

# RISK AND OPPORTUNITY MANAGEMENT IN PROJECTS

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## ABSTRACT

Risk analysis and risk management in project management field is often considered as a separate planning and response function. Its principle thrust is to minimize cost and schedule effects due to risky factors. This paper advocates a project management approach, which is based on business strategy. As a key element to this philosophy this paper aims at bringing out the concept of utilizing a life cycle project management approach for risk management. Risk and opportunity management is a way of approaching business and should cover the entire gamut of project activities. In this context it would be beneficial to club risks, uncertainty and opportunity management as a single management exercise. Focusing on key business objectives in light of risks and rewards is a significant aspect to be looked into while formulating project management philosophy. Risk evaluation should not be limited to schedule and cost factors but should be extended to development and operation of a long term business entity capable of realizing the business goals of the stake holders without diluting community expectations. This may require better knowledge management.

**Keywords:** Risk Management, Project Management, Construction Management, Life Cycle

## 1. INTRODUCTION

Risk in Project Management has the dimensions of Impact, or exposure to loss/gain, and the Probability of occurrence (PMBOK, 2005). The product of these two numbers, measured on a scale of 0.0 to 1.0, is referred to as the Risk Index (PMBOK, 2005). Events are said to be certain if the probability of their occurrence is 100% or totally uncertain if the probability of occurrence is 0%.

In a project scenario, we can define one or a number of objective functions to represent the project under consideration and then measure the likelihood and probability of achieving certain target values for them. A few examples of objective functions are capital expenditure, completion time and so on. Risk management involves modeling the project's objective functions against project variables, such as cost, quantities of input resources, external factors, etc. Since the project variables are often stochastic in nature and dynamic (i.e. exhibiting varying degrees of uncertainty over time) it is only to be expected that the objective functions will also exhibit

uncertainty. Project uncertainty can then be considered to be the probability that the objective function will not reach their planned target value.

As project variables cannot be expected to remain unchanged in their behavior during the course of a project, it is not possible to estimate the risks associated with these variances. Also it is not possible to identify all of the variables at the outset of the project. Many things unique to each project emerge as the project progresses, and this will compound the difficulty of Risk Management.

The problem is that usually there is no single measure to represent project uncertainty. However, one approach is to identify a theme key to the project. For example in a tight scheduled project where stakes on the schedule are very high, the possibility that the project will not come on time could be considered as representative of the entire project uncertainty. Against this all the project variables can then be evaluated for forming the basis of risk analysis throughout the project. This is however not very successful in complex projects where the traditional theory that uncertainty is high during conceptualization stage and typically gets reduced by planning and decision making does not hold good. In such projects, uncertainties crop up in a dynamic fashion, and do not pursue any specific pattern. As such risk management has to be very flexible continuously monitoring the project variables with a view to constantly re-evaluate objective functions and readjust the strategies.

Projects are usually subject to uncertainties due to three principal sources: external factors, shifting business objectives and poorly defined methods for project planning and execution. The latter is not only due to poor knowledge and experience of the project team but also due to project complexity and absence of repetition (most projects are unique undertakings). Examples of external factors include commercial and competitive pressures, collision of social, political and institutional norms and rules with project financial and technical goals, shifting requirements of project stakeholders etc. Developing a knowledge management (KM) system to harvest lessons learned and their contexts through learning histories (Eppler and Sukowski, 2000) would be a vital part of improving access to knowledge of risks and more importantly, their likely causes and impacts. Knowledge about stakeholders and their power to kill or maim projects has been addressed through using visualization tools see for example Bourne and Walker (2005b; 2005a).

Early resolution of project variables is not often possible as the basic information needed to make decisions is not available or it is fuzzy and changes with time. Even when the status of a project variable has been determined it could change over time. This then creates unknown exposure to risks. New risks can be encountered during the currency of the project and seemingly unimportant risks could pose new threats. The combined effects are often so complex that many issues cannot be forecast clearly early on in the life of a project, despite the magnitude of planning and evaluation efforts typically spent on most projects. Uncertainty surrounds many aspects of the project or its parts. Against this background of complexity and uncertainty the challenge is to pursue project objectives earnestly and to look for opportunities to further improve the project's base value.

Thus, project conceptualisation, planning and implementation is a complex, dynamic and evolving process. It should be managed on the basis of a set of strategic

objectives, which themselves would be subject to change (in response to the project's shifting environment), on a fully fluid and flexible basis. Further, a holistic and integrative framework is needed in which not only planning and proactive management of technical and financial factors receive attention but equally the social, environmental, political and community aspects are placed at the centre of decision making. The objectives chosen should embrace the project's viability in its broadest sense, over its entire life, and should facilitate management of the process using a continuous risk and uncertainty reduction within a fluid and flexible management framework. Flexibility is very much tied in with a project leader's sense of security and openness to new ideas to ensure that cross-cultural diversity of teams opens up potential dialogue and knowledge sharing within teams (Walker and Shen, 2002).

## **2. FRAMEWORK**

A framework for conceptualization and implementation of complex projects following a strategy-based decision making philosophy can be developed. It will be argued that risk and uncertainty management should not be seen as a discrete set of activities taking place at the time of conceptualization. Rather, risk and uncertainty management permeates all decisions and should form a component of all evaluations and decisions made during the currency of the project. In particular, management of risks and uncertainties should be a continuous real time operation integrated with other project management operations. This is vital for facilitating the realization of the strategic objectives underlying the project. Properly constituted, risk management processes can provide functional, adaptable, suitable and timely (FAST) knowledge from risk management processes—Cavaleri and Seivert (2005) refer to this as Pragmatic Knowledge. Creating an environment where continuous questioning takes place, reflective experimentation and analysis of causal loops lies at the heart of KM and reduces what is sometimes termed as the 'stickiness' of knowledge transfer (Szulanski, 1996). Linking risk management to KM develops the requisite culture.

### **Project Management and Risk Management**

According to the Project Management Body of Knowledge, risk management forms one of the so called nine functions of project management (the other eight being integration, communications, human resources, time, cost, scope, quality and procurement management). The traditional concept is that these functions should form the basis of planning and that each should be the focus of attention in each phase of the project. This approach is fundamentally flawed due to the following reasons:

- It is a disjointed approach as project decisions are evaluated against individual functions using their respective plans.
- It is neither proactive, nor dynamic, as it follows a stepwise (plan-implement-monitor) and somewhat linear approach.
- It focuses on the implementation process and activities, whereas most risks and uncertainties are associated with the project outcome and its viability as a business entity. On many projects risks and uncertainties are particularly high during the pre-implementation stage.

### **Formulation of Strategic Objectives**

Different prospects and strategic business considerations motivate project promoters, including securing a presence in a particular market, entering global competition and

maintaining technological supremacy. However, more often than not, the overriding motivator will be the prospect of achieving a target EIRR (Equity Internal Rate of Return). Generally speaking, the promoter's interest on a project can be classified as one or a combination of the following:

- Limiting up-front expenditure on a project prospect (minimizing risk money), while protecting any resultant rights.
- Achieving a target EIRR.
- Limiting or transferring to other parties' risks and liabilities. Risks arise from the likely impacts the proposed project may have on the host community, the surrounding environment, users and other stakeholders. (Risk management will only be plausible when the probability of occurrence and magnitude of impacts can be estimated with a reasonable degree of accuracy.)
- Putting in place a proactive system to reduce project uncertainty continuously.
- Building up a desired corporate profile.

Sometimes, promoters are not investors, and the investors' interests may be different in the sense that many institutional and individual investors are not active participants in the management of the process. Their interests are investment, and receiving dividends and capital gain. Put differently, promoters' objectives are to create a long-term financially viable and balanced business entity of which the project completion is only one part. The ultimate project is a compromise between the promoters' interest and the interests of the community at large. If the objectives are to create a viable business entity then the processes of development and decision-making must also be proactively and deliberately directed to achieving the same.

As seen from the above review, the basis for project development and implementation should be a set of strategic objectives reflecting the worth of the project as a business, and then tying in the project decisions to strategic business decisions. These are referred to as Life Cycle Objective Functions (LCOF's), and classified into the following classes:

- Financial, i.e., those, which relate to the financial state of the project, such as project net worth, EIRR, total life cycle cost, cost/worth ratio and similar functions.
- Customer satisfaction, i.e., those affecting project utility, operability, quality and safety aspects.
- Due diligence, concerns management of statutory, societal, and environmental issues, particularly if the project is located in populated areas or adjacent to sensitive ecological systems.

The aim is to plan the project proactively vis-à-vis its variables, and manage it optimally in respect of its LCOF's. An aspect of this involves real time minimization of project uncertainty. The goal is ensure that projects get conceptualized and implemented based on a set of strategic objectives.

### **Typical Risk Variables**

On large projects the following risk variables are typically encountered: *promotion, market, political, technical, financing, environmental, cost estimate, schedule, operating, organizational, integration and force majeure risks*. In particular, the thrust of management effort tends to be on the individual risk variables and provision of legal protection, should risk variables materialize.

### **Risk Management Philosophy and Framework**

In a conventional project management scenario, Risk Management is considered as a separate activity wherein the managers are alerted to the risks and uncertainties. Very little attention is paid towards quantification of the risks. Simply enumerating a few Risk factors with qualitative categorization as high risk, low risk etc. is not the best way and at times can lead to totally erroneous conclusions. Also, documentation of risk assessment should have cause-and-effect linkages clearly spelled out. This latter point is often overlooked or poorly understood.

The reality is that projects are subject to the shifting forces and constant changes due to the external factors, changing objectives and poor methods for project realization. One important aspect of achieving project success is maintaining a the project vision that aligns with the strategic project objectives (Christensen and Walker, 2004). The vision should be easily understood, inspirational, credible and provide stretch goals to prompt smarter risk management practices (Lynn and Akgün, 2001). So the process of risk and uncertainty management must be continuous, holistic and conducted in real time to be of any value to project managers. This leads us to consider an entirely new approach to risk analysis and management, based on the following general principles:

- Project risk assessment must not be based on a collection of individual assessment of project risk variables, but be based on assessing the likelihood of achieving project's strategic objectives.
- Risk analysis must not be viewed as a stand alone activity; any strategies developed must not be seen as cast in stone commandments. Rather, these should be seen as a component of all decisions made continually to respond to project dynamics.
- Because of the poor understanding of business objectives, scope, method of execution and as well as the shifting influence of the project risk factors on complex projects the project uncertainty tends to be initially high, and difficult to evaluate.
- Even with the best planning and evaluation efforts it will not be possible to gather all the relevant information quickly and craft a viable project, doing so will run the risk of achieving sub-optimal results. As such, the project options should remain open so that uncertainties surrounding the project variables can be resolved optimally at appropriate junctures to minimize their impacts on project objectives.
- Efforts should be made to capture experience not just as a set of bullet points of lessons learned but making explicit likely cause-and-effect impacts.
- Life cycle objective functions must be formulated as the vehicle for analysis and management of risks. The use of LCOF's permits a holistic analysis of the project risks and within a life cycle framework.

Project options should be kept open and flexible throughout, the concept, planning and implementation stages. Risk mitigation strategies to counter the adverse impacts of known events should be developed. This presupposes that there will be a process whereby knowledge of exposure to such events exists. No amount of technological advance can predict with exactitude as to what lies ahead. The real challenge lies on exposure to unknown events. The Risk Management Philosophy must be able to

quickly reevaluate the project options against the unpredicted developments and come out with a re-structuring of the options to adapt to the project objectives.

Occasionally, it is seen that a sub-optimal decision wrongly taken (due to poor reading of the situation) multiplies its effects and forces the project management to take a series of sub-optimal decisions to support the initial sub-optimal decision. This could lead to a vicious circle. Also, at times personal ego and focus of a manager to maintain his/her power position at any cost could lead to questionable decisions being taken, and to intransigence. Lack of access to past experience and the context might also exacerbate problems associated with poor risk management.

Such departure from rationality in decision making is a risk that can not be mitigated easily. Strategy based and goal focused approach is the most effective way to counter such irrationality.

Some of the key factors leading to successful project management are (a) recognizing complexities and proactively managing them (b) Strategy based reason decision making (c) Integration of external variables (d) Integration of project phases.

However, it is seen in most cases that project managers (including the successful ones) tend to exercise these factors rather intuitively rather than on any scientific model. Each project manager based on his/her experiences makes up his or her own mental model or project challenges and risks. This model becomes the basis of formulation of project plans, strategies and decision making processes. The whole process is a sort of trial and error effort with the project manager trying to gauge what will work. Success of projects is largely person centric depending on the knowledge, experience and forward thinking capacity of the project manager.

Yet another aspect noted in some project scenarios is that the real decision makers (often called project directors) are different from the project managers who are relegated to the level of mere day to day coordinators and project report generators. The project manager should be put back to don the role of strategy formulator and should make decisions synchronous with the overall objectives.

### **Life Cycle Project Management**

Life cycle project management (LCPM) as a concept acknowledges the above success factors as the basis of project management. This approach attempts to formulated life cycle objective functions to form the basis of evaluation and decision making at all stages of the project.

### **Life Cycle Project Risk Management**

A system for successful life cycle project management will thus have risk and uncertainty management at its core. Risk assessment will be the real time evaluation of the probability at which LCOF's will fall short of their target values. A high value indicates a high project failure risk.

Some key features of the concept are:

- All project procurement strategies and sales and marketing efforts on strategic deals are based on the LCOF's and sharing of risks and rewards on these.

- All project decisions are based on all project life cycle information (including both downstream requirements and business objectives). Such information will be generated, integrated, shared and accessed by teams throughout project life cycle. There is a focus on knowledge through action and with reflection this can provide valuable feedback for improved risk assessment in future.
- The LCPM approach employs concurrency as well as pooling of the expertise of project participants within an integrated organization and establishment of a shared design space as well as a facility to integrate and evaluate inputs in real time. Pragmatic knowledge sharing becomes easier to share and there is better opportunity to explore reasons why things happened the way they appear.
- The LCPM approach attempts to integrate decisions on soft variables with decisions on the core technical and financial objectives so that a holistic approach to the management of the project is promoted.
- The evaluation of all project variables and associated uncertainties are based on LCOF's, at any given juncture, so project completion, cost estimate and other implementation risks will be considered as intermediary risks and evaluated only for communication purposes or for meeting intermediary objectives.

Risk Dimensions	Financial			Satisfaction			Sustainability			Sum
	P	I	P x I	P	I	P x I	P	I	P x I	P x I
<b>Due Diligence</b>										
Environmental Issues	0.2	0.4	0.08	0.8	0.8	0.64	0.8	0.8	0.64	1.36
Social Issues	0.2	0.4	0.08	0.8	0.8	0.64	0.8	0.8	0.64	1.36
Legal Issues	0.2	0.4	0.08	0.8	0.8	0.64	0.8	0.8	0.64	1.36
<b>Financial</b>										
EIRR	0.8	0.8	0.64	0.2	0.2	0.04	0.2	0.2	0.04	0.72
Cashflow Disruption	0.8	0.8	0.64	0.2	0.2	0.04	0.2	0.2	0.04	0.72
<b>Satisfaction</b>										
Customer Satisfaction with Scope	0.2	0.3	0.06	0.8	0.8	0.64	0.8	0.8	0.64	1.34
Customer Satisfaction with Quality	0.2	0.3	0.06	0.8	0.8	0.64	0.8	0.8	0.64	1.34
<b>Project Risk Rank</b>										<b>1.17</b>

P = probability of the risk occurring and I = the impact intensity—each with a maximum value of 1

Figure 1 - Example LCOF Matrix

Figure 1 provides an example of how a Project Ranking scale could be established for a firm. Figure 2 provides the worst case Risk Ranking if everything was ranked as 1.0. Thus, the Risk Ranking for the example project would be below the 1.5 average mean for the scale. A firm could then establish a range for risks, for example low being less than 1.2, medium from 1.2 to 1.6, and high above 1.6. As has been suggested in this paper, the Risk Ranking would be evaluated on a regular basis along with each progress update. This is a distinct shift from the conventional process and activity based project management.

Risk Dimensions	Financial			Satisfaction			Sustainability			Sum
	P	I	P x I	P	I	P x I	P	I	P x I	P x I
<b>Due Diligence</b>										
Environmental Issues	1	1	1.00	1	1	1.00	1	1	1.00	3.00
Social Issues	1	1	1.00	1	1	1.00	1	1	1.00	3.00
Legal Issues	1	1	1.00	1	1	1.00	1	1	1.00	3.00
<b>Financial</b>										
EIRR	1	1	1.00	1	1	1.00	1	1	1.00	3.00
Cashflow Disruption	1	1	1.00	1	1	1.00	1	1	1.00	3.00
<b>Satisfaction</b>										
Customer Satisfaction with Scope	1	1	1.00	1	1	1.00	1	1	1.00	3.00
Customer Satisfaction with Quality	1	1	1.00	1	1	1.00	1	1	1.00	3.00
<b>Project Risk Rank</b>										<b>3.00</b>

Figure 2 - Worst Case Risk Ranking

The project manager in this scheme of things takes on the responsibility for achievement of the project LCOF's. In addition to the project evolution, its entire life cycle activities are planned. The project team inputs are always evaluated against LCOF's. Risk and uncertainty management is an integral part of the implementation of any activity as also the evaluation of any project plan. This calls for a highly dynamic process which entails constantly looking for solutions to meet conflicting influences on the project options. As this is not static or linear in nature, iterative cycles of planning and evaluation needs to be carried out so before one can not hit on the optimum solution.

There is also a need to revisit the status of LCOF's from time to time keeping in view the dynamic nature of the project variables and constants. By the same token there is a need to constantly evaluate the extent of uncertainty associated with achieving the target LCOF's. It is important that documenting reviews also clearly and comprehensively spell out contextual issues identifying cause-and-effect links.

Uncertainty was defined as an unknown probability of occurrence of an event times its impact. Projects are typically influenced by multiple variables with varying degrees of uncertainties within the context of a changing environment. This paper has suggested a major shift in practice, from the current task and activity based approaches to a strategy-based management within an integrated and collaborative framework, which has the potential to overcome traditional dispersion of responsibilities on these projects. Risk management should form a core function of this strategy-based project management approach, using life cycle objective functions as the main drivers for risk reduction and value addition. Employment of concurrent project management approach involving aligned commercial arrangements between the partners is also a vital aspect in this approach.

Going a step ahead we would like to emphasize that concern with uncertainty will continue to grow rapidly, as the KM field matures. As seen uncertainty management should be a key skill set in the armory of a project manager. In the traditional mould project management deals with uncertainty based on a probabilistic approach. However, many key aspects of uncertainty cannot be analyzed accurately using probability theory. There is a lot of expert judgment necessary and that is based upon knowledge that it turn may be supported by robust KM practices.



For probability theory to succeed in project management context, the project options and events should follow random pattern which is often not the case as human intervention is needed for project functioning which is rarely random in nature. Similarly for achieving a good fit with probability theory it is essential that projects should exhibit a fair degree of repeatability. This too is not the case as mostly the projects are unique in nature and knowledge gained from earlier projects often does not apply exactly for the future projects.

Another limitation arises from the fact that the traditional project management techniques call for breakdown of work structure and decomposition of problem into small comprehensible units. This does not gel well with requirements of the probability tools that need to deal with complete set of possible future outcomes. As such it can be seen that risk management through LCOF's which gives a holistic view of project options could be a better platform for uncertainty management. Therefore, it is suggested that the WBS functions for monitoring and controlling the project be managed separately from the Risk Index efforts.

### 3. CONCLUSION

If the management of construction projects is benefit from risk management techniques, it is essential that the enterprise factors for the firm or organization be established and considered when preparing a new project. An enterprise risk profile is necessary to rank individual projects. The profile then needs to be adjusted to take account of the lessons learned from ongoing projects, frequently. The PMBOK suggests that this be done during the close-out of a project, but a better approach is to perform this feedback at regular progress update intervals.

Recording, sharing, and analyzing the knowledge that is discovered on each project can help to reduce the uncertainty on construction projects, especially in the international marketplace.

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