[Academic Script]

Statistical Tools to Handle Risk

Subject:	Business Economics
Course:	B. A. (Hons.), 5th Semester, Undergraduate
Paper No. & Title:	Paper – 551 Elective PaperP1 – Project Management
Unit No. & Title:	Unit – 3 Incorporating Risk in Projects
Lecture No. & Title:	Lecture – 2 Statistical Tools to Handle Risk

Academic Script

1. Statistical Tools of Incorporating Risk

In the earlier session we discussed traditional methods of handling risk in projects. As per trend, a project manager should adopt statistical tools in analysis and interpretation of risk with regard to project. In this discussion session we are going to discuss the statistical tools like Probability Distribution (including dependent, independent and decision tree techniques), Project termination and abandonment analysis.

Let us first discuss Simple probability analysis:

This is one of the most effective and sound tools of appraising project in case of uncertainty. The basic underlying assumptions on which this model has been developed are as under:

- There is an array of potential future returns.
- Mangers know the probabilities of each of such possible future returns.

Thus, the difficulties encountered by mangers in assigning probabilities to such an array of potential future returns may be regarded as the potential limitation of estimating such probabilities with a reasonable degree of accuracy. It goes without saying that this model enjoys the inherent advantage of being based on a foundation that is conceptually extremely strong.

Advantages:

The major advantage of the simple probability analysis is its simplicity in execution.

Limitation:

Owing to the difficulty in assigning the exact probability under different options may be the main drawback.

Now let us move on to next tool. Do you know what standard deviation for risk analysis is?

The assignment of probabilities and the calculation of the expected net present value include risk into the investment decision, but a better insight into the risk analysis of capital budgeting decision is possible by calculating standard deviation and coefficient of variation

Standard Deviation:

Standard deviation (σ) is an absolute measure of risk analysis and it can be used when projects under consideration are having same cash outlay. Statistically, standard deviation is the square root of variance and variance measures the deviation about expected cash flow of each of the possible cash flows.

Variance can be calculated using the following equation:

$$\mathrm{Var}(R) = \sigma^2 = \sum_{i=1}^{N} p_i (R_i - E[R])^2$$

Where

- N = the number of states,
- p_i = the probability of state i,
- R_i = the return on the stock in state i, and
- E[R] = the expected return on the stock.

While the standard deviation is calculated as

$$\mathrm{SD}(R) = \sigma = \sqrt{\sigma^2} = \left(\sigma^2\right)^{\frac{1}{2}}$$

Coefficient of Variation:

If the projects to be compared involving different outlays/different expected value, the coefficient of variation is the correct choice, being a relative measure.

Formula

$$\text{Coefficient of Variation} = \frac{\text{Standard Deviation of the Investment}}{\text{Expected Return on the Investment}}$$

Advantages:

- The higher the coefficient of variation, the riskier the project.
- It is a better measure of the uncertainty of cash flow returns than the standard deviation because it adjusts for the size of the cash flow.

Limitations:

To evaluate all the parameters need expert's help which is not affordable by all organizations.

2. The next tool for analyzing risk in a project is Probability distribution approach

It is the concept of probability distribution for incorporating risk in evaluating capital budgeting proposals. The probability distribution of cash flows over time provides valuable information about the expected value of return and the dispersion of the probability distribution of possible returns which helps in taking accept-reject decision of the investment decision. The application of this theory in analyzing risk in capital budgeting depends upon the behavior of the cash flows, being

- Independent
- Dependent.

Independent:

The assumption that cash flows are independent over time signifies that future cash flows are not affected by the cash flows in the preceding or following years. When the cash flows in one

period depend upon the cash flows in previous periods, they are referred to as dependent cash flows.

Dependent:

If cash flows are perfectly correlated, the behavior of cash flows in all periods is alike. This means that if the actual cash flow in one year is α standard deviation to the left of its expected value, cash flows in other years will also be α standard deviations to the left of their respective expected values, cash flows of all years are linearly related to one another. The expected value and the standard deviation of the net present value will consider when cash flows are perfectly correlated.

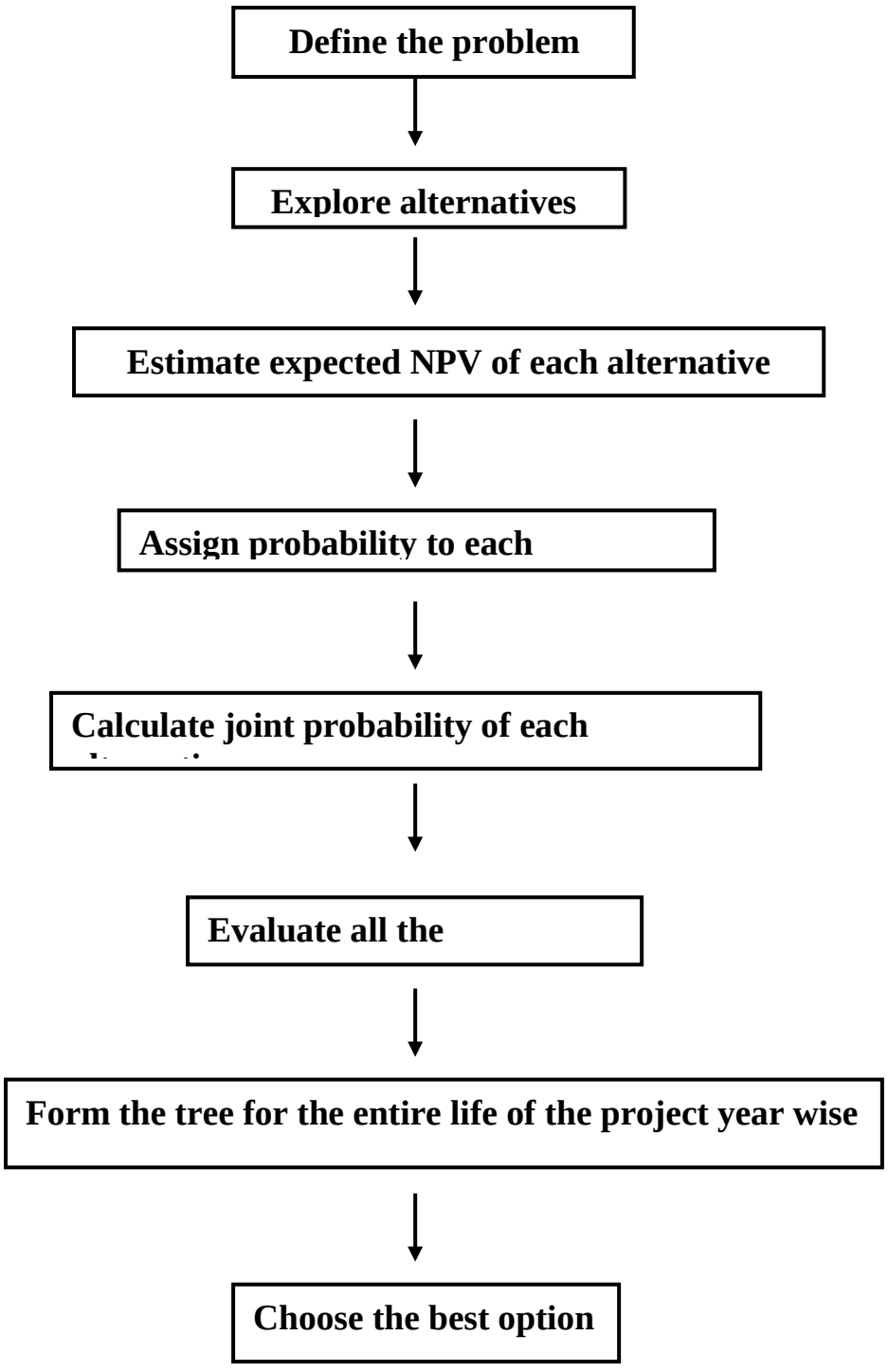
Decision tree analysis:

In this method, a decision tree is constructed to give a better presentation of related information connected with an investment proposal. Investment decisions in practice are quite complicated, especially because the outcomes are not certain. Further, the projections of the future are dependent up on the outcomes of the present. To be more specific, the net cash outflows of the second year may be dependent on the net cash outflows of the first year. The net cash outflow of the first year itself is dependent on certain event and this makes all the future events as well as their expected consequences dependent on each other. A decision tree here helps to simplify the decision making process.

E.g. As a project head hypothetically develops a decision tree for a new venture of your construction company with suitable assumptions and profitability related to it.

Being an investor provide critical evaluation of the current project which needed to close down. Draft a report with concrete

fact and figure to your BOD with utilization of decision tree method.



Advantages:

- It is helpful to analyze situations where sequential decision making in the face of risk is involved.
- The decision tree analysis is a simple tool to apply

- It is a step by step approach which helps the analyst understands what can be done at each point of the decision.
- It is a better presentation of information related to any investment proposal.

Limitations:

- It requires a huge amount of information before it can be applied.
- It becomes difficult to apply the method to a new or green project
- It becomes difficult to apply where the firm has very little information on how the market will respond to it.

When investment targets are gradually met over a period of time, instead of investing in well-defined stages, decision tree is not easy to construct and apply.

3. Real option analysis of project termination and abandonment

Real options exist when managers can influence the size and riskiness of a project's cash flows by taking different actions during the project's life.

Real option analysis incorporates typical Net Present Value (NPV) budgeting analysis with an analysis for opportunities resulting from managers' decisions.

What are some examples of real options?

- Investment timing options
- Abandonment/shutdown options
- Growth/expansion options
- Flexibility options

Issues with abandonment options are

- The company does not have the option to delay the project.
- The company may abandon the project after a year, if the customer has not adopted the product.
- If the project is abandoned, there will be no operating costs incurred nor cash inflows received in future
- Is it reasonable to assume that the abandonment option does not affect the cost of capital? No, it is not reasonable to assume that the abandonment option has no effect on the cost of capital.

The abandonment option reduces risk, and therefore reduces the cost of capital.

Now let see when do Projects Terminate?

Termination rarely has much impact on technical success or failure but has a huge impact on other areas

Residual attitudes toward the project (client, senior management, and project team)

Success of subsequent projects

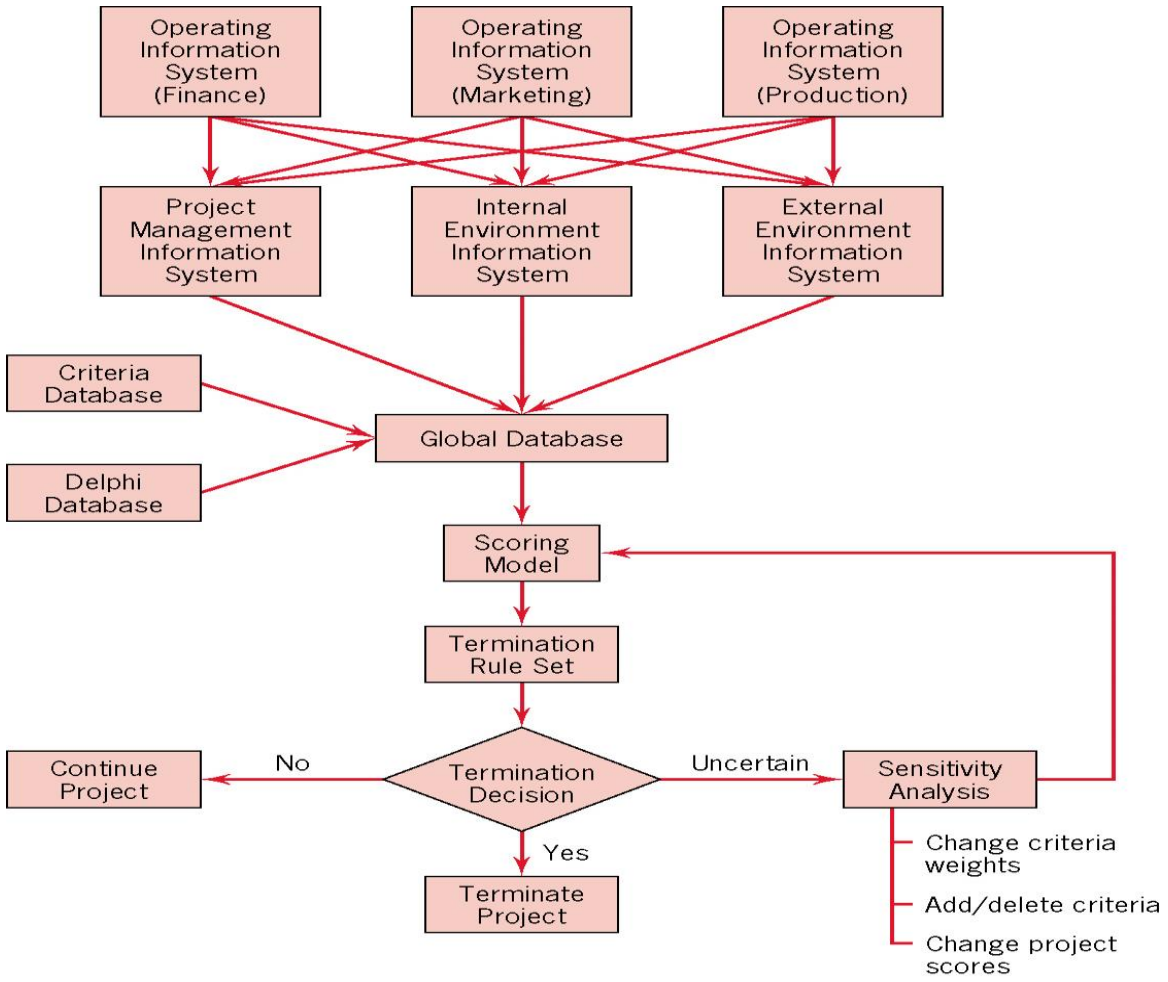
So it makes sense to plan and execute termination with care

Upon successful completion, or . . .

When the organization is no longer willing to invest the time and cost required to complete the project, given its current status and expected outcome.

Most Common Reasons Projects Terminate are-

1. Low probability of technical/commercial success
2. Low profitability/ROI/market potential
3. Damaging cost growth
4. Change in competitive factors/market needs
5. Irresolvable technical problems
6. Higher priority of competing projects
7. Schedule delays



Four Varieties of Project Termination

"Termination by extinction"

Project has successfully completed, or it has failed

Natural passing, or "termination by murder"

Either way, project substance ceases, but much work needs to be done

Administrative Organizational

"Termination by addition"

The project becomes a formal part of the parent organization

People, material, facilities transition

The example of Nucor

"Termination by integration"

Project assets are distributed to and absorbed by the parent

"Termination by starvation"

Withdrawal of "life support"

Can save "face," avoid embarrassment, evade admission of defeat

4. Summary

Risk refers to the chance that some unfavorable event might occur. No project should be undertaken unless the expected rate of return is ascertained in an environment of uncertainty, business operates and managers can never be sure about what might happen in the future. The various types of risk encountered during project financing are project risk, credit risk, Commercial risk etc. Different methods helpful to the evaluator enable them to take sound and wise decision based on their data and evaluation techniques. In this way in-depth understating of the project reduces chances for termination and abandonment.