ESOP
STRATEGIES & ITS INTRICACIES

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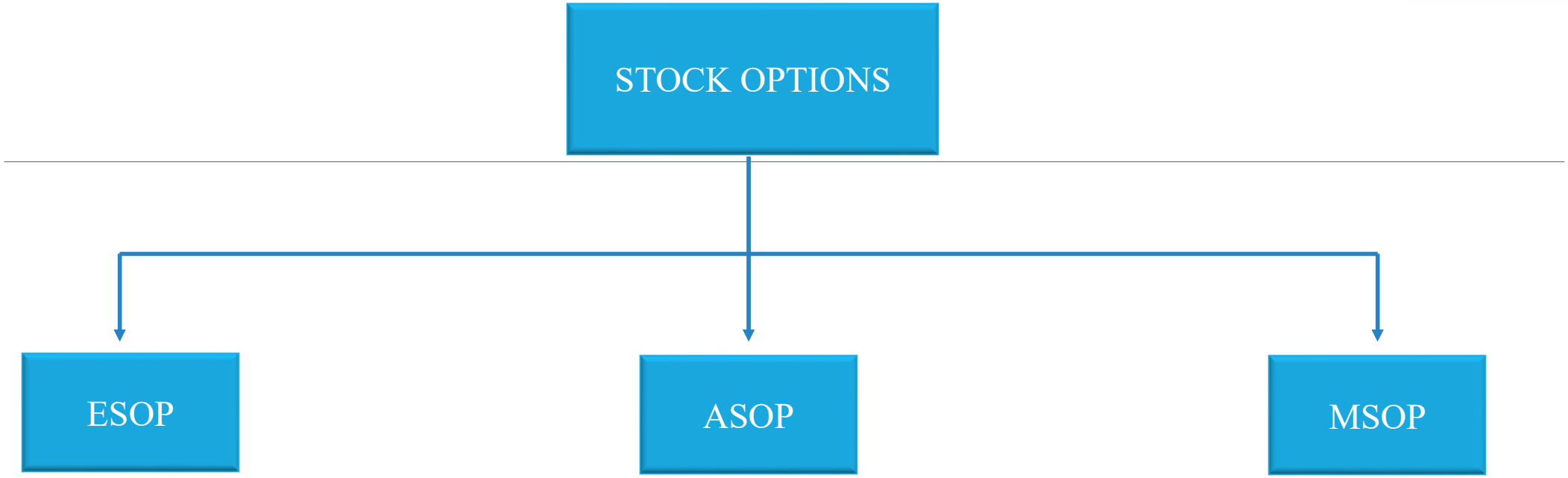
AGENDA & COVERAGE

- Overview on ESOPs: Meaning, Concept & Types
- ESOP Structures
- Applicability of Companies Act
- Income Tax position
- Accounting & Valuation Aspects

Overview on ESOPs: Meaning, Concept & Types

SECTION I



ESOP: Grants employees company shares to align interests and provide retirement benefits.

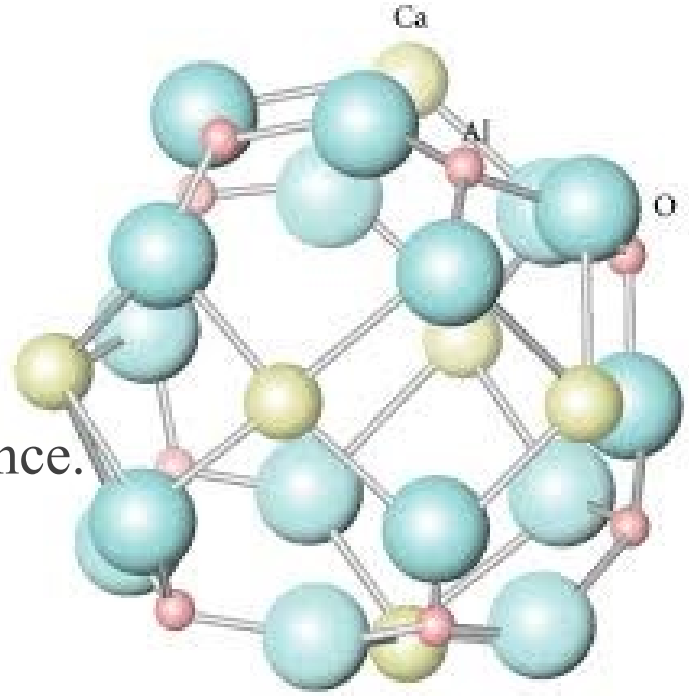
ASOP: Awards employees stock options as part of their compensation package.

MSOP: Offers management stock options to incentivize and retain key executives.

ESOP (EMPLOYEE STOCK OWNERSHIP PLAN)

ESOPs defined as tools that:

- ***Grants Ownership:*** Employees acquire company shares.
- ***Aligns Interests:*** Incentivize employees with company performance.
- ***Provides Savings:*** Offer a retirement benefit for employees.



ESOP TERMINOLOGIES

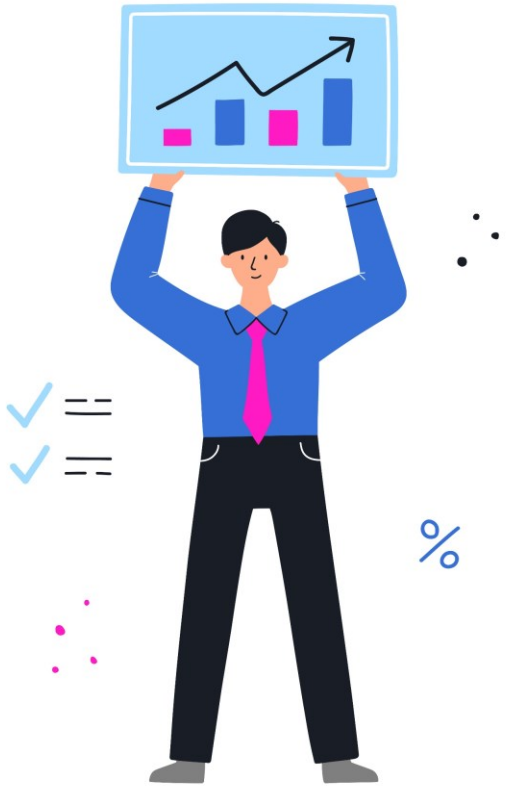
Grant Price / Exercise Price	*Vesting Period*	*Exercise*	*Exercise Period*
• The price at which shares are offered to the employees.	• The period after which the options can be converted into shares.	• The action of paying the price and converting the options into shares.	• The period after vesting within which the employee has to take the decision of exercising Options.

ADVANTAGES OF ESOPS

- **Boosts Motivation**: Aligns employee interests with company success.
- **Enhances Retention**: Encourages long-term commitment.
- **Tax Benefits**: Provides favorable tax treatment for employees.
- **Succession Planning**: Facilitates smooth ownership transitions.

FACTORS COMPANIES CONSIDER WHEN GRANTING ESOPs

- Loyalty
- Performance
- Designation
- Present & Potential Contribution
- Opportunity Cost



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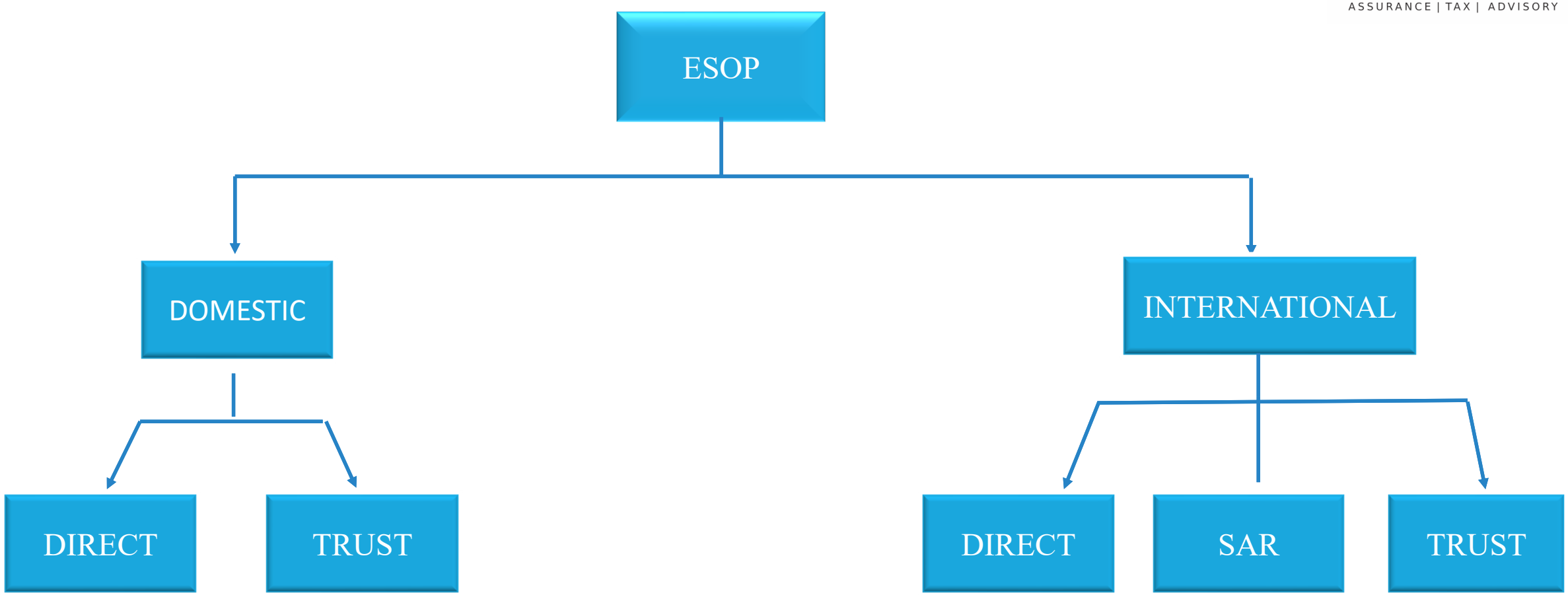
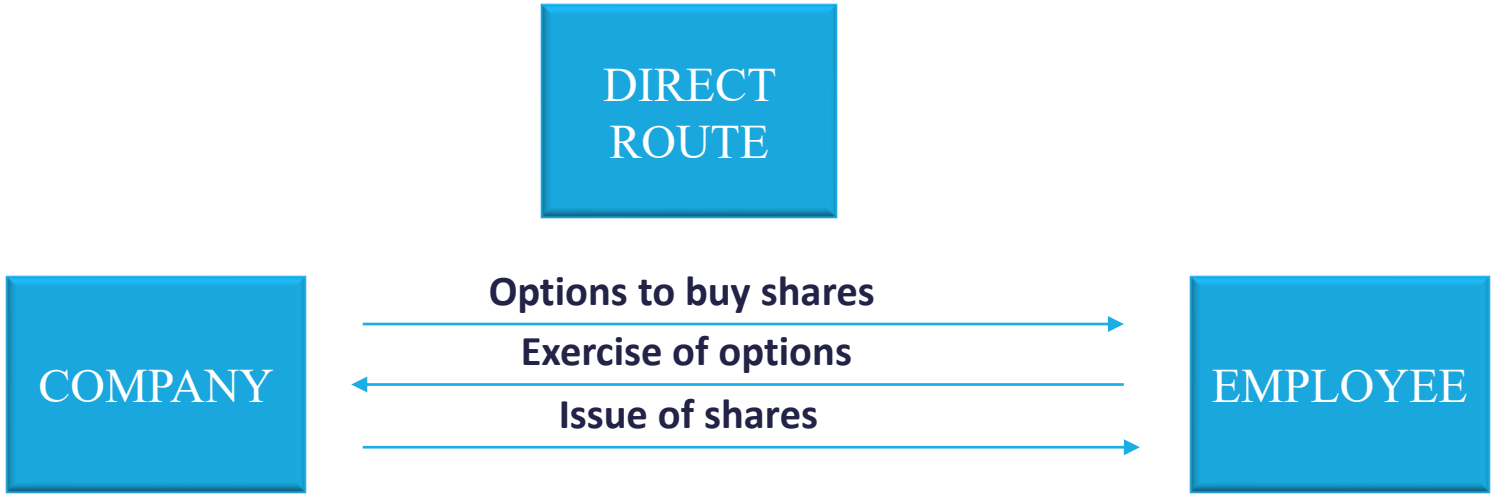
ESOP STRUCTURES

SECTION II


ESOP
DOMESTIC
INTERNATIONAL
DIRECT
TRUST
DIRECT
SAR
TRUST

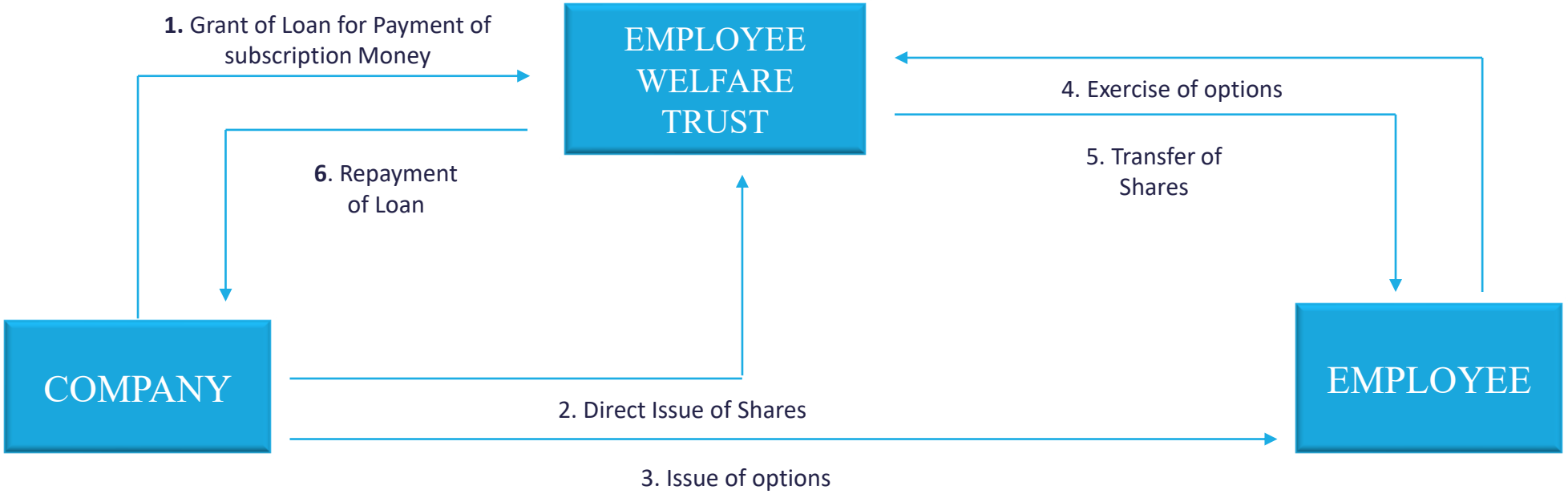
DIRECT ROUTE

The route involves issuing stock options under ESOP to eligible employees, who exercise these options after the vesting period, leading to a fresh issue of shares and making them company shareholders.



TRUST ROUTE

A separate entity is created, which is called employee welfare trust and this trust keeps shares in a fiduciary position for the employees and whenever employee exercises his option, trust transfers shares to the concern employee who has exercised his options.

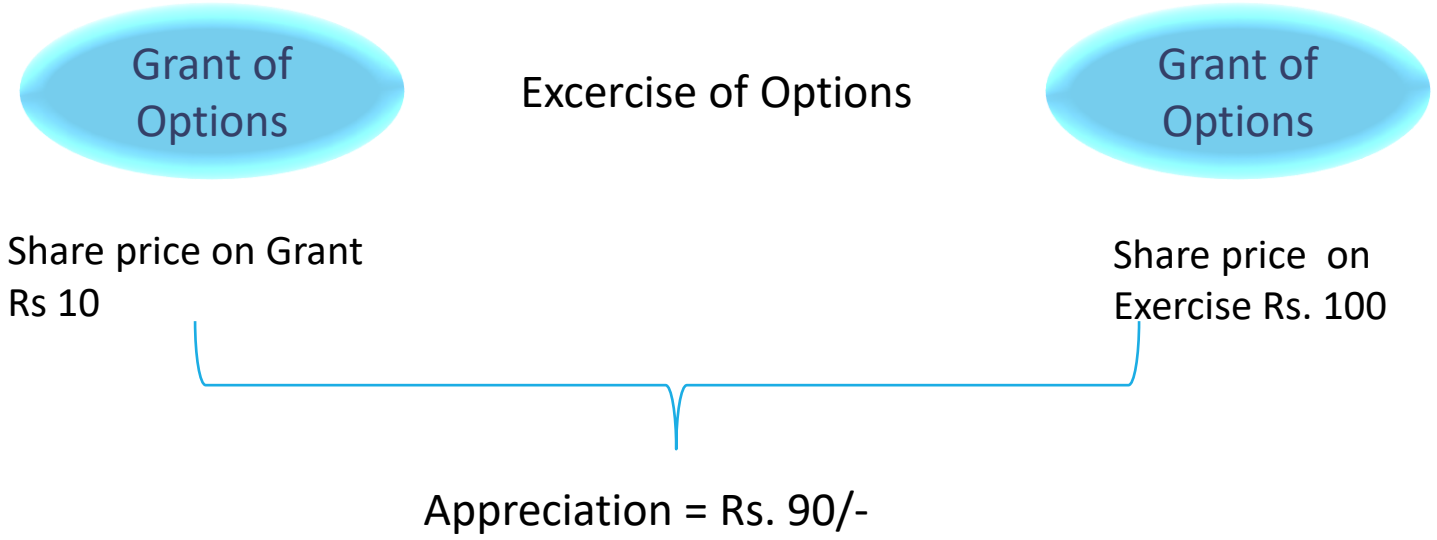


TRUST ROUTE

- ***Trustee of ESOP Trust:***
  - For Private Companies : *Anyone can be a Trustee*
  - For Public Unlisted & Listed Companies : *Anyone can be a Trustee except a person:*
    - *i. is a director, key managerial personnel or promoter of the company or its holding, subsidiary or associate company or any relative of such director, key managerial personnel or promoter; or*
    - *ii. beneficially holds ten percent or more of the paid-up share capital of the company.*

SAR: STOCK APPRECIATION RIGHTS

A stock appreciation right (SAR) is a form of cash / equity given to employees that is equal to the appreciation of company share price over an established time period.



INTERNATIONAL ROUTE

Transfer of ESOPs in Indian Company to Overseas Employee

Transfer of ESOPs in Overseas Company to Indian Employee

TRANSFER OF ESOPs IN INDIAN COMPANY TO OVERSEAS EMPLOYEE

- An Indian company is permitted to issue ESOPs to non resident employees of its holding company / joint venture / wholly owned overseas subsidiary subject to the following conditions:
  - ❑ The ESOP scheme is in accordance with regulations issued under SEBI Act 1992 / rules notified by Central Government under the Companies Act 2013.
  - ❑ The ESOP is in compliance with the sectoral cap applicable to the said company.
  - ❑ Issue of ESOP in a company where investment by non resident is under approval route requires prior Government approval.
  - ❑ Issue of ESOP to a citizen of Bangladesh / Pakistan requires prior Government approval.
  - ❑ The Indian company must report the issuance of ESOPs to the overseas employees to the RBI through the designated Authorized Dealer (AD) bank within a specified time frame.

TRANSFER OF ESOPS IN OVERSEAS COMPANY TO INDIAN EMPLOYEE

- Resident individuals can acquire foreign securities under stock option scheme of its overseas parent / subsidiary company provided:
  - ❑ The Options are issued to the employee under Cashless Employee Stock Option Scheme / does not involve any remittance from India.
- An Indian company in knowledge based industry may allow its resident employees to purchase foreign securities under the ADR/GDR linked stock option scheme provided it is in accordance with applicable guidelines.
- The Indian subsidiary or branch must notify the RBI through the AD bank about the issuance of ESOPs by the overseas company within a specified time frame.

BLACK MONEY VIS-À-VIS ESOP

❑ *Foreign Asset Disclosure for ESOPs under Black Money Act.*

➢ **ESOPs / SARs by Foreign Parent Companies:**

- Considered as **"foreign assets"** for Indian employees.
- Must be disclosed under **"Schedule FA"** in the income tax return.

➢ **Disclosure Requirements:**

- Applicable to resident taxpayers (Indian employees).
- Non-disclosure can attract penalties of Rs.10,00,000 under Section 42/43of the Black Money Act and imprisonment for a term which shall not be less than 6 months, but which may be extended to 7 years.

BLACK MONEY VIS-À-VIS ESOP

- *The Black Money (Undisclosed Foreign Income and Assets) and Imposition of Tax Act, 2015*, effective from July 1, 2015, addresses Black Money issues by establishing procedures for handling undisclosed foreign income and assets and imposing tax on such assets held outside India.

- ***Definition of "UNDISCLOSED ASSET LOCATED OUTSIDE INDIA"***

  Section 2(11) of the Black Money Act, ***"Undisclosed asset located outside India"*** *means an asset (including financial interest in any entity) located outside India, held by the assessee, in his name or in respect of which he is a beneficial owner, and he has no explanation about the source of investment in such asset or the explanation given by him is in the opinion of the Assessing Officer unsatisfactory;*

REGULATORY FRAMEWORK

UNLISTED COMPANY

- Companies Act, 2013 & Applicable Rules
- Income Tax Act, 1961

LISTED COMPANY

- SEBI (SBEB) Regulations, 2014.
- SEBI (LODR) Regulations, 2015.
- SEBI (PIT) Regulations, 2015.
- Income Tax Act, 1961

WHEN FOREIGN EMPLOYEE ARE COVERED

Foreign Exchange Management Act, 1999

FEMA PROVISIONS APPLICABILITY ON ISSUING ESOPs

- Now there is no limit on %age of capital which can be issued as ESOP to foreign employees.
- Companies need to adhere the provisions of CA, 2013/ SEBI Regulations, as the case may be, while issuing ESOPs outside India.
- Companies falling under Approval Route need to obtain prior approval for issuing ESOPs
- Form ESOP is required to be filed with AD-Bank within 30 days of Grant of Options
- Form FC-GPR to be filed with AD-Bank within 30 days of allotment of shares

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COMPANIES ACT 2013

SECTION III

APPLICABILITY OF COMPANIES ACT, 2013

Section 62 (1) (b) of Companies Act, 2013-

- Where at any time, a company having a share capital proposes to increase its subscribed capital by the issue of further shares, such shares shall be offered to employees under a scheme of employees' stock option, subject to **special resolution passed by company** and subject to such conditions as may be prescribed.
- Such prescribed conditions are mentioned in Rule 12 of The Companies (Share Capital and Debentures) Rules, 2014.

HOW TO ISSUE ESOPs

Part 1 – Pre - Grant Process

Board Meeting - 1

In Principal Decision to Grant ESOPs

Appointment of Consultant / Internal Team for Drafting ESOP Scheme

Board Meeting - 2

Approval of ESOP Scheme

Preparing Recommended

- List of Employees / Class of Employees / Manner of Selection of Employees eligible for ESOPs
- Appropriate ESOP Pool
- Authorization to Grant ESOPs subject to Scheme and Guidelines approved by Shareholders.

Extra Ordinary General Meeting

Approval by way of Special Resolution of

- ESOP Scheme
- Delegation of Powers to grant ESOPs up to the Level of ESOP Pool to multiple Employees / Class of Employees etc

HOW TO ISSUE ESOPs

Part 2 – Grant, Vesting & Exercise Process

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Grant

Approval of ESOPs to be Issued by Board Meeting

Issuance of Grant Letter in terms of ESOP Scheme

Vesting

The Options shall vest in an Employee over the Vesting Period (Not Less than 1 year)

ESOP Scheme may include circumstances in which ESOPs Granted / Vested can be terminated

- Cessation of Employment (Normally Grants Lapse and Vested Options Continue)
- Termination due to Breach of Duty / Disciplinary Reasons / Fraud – All Granted / Vested may Lapse

Exercise

Employee can exercise Options once Vested and Before Expiry

Expiry is normally some years from last vesting or cessation of employment or linked to a Pre-IPO event

On Exercise, an employee shall give

- Request for Exercise
- Pay the Exercise Price
- Pay the Applicable Withholding Tax on Gain, except in cases of Eligible Startup (where taxability is deferred for 5 years)

ALLOTMENT OF SHARES TO THE EMPLOYEES

THE COMPANIES (SHARE CAPITAL AND DEBENTURES) RULES, 2014:

- Applicability
- Eligibility
- Shareholders approval
  - Special Resolution
  - Separate resolution for grant to Subsidiary / Holding employees or to identified employees equal to or greater than 1% of issued capital.
- Pricing & Lock in
- Accounting for ESOPs as per AS / IndAS / ICAI guidance note.
- Annual disclosures in Directors' Report
- Register to be maintained.
- Administration.

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INCOME TAX ACT 1961

SECTION IV

TAX IMPACT ON ESOP

Grant of ESOP: When the ESOP is granted to the employee, it is not taxable as income. However, when the employee exercises the ESOP and acquires the shares, the difference between the fair market value of the shares on the date of exercise and the exercise price paid by the employee is taxable as perquisite in the hands of the employee.

Sale of ESOP shares: When the employee sells the ESOP shares, the difference between the sale price and the fair market value of the shares on the exercise date is treated as capital gains.

Tax deduction for employers: Employers can claim a tax deduction for the cost of the shares issued to employees under the ESOP scheme.

POSITION OF INCOME TAX ACT

- ***ESOP Taxation Shift:*** From FBT to 'Perquisites' taxable in employees' hands.
- ***Cost Basis:*** FMV on exercise date as acquisition cost; taxable in India for foreign ESOPs.
- ***Two-Stage Taxation:***
  - First, as 'Perquisite' on exercise (FMV minus exercise price); TDS by employer or Payment within 5 years by Employee.
  - Secondly, Capital Gain on Sale of Shares (Sale Price – FMV)
- ***FMV Calculation:*** Average market price (listed shares) or Valuation Certificate (unlisted shares, max 180 days old).
- ***Capital Gains Tax:*** Upon sale, long-term (1+ year for listed, 2+ years for unlisted) at 10% (Section 112A) or 20% (unlisted); short-term at 15% (Section 111A).
- ***Indexation Option:***
  - Non – Resident - For Unlisted shares can opt for 10% tax without indexation or 20% with indexation
  - Resident – 20% with Taxation

TAX TREATMENT FOR EMPLOYEES

❑ ***Example (Perquisite Tax):***

FMV on Exercise :- Rs.100/-

Exercise Price :- Rs.10/-

Perquisite Value :- (Rs.100 – Rs.10) = Rs.90/-

Tax @ 20%* :- Rs.18/-

** Tax as per applicable slab, assumed to be 20% in given case for simplicity.*

❑ ***Example : (Capital Gain Tax)***

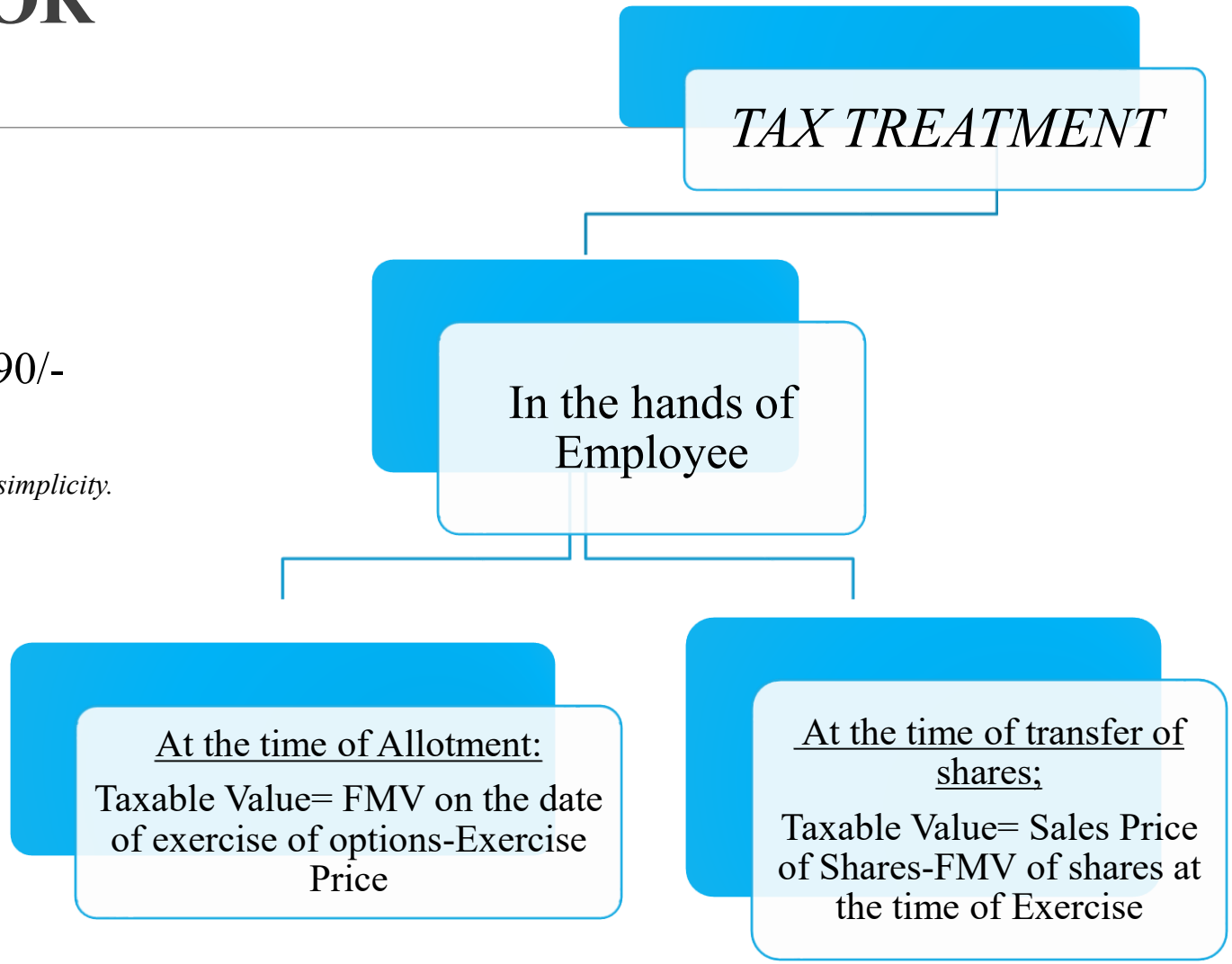
Sale value :- Rs.120/-

Holding period less than 1 year

Short Term Capital Gain

Gain Value: - (Rs.120– Rs.100) = Rs.20

Tax @ 15% :- Rs.3/-



TAX TREATMENT FOR COMPANIES

Company has no tax liability, it has to book Compensation Cost in its P&L Account

- *Point of Calculation :* ***Grant***
- *Period of Booking :* ***Over vesting period***

Decided Judgements:

- *In the Case of* ***CIT vs. Lemon tree Hotels Ltd.*****, August, 2015**, it was decided that the expense incurred by employer is allowable and can be debited from P&L account of the company.
- In the case of ***CIT(A) vs. People Interactive India Pvt. Ltd.*****, October, 2015**, It was decided that discount under ESOP is in the nature of employee cost and hence is deductible during the vesting period.

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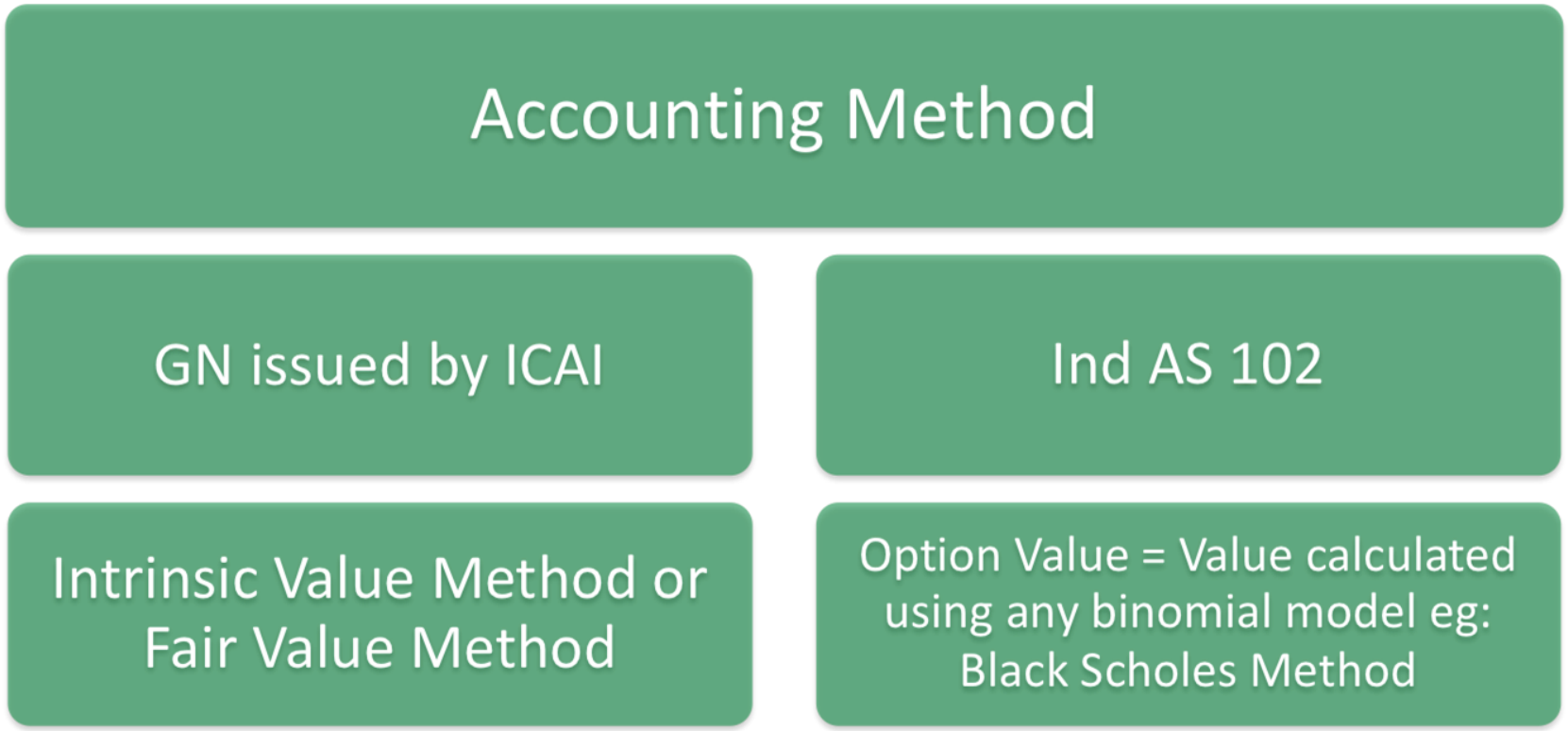
ACCOUNTING & VALUATION

SECTION V

ESOP Accounting



- Aggregate Option Value to be amortised over the vesting period on SLM.

Vesting: Types of Terms through which employee becomes eligible to exercise options

- Time-based vesting
- Graded vesting
- Milestone-based vesting
- Cliff vesting
- Hybrid vesting

There shall be a minimum period of one year between the grant of option and vesting of option subject to the proviso under Rule 12 (6)(a)

Intrinsic Value Method

- Market price as on the date of grant – Rs.100/-
- Exercise price per Option – Rs.25/-
- Number of Options Granted – 1000
- Vesting period – 100% after 3 years
- Date of Grant – 1st April 2023

- Intrinsic Value = 100 – 25 = 75 per Option
- Aggregate ESOP Cost = 1000 x 75 = 75,000
- ESOP cost to be debited to P&L
- –In 2023-24: (75000 / 1095 days) x 365 days = 25,000

Accounting in case of Graded Vesting

- Vesting period – 25% at the end of every 12 months (i.e. equal vesting over 4 years)
- Details of vesting of Options:
- 25 Options vest at the end of 1 year from date of grant.
- 25 Options vest at the end of 2 years from date of grant.
- 25 Options vest at the end of 3 years from date of grant.
- 25 Options vest at the end of 4 years from date of grant.

- Treat each vesting as a separate grant and calculate the accounting impact.

Accounting in case of Graded Vesting

- New Example:
- 25 Options granted on 1/4/23 which vesting 100% after 1 year.
- 25 Options granted on 1/4/23 which vesting 100% after 2 years.
- 25 Options granted on 1/4/23 which vesting 100% after 3 years.
- 25 Options granted on 1/4/23 which vesting 100% after 4 years.

- Previous Example:
- 100 Options granted with 25% vesting at end of every 12 months (i.e. equal vesting over 4 years)

- Treat each vesting as a separate grant and calculate the accounting impact.

Accounting Entries

- **At the end of each year (For amortization of ESOP cost)**

  Employee Compensation Expense A/c

  To Employee Stock Option Outstanding A/c

- **At the time of Exercise of Options**

  Bank A/c

  Employee Stock Option Outstanding A/c

  To Share Premium A/c

  To Share Capital A/c

- **If Options lapse**

  Employee Stock Option Outstanding A/c

  To Employee Compensation Expense A/c

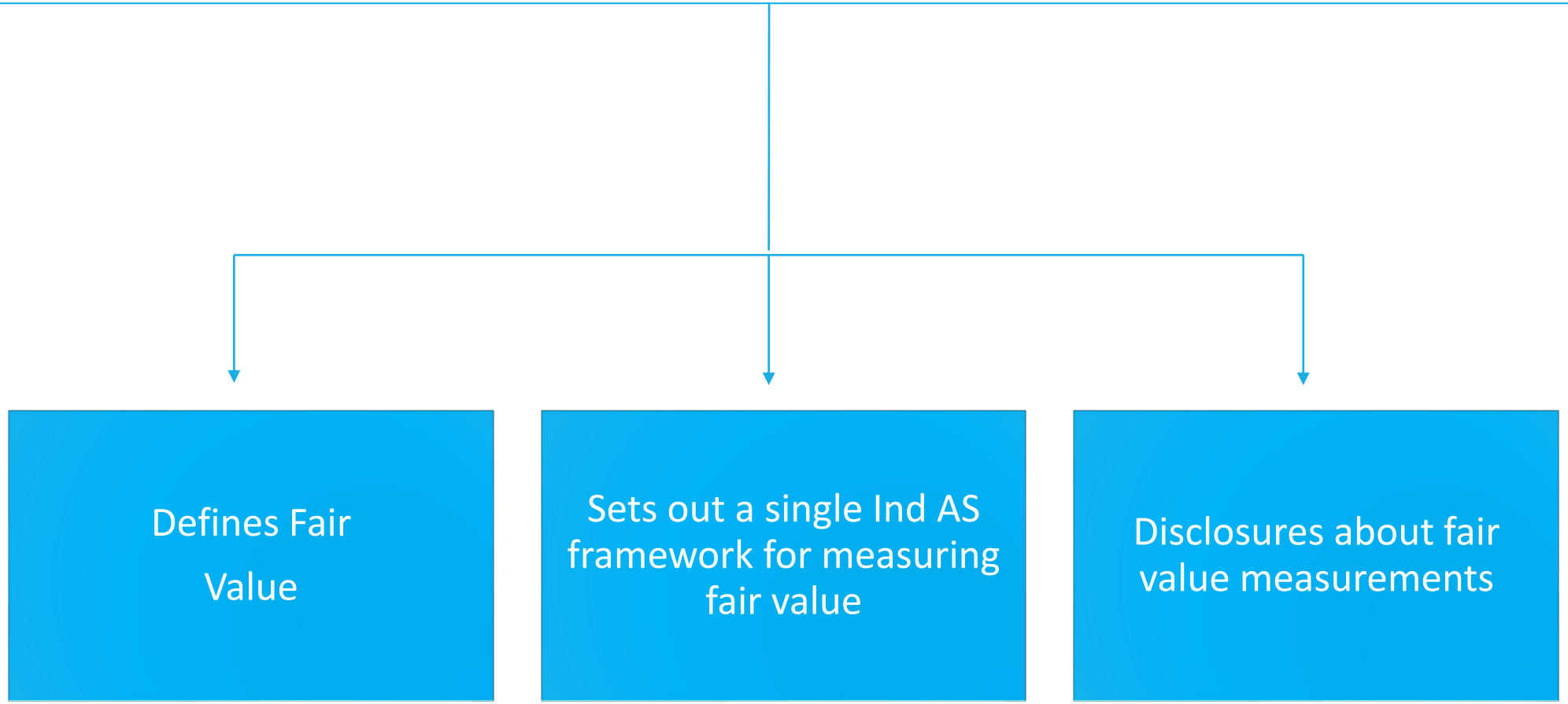
VALUATION ASPECTS

- An Employee Stock Option Plan (ESOP) is a plan through which the company grants stock options to the employees based on their performance.
- Stock option gives a right to an employee to acquire the company stock at the pre-determined price over a term which generally extends to many years usually 4 to 10 years.
- Presently, the Indian Accounting Standard (Ind AS) 102 specifies the financial reporting by the company when it undertakes a share-based payment transaction.
- **Companies to whom Ind AS 102 Applies**
  - *Financial Year 2016-17:* Listed and unlisted companies both with net worth above Rs. 500 crores
  - *Financial Year 2017-18:* All listed companies and unlisted companies with net worth above Rs 250 crores

VALUATION ASPECTS

- **Share-based payment transactions-Types**
  - Equity settled share-based payment transactions: Company receives goods/services as consideration for equity instruments. E.g. shares, options, warrants.
  - Cash settled share-based payment transactions: Company receives goods/services by incurring a liability to transfer cash or other assets to the supplier for amounts that are based on the price (or value) of the entity's shares. E.g. share appreciation rights
  - Share-based payment transactions with cash alternatives: Either the company or the counterparty (employee or non-employee) has a choice to settle in equity instruments or in cash or other assets
- **Fair value as per Ind AS 102:** For share options granted to employees, in many cases market prices are not available, because the options granted are subject to terms and conditions that do not apply to traded options. If traded options with similar terms and conditions do not exist, the fair value of the options granted shall be estimated by applying an option pricing model.

Ind AS 113: Fair Value Measurement



Key Principles

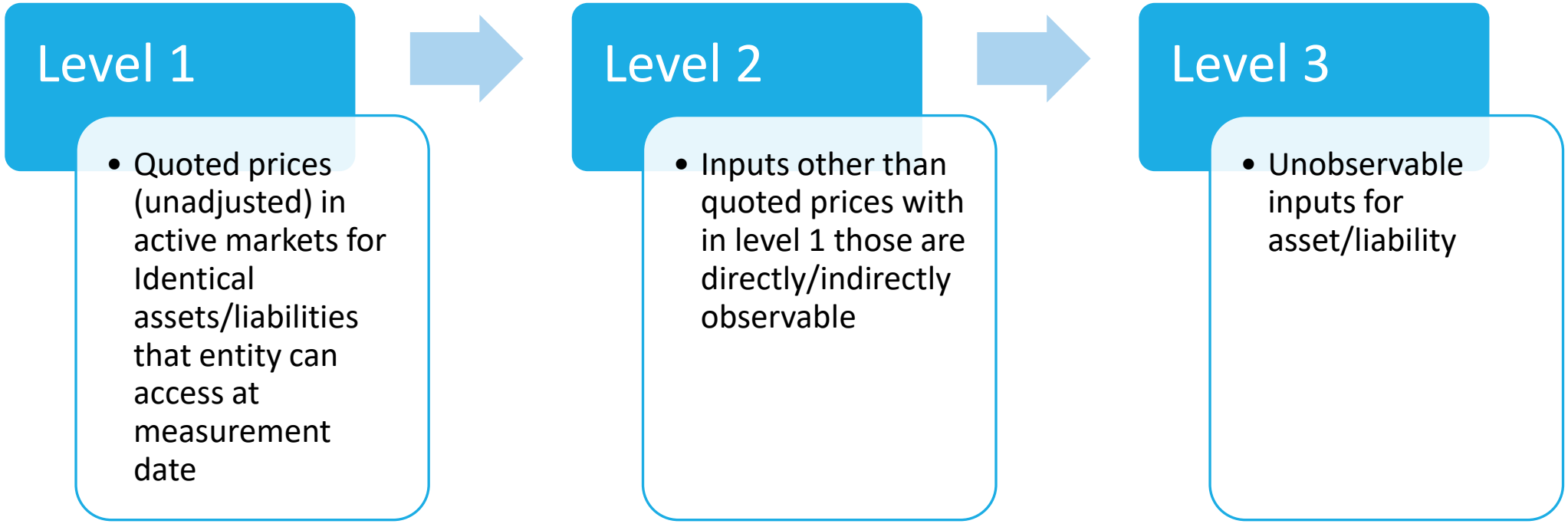
“Fair value is the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date.”

A fair value measurement requires determination of the following:

- The particular asset or liability that is the subject of measurement
- The highest and best use for a non-financial asset
- The principal (or most advantageous) market
- Fair value hierarchy
- The valuation technique Ind AS 113 addresses how to measure fair value, but does not stipulate when fair value can or should be used.

Fair Value Hierarchy

To increase the consistency and comparability in fair value assignments and related disclosures, fair value hierarchy categorises inputs into three levels as defined below.



Valuation techniques prescribed in Ind AS 113

Market approach

- Market Approach uses prices and other relevant information generated by market transactions involving comparable assets/liabilities/business , and considers qualitative and quantitative factors (Comparable Companies Valuation Method) by using market multiples (EBITDA, revenue, etc.) or matrix pricing (compare with benchmark securities).

Income Approach

- Income Approach converts future amounts to the current (i.e. discounted) amount (for example Cash Flows or Income and Expenses) resulting in the current market expectations about those future amounts. For example, Present Value Techniques, Option Pricing Models, Multi-period Excess Earning Method, etc.

Cost Approach

- Cost Approach reflects the amount that would be
- required currently to replace the service capacity
- of an asset. This approach is ideally used for
- tangible assets (Replacement Cost method).

Factors to be considered while selecting a valuation technique

- Appropriateness in the given facts and circumstances
- Availability of sufficient data
- Maximising the use of relevant observable inputs and minimising the use of unobservable inputs and as a result, multiple-valuation techniques can be applied.

If multiple valuation techniques are used to measure fair value, the results should be evaluated considering the reasonableness of the range of values. Fair value is the point within the range that is most representative of the fair value in the given scenario

Change in valuation techniques

Valuation techniques used to measure fair value shall be applied consistently. However, a change in the valuation technique or application of multiple valuation techniques is appropriate if the change results in a measurement that is equally or more representative of fair value in the circumstances.

Examples:

- New markets develop or market conditions change
- New information is available
- Information previously used is no longer available
- Valuation techniques improve

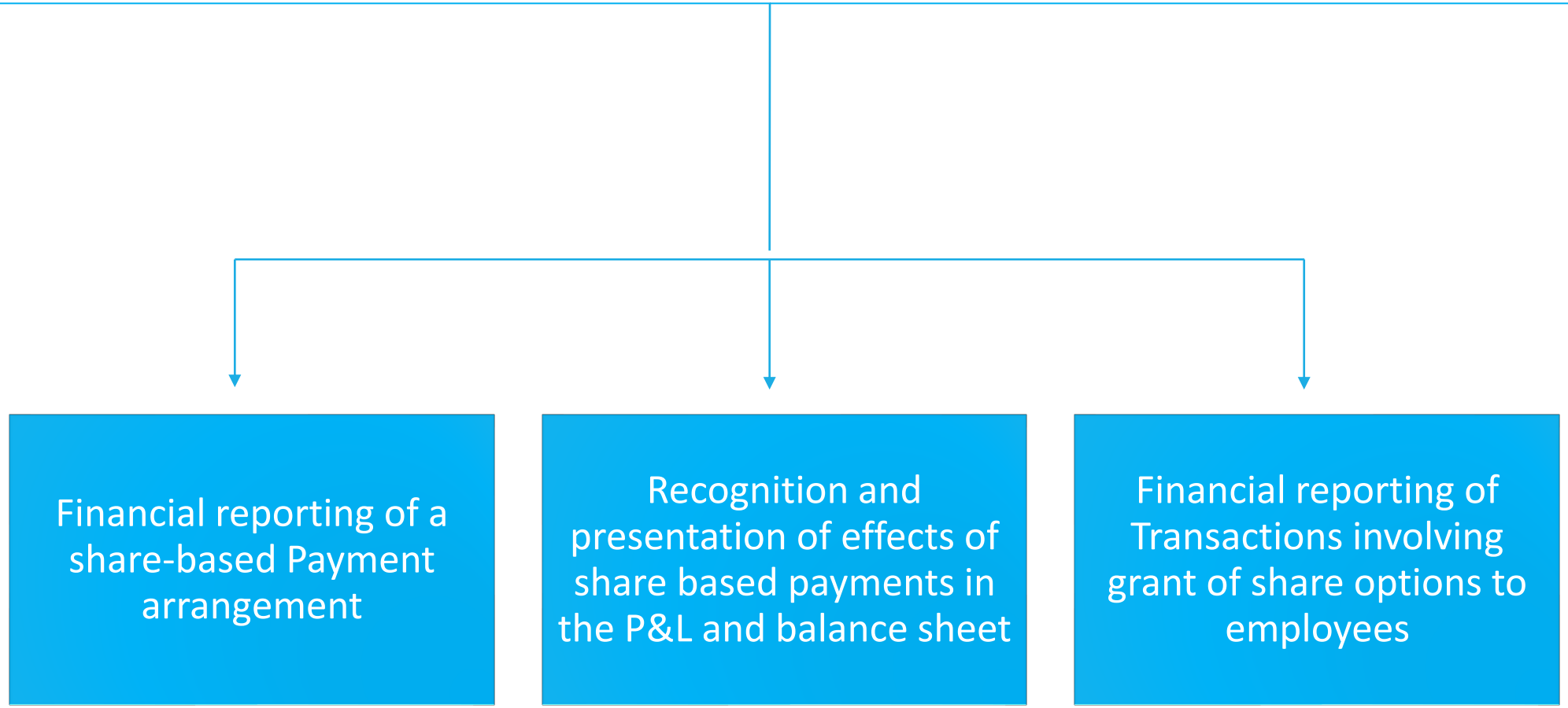
Disclosures

Ind AS 113 aims to equip the users of financial statements with additional transparency with respect to the following:

- The extent of usage of fair value in valuation of assets and liabilities
- Valuation techniques, inputs and assumptions used in measuring fair value
- The impact of level 3 fair value measurements on profit and loss account or Other Comprehensive Income (OCI).

The standard has set broad disclosure objectives and has also stipulated the minimum disclosures an entity must make.

Ind AS 102: Share-based Payment



Ind AS 102: Share-based Payment (Contd.)

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Share-based payment transaction

Share-based payment transaction is a transaction in which the entity:

- ❑ Receives goods or services from the supplier of those goods or services (including an employee) in a share-based payment agreement;

OR

- ❑ Incurs an obligation to settle the transaction with the supplier in a share-based payment arrangement when another group entity receives those goods or services.

Share-based payment arrangement

Share-based payment arrangement may be defined as an agreement between the entity (or another group entity or any shareholder of any group entity) and another party (including an employee) that entitles the other party to receive:

- ❑ Cash or other assets of the entity for amounts that are based on the price (or value) of the equity instruments (including shares or share options) of the entity or another group entity; OR
- ❑ Equity instruments (including shares or share options) of the entity or another group entity.

Ind AS 102: Share-based Payment (Contd.)

APPLICABILITY

Ind AS 102 is applicable to all share-based payments including:

- Equity-settled share-based payment transaction
- Cash-settled share-based payment transaction
- Share-based payment transactions with alternatives.

RECOGNITION

- All transactions involving share-based payment are recognised as expenses or assets over the underlying vesting period.
- Transactions with employees are to be measured at the date of grant and those with non-employees are measured when goods or services are received.

Ind AS 102: Share-based Payment (Contd.)

Measurement for Equity-Settled share-based payment transaction

Goods or services received by an entity are directly measured at fair value of such good or services received. In case fair value cannot be estimated reliably, the fair value is measured indirectly with reference to the fair value of the equity instruments granted.

Measurement for Cash-Settled share-based payment transaction

Goods or services received by an entity and the liability incurred will be measured at the fair value of the liability. The liability has to be re-measured at each reporting date up to the date of settlement, and the changes in the fair value are to be recognised in the profit and loss account for the period.

Measurement for transactions with employees

In case of transactions with employees, the fair value of the equity instruments must be used. In case fair value cannot be measured reliably, the intrinsic value of the equity instruments may be used.

Disclosure

- An entity shall disclose the information that enables users of the financial statements to understand the nature and extent of share-based payment arrangements that existed during the period. This Standard uses the term ‘fair value’ in a way that differs in some respects from the definition of fair value in Ind AS 113, Fair Value Measurement. Therefore, when applying Ind AS 102, an entity measures fair value in accordance with this Standard, not Ind AS 113.

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Option Pricing

- General Principals of Option Pricing
- Practical Use
- Black and Scholes Methodology
- Black and Scholes Merton Option Pricing Method
- Binomial Option Pricing Model
- Monte Carlo Simulation

Options

- In general, the value of any asset is the present value of the expected cash flows on that asset. In this section, we will consider an exception to that rule when we will look at assets with two specific characteristics:
  - They derive their value from the values of other assets.
  - The cash flows on the assets are contingent on the occurrence of specific events. These assets are called options and the present value of the expected cash flows on these assets will understate their true value
- An option gives the owner the right but not the obligation to buy or sell an underlying asset at the predetermined strike price during a period or on a specific date.
- Based on exercising the option it can be classified into two categories:

Type	Description
European Option	When an option is allowed to be exercised only on the maturity date.
American Option	When an option is exercised any time before its maturity date.

- Types of Options: There are many different types of options that can be traded and these can be categorized in a number of ways. In a very broad sense, there are two main types:

Type	Description
Call Option	The option to buy an asset is known as Call option.
Put Option	The option to sell an asset is known as Put option

Options

Terms used in Options

Type	Description
Expiration Date	Expiration date is the day on which the option matures.
Strike Price	The strike price is the price at which an option can be exercised
Option Price	A call option gives the holder the right but not the obligation to buy an asset by a certain date for a certain price.
In the Money Option	An In the money (ITM) Option is an option that would lead to a positive cash flow to the holder if it is exercised immediately.
At the Money Option	At the Money Option is an option that would lead to zero cash flow , if it is exercised immediately.
Out of Money Option	Out of Money Option is an option that would lead to a negative cash flow if it is exercised immediately.

ESOP, ESPP and Stock Appreciation Rights (SARs)

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Terms Used in ESOP

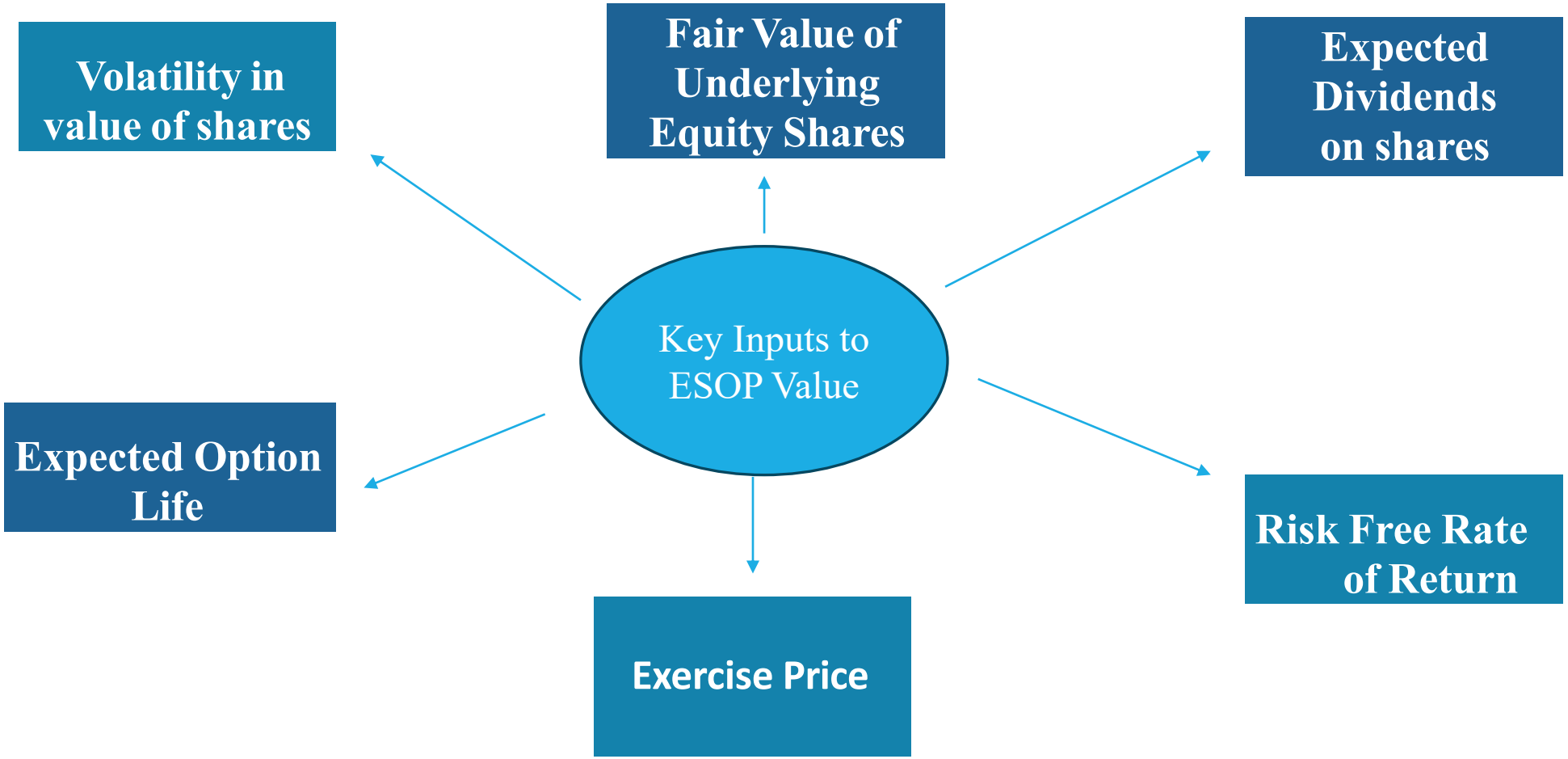
Type	Description
Vesting	The process by which the employee is given the right to apply for shares of the company against the option granted to him in pursuance of ESOP.
Vesting Period	It is the period between the grant date and the date on which all the specified vesting conditions of the ESOP are to be satisfied.
Exercise Period	It is the time period after vesting within which the employees has the right to apply for shares against the option vested in him/her, as per ESOP.
Exercise Price/Strike Price	It is the price payable by the employee for exercising the option granted to him/her in pursuance of the ESOP.
Market Price/Stock Price	Means the latest available closing price, prior to the date of grant, on the stock exchange on which the shares of the company are listed. If the shares are listed on more than one stock exchange, then the stock exchange where there is highest trading volume on the said date shall be considered. In case of unlisted enterprise, independent valuer's valuation report for the value of share is to be considered as the stock price

Fair Value of Option

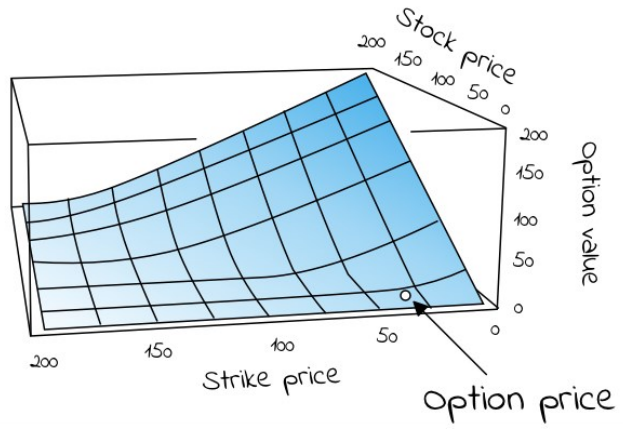
- Fair value of Options to be calculated using any binomial valuation method which takes into consideration the following:
  - Fair market price of share as on the date of grant
  - Exercise price
  - Volatility in share price
  - Expected Life
  - Risk free interest rate
  - Dividend yield

- Generally Black Scholes model is used for arriving at Fair Value of the Option.

INPUTS FOR ESOPs VALUATION



Black Scholes Model
&
Black and Scholes Merton Option Pricing Method



The Black Scholes Model

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Overview:

- The formula, developed by three economists – Fischer Black, Myron Scholes and Robert Merton – is perhaps the world's most well-known options pricing model. It was introduced in their 1973 paper, "The Pricing of Options and Corporate Liabilities," published in the Journal of Political Economy.

- The Black Scholes model is a model of price variation over time of financial instruments such as stocks that can, among other things, be used to determine the price of a European call option.

- It's used to calculate the theoretical value of European-style options using current stock prices, expected dividends, the option's strike price, expected interest rates, time to expiration and expected volatility

Assumptions:

- The option is European and can only be exercised at expiration.
- No dividends are paid out during the life of the option.
- Markets are efficient (i.e., market movements cannot be predicted).
- There are no transaction costs in buying the option.
- The risk-free rate and volatility of the underlying are known and constant.
- The returns on the underlying are normally distributed.

The Black Scholes Model

Formula for the Calculation of Call and Put Option Price:

Values for a call price c or put price p are:

$$c = s\Phi(d_1) - xe^{-rt}\Phi(d_2)$$

$$p = xe^{-rt}\Phi(-d_2) - s\Phi(-d_1)$$

where:

$$d_1 = \frac{log(s/x) + (r + \sigma^2/2)t}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

S: Spot Price of the underlying stock,
P: Price of Shares
X: Exercise Price
r_{RF}: Risk rate of Return
t: Time to expiry of Options
σ: Volatility
e: Exponential Functions

The Black Scholes Model

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Determinants of Option Premium

Input	Description
Striking Price	• The lower the striking price for a given stock, the more the option should be worth, because a call option lets you buy at a predetermined striking price
Time Until Expiration	• The Longer the time until expiration, the more the option is worth. The Option premium increases for more distant expirations for puts and calls.
Stock Price	• The higher the stock price, the more a given call option is worth. A call option holder benefits from a rise in the stock price.
Volatility	• The greater the price volatility, the more the option is worth. The volatility estimate Sigma cannot be directly observed and must be estimated. • Volatility plays a major role in determining time value
Dividends	• A Company that pays a large dividend will have a small option premium than a Company with a lower dividend, everything else being equal. Listed options don't adjust for cash dividends. The stock price falls on the ex-dividend date.
Risk- Free interest Rate	• The higher the risk free interest rate, the higher the option premium, everything else being equal.

The Black Scholes Model

The Impact of Various Factor in Option

	Effect on	
Factor	*Call Value*	*Put Value*
Increase in underlying asset's value	Increases	Decreases
Increase in strike price	Decreases	Increases
Increase in variance of underlying asset	Increases	Increases
Increase in time to expiration	Increases	Increases
Increase in interest rates	Increases	Decreases
Increase in dividends paid	Decreases	Increases

The Black and Scholes Merton Option Pricing Method

- Value of Option determined by 6 Factors:

  - S, the current price of the underlying stock,
  - Y, the dividend yield of the underlying stock,
  - K, the strike price specified in the option contract,
  - r, the risk-free interest rate over the life of the option contract,
  - T, the time remaining until the option contract expires and
  - σ, (sigma) which is the price volatility of the underlying stock

Note: Difference with BSOPM is the dividend yield is also factored

FORMULA USED FOR VALUING ESOPS

In order to estimate the value of the stock options of the employees, Black-Scholes-Merton method is used, by applying the following formula:

$$C = SN(d_1) - N(d_2)Ke^{-rt}, \text{ where } d_1 = \frac{\ln(S/K)+(r+\sigma^2/2)t}{\sigma\sqrt{t}}, \quad d_2 = d_1 - \sigma\sqrt{t}$$

where,

C = Call Premium

S= Current Stock Price

t= time until option exercise

K= Option striking Price

In= Natural Log

r= Risk-free Interest Rate

N= Cummulative standard normal Distribution

e= Exponential Term

σ= Standard Deviation

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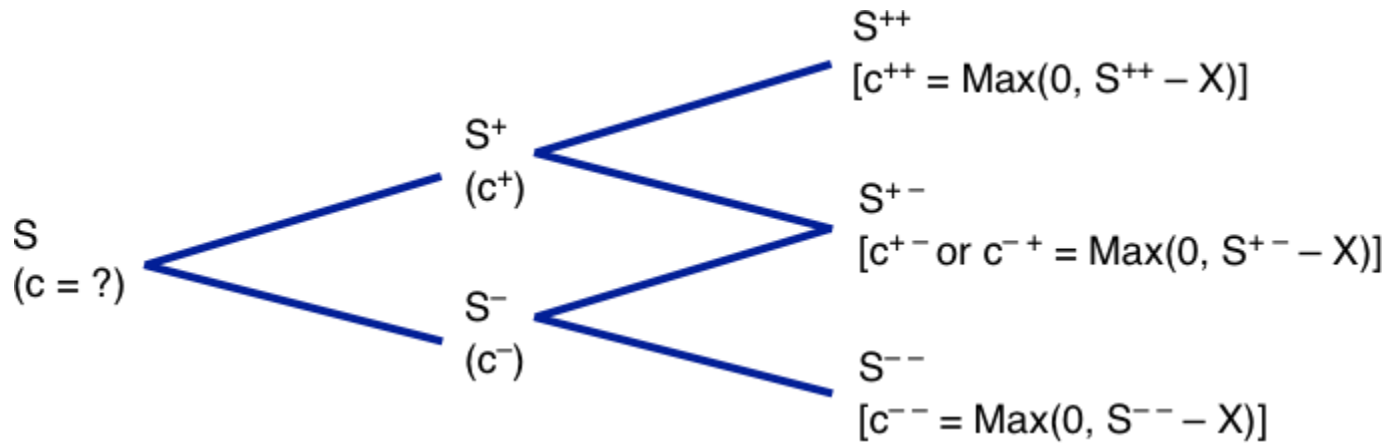
BLACK SCHOLES OPTION VALUE

Template - Black-Scholes Option Value		
Input Data		
Stock Price now (P)		50
Exercise Price of Option (EX)		50
Number of periods to Exercise in years (t)		5
Compounded Risk-Free Interest Rate (rf)		3.66%
Standard Deviation (annualized s)		62.00%
Output Data	**Formula used**	
Present Value of Exercise Price (PV(EX))	C5*EXP(-C7*C6)	41.6384
s*t^.5	C8*C6^0.5	1.3864
d1	(LN(C4/C5)+(C7+C8*C8/2)*C6)/(C8*C6^0.5)	0.8252
d2	D14-D13	-0.5612
Delta N(d1) Normal Cumulative Density Function	NORMDIST(D14,0,1,TRUE)	0.7954
Bank Loan N(d2)*PV(EX)	NORMDIST(D15,0,1,TRUE)*D12	11.9643
Value of Call	D16*D4-D17	27.8040
Value of Put	D19+D12-D4	19.4424

Binomial Option Pricing Model



Binomial Option Pricing Model

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Overview

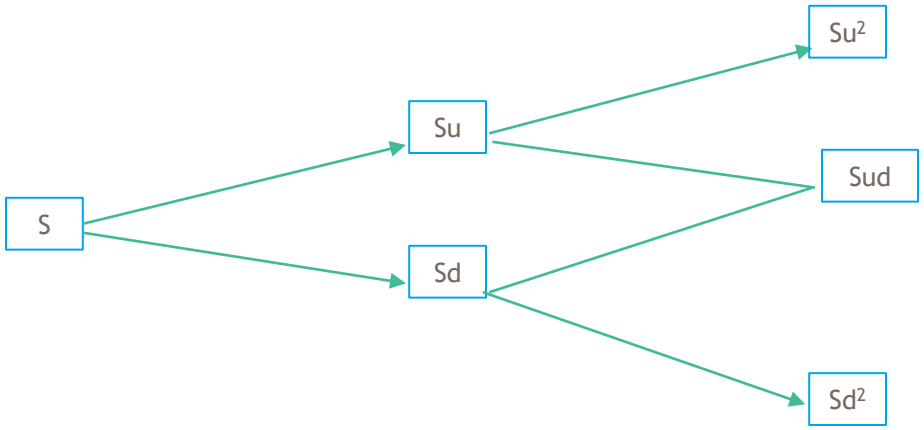
- The binomial option pricing model uses an iterative procedure, allowing for the specification of nodes, or points in time, during the time span between the valuation date and the option's expiration date.

Assumptions

- There are two (and only two) possible prices for the underlying asset on the next date. The underlying price will either:
  - Increase by a factor of u% (an upstick) and
  - Decrease by a factor of d% (a downtick).
- The uncertainty is that we do not know which of the two prices will be realized.
- No dividends.
- The one-period interest rate, r, is constant over the life of the option (r% per period).
- Markets are perfect (no commissions, bid-ask spreads, taxes, price pressure, etc.)

Binomial Option Pricing Model

Binomial Tree



Monte Carlo Simulation

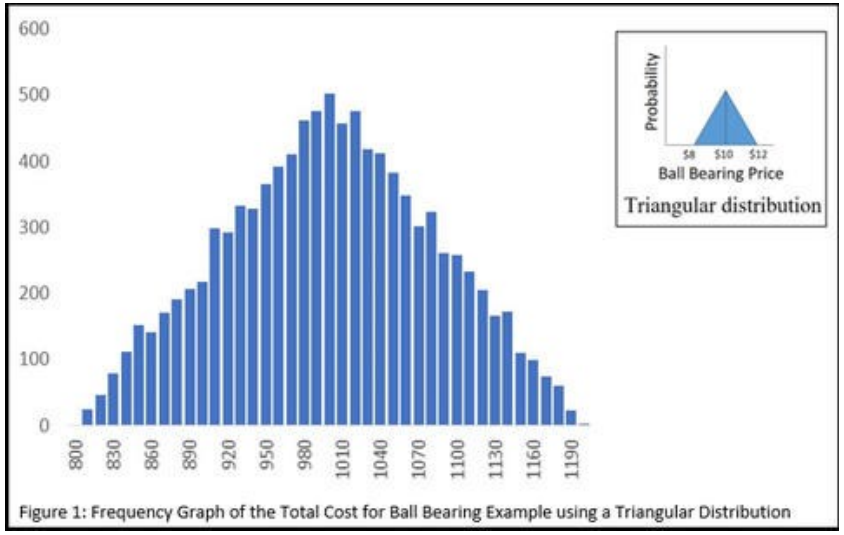


Figure 1: Frequency Graph of the Total Cost for Ball Bearing Example using a Triangular Distribution

Monte Carlo Simulation

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Overview

- Monte Carlo Simulation (“MCS”) or Probability Simulation is a technique used to understand the impact of risk and uncertainty in financial, project management, cost and other forecasting models.
- In Monte Carlo Simulation (“MCS”) a random value is selected of the tasks based on the range of estimates.
- The model is calculated based on the random value.
- The result of the model is recorded and the process is repeated.
- A typical MCS calculates the model hundreds or thousands of times, each time using different randomly-selected values.
- The Completed simulation yields a large results pool with each result based on random input values.
- These results are used to describe the likelihood, or probability of reaching various results in the model.

Monte Carlo Simulation

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Overview

- The Monte Carlo method is based on the generation of multiple trials to determine the expected value of a random variable.

- Vital to the execution is the (mathematical) assumptions that each (project) variable/activity being simulated is not influenced by other variables.

Schema of the Monte Carlo Method

- Generate random values for each of the activities (time/cost),
- Sum each series of random values to arrive at the total project (cost/time),
- Three point estimates are the weighted average of three estimates for a particular task based on predictive distribution of possible outcomes against a set of choices as:

    - Best Case (Conservative),
    - Most Likely (expected) and
    - Worst Case (Extreme).
- The Formula is expressed as: $E = (B+4M+W)/6$

Monte Carlo Simulation

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Schema of the Monte Carlo Method

- Depending on the number of uncertainties and the ranges specified for them
- The method could calculate 1k/10K cycles to complete (“Skewness”)
- The technique works particularly well when;
  - The underlying probabilities are known and
  - But the results are difficult to determine.

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Monte Carlo Simulation

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Example Continued

- We are estimating the total time it will take to complete a particular project.
- In this case, it's a construction project, with three parts.
- The parts have to be done one after the other, so the total time for the project will be the sum of the three parts.

Task	Time Estimate (Months)	Best case	Most Likely	Worst Case
Job 1	5	4	5	7
Job 2	4	3	4	6
Job 3	5	4	5	6
Total	14	11	14	19

- The project might be completed in as little as 11 months, or as long as 19 months.

Monte Carlo Simulation

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Example Continued

- Post Carrying out stimulation 500 times, the result of completing the assignment is given below:

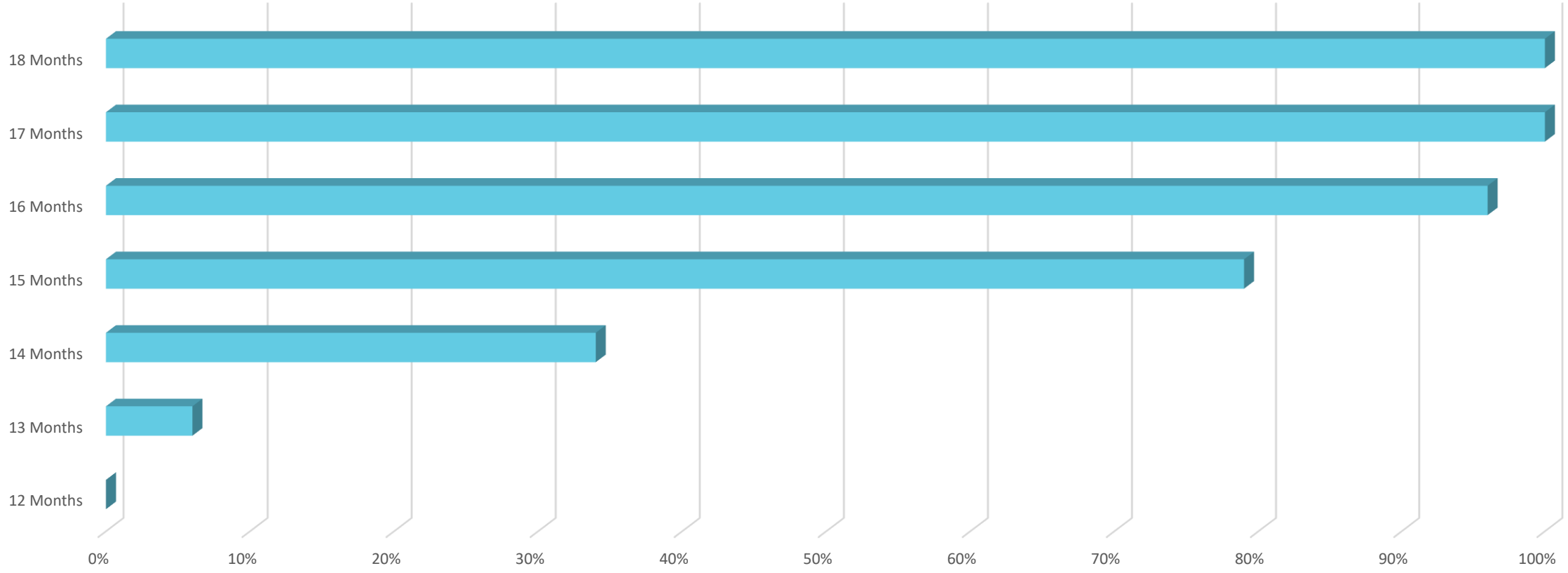
Time	Number of Times (Out of 500)	Percent of Total (Rounded)
12 Months	1	0%
13 Months	31	6%
14 Months	171	34%
15 Months	394	79%
16 Months	482	96%
17 Months	499	100%
18 Months	500	100%

- Above results depict that there is only a 34% chance – about 1 out of 3 – that any individual trial will result in a total time of 14 months or less. On the other hand, there is a 79% chance that the project will be completed within 15 months.
- Further, the model demonstrates that it is extremely unlikely, in the simulation, that we will ever fall at the absolute minimum or maximum total values.

Monte Carlo Simulation

Example Continued

- Stimulation graph will be look like this:



Questions

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Thank You!

CA. CS. Vaibhav Jain

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