

# RISK MANAGEMENT IN CAPITAL BUDGETING

By

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## Introduction

What is certain is uncertainty. All decisions and actions are taken to attain desired results. Decision and action precede the result. The future holds a certain uncertainty. Success, therefore, gives a sense of satisfaction. When the results of action are expected to arrive over a long period, the uncertainty is likely to be more, as the distant future is far less predictable. Corporate investment decisions are taken in anticipation of a stream of benefits over a long period. Mistakes may be expensive. All care must be taken to ensure that the future unfolds as per expectations.

Management of risk is a complex subject. The total risk management in capital budgeting has been divided into three chapters. This chapter discusses the meaning of risk, the sources of risk and the decision maker's attitude towards the risk. Risk management aims at appropriate designing of the proposed project so that inherent risk is reduced without a corresponding reduction in returns. The issues related to the designing of a project are discussed here. The next chapter discusses the risk analysis in the context of the project after it is designed. The concept of portfolio risk is finally dealt in chapter 15.

## Risk and uncertainty

These two terms are interchangeably used in practice. In our text too, these two terms are used interchangeably. In the outset however, it is necessary to know the difference between the terms 'risk' and 'uncertainty'. First let us take the meaning of these two terms as used by statisticians. "Risk is that uncertainty which is predictable, and to which probability can be assigned." This definition has two conditions.

- a) The decision maker is aware of all possible outcomes which may occur and affect his decision
- b) The decision maker is in a position to assign a probability to each possible outcome envisaged by him.

If these two conditions are absent it is called uncertainty. That means, uncertainty is that event which cannot be predicted, and therefore, there is no question of being able to assign probability to it.

In the layman's eyes these two terms may have different meanings. There are two projects, A and B. Project A is likely to offer an internal rate of return (IRR) in the range of 25 to 45 per cent, and project B 15 to 35 percent. If the cutoff rate of the firm is 20 per cent one would say that project B is riskier than project A, though in both cases the uncertainty (difference of 20 percent between the highest and the lowest IRR) level is the same. A layman's understanding of the two terms is quite different from statisticians' definitions. A layman looks at the downside risk (a possibility of earning an IRR less than the minimum acceptable rate of return). We shall use the terms 'uncertainty' also to denote 'risk'

## Risk and Decision Making

Gamblers also take risks, or chances. Blind and thoughtless chance taking are the characteristics of gambling. Risk taking is different. When decisions are taken on the basis of a calculated chance within the acceptable limit, it can be termed as risk taking. Business managers are expected to take an informed and calculated risk when they decide on investment plans.

Two elements distinguish risk taking from gambling, (a) information or knowledge, and (b) awareness about the ability to survive (absorb) the ill-fated outcome of a decision. The former lays emphasis on building a database and skill to interpret data, and the latter work as a constraint on greed. The ability to absorb an adverse result if any, also means the attitude towards risk.

**Knowledge base:** The need for a sound database is also felt by decision makers. The root cause of risk, therefore, is found in data and its interpretation. There are three types of data

Known known

absolute certainty



Known unknown

Unknown unknown absolute uncertainty

One more type of data can be mentioned namely, 'unknown known'. It is not mentioned here as it is not a characteristic expected of any business manager. Knowledge about the need for information, and availability of required and reliable information are the two aspects considered in the above classification. If a manager knows about the need for information, and that required information is available and very reliable, giving absolute confidence to the manager, then it can be called 'known known'. 'The known unknown' category implies that the manager is aware of the need for some information, but that information is not available, or if available it may not give a very high degree of confidence. The 'Unknown unknown' category implies that the manager is neither aware of the need for information, nor is that information available. Unpredictable acts of God are 'unknown unknown'.

The classification of information given above is only for convenience. Some projects are typically such that unknown elements are very high, like research projects. On the other hand in replacement projects the knowledge base is very high, and therefore managers have a high degree of confidence about their decision being right. In project preparation, some ideas have to pass through many steps, namely, brain-storming, feasibility study, market study, pilot plant, etc. before the project is formed. Projects with very little or no information base in the initial point (at point 'A' in Fig.1), where very little logic is available and the proposal is based on high intuition) will pass through many stages like project feasibility, market survey, test marketing and then the project report stage. Building information at minimum additional cost before moving over to the next stage is the main purpose behind the stages. A project is seriously considered for adoption only at a stage when a comfortable position (confidence) is attained, by the management.

Some decision makers feel comfortable with the idea at the early stage, whereas others opt to wait and do some more homework before funds are committed on projects.

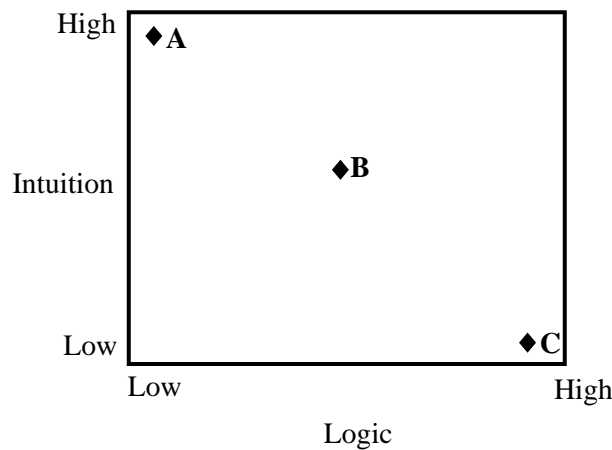


Fig.1 Decision-making grid

**Attitude towards risk:** Risk is a perception. The management decision therefore, is guided by the attitude of the decision-maker towards risk. People can be classified into three main groups in this connection, risk-averse, risk-lover and risk-neutral

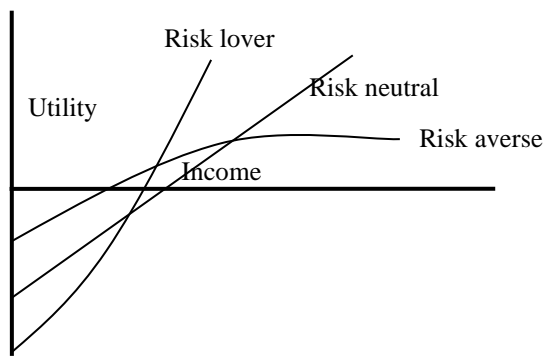


Fig .2 Relationship between income and utility

All those who take risk would do so if the corresponding returns expected by them are high enough to justify the degree of risk taken. Managers would take every additional unit of risk if the corresponding additional returns satisfy them. This means that a different amount of risk premium is attached to different degrees of risk. Risk premium therefore, is the function of the utility of returns. It can be explained with the help of utility curves shown in Fig 2.

A rational business manager is expected to be a risk-averse person. Risk-averse person' utility curve is concave. Their marginal utility of additional income will be low. Consequently, a rational manager would expect a higher marginal return for every additional unit of risk taken. This relationship between the risk and expected return is depicted in Fig .3

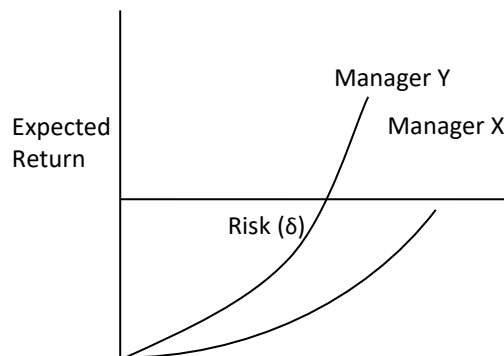


Fig 3 Different Utility functions of Risk Averse Managers

As one can see from Fig .3 the utility functions of different risk-averse persons may vary. That variation is due to different attitudes towards risk. Within the risk-averse class also some managers are willing to take more risk for a given expected return (like manager X in fig.3) and some others take less.

The difference in the attitude of managers and organizations towards risk, makes a qualitative difference in taking informed decisions.

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

Risk is denoted by the variability in operating income. The variability of the operating income is always higher than the variability of the event outcome. The variability of project returns, therefore, is the function of project construction efficiency and operating efficiency.

### **Project Construction Risk**

Inefficient project execution may result in any one of the following:

- a) Project time-overrun
- b) Project cost-overrun

c) Project quality deterioration

The first two result in the higher cost of the project and lost opportunities. The last one has a bearing on the quality of earnings.

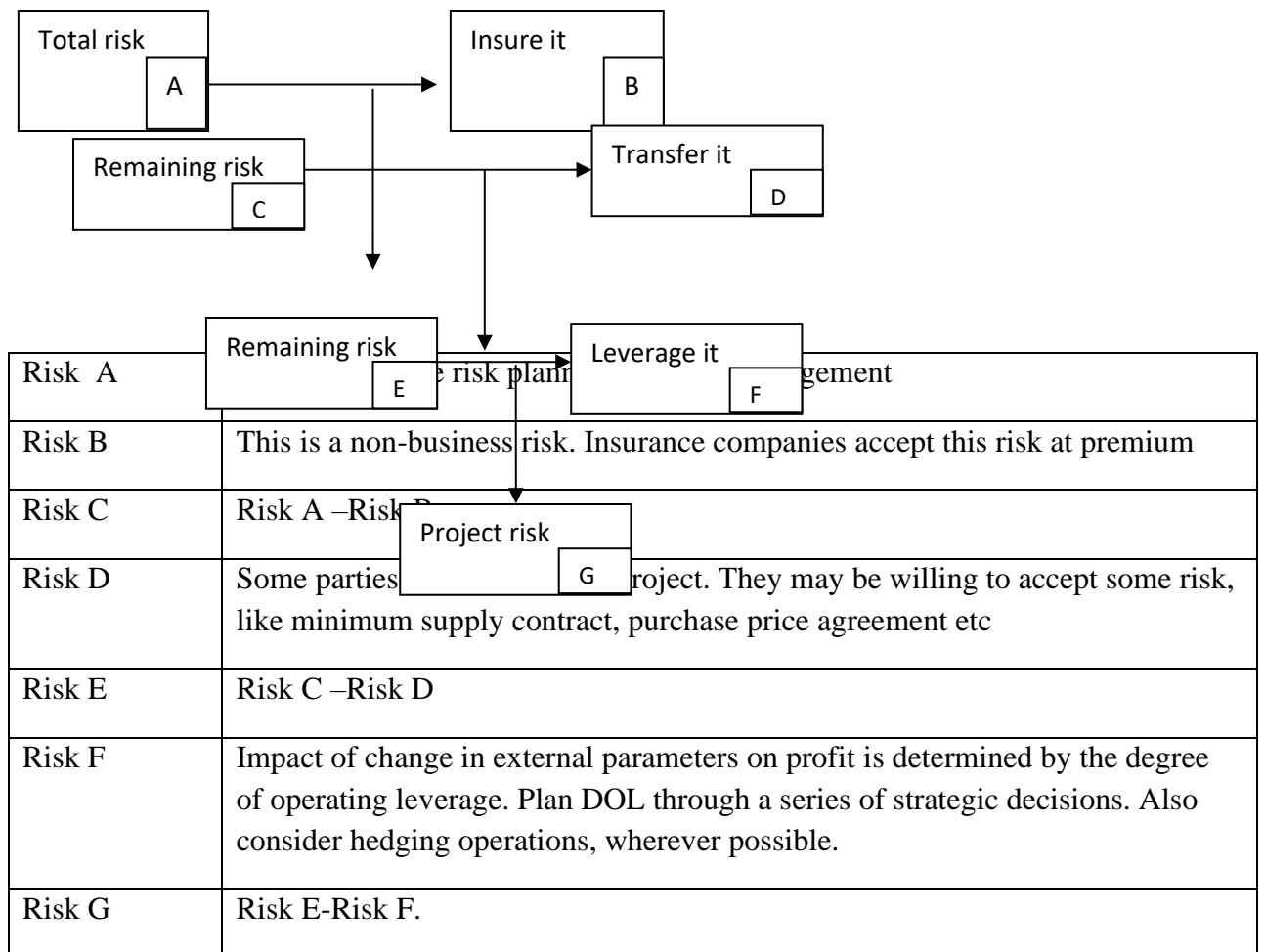
The project design and its construction need extraordinary care and skills. The company must assess its own strengths and weaknesses before deciding whether to construct the entire project on its own, or give it away on a turnkey basis. Any combination of the two can also be considered. The choice of the project construction alternative should aim at the completion of the project in time, within the budgeted cost and as per quality specifications. The importance of the management of projects, contract management and project monitoring cannot be understated, especially in a competitive environment.

**Operating Risk**

Benefits from a project may be uncertain. Sales quantity, sales price, sales mix, input price and input productivity may not be certain. Variation in any of these factors has an impact on profits. Variation in profit is caused by variation in these factors (external reasons) and the degree of impact (internal factors) on profits due to change in external factors. Of course, the portfolio effect of variation is equally important. This brings about three concerns in project risk management, namely,

- a) Studying and reducing variability in external factors
- b) Selecting a project efficiency level so that the impact of change in external factors will be within an acceptable range, and
- c) portfolio effect risk.

In this chapter only a broad structure of project risk management has been given so that the process of designing of project parameters can be understood. A perusal of Fig.4 will be helpful in understanding the points that are driven home hereafter.



	This is the project risk that the firm is willing to take. It should be studied in detail.
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Fig. 4 General framework of risk management in project design

### Framework of Project Risk Management Explained

The discussion on the framework of project risk management presupposes the existence of sketch of project design. This implies that the firm has conducted market and technical evaluations on the conceived project proposal, and the location of the plant has been carefully selected. The conceived project also fits well in the strategic game of the business. Strategic fit in terms of product and size of investment provides a synergic benefit, which is essential in minimizing risk. The choice of location also reduces some elements of risk.

Having decided on the strategic fit and the location of the project, the firm should proceed with the idea of systematically designing the project, for better risk management. A businessman need not take on himself the entire external and internal risks of a project. Some risks can be transferred, some can be leveraged out and some can be managed.

**Transfer the risk** One part of the risk can be transferred to some parties. Some risks can be insured, some can be contracted out and some can be hedged.

- a) *Insurance and risk:* Insurance companies are in the business of buying some types of risks of businesses. Risk arising out of ‘unknown unknown’ must be insured with an insurance company. Natural calamities, gas leaks, etc. create risk, but a wise businessman would take insurance cover against such unknowns. They are therefore also called non-business risks. Insurance companies buy some business risks also, at a higher premium. Insurance companies have launched profit insurance and project-cost schemes. A firm has to decide on which risks should be insured. It is a general experience that coverage of small losses proves uneconomical to the firm. Insurance management is a crucial function in project risk management.
- b) *Contract out risk:* Some part of the risk which is not insured can be passed on to some parties, who may be willing to accept that risk. An ancillary unit may contract with the parent company for a ‘minimum supply’ contract at a cost-based price mechanism. The parent company may sign such a contract if it is in dire need of developing ancillaries. Infrastructure projects in a developing economy are essential in the eyes of Government. A company willing to invest in an infrastructure project may insist that the Government take up a part of the risk. Power purchase agreement (PPA) by independent power projects with the state electricity board, and counter guarantees by government is nothing but passing on risk to the willing and needy parties. There are examples in some countries where the Government has taken up foreign exchange risk for the foreign direct investor. Supply contracts are also not uncommon. If there exists any party which needs investment most, then that party may be convinced to acquire a part of the risk.
- c) *Hedge:* The degree of variability of some factors can be reduced if the firm is willing to spend some money on the hedging operation. In some factor markets and in foreign exchange market the price and supply can be hedged. A cotton textile mill can do hedging for the price of cotton. If the forward market mechanism is in place for the commodities, then hedging operations become possible. Hedging operations are complex, involving a series of buy and sell transactions in forward and spot markets. A continuous eye on market movement is also necessary with a view to benefit from hedging. Readers who are interested in getting familiarity with hedging operations should take up any good book on forward trading.

Thus, through insurance the insurance company finally sustains any possible loss. Contracting out and hedging reduce variability of the factor. These must be planned at the time of project formation stage.

- d) **Leverage out:** Even after insurance, contracting out and hedging, some factors are still uncertain. Any variation in those factors will have an impact on the operating profit of the business. The impact is always more than proportionate, due to the element of fixed costs in the operating cost structure. The impact ratio is measured in terms of the degree of operating leverage. Look at the following example,

	Company A		Company B	
	Present	Expected	Present	Expected
Sales	100,000	110,000	100,000	110,000
-variable				
Costs	60,000	66,000	20,000	22,000
Contribution	40,000	44,000	80,000	88,000
Operating				
Fixed costs	20,000	20,000	60,000	60,000
Operating				
Profit (EBIT)	20,000	24,000	20,000	28,000
Degree of				
Operating				
Leverage	2		4	

The operating profit of company A increased by 20 per cent when sales went up by 10 per cent. The percentage change in the operating profit of company A is double the percentage change in sales. Company B experienced an increase in profit by 40 per cent for 10 percent increase in sales, which is four times the change in sales. This relationship between the profit and sales is direct and proportionate. It holds true ever when sales decline. The relationship between the percentage increase in profit and sales is called the degree of operating leverage (DOL). The degree of operating leverage of the company A is 2 and that of company B 4.

Operating leverage is the function of investment decisions. Modern technology, a high degree of automation, backward integration and a host of such investment decisions push up the operating fixed costs and the operating leverage. A higher level of fixed cost commitment and consequent higher operating leverage would put the company in trouble under adverse conditions, if that could benefit the firm in favorable situations. The swing in operating profit must be within the acceptable (affordable) range if external factors are likely to behave in an uncertain fashion.

The project planning team must decide on various issues related to the level of technology, automation level and degree of sub-contracting activities, with a view to plan the impact ratio at the acceptable level. A low degree of operating leverage should be planned for projects of high-risk class.

**Designing the project:** The first two steps of transferring risk and leveraging of risk would give shape to the project design. However, some more issues related to the features of project-design should be taken up for consideration. The following issues warrant the attention of project planning team:

- a) Should machines and processes be flexible or special purpose ones? Special purpose machines and fixed processes are cost effective in volume production. But the same is counterproductive where manufacturing flexibility is warranted. Special purpose machines are less adaptable to changes in product design or changes in process design and even in batch lot production. If the market is competitive (uncertain) and new product development gives a competitive advantage then flexible machines are desirable. However, if cost effectiveness is the key competing factor in the market, then special purpose machines are desirable.
- b) In the case of mega-projects and green field projects some more issues crop up. Support and logistic assets are usually larger than what is immediately required for running the core plant and equipment planned to be acquired initially. The buffer is for meeting the growth needs of the firm. An option of spreading out of such indirect investment over a longer period must be carefully evaluated so that initial commitment is kept only at an optimum level and the growth requirement could be easily met subsequently.
- c) The core investment in a plant can be phased over a period; so that the investment starts giving returns at the earliest. This requires careful planning.
- d) Various options of financing must be evaluated. Though theoretically financing and investment decisions are independent of each other, in reality for a major investment plan it is not so. Well designed financing instruments can reduce the cost of funds and match the project cash flow with the debt servicing requirement. Debt servicing during the project construction period, would add to the financial worries and cost of the project.
- e) Lenders of money will attach a high premium for risk and charge a higher cost for their funds. If high gestation and other surrounding uncertainty is likely to cause a default risk, then the cost of funds will rise sharply. The project planning team should arrange for funds (usually consortium funds are planned) and also arrange to reduce default risk, if any. An escrow account mechanism in the case of power projects is one such example, wherein through a multi-party agreement the cash collected from the end consumer is disbursed by the collecting agency (bank) among the lenders of money to the power company. This reduces the default risk and makes it possible to access cheaper debt funds.

**Analysis of project risk and portfolio risk** After the design of a project is ready, the statistical risk analysis for the project begins. At this stage, the critical success factors, which are sources of risk, are studied. The risk (variability in profit) is measured and finally the risk is incorporated in the decision making process.

Sensitivity analysis, in various forms, is the prescribed tool for identifying the important sources of risk. Various statistical techniques, which measure dispersion, are employed for quantifying the pertinent risk, and then various statistically convincing rules are applied for decision making. The risk can be incorporated in either the cash flow or in the discount rate so that the right choice of project is made.

Study of the project risk in isolation is important, but not as much as its impact on total business risk. A risky project may reduce the risk of overall portfolio of projects if the cash flows of both are negatively correlated. If the new project is positively correlated with the existing business, then the riskiness of the business will increase. Project risk analysis and portfolio risk aspects are addressed in the next two chapters.

## Summary

The term 'risk' and 'uncertainty' are different in the eyes of a statistician and a layman. However, they are used interchangeably. Risk taking is distinguished from gambling on the basis of the content of knowledge and attitude towards risk. Information required and information available should both be at an adequate level at the time of taking the decision. They are grossly inadequate in some projects like new product development. The planners build a data base through various stages such as the feasibility report, market survey, test marketing, project report, etc. before the decision is taken. The final decision is taken at a time when some unknown (uncertain) elements still exist. The decision of two persons on the same project with the same information base may still be in variation because risk is a perception. Different persons expect different additional returns for every additional unit of risk they take. The utility curve of all business managers is expected to be concave but will be of different degrees. The final decision is getting the shade of the decision-maker's attitude towards risk.

Broad strategies for project risk management are brought into the discussion. Risk related to project construction (in terms of cost and quality) warrants attention. Operating risk must be planned at the time of designing of the project. A part of the risk should be transferred to an insurance agency, some may be offloaded on any willing party, and some can be managed through hedging. Another part of the risk can be leveraged out. The operating leverage decision is essentially a decision regarding an impact ratio of change in variables to the change in operating profit. The degree of operating leverage should be within an acceptable limit. This limit can be preset and some decisions can be taken regarding the level of technology, degree of automation and degree of backward integration. This is called leveraging out the risk. A project has to be designed accordingly before the project specific risk analysis is carried out.

## REVISIONARY QUESTIONS

- 1) What is 'risk' and what is 'uncertainty' as understood by (a) a statistician and (b) a layman?
- 2) What are the three types of information? Explain the significance of the classification in the context of project risk management.
- 3) What is 'unknown known'? Why is it not expected of business managers?
- 4) Explain the framework of project risk management in detail. What care and decisions should a project planning team take while designing the project details?
- 5) Explain different ways in which some risk can be transferred to external parties.
- 6) What is operating leverage? What is its significance in the management of project risk?

## References

- Bierman H. (1995) An Introduction to Managerial Finance London: Pitman
- Bolton, S.E. (1976) Management Finance, Principles and Practice Boston: Houghton: Mifflin Company.
- Citman L.J. (2005) Principles of Management Finance, New York: Harper & Row
- Horn, J.C.V. (1980) Financial Management and Policy, New Jersey: Engle Wood Cliffs, Prentice Hall, Inc.
- Horne, J.C.V. (1999) Fundamental of Financial Management, New Delhi: Prentice-Hall of India
- Mathur, I. (1979) Introduction to Financial Management New York: Macmillan
- Solomon E. (2000) The Theory of Financial Management, Columbia University Press.
- Weston J.F. And Brigham E. F. (1979) Managerial Finance, London: Holt, Rinehart and Winston.