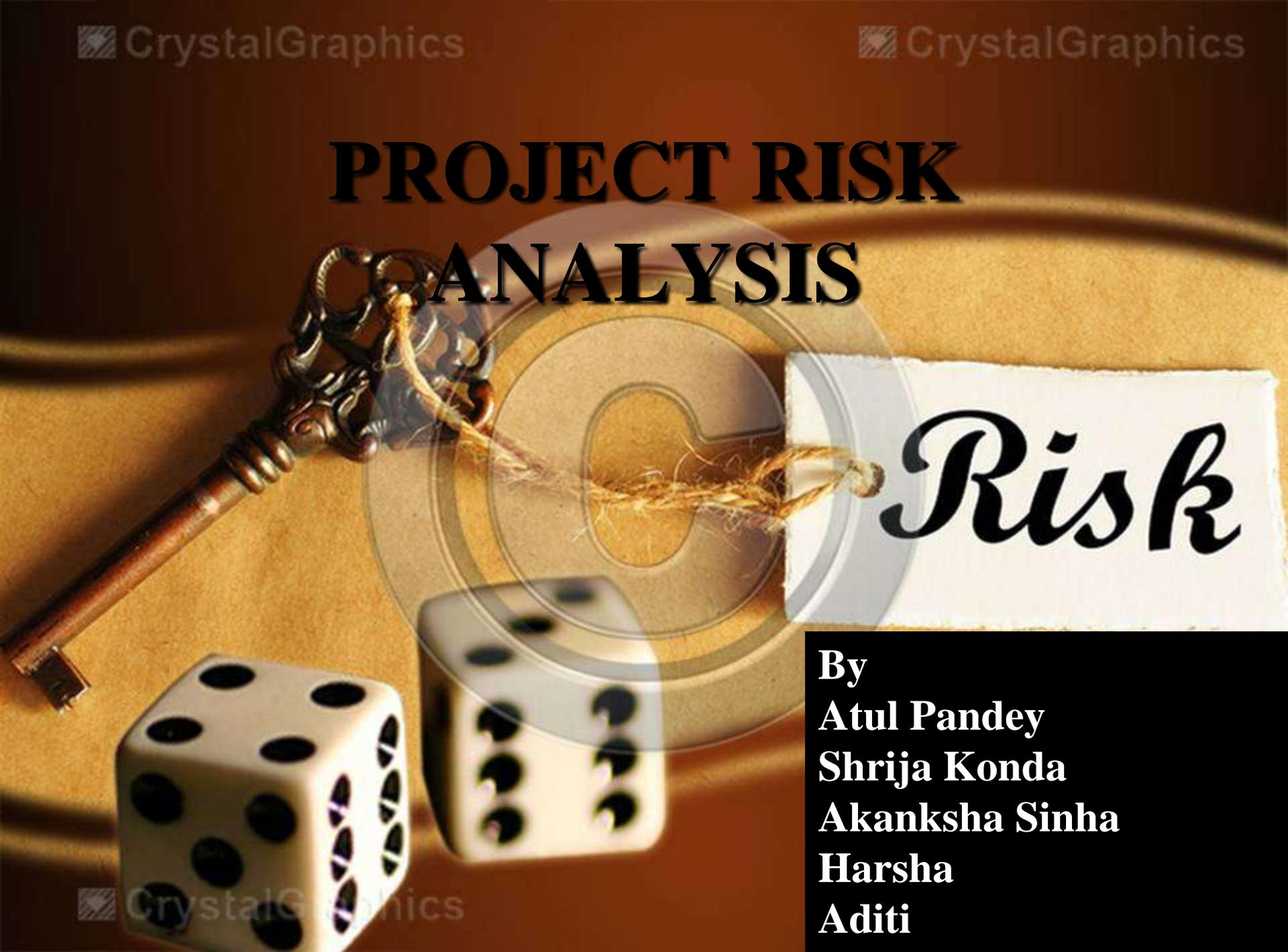


PROJECT RISK ANALYSIS



Risk

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Risk

INTRODUCTION

- Through this presentation we will try to identify the underlying sources of risk and explore the consequences.
- Risk is inherent in almost every business decision. More so in capital budgeting decisions as they involve cost and benefits extending over a long period of time during which many things can change in unanticipated ways.
- The following slide suggests ways to handle risk in capital budgeting.

Risk

Techniques of risk analysis

Analysis of stand-alone risk

Analysis of contextual risk

Sensitivity analysis

Scenario analysis

Corporate risk analysis

Market risk analysis

Break-even analysis

Hillier model

Simulation analysis

Decision tree analysis

Risk

SOURCES OF RISK

- Project risk
- Competitive risk
- Industry-specific risk
- Market risk
- International risk

MEASURES OF RISK

NAV	PROBABILITY
200	0.3
600	0.5
900	0.2

PROBABILITY WEIGHTED NPV:

$$\begin{aligned} E(\text{NPV}) &= \sum P_i \text{NPV}_i \\ &= 0.3 \times 200 + 0.5 \times 600 + 0.2 \times 900 \\ &= 540 \text{ (expected value)} \end{aligned}$$

$$\begin{aligned} \text{RANGE} &= \text{highest value} - \text{lowest value} \\ &= 900 - 200 \\ &= 700 \end{aligned}$$

Risk

Standard deviation

$$\begin{aligned}\sigma &= [\sum P_i(X - \bar{X})^2]^{1/2} \\ &= 249.8\end{aligned}$$

$$\begin{aligned}\text{VARIANCE} &= \text{square of Std Deviation} \\ &= 249.8^2 \\ &= 62400\end{aligned}$$

$$\begin{aligned}\text{Coefficient of variance} &= \text{std dev/ expected value} \\ &= 249.8 / 540 \\ &= 0.46\end{aligned}$$

$$\text{SEMI VARIANCE} = \sum P_i D_i^2$$

$$\begin{aligned}\text{VARIANCE} &= 0.3(200-540)^2 \\ &= 34680.\end{aligned}$$



Risk

SENSITIVITY ANALYSIS

Sensitivity of NPV to variations in the value of key variables

Key variables	Range			NPV		
	Pessimistic	Expected	Optimistic	Pessimistic	Expected	Optimistic
Investment (m)	24	20	18	-0.65	2.60	4.22
Sales (m)	15	18	21	-1.17	2.60	6.40
VC as % of sales	70	66.66	65	0.34	2.60	3.73
Fixed cost (m)	1.3	1	0.8	1.47	2.60	3.33

SCENARIO ANALYSIS

- In this analysis several variables are varied simultaneously. Most commonly 3 scenarios are considered.
- 3 scenarios are:
 - Expected scenario
 - Pessimistic scenario
 - Optimistic scenario

Risk

Cont...

Rs. In millions	Pessimistic scenario	Expected scenario	Optimistic scenario
investment	24	20	18
Sales	15	18	21
Variable cost	10.5(70%)	12(66.7%)	13.65(65%)
Fixed cost	1.3	1	0.8
Depreciation	2.4	2	1.8
Pre tax profit	0.8	3	4.75
Tax	0.27	1	1.58
Profit after tax	0.53	2	3.17
Annual cash flow from operations	2.93	4	4.97
NPV(PVIFA:12%,10 years)	(7.45)	2.6	10.06

LIMITATIONS

- Based on the assumption that there are few extreme scenarios. the economy does not necessarily lie in 3 discrete states - Recession, Stability and Boom.
- It expands the concept of estimating the expected values. thus in a case where there are 10 inputs the analyst has to estimate $30(3*10)$ expected values to do the analysis

BREAK EVEN ANALYSIS

- This analysis helps in knowing how much should be produced and sold at a minimum to ensure that the project does not “lose money”.
- BEP occurs when
- Total revenue = Total cost

TYPES OF BREAK EVEN ANALYSIS

- Accounting break even analysis:
- Break even in accounting terms is like a stock that gives a return of 0% without considering the time value of money
- A project that merely breaks even in accounting terms will have a negative NPV.
- Financial Break-even Analysis: It takes into account the time value of money and is only concerned with the NPV and not accounting profits.



Risk

MANAGING RISK

A common way to modify the risk is to change the proportion of fixed and variable cost.

Fixed and Variable cost

RISK

A lower price increases the potential demand, but also raises the break-even level

Pricing Strategy

RISK

Start with small product and later expand as the market grows.

Sequential Investment

RISK

Gather more information about the market and technology before taking the plunge.

Improving Information

RISK

Reducing the dependence on debt lowers risk.

Financial Leverage

RISK

Enter into long-term arrangements with suppliers, employees, lenders and customers.

Long-term Arrangements

RISK

Partnership between two or more companies to achieve a common purpose.

Strategic Alliance

RISK

Derivative instruments like options and futures can be used for managing risk.

Derivatives

RISK



Risk

PROJECT SELECTION UNDER RISK

Judgmental Evaluation

Payback Period Requirement

Risk Adjusted Discount Rate Method

Certainty Equivalent Method

Risk

JUDGMENTAL EVALUATION:

The decision is made on the basis of risk and return characteristics of a project without using any formal method.



PAYBACK PERIOD REQUIREMENT:

If an investment is considered more risky, a shorter payback period is required even if the NPV is positive or IRR exceeds the hurdle rate.



Risk

RISK ADJUSTED DISCOUNT RATE METHOD:

This method calls for adjusting the discount rate to reflect project risk.

**Risk-adjusted
discount rate**

=

**Risk free
rate**

+

**Risk
premium**

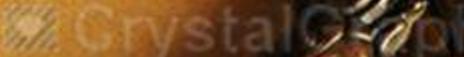
- If project risk is equal to the risk of existing investment of the firm, the discount rate used is the average cost of capital of the firm.
- If project risk is greater than the risk of existing investment of the firm, the discount rate used is higher than the average cost of capital of the firm.
- If project risk is less than the risk of existing investment of the firm, the discount rate used is less than the average cost of capital of the firm.

Risk

The project is accepted if its NPV is positive:

$$\text{NPV} = \sum_{t=1}^n \frac{A_t}{(1+r_k)^t} - 1$$

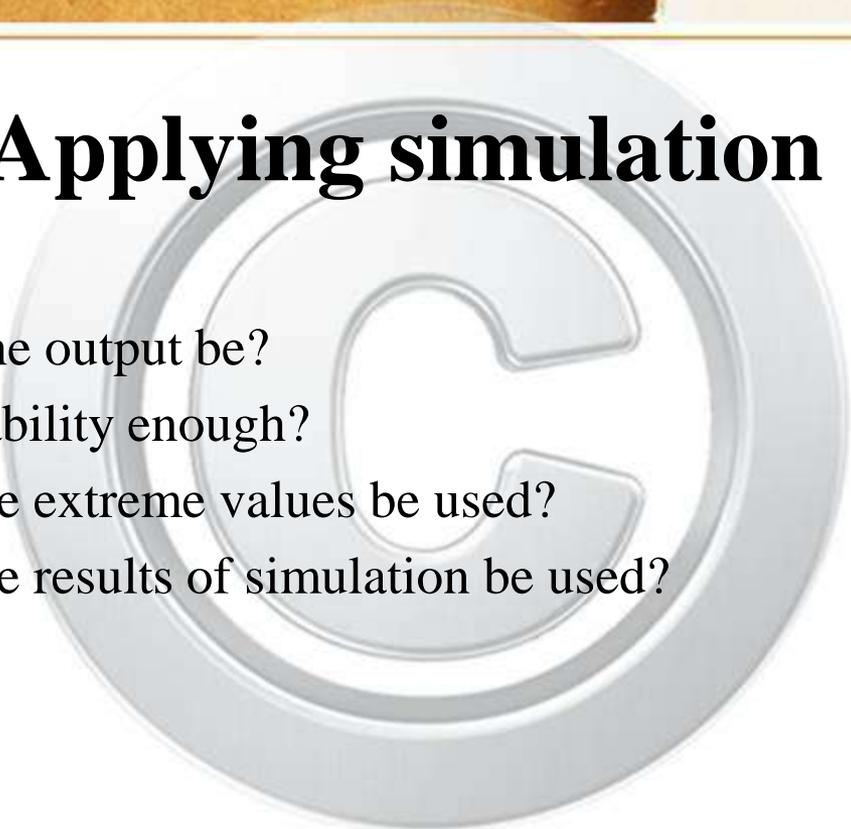
Where, NPV is the net present value of project k,
 A_t is the expected cash flow for year t, and
 r_k is the risk adjust discount rate of project k,



Simulation Analysis

- Procedure

1. Model the project. The model of the project shows how the net present value is related to the parameters and the exogenous variables.
 2. Specify the values of parameters and the probability distributions of the exogenous variables.
 3. Select a value, at random, from the probability distribution of each of the exogenous variable.
 4. Determine the net present value corresponding to the randomly generated values of exogenous variables and pre-specified parameter values.
 5. Repeat 3 & 4 steps to get a large number of simulated net present values
 6. Plot frequency distribution of the net present value.
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- CrystalGraphics



Issues in Applying simulation

- What should the output be?
- Is project variability enough?
- How should the extreme values be used?
- How should the results of simulation be used?

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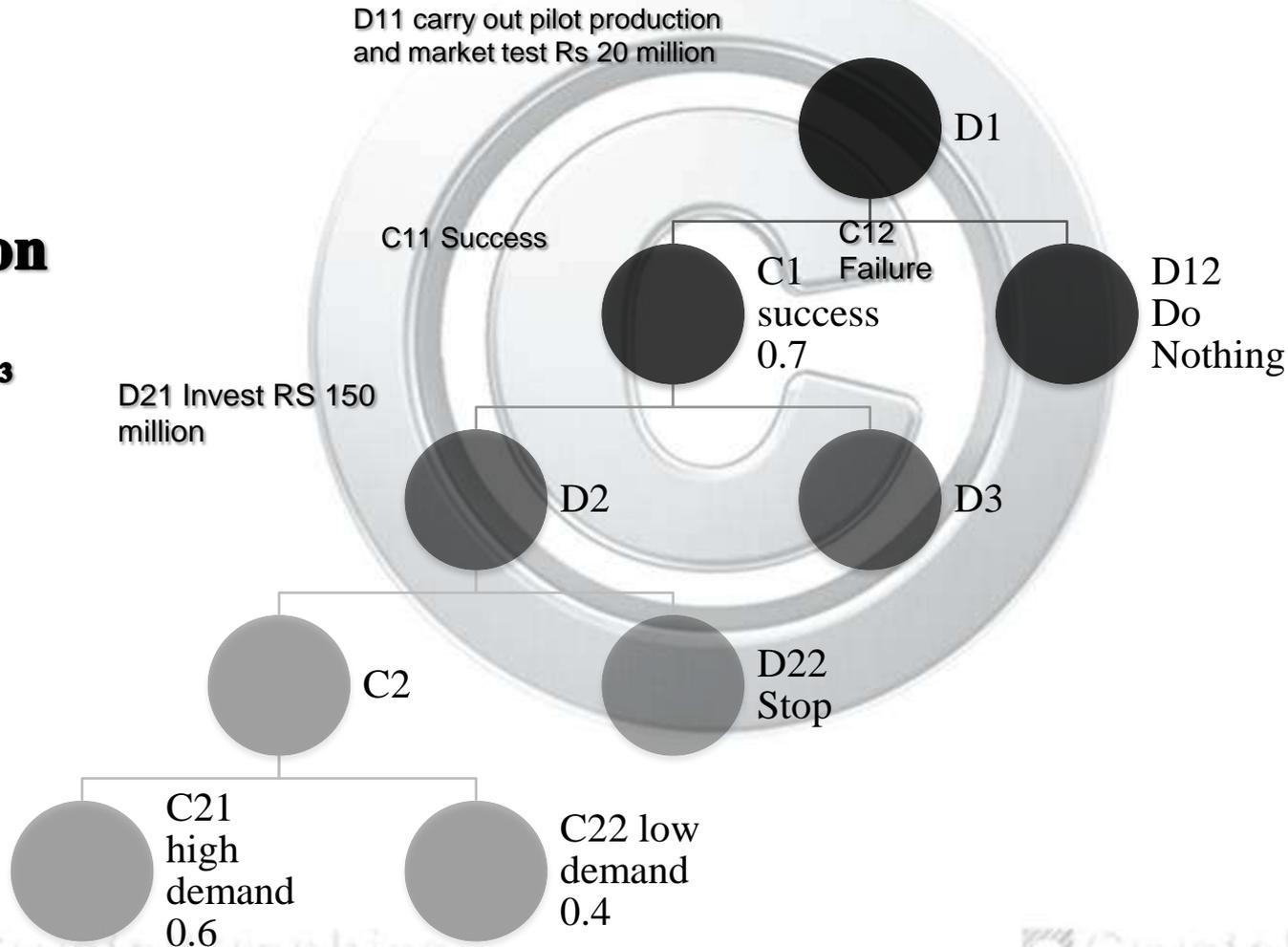
Decision Tree Analysis

- Identify the Problem & Alternatives.
- Delineating the Decision Tree.
- Specifying the probabilities & Monetary Outcomes.
- Evaluating various decision alternatives.

Risk

Decision Tree

Exhibit 11.13



CERTAINTY EQUIVALENT METHOD

- It is a method which is used to calculate a guaranteed return that someone would accept, rather than taking a chance on a higher, but uncertain, return.
- Under this method NPV is calculated as
- $NPV = \sum(\alpha t * A_t / (1+i)^t) - I$
- αt = certainty equivalent coefficient (0.5-1)
- A_t = expected cash flow
- i = risk free interest rate
- I = initial investment

METHODS TO INCORPORATE RISK

- Conservative estimation of revenues: Revenues expected from a project are conservatively estimated to ensure the viability of the project
- Safety margin in cost figures: A margin of safety is included in estimating cost figures
- Flexible investment yardsticks: The cut off point for an investment varies according to the judgment of management about the riskiness of the project

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Risk

- Acceptable overall certainty index: Most companies calculate this index based on factors affecting the success of the project.

E.g.:

Raw material availability 70%

Power availability 60%

Freedom from competition 80%

Overall certainty = $(70+60+80)/3 = 70\%$

Risk

Cont...

- Judgment on three point estimates:
- Three estimates are developed for one or more aspects of the proposed investment.
- E.g.:
- Rate of return:
 - Pessimistic
 - Likely
 - optimistic



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*Thank
You*