to measure value?

Value

Museums share stories of great importance, and these stories are communicated to the visitor through exhibits and other educational programming. "Their special role in public education is centered on the capacity of museums to provide the public an interactive, object-based place to better understand its community, our nation, and our world" (AAM Site 2006).

The marketing departments of museums are constantly looking for new concepts to make people come through the door. Changing exhibits are one way to accomplish increased interest and awareness in the community. They are also used as a vehicle to entice people to rediscover the museum's permanent exhibits as well.

A final, and arguably more important, factor that must be mentioned here is the role that revenue generating changing exhibits can have when a museum must close portions of its permanent halls for renovation. As we noted earlier, the average museum exhibit's life expectancy is declining. Large, changing exhibits, often referred to as blockbusters, help fill the void when permanent halls are closed for renovation.

One example is the renovation of the Detroit Institute of Arts (DIA), where the museum's growth correlated directly with the numbers of collection materials (Abt 2001) as opposed to the number of visitors. The museum is growing once again by adding on to the already 500,000 square foot building.

The museum has closed roughly 40% of its galleries and visitors must struggle with construction crews just to enter the building. This can cause museum visitors to consider other more hassle-free options to spend their time and money.

"Thus, lining up a string of potentially popular shows that can be presented in the DIA during the renovations, even as permanent collection galleries must be closed, is a high priority in generating higher attendance, earned income, and the type of publicity that helps cultivate major private and corporate donors" (Abt 2001, 258).

Research

A major question that a museum manager must face early on is deciding whether the museum should produce the exhibit in-house (internal) or rent a complete exhibit program from other science venues or associations (external). Costs (both known and unknown) are often the main factors.

Internally Produced Exhibit
Producing an internal exhibit can be daunting. Labor, sufficient shop space, tools and equipment, materials, content, and proper project management techniques are just some of the factors to be considered. These unknown variables all have dollar figures attached to them. Certain estimates can be made by an institution on what it costs to produce an exhibit internally. Parametric estimating techniques are used in the museum field similar to that of the construction industry.

Museum professionals can look historically at what the total cost to produce exhibits (TC) for that museum has been and divide that number by the total number of square feet (Sq Ft) the exhibit takes up. This would provide the formula TC/Sq Ft. = Cost per Square Foot.

If there is no historical information available for the museum then data can be acquired by benchmarking against a museum of similar size and discipline. A general estimate could also be found through various articles and museum associations as well.

The Smithsonian Institution (SI) produced *The Costs and Funding of Exhibitions*, in which it examined the "Direct Costs of Smithsonian Non-art Exhibitions, by Type" (Neves 2002, 7-8).

- Traveling Exhibits (Those that originated at SI and were sent elsewhere)
- Temporary (non-traveling exhibitions that originated at SI, on display under 5 years)
- Permanent (new and re-installed displays of indefinite duration)

The study then compared the cost of Smithsonian exhibits to other museums on a dollars per sq. ft. basis. (See Exhibit 1)

Traveling Exhibit Median Costs (SI)	$56
Traveling Exhibit Median Costs (other)	$107
Temporary Exhibit Median Costs (SI)	$71
Temporary Exhibit Median Costs (other)	$92
Permanent Exhibit Median Costs (SI)	$193
Permanent Exhibit Median Costs (other)	$197

Exhibit 1: Exhibit Costs

One benefit of internal production is the possible involvement of all levels of museum staff in the design, development, and production process, which allows other collaborative projects to occur. An example could be the digital documentation of artifacts from the museum's collections that are used in the exhibit. These could be archived on the museums web site, providing visual access to schools, the community, and other museums.

The direct costs, however, may potentially outweigh the benefits of providing such a service. This leads to museums looking for other answers to provide changing displays for its visitors. Externally produced exhibits have been the answer for some.

Externally Produced Exhibit
The second approach a museum can take to produce temporary exhibits is to simply rent them. This eliminates the manufacturing costs (direct materials, direct labor, and overhead for production) that the museum would incur with an internally produced exhibit. This approach is beneficial mainly because with durations running around 3 months, an ever-changing exhibit program is easily created and introduced to the museum.

Where could a museum rent such exhibits? Larger museums, such as the Field Museum and Ontario Science Centre, produce exhibits internally for traveling purposes, and can be contacted directly or through databases such as The Exhibits Database (TED). Another common exhibit rental source is the Association of Science-Technology Centers Incorporated (ASTC).

Looking at the information provided by ASTC the average cost per square foot is:

Total Cost of all exhibits combined / Total Square Feet = Cost per Square Foot

Member Price of $424,000 / 30,700 Square Feet = $13.81

Non-Member Price of $463,000 / 30,700 Square Feet = $15.08

External exhibits cost roughly 20% of what an internal exhibit would cost to produce for the same time frame making it a very cost-effective option for a museum that is not already engaged in the process of producing internal exhibits.

Mixed Produced Exhibit
The last approach that a museum could utilize is a combination of internal and external resources. This route could be utilized if a museum wanted to rotate out its collections materials for viewing. However, hands-on interactivity would be limited. Exhibit casework would not have to be remade or rented, but rather simply its contents and environment change.

The production of exhibit cases could be done externally while the exhibit program and artifact selection could be done in-house. The exhibit cases themselves could change configuration, appearance, and contents (say only twice a year instead of three times); but physically they would not have to change or be recreated. This lengthens the time until the exhibit has to be reworked, thus decreasing the overall costs.

- Theatrical lighting and scenery techniques could also be directly applied to create an environment that is different than the exhibit before it.
- Computer interactives could be rewritten, but the computer itself would not have to be purchased again.
- Blank walls and ceilings could become 57" HDTV quality virtual scenery, such as at new LED backdrops of Radio City Music Hall (Jordahl 2005, 10), changing the environment of the room effortlessly.

The temporary exhibit hall could take on ever changing looks, content and interactivity with start up costs similar to an internal permanent exhibit, but with much lower overall costs than an external temporary exhibit.

Potential Tools

Museums have various tools at their disposal to compare how they are performing to others in their field. This process is called benchmarking, and two main general sources are from well-respected associations that museums join through an accreditation process. These associations are the American Association of Museums (AAM) and the Association of Science-Technology Centers (ASTC).

A museum can also look at its own performance when judging temporary exhibits success. Using general attendance figures over a period of time it may be possible to show that a changing exhibit program sustains attendance for the institution. One reason this may occur is because the changing exhibit is newsworthy and therefore advertised to people through the media.

"One of the best means for achieving repeated public announcements of a kind to arouse interest throughout the community is the temporary exhibit. Since it is temporary and tied to a particular time span, it is news" (Burcaw 1997, 147).

Cost Analysis

In addition to known rental costs of external exhibits, there are also additional costs such as: installation labor and supervision, storage of empty crates and shipping. All of these costs are variable because they are monies paid that otherwise would not have to be if the museum stayed about its normal permanent exhibit operations. These costs also vary with the size of the exhibit.

How can a museum tell if a traveling exhibit program would be profitable to undertake? The answer lies in a cost-volume-profit (CVP) analysis.

For the purposes of this example, all information will be taken from the *ASTC Sourcebook*. ASTC provides statistical and resource data to its members with an overall mission that: "encourages excellence and innovation in informal science learning by serving and linking its members worldwide and advancing their common goals" (Pollack and Ruffo 2004). Another function that this organization serves is as a clearing house for science exhibits produced by the member museums that can be rented for a temporary exhibition at another location.

Using CVP analysis, an exhibit manager would be able to determine if the exhibits offered by ASTC, would provide a profit or loss to the organization.

Parametric Estimates to find Unit Variable Costs

Looking at the data from ASTC an institution can utilize parametric estimating to come up with an average unit cost of a rented exhibit according to the space that it physically takes up per square foot. The other part of the variable costs should also be included. For estimating purposes, 15% of the exhibit cost will be used as the baseline. In the following example it is assumed that the museum is a member institution.

Exhibit Rental Unit Cost (C) = $13.81
Additional Unit Variable Costs (15%) = $2.07
Total Unit Variable Costs = $15.88 per sq. ft.

Next, unit variable costs can be determined for the course of one year by simply multiplying the unit variable costs by 3 (number of exhibits able to be installed given the three month rental periods).

Annual variable costs to rent and install temporary exhibits through ASTC are $15.88 sq. ft. x $3 = $47.64 per sq. ft.

According to the *ASTC Sourcebook* it was reported the median size for a traveling exhibition space is 5,000 sq. ft. for all respondents. Cranbrook Institute of Science (CIS) will be used as a case study throughout this paper. This museum also has a 5,000 square foot changing exhibit hall.

Total ASTC variable costs can thus be calculated for this median size hall:

Annual Unit Variable Cost ($47.64)
x 5000 Median sq. ft. Hall

$238,200 Total Variable Costs

Admissions Sales Figures
"The sheer size of the public space of the facility is perhaps the most significant factor influencing attendance, according to a statistical model for estimating attendance" (Russell 1999).

This model, in part, was developed by Thomas Krakauer, Ph.D. His computer attendance model predicts attendance figures based on factors such as days open, the number of hours open, pricing levels, as well as various facility and demographic information. The model used data obtained at 46 science museums and utilized statistical regression techniques to predict attendance for future projects (Krakauer 1990, 5).

The model is ideal for the prediction of attendance for medium to large museums that are contemplating an expansion of substantial size, or for the planning and prediction of attendance for museums that are yet to be built. Taking the multiple variables into account, and weighing them differently, the program is able to generate accurate attendance projections without prior admission data.

For the purposes of this paper however, parametric estimates are used to analyze the number of visitors per interior exhibit square foot for given data that has been collected in the past. The most accurate estimate would be to use the historical admissions information for a given year(s) and dividing by total interior exhibit square feet. The more years used, the more accurate the attendance data would be.

Using the 2004 ASTC data for Cranbrook Institute of Science as an example, it is shown that the total Interior Exhibit Square Footage is 19,300 sq. ft. The total On-Site Attendance is 158,367. From here the attendance per square foot can be calculated.

158,367 Annual Attendance
/ 19,300 Exhibit Square Footage

8.2 visitors per sq. ft of exhibit space.

ASTC has also provided the results of their survey of on-site visits per interior exhibit square footage for various institutions. They have broken the results down by location, institution type, size and operating expense. Looking at size as a determining factor the following is shown:

Very Small (< 12,000 sq. ft.)
9.18 visitors per sq. ft.
Small (12,001 – 25,000 sq. ft.)
5.45 visitors per sq. ft.
Medium (25,001 – 50,000 sq. ft)
6.28 visitors per sq. ft.

With 19,300 square feet of interior exhibit space, Cranbrook outperformed the average visitors per sq. ft. for a small museum according to the data compiled by ASTC. This may mean that the halls are too crowded for a museum of this size. Further analysis by benchmarking against museum type, would help to clarify if the hall is under or over utilized (Stahl 2004, 41). The main restriction here is that all the halls are weighed the same.

Earned Income Per Museum Visitor

Total earned income for Cranbrook for the same time was $1,504,158. Dividing this number by the total number of visitors for that time period, earned revenue per visitor is calculated to be $9.50.

Cost per Visitor
Cost per museum visitor is figured in the ASTC data and can be figured for Cranbrook as well using the following equation:

$3,883,454 operating expenses
/ 158,367 visitors

$24.52 per-visitor

While providing an accurate cost per-visitor over a certain period time, the per-visitor amount would decline or increase based on attendance (See Exhibit 2).

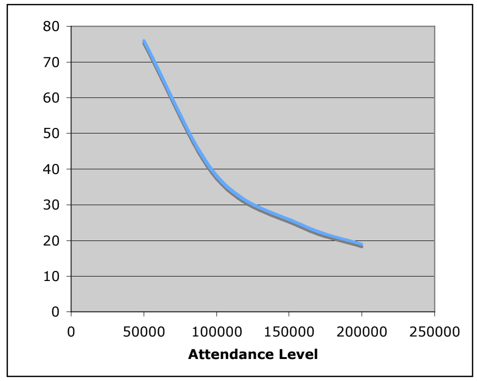


Exhibit 2. Cost per visitor in relation to overall attendance.

Exhibit 2 assumes that the operating expense would remain constant and independent of the attendance level of the museum. This would not likely be the case over many periods, as the museum would have to cut operating expenses as attendance levels decreased and increase them (additional staff) as attendance increased. However, this graph does emphasize how quickly the cost per visitor can increase if the museum were to have an unexpectedly bad year. It remains more constant as attendance increases.

Revenue for Changing Hall
Using the past attendance data it is now possible to derive the attendance and income that a median size changing hall (5000 sq. ft.) brought in to Cranbrook by simply plugging in the numbers.

5,000 sq. ft. x 8.2 visitors
41,000 annual C.H. visitors

41,000 visitors x $9.50
$389,500 annual C.H. revenue

$389,500
/ 5000 sq. ft.

$77.90 annual C.H. revenue per sq. ft.

Working with the numbers

Now that the raw data has been computed it is possible to perform the various CVP analyses to determine the answers to many questions that managers need to be able to quickly determine, such as how much money a changing exhibit contributes to an organization.

Contribution Margin

Using the data above, CM can be figured for Cranbrook's Changing Hall for 2003 as:

$389,500 annual C.H. revenue
- $238,200 variable costs

$151,300 annual CM

In other words, the changing exhibit hall contributed $151,300 to the organization's bottom line based on data provided by ASTC and historical data from Cranbrook itself.

Unit CM

For Cranbrook, the unit CM for the changing hall can be calculated by using the per-unit costs that were determined above.

$77.90 revenue per sq. ft.
- $47.64 variable cost per sq. ft

$30.26 annual unit CM.

Net Income

Now that the CM is known, is it possible to determine the net income that the results with the changing hall? All that would need to be done is subtract the fixed costs from the CM that the exhibit contributes to the organization.

Looking at the operating expenses could shed some insight into what this figure may be though generally fixed costs should not be broken down per unit.

Operating expenses per sq. ft.
$3,883,454 operating expenses
/ 65,500 building sq. ft.

$59.29 per building sq. ft.

The operating expenses may contain other variables, mixed and fixed costs, so this $59.29 may, or may not be a fixed cost. It would be up to the organization and its specific accounting department to determine what the fixed costs for the space would be for the year and charge the department accordingly. Fixed Costs also cannot be broken down on a per unit basis, as with variable costs. Overall fixed costs for the space must be used in combination with the overall CM.

In the following example, we assume the accountants decided to charge the Exhibit Department rent and other fixed costs of $275,000 for the space.

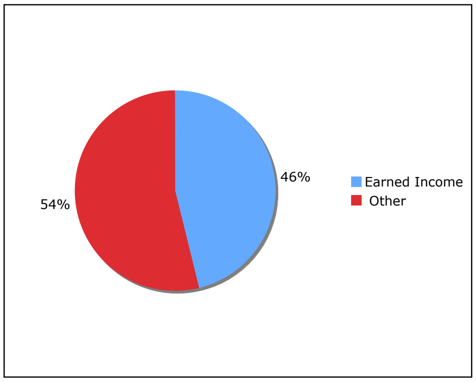
$151,300 annual contribution margin
–$275,000 fixed costs

$123,700 annual net income

What does this mean for the changing hall? Should the museum not rent exhibits to fill the hall because a loss of income is predicted? If the exhibits were not rented to fill the hall than the museum would lose out on the $151,300 CM and the $275,000 in fixed costs would still have to be paid (again, fixed costs vary amongst organizations and it is the accounting departments responsibility to determine fixed costs so the exhibit manager can analyze the data correctly). Renting the traveling exhibits lessens the losses by almost half.

This "other" half would be made up by donations and sponsorship. This data could be benchmarked against the data from ASTC and adjusted accordingly (See Exhibit 3 -- Income Sources).

Exhibit 3 compares the Changing Hall earnings at Cranbrook compiled in this paper against the average income earnings of all ASTC museums surveyed



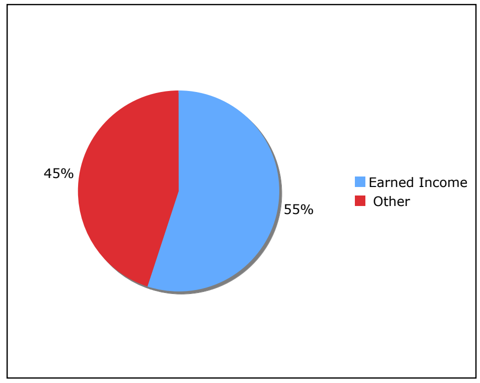


Exhibit 3: Income Sources: ASTC and Cranbrook

Conflicts

Due to extremely small sample sizes when compared to other similar institutions, and the unknown exact number of museums, the ASTC data (as well as similar data from AAM) are inherently flawed. Confidence levels can be as high as ±20 percent according to AAM.

Why would a museum look to these figures as indicators if they are not 100% accurate? As AAM states, "For one thing, there are no better data out there. Data for these segments can give you a feeling, though approximate, for the relative expenditures and earnings of different museum types" (Merrit 2003).

Though not governed by GAAP, the tools above provide managers with insight and knowledge of exhibit halls that may otherwise not exist. Michael Westcott, vice president of marketing for event marketing agency The George P. Johnson Company states that the real story goes behind the numbers, "and how you can use measurement insight to direct event strategy, event selection, event design, and overall investment to improve performance over time" (Westcott 2005).

By analyzing parametric data, the exhibit manager can estimate the value of an exhibit as it contributes to an organization. This can provide strong evidence to continue an exhibit program, or rethink possibilities for the space (i.e. facility rentals). As shown here, contribution margin can justify the price that an organization pays for a traveling exhibit program. It should also be stated that using more than one year of historical attendance data would naturally provide a more reliable attendance figure for calculations.

"As competition for donations and public resources intensifies, more nonprofits are likely to turn to activities that have the potential to generate earned income. Setting prices for these services can involve an intricate balance of economics, ideology and common sense" (Oster 2000).

The data presented assumes that the changing hall carries the same weight as other permanent halls. This is most likely not the case. Further cost analysis and techniques can be used to take all quantitative factors into account and weigh them accordingly in a multiple regression analysis.

Dr. Krakauer, who helped develop the desktop multiple regression analysis model, is currently a practicing museum consultant. In 2004 he wrote an article for ASTC's Dimension Magazine in which he provides insight to a possible reason why many museums are facing financial troubles, even with all the tools available to them:

"In recent years, the field has focused on driving attendance and building the earned income side of our ledger. But as our budgets have increased – whether through growth, or merely the passage of time – have we devoted the same kind of energy to our cultivation of unearned income? Any future dialogue about new models should give equal weight to this second 'engine.'

In economics, as in other areas, it comes back to the need for intensive self-examination. Of course, it is important to keep up with the science center field, but our motivation in examining other models should be to better understand how to do those things that are consistent with our core ideology, not to imitate some else's 'best practices.' If there is a magic bullet, I believe it lies in that." (Krakauer 2004)

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Risk Management: "Is the Army doing it right?"

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Abstract

In this paper we will examine and evaluate the United States Army's policy concerning risk management. Overall, from WWII to Desert Storm the Army has lost an average of 59% of casualties due to accidents and fratricide, compared to an average of 41% due to enemy action. We will examine what the Army is doing to curb these alarming statistics. Furthermore, I will evaluate the effectiveness of current policies in risk management.

Introduction

In this essay, we will evaluate the United States Army's approach to risk management. Moreover, I will examine the historical background of risk in military operations, and evaluate the Army's "Five Steps to Risk Management" and the "Six Elements Central to Mission Safety." I will then evaluate how a commander utilizes controls, evaluates and mitigates residual risk, and the overall leadership of risk.

"Sizing up opponents, to determine victory, assessing dangers and distances is the proper course of action for military leaders."
Sun Tzu, The Art of War

History

Historically, the United States Army has always been risk conscious. The military leader must balance national objectives against the effect of casualties, impact on civilians, damage to the environment, loss of equipment and level of public reaction.

Commanders since the beginning of time have used risk management. "Throughout the history of armed conflict, government and military leaders have tried to reckon with the effect of casualties on policy, strategy, and mission accomplishment" (FM 100-14). It was not, however, until the mid 1980's that formal risk management practices were implemented in the United States Army. "The Army achieved steady gains in safety from the late1980's through the mid 1990's by implementing the 5 Step Risk Management process as its principal risk reduction tool." (Lessons Learned, Risk Management Integration)

History proves that the United States Army has lost more soldiers through accidents and fratricide than through direct enemy action. Exhibits 1 and 2 depict the losses through accidents, friendly fire and enemy action from 1942 to 1991.

Army's Principle of Risk Management

Now that we have viewed the historical contexts of risk management in the Army, I will evaluate the Army's basic principles of risk management. The Army has identified three basic principles, which create a framework for Army risk management. These principles are:

- integrating risk management into mission planning
- preparation and execution

- making risk decisions at the appropriate level in the chain of command
- accepting no unnecessary risk.

These principles provide the commander with guidance when evaluating and implementing risk management into the daily workings of their unit.

Army	World War II	Korea	Vietnam	Desert Shield/ Storm
	1942-1945	**1950-1953**	**1965-1972**	**1990-1991**
Accidents	56%	44%	54%	75%
Friendly Fire	1%	1%	1%	5%
Enemy Action	43%	55%	45%	20%

Exhibit 1: Losses

Risk Management Steps					
Military Decision Making Process Mission Receipt	**Step 1: Identify Hazards** X	**Step 2: Assess Hazards**	**Step 3: Develop Controls & Make Risk Decisions**	**Step 4: Implement Controls**	**Step 5: Supervise and Evaluate**
Mission Analysis	X	X			
COA Development	X	X	X		
COA Analysis	X	X	X		
COA Comparison			X		
COA Approval			X		
Orders Production				X	
Rehearsal	X	X	X	X	X
Execution and Assessment	X	X	X	X	X

Exhibit 2: Risk Management Steps

The Army has further developed a standardized strategy for evaluating risk. This standardized form of risk evaluations is called, "The Army's Five Steps to Risk Management."

Step 1:
Identify hazards
Step 2:
Assess hazards to determine risks
Step 3:
Develop controls and make risk decisions
Step 4:
Implement controls
Step 5:
Supervise and evaluate

These fives steps guide the commander, step by step, through the risk evaluation and mitigation process. Below, the five steps to risk management are broken down into a "Military Decision Making Process" matrix. This matrix unifies the five steps to risk management and the process a commander takes from mission receipt to execution and assessment.

The Army has identified two types of risk which exist in a military environment: Tactical risk and Accident risk. Tactical risk applies to engagements with the enemy and exists within all areas of operations. Accident risk applies to everything which is not tactical. Accidents cost the Army about $500 million each year and significantly reduce mission capabilities. Although tactical risks, often, cannot be mitigated, the mitigation of accidental risk would profoundly impact the Army's overall threat.

The necessity of risk management is to identify risks associated with a particular operation and weigh the risks against the overall mission or training value to be gained. The Army has identified four rules, for commanders to follow when evaluating risk management. The four rules of risk management are to:

- Accept no unnecessary risk
- Accept risks when benefits outweigh costs.
- Make risk decisions at the right command level.
- Manage risk in the concept and planning stages whenever possible.

Additionally, the Army provides steps to manage risk:

- Identify hazards. Look for hazards in each phase of the training or operation.
- Assess the risk. Ask these questions:
- What type of injury or equipment damage can be expected?
- What is the probability of an accident happening?

To evaluate and identify mission risks both tactical and accidental, the army has developed a series of matrix to assist the commander in determining the severity of risk.
Standard Army Risk Matrix:

			Hazard Probability				
			Frequent	Likely	Occasional	Seldom	Unlikely
			A	B	C	D	E
Severity	Catastrophic	I	Extremely High	Extremely High	High	High	Moderate
	Critical	II	Extremely High	High	High	Moderate	Low
	Marginal	III	High	Moderate	Moderate	Low	Low
	Negligible	IV	Moderate	Low	Low	Low	Low

Exhibit 3: Risk Matrix

Missions vary in scale and complexity. For a small mission or training exercise the five steps to risk management may be adequate. However, for missions on a grander, more complex scale, the Army has provided additional assistance for risk assessment. FM 55-50 identifies six elements are central to safely completing most missions and then provides a risk matrix for each element to assess the risk of any mission in more detail

Six Elements Central to Mission Safety:

These are:

- Planning.
- Supervision.
- Soldier selection.
- Soldier endurance.
- Weather.
- Mission essential equipment.

Now that I have identified the six elements, we will evaluate each individually.

Planning

The first element central to mission safely is planning. Planning, like leadership, is completed with varying degrees of effectiveness, which may vary from vague to specific, in-depth to minimal.
Below is the matrix for planning.

Planning			
	Preparation		
Guidance	In-depth	Adequate	Minimal
Vague	Medium	High	High
Implied	Low	Medium	High
Specific	Low	Low	Medium

Supervision

The second element central to mission safely is Supervision and Evaluation. "Leaders must supervise the execution of their orders. The more untrained the troops, the more detailed this supervision must be." Infantry in Battle, 1939 (FM 100-14) Leaders must constantly evaluate the risk in ongoing missions and use situational awareness to ensure that they are effectively managing risk.

Leadership must ensure that troops completely understand the mission at hand. "Techniques may include spot-checks, inspections, situation reports, brief-backs, buddy checks, and close supervision. (FM 100-14) Leadership must ensure that troops do not become overconfident or lazy when completing repetitive tasks which may contain a high level of risk. Below is the matrix for supervision.

Supervision			
	Mission Environment		
Command and Control	Nontactical	Day Tactical	Night Tactical
OPCON	Medium	High	High
Attached	Low	Medium	High
Organic	Low	Low	Medium

Soldier Selection

The third element central to mission safely is soldier selection. Soldiers, like civilians come to any mission with a specific skill set. It is the challenge of the commander to match those skill sets with the mission at hand.

This, however, is not always possible. At times soldiers are inexperienced and poorly trained for the mission at hand. Below is a matrix to assist the commander in evaluating soldiers in selection for a mission.

Soldier Selection			
	Soldier Experience		
Task	Highly Qualified	MOS Qualified	On-the-job Training Only
Complex	Medium	High	High
Routine	Low	Medium	High
Simple	Low	Low	Medium

Soldier Endurance

The fourth element central to mission safely is soldier endurance. Unlike civilian projects, in the Army, the needs of employees, which must be provided by the employer, does not cease at the end of the work day. In military operations, military leaders must provide for purification, food, mental health, equipment and clothing.

FM 100-14 identifies three causes for failure concerning risk assessment of soldier well being:

- Hazards to the physical and emotional health of soldiers
- Hazards to task organization or units participating in an operation
- Hazards associated with long-term missions

Below is the risk matrix concerning soldier endurance: every aspect of troop welfare. This includes housing, healthcare, water

Soldier Endurance			
	Availability of Basic Needs		
Mission Environment	Optimum	Adequate	Minimal
Complex	Medium	High	High
Routine	Low	Medium	High
Simple	Low	Low	Medium

Weather

The fifth element central to mission safely is weather. Dissimilar form many civilian projects, weather is an essential component in military risk management. Military units operate and exist under various and often hazardous weather conditions. These conditions pose a threat to mission success and troop welfare.

Weather			
	Availability of Safe Haven		
Conditions	Optimum	Adequate	Minimal
Severe	Medium	High	High
Unfavorable	Low	Medium	High
Favorable	Low	Low	Medium

Common command mistakes, when considering weather conditions include (FM 100-14):

- Adverse effects of heat and cold hazards on the performance of soldiers
- Effects of climate and weather on maintenance of equipment
- Hazardous effects of weather on terrain

Mission Essential Equipment

The final element central to mission safely is equipment readiness. This is an aspect of safety with is closely aligned with the values of civilian risk mitigation. Faulty equipment is one to leading causes of accidents and death, both in the civilian and military sector. Below is a risk matrix concerning equipment readiness.

Mission Essential Equipment			
	Equipment Readiness		
Availability	Optimum	Adequate	Minimal
Short Critical	Medium	High	High
Short Not Critical	Low	Medium	High
No Shortages	Low	Low	Medium

Army's Risk Mitigation Process

Once the commander has utilized these risk matrixes and understands the situations more fully, a commander must evaluate what the risk response will be. As seen in the matrixes, risk is evaluated as ratings of high, medium and low risk. If the assessment is high, the commander is encouraged to eliminate the risk totally, if possible, or substitute a less hazardous alternative. If the risk is medium one should reduce the magnitude of the hazard by changing tasks, locations, or times. Or, modify operational procedures to minimize risk exposure consistent with mission needs. And finally, if the risk is low the commander should train and motivate their personnel to perform to standards to avoid hazards.

Once the commander has identified the risks and determined what course of action will be taken, controls must be added to reduce or prevent the risk from materializing. The Army has identified three types of controls which are valuable in reducing a threat's impact. These controls are: educational controls, physical controls, and avoidance. Educational controls are based on knowledge and skills of the soldier or soldiers collectively. Physical controls are controls with physically prevent the risk from materializing. The final control is avoidance, which allows the commander to simply avoid the threat all together.

Commanders must understand that although controls are in place, some form of residual risk exists. If the residual risk is deemed unacceptable, then additional controls must be implemented. This process is repeated until the risk is mitigated to the satisfaction of the commander.

The role of leadership in Army risk management is essential:

"Everyday as we respond to the nation's needs, we expose our soldiers to hazards in uncertain and complex environments. We do this with the full knowledge that there are inherent risks associated with any military operation. The nature of our profession will not allow for either complacency or a cavalier acceptance of risk.

General Dennis J. Reimer
Chief of Staff, Army

Leadership

Army leadership has a difficult objective concerning risk management. "Commanders are responsible and accountable for their own actions and those of units under their charge. Commanders must weigh the repercussions of casualties, damage to the environment and loss of equipment. They must also consider the level of public reaction to loss against national, strategic, operational, or tactical objectives." (FM 100-14)

To begin, there are three decisions presented to commanders: select from available controls, modify the mission if the risk is deemed too great, or accept the risk because mission benefits outweigh potential loss. Then, there are three tasks identified for all commanders. Implement risk control measures, supervise the operations, and evaluate the results.

As leaders we operate in an environment, which by definition is unpredictable and violent. Army leadership is asked to balance national objectives against the effects of casualties, impact on civilians, damage to the environment, loss of equipment and level of public reaction (FM 100-14).

Conclusion

In conclusion, it is my opinion that the United States Army has implemented an effective, standardized, user friendly risk management system. Furthermore, risk management has effectively permeated to the lowest levels of military operations. "To achieve and sustain additional gains in safety, we must close the gap that still exists in the full integration of risk management into Army culture." (Lessons Learned, Risk Management Integration)

That being said, my criticism of the Army's current system is that this outstanding policy is misunderstood and misused. I began to see a change in the military, almost upon entry into active duty in the mid 1990's. The tempo of training was slowing. Some training was eliminated, deemed too dangerous. Most enlisted military members begrudged this invisible force of change. Most officers feared it, but all obeyed it. This was the invisible force that we now know as risk management.

I cannot say when risk management was inculcated in the military. What I can say is that it has not had the intended effect. Though processes are in my opinion, beyond most corporate risk management programs. The employees, enlisted members ignore it all together, believing that it is another form of bureaucracy, which simply must be "pencil whipped."

Lower level managers, the noncommissioned officer corps use it to bridal unwanted training, deeming it too risky and scaring officers into submission. Officers, conversely, feel that it is something that they are bridled with. Risk management is often seen as something which limits their capability to properly train the troops. Or, they see it as a "CYA."

They make military members complete unrealistic risk assessments, which are far outside their scope of knowledge, and sign insignificant promises for activities, such as going out of town for the weekend. All with the confidence that when the military member falls victim to indiscretion, the commander may say, "Sir, I did my risk assessment. I told that military member that their planned activity risk was 'high' with a threat number of 23 (of 25). I clearly did my job."

Additionally, upper level management, senior officers, seem to view risk management as a means to eliminate loss from the Army. Thus it is portrayed in the zero defect mentality which surrounds loss. "If the proper risk mitigation was in place, this never would have happened. Someone is to blame."

In short the Army has implemented an outstanding policy for risk management, but it has been confused, and thus created this zero defect mentality. Risk management in the Army should be seen for what it is: a tool to mitigate undue risk. Risk mitigation in the Army will remain ineffective and impotent until it ceases to be seen as the enemy, a tool to eliminate unwanted work, a bridal, or a get out of jail free card.

Proposed Corrective Action

The Army, in my opinion, must change the culture of risk management, from the top down. We must educate the public and earn their trust and understanding with the confidence that the Army has implemented the best policies to protect their sons and daughters. They must also understand that even with the best policies and best leadership, the military is a dangerous business.

Senior management, staff officers and above, must understand that risk mitigation does not mean risk elimination. They must shed this zero defect mentality. Middle management, junior officers, must be more educated in risk management. They must understand it to be a tool and not a bridle. Furthermore, they, must be freed from the yoke of the zero defect mentality, so that they will cease to use risk management as a "get out of jail free card" or "all the holes were punched" excuse, for when something unforeseeable goes wrong.

In a dangerous business, such as we are in, accidents, fatal accidents, will happen. We must simply realize that sometimes, there is no one to blame. Lower management, the noncommissioned officer corps, must be better educated in risk management. Moreover, they must be properly supervised, with the understanding that risk mitigation does not mean the cancellation of unpleasant training.

And, finally, the employees, the enlisted, must be educated that risk mitigation is not a plan to spoil their fun, but to potentially save their life. Moreover, a substantial amount of the bureaucratic ticket punching and CYA(ing), must stop. Enlisted must be educated to view risk mitigation as an asset and not an adversary. In conclusion, the culture must change.

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Risks around IT Outsourcing

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Abstract

Outsourcing as we all know, is the delegation of tasks or jobs from internal production to an external entity (such as a subcontractor). IT outsourcing today is growing very fast. The strategy has proven to be effective, but brings with it significant risks that must be recognized and managed. While most organizations continue to move in this direction, there are some undiscovered or hidden risks which can make the venture of outsourcing a huge challenge or even a failure. Outsourcing, therefore, is just another example of a critical project, which if not planned and executed successfully can put any organization at risk or in trouble. Just like any other project (if not more so) outsourcing requires a company's sponsors and managers to pay careful attention to the areas of quality management, which in-turn means putting in place quality planning, quality assurance, and quality control.

Introduction:

According to Carr (2005), the outsourcing of support services has existed since the start of the 20th century when the unthinkable occurred in manufacturing world. "Forrester's recent survey of 1,377 technology decision-makers at North American and European enterprises shows that most firms have still yet to plunge into the offshore world. But of those using these services, 48% have avoided hiring more IT staff, and 31% have reduced the number of full-time employees" (Forrester Research).

"Offshore outsourcing is growing 25 to 30 percent annually, with little evidence of slowing" according to Information Week magazine. Indeed, while most enterprises experience initial resistance, most technical issues are quickly resolved and geographical and/or political risks seem to be insignificant after careful evaluation. Even the current political argument about jobs being moved offshore via outsourcing is not impacting the strategy of IT organizations. Offshore outsourcing will continue to grow as companies are striving for savings and competitiveness.

Companies interested in Outsourcing should consider both the up front price tag of information systems outsourcing as well as the hidden, or opportunity costs, involved in such deals. Travel, communications, vendor governance, and transition costs (visible and hidden) costs often surprise IT organizations. As IT organizations consider the vast benefits and allure of offshore outsourcing, they must balance the risks and uncertainties with the potential for labor arbitrage.

Risk Definition
To understand the risks involved in outsourcing, the definition of risk and risk management should be understood. However, these terms can be as ambiguous as that of outsourcing in general. Kliem (2004) proposes that risks can be both positive and negative, respectively relating to opportunities and the more common view of risk in business, a threat that can negatively affect operations.

In this paper we analyze some of the critical areas of risks associated with outsourcing. In particular, we will concentrate on the following risk areas:

1. High Expectations

Many times outsourcing brings a lot of high expectations such as: "We will save 50% of the cost by Outsourcing" (Nevison 2005). However, the reality is that those savings are not realized in most cases. "Statistically, at best companies are breaking even during the second or third year of outsourcing."

2. Hidden Costs

Companies outsourcing offshore do not sufficiently invest in internal preparation and organizational change management activities. Most rush into offshore outsourcing to take advantage of the savings opportunity — an opportunity that proves elusive to the majority of companies interested in this venture.

The savings are mostly available because of the difference in labor rates. These savings quickly disappear when the complexities of an outsourcing relationship are realized. To reap the benefits of offshore outsourcing, companies must alter their processes, expectations, and employees' skills, roles, and responsibilities. In addition, they must develop an outsourcing strategy that defines their objectives so that organizational changes accommodate these objectives. Companies that neglect internal preparation requirements may not achieve the savings or efficiencies available in offshore outsourcing relationships. Furthermore, they may lose money and damage the relationship between the business and IT.

3. Actual Costs

Below is an example of costs related to a two year outsourcing deal. As you can see, this Company will only start seeing the economical benefits of outsourcing during the second year (See Exhibit 1). And this is only assuming everything goes as planned and in accordance with assumptions made in advance.

4. Management cost.

People often underestimate the amount of effort, energy, and resources it takes to manage the relationship properly. There can be significant overhead costs in just managing the financial terms on an ongoing basis. There can be substantially more overhead just handling the coordination of work transfer between the offshore site and onshore analysts. We believe that it is often underestimated.

Today, saving money is the primary motivation for companies seeking outsourcing vendor relationships. Some companies, not satisfied with potential savings of 20% to 40%, are looking for greater savings by opening their own offshore development and maintenance centers. This practice is particularly common in the high-tech sector, where companies may already have offshore R&D centers, and in the financial services sector, where companies are looking to reduce costs and/or better secure their internal systems.

Unfortunately, the management investment and overhead costs associated with opening a high-quality offshore development center that is intended to support an enterprise IT organization, rarely justifies the payoff. Indeed, companies that are supported by designated offshore facilities often find that customer service, flexibility, and staff quality is not as good as the leading outsourcing vendors, whose core competency is remote software development and support. Companies that are interested in opening their own offshore development centers should weigh the risks and benefits carefully and realistically before they venture into off shoring.

Year one	**Year two**	
48,000	48,000	Total hours (calculated)
$3,600,000	$3,600,000	Total cost of US outsourced project (calculated)
$1,819,200	$1,819,200	Total cost of an outsourced and blended project (calculated)
$2,766,000	$2,766,000	Total cost of US in-house project (calculated)
Additional hidden costs of offshore outsourcing		
Year one	**Year two**	**Additional Hidden Cost**
35%	**10%**	Productivity loss
25%	**10%**	Process and documentation upgrades
10%	**5%**	Transition costs and knowledge transfer
10%	**5%**	Additional governance
10%	**1%**	Infrastructure problems
8%	**3%**	Contingency planning
1.50%	**0.75%**	Annual management travel
3%	**0%**	Vendor selection
103%	35%	Total percentage hidden costs (calculated)
Year one	**Year two**	
$3,600,000	$3,600,000	Total cost of US outsourced project (above)
$3,683,880*	$2,451,372*	Total cost of an outsourced project with hidden costs added (calculated)
$2,766,000	$2,766,000	Total cost of US in-house project (above)

Exhibit 1: Offshoring Costs
(C) 2005 by John M. Nevison.

Pit falls due to poor Ground rules.

"Companies doing offshore outsourcing must teach their business analysts and internal customers how to work within the confines of an offshore outsourcing relationship. The process change required for this is, in most cases, revolutionary, not evolutionary, for both IT and the business. But if internal IT and its customers cannot work within the new process model, companies will not be able to satisfy the end user requirements, and any savings that offshore outsourcing initially promised will not materialize"

Organizations face a complex web of business partner relationships. This may be good for streamlining business, but it is hard to secure. While organizations focus on the technical controls around network connections, they forget about the people, process, policies, and contractual agreements necessary to secure these relationships. The impact of legal and regional regulation adds to this confusion by putting further requirements on business partner relationships. One particular area of information risk is in the world of offshore outsourcing. How safe is a proposition of sending a mission-critical information, security, intellectual property, and regulated data offshore?

Organizations want to ensure the security of their intellectual property while still taking advantage of the cost benefits and potential savings. The risk of sending information offshore is entirely dependent on the controls in place to protect the organization. To be sure, these controls are the same controls that should be used when dealing with any external business partner. Interestingly enough, offshore outsourcing is a potential catalyst for formalizing business partner security processes.

We believe in utilizing the "KEP" rule which is combining three most important areas required for inspection in any major process"

- Knowledge
- Experience
- Performance

Below is a limited ground rules set which we believe should defined and covered properly to avoid some of the pit falls:

- Operating agreements.
- Define communication frame-work including its mechanics.
- Define engagement model.
- Problem-solving / decision-making framework.
- Accountability definition.
- Conflict resolution framework

Cultural norms and behaviors

There are many cultural differences which will be only revealed by a comprehensive visit to a potential target outsourcing site. For example, beneath the coverage layer of well traveled westernized senior management there is a significant number of middle management layers who rarely understand foreign humor, their culture and the way they conduct themselves in business.

Furthermore, for example, Indian companies' organizational structures are extremely hierarchical, more like UK companies were before the 1980's. Managerial and motivational techniques are more aligned to the stick and carrot approach. It is not uncommon to see call centre agents being severely reprimanded in public. Middle managers and workers tend not to be proactive and generally will only work if their superiors request and oversee it. Often a real problem comes from the failure to deliver to high expectations.

Even as simple thing as a personal courtesy during day-to-day normal business related interruption can play a major role in people's relationship. For example, in Japan you are not suppose to shake hands and in Saudi Arabia shaking female's worker hand is not considered as a polite gesture.

Another example is a mismatch of a five day work week. For example in Israel, where significant amount of High-tech development goes on a starting day of a work week is Sunday which is a common day off in USA. Add to it a time-zone difference and you can easily have an issue in communication break-down.

Communication:
Different ways of communicating can lead to problems. It takes a few weeks before you get used to the head wiggle and work out whether someone is agreeing with you or not.
Simple ground rules for the communication should include at least the following items:

E-mail:
How often it is red and responded to?
Should there be a common format for e-mails?
Should there be a severity indication in each e-mail?

Should forwarding rules be in place to avoid broadcast?
Rules for attachment sizes not to overwhelm the system.

Conference Calls:
Frequency of calls
Agenda, minute's taker for each conf. call
Roll call
Use of mute button
Use of open-ended questions
Courtesy introduction before speaking up
Sticking to agenda and lack of use of personal/mobile phones

Negotiation styles
Often frustrating for westerners, negotiating in foreign countries is all about sellers starting with a high price and being knocked down by the buyer. It's a game that takes place in flea markets, bazaars and even hotels and is just as common in business deals.

The following are some of the examples of the wrong approach for a negotiation style. One businessman, who was impressed by the Indian businessman's charm and willingness to deliver, agreed a price for a call centre outsourcing contract before visiting India or even involving competitors to bid. This resulted in a 30% inflated price.

Another businessman, moving an entire function of his business to India nearly walked away from the deal as the target goals kept moving. What had initially been agreed was then pulled back by the Indian vendor, making the negotiating process a nightmare.

Finally, to summarize cultural differences in negotiation techniques and political rules and regulations can easily affect and jeopardize a successful outsourcing project.

Losing an established customer base

Referring to the Hamel and Prahalad's (1996) concept of core competence , Sullivan and Ngwenyama (2005) explain that outsourcing almost always leads to loss of some core competence because of the interconnectedness of processes and activities. The risk event is that the service provider could replace the client in their current position or move in a different direction that is or was set by the client, as they no longer possess their competitive advantage.

Where strategic functions like IT are concerned, operating vertically through the company, the likelihood of this interconnectedness increases. This is also discussed by Leavy (2004), who proposes that one of the two most significant risks associated with outsourcing is losing skills key to competing in the future. If companies fail to consider long term implications they may unwillingly mortgage their future opportunities.

He discusses this point with the aforementioned case of GE outsourcing to Samsung without properly analyzing what skills it was giving up to them, inadvertently allowing Samsung access to its US customer base and a significant loss of competitive advantage in this sector.

However, the aforementioned case by Lacity and Willcocks (2001) presents an example where despite heavy dependence due to outsourcing of a related core competency, its technical fixing capability, the outsourcers careful choice of supplier, strong contracting and monitoring and retention of some capabilities offset this risk factor.

Even when the bulk of IT is outsourced, several key functions should be retained because they: supply continuity for clients of IT, provide for the oversight of the outsourcer, are highly specific to the way the business operates, and are strategic to the organization. To some extent, the mix will vary with the reason for outsourcing. However, all organizations will need to retain some expertise in strategic functions, such as project oversight, architecture, planning, vendor management, and security.

Losing the Home Team.

Outsourcing can potentially lead to a very serious risk factor of loosing a proven work force currently managing business needs. Few words strike fear into the hearts of IT professionals like "outsourcing" and its closely related variation called "offshoring." For many, the outsourcing word is simply echoing for layoffs.

A fear of “O” word can put existing employees in an unsecure job environment which ultimately can force current employees to start looking for different jobs. Considering the impact and probability of this risk happening consequently leads to a mitigation strategy to be put in place in order to avoid the situation.

An example of a mitigation strategy could be a bonus (retention incentive) offered to employees to stay till the very end or promotion and /or organizational restructuring that can motivate employees to stay.
A strong contingency plan must be established if this risk is unavoidable (from rehiring an employee back to having an agency on a stand-by as a backup plan).

Conclusions

Organizations that don't continuously manage and evaluate the contractor relationship could end up with additional costs or loss of benefits because they're not getting what they paid for. This is especially true for companies that have hired multiple outsourcing vendors for different functions.

The use of active management, essentially where management meets on a regular basis to review the outsourcing project and its performance levels with the supplier/vendor is a crucial factor to be a successful engagement.

You have to have lawyers who know about outsourcing of IT contracts who are involved from the start. We were using lawyers, who were perfectly good, but they were not specialists in IT contracts - specialists would potentially have seen the holes in it.

Firms should consider both the up front price tag of information systems outsourcing as well as the hidden, or opportunity costs, involved in such hidden, or opportunity costs, involved in such a deal

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Project Management Practices as defined by PMI and PRINCE2

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Abstract

Project Management requires standards and procedures. In the United States the primary organization is the Project Management Institute (PMI). In the United Kingdom the organization defining standards and procedures for Project Management is the Office of Government Commerce (OGC). PMI has defined the standards for Project Management as the Project Management Body Of Knowledge (PMBOK). The PMBOK is the sum of the knowledge within the PM profession and rests within the practitioners and academics who apply and advance it. The OGC has defined a methodology called PRINCE2 (PRojects In a Controlled Environment 2). This methodology was first developed by an OGC agency and then enhanced by a consortium of project management specialists under contract to OGC. This paper compares and contrasts the two methodologies from the perspectives of similarity of procedure, methods of development, and central organization control. The areas of Risk, Cost, and Procurement are reviewed.

Introduction

> "There shall be standard measures of wine, ale, and corn (the London quarter), throughout the kingdom. There shall also be a standard width of dyed cloth, russett, and haberject, namely two ells within the selvedges. Weights are to be standardised similarly."

The Text of the Magna Carta

In 1215 in England the Magna Carta was created to give protection to the rights of the nobles and common citizens alike. One of these rights was the setting of standards so consumers would know what they are purchasing.

A key element of any profession is to have a set of standards. This allows the profession to have a repeatable and auditable process. For project management, this means that the project owner is assured that their project will meet the requirements of Scope, Time and Cost and result in a quality product.

Standards Organizations

There are two organizations which play a significant role in developing standards for project management. They are the Project Management Institute (PMI) and the Office of Government Commerce (OGC).

PMI is a world wide professional organization for project managers. Their function is to be a steward of the project management profession. They have developed standards, education, and a certification program.

The OGC is a United Kingdom Government department. OGC is an independent office of the Treasury and works with public sector organizations to help them improve their efficiency, gain better value for money from their commercial activities and deliver improved success from programs and projects. They have also developed standards, education and a certification program.

Standards and Processes

PMI

PMI has created the Guide to the Project Management Body of Knowledge (PMBOK). Their approach is that there is a "Body of Knowledge that rests with the practitioners and academics who apply and advance it." (PMI, 2004) The Guide is intended to identify Project Management Knowledge that is universally recognized as good practice.

Therefore the Guide to the PMBOK defines a set of standards and processes from which the project manager selects tools and skills appropriate to their project and uses that subset for the project. The Guide to the PMBOK identifies five process groups and nine knowledge areas to support the process groups. The primary focus in the Guide to the PMBOK is the knowledge areas. Figure 1 contains a summary of the Guide to the PMBOK process groups and knowledge areas.

OCG

The OGC created a structured method for the management of projects known as PRINCE2 (Projects IN a Controlled Environment 2). PRINCE2 is a project management method designed to provide a framework covering the wide variety of disciplines and activities required within a project (Hutchings, 2006). One key difference is that this framework is to be used on all projects and is adaptable to varying sized projects. PRINCE2 consists of eight processes and eight components to support the processes. PRINCE2 focuses on both processes and components.

PMI

Process Groups
- Initiating
- Planning
- Executing
- Monitoring and Controlling
- Closing

Knowledge Areas
- Integration
- Scope
- Time
- Cost
- Quality
- Human Resources
- Communications
- Risk
- Procurement

Exhibit 1 Summary of PMBOK

PRINCE2

Processes
- Directing
- Planning
- Start Up
- Initiating
- Controlling a Stage
- Managing Product Delivery
- Managing Stage Boundaries
- Closing

Components
- Business Case
- Organization
- Plans
- Controls
- Risk
- Quality
- Configuration Management
- Change Control

Techniques
- Product based planning
- Planning activities and resources
- Change control approach
- Quality review

Exhibit 2: Summary of PRINCE2

In addition PRINCE2 defines a few optional techniques that are not pertinent to this discussion. Exhibit 2 contains a summary of the PRINCE2 processes, components and techniques.

PMI & PRINCE2 Comparison

We will now compare the PMBOK and PRINCE2 as they apply to three areas of project management – risk, cost and procurement. In addition, selected textbooks will be reviewed to see if they support the standards developed by PMI or OCG.

Risk

Risk is the uncertainty that the outcome of future events will have on a project. Risk management is the process put into place to deal with the future events. While any given future event can have a positive or negative impact on a project, risk management usually deals with the negative impact events.

PMBOK Risk Approach

The PMBOK handles risk as a knowledge area and identifies six steps in the risk process (Exhibit 3). These steps fall into four logical groupings: what plan will we use to manage risk, how will we size and evaluate risk, how will we respond to risk and how will we monitor our success. The last three are iterative.

The purpose of the planning phase is to create the Risk Management plan based on organization, project scope and project management plan. The Risk Management Plan identifies the methodology, roles and responsibilities, risk categories and definitions. This is usually done through meetings, information from prior projects, organizational standards, etc.

The sizing and evaluating phase includes the identification of risks and determining the potential impact by using qualitative and quantitative analysis. The identification can be done by brainstorming sessions, documentation review, use of experts, checklists, etc. The impact analysis can use techniques such as matrix analysis, probability distribution, interviews, etc. A Risk Register is created that identifies the risks, potential impacts and priorities. The Risk Register serves as the risk communication vehicle throughout the project.

Risk

<u>PMI</u>

- Planning
- Identification
- Qualitative Analysis
- Quantitative Analysis
- Response Planning
- Monitoring and Control

<u>PRINCE2</u>

- Identify
- Evaluate
- Identify Responses
- Select Responses
- Planning and Resources
- Monitoring and Reporting

Exhibit 3: Risk Comparison

The response phase develops options and actions to reduce or minimize the impact and includes techniques such as avoidance, transfer, mitigation and acceptance.

The monitoring and control phase validates that the risk management policies and procedures are being followed and are still valid, that the identified risks and impacts have not changed, and that no new risks have surfaced. Techniques such as variance tracking, trend analysis, audits and status meetings are used.

If the monitoring and control phase indicates risk mitigation is not working or new risks are created the sizing and evaluating step phase is entered again for new corrective action.

PRINCE2 Risk Approach
PRINCE2 handles risk as a component. This component has two major elements: Risk Analysis and Risk Management. Before these elements are executed the Project Manager and the Project Board meet and agree on the Risk Tolerance the organization will accept and the Risk Responsibilities of both the Project Board and the Project Manager. This is done during the Start Up process and is analogous to the planning phase in the PMBOK. Risk Analysis and Risk Management are an iterative feedback loop process executed throughout the project.

Risk Analysis consists of Identifying risks, Assessing risks, Identifying risk responses and Selecting risk responses. This is similar to the Sizing and Evaluating phase in the PMBOK.

Identifying risk is a process that uses techniques such as brainstorming, meetings and other experts. A Risk Log is created and this will be the central risk document for the project.

During the Assessing risks step each identified risk is examined and probability of occurrence and scope of impact are determined. This is used to create a risk profile matrix to prioritize the risks to be handled.

The Identifying Risk Response step uses the techniques of prevention, reduction, transfer, contingency plan and acceptance to create responses for each risk.

The countermeasures to be used are then identified in the Selecting Risk Response step. This takes into consideration costs, impact on the business case, impact on other parts of the project and new risks introduced by countermeasures. This becomes the risk management plan.

The Risk Management portion is where the results of the Risk Analysis are put in the Project Plan for execution and monitoring. This step consists of Planning and Allocation and Monitoring and Reporting.

Planning and Allocation is the process by which the countermeasures are actually put in the project plan and assigned to task owners for execution after appropriate approvals are obtained. This will create plan changes and new or modified work packages.

The Monitoring and Reporting are normal project management steps to make sure the countermeasures are working as planned. The effectiveness of the countermeasures and project impact are evaluated and corrective actions taken as needed.

As mentioned above this is a feedback process. If the Monitoring phase indicates the countermeasure is not working or new risks have been introduced the Identifying and Assessing steps are repeated.

Risk Summary
In establishing standards on Risk the PMBOK and PRINCE2 approaches are very similar (See Exhibit 3). The basic elements of Identify, Evaluate, Respond and Monitor are present in all two. The PRINCE2 handbooks do not go into the tools and techniques as much as the PMBOK, since there are established sources for education in this area, such as the PMBOK and textbooks. The textbooks

reviewed also support the approach of Identify, Evaluate, Respond and Monitor.

Cost

Cost Management is the process that insures the project is delivered within the approved budget. The PMBOK identifies Cost as a knowledge area. PRINCE2 does not identify cost as a unique component, but works on the premise that if you have all the appropriate controls in place cost will be controlled. This will be examined further.

PMBOK Cost Approach
The PMBOK identifies three steps for Cost: Estimating, Budget and Control.

The Estimating step involves working with the project scope, project plan, work breakdown structure and organizational factors to create an estimated cost. Techniques such as top down estimating, bottom up estimating, parametric techniques, vendor estimates and reserves. Activity cost estimates and a cost management plan are created. The framework for the cost management will have been created during the project initiation phase.

The Budget step takes all the information from the Estimating step and factors in the effects of the project plan, resource availability and the contract to create a cost baseline for the project. The activity costs are aggregated, reserves and funding limits are taken into consideration and the baseline is created.

The Control step is where the baseline is managed to control cost overruns, control changes, suggest corrective actions and update the plan. The Earned Value technique is a key tool here as are project reviews and performance measurement analysis

PRINCE2 Cost Approach
PRINCE2 does not have a specific component for cost control. Instead it uses the overall project control framework to control costs.

This starts with the Business Case component. PRINCE2 looks at the return on investment to determine if the project should even be started, what the rate of return to the organization will be and lifecycle benefits. Techniques such as Internal Rate of Return, Net Present Value and Cash Flow analysis are used. This requires cost estimates to be created and used as part of the analysis and these cost estimates form the basis of cost control.

Cost
<u>PMI</u>
- Estimating
- Budgeting
- Control

<u>PRINCE2</u>
- Benefits
- Cost and Timescale
- ROI
- Cash Flow
- Project Planning
- Project Control

Exhibit 4: Cost Comparison

The Plan Component is the next part of cost control. Using the framework from the business case the plan includes the resources that will be used and the timelines for those resources. Controlling the plan will control costs. Standard project management techniques are used.

Change control is another aspect of cost control. Limiting the number of changes accepted and getting management approval for added resources for approved changes will prevent cost overruns.

Therefore PRINCE2 does not have any specific cost management processes similar to the PMBOK but due to the fact that the project manager will be using good project controls (as found in the PBMOK or other textbooks) and these project controls include cost elements the cost will be controlled.

Cost Summary
For this item there is a difference in approach between PRINCE2 and the Guide to the PMBOK (See Exhibit 4). PRINCE2 focuses more on the overall cost and benefit to the organization than does the PMBOK.

While the PMBOK does mention these factors, the majority of the Guide covers tools and techniques for controlling project costs. PRINCE2 uses the business analysis approach to create the business case and determine if the project should even be started, and includes this as part of the project management process. The business case becomes the basis for the cost baseline. You then use basic project control techniques to manage cost.

The PMBOK section on cost describes these basic techniques. In effect, it is a toolbox to be used in the PRINCE2 process. The textbooks reviewed also include analysis for business benefit and return to the organization so they are more in line with PRINCE2.

Procurement

Procurement is the process by which a project acquires products or services from outside the project team. The PMBOK has Procurement as one of its knowledge areas. PRINCE2 does not have procurement as a component. However the OCG has a section on Procurement and that will be used here.

PMBOK Procurement Approach
The Guide to the PMBOK identifies six steps in the Procurement Knowledge area (Exhibit 5). These steps fall into three logical groups: planning, seller selection and contract administration.

Planning includes the first two steps and determines what should be procured and what needs to be put in the contract. This is done by using techniques such as make/buy analysis, experts, organizational requirements, audit and governmental requirements, legal requirements and standard business practices. The outputs from this step are the procurement documents and evaluation criteria for selecting the seller.

Seller selection includes the middle two steps and determines what sellers will be invited to bid, what the proposal request will consist of, what evaluation criteria will be used and what the final contract will look like. The proposal request is sometimes called a Request for Price (RFP) or Request for Quote (RFQ). In addition the seller's responses are received, reviewed and seller selected and the contract is created. The techniques used in this step include bidders conferences, experts, approved seller lists, contract negotiations. The final contract and final seller selection is done here.

The final group contains the last two steps. This is where the contract administration and contract closure occurs. Techniques include performance reviews, audits and inspections, payment terms and conditions, change control, validation of completion and contract closure.

Procurement
<u>PMI</u>
- Plan Purchases and Acquisitions
- Plan Contracting
- Request Seller Responses
- Select Sellers
- Contract Administration
- Contract Closure

<u>PRINCE2 – OGC</u>
- Objectives
- Constraints
- Funding Mechanisms
- Risk Allocation
- Funding
- Contract Strategy

Exhibit 5: Procurement Comparison

PRINCE2 Procurement Approach
PRINCE2 does not have a component for procurement. It would use the procurement process that is part of OCG and that is summarized here.

OCG has created a Decision Map that is a Best Practice (Exhibit 6). This process uses the organizational factors, business needs, internal and external factors to determine the procurement strategy to be used for a specific project. It then helps you develop an approach for contracting, guidance on contracting issues and how to choose a procurement path. Model contracts are included. While this practice was initially created for the Information Technology (IT) area its scope is being expanded to non IT contracts.

The OGC also has a Supplier Relations Division to help the public sector customers with key suppliers. They also have a Government Procurement Service to assist their members.

OCG Decision Map
Business need and duration
Key strategic issues – internal and external
Project Strategy
Commercial principles and model contracts for IT
Guidance on IT contracting issues (10 modules)
Procurement Routes

5

Exhibit 6: OGC Decision Map

Procurement Summary
Since the PRINCE2 methodology is owned by the OGC it is fair to use the OGC Procurement process as part of this comparison (Exhibit 6). Both models have a comprehensive description on how to evaluate the procurement decision, how to select sellers and manage contracts. In addition the OCG has other departments to assist with contracting. Therefore the two approaches are similar.

It must be noted that the OCG process will apply if you are dealing with an organization that is either in the UK or closely associated with the UK in terms of adherence to OGC standards. If you were to use the PRINCE2 methodology in other geographies the Decision Map process might not be applicable. In this case the PRINCE2 methodology would not cover procurement and then other tools would be needed.

Most corporations have a procurement function and that could be used to supplement the PRINCE2 methodology. In addition the PMBOK could be used as a tool to supplement the PRINCE2 methodology. The textbooks have varying levels of information on procurement ranging from PMBOK level to not being mentioned at all.

Conclusions

The following two quotes state the philosophy of the approach of PMI and OGC to project management.

PMI states "Project management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements. Project management is accomplished through processes, using project management knowledge, skills, tools and techniques that receive inputs and generate outputs." (PMI, 2004)

OGC states "PRINCE2 is a process-based approach for project management providing an easily tailored and scaleable method for the management of all types of projects. Each process is defined with its key inputs and outputs together with the specific objectives to be achieved and activities to be carried out." (Introduction to PRINCE2, 2003)

PMI tends to focus on the tools and OGC tends to focus on the process. Both tools and processes are required for successful project management.

From a tools perspective PMI has emerged as a standard for the knowledge, skills, tools and techniques for project management. The educational institutions, independent consultants, and many organizations have adapted the knowledge areas from the guide to the PMBOK.

For processes, PRINCE2 has emerged as a standard in the UK and many other European countries and is being adopted in many other parts of the world. In addition many organizations have developed their own process and that could be used in place of PRINCE2. If your organization does not have a process PRINCE2 is a good starting point.

In conclusion, using PRINCE2, or your organization's process, supported by the PMBOK tools will allow you to have a project management process that meets the standards requirements of a profession.

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Project Risk Quantification and Risk Mitigation Methods

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Abstract

The risk quantification and risk mitigation processes are critical to the success of a project. Furthermore, an organization's risk strategy should be considered and consulted when developing mitigation strategies for risks with varying degrees of impact. The PMBOK Guide states that the Qualitative Risk Analysis process requires that different levels of the risks' probability and impacts be defined. Risk mitigation involves the practice of planning, monitoring, and reducing previously quantified risk during the life of the project. Imagine a high profile project whereby exhaustive project risk planning is undertaken. This exhaustive process includes risk qualification, risk quantification and risk mitigation methods. During the execution phase of the project the two project risks with the highest likelihood and impact resulted in the eventual failure of the project. How could this failure have happened if the risks were properly identified, quantified and mitigated? How can the lessons learned from this failed project be used in future projects so that similar failures can be avoided.

Introduction

Two important aspects of the Risk Management process, risk quantification and risk mitigation, play an important role in managing project risk. The Risk Management process is a key element in the Project Management process and also critical to the success of the project. "The goal of risk management is to identify, quantify, and mitigate risk." (Kanabar, 2005, p. 2).

The Risk Management process is a methodical process that allows the Project Manager and the project team to properly address project risk and uncertainly within the planning stages of the project. During the execution and controlling phases of the project risk monitoring and risk mitigation techniques can be used to manage identified risk.

Many failures within a project can be attributed to inadequate risk management methods and planning. At the start of a brand new project optimism is high within the project team. The project is on schedule and on budget because no work has started yet and there may be reluctance to properly discuss and analyze all that can go wrong in a brand new project. "Step back, develop a good risk list, and determine which you can avoid, which you can mitigate and which you can accept," says Rob Fritz, senior vice president with Ares Corp., Richland, Wash., USA" (Foti, 2004). A complete and exhaustive investigation of project risk in the planning phases of the project will help to insure the success of the project.

Quantitative Risk Assessment

"Risk Quantification leads to further organization and classification of the identified risks and provides us a prioritized list for further evaluation" (Kanabar, 2005, p. 62). In order to establish both a likelihood and degree of damage that perceived project risk can cause then an analysis of each risk must take place.

Tools to analyze risk include mathematical methods such as decision tree diagram, Monte Carlo assessment, statistics, simulations and historical data. The PMBOK Guide (2004, p. 255) list Quantitative Risk Assessment Tools and Techniques as:

1. Data Gathering and Representation Techniques. Includes interviewing, probability distribution and expert judgment.
2. Quantitative Risk Analysis and Modeling Techniques. Includes sensitivity analysis, expected monetary value analysis, decision tree analysis, modeling and simulation.

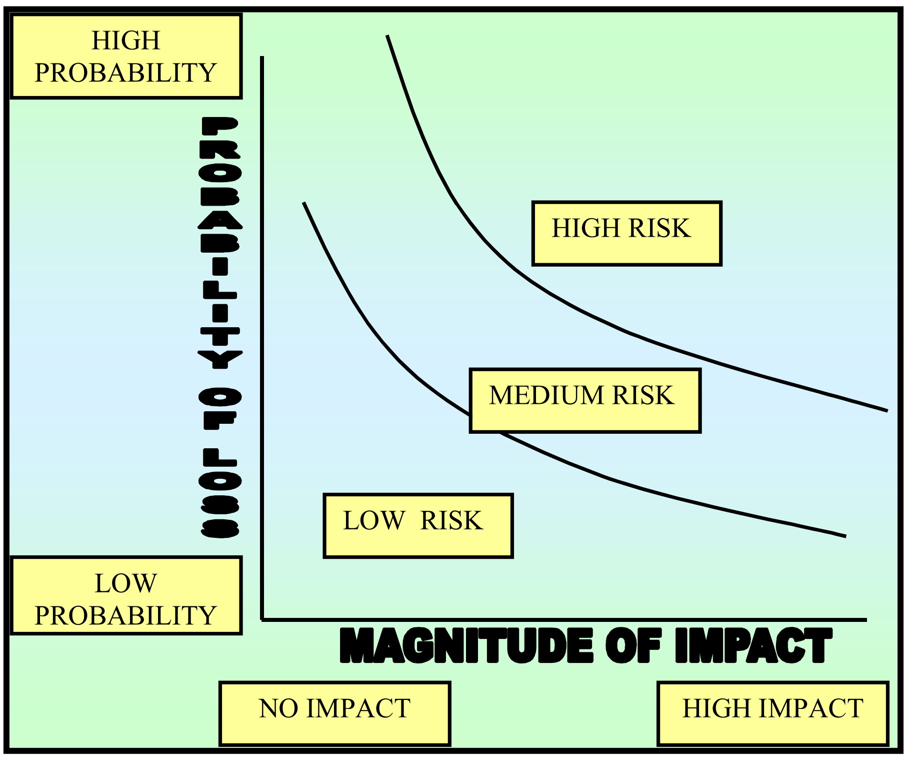

Figure 1 Risk Quantification, Probability vs. Impact

"Conceptually, risk for each event can be defined as a function of likelihood and impact; that is, Risk = *ƒ*(Likelihood, impact)" (Kerzner 2001, p. 905). In simple terms, risk quantification is simply establishing the level of both the likelihood and impact for each risk.

Exhibit 1 shows a graphical representation of risk quantification. The highest possible project risk can be classified as both high probability of occurrence and high magnitude of impact. Magnitude of impact is usually represented in the form of monetary or financial impact to the project.

A proper risk assessment therefore would include an assessment of likelihood vs. impact for each identified risk element. Furthermore, each risk element should also be revisited by the project team on a regular basis to reevaluate the risk element's likelihood vs. impact relationship.

NASA has realized that a thorough and diligent risk assessment during the implementation phase of a project can avert major issues later. "By not establishing a minimum threshold for technology maturity, NASA increases the risk that requirements will not be met and design changes will be required later in development, when such changes are typically more costly to make." (United States Government Accountability Office: Report to Congressional Requesters., 2005).

Risk Mitigation Methods

Risk mitigation is defined by Kanabar (2005, p. 83) as "reducing the expected monetary value of a risk event by reducing the probability of occurrence." Furthermore, the Merriam-Webster (2005) dictionary defines mitigate as "to cause to become less harsh or hostile." Any experienced Project Manager can certainly identify with and associate the words "harsh" and "hostile" to project risk.

The risk qualification process identifies project risk elements. Risk quantification identifies the likelihood and impact of project risk elements. Finally, the risk mitigation process seeks to reduce both the risk likelihood and risk impact. "There are basically two strategies for mitigating risk: (1) reduce the likelihood that the risk event will occur and/or (2) reduce the impact that the adverse event would have on the project" (Gray & Larson 2006, p. 215).

Risk mitigations methods can be classified into four broad strategies. The following strategies makeup the basic choices that a Project Manager may use when planning risk mitigation strategies. The four strategies are:

1. *Risk Avoidance*. Risk avoidance removes the risk from the project altogether. An example of risk avoidance may be the removal of a line item from a purchase order or project due to the high risk nature of that item.
2. *Transferring risk*. Transferring risk is a method that moves the risk to another's responsibility, usually outside of the project's scope. An example may be the purchase of extra freight insurance on a fragile shipment of project deliverables.
3. *Sharing risk*. Sharing risk is a process of spreading the risk out among multiple parties so that the risk is minimized for each of the parties. An example may be four towns deciding to build a regional High School rather than each town building their own High School separately.
4. *Retaining risk*. Retaining risk is the acceptance of the risk without provisions for reducing or mitigating a risk. An example of retaining risk may be planning an outdoor wedding and not making any provisions or alternate plans for bad weather. If one is planning a wedding in Phoenix then this approach may be acceptable, however, it probably would not be an acceptable approach for an outdoor wedding in Seattle.

Each of the basic risk mitigation strategies listed above should be carefully applied to each risk element. Adoption of the wrong strategy could lead to failure of the project. The Project Manager, Project Sponsors and Key Stakeholders should be sure that the strategy chosen is appropriate and very well considered.

A Case Study Project

A Fortune 500 company, DELTA Inc., has been contracted by another Fortune 500 company, OMEGA Inc., to supply two advance manufacturing machines that will produce high valued coatings on OMEGA product components. The machines include advanced control systems, process control equipment, robots for process manipulation, and complicated systems for pollution, noise and dust control. The sales value of the contract is $1.2M.

The purchase order contract includes a fiscal penalty clause for DETA Inc. if certain milestones are not met by certain dates. Furthermore, not only does the contract include turnkey engineering design, manufacture, installation and commissioning of the new machines but also includes turnkey development of process parameters (coating development) and creation of robot programs for two of the customer's parts. Contract purchase order acceptance procedures for the project require DELTA Inc. to test the coatings to very strict OMEGA Inc. specifications. If DLETA Inc. fails to produce the coatings to OMEGA Inc. specification on the new equipment then DELTA Inc. will be in default of contract and subject to stiff penalties.

Exhibit 2 shows the major risk elements that were qualified and quantified at the start of the project. The table includes a column that identifies the risk and risk owner, a column that suggests mitigation methods, and lastly a column that quantifies risk relative hazard rank. Clearly missing in this risk analysis is any mention of the trigger event or indication of the likelihood or impact of the risk. The ranks shown in Exhibit 2 give a clear indication of severity. However, a deeper analysis with regards to quantification and mitigation could be made.

Project OMEGA Inc. Risks
October 19, 2004

Risk (Risk Owner)	**Risk Mitigation Methods**	**Rank[1]**
Offline Robot Programming (John Smith): ◆ Very difficult program ◆ Never done by DELTA INC. before, ◆ Little time available to perfect ◆ Critical path activity	**Offline Robot Programming:** ◆ Use ABB Robot Studio to Develop the Program ◆ Hire expert consultants to help with program development	**9**
Manufacturing (Mark Johnson): ◆ Need 6 - 8 technicians working in the high bay starting November 1 ◆ Critical path activity	**Manufacturing:** ◆ Working with Manufacturing Manager to staff the high bay ◆ Develop detail focus plan for resource activity ◆ Review resource plan weekly	**7**
Coating Development (Jane Doe): ◆ Difficult coating development program ◆ Very large scope for DELTA INC. ◆ Very little time to complete ◆ Critical path activity	**Coating Development:** ◆ Created coating development team ◆ Hold regular CD summit to review progress ◆ Use resources from Parent Company when needed	**9**
Allen Bradley - Siemens port (Peter Smith): ◆ Large program, resource intensive ◆ Critical path activity ◆ Little time available to complete and test ◆ Critical path activity	**Allen Bradley - Siemens Controls port:** ◆ Formed high power team to complete ◆ Two consultants hired ◆ Two full time support personnel ◆ Meet regularly to review progress	**4**
Late delivery of materials from outside Vendors (George Jones): ◆ Late delivery of critical path items	**Late delivery of materials from outside Vendors:** ◆ Develop expedite and rank delivery priority ◆ Expedite critical deliveries	**4**

[1] 0 Low – 10 High

Exhibit 2: Risk Elements October 19, 2004

Exhibits 2 and 3 contrast the status of the major risk elements of the OMEGA project over a four month period. The risk elements shown in figure 3 are the only remaining risks on the project. The risk elements shown in figure 2 and not shown in figure 3 have been successfully handled using one of the four risk mitigation strategies and no longer warrant any attention. The remaining two risks shown in Exhibit 3 have evolved into major problems for the project. The last two risks, offline programming and coating development, were both identified as the highest risks of the OMEGA project at the start of the project, how then could these two risks have caused so much damage to the OMEGA project?

Project OMEGA Inc. Risks
February 20, 2005

Risk (Risk Owner)	Risk Mitigation Methods	Rank[1]
Offline Robot Programming (John Smith): ♦ Very difficult program ♦ Never done by DELTA INC. before, ♦ Little time available to perfect ♦ Critical path activity	**Offline Robot Programming:** ♦ Robot Studio inadequate in teach offline programs ♦ DELTA Inc. does not have the in-house talent or experience to complete ♦ Expert consultants are unavailable for the time required to complete the program	**9**
Coating Development (Jane Doe): ♦ Difficult coating development program ♦ Very large scope for DELTA INC. ♦ Very little time to complete ♦ Critical path activity	**Coating Development:** ♦ DELTA Inc. in-house personnel are incapable of completing the task ♦ CD summits failed after parent company resources were unavailable ♦ Parent company resources are unavailable	**9**

[1] 0 Low – 10 High

Figure 3 Risk Elements February 20, 2005

Risk Management Failure, Coating Development and Off Line Robot Programming

A number of factors lead to the failure of the OMEGA project. However, poor risk management practices are perhaps the leading cause.

The project initiating phase identified the two highest risks as the two risks that eventually caused the failure of the project. Outlined below are the primary reasons why these two previously identified risks caused the failure of the OMEGA project.

Management indifference
The project initiation phase identified serious risks that had the potential to wreak havoc on the project. Mitigations methods were suggested and trigger events discussed. Risk mitigation contingencies were established. However, soon after the start of the project the subject of risk and risk mitigation was not visited again by senior management. One of the risk sharing strategies identified called for the

development of a team of coating development experts.

Soon after the start of the project coating development experts identified as key stakeholders were removed from the project by senior management with complete indifference to the effect on the project. The consequences of this action were devastating to the project. However, the matter was not revisited by senior management.

Removal of key stakeholders by senior management from the project tasks that were identified as the most risky almost certainly resulted in the trigger of the coating development risk. The disbanding of the coating development team and the coating development summit plan midstream in the project resulted in inexperienced personnel being responsible for the most difficult project tasks.

Denial and Work Around.
Once coating development and robot programming tasks both fell behind schedule, the natural reaction was to focus on the micro aspects of the issue. The following list was created at the start of the project and identifies the exact nature of the risks:

Offline Robot Programming (John Smith):
- Very difficult robot programming program
- Never attempted or done by DELTA INC. before, outside of core corporate competency
- Little time available to perfect the program
- Critical path activity

Coating Development (Jane Doe):
- Extremely difficult coating development program, outside of core corporate competency
- Very large scope for DELTA INC.
- Very little time to complete
- Critical path activity

Once these two risks were triggered and negative impact on the project was realized, more attention was placed on solutions. However, these solutions did very little to address the causes of the risks listed above, but rather only focused on the symptoms of the problem.

Generally speaking, half measures and feel good short term solutions were implemented. Short term workarounds were implemented rather than serious discussions related to risk causes.

An example of a short term solution is to have people work weekends rather than asking if the task can be completed at all. Soon, workaround after workaround continued on, while project team members toiled away in good faith. The fact is that severe risks merit equally sever risk mitigations and responses. “Most of the risk associated with a project comes from the people directly associated with the project and its results” (Humphrey 2003). The response of DELTA Inc. to these two damaging risks did not match the severity and potential impact of the risk.

New schedules and workarounds continued on for many months. Thousands of dollars were spent trying to complete the coating development and robot programming tasks. In the end the project contract was defaulted between OMEGA Inc. and DELTA Inc. resulting in the failure of the project.

Conclusions

Risk quantification methods are used to predict the likelihood and severity of impact that can be caused by project risk. Risk mitigation methods must then address each of these risks by implementing a strategy that is capable of reducing the risk to tolerable levels. The severity of risk, such as the two severe risks identified in the case study, requires equally severe and comprehensive planning.

Risk mitigation and assessment involves the application of four basic strategies to the identifiable risk. The selection of which strategy to use can be determined by quantification of the risk impact and likelihood of occurrence. As an example, high risk should be only be countered with mitigation methods that avoid the risk altogether. On the other hand low risk can be mitigated by retaining and sharing risk mitigation strategies.

Exhibit 4 shows a basic risk strategy that a company can use as a guide in selecting the correct risk mitigation strategy. Note that the most severe risk is matched with risk avoidance. Risk avoidance of the coating development risk and off line programming risk in the case study would have been the best mitigation method. Clearly the severity of the risk impact and the likelihood of the risk warranted avoidance of that risk. In the end, the failure of the project and the inability of DELTA Inc. to complete the contract in effect proved avoidance would have been the most prudent mitigation strategy. “If you link risks to objectives, you can see how addressing project risk links to organization risk” (Foti, 2004, p. 40).

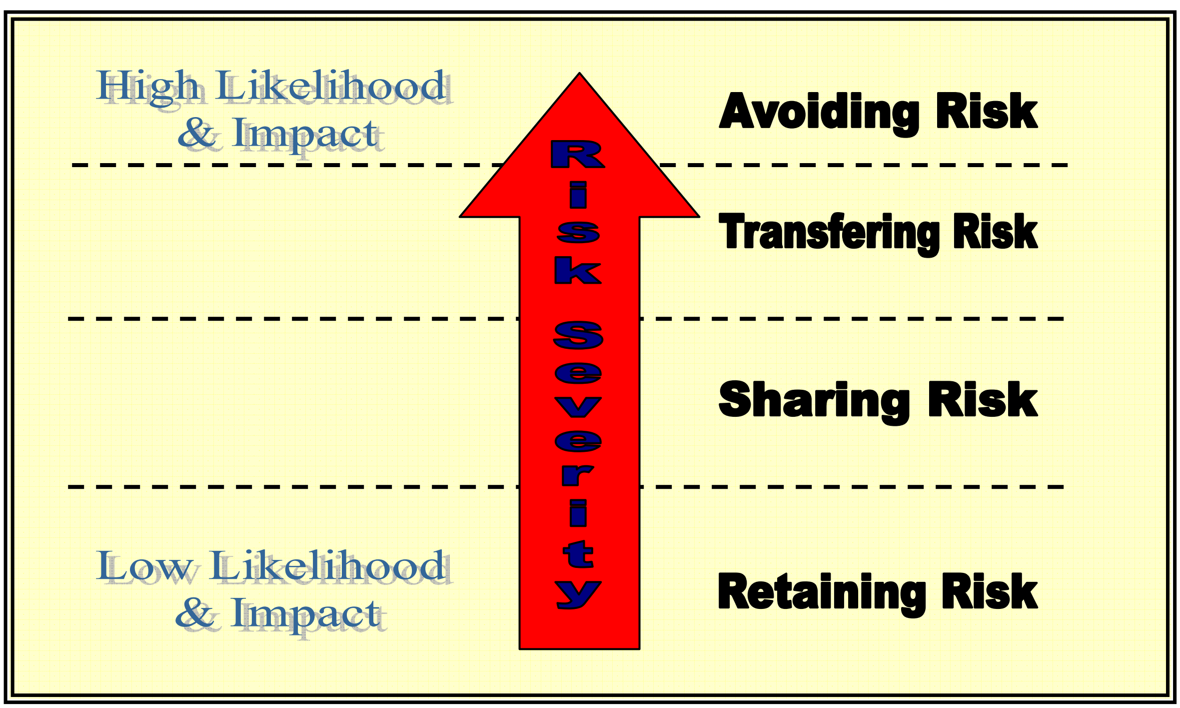

Figure 4 Risk Mitigation Strategies

We have learned from the case study example that it is not enough to identify and quantify risk but that a coherent risk management policy must also be in place to deal with severe risk. Severe risks warrant severe risk management measures. Listed below are the lessons learned from the case study example.

1. Risk management planning must include aggressive and comprehensive mitigations methods for sever risk. Risk retaining and sharing methods may not be acceptable mitigation strategies for sever risk.
2. The project sponsor and corporate management must participate in and acknowledge ownership of sever risk elements.
3. Severe risk may warrant extreme measures such as cancellation and refusal of contracts and orders.
4. Continuous focus on the causes and reasons behind severe risk rather than symptoms of severe risk will help to reduce implementation of half measure mitigation methods. Understand and monitor severe risk triggers.
5. Corporations should adopt project risk mitigation policies that include structured strategies to varying degrees of risk. Severe risk = risk avoidance is one example of a structures risk mitigation rule.
6. Routine and rigorous risk reviews should be held on a regular basis. Risk reviews should follow specific guidelines that examine severe high risk elements in a very discriminating way.

Diligent project risk quantification and mitigation methods are critical to developing proper strategies for protecting the project from risk impact. Furthermore, corporations and other organizations that engage in projects where high risks are likely need to establish clear policies regarding high risk.

Corporations and organizations should develop a risk strategy depending on whether or not the corporation or organization is inherently risk averse or risk takers. “A consistent approach to risk that meets the organization’s requirements should be developed for each project, and communication about risk and its handling should be open and honest. Risk responses reflect an organization’s perceived balance between risk-taking and risk-avoidance” (PMBOK Guide, 2004, p.240).

The case study project is a good example of identification, quantification and mitigation planning of high risk project elements. However, the severe nature of two of the risk elements in the end caused failure of the project. If a risk avoidance policy had been in place at the time of risk mitigation planning, then perhaps the project would have been rejected or cancelled sooner, and much time, resources and money would have been saved.

“An organizational culture that has previously had problems executing projects will be likely to repeat the same mistakes. These problem areas should be understood and managed as significant project risks. They must be counteracted by specific bold mitigating management initiatives or repeated failures are guaranteed” (Chapman, 1997).

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Developing a Continuous Operations Capability

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Abstract

A company's disaster recovery plan does not provide the same level of stability and protection of the firm's assets that the business continuity plan does. When a disaster strikes, a company acts in a reactionary mode and they're already losing valuable time and money. A disaster recovery plan can help reduce the amount of downtime or financial loss, but it cannot prevent these things from happening. The next step in disaster recovery planning is business continuity, which allows for the creation and execution of continuous business operations even if a disaster occurs. In fact, continuous operations are increasingly becoming a best practice in the continuity industry, as it allows for business as usual, with no substantial impacts on performance or production. This paper will focus on how creating a continuous operations environment mitigates the financial and operational risk due to a network outage or other incident. I will discuss a recommended approach to business continuity, including the importance of risk assessments and business impact analyses, documentation and testing.

Introduction

On September 10, 2001, I stood in a half filled auditorium of my colleagues and peers and explained point-by-point the purpose and importance of the firm's disaster recovery and business continuity plan and program. The entire session took 15 minutes, with limited questions at the end.

On September 12, 2001, I stood in the same auditorium. This time it was filled to capacity and I gave the same presentation. However, this session lasted over an hour and a half, with numerous questions regarding employee safety, viability of the business after a disaster, job security, and what the firm was doing to mitigate impacts of a wide-scale disaster.

Because of my background in disaster recovery planning, I had a unique perspective on the incidents of September 11th and was able to relate to my colleagues how the firm was ready to respond to such an event with limited interruption to our normal business process. Not only could we recover from a disaster, but because of our planning, we could ensure the continuation of critical business processes, and thus ensure survival of the business.

A comprehensive disaster recovery and business continuity program provides a level of stability and protection of a firm's assets. The purpose of a disaster recovery plan is to recover from a disaster that renders the company's network or other assets unavailable. The plan itself can help reduce the amount of downtime or financial loss, but it cannot prevent these things from happening because by virtue of the definition, it is a *recovery* plan.

The next step in disaster recovery planning is business continuity, because it allows for the creation and execution of continuous business operations even if a disaster occurs. In this paper, I will discuss a recommended approach to business continuity, including the importance of risk assessments, business impact analyses, documentation and testing. By developing a continuous operations strategy, a firm mitigates the financial and operational risk to which they are exposed during a network outage, natural disaster, man-made disaster, or other type of incident. The firm thus achieves a state where critical systems and resources are continually available, regardless of what happens.

Disaster Recovery Planning

Disaster is defined as a sudden, unplanned event causing great damage, loss or destruction. (Merriam Webster 2005). In the business world, a disaster can create the inability to provide critical business functions for a period of time. Disaster recovery is defined as activities and programs designed to return an organization to an acceptable condition (Disaster Recovery Journal 2006).

Disaster recovery planning spans all organizations and industries. Regulatory agencies for industries require that each organization have a formal, documented plan and recommend that the plan is tested annually, at a minimum. Furthermore, although the methodology for disaster recovery planning has its origins in the information technology sector, plans can be scalable for an organization of any complexity or size.

Disaster recovery planning emerged as a formal discipline in the late 1980's (IBM 2004). At the time, the focus was on protecting the centralized data center, which was the hub of a firm's technology infrastructure. Throughout the 1990's, there was a shift from a "mainframe" mentality to that of a client/server environment. Critical business data is now also found in all facets of an organization – from data on desktops to localized networks to the data center itself.

The reliance on information technology does not end at data; today a business cannot function with out its network, software, hardware, telephones and other communication tools. The need to be able to access data constantly has made disaster recovery planning more challenging because once a disaster has struck, a company acts in a reactionary mode and once the problem has occurred they're already losing valuable time and money. Thus the goal for a firm that cannot afford to tolerate any downtime is to be proactive and plan for such disasters.

Completing a Threat Assessment

As important as having a disaster recovery plan is, taking measures to prevent a disaster or mitigate its effects ahead of time is even more important. Thus, identifying the firm's liabilities allows a firm to pinpoint the disaster, determine the vulnerabilities, and the steps that need to be taken to minimize the risk. The most common threats that companies face are fire, hurricanes, tornadoes, flood, earthquakes, computer crime and terrorist activity, and sabotage (Hiles 2001). An assessment of these common threats is displayed in Exhibit 1.

Threat	Impact	Preventive Measures	Recommendations
Fire	Destruction of property Destruction of contents Injury or loss of life Loss of revenue	Fire alarms Fire extinguishers Halon system Evacuation training Backup generators / supplies	Conduct evacuation training Conduct inspections of fire prevention equipment
Hurricane/Tornadoes	Destruction of property Destruction of contents Injury or loss of life Loss of revenue	Detection methods Building construction Shelters Backup generators / supplies Evacuation training	Conduct evacuation training Work from alternate location

Flood	Destruction of property Destruction of contents Electrical Shock Injury or loss of life Loss of revenue	Sump pumps Modification to drainage systems Water detectors Backup generators / supplies	Conduct safety inspection of detectors and pumps Inspect building perimeters to check for water damage Conduct shutdown drills
Earthquakes	Destruction of property Destruction of contents Injury or loss of life Loss of revenue	Earthquake resistant building construction Backup generators and supplies	Conduct earthquake training Work from alternate location
Computer Crime	Compromised data Viruses Loss of revenue Loss of reputation	Anti-virus protection Firewalls System security Data backup	Training on security measures Institute data encryption on network
Terrorist Activity/ Sabotage	Destruction of property Destruction of contents Injury or loss of life Kidnapping of key personnel Loss of revenue	Controlled security access Shelter in Place Upgrade ventilation systems Shipping/receiving procedures	Maintain infrastructure security Annual employee security training

Exhibit 1: Threat Assessment Matrix

Rather than attempting to determine exact probabilities of each potential threat, a general probability (high, medium, low) can be assigned to each factor, for example, high = 10 points, medium = five points, low = 1 point. Also, you can assign a number to the impact if the event were to occur. For example, 0= no impact to operations, 1= noticeable impact for up to 8 hours, 2=damage to facility/equipment for up to 48 hours, 3= major interruption for more than 48 hours. To obtain a weighted risk rating, multiply the probability points by the impact rating for the entity for which you are performing the assessment. Results are detailed in Exhibit 2.

Threat	Probability	Impact	Weighted Risk Factor
Fire	5	3	15
Hurricane/Tornadoes	5	3	15
Flood	1	2	2
Earthquakes	1	3	3
Computer Crime	5	1	5
Terrorist Activity/Sabotage	10	3	30

Exhibit 2: Weighted Risk Factor Table

The scenarios are further defined below:

Scenario 1:
Access to main facility is unavailable, but all systems and networks are operable (i.e. building evacuation, bomb threat, inclement weather). In this scenario, critical personnel will relocate to the recovery facility and connect via the network to the production data center

Scenario 2:
No access to the data center, critical applications, computer equipment and standard operating procedures (i.e. flood, fire, computer crime). In this scenario, only the data center is affected but the building is habitable, thus users will connect to the mirrored data center via the network.

Scenario 3:
Building and data center destroyed (i.e. terrorist attack). In this scenario, data center fails over to mirrored counterpart and critical business users only report to the recovery facility to recover critical business function processing.

These assumptions should be reviewed and approved by management. Once the threat assessment has been completed, the next step is to identify subject matter experts who will serve two purposes. First, they provide input regarding their group's functions. Second, they provide the necessary leadership and carry out their group's responsibilities at the time of a disaster.

Another critical component of the disaster recovery plan is the identification of recovery time objectives and recovery point objectives for applications and infrastructure. The recovery time objective (RTO) is the amount of time that is required for the data to be recovered.

For example, a trading platform on the New York Stock Exchange might have a RTO of 1 hour. The recovery point objective (RPO) is the point in time to which the data has to be restored, and it can be measured in minutes or days, e.g., the RTO might be 1 hour, but the RPO is as of the point of failure, or the last keystroke entered. This information will assist in determining the best course of action relating to recovery, remote data backup, data replication or remote clustering (Jones 2002).

The next step in disaster recovery planning is to determine the requirements for alternate processing. This can mean relocating to an alternate facility, such as a hot site, warm site or cold site, having simultaneous data center processing, using vendor supplied equipment or any combination of the above.

A hot site is an alternate facility that already has a firm's computer, infrastructure and communication requirements in place so personnel can begin working after minimal setup. A warm site is a facility that contains some of the computer, infrastructure and communication needs. At the time of a disaster, additional configuration or customization is required. A cold site is an alternate facility that has the physical space and building infrastructure required by an organization, but contains none of the technology requirements. Factors such as cost and maintenance play a huge role in deciding which disaster recovery technique to employ.

At the time of a disaster, having an effective disaster recovery plan allows an organization to eliminate chaos and errors based on the incident, reduce bottlenecks in their technological or business processes, provide training on applicable policies and procedures to their employees, minimize potential revenue and economic losses, protect the firm's reputation and continue the business. The disaster recovery plan provides the basis for recovering the firm's infrastructure and providing a location to resume the business. It also has identified the most likely threats to an organization and the steps taken to mitigate that risk and flows into the next step, business continuity planning.

Business Continuity Planning
Business Continuity is the ability of a business to continue operations in the face of a disaster condition (Glenn 2002). The keys to business continuity are understanding the business, determining which functions are critical to staying in business, and identifying all the resources required to support those functions. The two main tools are risk assessments and business impact analyses.

A business interruption can render a business user unable to process. Thus, a risk assessment allows an organization to assess an interruption and prioritize business function processing at the time of an incident. The following table allows for this assessment:

ASSESSMENT	DATE/TIME	STATUS
Impact on Business Unit:		
➢ How does the event impact daily functions?		
➢ Today's Deadlines: what business units have time critical deadlines?		
➢ Tomorrow's Deadlines		
➢ If time critical functions are not performed, what is the impact?		
Impact on Facilities:		
➢ Update on building status		
➢ Damage to business unit's work area		
➢ Impact to business unit's assets and vital records		
➢ Timeframe for re-entering work area		
Impact on Voice Communications:		
➢ Incoming calls and faxes		
➢ Voicemail capabilities		
➢ Ability to redirect calls and faxes		
Impact on Systems:		
➢ Mainframe, Mid Range, Client/Server		
➢ Availability of critical applications		
➢ Availability of necessary and optional applications		
➢ Are connections to data center functional?		
Impact on LAN's:		
➢ Availability of LAN's supporting each work area		
Impact on Remote Offices		
➢ Connectivity available?		
➢ Financial Risk		
Impact on Clients:		
➢ Financial Risk (if any)		
➢ Perception		
➢ Impact on client connection		
Impact on Dependent Parties		
➢ Internal dependencies that rely on our data		
➢ External dependencies on whose data we rely		
Other:		
➢ Contact Senior Management		
➢ Contact Recovery Location		
➢ Contact Help Desk to redirect phones		

Exhibit 3: Risk Assessment Guidelines (from firm's Business Continuity Plan)

On September 11, I was able to use this tool to assess my firm's risk based on what was happening in the financial markets and the general demeanor of personnel in the office. The assessment proved useful in the meeting with the incident management team as they were able to glean at one glance the state of the firm and we made the decision quickly to activate our recovery location to ensure continuation of critical business processing.

This proved to be quite astute on our part, because in the immediate days after September 11, there were over 15 evacuations of our primary location. Being a leader in the investment management industry, we couldn't afford to miss potential million dollar trades because of the evacuations, so processing dually in both locations simultaneously allowed us to stay in business.

A business impact analysis (BIA) involves identifying all business functions and determining the impact of not performing the function beyond a maximum acceptable outage (Fulmer 2005). This is accomplished by assigning a ranking to categories such as impact on operating efficiency, impact if legal/regulatory requirements are not met, impact on reputation and impact to customer. The BIA also identifies costs associated with any interruptions or disasters, thus providing management with an estimated cost of failure which will ensure their buy in to the recovery program overall.

Each department should perform a BIA with a questionnaire that contains a standard set of questions for each business function. The following categories should be considered:

- Business Function – a brief description of the business function being performed
- Loss of Revenue –These numbers should be as accurate as possible.
- Additional Costs – in addition to lost revenue, which functions, if not performed, will result in increased costs
- Frequency that the function is performed
- Most critical time of day that the function needs to be completed by
- Interdependencies (inputs/outputs) to the business function
- Human resources – skill level and man hours required to complete the function
- Technology resources – network, application, hardware, software requirements needed to complete the function
- Vital records – forms, documents, reference materials, manuals, etc. required to complete the function

The following Exhibit is a typical example of a business impact analysis:

GENERAL INFORMATION
Business Area:
Division:
Business Unit:
Manager's Name:
Department Address:
Business Function Name:
Function Description:
Interdependent Business Functions (Inputs/Outputs):
How Frequently is Function Performed? (Annually/Quarterly/Monthly/Weekly/Daily/Hourly)
Deadline/Processing Window
BUSINESS IMPACT RANKINGS
o What is the expected revenue loss to the business area if this function were not performed following a

business interruption? For a half day? $ For a day? $ For a week? $ For a month? $
o Estimate what additional costs the business area would incur if this function were not performed following a business interruption? For a half day? $ For a day? $ For a week? $ For a month? $
RANK THE IMPORTANTE OF THE FOLLOWING STATEMENTS ON A SCALE OF 0 TO 9 (9 BEING THE HIGHEST)
o The business are will experience ill will if his function were not performed following a business interruption. For a half day? $ For a day? $ For a week? $ For a month? $
o Customer service would be impact if this function were not performed following a business interruption. For a half day? $ For a day? $ For a week? $ For a month? $
o Legal requirements would not be met if this function were not performed following a business interruption For a half day? $ For a day? $ For a week? $ For a month? $
o Regulatory requirements would not be met if this function were not performed following a business interruption For a half day? $ For a day? $ For a week? $ For a month? $
o Public embarrassment would result if this function were not performed following a business interruption. For a half day? $ For a day? $ For a week? $ For a month? $
CRITERIA FOR DETERMING IF A FUNCTION IS CRITICAL
Revenue Loss Criteria: Critical Function is when the loss per day is larger than $1,000,000 or per week larger than $10,000,000 Necessary Function is when the loss per day is larger than $500,000 (but less than $1,000,000) or per week larger than $5,000,000 (but less than $10,000,000) Optional Function is when the loss per day is larger than $100,000 (but less than $500,000) or per week larger than $1,000,000 (but less than $5,000,000)
Additional Cost Criteria: Critical Function is when the loss per day is larger than $1,000,000 or per week larger than $10,000,000 Necessary Function is when the loss per day is larger than $500,000 (but less than $1,000,000) or per week larger than $5,000,000 (but less than $10,000,000) Optional Function is when the loss per day is larger than $100,000 (but less than $500,000) or per week larger than $1,000,000 (but less than $5,000,000)
QUESTION RATINGS (determined at the beginning of the process by Senior Management)
1. Revenue loss = 9 2. Additional costs = 9 3. Potential to cause ill will = 8 4. Impact on operating efficiency = 5 5. Impact on customer service = 8 6. Legal requirements not met = 7 7. Regulatory requirements not met = 8 8. Public embarrassment would result = 9

Exhibit 4: Business Impact Analysis Template
(Written by Kelley Warner for firm's Business Continuity Plan, 1999)

The results of the BIA allow the business continuity team to develop recovery priorities based on the identification of the firm's critical functions. It also provides an assessment of the impact a failure will have on the business units, quantifies the expected financial impact of the failure, identifies key interdependencies of each function and finally provides a starting point for documenting the business unit's continuity plan requirements. The BIA is perhaps the most important piece of the continuity plan. I would always recommend this to be the starting point for any firm starting from square one when developing a continuity plan and program.

The next step is to design the technology recovery architecture for the business continuity model. What was once solely a tape backup and restore processes has evolved into data mirroring, redundant storage capability and other high availability techniques that create near instantaneous copies of real-time data. Because today's electronic transactions and communications take place so quickly, the amount of work and business lost in an hour far exceeds that of previous decades.

According to a report published by Strategic Research Corporation, the financial impact of a major system outage can be enormous: USD $6.5 million per hour in the case of a brokerage firm, USD $2.6 million per hour for a credit card sales authorization system or even USD $145,000 in ATM fees if a machine is unavailable (IBM 2006). These statistics underscore the need for a continuous operations capability.

Documenting the Continuity Plan

A business continuity plan contains many important components, chief among them the purpose of the plan, scope, objectives, assumptions and the identification of critical resources, materials, personnel and supporting documentation.

The purpose will provide a high level overview of the organization, its business practices, what analysis has been completed prior to the documentation of the plan, the identification of the team members and what the plan itself will relay about all of the planning that has occurred.

It is important early on in the plan documentation to specify the assumptions that have been made regarding the planning that has occurred. It also provides the basis for test scripts that will be developed once the plan documentation is complete.

One important component of business continuity planning that should be included is the organization's emergency response plan. At the outset of an incident, an employee's first thought is going to be concern for themselves as well as the safety of their family. Once that need has been met, then they will think about the recovery of the firm. The emergency response plan dictates the response to and recovery from an incident, which includes not only the evacuation routes from a building, but also rally points, personal safety and communication responsibility from senior management down to individual employees.

The other major components of the continuity plan are the identification of team members and their responsibilities and the identification of the organization's critical business functions and the resources required to support them. Based on the risk assessment, the plan should document the overall strategy to maintain or recover critical business functions, recover equipment or property losses and resume normal operations. Each business unit that completed a business impact analysis should also document the steps which specifically outline the requirements (resources) to reestablish that particular function.

There are a number of vended products that allow an organization to organize the different information and elements into a cohesive continuity plan. I have also found that a word processing document works as well, as long as there is a table of contents. As a continuity manager, I have even planned for the scenario that I am unavailable at the time of an incident and have written the plan assuming that anyone could pick it up, reference the table of contents and flip to the corresponding page to see what steps need to be taken.

Once the plan is documented, it is important to plan for updates because there is a continual need to revise information such as changes in personnel, business functions, software, and hardware.

Testing the Continuity Plan

If a documented plan is not tested, it really is of little value, and all of the risk assessments, business impact analyses, and written documentation will have been in vain. Not only will testing the plan allow an organization to gain buy-in from all business areas, but will prove out the strategies that have been documented as being workable and practical solutions for recovery. Annual exercises also allow an organization to improve their procedures. A good example of this is tracking actual recovery times during an exercise and upgrading recovery solutions to recovery time objectives.

The testing objectives should be defined so expectations are managed from a senior management level to the level of the tester themselves. Test scripts are developed by the business testers and supported by the information technology department. Debriefing meetings are held with the test team to ensure that all aspects of the test are covered. Amenities are secured, such as catering, transportation or accommodations. Detailed test evaluations are completed and findings discussed at the post mortem meeting.

Business Continuity Planning Lifecycle

Business continuity planning is not a one time, static process. Requirements are constantly evolving and changing and organizations need to ensure survivability by adapting their plans and programs and keeping pace with maintenance and testing. If an organization thinks of a cyclical process to their business continuity plan and program, they will always ensure they are up to date.

Continuous Operations

Given the complexity of doing business in today's economy, an organization must have an integrated business continuity program. In order to achieve continuous operations, an organization should acquire a recovery center close enough to its primary location to make it feasible to get to in a declared incident, but far enough away so that it is on a separate power grid from the production site and other utilities are also handled by different carriers.

A clustered solution helps minimize downtime because solutions are already built around planned failures. In today's global economy, organizations are likely to have multiple multi-national offices in addition to its domestic sites; therefore a failure outside of the operating hours of their headquarters is not an option, because it affects the processing capabilities of their employees at their international locations. High availability solutions ensure that the applications that support critical business function processing are always available.

Conclusions

Business continuity is vital to the success of an organization today. It has grown from the responsibility of a technology department to an integrated organization wide initiative, where proven strategies that support and protect the infrastructure, as well as the business processes and vital data, are implemented and tested annually. In some respects, business continuity is also the fiduciary responsibility of a firm to its stakeholders, shareholders or clients because not to do so would result in negligent handling of the beneficiary's interests (SEC 2003).

Since organizations are increasingly dependent upon computer supported information processing and telecommunications to perform its mission critical functions, this paper has presented a strategy for achieving continuous operations capability by proactively assessing threats, preparing risk avoidance techniques, documenting continuity plans and testing them to ensure workability. The high availability technological solution employed is critical for an organization that needs to operate in a business as usual scenario with no substantial impacts to performance, production or reputation, thus employing a continuous operations capability will allow businesses not only to process in the event of a real disaster, but also to retain a competitive edge in today's economy.

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Integrated Risk Management Process

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Abstract

What if the Project Manager does not get involved in a project until the contract is signed? Does this mean that your risk process begins too late? The answer for a GE Energy business organization was yes to both questions, and its need to become pro-active on risk management led them to use the Six Sigma methodology in order to satisfy their business objectives. The probability of occurrence, and the severity of the risk impact can be identified up front by calculating the RPN (risk priority number). Through a set business criteria, only the high or medium RPN numbers require mitigation plans. But since the RPN is not a static number and can change during the project's life. Consequentially, risks that may occur as a result of changes are recorded as new risks and given their own RPN number for tracking purposes.The Business requires establishing performance measurements to monitor the risks from the bid stage through to the contract hand-off meeting, customer kick-off meeting, multiple project reviews, management reviews up to the project closure, and Project Management Center of Excellence (PM CoE) internal process assessments. Risk reviews are considered an agenda item in all these meetings. Ensuring all risks recorded are not lost once the project is closed, post mortems are conducted. The risks are incorporated within the project's lessons learned and they are consolidated in the risk library. This same library is used in the inquiry phase for future bids, closing the loop and making the risk management process virtually flawless.

Introduction

The overall purpose of risk management is to identify, analyze, respond, and control risks and opportunities throughout the life of a project. Risk management identifies the risk events, assessing their impact to the project, determining the best way to deal with them, developing and executing a plan to respond to them, and monitoring progress. Most importantly, risk is a team function.

Some of the characteristics for effective Risk Management are:

- The process starts early within the project life cycle
- The process is continuous throughout the life of a project - Risk Management is iterative and as the steps are performed from planning through to closure they should be continuous
- All process steps are present and adhered to by the project team

Well-established feedback comes in terms of cost, schedule, and technical or risk-related performance. Expanding on this thought, some items to think about when identifying risk in a project are:

- Commercial Responsibility & Liability (i.e. unclear scope; force majeure)
- Financial (i.e. payments; bonds)
- Political (i.e. location stability; environmental working conditions)
- Schedule (i.e. scope creep)

- Resources (i.e. specific skills; availability)
- Technical & Technological (i.e. Quality Assurance regulations)
- Warranty (i.e. nonstandard / project specific warranty)

The organization defines risk as an unplanned event that can have a positive or negative influence on the project's success. Once risks are identified during the planning stage, a major duty of an effective Project Manager is in performance project tracking since one main reason for tracking projects is to discover potential problems before they occur. This paper will cover a GE Energy business organization's Risk Management Best Practice. This business organization defined risks primarily as negative issues that impact the project's success.

The Business need for one integrated risk process
The business' management team was being introduced to project risks in the monthly project reviews. During these reviews, they found themselves spending a majority of their time being reactive and not enough time looking into forecasting unforeseen project risks. For the most part, the Project Managers were identifying major risk issues in their projects only prior to these project reviews with management. At that point, the identified risk was already costing time, resources and money, and mitigation plans were primarily used to minimize the impact and advise management. Signs of pro-actively identifying and setting up mitigation plans for risks prior to their occurrence were performed in an ad-hoc fashion.

Yet the business believes that its employees are responsible to maintain the profitability of the organization and deliver shareholder value, and a key way of accomplishing this objective is by minimizing the inherent risk of doing business. Therefore the risk management process became a focal point for improvement with the main focus geared toward simplification - having one integrated risk process.

Use Six Sigma methodologies to develop the process
This business promotes the six-sigma methodology, a statistical method used to identify the distribution about the mean of any process. Within this methodology, DMAIC (DMAIC stands for Define, Measure, Analyze, Improve and Control) is a standard approach that is used to improve existing Products / Services / Processes. Thus DMAIC was used as the Standard improvement approach to assess the current situation and establish an improvement plan. The first step in this method is defining the Critical to Quality (CTQs) requirements from the business.

Establishing the Critical to Quality (CTQ) deliverables
The Business' management team sponsored the initiative on improving its existing Risk Management process. They wanted to focus on early risk detection and better understand their project portfolio in order to give them the proactive edge to plan. Its main CTQs was to focus on:
1. One short-term goal which entailed decreasing the liquidated damages;
2. Yield customer satisfaction as an external focus which is primarily measured through On-time delivery;
3. Decrease the CoQ (cost of quality) and thus increasing profitability as an internal focus.

Now that the six-sigma team had the sponsor's CTQs, the next step was to identify the existing process and tool(s).

Feasibility on the existing process and tool
The existing process entailed the Project Manager identifying the risks in preparation for the project review and highlighting it to business through the management reviews (refer to Figure A for a flow chart of the process). This constitutes late identification of risks in the project life cycle. Thus a fishbone or cause-and-effect analysis was used to find the root causes that effected poor risk identification and late mitigation plans.

The outcome of the analysis yielded the following key causes affecting the CTQs:

- Unclear rules on the existing risk method used;
- Missing quantification & qualification fields in the tool, lack of consolidation of risks;
- No risk evolution or tracking the risk;
- Limited prioritization of projects.

Following this measurement technique, a gap analysis identified the common factors that constrained the business organization from a successful performance. This meant there was a necessity to redesign the process.

Baselining the Process Capability Analysis
Now that the current CTQs and existing processes are clearly defined and measured, the next step is to analyze the data and baseline business organization within their current situation. This phase entails estimating the long-term process capability and benchmarking the key product performance metrics.

The performance standard showed 582 risk opportunities were identified across all projects with a calculated long-term sigma value of 2.85 and a defect per million opportunities (DPMO) of 560,137. This meant that for every million-sample size, 560,137 defects would occur. Thus in order to increase the Business' sigma value, it was important to decrease the DPMO.

Target Improvement ITR Process
The target set by business organization to the six-sigma team was 90% reduction of DPMO. This aggressive target was placed in order to achieve a greater impact over the operational goals of decreasing cost of quality, increasing profitability, and improving customer satisfaction. This also meant that the business require a behavioral change when implementing the process modifications. The challenge was to find the right balance of implementation, which would introduce change but limit the impact on people's day-to-day operations.

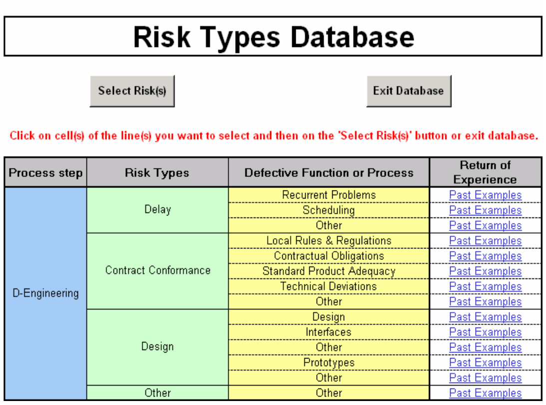
Integrated Inquiry to Remittance (ITR) Risk Management Strategy & Process

The first change in the current risk process was the need to identify as far up front in the projects life cycle as possible. Therefore as soon as an inquiry to bid made its way into the company, the risk process needed to be initiated. Early risk identification was set up in each of the two groups of the business. At the *Inquiry to Order* (ITO), the risks were established through a tollgate process. The Hand-Off meeting criteria included the ITO risks passed onto the *Order to Remittance* (OTR). Then in OTR, the internal project kick-off meeting took the ITO risks and built them into a risk breakdown structure that the Project Manager would own for the remainder of the project's life.

Starting risk identification in the Inquiry to Order (ITO) phase
Project conception in the business organization begins at ITO. The first risk analysis is conducted as soon as the inquiry to bid comes into the business by asking the question "Do we bid on this project?" This question is answered depending on business and technical requirement.

Once it is decided to bid, then it is up to the Proposal Manager to conduct a project risk analysis using past project information and experts. The technical and commercial risks that have been identified, qualified and quantified are done so through using the following specifics: the contract analysis, the manufacturing risks identified by Global Supply Chain Group and finally the other risks that have been identified by the Proposal Manager from previous projects.

Inquiry to Order (ITO) to Order to Remittance (OTR) Hand-Off Meeting
Risk management is defined in the business organization as actively predicting problems that might negatively impact the project objectives and managing the problems that already occurred. Thus risk analysis becomes an integral part not only to project management but also to the business' operational methodology.


Risk Types Database

Select Risk(s) Exit Database

Click on cell(s) of the line(s) you want to select and then on the 'Select Risk(s)' button or exit database.

Process step	Risk Types	Defective Function or Process	Return of Experience
D-Engineering	Delay	Recurrent Problems	Past Examples
		Scheduling	Past Examples
		Other	Past Examples
	Contract Conformance	Local Rules & Regulations	Past Examples
		Contractual Obligations	Past Examples
		Standard Product Adequacy	Past Examples
		Technical Deviations	Past Examples
		Other	Past Examples
	Design	Design	Past Examples
		Interfaces	Past Examples
		Other	Past Examples
		Prototypes	Past Examples
		Other	Past Examples
	Other	Other	Past Examples

In the OTR phase, also known as the execution phase, the Project Manager becomes the Risk Analysis Owner and is responsible for the project risk analysis information for the remained life of the project once the Proposal Manager conducts the hand off meeting where the ITO passes on the risk information for the project to the OTR group. Next the OTR Risk Process rhythm is established.

Establish the OTR Risk Process rhythm
A risk analysis is conducted for all projects in the Risk Review Meeting, which is part of the internal project team, kick-off meeting and held prior to the Customer kick-off meeting (CKOM). At this kick-off meeting, the Project Manager and team have received from ITO the project risks and are now responsible to complete the risk identification assessment in the planning phase. The risks identified are categorized using a decision-tree approach establishing the RBS - risk breakdown structure (refer to Figure to the left).

This RBS forms three risk packages, which are:

1. *Process tasks* – a list of the specific business' process sections (e.g. Engineering, procurement, manufacturer, etc);
2. *Risk types* – a list of the different kinds of risks that can occur in a project (e.g. Liquidated Damages, Delay, Supplier, etc.);
3. *Defective function or process* – a list of specific process activities that can go wrong.

When the Project Manager lists the risks in the *Risk Analysis Application*, he or she tags these risks with the RBS. If the Project Manager feels that there is a risk that does not fall in the RBS, it is his or her responsible to record the new risk. Every month, the application owner consolidates all the risks. If a new risk appears in more than one project, it gets incorporated within the RBS template structure for future projects.

Flawless ITR Risk process – tying it all together

Since Project Managers may not be involved at the front end of the project life cycle, it is important to ensure that the information transfer from the Proposal Manager to the Project Manager is seamless. A key behavioral way is to have everyone think of risk management the same way. Thus the answer becomes apparent and simple – Communicate.

One vehicle of communication used is in the process through hand off meetings and the other is the *Risk Analysis Application* tool. Since the ITO and OTR groups have their respective tools and are not the same, it is therefore important to incorporate a specific way of identifying, qualifying, quantifying, and mitigating risks by a set procedure. This ensures that the risk information transferred requires little interpretation for the Project Manager when integrated it in their *Risk Analysis Application*.

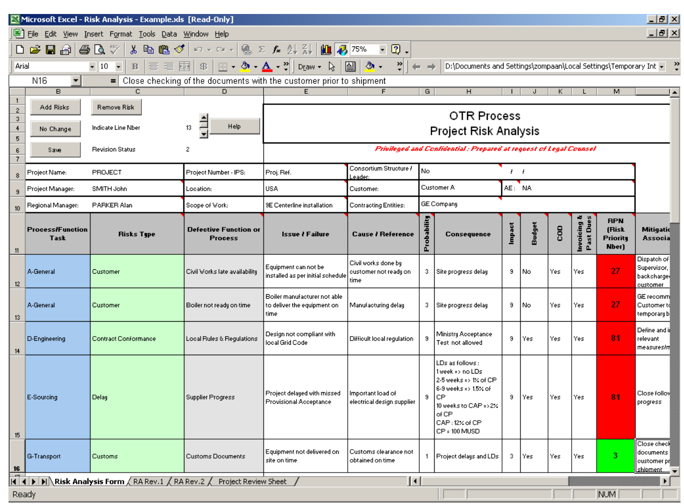
Establish a centralized identification & tracking tool

Having laid out the process and the communication flow between ITO and OTR groups, to tie it all together is to create a flawless process flow. Hence a single directory for capturing all project risks is used throughout the project's life cycle. The ITO group uses a tool called eRisk that captures detailed commercial transactional information, performance engineering, environmental & health safety, technical product knowledge, and financial management.

This eRisk Application yields the risk data that is then given to the Project Manager for him/her to effectively integrate along with new identifiable risks in the *Risk Analysis Application*. This *Risk Analysis Application* is an Excel based application leveraging a six-sigma's tool called FMEA (Failure Mode and Effects Analysis). This *Application* also creates a consolidated risk report (with multiple filters and options to extract different views of the reports) helping the Regional Managers conduct detailed analysis and a global overview of their risks portfolio.

Customize the FMEA tool into the Risk Tool

When choosing a tool, the business organization wanted to keep it simple and incorporate a six-sigma technique that was already used by their employees. FMEA as part of the six-sigma toolkit is used to identify ways a sub-process or product characteristics can fail and plan to prevent failure.



This technique identifies the potential failure modes, detectability of the failures, and rates the severity of their effect. It evaluates objectively the probability of occurrence of causes and the ability to detect the cause when it occurs and rank orders potential product and process deficiencies in order to focus on eliminating product and process concerns and help prevent problems from occurring. For the risk tool, the FMEA is used to record, prioritize and track all risks.

Note that the risk tool does not use the detectability column of the FMEA but only the probability and impact. This method is definitely more statistically driven than other approaches, i.e. the Contour Method, [7] which is a less statistically driven as a technique but can effectively prioritize risks by calculating the amount at stake and probability of risk occurrence.

Calculate the Risk Priority Number (RPN) criteria

The business organization considers all project risks to be permanent throughout the active life of the project. Therefore the probability of occurrence and the severity of the risk impact can be identified up front by calculating the RPN (risk priority number).

Qualifying the risk in this business is achieved by calculating the RPN rating. RPN is calculated by multiplying the project probability and impact. The probability is estimating the chance that the risk will actually occur while the impact is estimating the weight this risk will have on the project if it were to occur. To ensure that all Project Managers within the business will uniformly assign the probability and impact similarly, there is a business guideline dictated in the application. The classification rules followed when numbering the probability and impact are shown in Tables 1 & 2.

Note that the RPN is not a static number and can change during the project's life, so can the risks that were initially identified as low can climb to high or visa versa. Even though all risks are identified and monitored in the *Risk Analysis Application*, only the risks deemed high or medium from the RPN (risk priority number) incorporate a mitigation plan.

Table 1: Probability classification Rule

Probability	Description	Rating
High	Experience says likely or expected	9
Medium	Likely to occur, but not certain	3
Low	Not very likely or unlikely	1

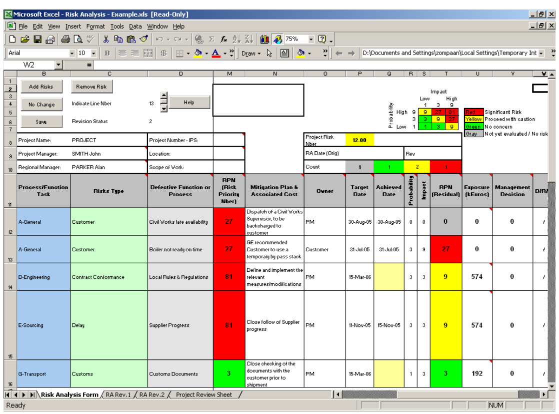
Table 2: Impact classification Rule

Impact	Description	Rat-ing
	Budget Impact	
Severe	> 1% of contract price	9
Medium	10K EURO > x > 1% of contract price	3
Low	10K EURO	1
	Scheduling Impact	
Severe	> 1 week delay	9
Medium	1 day > x > 1 week delay	3
Low	1 day	1
	Cash Impact (invoicing)	
Severe	> 5 (% contract price x weeks of delay)	9
Medium	No medium impact	3
Low	< 5 (% contract price x weeks of delay)	1

Establishing the Mitigation Plans

It is a known fact that a project rarely executes flawlessly like its original plan. Things will undoubtedly go not exactly as anticipated so the best way to prepare during the planning phase is to incorporate contingencies for the identified risks and the unforeseen risks. Furthermore, the plan includes triggers that alert you that the event may be occurring to the project. In business organization's case, the triggers are incorporated within the *Application*.

For example, they had a series of projects in China that continued having recurring risks, which were never found to be a risk within the European sector. The *Application* was set up that as soon as a project was classified as China, standard risks were automatically assigned in the *Project Risk Analysis* Table.



A known fact is that the Project Manager needs to articulate the project issues, bring the right people together to solve the problems and know when the problem has been properly addressed and closed.

Furthermore, the Project Manager needs to understand the proper sense of urgency and communicate it effectively throughout the project team and organization. Therefore the Project Manager uses the *Project Risk Analysis* to establish and monitor the mitigation plans. The rule of thumb is that a mitigation plan is to be prepared and implemented for all risks that have an RPN (probability x impact) > 27.

Next the high and medium RPN risks may have an exposure (Euro amount) that tells management what the risk would translate into financials. Usually the exposure amount is the expected costs that would be absorbed if this risk were to materialize. This amount may include liquidated damage assumptions, additional engineering costs, additional site costs, etc. Management decides whether a management reserve is assigned to the risk and updates their portfolio reserve in order to cover this amount. Refer to the Figure which displays a sample of the *Risk Analysis Application* that includes the RPN criteria.

Risk Management Performance Measurements

The risk metrics, which are put in place, are reviewed at two levels – Project and Management. At the project level, the Project Manager reviews the project with the team and the Regional Manager looking at all the project risks. It is the project manager's responsibility to keep the risk analysis application updated and monitor along with his/her team the mitigation plans in order to reduce the risks and ultimately avoiding them from materializing.

The Management level requires viewing all projects' risks at a portfolio level by the Regional Managers and the General Manager. Thus the *Risk Analysis Application* automatically collects all projects' risks across projects and creates a *Risk Management Scorecard* that identifies the top risks impacting the business. Top risks are identified by RPN number and show no reduction in RPN number due to the in-place mitigation plan. In some instances, high risks that were mitigated down to medium risks but initially showed high adverse consequences (i.e. contract cancellation) are also reviewed. In these instances, management may be required for action as part of the mitigation plan. Refer to section 4.4 for a mock up of the *Risk Management Scorecard.*

Setting the Contingency Reserves – Project and Management

Within this business there are two types of contingency reserves that are established. The first is at the project level and it is called the Project reserve. During the ITO phase, there may be a number of risks identified that may impact during execution of the project. These risks get quantified and an amount is added to cover the possibility of their occurrence within the budget. The Project Manager is responsible for managing this contingency.

The second is at the Business level and it is called the Management reserve. During the ITO phase, for new product projects or complex turnkey projects, management may consider building in a contingency for the unforeseen risks that may occur. The Regional Manager controls this contingency. Thus all reserves are finalized during the ITO phase.

Customer Kick-Off Meeting

The main reason for holding a Risk Review prior to the Customer Kick-Off meeting is to give the project team the possibility to identify project risks and prepare action plans for mitigation. At the Kick-Off meeting, the Project Manager and team discuss the project plan along with the potential project risks with the Customer. One key item reviewed in this meeting is the scope clarification and all assumptions / constraints identified by the ITO group. Any additional assumption and/or constraint may be recorded at this time. The meeting's output produces official minutes to all attendees as well as additional risk identification and mitigated action plans for the *Risk Analysis Application*. The goal of this meeting is to build a customer relationship and enhance project success.

The Project Manager shall update the *Risk Analysis Application* immediately after the CKOM in order to incorporate the latest information. The Regional Manager must then review the *Risk Analysis Application* at the first Management Risk Review for consensus and final approval.

Project Reviews - The Project level monitoring & controls

The Project Manager organizes project reviews that are held at least on a monthly basis and in many cases replace one of the Project Manager's team meetings. These reviews are not always formal, but do bring all project stakeholders together to review the status and progress of the project. All risks are reviewed, and any new risks are recorded. Existing and new risks are updated with RPN ratings and/or mitigation plans.

During project execution, when a risk materializes, it falls in one of the following main categories:

- External Change Orders: Is the additional work that the customer agrees to pay. For example, a site mobilization date change due to late construction from the customer. To keep to schedule additional site resources are required and the customer pays for these resources.
- Cost Overruns: Are internal problems that cause additional work to be performed in order to satisfy the

contract. For example, to absorb the costs for airfreight versus using ground transportation to get the items into site to keep to the contractual schedule. These costs can also encompass cost of quality when dealing with product quality (i.e. rework and scrap).

- Disputable Claims: Are additional works that require to be done to rectify the problem but may not be agreed upon with the Customer. For example, the site required to install additional safety devices that the Customer agreed to have but refused to pay for.

Project Portfolio Management Reviews
The *Risk Analysis Application* automatically consolidates all project risks and generates a *Risk Management Scorecard*. The review of the consolidated report by the Regional Managers and of the scorecard by the Management team is to be done monthly. The aim is to have an overview of all the risks and to focus on the most critical issues and the relevant mitigation plans.

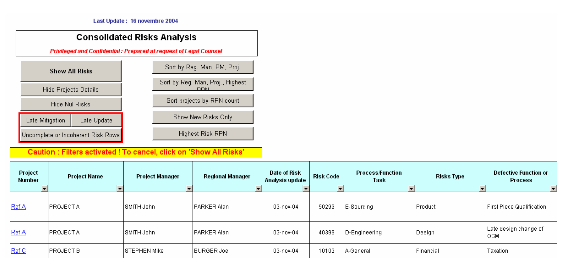
The dashboard includes the following metrics:

- Total active projects and total recorded risks for the business;
- Breaks down the RPN values to show what the % high / medium/ low RPN numbers;
- Lists the top 10 projects that have the highest RPN numbers and the Exposure associated with the risks;
- Records the last updates done by the Project Managers and any missing information detected.

The business organization also conducts systematically "Blank Reviews" in order to verify if there are other projects with possible rising risks that are soon to make the Top 10. This blank review is held by the Regional Managers prior to the portfolio management review with the General Manager.

Project Post Mortem Reviews
During the closing meeting, the Project Manager reviews the end of the project life cycle and its final status. In this meeting, one section is dedicated to risk management where all the risks that were identified are reviewed. A project trend is used to show how well the risks were mitigated in this given project. Whenever a risk was deemed no longer applicable, it was identified by the Project Manager and set within the *Risk Analysis Application* with a zero probability and impact. The *Application* does not permit the risk to be removed in order to retain a clear picture of the risk trend as well as a record for future projects. Presently, The business organization is upgrading the process and *Application* so that it is able to identify, using the RPN number, the risks that have occurred and improve on the capturing of lessons learned.

Incorporating Lessons Learned to update the Risk Library
All new risks that may be identified are captured in a consolidated file, called the *Risk Library*. A snapshot of this library is below. A strong point of the tool is that it does not require any effort to consolidate the information. Thus the responsibility of the risk application owner is to maintain this *Risk Library* with new RBS.



Last Update : 16 novembre 2004

Consolidated Risks Analysis

Privileged and Confidential : Prepared at request of Legal Counsel

Show All Risks | Hide Projects Details | Hide Nul Risks | Late Mitigation | Late Update | Uncomplete or Incoherent Risk Rows

Sort by Reg. Man, PM, Proj. | Sort by Reg. Man, Proj., Highest RPN | Sort projects by RPN count | Show New Risks Only | Highest Risk RPN

Caution : Filters activated ! To cancel, click on 'Show All Risks'

Project Number	Project Name	Project Manager	Regional Manager	Date of Risk Analysis update	Risk Code	Process/Function Task	Risks Type	Defective Function or Process
Ref A	PROJECT A	SMITH John	PARKER Alan	03-nov-04	50299	E-Sourcing	Product	First Piece Qualification
Ref A	PROJECT A	SMITH John	PARKER Alan	03-nov-04	40399	D-Engineering	Design	Late design change of OSM
Ref C	PROJECT B	STEPHEN Mike	BURGER Joe	03-nov-04	10102	A-General	Financial	Taxation

The new RBS incorporated in the *Risk Type Database* then upgrades the *Past Examples* repository that is used as an aid in future projects. The consolidated file is used in the management reviews as well as the project-closing meeting as a centralized repository of risk information. For continuous improvement, the business organization also uses the information to spot reoccurring defects and apply six-sigma methods to remove the defects.

Closing the loop between OTR and ITR

As described above, to ensure all risks recorded are not lost once the project is closed, post mortems are conducted. In order for OTR to close the loop with ITO, all commercial risks are communicated to the ITO team through a workflow process.

All technical risks are recorded as part of the Engineering's lessons learned process. Both methods are digitized applications used during the closing meeting in order to have the teams instill corrective and preventive actions for future projects. For the Projects OTR team, all identified risks are consolidated in the *Risk Library*, which is used in the inquiry phase for future bids, closing the loop and making the risk management process flawless.

Conclusions

As a result, this six-sigma project was a success, and when the process capability was measured with the improvements, the team reached a long-term sigma value of 4.92 and a DPMO of 23,382 yielding a 95% reduction in DPMO. Bi-yearly, the six-sigma project is reviewed to ensure the controls are still in place. Furthermore, a cross-business initiative, the Project Management Center of Excellence (PM CoE) team conducts yearly assessments to ascertain the business' project processes remain in control.

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