



STUDY NOTE - 10

CORPORATE RISK MANAGEMENT

This Study Note includes:

- **Traditional risk**
- **Asset liability model**
- **Tools and models**
- **Enterprise risk management**
- **Project risk management**

CORPORATE RISK MANAGEMENT

Any corporate activity involves risk and according as the risk involved in the corporate activity return needs to be computed for the investment made. Normally, an individual is risk averse and prefers liquidity to the extent of scheduled commitments. Always the individual keeps his money safely at a place where it is risk free, say a scheduled bank. He gets a return for keeping the money in a bank and that interest rate is “risk free rate”. The incentive to invest this money in an activity involving risk could be to get a higher return for the increased risk. This is known as “risk premium”.

RISK IN A TRADITIONAL SENSE

The risk is understood as the sacrifice made by an individual by deferring the use of money to a future day by investing that money in a venture promising a higher return which has uncertainty. The forces that contribute to the variations in return can both be external or internal to a company in which an individual has invested. These forces can partly be controllable and the remaining uncontrollable. The uncontrollable portion, which is essentially external, is known as systematic risk and the controllable internal risk is known as unsystematic risk.

The external or systematic risk can be classified as three types of risk:

Market Risk: Variability in return on investments in the market is referred to as market risk. This is caused by investor reaction to the tangible as well as intangible events. Tangible events like economic, political, social events and intangible events arising out of a market psychology or the other factors like interest rates and inflation also form part of the forces behind market risk.

Interest Rate Risk: This risk refers to the uncertainty of market volumes in the future and the quantum of future income caused by the variations in the interest rates. These interest rates are normally controlled by the Reserve Bank of India in our country and the exigencies for changing the interest rates arise out of many economic factors which are monitored by the central bank i.e., R.B.I. Normally, when the interest rates increase the companies with higher quantum of borrowed money will have to pay out higher quantum of interest reducing their earnings and vice versa.



Purchasing Power Risk: Purchasing power risk is the uncertainty of the purchasing power of the monies to be received, in the future. In short purchasing power risks refers to the impact of inflation or deflation on an investment. Prudent investors normally include a premium for purchasing power risk in their estimate of expected return.

Exchange Risk: With the globalization of market cross border transactions are on the increase. Balance of payments comprising the net effect of exports and imports are subject to fluctuation in the various currencies. As recently, the strengthening of Rupee against the Dollar imports has made imports cheaper and exports costlier. The need to recognize this exchange risk is obvious as the international trade operations may be profitable or loss-making unless this risk is taken care of.

Unsystematic Risk: Unsystematic Risk is that fraction of total risk which is unique to a company or an Industry due to inherent internal factors like managerial capabilities, consumer responsiveness, Labour unrest, etc. The operating environment of the business and the financing modalities involve this unsystematic risk. The first one is known as the *Business Risk* and the second is the *Financial Risk*

Business risks can be again divided into internal and external business risks. Internal business risk is mainly due to the variations in the operational efficiency of the company. The external business risks arise out of circumstances imposed on the company by external forces like business cycle, certain statutory restrictions or sops

Financial risk is associated with the modalities adopted by a company to finance its activities. For instance the financial leverage like the Debt Equity Ratio or the type of borrowings and the variations thereof introduce financial risk. Lower the debt less is the financial risk

ASSET - LIABILITY MODEL

Financial risks arising out of **assets and liabilities** need to be aggregated. A composite risk picture has to be drawn by following an approach known as “building block

Asset liability management is a technique to compute matching of assets and liabilities by which a prudent management of an investment portfolio can be properly taken care of. Asset liability management is defined as “maximizing the risk adjusted returns to shareholders over the long run”. It is also defined as management of total balance sheet in terms of size and quality (composition of assets and liabilities).

Liquidity risk management through asset liability management

It is difficult to measure liquidity risk as it entails expecting likely inflow of deposits, loan dispersals, changes in competitive environment, etc. The most commonly used techniques for measurement of liquidity risks is the gap analysis. The assets and liabilities are arranged according to their maturity pattern in time brackets. The gap is the difference between the maturing assets to the maturing liabilities. A positive gap indicates that maturities of assets are higher than those of liabilities. A negative gap indicates that some rearrangement of funds will have to be done during that time bracket. It can be from sale of assets or issue of new liabilities or rolling over existing liabilities.

Exchange rate risk management through asset liability management

At a particular exchange rate assets and liabilities of a financial institution match exactly. As the exchange rate fluctuates this balance gets disturbed. A simple solution to correct this risk



is to match assets and liabilities of the same currency. Many financial institutions do not have foreign exchange exposure as all their assets and liabilities are in rupee currency. The risk of foreign exchange borrowings of these institutions are passed on to the lenders through dollar denominator loans. The uncovered loans are hedged at the time of contracting them through forward covers for the entire amount.

Risk vs. exposure

Risk is the changes in price of assets, whereas exposure is the sensitivity to changes in the price of assets. The risk perceptions in a corporate body differ from organization to organization depending upon the nature of business.

Risk perceptions

According to the type of business activity and the stakeholders involved, risk perceptions can vary and can be manifold as below:

- Default risk
- Transaction risk
- System risk
- Legal risk
- Accounting risk
- Country risk / Sovereign risk
- Political risk
- Management risk
- Off-balance sheet risk
- Racial risk

RISK MEASURES, TOOLS AND MODELS FOR MANAGEMENT

Measures relating to risk profiling are related either to the solvency aspect of organization or the performance areas.

- *Solvency-related* measures (these measures concentrate on the adverse “trail” of the probability distribution – and are relevant for determining economic capital requirements)

Probability of ruin – the percentile of the probability distribution corresponding to the point at which the capital is exhausted.

Shortfall risk – the probability that a random variable falls below some specified threshold level. (Probability of ruin is a special case of shortfall risk in which the threshold level is the point at which capital is exhausted.)

Value at risk (VAR) – the maximum loss an organization can suffer, under normal market conditions, over a given period of time at a given probability level. VaR is a common measure of risk in the banking sector, where it is typically calculated daily and used to monitor trading activity.

Expected policy holder deficit (EPD) or economic cost of ruin (ECOR) – an enhancement to the probability of ruin concept (and thus shortfall risk and VaR) in which the severity of ruin is also reflected. Technically, it is the expected value of the shortfall.

Tail Value at Risk (Tail VaR) or Tail Conditional Expectation (TCE) – an ECOR-like measure in the sense that both the probability and the cost of “tail events” are considered.



Tail events – unlikely but extreme events, usually from a skewed distribution. Rare outcomes, usually representing large monetary losses.

Performance-related measures (these measures concentrate on the mid-region of the probability distribution –see “risk profile” above – i.e., the region near the mean, and are relevant for determination of the volatility around expected results):

Return on equity (ROE) – net income divided by net worth

Operating earnings – net income from continuing operations, excluding realized investment gains

Earnings before interest, dividends, taxes, depreciation and amortization (EBITDA) – a form of cash flow measure, useful for evaluating the operating performance of companies with high levels of debt (when the debt service costs may overwhelm other measures such as net income).

Cash flow return on investments (CFROI) – EBITDA divided by tangible assets.

Weighted average cost of capital (WACC) – the sum of the required market returns of each component of corporate capitalization, weighted by that component’s share of the total capitalization.

Economic value added (EVA) – a corporate performance measure that stresses the ability to achieve returns above the firm’s cost of capital. It is often stated as net operated profits after tax less the product of required capital times the firm’s weighted average cost of capital.

Risk Measure	Formula
Shortfall Risk	$\frac{\sum_{i=1}^n [\text{if } (x_i \leq T) \text{ then } 1, \text{ else } 0]}{n} \times 100$ Where T is the target value for the financial variable and n is the number of simulation iterations. This is an improvement over standard deviation because it reflects the fact that most people are risk averse, i.e., they are more concerned with unfavorable deviations rather than favorable deviations. It is interpreted as the probability that the financial variable falls below a specified target level.
Value at Risk (VaR)	In VaR-type measures, the equation is reversed: the shortfall risk is specified first, and the corresponding value at risk (T) is solved for.
Downside Standard Deviation	$\sqrt{\frac{\sum_{i=1}^n (\min[0, (x_i - T)])^2}{n}}$ Where T is the target value for the financial variable and n is the number of simulation iterations. This is a further improvement over the other metrics because it focuses not only on the probability of an unfavorable deviation in a financial variable (as with shortfall risk) but also the extent to which it is unfavorable. It is interpreted as the extent to which the financial variable could deviate below a specified target level.
Below Target Risk	BTR is similar, but the argument is not squared, and there is no square root taken of the sum.



Risk management tools are essentially the methodology for measuring the risks as well as analyzing the same as support systems for decisions. The methodologies can be either a management technique or a model and is dependent on the type of risk. Selection of such a tool can follow guidelines as below:

Type of risk	Narration	Tools
Market	Risk arising due to change in market factors like asset prices, exchange rates, interest rates, etc	Value at Risk (VaR), Scenario analysis
Credit	Risk arising out of the failure to honor obligations for payments	Expected loss, unexpected loss
Business	Due to change in conditions in revenue recognition and exposure such as fluctuation in demand, competition etc.	Historical earnings volatility, analogues

Risk management modeling process relates to the methodology adopted for measuring risk and performance. The two general classes of stochastic risk models are either statistical analytic models or structural simulation models. Understanding these two models would involve defining the four terms used, namely:

Analytic methods: These methods often require a restrictive set of assumptions and certain assumed probability distribution. This method is easy and speedy.

Simulation methods (Monte Carlo): These models require a large number of computer generated trials to estimate a solution. While, simulation is robust and flexible and can deal with complex problems data requirement is a challenge. The advantage of simulation over analytic method is the greater degree of precision and alignment to real life situation, which is so much important in corporate world.

Statistical methods: These are more based on observations of random variables and the statistical qualities they exhibit. They do not consider cause and effect relationship. The advantage of statistics over structural models is an ease of application using available data.

Structural methods: These are based on cause and effect relationship and are derived both by quantification of data as well as quality related data. Because of the cause and effect approach, decision support systems are best available from these methods. Dynamic financial analysis which is a particular form of structural simulation model focuses on hazard and financial risk.

Corporate risk management strategies

In risk management, the following strategies are generally adopted:

Risk Avoidance is a strategy by which the organization does not engage in the activity which involves any risk.

Risk Reduction is another strategy where the organization takes two steps. One is preventing the occurrence of risk and the second one is controlling the number of occurrences. One of the possible ways of reducing the risk is going for large number.



Risk Retention is the most popular method of dealing with risk. Risk retention may be conscious or unconscious. Conscious risk retention takes place when the risk is perceived and not transferred or reduced. When a risk is not recognized, it is unconsciously retained.

Risk Transfer is another method of managing risk. Risk can be transferred to a person willing to take it. Hedging or insurance are best examples for risk transfer

Risk Sharing is process by which the potential risk is shared among many, so that the loss is not borne by a single person.

These strategies can be discussed under two specific heads namely

- Enterprise risk management and
- Project risk management

1. ENTERPRISE RISK MANAGEMENT

“Enterprise risk management is the discipline by which an organization in any industry assesses controls, exploits finances and monitors risks from all sources for the purpose of increasing the organization’s short and long term value to its stakeholders”. This definition has been adopted by the Casualty Actuarial Society (www.casact.org/research/erm).

There are seven components to the enterprise risk management and they are:

- Corporate risk governance
- Line management
- Portfolio management
- Risk transfer
- Risk analytics
- Data and technology resources
- Stakeholders management

Corporate risk governance

Responsibility of a corporate body encompasses

- Identifying the organization’s appetite for risk in the areas of capital leverage, credit rating, etc
- The capability of the organization to manage risk and support its business strategy
- Establishing the structural relationship between the roles and responsibilities for risk management
- Pooling of risk and develop such integrated risk measures encompassing the various spheres of activity like finance, marketing, human resources and operations
- Establishing proper tools for risk assessment, measurement and analysis
- Developing a proper culture and awareness in the organization through leadership
- Educating the various layers of organization about risks absorption and management through case studies

Corporate governance has become a buzzword in Indian corporate world and SEBI has laid down guidelines in this regard. Every annual report contains a section on corporate governance along with management’s discussion on performance and future outlook.



2. Line management

Line management develops the strategy on a cross functional basis using various models identifying strengths, weakness, opportunities and threats. This analysis identifies the risks that are involved in the formulation and implementation of the strategy. Enterprise risk management specifically lays down the criteria for risk acceptance and also evolves the corporate risk policy that needs to be aligned with the strategy.

3. Portfolio management

Pooling of risks should not just happen, but must be aggregated properly so that appropriate diversification of risk can be attempted. This will lead to optimal portfolio where natural hedges can be fully implemented so that risk and return are well balanced.

Portfolio theory essentially guides an investor to reach an optimal portfolio position. This theory as originally postulated by Harry M. Markowitz assumes that the utility of the investor is a function of mean return and variance of return [or standard deviation (Square root of variance)]. The expected return on a portfolio is simply the weighted arithmetic average of the expected returns on the assets constituting the portfolio. The riskiness of the portfolio is measured by the standard deviation of the portfolio rate of return which is a function of The proportions invested in the components

The riskiness of the components

The correlation of returns on component securities

The principle of portfolio theory can be likened to pooling of risks and diversifying them.

Capital Asset Pricing Model (CAPM)

This model addresses itself to the problem of developing an appropriate measure of risk for an efficient portfolio and also the relationship between the risk and return of the efficient portfolio, both in the aggregate as well as individual securities. The CAPM is based on following assumptions:

Individuals normally exhibit risk averse behavior

Over a single time horizon individuals attempt to maximize the expected utility of their portfolios

All individuals have congruent expectations in regard to means, variances and co-variances among returns

Monies are available for borrowing and lending freely at risk less rate of interest

There is a perfect competition with no taxes, no transaction costs and securities are totally divisible

The quantum of risky securities in the market is available

Arbitrage pricing theory (APT)

As the CAPM assumes idealistic assumptions, it has its own limitations. Arbitrage pricing theory was developed to overcome the shortcomings of CAPM. The APT assumes that asset prices can be influenced by factors beyond means and variances. APT allows the equation to include any number of risk factors in the equation as long as they have an influence on the return.



4. Risk transfer

Risk transfer objectives aim at lowering the cost of hedging of risks which are already balanced in a portfolio. Honeywell and Mead have developed alternative risk transfer (ART) products which combine both insurance protection and financial risk protection leading to about 30% savings.

5. Risk analytics

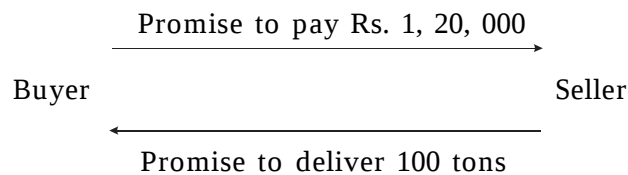
The tools and techniques are used to evaluate risk transfer products such as derivatives, insurance and hybrid products. For example, the cost of risk transfer can be made lower than the cost of risk capital. Apart from risk management advanced risk analytics can also be used to energize decision tools based on net present value and economic value added systems. In this type of analysis VaR that has been discussed earlier comes in handy.

Derivatives

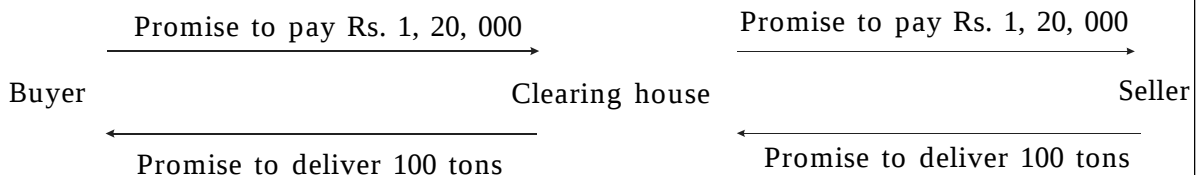
Derivatives can be broadly categorized into futures and options. **Futures** are used as a hedging mechanism against risk. For example, a farmer may have sown wheat in his field and incurs certain costs today. The harvest may take place after a few months. Then the price of wheat is uncertain. This uncertainty can turn into risk and as such the farmer would like to safeguard his risk by hedging against it. He can contract futures at a particular price which will cover his cost and also give a margin. This price may not be the best, but assures him of a return and also covers his risk. Commodities exchanges all over the world have introduced futures and they safeguard the financial risk of the producers. The futures contract is standardized in terms of delivery as well as the type of asset that is permissible for delivery.

Creating a Futures contract

a) Buyer and seller agree on a Rs. 1200 per ton August wheat futures contract:



b) The Clearing house becomes an intermediary to the Futures Contract:





Option is another derivative, which is a type of contract between two people wherein an individual offers the other person the right to buy a specific asset at a specific price within a specific time period. The advantages of Options are as follows:

Delay or defer making an investment (Delay)

Adjust or alter production schedules to match price changes (Flexibility)

Expand into new markets based on observation of favorable results at the beginning stages itself (Expansion)

Cessation of production or abandon investments, if the results are likely to be unfavorable at the early stages (Abandonment)

As futures and options involve expected future cash flows, the standard discounted cash flow procedure involves two steps.

- Estimation of expected future cash flows and
- Discounting cash flows using an appropriate cost of capital

It is difficult to quantify expected cash flows and it is even more difficult to determine the opportunity cost of capital as the variables involved are many. Towards this Black and Scholes model developed a single period binomial model. The basic idea of the model is to set up a portfolio, which imitates the call option in its pay off. In other words, the cost of such a portfolio must represent the value of call option. Use of this formula as an exercise to reduce risk in computing call option has been fairly successful. Black and Scholes model assumed as many variables in the computation on the basis of their relative impact on the valuation of call option.

6. Data and technology resources

Collection and collation of data have been the most difficult part of analytics. The population on the one hand and the veracity on the other hand plagued the analysts for developing a proper platform where solutions can be obtained. A system to collect data and aggregate it has to be built carefully, which should enjoin sifting data for quality. This should be a continuous exercise and proper monitoring is required to see that the data are captured both spatially and temporally as originally planned. The power of internet cannot be more emphasized in this regard and should form part of the design of enterprise risk technology platform.

7. Stakeholders management

Stakeholders are all interested in their acumen of the enterprise management in regard to the risks that face the organization. SEBI in India has clearly included transparency and communication as the two important facets of an annual report of a company. Management's discussion note normally presents the steps taken by the top management in tackling the various risks and also presents a proper perspective of their future outlook. In the course of business, the bargaining power with the creditors (Vendors) and the bargaining power with the debtors (Customers) always come under stress and strain. Risks involved in solvency transactions as well as ageing debts have to be taken care of on a day to day basis in the business. Towards that many tools (instruments) have been devised and continue to be around. Major tools are discussed below:



Instrument	Purpose	Remarks
Guarantee	Guarantees can be financial guarantees or performance guarantees. Financial guarantees protects against the financial loss on failure to meet financial obligations Performance guarantees are protection against non-performance of contractual obligations	Financial institutions provide guarantees as a risk cover against a collateral by the buyer for a consideration
Letter of credit or documentary credit	Guarantee against non payment of purchase consideration by the buyer	Financial institutions issue this instrument for a consideration. It can be revocable or irrevocable. Can also be revolving
Underwriting	Underwriting is a protection mechanism available in the capital market to cover the risk of non-subscription to a public issue	Financial institutions offer this risk cover for a consideration after due evaluation of risk
Collateralized debt obligations	Taken against short term and long term loans for working capital as well as fixed assets	Financial institutions offer this risk cover for a consideration after due evaluation of risk and cover themselves completely either through hypothecation or pledge or equitable markets
Asset Securitization	Companies offering financial services of hire purchasing, leasing, etc try to raise finance through this method	This is a special purpose vehicle (SPV) to manage default risk. Financial institutions as well as public subscribe to this method for a consideration in the form of interest and securitization is available from the assets that are being traded
Factoring	Companies resort to this instrument both as a risk cover and insure cash flow	Specific financial institutions called factoring companies offer this service for a commission with recourse or without the recourse



In conclusion, enterprise risk management is emerging as the best practice model, which is often benchmarked among the competitors. The enterprise risk management becomes all the more important, for, the absence of it would lead to crisis management.

2. Project risk management

Projects are one time processes unique in nature. Each project is different from the other and has a gestation period before it starts operation and yielding results. A project has to be conceived, feasibility is established both technically and commercially, funded for implementation and operation. By its own nature a project is based on many assumptions to be realized at a future point as also regarding environment and statutory policies. With a gestation period running into a few years any change or revision in assumptions can transform itself into a big risk. Management of such risks can be difficult and would require special tools and models. Normally, projects are considered as dynamic, iterative and often chaotic systems. They are also path dependent systems composed of networks displaying different dynamics.

The nature of risks in projects

Normally, risk is defined as “a possibility that the resulting impacts of events and the dynamic interactions may turn out to be different from the expectation”. Each project is different in terms of the impact of the market related, completion, institutional risks and turbulence. But all of them exist in each project.

Market related risk

Demand forecasts are often made with reliable data choosing a proper forecasting model. However, the element of risk compounds itself due to correlation coefficients being different among the variables. For example, many road projects have a specific set of customers, but these customers have alternatives. So, forecasting behaviors of these customers becomes extremely difficult and failures to achieve the required traffic volumes turn into a major risk threatening the project itself.

Completion risks

Projects face both administrative and technical risks during implementation, which require a high degree of innovation to solve them. These risks may arise out of the designs employed, from the contractors building the project, conflicts during execution, etc affecting the completion of the project.

Institutional risks

Institutional risks relate to unexpected changes in the conditions and norms laid down by the institutions that have either funded the projects or statutorily approved the project. Social acceptability risks arise due to certain sponsoring institutions opposing the implementation of the projects. Again, the governmental agencies which have approved the project in a particular form may call for renegotiation resulting in institutional risks.

Turbulence

All the three earlier can create certain consequences of events compounded by unforeseen circumstances. This leads to turbulence when multiple issues arises initiating moves and



counter moves and often ending in deadlock and the entire project may collapse. Opportunity failures or oversights can also create the risk of aggravation or overrun in costs resulting in financial risks.

Types of project risks, measurement and models

The project risks can be classified under three different heads:

Standalone risks: This is quantification of risk of a project when it is viewed in isolation.

Corporate risks: When the project is taken as part of a corporate entity its contribution towards the total risk of the company

Systematic risks: This represents the market risk of the project

These risks can be measured statistically by applying:

Range

Mean absolute deviation

Standard deviation

Coefficient of variance

Semi-variance

Out of the above, standard deviation is the most popularly used measure of risk and the reasons therefor are:

If there is a normal distribution of the variable, its mean and standard deviation will contain all data relating to its probability distribution

The concept of expected utility is again a function of mean and standard deviation

Standard deviation can be easily determined

While risk analysis is attempted, what-if analysis becomes very important to determine the interdependencies of the variables. Towards this, sensitivity analysis is a tool. Sensitivity analysis can be done by following steps:

Identify the relationship between the basic factors like the quantity sold/produced, unit selling price, life of the project, etc. and the net present value

Compute the range of variation and the acceptable value of each of the basic underlying factors

Interpret the effect on net present value of variations in the basic variables

The models normally used in project risk management are (Discussed in earlier chapters):

Scenario analysis

Monte Carlo simulation

Decision tree analysis

For value imputation of the results from the above models the following methods are used for deciding whether the project shall be accepted or rejected:



Risk profile method

Risk adjusted discount rate method

Certainty equivalent method

Risk profile method

The probability distribution of net present value, which is an absolute measure, is transformed into probability distribution of profitability index which is a relative measure. Normally, profitability index is linearly correlated to net present value and as such both the probability distributions are more or less identical. The dispersion of the profitability index of the project is compared with the maximum risk profile, which the management is ready to bear. If the risk of the project is less than the maximum risk acceptable to the management for the assumed level of profitability index, then the management will proceed with the project.

Risk adjusted discount rate method

Normally, the discounting rate used for arriving at the present value is the average cost of capital for a company. If the net present value of the future cash flows is positive, then the project is accepted. However, if the risk of the project under construction is greater than the present risk profile faced by the company, then the company would like to have a higher return on the project and as such would consider a “risk premium” for undertaking the project. This risk premium is normally converted into additional quantum of return that is to be required. The existing discounting rate is increased to incorporate the risk premium and that is known as the risk adjusted discount rate. The risk adjusted discount rate is commonly employed differently for different projects like routine replacement investments, expansion investments, risky new investments and highly risky research and development investments. This is a popular method, but entails certain limitations:

Determination of risk premium and corresponding addition return frequently is ad hoc and arbitrary

The assumption that risk increases with time at a constant rate may not be always valid

Certainty equivalent method

The concept of certainty equivalent coefficient represents the computation of a certain amount equivalent to a probable income or loss. Rather this method introduces the concept of expecting the unexpected and trying to quantify the unexpected profit income or loss with this probability into an equivalent. The process of developing certainty equivalent quotient entails the following steps:

- Identify the outcomes with the probabilities
- Develop the expected total value on the basis of weighted values summation
- Develop the minimum required outcome which is acceptable to the management for a project
- Develop a ratio of 3 over 2 to obtain certainty equivalent coefficient
- If this coefficient is acceptable to the management the project goes through

**PROJECT RISK ASSESSMENT IN PRACTICE**

In reality, the risk assessment is done through considering the various components of the financial estimates and developing certain judgmental approaches:

Estimation of revenues: Revenues projected for a project need to be justified on the basis of real data available and then the projections are made conservatively. This avoids optimistic projections of income

Cost estimates: Always include a margin of safety to take care of impact of inflation over the time horizon for which the projections are being made. Here again the margin of safety is computed on the basis of trend analysis of inflation over the recent past and the lead indicators that are available from fundamental analysis

Acceptable return on investment: This is the prime measure and as such it should be arrived at on the basis of certain consensus. It will depend on the payback period to be assumed, the industry experience and the company's norm for return on any new project on the basis of the current experience

Overall certainty index: The critical risks of the project are identified and the certainty index of each of these risks is quantified. Then the overall certainty index is developed as an average of the critical indices already computed. For instance, raw material availability, power availability, intensity of competition is a few of the risks, which are quantified in terms of certainty indices. The cumulative average is the overall certainty index

Judgmental perceptions: Three different estimates of return on the investment are developed – pessimistic, most likely and optimistic on the basis of the stage at which the particular industry is in its life cycle. On the basis of the three estimates and comparing them with the earlier methods available on certainty equivalent coefficient, a judgmental decision can be taken

Approaches to project risk management

The approaches are six fold as follows:

Decisioneering to assess and mitigate risk

Build robust strategic systems

Instilling govern ability

Shaping institutions

Hedging and diversifying risks through portfolios

Embracing risks

Approaches	Risk avoidance	Risk reduction	Risk retention	Risk transfer
Assess mitigate E.g., quantitative sensitivity analysis, scenario analysis, decision trees and influence diagrams	Endogenous risks specific to the project	If risk cannot be mitigated, reduction techniques will have to resorted to	Known risks will be retained and self insured	General risks applying to similar projects transferred to a competent agency
Build robust systems Using five different devices: information search, network building and cooptation, structures of incentives and contracts, project / design configuration, influence and bold actions	Risks arising out of partnerships with suppliers or contractors, methods of contractor selection, selection of geographic location / site, preemptive action and education of regulator rating agencies, statutory agencies, etc.		Institute adequate controls through multidisciplinary strategy teams, early involvement of financiers, operators and others, incentives / penalties in increments, signal probity, set up controls for monitoring	
Instill govern ability Instill cohesion, reserves, flexibility and creativity			• Build strong relationships between project participants • Fall back strategies expecting contingencies • Develop alternatives for decision making by proper delegation of authority • Develop creative thinking and innovative approaches for solving crisis through brainstorming sessions among participants	
Shape institutions and systems Anchor projects, ensure repayment of investments, provide social utility	Stabilization of long term future to enable investments, enhance the legitimacy of the project by developing practices like inviting the representatives of both			



Approaches	Risk avoidance	Risk reduction	Risk retention	Risk transfer
		the institutions and the public. Develop a strong framework for structuring decision making		
Hedge and diversify E.g., portfolios, insurance and hedging		Build a diversified portfolio to balance risks and cash flows, hedging against currency fluctuations or commodity exposures applying financial derivatives		Insuring risks as well as diversifying investments in different countries to reduce political risk
Embrace Comprehend the residual risk			• Develop a proper information system regarding the residual risks, commercial aspects • Develop a clear sense in bearing various risks, then understanding of particular risk domains to develop ability to bear commercial risks.	• Develop information system regarding financial institution capital markets and special vehicle applications • Identify local industrialists who are ready to partner for sharing risks through a portfolio of investment • Identify international partners for sharing investments through a portfolio of investment • Identify financial institutions locally like commercial banks • Identify international financial institutions





Concept of critical chain and theory of constraints

The inherent risks in a project formulation and implementation can arise due to misalignment of objectives. The physical objectives and financial objectives need to be properly aligned as otherwise the misalignment itself can develop into a major risk. It is accepted that to achieve good cost performance in a project is through good performance at every stage. However, achieving good throughput or a holistic performance need not be through good performance at every stage. This follows the principle that optimization of paths need not lead to optimization of the whole.

This misalignment can be taken care of by the application of theory of constraints. According to this theory, the management focuses on whatever impedes the progress towards the goal of maximizing the flow of total value added funds or sales less discounts and variable costs. This involves the following steps:

- Identify the system bottle neck
- Exploit bottle neck
- Subordinate all the decisions to step 2
- Elevate the bottle neck or de bottleneck
- Do not let inertia set in

In conclusion, project risk management presents a milieu of many imponderables, which are external to the company. To that extent, strategic inputs are necessary which have been reflected in the measurement and mitigation of risks. As projects by themselves are unique comparisons do not lend themselves equal. Specific approaches are needed to be developed in each case.