Strategic Finance and Corporate Restructuring

Block

2

ADVANCED CORPORATE FINANCE

Editorial Team

Prof. K. Seethapathi
IFHE (Deemed-to-be-University), Hyderabad

Dr. Ranajee
IFHE (Deemed-to-be-University), Hyderabad

Prof. A. Suresh Babu
IFHE (Deemed-to-be-University), Hyderabad

Prof. U. L. Sunitha
IFHE (Deemed-to-be-University), Hyderabad

Content Development Team

Prof. Rajendra Tolety
IFHE (Deemed-to-be-University), Hyderabad
Hyderabad

Prof. Koya Raghu Nadh
IFHE(Deemed-to-be-University),

Dr. M. R. Senapathy
IFHE (Deemed-to-be-University), Hyderabad
Hyderabad

Prof. Dibyendu Dutta
IFHE(Deemed-to-be-University),

Prof. M. Aparna
Academic Associate, ISB
Hyderabad

Dr. K Veena
IFHE(Deemed-to-be-University),

Proofreading, Language Editing and Layout Team

Ms. M. Manorama
IFHE (Deemed-to-be-University), Hyderabad
Hyderabad

Ms. C. Sridevi
IFHE(Deemed-to-be-University),

Mr. Chandra Sekhar Rao
IFHE (Deemed-to-be-University), Hyderabad

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Our E-mail id: cwfeedback@icfaiuniversity.in

Centre for Distance and Online Education (CDOE)
The ICFAI Foundation for Higher Education
(Deemed-to-be-University Under Section 3 of UGC Act, 1956)
Donthanapally, Shankarapalli Road, Hyderabad- 501203.

BLOCK 2 ADVANCED CORPORATE FINANCE

This is the second block for Strategic Finance and Corporate Restructuring text book. This block introduces advanced corporate finance topics like decision support models, financial distress and restructuring, real options, working capital management and strategic cost management. This block consists of five units.

Unit 5 titled Decision Support Models covers the Modelling Process, Financial Modelling, Marakon Model, Alcar Model, and McKinsey Model. Corporate decisions are affected by a large number of variables. Many-a-times, the interlinkages between these variables, and their resultant effect on the decision are extremely complex. Decision-support models are tools used to spell out the relationships clearly in order to help the management arrive at the optimal decision.

Unit 6 discusses all the models to predict bankruptcy, explains how to reorganize a distressed firm and details the rules of liquidation. A firm never goes bankrupt immediately. Before a firm goes bankrupt, it exhibits a number of symptoms, which when diagnosed and corrected in time can save the company from bankruptcy. A number of models available to predict bankruptcy are discussed in this unit.

Unit 7 gives an insight into valuation and analysis of real options. There are number of options available in real world to invest the scarce financial resources. One of them is real options. The unit covers Comparing Financial and Real Options, types of real options, and the valuation models.

Unit 8 discusses working capital which facilitates smooth functioning of business operations. This unit outlines the need for working capital, various components of current assets and current liabilities, and the various factors affecting the composition of working capital. Estimation of a firm's working capital needs using operating cycle, measures applied for evaluation of working capital, and the significant working capital ratios are included in this unit.

In today's competitive environment, the survival of a firm depends on the pricing of its products. The fixing of price of a product is a process of analyzing the cost of production. Unit 9 titled 'Strategic Cost Management' gives an insight into Strategic Perspective of Cost Management, Value Chain Analysis, Activity Based Costing, Target Costing, Quality Costing, and Life Cycle Costing.

Unit 5

Decision Support Models

Structure

"It's far better to buy a wonderful company at a fair price than a fair company at a wonderful price."

– Warren Buffett

5.1 Introduction

Corporate decisions are affected by a large number of variables. Many-a-times, the interlinkages between these variables and their resultant effect on the decision is extremely complex. Decision-support models are tools used to spell out the relationships clearly in order to help the management arrive at the optimal decision. There is a wide variety of decision-support models – optimization models, simulation exercises, models for predicting a firm's bankruptcy etc. In this unit, the Modelling Process, Financial Modelling, Marakon Model, Alcar Model and McKinsey Model are discussed.

5.2 Objectives

After going through the unit, you should be able to:

- Know the steps involved in the process of using a model
- Illustrate Financial Modelling
- Develop Marakon Model
- Analyze Alcar Model
- Identify McKinsey Model

5.3 Financial Objectives of a Company

The following are the major steps in the process of using a model to arrive at the optimal decision:

- Feasibility study
- Model construction
- Compatibility of the model with the tools used
- Model validation
- Implementation
- Model revision
- Documentation

Feasibility Study

The foremost step in developing a model is to ascertain the feasibility of a model assisting the decision making process. The various points that are required to be considered are:

- Whether the decision under consideration is a one-time process, or is required to be taken as a routine measure.
- The suitability of the area in which the decision is required to be made, to be supported by a model.
- The possibility of all the relevant variables being unambiguously identified.
- The possibility of all the variables being built-in into a single model.
- The expected effectiveness of the model.
- The acceptability of a model replacing human judgment to the management.
- The possibility of obtaining the required data on an ongoing basis.
- The possibility of integrating the model with the normal decision-making process.
- The costs involved with setting up and running the model, and its comparison with the expected benefits.

If it is feasible to construct an efficient and effective model for the decision process under consideration, and if the model can be easily integrated with the process, the firm can proceed to the next step of constructing the model.

Model Construction

The construction of the model depends on a number of factors. Some of these are:

- The decision to be made using the model.
- The issues those are relevant for making the decision.
- The way in which these issues and factors affect the decision.
- The external factors that restrict the decision making process.

Depending on these factors, the input requirement for the model is identified and the numerical and theoretical relationships between variables are specified. This is followed by developing the structure of the model.

Model Compatibility

Once the model is in place, it needs to be made compatible to the tools to be used to implement it. For example, if a particular model is to be solved using computers, the model needs to be programmed and converted to a language that the computer understands.

Model Validation

A number of test runs are conducted on the model to check whether it produces reasonably accurate results. The test runs may use actual past data of the input variables, and the results generated by the model are compared with the actual results. Alternatively, the model may be tested by using probability distributions. Test running a model checks the effectiveness of the structure of the model, as well as its predictive ability.

Implementation

The implementation of a model includes integrating it with the normal decision-making process. Further, it needs to be ensured that the results generated by the model are relevant enough for the decision-maker to take them into consideration while making a decision.

Model Revision

No model remains useful for an indefinite period. The relationships between different variables that form a basis for the model may change over a period of time. External factors affecting a model may also change. Use of the model over a period may provide an insight into its drawbacks. It is necessary that such changes are noted and the model periodically revised to accommodate them. Unless a model is continuously updated, it may lose its relevance.

Documentation

Documentation is a way of institutionalization of the knowledge created during the process of developing and installing a model. It involves making detailed, systematic notes at all the stages of the process. The records should be maintained right from the stage when the need for the model was felt, detailing the factors that gave rise to the need. The various ideas considered at different stages need to be documented along with the reasons for their acceptance or rejection. The various problems faced during the development and implementation of the model, together with their solutions should also form a part of the records. Documentation also helps in proper communication between the members of the team working on the development of the model. In addition, it makes the process of revising the model less tedious.

While developing and implementing models, certain issues need to be kept in mind. It is not just necessary to specify the objectives of the model, it is also necessary to build the relative importance of the different objectives into the model. For example, the objective may be to maximize the profits of the firm, while restricting the debt taken by it to a certain percentage of the total assets. The model should specify the objective (maximum profits or limited debt) that would be held supreme, if there were a clash between the two. Another important point to be remembered is that the model should preferably focus on some key aspects, rather than be a collection of all relevant and irrelevant data. A focused model is more likely to generate effective decisions.

Example: Impact on the revenue and profits of Infosys due to acquisitions

Businesses adopt various financial models to arrive at the optimal decision as the main objective of any firm was to maximize the profits, while restricting the debt taken by it to a certain percentage of the total assets as in case of Infosys acquisition through internal accruals. Infosys acquired following companies over the last three years as hereunder:

Name	Price in mn	Year	Revenue impact
Oddity	$ 50.00	March 22	€ 26.10 million
Singtel	$ 4.40	December 21	$16 million
Carter Digital	€ 30 .00	January 21	$ 5 million
Simplus	$ 250.00	February 20	₹ 1772 crore
Stater	$ 142.00	March 19	$172 million

The net profit for the past three FYs are as follows: *(₹ in crore)*

Parameter	2020	2021	2022
Profits	15,543	18,048	21,235
EPS	36.34	42.37	50.21

It can be observed that revenue, profits and EPS increased considerable after acquisition of these smaller companies which was the financial objective of Infosys. In addition to the revenue, Infosys will enjoy strategic benefits such as expansion of clientele base, technology, support services of the acquired companies etc.

Sources: (i) https://tracxn.com/d/acquisitions/acquisitionsbyInfosys dated 2nd May 2022, Accessed on 18th July, 2022

(ii) https://www.moneycontrol.com/financials/infosys/results/yearly/IT dated 4th June 2022, Accessed on 18th July, 2022

5.4 Financial Modelling

The following is an example of a model built to predict a firm's debt capacity during a recessionary period.

Extended Probabilistic Analysis

The assumptions underlying this model are

- All sales are cash sales
- The duration of recession is variable
- The daily sales during the recession are variable
- While the interest burden associated with debt is inescapable, the principal repayment obligation can be deferred till the recession lasts.

Given these assumptions, the cash balance at the end of the recession will be:

Cash balance at the beginning	+ Sales during the recession	– Variable cash expenses during recession
	– Fixed cash expenses other than debt servicing burden during the recession	– Interest payment during the recession
	– Income tax during the recession	

In symbols,

$$C_1 = C_0 + \tilde{n}\tilde{s} - v\tilde{n}\tilde{s} - \tilde{n}f - \tilde{n}i - T(\tilde{n}\tilde{s} - v\tilde{n}\tilde{s} - \tilde{n}f - \tilde{n}i - \tilde{n}f')$$

Where,

C_1 = Ending cash balance

C_0 = Beginning cash balance

$\tilde{n}$ = Duration of the recession in months

$\tilde{s}$ = Monthly sales during the recession

$\tilde{n}\tilde{s}$ = Total sales during the recession

v = Proportion of variable cash expenses to sales

$v\tilde{n}\tilde{s}$ = Total variable cash expenses during the recession

f = Monthly fixed cash expenses, other than debt servicing burden, during the recession

$\tilde{n}f$ = Total fixed cash expenses, other than debt servicing burden during the recession

i = Monthly interest payment associated with the contemplated level of debt during the recession

ñi = Total interest payment associated with the contemplated level of debt during the recession

f′ = Monthly non-cash fixed expenses

nf′ = Total non-cash fixed expenses during the recession

T = Corporate income tax rate

To illustrate the application of the above model, let us look at the case of Anekal Corporation which is considering the implication of employing a certain level of debt which will entail a monthly interest burden of ₹ 21,000. The joint probability distribution of $\tilde{s}$ and $\tilde{n}$ is given below.

Table 5.1

$\tilde{n}$ \ $\tilde{s}$	40	50	60
10	.01	.03	.06
20	.15	.15	.10
30	.10	.15	.12
40	.04	.04	.05

Other relevant information about Anekal is as follow:

C_0 = ₹ 2,50,000

v = 0.6

f = 15,000

f′ = 4,000

T = 0.5

Given the above information, the cash balance at the end of recession would be

$$C_1 = 2,50,000 + \tilde{n}\tilde{s} - 0.6\,\tilde{n}\tilde{s} - 15,000\,\tilde{n} - 21,000\,\tilde{n} -$$

$$0.5\,(\tilde{n}\tilde{s} - 0.6\,\tilde{n}\tilde{s} - 15,000\,\tilde{n} - 21,000\,\tilde{n} - 4,000\,\tilde{n})$$

$$= 2,50,000 + 0.2\,\tilde{n}\tilde{s} - 16,000\,\tilde{n}$$

The probability distribution of the cash balance at the end of recession would be as shown in the table given below. From this we find that the probability of cash inadequacy is 0.04. If this probability for cash inadequacy is acceptable to the management of the firm, then the contemplated level of debt is acceptable. Analysis of this kind would perhaps have to be done for several levels of debt to arrive at the most desirable level of debt.

Table 5.2: Probability Distribution of the Cash Balance at the End of Recession

ñ	s̃	C_1	Probability of the Event
10	60	2,10,000	0.06
10	50	1,90,000	0.03
10	40	1,70,000	0.01
20	60	1,70,000	0.10
20	50	1,30,000	0.15
20	40	90,000	0.15
30	60	1,30,000	0.12
30	50	70,000	0.15
30	40	10,000	0.10
40	60	90,000	0.05
40	50	10,000	0.04
40	40	–30,000	0.04

5.5 Models for Maximizing Shareholder Value

The following section discusses a few models for maximizing shareholders' wealth. Management focused on maximizing shareholders' wealth is referred to as value-based management. The models being discussed are:

- Marakon model
- Alcar model
- McKinsey model

5.5.1 Marakon Model

The Marakon model was developed by Marakon Associates, a management consulting firm known for its work in the field of value-based management. According to this model, a firm's value is measured by the ratio of its market value to the book value. An increase in this ratio depicts an increase in the value of the firm, and a reduction reflects a reduction in the firm's value. The model further states that a firm can maximize its value by following these four steps:

- Understand the financial factors that determine the firm's value.
- Understand the strategic forces that affect the value of the firm.
- Formulate strategies that lead to a higher value for the firm.
- Create internal structures to counter the divergence between the shareholders' goals and the management's goals.

Financial Factors

The first step in this model is to identify the financial factors that affect the value of the firm. The model states that a firm's market value to book value ratio, and

hence, its value depends on three factors – return on equity, cost of equity, and growth rate. This conclusion is drawn indirectly from the constant growth dividend discount model.

The constant growth dividend discount model says that

$$P_0 = \frac{D_1}{k - g}$$

Further,

$D_1 = B \times r \times b$

P_0 Current market price of the firm's share

D_1 Dividend per share after one year

k Cost of equity

g Growth rate in earnings and dividends

r Return on equity

B Current book value per share

b Dividend pay-out ratio.

Substituting the value of D_1 in the dividend discount model, we get

$$P_0 = \frac{B \times r \times b}{k - g}$$

Dividing both sides of the equation by B, we get

$$\frac{P_0}{B} = \frac{r \times b}{k - g}$$

Further, we know that

$g = r (1 - b)$ or,

$r \times b = r - g$

Replacing the value of r x b in the above equation, we get

$$\frac{P_0}{B} = \frac{M}{B} = \frac{r - g}{k - g}$$

Thus, a firm's market value to book value ratio can be derived from its return on equity, its cost of equity and its growth rate. It can be observed from the formula that,

- A firm's market value will be higher than its book value only if its return on equity is higher than its cost of equity. This is supported by the other theories of valuation of equity.

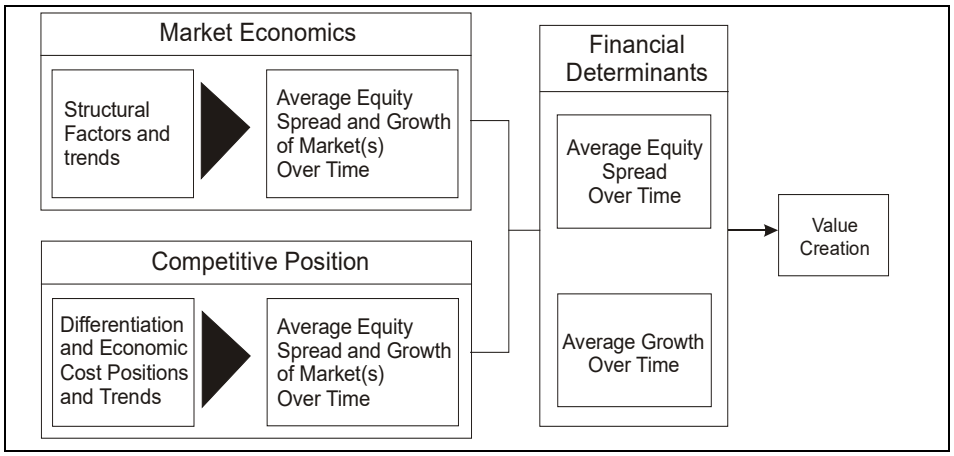
- When the return on equity is higher than the cost of equity, the higher a firm's growth rate, the higher its market value to book value ratio.

Hence, a firm should have a positive spread between the return on equity and the cost of equity, and a high growth rate in order to create value for its shareholders.

Strategic Forces

The financial factors that affect a firm's value are in turn affected by some strategic forces. The two important strategic factors that affect a firm's value are market economics and competitive position. The market economics determines the trend of the growth rate and the spread between the return on equity and cost of equity for the industry as a whole. The following figure illustrates the effect of the strategic factors on the firm's value.

Figure 5.1: Strategic Determinants of Value Creation



Source: ICFAI Research Center

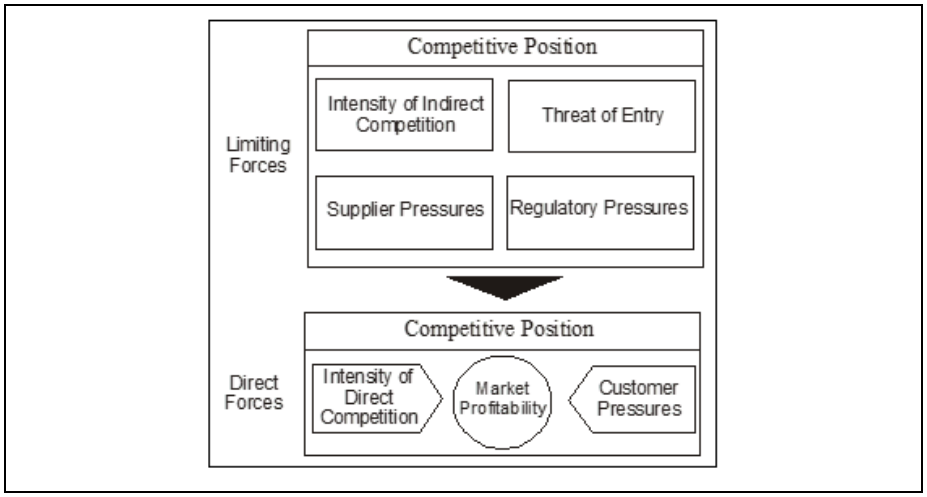
Market economics refers to the forces that affect the prospects of the industry as a whole. These include:

- Level of entry barriers
- Level of exit barriers
- Degree of direct competition
- Degree of indirect competition
- Number of suppliers
- Kinds of regulations
- Customers' influence.

While the degree of direct competition and customers' influence are considered as the core factors affecting an industry's prospects, the other factors are considered only limiting forces.

This is reflected in the following figure:

Figure 5.2: Determinants of Market Economics (or Profitability)



Source: ICFAI Research Center

Competitive Position refers to a firm's relative position within the industry. A firm's relative position is affected by its ability to produce differentiated products and its economic cost position. A product can be referred to as a differentiated product when the consumers perceive its quality to be better than the competitive products and are ready to pay a premium for the same. The firm can benefit from a differentiated product in two ways. It may either increase its market share by pricing it competitively, or can command a higher price for its product than its competitors, and forego the higher market share. Thus, the ability to produce differentiated products improves a firm's relative position vis-á-vis its competitors. The other factor that helps a firm enjoy a strategic advantage over its competitors is a low per unit economic cost. Economic costs include operating costs and the cost of capital employed. A low economic cost may result from a number of factors like,

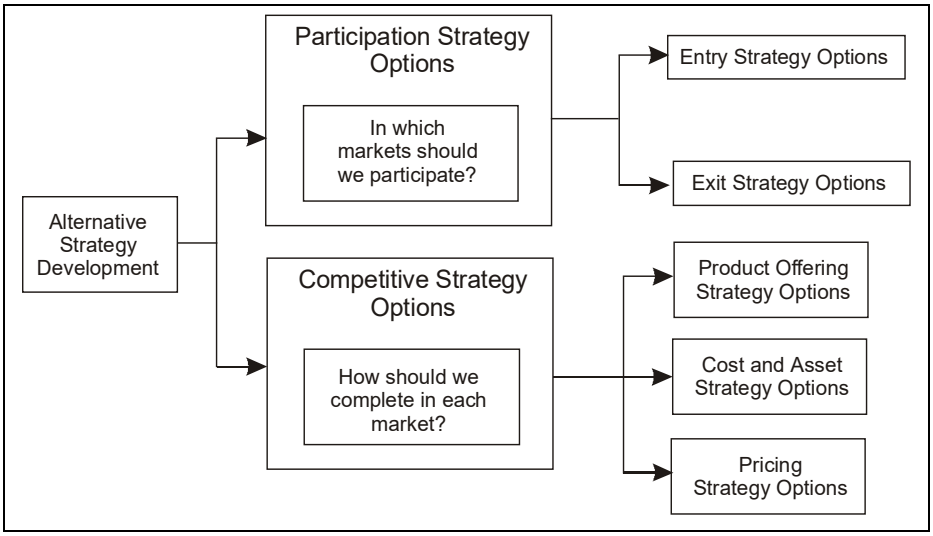
- Access to cheaper sources of finance
- Access to cheaper raw material
- State-of-the-art technology resulting in better quality control
- Better management
- Strong dealer network
- Exceptional labor relations.

Strategies

Once a company has identified its potential growth prospects and analyzed its strengths and weaknesses, it needs to develop strategies that would help it utilize its strengths and underplay its weaknesses, thus achieving the maximum possible growth and creating value. For achieving this objective two kinds of strategies are required – participation strategy and competitive strategy.

A company, to create value for its shareholders, has to either operate in an area where the market economies are favorable, or has to produce those products in which it can enjoy a highly competitive position. The strategy that specifies the broad product areas or businesses in which a firm is to be involved is referred to as its participation strategy. At the level of a business unit, this strategy outlines the market areas (in terms of the geographical areas, the high-end market or the low-end market, the level of quality and differentiation to be offered) to be entered.

Figure 5.3: Elements of Business Strategy



Source: ICFAI Research Center

The strategy on the preferred markets is followed by the competitive strategy, which specifies the plan of action required for achieving and maintaining a competitive advantage in those markets. It includes deciding the way of achieving product differentiation, the method for utilizing the differentiation so created (i.e. by increasing the price of the product or the market share) and the means of creating an economic cost advantage.

Internal Structures

The separation of ownership and management in the traditional manner results in the management bearing all the risks associated with value-adding decisions, without their enjoying any of the benefits. This often results in the management taking sub-optimal decisions. A firm needs internal structures which can control this tendency of the management. These may include:

- The management's compensation being linked to the company's performance.
- Corporate governance mechanisms that specify responsibilities and holds managers accountable for their decisions.

- Resource allocation among projects guided by the specific requirements of the projects rather than the past allocations and capital rationing.
- A mechanism for making sure that the various projects undertaken form part of a strategy, rather than being disjointed, discrete projects.

Plans being made in accordance with the long-term goals and target performance being fixed in accordance with these plans, rather than the level of achievable targets determining the plans. Performance targets should be a function of the plans, rather than being the base for the plans.

Target performance, when achieved, should be rewarded with promised incentives. Non-fulfillment of such promises affects the future performance.

Evaluation of the Model

The structure of the model is quite comprehensive as it provides a holistic perspective of the process of value creation. Nevertheless, the model's contention that a firm's value can be measured by its market value to book value ratio has attracted applauds as well as criticism. The major point in favor of the ratio's use is that the market value of a firm, and the three factors affecting the market value to book value ratio (namely, the return on equity, cost of equity, and growth rate) are widely accepted criterion for measuring a firm's performance. The criticism is that the return on equity is an accounting measure, while the cost of equity is a market measure. Hence, the two are not comparable. Besides, the presence of an accounting measure as a factor affecting the market value of a firm, leaves the value of a firm open for manipulation.

Activity 1.1

a. On which factors construction of decision-support models depends?

……...……..

……...……..

b. How do you measure the value of a firm under Marakon model?

……..……..…

……...……..……

5.5.2 Alcar Model

The Alcar model, developed by the Alcar Group Inc., a company into management education and software development, uses the discounted cash flow analysis to identify value adding strategies. According to this model, there are seven 'value drivers' that affect a firm's value. These are:

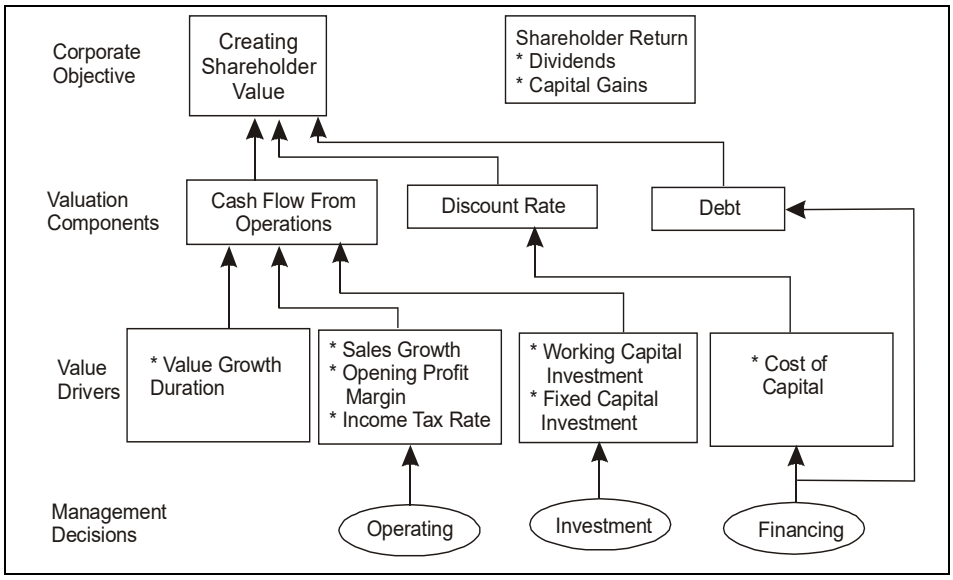
- The growth rate of sales
- Operating profit margin
- Income tax rate
- Incremental investment in working capital
- Incremental investment in fixed assets

- Value growth duration
- Cost of capital.

Value growth duration refers to the time period for which a strategy is expected to result in a higher than normal growth rate for the firm. The first six factors affect the value of the strategy for the firm by determining the cash flows generated by a strategy. The last term, i.e. the cost of capital, affects the value of the strategy by determining the present value of these cash flows. The following figure represents the Alcar approach.

According to the model, a strategy should be implemented if it generates additional value for a firm. For ascertaining the value generating capability of a strategy, the value of the firm's equity without the strategy is compared to the value of the firm's equity if the strategy is implemented. The strategy is implemented if the latter is higher than the former. The following steps are undertaken for making the comparison:

Figure 5.4: Alcar Approach



Adapted from Alfred Rappaport, Creating Shareholder Value: The New Standard for Business Performance.

Calculate the Value of the Firm's Equity without the Strategy

The present value of the expected cash flows of the firm is calculated using the cost of capital. The cash flows should take the firm's normal growth rate and its effect on operating flows and additional investment in fixed assets and working capital into consideration. The cost of capital would be the weighted average cost of the various sources of finance, with their market values as the weights. The value of the equity is arrived at by deducting the market value of the firm's debt from its present value.

Calculate the Value of the Firm if the Strategy is implemented

The firm's cash flows are calculated over the value growth duration, taking into consideration the growth rate generated by the strategy and the required additional investments in fixed assets and current assets. These cash flows are discounted using the post-strategy cost of capital. The post-strategy cost of capital may be different from the pre-strategy cost of capital due to the financing pattern of the additional funds requirement, or due to a higher cost of raising finance. The PV of the residual value of the strategy is added to the present value of these cash flows to arrive at the value of the firm. The residual value is the value of the steady perpetual cash flows generated by the strategy, as at the end of the value growth duration. The post-strategy market value of debt is then deducted from the value of the firm to arrive at the post-strategy value of equity.

The value of the strategy is given by the difference between the post-strategy value and the pre-strategy value of the firm's equity. A strategy should be accepted if it generates a positive value.

Evaluation of the Model

This model is considered superior to the Marakon model because it uses the discounted cash flow model instead of relying on accounting-based measures. However, the computations involved in the model are more tedious compared to the Marakon model. Nevertheless, the computations lead to a more reliable result as both the inputs and the process are less open to distortion. The disadvantage of the model is that it focuses on individual strategies rather than on the overall direction of the firm.

5.5.3 Mckinsey Model

The McKinsey model, developed by leading management consultants McKinsey & Company, is a comprehensive approach to value-based management. It focuses on the identification of key value drivers at various levels of the organization, and places emphasis on these value drivers in all the areas, i.e. in setting up of targets, in the various management processes, in performance measurement, etc. According to Copeland, Koller and Murrin, value-based management is "an approach to management whereby the company's overall aspirations, analytical techniques, and management processes are all aligned to help the company maximize its value by focusing management decision-making on the key drivers of value". According to this model, the key steps in maximizing the value of a firm are as follows:

- Identification of value maximization as the supreme goal
- Identification of the value drivers
- Development of strategy
- Setting of targets

- Deciding upon the action plans
- Setting up the performance measurement system
- Implementation.

Value Maximization – The Supreme Goal

A firm may have many conflicting goals like maximization of PAT, maximization of market share, achieving consumer satisfaction, etc. The first step in maximizing the value of a firm is to make it the most important goal for the organization. It is generally reflected in maximized discounted cash flows. The other goals that a firm may have are generally consistent with the goal of value maximization, but in case of a conflict, it should prevail over all other objectives.

Example: Maximization of the value of the firm

According to McKinsey model, the most important goal of any company was to concentrate on maximizing the value of a firm where managers should make all decisions so as to increase the total long run market value of the firm as we can observe in case of Reliance Industries Ltd (RIL):

Particulars	2021	2022
Revenue (₹ in crore)	2,60,485	4,59,247
PAT	27,640	39,084
Market capitalization $ in bn	184.42	235.09
EPS	47.24	57.77

The top management of the company has taken various decisions such as M&A, organic expansions in various verticals etc. to increase the MV of the company

Sources:(i) https://economictimes.indiatimes.com/reliance-industries-ltd/profitandlose/companyid-13215.cms dated 4th June 2022, Accessed on 18th July, 2022
(ii) https://companiesmarketcap.com/reliance-industries/marketcap/ dated 4th June 2022, Accessed on 18th July, 2022

Activity 5.2

a. Mention the value drivers that affect a firm's value according to Alcar model.

……...…….
……...…….

b. How is Alcar model better than Marakon model?

……..……..…
……...…….

Identification of the Value Drivers

The important factors that affect the value of a business are referred to as key value drivers. It is necessary to identify these variables for value-based management. The value drivers need to be identified at various levels of an organization, so that the personnel at all levels can ensure that their performance is in accordance with the overall objective. The other objectives of a firm mentioned above may act as value drivers at some level of the organization. For example, degree of innovation in products may be identified as the value driver for the design department. The three main levels at which the key value drivers need to be identified are:

The Generic Level: At this level, the variables that reflect the achievement or non-achievement of the value maximization objective most directly are identified. These may be the return on capital employed or operating margin or the net profit margin, etc.

The Department Level: At this level, the variables that guide the department towards achieving the overall objective are identified. For example, for the sales department, the key value drivers may be achieving the optimum product mix, maximizing market share, etc.

The Grass Roots Level: At the grass roots level, the variables that reflect the performance at the operational level are identified. These may be the level of capacity utilization, cost of managing inventory, etc.

Development of Strategy

The next step is to develop strategies at all levels of the organization, which are consistent with the goal of value maximization, and lead to the achievement of the same. The strategies should be aimed at and give directions for the achievement of the desired level of the key value drivers.

Setting of Targets

Development of strategies is followed by setting up of specific short-term and long-term targets. These should be specified in terms of the desirable level of key value drivers. The short-term targets should be in tune with the long-term targets. Similarly, the targets for the various levels of the organization should be in tune. They should be set both for financial as well as non-financial variables.

Deciding upon the Action Plans

Once the strategy is in place and the targets have been determined, there is a need to specify the particular actions that are required to be undertaken to achieve the targets in a manner that is consistent with the strategy. At this stage, the detailed action plans are laid out.

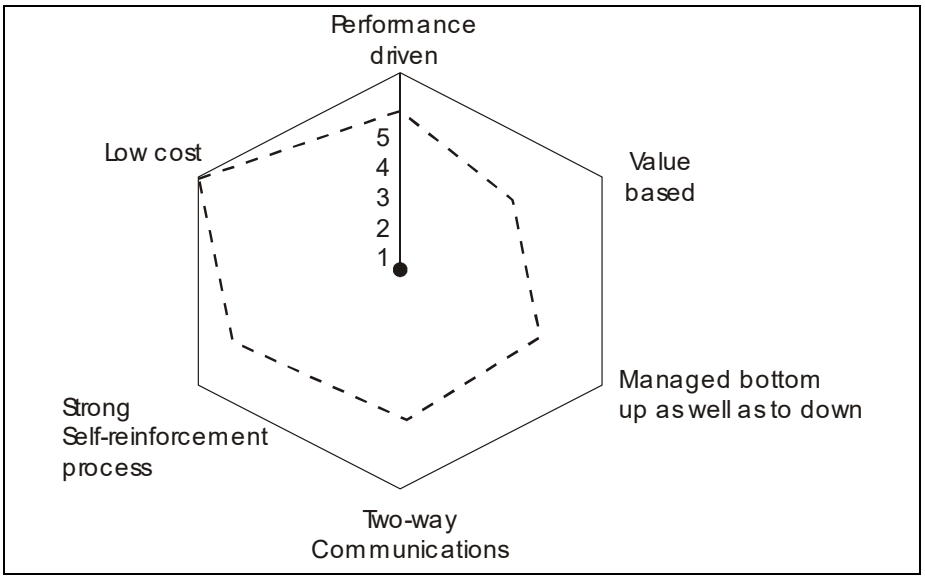
Setting up the Performance Measurement System

The future performance of personnel is affected by the way their performance is measured, to a large extent. Hence, it is essential to set up a precise and unambiguous performance measurement system. A performance measurement system should be linked to the achievement of targets and should reflect the characteristics of each individual department.

Implementation

The first step in implementing value-based management is to identify the current position of the firm in terms of the six factors shown in the figure below.

Figure 5.5: Elements of Business Strategy



Source: Adapted from McKinsey & Company Inc., Tim Koller, Marc Goedhart, David Wessels (2020). Valuation: Measuring and Managing the Value of Companies, 7th Edition

The next step is to use the action plans laid out to stretch the firm to the maximum possible extent in terms of each of these factors. The outer limit of the hexagon reflects the maximum limit to which an organization can stretch itself. The aim of value maximization is to make the firm reach these limits.

Check Your Progress - 1

1. As per the Marakon approach which among the following that shapes market economics can be termed as a direct force?
   a. Supplier pressures
   b. Regulatory pressures
   c. Customer pressures
   d. Threat of entry
   e. Intensity of direct competition

2. Which of the following is not a 'value driver' as per the Alcar approach?
   a. Income tax rate
   b. Operating profit margin
   c. Dividend payout
   d. Cost of capital
   e. Incremental Investment in working capital
3. Which of the following is analyzed at the generic level as per the McKinsey approach?
   a. Return on invested capital in terms of operating margin and invested capital
   b. Product Mix
   c. Customer Mix
   d. Capacity Utilization
   e. Operating Leverage
4. Which of the following value drivers is to be considered at the operational level as per the McKinsey Approach?
   a. Return on invested capital
   b. Capacity utilization
   c. Operating leverage
   d. Cost per unit
   e. Operating margin
5. Which of the following is an assumption underlying extended probabilistic analysis to determine the debt capacity?
   a. All sales are made for cash only.
   b. The duration of a recession is predictable with certainty.
   c. The firm can postpone both interest on debt and principal repayments during periods of recession.
   d. All sales are made on credit only.
   e. Both (a) and (c) of the above.

5.6 Summary

- Decision support models help management to identify the relationship between different variables and help them to get an optimal decision.
- Modeling process follows steps like feasibility study, model construction, compatibility of the model with the tools used, model validation, implementation, revision and documentation.
- Probabilistic analysis can be used at the time of recession.
- Marakon model uses four steps like understanding of financial factors that determine the firm's value, understanding the strategic forces that affect the firm's value, formulate strategies that lead to a higher value of the firm and

create internal structures to counter the divergence between the shareholder goals and the management goals.

- Alcar model uses the discounted cash flow analysis to identify value-adding strategies. According to this model there are seven value drivers that affect a firm's value.
- Mckinsey model identifies value drivers at generic level, department level and grass root level. The key steps in maximizing the value of a firm are identification of value maximization as the supreme goal, identification of value driver, development of strategy, setting of targets, deciding upon the action plan, setting up the performance measurement system and implementation.

5.7 Glossary

Financial Modelling $C_1 = C_0 + ñs̃ - vñs̃ - ñf - ñi - T(ñs̃ - vñs̃ - ñf - ñi - ñf')$

Where,

C_1 = ending cash balance

C_0 = beginning cash balance

$ñ$ = duration of the recession in months

$s̃$ = monthly sales during the recession

$ñs̃$ = total sales during the recession

v = proportion of variable cash expenses to sales

$vñs̃$ = total variable cash expenses during the recession

f = monthly fixed cash expenses, other than debt servicing burden, during the recession

$ñf$ = total fixed cash expenses, other than debt servicing burden during the recession

i = monthly interest payment associated with the contemplated level of debt during the recession

$ñi$ = total interest payment associated with the contemplated level of debt during the recession

f' = monthly non-cash fixed expenses

nf' = total non-cash fixed expenses during the recession

T = corporate income tax rate.

In financial analysis, **Leverage** represents the influence of one financial variable over some other related financial variable.

Internal Rate of Return is the rate of discount at which the net present value of an investment is zero.

Intrinsic Value of an asset is the present value of the stream of benefits expected from it. It is also referred to as the fair value or reasonable value or investment value.

The value drivers at the **Generic Level**, the variables that reflect the achievement or non-achievement of the value maximization objective most directly are identified.

The value drivers at the **Department Level**, the variables that guide the department towards achieving the overall objective are identified.

The value drivers at the **Grass Roots Level**, the variables that reflect the performance at the operational level are identified.

5.8 Suggested Readings / Reference Material

1. Richard Brealey and Stewart Myers and Franklin Allen and Alex Edmans (2023). Principles of Corporate Finance. 14th Edition, McGraw Hill India
2. Stephen A. Ross, Randolph Westerfield (Author), & Jordon (2018). Fundamentals of Corporate Finance. 12th edition, McGraw Hill College
3. Prasanna Chandra (2020). Strategic Financial Management: Managing for value creation. 2nd edition, McGraw Hill
4. Hubbard & Obrien (2022). Mony, Banking and Financial System. 4th edition, Pearson Education
5. Kalyani Karna (2019). Strategic Financial Management. 1st edition. Corporate Plus Publications Private Limited
6. Edward I Altman (2019). Corporate Financial Distress, Restructuring and Bankruptcy. 4th edition, Wiley
7. Rick Mann & David Tarrant (2020). Strategic Finance for Strategic Leaders: The First Five Tools. Clarion strategy publishing
8. Sheeba Kapil (2021). Financial Valuation and Modelling. Wiley

5.11 Answers to Check Your Progress Questions

1. (e) Intensity of Direct Competition

Degree of direct competition and customer's influence are considered as core factors affecting market economics

2. (e) Incremental investment in working capital

All others are value drivers as per the Alcar Model

3. (a) Return on invested capital in terms of operating margin and invested capital

At the generic level, the variable that reflects the achievement of value maximization objective is return on capital employed

4. (b) Capacity utilization

As per Mckinsey Approach, the value drivers considered is the capacity utilization

5. (e) Both (a) and (c) above

The assumptions underlying this model are

- All sales are cash sales
- The duration of recession is variable
- The daily sales during the recession are variable
- While the interest burden associated with debt is inescapable, the principal repayment obligation can be deferred till the recession lasts.

Unit 6

Financial Distress and Restructuring

Structure

"Our overriding goal in restructuring our financial architecture should be that taxpayers never again have to save a failing financial institution".

- *Henry Paulson*

6.1 Introduction

The basic causes of business failure can be categorized into four major heads – the economic factors, the financial factors, factors relating to neglect, disorder and fraud and some other factors. The economic factors relate to industry weakness and poor location of the firm. The financial factors relate to the over burdening debt capacity and insufficient capital. The importance of the different factors varies over the time, depending on such things as the state of the economy and the level of interest rates. Apart from this, sometimes some factors produce a combining effect so as to make the business unsustainable. Studies have provided further evidence that the causes of financial distress are a result of a series of errors, misjudgments and interrelated weaknesses that can be attributed directly or indirectly to the management of the firm. This unit highlights factors leading to failure of business and models to predict bankruptcy and financial distress.

Example: Is the business world of the UK staring at financial distress?

The number of businesses in the UK that are at risk of going under financial distress due to costs spiral and Covid loan repayments are on the rise. According to the report by Begbies Traynor, there was a 19% rise in businesses in critical financial distress during the last quarter of 2021-22, compared to the same quarter of 2020-2021. By the end of April 1, 2022, as many as 891 firms fell into the category of critical, suggesting their outlook to be precarious. The increased price of inputs, higher recruiting costs due to increased wages, reduced consumer spending due to high inflation, and post-Brexit hangover were a few reasons for this situation. According to Julie Palmer, a partner at the insolvency and restructuring specialist firm, without further help, there would be a wave of business failures in the UK.

Source: https://www.bbc.com/news/business-61258362, dated 29th April, 2022 (Accessed on May 23, 2022)

6.2 Objectives

After going through the unit, you should be able to:

- Explain the meaning of bankruptcy
- Recognize the factors leading to bankruptcy
- Identify the symptoms of bankruptcy
- Outline the mathematical models to predict bankruptcy
- Identify the effects of financial distress

6.3 Meaning of Bankruptcy

A firm is said to be bankrupt if it is unable to meet its current obligations to the creditors. Bankruptcy may occur because of a number of external and internal factors.

Definitions

Sick Industrial Company

The Sick Industrial Companies (Special Provisions) Act, 1985 or SICA defines a sick industry as "an industrial company (being a company registered for not less than five years) which has at the end of any financial year accumulated losses equal to or exceeding its net worth".

Repeal of the Sick Industrial Companies Act

SICA was repealed and replaced by the Sick Industrial Companies (Special Provisions) Repeal Act of 2003. This Act altered some SICA provisions and pointed out certain loopholes. Apart from combating industrial sickness, the new Act intended to reduce incidence of sickness by making sure that companies do

not declare sickness just to escape legal obligations and get access to concessions from financial institutions.

The repeal of SICA came into full effect on December 1, 2016. It was fully repealed, in part, because some of its provisions overlapped with the Companies Act of 2013. The Companies Act constituted the creation of the National Company Law Tribunal (NCLT) and the National Company Law Appellate Tribunal (NCLAT). The NCLT was initiated to deal cases related to the management of a company, mergers, and rehabilitations of companies, among other issues. Further, the NCLT's authority is the Insolvency and Bankruptcy Code of 2016, which tells that corporate insolvency processes can be initiated before the NCLT.

Weak Unit

A non-SSI industrial unit is defined as 'weak' if its accumulation of losses as at the end of any accounting year resulted in the erosion of fifty percent or more of its peak net worth in the immediately preceding four accounting years. It is clarified that weak units will not only include those which fall within the purview of Sick Industrial Companies (Special Provisions) Act, 1985 (of industrial companies) but also other categories such as partnership firms, proprietary concerns, etc. A weak Industrial Company should be termed as "potentially sick" company.

Sick SSI Unit

A small-scale industrial (SSI) unit, as per the RBI is classified as sick when:

a. Any of its borrowal accounts has become a doubtful advance, i.e. principal or interest in respect of any of its borrowal accounts has remained overdue for periods exceeding $2^1/_2$ years and

b. There is erosion in net worth due to accumulated cash losses to the extent of 50 percent or more of its peak net worth during the preceding two accounting years.

In case of tiny/decentralized sector units, if requisite financial data is not available, a unit may be considered as sick if the loan/advance in which any amount to be received has remained past due for one year or more.

Example: Cases Resolved Under Bankruptcy Code in India

By December 31, 2021, 43 large corporates, each with admitted claims of ₹ 2,500 crore and above, were resolved through the market-driven corporate insolvency resolution process (CIRP) under the Insolvency and Bankruptcy Code, 2016. While these corporates owed ₹ 5.44 lakh crore in total to banks and financial institutions, their liquidation value was only ₹ 1.06 lakh

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crore. Through the approved resolution plans, the realisable value for financial creditors came to ₹ 1.91 lakh crore. This was 79% more than the liquidation value of these debtors, and 35% of the admitted claims.

Source: https://www.ndtv.com/business/government-says-43-corporate-debtors-cases-resolved-under-bankruptcy-code-2754904, dated 8th February, 2022 (Accessed on May 23, 2022)

Factors Leading to Bankruptcy

External Factors

a. Change in government policies affecting the firm
b. Increased competition
c. Scarcity of raw material
d. Prolonged power cuts
e. Changes in consumer buying pattern
f. Shrinking demand
g. Natural calamities
h. Cost overruns
i. Inadequate funds.

Internal Factors

a. Mismanagement
b. Fraudulent practices and misappropriation of funds by the management
c. Labor unrest
d. Technological obsolescence
e. Disputes among promoters.

Symptoms of Bankruptcy

A firm goes bankrupt gradually. Before a firm goes bankrupt, it exhibits a number of symptoms, which when diagnosed and corrected in time can save the company from bankruptcy.

Some of these symptoms are

- Production
  - Low capacity utilization
  - High operating cost
  - Failure of production lines
  - Accumulation of finished goods
- Sales and Marketing
  - Declining/Stagnant sales
  - Loss of distribution network to competitors

- Finance
  - Increased borrowing at exorbitant rates
  - Increased borrowing against assets
  - Failure to pay term loans
  - Failure to pay current liabilities, salaries etc.
  - Failure to make statutory payments
- Others
  - A declining trend in market price of share
  - Rapid turnover of key personnel
  - Persistent cash losses
  - Frequent changes in accounting policies to enhance profits
  - Frequent change of accounting years for undeclared reasons.

6.4 Prediction of Bankruptcy

As the incidence of sickness became more frequent, a need was felt to evolve techniques and methods to predict failure of a firm. While symptoms listed earlier are good indicators of the financial health, they are not the best predictors of sickness.

A number of models are available to accurately predict sickness of a firm. These models provide early warning signals, so that a potentially disastrous situation can be averted. Most of these techniques involve financial ratio analysis. A study has revealed that financial ratios are useful in predicting the failure of a firm for a period up to 5 years before sickness accurately. A number of Indian models are also available. Some of the models are discussed below.

International Models:

- Beaver Model
- The Wilcox Model
- Blum Marc's Failing Company Model
- Altman's Z Score Model
- Argenti Score Board.

Indian Model:

- L.C. Gupta Model.

Beaver Model

Beaver was the first to make a conscious effort to use financial ratios as predictors of failure. He defined failure as "inability of a firm to pay its financial obligation as they mature."

He used 30 ratios classified under 6 categories. Beaver tested these ratios to predict the failure of a company. The ratio of cash flow to total debt was found to be the best single predictor of failure. The study further revealed that financial ratios are useful in prediction of failure.

The Wilcox Model

Wilcox proposed that the net liquidation value of a firm is the best indicator of its financial health. The net liquidation value can be obtained by the difference in liquidation value of firm's assets and the liquidation value of liabilities. Liquidation value is the market value of assets and liabilities, if liquidated at that point of study.

Blum Marc's Failing Company Model

Blum Marc's model predicts the financial health of a firm using 12 ratios divided into 3 groups: Liquidity ratios, Profitability ratios and Variability ratios. Using these ratios, Blum Marc tried to accurately predict failure and draw a distinction between bankrupt and non-bankrupt firms.

Altman's Z Score Model

Altman improved upon the earlier models using ratio analysis to predict failure. Altman's model is based on the fact that various ratios when used in combinations can have better predictive ability than when used individually. 22 ratios were considered in various combinations as predictors of failure. He used a statistical technique called the Multiple Discriminant Analysis (MDA) to distinguish between bankrupt and non-bankrupt firms.

Out of these 22 ratios, a final set of 5 ratios were selected as they were found to be better predictors of failure. Weights were given to these ratios on the basis of their significance to predict health of the model. He developed a discriminant score called the Z-score on the basis of these ratios.

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5$$

Where,

Z = Discriminant score

X_1 = Working capital/Total assets

X_2 = Retained earnings/Total assets

X_3 = EBIT/Total assets

X_4 = Market value of equity/Book value of debt

X_5 = Sales/Total assets.

If Z score for a firm is less than 1.81, the firm is likely to go bankrupt. If Z score is more than 2.99, it is regarded as a healthy company. The range between 1.81 – 2.99 is treated as an area of ignorance.

Z Score	Classification
< 1.81	Bankrupt firm
1.81 – 2.99	Area of ignorance
> 2.99	Healthy firm

Argenti Score Board

J. Argenti in his famous article 'Company Failure – Long Range Prediction is Not Enough', developed a score board for evaluating the health of the firm. The model is based on numerical assessment of the firms' weaknesses. The weaknesses are classified as defects (management and accounting), mistakes and symptoms. He has delineated a list of factors to be looked into along with the respective scores. All the scores are to be summed up. The cut-off point for a "healthy firm" is a score of 25. This model has been criticized for being "subjective" and "arbitrary."

Argenti Score Board – Factors to Predict Bankruptcy		
Defects	In management – Score	
	8	The chief executive is an autocrat
	4	He is also the chairman
	2	Passive board – an autocrat will see to that
	2	Unbalanced board – too many engineers or too many finance types
	2	Weak finance director
	1	Poor management depth
	15	Poor response to change, old-fashioned product, obsolete factory, old directors, out-of-date marketing
		In accountancy –
	3	No budgets or budgetary controls (to assess variance, etc.)
	3	No cash flow plans, or not updated
	3	No costing system. Cost and contribution of each product unknown
Mistakes		Pass should be less than 10
	15	High leverage, firm could get into trouble by stroke of bad luck
	15	Overtrading. Company expanding faster than its funding. Capital base too small or unbalanced for the size and type of business
	15	Big project gone wrong. Any obligation which the company cannot meet if something goes wrong
		Pass should be less than 15

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Symptoms	4	Financial signs, such as Z-score, appear near failure
	4	Creative accounting. Chief executive is the first to see signs of failure and, in an attempt to hide it from creditors and the banks, accounts are "glossed over" by, for instance, overvaluing stocks, using lower depreciation, etc. Skilled observers can spot these things.
	4	Non-financial signs, such as untidy offices, frozen salaries, chief executive "ill", high staff turnover, low morale, rumors
Total possible score	100	Pass should be less than 25

L.C. Gupta Model

L.C. Gupta's model was the first Indian model proposed to predict failure. He used 56 ratios and sought to determine the best set of ratios to predict failure. These were categorized as profitability ratios and balance sheet ratios. He applied these ratios to a sample of sick and non-sick companies and arrived at the best set of ratios.

These are given below:

Profitability Ratios:

- EBDIT/Net Sales
- OCF/Sales (Operating Cash Flow/Sales)
- EBDIT/(Total Assets + Accumulated Depreciation)
- OCF/Total Assets
- EBDIT/(Interest + 0.25 Debt).

Balance Sheet Ratios:

- Net Worth/Total Debt
- All Outside Liabilities/Tangible Assets.

The model was found to have a high degree of accuracy in predicting sickness for 2/3 years before failure.

Example: Bankruptcy Predictions and Government Interventions

Many of the major retailers, commercial landlords, and energy companies in the United States reeling from industrywide distress filed for bankruptcy in 2020. In 2021, the corporate restructuring professionals predicted more bankruptcies initiating a bankruptcy wave in the US. But the year witnessed

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the fewest annual bankruptcy filings in nearly four decades. They were 24% (about 3,000 in number) lower than the previous year. The year 2021 recorded the fewest bankruptcies since 1986. Low borrowing rates, greater debt forbearance, and chiefly the stimulus programs of the government disrupted the forecast of a wave of corporate bankruptcies for the year.

Source: https://news.bloomberglaw.com/bankruptcy-law/corporate-bankruptcy-wave-turns-to-dust-defying-expectations, dated January 5, 2022 (Accessed on May 24, 2022)

6.5 Financial Distress

The primary cause of a firm encountering financial distress starts when it finds it difficult to meet the scheduled payments or when the cash flow projections of the firm are indicative of the fact that it will soon be unable to do so. Few of the pivotal issues that arise in due course are as follows:

a. Primary cause of failure on part of the firm to meet the debt obligations. To ascertain whether such a failure is due to a temporary cash flow problem or because of the fact that the asset values of the firm has fallen much below its debt obligation.

b. If it is found out that the problem is a temporary one, then an agreement with the creditors of the firm can be worked out so that the firm has time to recover and satisfy everyone. But in case the long run asset values have truly declined then the firm is said to have incurred economic losses. In such a situation it is important to ascertain, who should bear the losses and how much of share should be given to each.

c. To ascertain the value of the firm both on liquidation as well as on working conditions and to take the decision on whether it is profitable to continue the business or liquidate it based on the valuations.

d. Whether the firm should file protection under chapter 11 of Bankruptcy Act, or should it go for informal procedures. It is to be noted here that in both the cases of reorganization and liquidation a firm can either resort to informal procedures or work under the direction of the bankruptcy Court.

e. Ascertaining the controlling force of the firm while it is being liquidated or rehabilitated. To ascertain whether the existing management be left in charge or should a trustee be placed in charge.

Activity 6.1

a. What are the External Factors that lead to bankruptcy?

……

……

b. How do you predict bankruptcy under Altman's Z Score Model?

……

……

Settlements without going through Formal Bankruptcy

When a firm goes through the period of financial distress, it is very important for its management and creditors to decide whether the problem is a temporary one and it is possible for the firm to continue its operations or whether the problem is more serious and permanent in nature that has the possibility of endangering the life of the firm. So having done this, the parties involved in the process decides upon solving the problem either through the intervention of the bankruptcy court or through informal process. If the firm goes for filing a formal bankruptcy under chapter 11 of the Bankruptcy Act it involves certain costs. Coupled to this, there is also the possibility of the fact that when the creditors come to know that the firm has resorted to the Court, it might lead to disruptions. Thus it is preferable to go for reorganization and liquidation through informal means. Here we first start our discussion with the informal reorganization and then go into the details of the procedures of the formal bankruptcy.

Informal Reorganization

Those companies that possess more strong economic fundamentals are always prepared to work with these companies so as to help to come out of their distress conditions and to re-establish themselves on a sound financial basis. Such voluntary plans rendered by the creditors, generally termed as the "workouts", involve restructuring of the firm's debt; because of the fact that the current cash flows of the firm are insufficient to service the existing debt. The restructuring process typically consists of extension and composition. In the former case, the creditors postpone the dates of the interest or the principal payments as well as both. In case of the latter, the creditors voluntarily reduce their claims on the debt by accepting a lower principal amount or by reducing the interest rate on the debt. They may even take equity for debt or they may resort to the combination of all these three possible ways.

The process of debt restructuring begins with the initiation of both the firm's managers and the creditors meeting for seeking a proper balance. The creditors form a committee with four to five representatives of the larger creditors and a few of the smaller ones so that each side is equally represented. The meeting is often arranged and conducted by an adjustment bureau that is associated with and run by local credit manager's association. The first step involves drawing up a list of creditors with the amount of debt that is owed to each. This follows by developing the information that shows the value of the firm in different scenarios.

One such scenario may be the firm going out of business, selling off its assets and then distributing the proceeds to the various creditors as per the importance of the claim that is associated with each of them with the surplus going to the common stock holders. The firm may even take help of an appraiser who can appraise the

value of the firm's property that can be used as a basis for ascertaining the value of the firm in different scenarios.

Other scenarios may include continued operations, frequently with some improvements in the capital equipments, marketing and perhaps some management changes. This information is then shared with the bankers and the creditors of the firm. It has been frequently observed that the debt capacity of the firm exceeds its liquidation value and it is further observed that the legal fees and the other costs that are associated with the formal liquidation process under the bankruptcy lowers the proceeds available to the creditors. Added to this, the process of resolving the case through formal procedure is also very time consuming, it may take a year or even more than a year. This reduces the present value of the proceeds to much lower level. When the creditors are supplied with this information, they might be somewhat convinced to accept something less than their full value of the claim. In case where the management and the primary creditors agree for a resolution, then a formal plan is drafted and is presented to all the creditors providing them the reasons why they should be willing to compromise on their claims.

While framing the reorganization plan, creditors offer extension because that promises them their full payment at some point of time. In certain cases, the creditors may agree to not only postpone the date of payment but also to subordinate the existing claims to the vendors who show their willingness to extend new credit during the workout period. In a similar way, the creditors may also be willing to accept a lower interest rate on the loans during the extension period. This may be perhaps in exchange for a pledge of collateral. Because of the sacrifices that are involved, the creditors should have more faith than the debtor firm will able to solve the problems.

In comparison to this, the creditors agree to reduce their claims. Typically, the creditors receive the cash and the new securities that have a combined market value that is less than the amounts owed to them. Generally it is observed that bargaining is taking place between the debtors and the creditors over the savings that in turn results from avoiding the cost of legal bankruptcy, administrative cost, legal fees, and investigative cost and so on. In addition to get away from such costs the debtor feels relieved that the stigma of bankruptcy is not put on him. It is also sometimes seen that the bargaining process may lead to the process of restructuring that may involve both extension as well as composition. As an example, the settlement may provide for a cash payment of 25% of the debt amount immediately, along with a new note that promises six future installments of 10% each for a total payment of 85%.

The process of voluntary settlement is both informal as well as simple. They are also relatively cheap because the legal and the administrative expenses that are associated with it are limited to the minimum amount as a result of which the

voluntary procedures normally result in the maximum return to the creditors. Although the creditors do not receive the payments immediately, and may some times have to accept an amount that is lower than that owed to them, they generally recover more money and sooner than in case the firm were to file a bankruptcy. Restructuring process also enjoys the benefit of avoiding the loss that is incurred by the creditors.

Informal Liquidation

When the management of the firm realizes that the value of the firm is more when it is dead than it is alive, it may resort to informal procedures to liquidate the firm. Assignment is an informal procedure for the purpose of liquidating a firm. This process generally yields them a greater return than they would have received in formal bankruptcy liquidation. However, the feasibility of the assignments finds its significance only when the firm is small and the affairs of the firm are not that complex. Assignments enjoy certain advantages over the process of liquidation in the American Bankruptcy Courts, in terms of time, legal formality, and expense. The assignee has more flexibility in disposing a property than does a federal bankruptcy trustee. So an action can be taken much faster when the inventory becomes obsolete or the machine rusts. At the same time, it is to be remembered that the assignment does not automatically result in a full and legal discharge of all the debtors' liabilities and neither does it protect the creditors against fraud. Formal liquidation in bankruptcy can help in solving both these problems.

Example: How the 5:25 lending scheme of RBI is helping companies under Financial Distress

As banks restrict their finance to a maximum period of 12-15 years, the huge capital requirements and long gestation periods of core industries and infrastructure projects make it difficult for banks to finance. RBI introduced the 5:25 scheme i.e., "Flexible Structuring of Long Term Project Loans to Infrastructure and Core Industries", to enable banks to provide longer repayment periods to infrastructure and core industries projects.

A 5/25 structure allows banks to lend to a project for 25 years, with an option of rewriting the terms of the loan or transferring it to another bank or financial institution after five years. This scheme finally gained traction by the end of 2021, especially due to the looming financial distress. Banks cleared a huge refinancing loan for Bhushan Steel and three other loan refinancing proposals: Jaypee Infratech, Adani Power and Uttam Galva Metallics, worth ₹25,000 crore.

Source: https://www.thehindubusinessline.com/money-and-banking/525-refinancing-scheme-making-headway-at-last/article7318940.ece , dated December 6, 2021 (Accessed on May 24, 2022)

6.6 Causes of Financial Distress

Macro Level factors affecting the Financial Distress, Liquidity and Recession

In his study, Bernanke made some key findings on the relationship among liquidity, economic growth and financial distress. His argument stressed on the fact that the existence of bankruptcy risk plays a role in the propagation of recession for both the firms as well as individuals. He says, that bankruptcy leads to social costs, as a result of which almost all the agents try to avoid the consequence of bankruptcy costs. From the viewpoint of the consumers, they try to avoid it by retaining considerable amount of liquid assets so as to meet their fixed expenses, the banks and the tenders try to avoid it by being selective as far as their borrowers are concerned and by limiting the size of the loan with recession creeping into any system, there is the reduction in the cash flow income that is available to meet the current obligation. This, in turn, increases the uncertainty about the future liquidity needs.

There is also the general demand to bring solvency which consequently results in a reduced demand for consumer and producer durables, which again may generate further income reduction. Bernanke's study focused on the critical relationship among the changes in liquidity, financial distress and recession for both the consumer and firms. He postulates, that recession leads to the creation of financial distress by bridging the gap of margin between cash flow and debt service. When there is a constrained flow, the fall in the current income reduces the expenditure on illiquid, long lived assets. Two reasons can be attributed for this.

- The first being, the lower level of current income enhances the short run probability, so that the flow constraint has to be satisfied through expensive means. Say for example, the distress rate of assets, borrowing at unfavorable terms, severe reduction in the current standards of living or even the last possible resort, the bankruptcy of the firm.
- The other reason being, the fall in the current level of income, reflects a hazy implication for the estimate by the consumer of the future income flows and thus too, for the level of durables holding consistent with maintenance of solvency in the long run. It must be remembered that, firms must bring together and balance the long-term spending plans with the need for having the cash flow so as to meet the short-term obligations. With a low level of internal liquidity, coupled with many fixed expenses, there is the possibility of increase in the level of financial embarrassment, for at least they raise the cost of new financing. At the same time, postponement of capital expenditures is a proper defence mechanism of the balance sheet, against any

expected fall in the current income. Bernanke has also stated the cause of bankruptcy. His suggestion is somewhat based on moral hazard.

Industry Level Causes of Financial Distress

The industry level causes of financial distress can be said to be a three tier system. They are competition, industry shocks and deregulation. Let us now discuss each of these factors in detail.

Competition

For identifying the possible industry level causes of financial distress, one can resort to Michael Porter's five forces model. The five forces that are included in it are:

a. Barriers to entry

b. Bargaining power of suppliers

c. Bargaining power of buyers

d. Threat of substitute products

e. Rivalry among the competing firms

Each of the above stated factors is associated with the financial distress of an individual firm that operates within the industry. One of the possible implications of the stated factors is that the firms in the different industries display different level of competition as well as different profit sensitivities to the changes in the macroeconomic and industry conditions over time. Financial distress is likely to be more in case of larger firms than that of the smaller ones as per conclusions drawn from Williams analysis. The author further states that a highly leveraged firm will commit to riskier projects as well as aggressive product market strategies so as to prevent other firms from entry.

Industry Shocks

Any negative shock to the demand of the product or its cost, especially over a period of time, eventually forces a shakeout of firms in the industry. The weakest of the firms are forced into bankruptcy or they must consider being taken over by a stronger firm in the industry. Studies conducted by Mitchell & Mulherin tested the proposition that industry shocks contribute to the frequency of takeover and restructuring activities. The shocks include, deregulation, changes in input costs of innovations in financial technology that brings about changes in the industry structures.

In a separate study, Long and Stulz examined the effect of bankruptcy announcements by one firm on the values of other firms in the industry. They tested for two contradicting effects. One may be the contagion effect. The market may pull down the values of other firms within the industry because of the fact that the bankruptcy announcement brings new, negative information about the status of the industry as a whole. On the other hand, the market may also raise the

value of other firms in the industry because one of their rival firms has failed. It has been found out that the balance between these contrary views is dependent on the financial characteristics of the firm, within the industry.

Industry Deregulation

The process of deregulation in an industry can bring in financial distress in many firms. This is mainly because of the fact, that deregulation within the industry brings forth a change in the economic structure of the industry. Let us now try to focus on some of the studies that reveal the effects of financial position of a firm due to deregulation creeping in.

Chen and Mercrilte studied the forced breakup of AT&T, that was initiated by Court Order, and continued for almost two years. The authors concentrated on the issue on whether the break up resulted in wealth transfers among the security claimants of AT&T and other stakeholders as well. The findings of their studies showed that economically significant events took place during the deregulation process, which resulted in the transfer of funds from third parties to the operating company shareholders. At the same time, it was also observed that, no transfer of wealth from the bondholders to stockholders took place during the deregulation process.

In another study, Kote and Lehn examined the effects of the Airlines Deregulation Act of 1978, along with the associated increase in competition, on airline firm's governance structures. They were able to develop several hypotheses about the expected effects based on the agency theory. They stated that deregulation may bring in the concentration of equity ownership. Deregulation may also lead to the increase in the costs of monitoring managers. This can have a dual effect. The first being, the outside shareholder will engage in monitoring only if his private benefits, which are proportional to his equity stake, exceed the cost of monitoring. The other effect being, in order to internalize the agency problems that are associated with higher monitoring costs, the managers themselves may own larger stakes so that they can have a larger proportion of wealth associated with their decisions. The authors also made predictions regarding the increase in the level of executive compensation for the airline executives, and also involving a change in the form of the compensation provided. They also put forth the argument that before the process of deregulation, the executives pay would relatively be more sensitive towards the firm's earnings, whereas it would be more sensitive towards the stock's price after the process of deregulation.

Firm Level Causes of Financial Distress

Though it is needless to mention about the importance that macroeconomic and industry factors have on the firm's financial distress, but it is also to be said that there are certain firm specific factors that contribute substantially to the firm's risk of financial distress. These factors can be

i. Ownership and governance structures

ii. Operating risk

iii. Leverage

Say for instance, the firm's operational efficiency, leverage and profitability of risk may be affected by the existence of the agency cost that is associated with both managerial discretion and debt. At the same time, it is also seen that when a firm is experiencing financial distress and even if the cause behind such distress can be traced out, it might be difficult to distinguish whether the decisions that resulted in the distress are due to the management's self-serving behavior or due to incompetence.

Example: COVID Pandemic, the Cause of Financial Distress of the Decade in OECD Countries

Due to the COVID-19 shock, the decline in firms' profits was estimated to be between 40% and 50% of business-as-usual profits.

About 7-9% of viable companies had become distressed, as the book value of their equity became negative.

The increase of leverage between 6.7 and 8 percentage points, due to borrowing during COVID, resulted in an increase of the servicing costs, making between 30% and 36% of firms unprofitable.

Investments in OECD countries were estimated to come down by 2 percentage points.

Source: https://www.oecd.org/coronavirus/policy-responses/insolvency-and-debt-overhang-following-the-covid-19-outbreak-assessment-of-risks-and-policy-responses-7806f078/ , dated 27th November, 2020 (Accessed on May 24, 2022)

6.7 Effects of Financial Distress

Loss of Tax Benefits of Debt and Depreciation

If a levered firm fails to earn profits on a regular basis, it loses the value of the tax shield provided by the debt interest and depreciation. These losses alone can put a firm at a most competitive and strategic disadvantage, based on the firm's initial leverage and depreciation.

Transaction Costs

For a firm that is facing financial distress, the transaction costs in the financial market seem to be much higher. It may also happen that the capital market has close proximity to the distressed firm. This may be partly due to the high underwriting spread offered by the investment bank to raise the firm's equity. Added to this it is also to be remembered that the transaction costs are high for a distressed firm that is in the process of debt restructuring.

Agency Costs

For a firm that is in financial distress, the agency costs associated with managerial discretion and debt are pretty high. As far as the former is concerned, the firm's senior management may be compelled to make decisions that keep their pay secured rather than making long-term strategic, risky decisions on behalf of the shareholders. To worsen the situation, the key employees of the firm may leave the firm, or may look for other avenues of employment. The agency costs of debt may also be severe as the firm has very little equity value against a relatively large amount of debt. Such situations can be considered to be ideal for the expropriation of creditors.

Negative Liquidity Effects

The substantial loss in the market value of a firm's equity can result in several liquidity effects. They can be summarized as follows –

a. The firm may go on losing out its professional analysts who play a vital role in supporting the flow of information about a stock.

b. This may result in the normal trading activities of the stock and increase the normal bid ask spread.

c. The exchange may also delist its stocks based on its listing requirements.

When this situation comes, the firm loses most of its potential to raise equity funds. At the same time, rising of debt funds becomes equally problematic. And this may happen in such situations when the firm is in severe need of external finance in order to survive. So, lack of access to external capital may even lead the firm to bankruptcy. It has been seen that firms with higher growth opportunities and riskier cash flows tend to have a relatively high ratio of cash to total non-cash assets. Those firms that have the highest credibility in the capital markets, such as firms with highest credit ratings, tends to have lower ratio of cash to total non-cash assets. At the same time, it is found that firms that perform well, accumulates more cash than that is predicted by the static trade off model.

Debt Holder-Equity Holder Conflicts

It is to be kept in mind that bankruptcy cost is not the only cost that is associated with debt financing. If it were so, it would not have been possible for companies like IBM to have relatively low debt ratios and at the same time having histories of generating taxable earnings. Added to this, such companies were also able to lower their costs of capital by increasing their leverage. Here one can conclude that the predicted present value of the direct costs of bankruptcy is incorporated into the firm's borrowing costs. So one can say that these direct costs cannot be more than the present value of the yearly difference between the firm's borrowing rate and the comparable default rates of interest. In order to provide a justification for the use of the costlier equity financing to finance their projects, one must take into account the bankruptcy cost that is associated with it.

Equity Holder Incentives

It is to be kept in mind, that the incentives of the equity holders in order to maximize the value of their shares are not necessarily consistent with the incentives to maximize the total value of the firm's debt and equity. As a matter of fact, it has been observed that the shareholders of a leveraged firm often have an incentive to put into practice the investment strategies that reduce the value of the firm's outstanding debt.

Here it is important to note that the total value of a firm equals the value of the firm's debt along with its equity; so it can be said that these strategies that reduce the value of the firm's debt keeping its total value intact, actually increases the share price of the firm. So, the equity holders have an incentive to carry out these kinds of strategies if permitted to do so. At the same time, they may also implement strategies that reduce the total value of the firm's debt and equity claims if these strategies are capable of transferring a sufficient amount from the debt holders to the equity holders.

For a sophisticated lender it is important to anticipate the equity holders' incentives to implement strategies of self-interest and thus he will determine the interest rates they charge on their loans. For the lender who anticipate that the equity holders will take actions in the future that reduces the value of the lender's claim will charge a higher rate of interest. From this point of view, the equity holders bear the expected costs of their future adverse incentives in the form of higher interest rates at the time they borrow. As a consequence, the firms find it important to convince their lenders that they will not indulge in such behavior and they will act so as to maximize the total value of the firm.

At the same time, firms may have difficulty in committing credibility to a policy of maximizing its total value rather than the value of their shares. There can be several ways by which the firm's equity holders can expropriate wealth from its debt holders say for example, the equity holders of the firm can instruct the firm's managers to sell-off all its assets and pay off the proceeds as dividends to the shareholders. This left the debt holders with value less papers. The debt holders, on the other hand, having knowledge of such actions to be taken by the equity holders start demanding for covenants, which are actually contracts between the lender and the borrower that prevents such actions. There can be several types of conflicts arising between the debt holders and the equity holders some of which can be categorized as follows:

a. The debt overhang problem, which involves the equity holders under-investing, that is to say, pass up profitable investments due to the reason that the firm's existing debt captures most of the projects' benefits. That is also referred to as the underinvestment problem.

b. The asset substitution problem, whereby the equity holders have a tendency to take on too risky projects, even when they entail a negative net present value.

c. Short-sighted investment problem in which the equity holders show a tendency to pass up profitable investment projects that pay off over a long time horizon in favor of ten profitable projects that may pay off more quickly.

d. The reluctance to liquidate problems involves the equity holders to keep a firm operating when its liquidation value exceeds its operating value.

Financing Choices influencing Investment Choices

There can be primarily two reasons that can be attributed to the fact that the debt holder equity holder conflict can be worse for the smaller firm. They are –

a. Being more flexible, the smaller firms are better able to increase the risk of their investment projects.

b. The major shareholders of the smaller firms are the top managers. This gives them the incentive to make choice that in turn benefits the equity holders at the expense of the debt holders.

These reasons are actually points to the fact, that smaller firms should have lower debt ratios. But, in reality this does not seem to happen. The smaller firms tend to choose the debt instrument that minimizes the conflicts between debt holders and equity holders. To be more specific, their long-term debt seems to be more convertible of a major portion of their total debt financing tends to be short-term debt.

It is also seen that the small firms avoid the long-term debt because of the involvement of transaction costs. As a result, the smaller firms may go for less expensive loans from banks that have lower fixed transaction cost than bond issues, but which at the same time provides only short-term financing.

Debt Restructuring

Most of the firms that are in financial distress find it very difficult to service their debt. If it is otherwise viable, for longer span of time, a distressed firm may even go for private debt restructuring or work out with its creditors so as to restructure its debt obligations. But this can be a very difficult task, especially in case the firm has any public debt outstanding. One of the problems that are often encountered in a debt restructuring process is that of a hold out problem. The problem involves the issue that all the debt claimants must agree on the re-assignment of debt claims, but one or more of the claimants is likely to have an incentive to hold out for a better deal.

Getting to an agreement among the creditors that is outside the formal process of bankruptcy depends upon the type of debt that is restructured, i.e., public debt or private debt. In exchange offers, the bondholders are given the option to exchange

their bonds for a package of new securities. They are often accompanied by modifications of the original bonds covenants through a technique that is better known as consent solicitation or exit covenants.

Example: Suzlon Energy completes debt restructuring as banks take a steep haircut

Debt-laden wind turbine manufacturer Suzlon Energy's board in April 2020, approved proposals to facilitate debt restructuring. Suzlon owed SBI-led consortium of 18 banks over ₹ 13,800 crore, of which only ₹ 5,200 crore was deemed sustainable, and was expected to be repaid at a lower interest rate of 9 percent per annum over a 10-year period. According to the restructuring plan, completed by July 1, 2020, ₹ 8,600 crore which is seen as unsustainable, would be converted into OCD (Optionally Convertible Debenture) and CCPS (Compulsorily Convertible Preference Shares) at nominal rates and shall be redeemable after 20 years. This meant a 62 percent haircut for the banks involved, but on paper, no debt has been written off.

Sources: (i) https://www.cnbctv18.com/energy/suzlon-debt-restructuring-6237891.htm (Accessed on July 11, 2022)

(ii) https://www.business-standard.com/article/pti-stories/suzlon-board-okays-various-tools-to-restructure-outstanding-debt-bonds-dues-120041800838_1.html (Accessed on July 11, 2022)

Acquisition or Takeover of a Distressed Firm can Create Value

The financial distress that any target firm faces contributes to a major factor in a substantial proportion of acquisitions when a firm acquired by another stronger firm within the industry can result in its value creation for its shareholders. This is mainly due to the following reasons:

a. The combination may result in increased economies of scale.

b. The combination may increase the product market power.

c. The acquiring firm may be able to enhance the troubled firms' operations through superior management techniques.

d. The acquiring firm may be able to contribute badly needed capital to the troubled firms, which may have been lacking both internally generated cash and effective access to external capital markets.

It is also seen that hostile takeovers are also often triggered by financial distress. Before the takeover process, the takeover firms generally substantially underperform other firms in their industry and the motives behind such takeover may be to correct the management failures. Further, it is to be noted that diversified firms that perform poorly and loose value are often targets for a bust up takeover.

Leverage Buyouts (LBOs) and Financial Distress

Leverage buyouts are often resorted to by firms that lack incentives to pursue value enhancing activities. An LBO can alleviate this problem by both increasing managerial equity ownership and imposing the discipline of debt. Though it was observed by Opter and Titman the firms with high expected costs of financial distress are less likely to go for a leveraged buyout.

Alternatives available with the Firm

A firm faced with imminent bankruptcy has two alternatives to choose from: Reorganization and Liquidation.

Reorganization of a firm is a more sensible solution when faced with the possibility of bankruptcy as it will be in a better position to repay its debts, when it is alive and operating, than when it is liquidated. There are a number of cases of firms that have been successfully turned around from a state of hopeless bankruptcy.

In case, reorganization is not a viable option and the firm no longer has the ability to operate and earn profits to pay-off its liabilities, liquidation is the only alternative available. All the assets are sold and the proceeds are distributed to creditors and other concerned parties.

Reorganization

The steps involved in reorganization of a firm are:

- Techno-economic viability study
- Formulation and execution of the reorganization plan
- Monitoring the activities of the firm.

Techno-economic Viability Study

A reorganization plan is worked out on the basis of a techno-economic viability study of the firm. This study sets out to identify the strengths and weaknesses of the firm, the causes of failure, the viability of future operations and the course of action to be taken to bring about a turnaround. The techno-economic viability study is undertaken by the operating agencies assigned to the firm. These operating agencies are generally financial institutions and banks such as IDBI, IFCI, ICICI, IRBI etc.

The techno-economic viability study covers all the functional areas of a firm: management, finance, production and marketing.

Management: The effectiveness and ability of the management is one of the most important factors that determines the success or failure of a firm. A detailed study is done in terms of the objectives of the firm, both short-term and long-term, the corporate strategy, the corporate culture, the management-labor relations, the organizational hierarchy, the decision-making process, etc. The study tries to

determine the effectiveness of management and its integrity. The areas of mismanagement are also determined.

Finance: Finance is the main functional area of business. It is a measurable indicator of the firm's health and performance. A thorough analysis of the firm's Balance Sheet and Profit/Loss statement is made.

These statements when properly analyzed give the financial stability and liquidity of the firm; profitability and uses of funds. The analysis also identifies the capital structure and the sources of funds. The analysis gives insight into working capital management and management of earnings.

Production and Technology: Production and Technology function assumes immense importance in the viability study. The various areas that are looked into are, the firm's equipment and machinery, maintenance of the equipment, technology used in production, production capacity and utilization, products being offered by the firm, quality control system, production planning and inventory control.

Marketing: A number of firms have failed because of lack of good marketing management. The various areas of marketing that are studied are, the product mix of the firm, the past sales of the product in terms of quantity and value, the market share of the firm, demand for the product range, the study of the customer profile, price of the products, the distribution channels being used, the kind of promotion mix being used and the most important of all is the marketing team. This study is done in comparison with the competitors.

Formulation and Execution of the Plan

The viability study serves as the basis for formulation of a rehabilitation plan. A thorough study of the various functional areas of the firm reveals the strengths, weaknesses, opportunities and threats of the firm. It gives a comprehensive idea about the status of the firm, the viability of the firm both technically and economically and the additional funds required for rehabilitation.

The formulation plan involves the changes and action to be taken regarding the various functions of the firm. It may decide to make changes in the management, if it is not found competent. Some of the labor may be retrenched/recruited depending on the situation. The amount of financial assistance to be given is determined and arrangements are made to secure the loan. Various steps are taken to improve the production function in terms of new machinery and new technology. The viable levels of operations are determined and steps are taken to achieve this production level.

The product-mix, the pricing, the quality of the products, distribution channels and the promotion-mix are to be changed to suit the needs of the customers, to achieve the desired sales levels. Once the plan is formulated, the plan is carefully executed. All the necessary changes prescribed by the plan are made. The funds

are disbursed in a phased manner as and when required. The necessary concessions and reliefs are provided. A close watch is kept on the activities of the firm and a continuous evaluation is done.

Monitoring: Monitoring is a very important part of a rehabilitation plan. It is done to evaluate the execution of the plan. Regular meetings are held between the firm, the bankers, the financial institutions and other concerned parties to verify and evaluate the process of execution. Monitoring is done to ensure the proper utilization of funds and adherence to the terms of rehabilitation plan. It also ensures the proper working of the firm. Feedback is obtained and remedial measures are taken as and when the situation demands. The impact of rehabilitation becomes evident in a short period. Once the success of the firm becomes evident, the role of agencies and banks is confined to constantly hold meetings to assess and review the process. This continues till the firm is successful. In case the firm is found incapable of making a turnaround despite the plan, then the steps to liquidate the firm are undertaken.

Liquidation: A firm is faced with liquidation when it is established that there is no hope of bringing about a turnaround and coming out of financial crisis. Liquidation requires the firm to dispose its claims and settle liabilities on a priority basis.

In the process of corporate liquidation, the assets of the firm are solo, the proceeds are used to retire debt, and remaining cash, if any, is distributed to the stockholders of the firm as a liquidating dividend. The liquidation of a firm may be of two types – voluntary and involuntary. A firm may be able to generate more value for its creditors and shareholders by going in for liquidation than by continuing to operate.

Activity 6.2

a. How does Acquisition or Takeover of a Distressed Firm Create Value to the shareholders?

……...…….

……...…….

b. Define Voluntary liquidation.

……..……..…

..……...…….

Check Your Progress -1

1. Which of the following is an external factor leading to Bankruptcy?
   a. Scarcity of raw material
   b. Technological obsolescence
   c. Mismanagement
   d. Disputes among promoters
   e. Fraudulent practices
2. M/s MAZE Industries, a company engaged in job work of manufactured goods, basically iron and steel, has been witnessing steep rise in shop floor operating cost for the past couple of years. To which of the following departments can this symptom of bankruptcy be attributed to?
   a. Sales and Marketing
   b. Finance
   c. Human resource
   d. Strategy
   e. Production
3. Which of the following models of bankruptcy uses 12 ratios classified into liquidity, profitability and variability ratios, for predicting bankruptcy?
   a. Beaver Model
   b. Wilcox Model
   c. Blum Marc's Failing Company Model
   d. Argenti Score Board
   e. LC Gupta Model
4. Which form of restructuring involves voluntary plans rendered by creditors which are called "workouts"?
   a. Debt restructuring Reorganization
   b. Informal
   c. Formal Application for Bankruptcy
   d. Informal Liquidation
   e. Formal reorganization
5. Which of the following is/are firm specific factors that contribute substantially to the firm's risk of financial distress?
   a. Ownership and governance structures
   b. Operating risk
   c. Leverage
   d. Ownership and governance structures, Operating risk and Leverage
   e. Threat of Substitutes

6.8 Summary

- Sick Industrial Companies Act, 1985 (SICA), defines "a sick industry as an industrial company (being a registered company for not less than five years) which has at the end of any financial year accumulated losses equal to or exceeding its net worth".
- Factors for bankruptcy is divided into external and internal.

- A firm that faces imminent bankruptcy has two alternatives – reorganization, and liquidation.
- Reorganization of a firm is a more sensible solution when faced with the possibility of bankruptcy as it will be in a better position to repay its debts, when it is alive and operating, than when it is liquidated.
- A firm is faced with liquidation when it is established that there is no hope of bringing about a turnaround and coming out of financial crisis. Liquidation requires the firm to dispose its claims and settle liabilities on a priority basis.

6.9 Glossary

Acquisition	**:**	Buying of a firm by another firm.
Agency Problem	**:**	Refers to the Conflicts of interests among stockholders, bondholders and managers.
Joint Venture	**:**	An agreement between two or more companies where there will be an agreed contribution and participation of the respective companies.
Leveraged Buy-Out	**:**	The purchase of the company by a small group of investors, financed largely by debt. Usually involves going private.
Liquidating Value	**:**	The value of a company based on the market value of its assets, net of liabilities.
Liquidation	**:**	Divestiture of all the assets of the firm so that the firm ceases to exist.
Merger	**:**	The fusion of two or more companies (OR) Merger is a combination of two or more companies into a single company where, it survives and others lose the corporate identity. The survivor acquires the assets and liabilities of the rest.
Sick Industrial Company	**:**	An industrial company (being a company registered for not less than five years) which has at the end of any financial year accumulated losses equal to or exceeding its net worth.

6.10 Suggested Readings / Reference Material

1. Richard Brealey and Stewart Myers and Franklin Allen and Alex Edmans (2023). Principles of Corporate Finance. 14th Edition, McGraw Hill India
2. Stephen A. Ross, Randolph Westerfield (Author), & Jordon (2018). Fundamentals of Corporate Finance. 12th edition, McGraw Hill College

3. Prasanna Chandra (2020). Strategic Financial Management: Managing for value creation. 2nd edition, McGraw Hill
4. Hubbard & Obrien (2022). Mony, Banking and Financial System. 4th edition, Pearson Education
5. Kalyani Karna (2019). Strategic Financial Management. 1st edition. Corporate Plus Publications Private Limited
6. Edward I Altman (2019). Corporate Financial Distress, Restructuring and Bankruptcy. 4th edition, Wiley
7. Rick Mann & David Tarrant (2020). Strategic Finance for Strategic Leaders: The First Five Tools. Clarion strategy publishing
8. Sheeba Kapil (2021). Financial Valuation and Modelling. Wiley

6.11 Suggested Answers

Self-Assessment Questions – 1

a. The External Factors that lead to bankruptcy are:

a. Change in government policies affecting the firm
b. Increased competition
c. Scarcity of raw material
d. Prolonged power cuts
e. Changes in consumer buying pattern
f. Shrinking demand
g. Natural calamities
h. Cost overruns
i. Inadequate funds.

b. Altman's model is based on the fact that various ratios when used in combinations, can have better predictive ability than when used individually. 22 ratios were considered in various combinations as predictors of failure. He used a statistical technique called the Multiple Discriminant Analysis (MDA) to distinguish between bankrupt and non-bankrupt firms. He developed a discriminant score called the Z-score on the basis of these ratios.

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5$$

If Z score for a firm is less than 1.81, the firm is likely to go bankrupt. If Z score is more than 2.99, it is regarded as a healthy company.

Self-Assessment Questions – 2

a. The financial distress that any target firm faces contributes to a major factor in a substantial proportion of acquisitions when a firm acquired by another stronger firm within the industry can result in its value creation for its

shareholders.

This is mainly due to the following reasons:

a. The combination may result in increased economies of scale.

b. The combination may increase the product market power.

c. The acquiring firm may be able to enhance the troubled firms' operations through superior management techniques.

d. The acquiring firm may be able to contribute badly needed capital to the troubled firms, which may have been lacking both internally generated cash and effective access to external capital markets.

b. Voluntary liquidation is a form of liquidation under which the firm and creditors come up with a creative plan to dispose off the liabilities in a manner that makes sense to everybody involved. This happens when the firm realizes that there is no hope of turnaround and liquidation is the only option that either occurs without the involvement of the Court or under the supervision of the Court.

6.13 Answers to Check Your Progress Questions

1. **(a) Scarcity of raw material**
   All other options are internal factors

2. **(e) Production**

   Some of symptoms of bankruptcy in Production include low capacity utilization, high operating cost, failure of production lines and accumulation of finished goods

3. **(c) Blum Marc's Failing Company Model**

   This model predicts the financial health of a firm using 12 ratios divided into 3 groups – liquidity ratios, profitability ratios and variability ratios.

4. **(b) Informal Reorganization**

   Under informal reorganization, voluntary plans rendered by the creditors, generally termed as the "workouts", involve restructuring of the firm's debt; because of the fact that the current cash flows of the firm are insufficient to service the existing debt

5. **(d) Ownership and governance structures, Operating risk and Leverage**
   Firm specific factors include all of them except threat of substitutes which is an industry specific factor

Unit 7
Real Options

Structure

"It's easy to make good decisions when there are no bad options".

- Robert Half

7.1 Introduction

Investment of financial resources is very crucial to the success of a business firm. There are so many investment opportunities available. In one way, the investment opportunities are termed as options. These options are of two types, viz., financial options and real options. Investments in financial assets like shares and bonds are known as financial options whereas investments in real assets like land and realty are termed as real options. Investing money in available options is not a simple activity or decision. It is a process which affects the short-term as well as long-term solvency of the firm. This unit discusses the various approaches that the managers have to adopt to manage strategic investments.

Example: Real Option of Hyundai

With auto industry's imperative shift from conventional fuels to electric power, investing in EV technologies created real options for firms in the automobile industry. The real option would be about developing own technology or buying it from outside. Availability of many alternative technologies to invest in, created further real options. Hyundai planning to invest a total of 21 trillion won ($16.54 billion) through 2030 for the expansion of its electric vehicle (EV) business in South Korea to annually build 1.44 million units of EVs in South Korea by 2030 was one such big real option.

Source: https://economictimes.indiatimes.com/industry/renewables/hyundai-motor-group-plans-to-invest-16-5-bln-in-south-korea-ev-business/articleshow/91634192.cms, dated May 18, 2022 (Accessed on May 26, 2022)

7.2 Objectives

After going through the unit, you should be able to:

- Define real options and differentiate them from financial options
- Discuss the types of real options
- Describe the valuation of real options
- Explain the application of real options

7.3 Definition of Real Options and Difference with Financial Options

A real option is an option that arises naturally in the course of business activities rather than one purchased on a financial market. A common example of a real option is early investment in a technology, which will enable a firm to exploit the new technology should it prove successful. In a narrower sense, the real options approach can be viewed to be an extension of the financial option theory. In case of the real options the underlying are real assets unlike financial assets in the case of financial options. The difference lies in the fact that the financial options are detailed in their contract; the real options that are embedded in strategic investments must be identified and specified. The real option approach provides the managers with opportunities for the way they have to plan and manage strategic investments.

Comparison of Real Options with Financial Options

The basic difference that exists between a financial option and a real option lies in its underlying. The underlying that exists in case of the former is a security such as a share of a common stock or a bond, whereas the underlying for the latter is a tangible asset, say for example, a business unit or a project. It is to be noted that both types of options give the right but not the obligation to take an action.

Financial options are written on traded securities, whose price is usually observable and one can estimate the variance of its rate of return. In the case of real options, the underlying risky asset is usually not a traded asset, thus one estimates the present value of the underlying without flexibility by using traditional net present value techniques.

A further difference exists between the two. Most financial options are not issued by the companies on whose shares they are contingent, but rather by the independent agents who write them and buy those that are not written. As a result of which, the agent that issues a call option has no influence and control of the company and its share price. The real options are different in this aspect because here, the management controls the underlying real assets on which they are written. As an example, a company might have the right to defer a project and it may choose to do so if the present value of the project is low.

Now if the company comes up with an innovative idea that has the potential to enhance the NPV of the project, the value of the right to defer may fall and the company may decide not to defer. As a matter of fact, the act of enhancing the underlying real assets value also increases the value of the option. A point of similarity that exists between a financial option and a real option is that in both cases, the uncertainty of the underlying, i.e., the risk is assumed to be exogenous. The uncertainty concerning the rate of return on a share of a stock, is beyond the control and influence of individuals, who are the actual traders of the stock. In case of real options, the actions of the company that own it may influence the action of its competitors, and consequently the nature of uncertainty that the company faces.

Example: Real Option and Financial Option of Apple

BBC estimated that Apple buys a company every 3 to 4 weeks. For instance, it was reported that Apple in May 2022, acquired Credit Kudos, a UK open banking startup that helps lenders make better decisions. Credit Kudos' technology was based on the UK's open banking framework which Apple can modify to work with the U.S.'s growing open banking sector for strengthening Apple Card's credit checker or work to expand operations to the UK. As the underlying asset here was an organization (Credit Kudos), this was a real option.

Apple shipped approximately 1 million 'Make-in-India' iPhones in India in the first quarter of 2022, a staggering 50% increase YoY. If Apple buys an option (call) with any bank to buy USD, with the INR it earned in India, then it would be a financial option as the underlying asset was USD.

Sources: (i) https://www.bbc.com/news/business-56178792, dated 24th February, 2021 (Accessed May 26, 2022)
(ii) https://www.macrumors.com/2022/03/23/apple-acquires-uk-banking-startup/, dated March 23, 2022 (Accessed May 26, 2022)
(iii) https://tracxn.com/d/acquisitions/acquisitionsbyApple, dated April 21, 2022 (Accessed May 26, 2022)

7.4 Types of Real Options

The very first step in valuing a project lies in identifying the options that are embedded within the project. It may happen that though two projects are exactly identical, there may be the presence of several types of real options.

Growth Options

A growth option lets a company to increase its capacity of operation if the market conditions are better than expected. They may be of different types. In one type of growth option, a company may resort to increase the capacity of an existing product line. Another type allows a company to expand into new geographic markets. The third type may deal with the opportunity to add new products that

even includes the complementary products and successive generations of the original product.

Example: The Expansion Option of MG Motor

By May 2022, MG Motor was already in the process of expanding the annual production capacity of its Gujarat-based Halol plant to 1.25 lakh units by 2023. The proposal of the firm, in May 2022, to pump ₹ 4,000 crore, for its second manufacturing plant, as part of its expansion plan, to take the annual production of the company to 3 lakh vehicles, was a real option. The investment proposal to increase the capacity by 1.75 lakh units per annum, was an expansion option.

Source: https://www.livemint.com/companies/mg-motor-to-invest-rs-4-000-cr-for-2nd-plant-to-take-capacity-to-3l-units-11649675213529.html, dated 11th April, 2022 (Accessed on May 26, 2022)

Abandonment Option

There may be many projects that contain abandonment options. When one goes for evaluating a potential project, the standard DCF method is used. The DCF assumes that the assets that are involved in the project will be used over a specified economic life. Though it is correct to say that some projects can be operated over their full economic life, though the market conditions can get adverse and lower the expected cash flows, there may be other projects that may be abandoned.

Say for example, some contracts between the automobile manufacturers and their suppliers mention the quantity and the price of the parts that must be delivered. If the labor cost of the supplier increases, then he might as well lose money on each part he ships. Thus the inclusion of the option to abandon such a contract might be quite valuable.

Flexibility Options

There are many projects that offer flexibility options which allow the firm to alter operations depending on how the conditions change during the life of the project. It may happen that either the inputs or the outputs can be changed. The electric power plants provide a good example of the input flexibilities.

Investment Timing Options

The conventional type of Net Present Value (NPV) analysis is based on the implicit assumption that the project will either be accepted or rejected. This has a simple implication, that a project will be undertaken now or never. Though in practice, companies may even go in for a third choice. They have the option to delay the decisions until at a later point of time when more information is available. Such Investment Timing Options (ITO) result in altering the projects, estimated profitability and risk.

Say for example, a particular company has plans to introduce an innovative mobile set with a lot of added features. Your company may be left with two alternatives:

- To immediately start of with providing the services that are compatible with the mobile sets.
- To delay the investments in the projects until one gets a better idea of the size of the market for the innovative mobile sets.

Well, here one should prefer in delaying the investment on the project implementation. It should be borne in mind that the option to delay will only be valuable if it more than compensates any harm that might arise from delaying. It might happen that if one delays, any other company may take advantage of it and create a strong loyal customer base that in turn might make it difficult for the company to enter the market at a later point of time.

The option to delay projects is usually most valuable to the firms with proprietary technology, patents, licenses or other barriers to entry, because these factors tend to lessen the threats of competition. Further it is also valuable when the market demand is uncertain, at the same time it is also valuable during periods of volatile interest rates, since the ability to wait aids in allowing the firms to delay the raising of its capital for the projects until the interest rates are lower.

7.5 Valuing Real Options

Let us now try to focus on the valuation of real options. Let us first consider a simple project that consists of a single risk-free cash flow that is due one year from today. The pure DCF value of the project can be calculated as follows:

$$\text{DCF value of the project} = \frac{\text{Cash flow}}{1+K_{RF}}$$

Where,

K_{RF} denotes the risk-free rate of return at which the cash flow is discounted.

The inputs are the cash flow and the risk-free rate that help in accurate estimation of the project's DCF value.

In contrary, valuing real options calls for a greater level of judgments in areas of both formulating the model as well as in estimating the values of the inputs. This implies that the value of the project using real options will not be as accurate as it had been stated in a simpler DCF model for valuation. There can be five possible procedures that can be used in order to deal with real options. They are:

a. Use of DCF valuation and ignoring any real option, with the assumption that their values are zero.

b. Using the DCF valuation and including a qualitative recognition of any real options value.

c. Use of decision tree analysis.

d. Using a standard model for a financial option.

e. Developing a unique, project specific model using financial options.

Example: Calculating Net Value of an Option for Euler Motors

Euler Motors, which had a capacity of manufacturing 4000 electric vehicles per annum till FY 2021-22, planned to reach a capacity of 35,000 units per annum by the end of FY 2022-23. For this, the company intended to invest ₹ 200 crore.

Let's assume that the company got an advance order from a logistics corporate to supply 31000 vehicles per annum for the next 4 years. This would generate a cash inflow of ₹ 75 crore per annum to Euler Motors. Due to technological obsolescence, the value of the plant cannot be estimated after 4 years and was hence assumed to be zero. If the cost of funds was estimated to be 15%, what is the net value of this option? Should Euler Motors accept this order from the logistics company?

Net value of the option (using DCF) = (Annual Cash Inflow x $PVIFA_{k,n}$) – Initial Investment

= (₹ 75 crore x $PVIFA_{15,4}$) – ₹ 200 crore

= (₹ 75 crore X 2.8550) – ₹ 200 crore

= ₹ 214.125 crore – ₹ 200 crore = ₹ 14.125 crore

As the net value of the option was positive, the order may be accepted.

Source: https://www.livemint.com/auto-news/ev-maker-euler-motors-to-invest-rs-200-crore-in-capacity-expansion-11645941560033.html, dated 27th February, 2022 (Accessed on May 26, 2022)

Let us now try to understand each of these with the help of an illustration.

Illustration 1

Opportunistic India Ltd. is considering a project for an innovative set up device that will enable cable users to view satellite channels according to their own wish. The total estimated cost of the project is ` 5 crore, but the future cash flows of the project depend on the demand of the Conditional Access System (CAS) that is to be provided by the government, which is not very certain. The company feels that there lies a 25 percent chance that the demand for the new set up device is very high, in which case the project will be able to generate a cash flow of Rs.3.3 crore for each of the following three years. It also feels that there lies a 50 percent chance for the demand to be average with subsequent generation of cash flows that will amount to Rs.2.5 crore per year, along with that the chances that the demand will be low is 25 percent in which case the cash flow generation will be only 50 lakh. A basic analysis reveals that the project is somewhat riskier than

any other average project, as a result of which the cost of capital that would be used to discount its cash flow is 14 percent.

Opportunistic India Ltd. enjoys patent rights on the device's core modules, so instead of implementing the project immediately, it can also choose to delay the decision until the coming year. The cost of the project will still amount to Rs.5 crore if it waits, and the project will still generate the expected cash flows that have been stated earlier. But each of the expected cash flows will be delayed by one year. It should be remembered that if the company waits, it will be able to know which of the demand conditions, and in return which of the set of cash flows, will exist. Thus on delaying the project it will go in for investments only if the demand is sufficient enough to provide a positive value of net present value.

(₹ crore)

Demand for the Device	Probability (P_i)	Annual Cash Flows (CF)	Expected Cash Flows (P_i x CF)
High	0.25	3.3	0.825
Average	0.50	2.5	1.250
Low	0.25	0.5	0.125
			2.200

Using DCF Valuation and not considering any Real Option by Assuming that their Values are Nil

So, as calculated above, the expected annual cash flow per year is Rs.2.2 crore.

If we do not take into account the investment timing option, then the traditional value of the net present value will be

$$\text{NPV} = -\text{Rs.5 crore} + \frac{2.2\,\text{cr.}}{(1+0.14)} + \frac{2.2\,\text{cr.}}{(1+0.14)^2} + \frac{2.2\,\text{cr.}}{(1+0.14)^3}$$

= Rs.10,80,000 (approx. value)

So, based on the discounted cash flow method, the company should go in for the project. It is to be noted here, that if the expected cash flow had been slightly lower, say for example Rs.2.15 crore, the NPV would have been negative and this would have resulted in rejection of the project.

Further, the project is risky, as there is 25 percent chance that the demand for the devices may be low, in which case the net present value would turn out to be a negative Rs.3.84 crore.

Using the DCF with Qualitative Recognition of the Real Options Value

As it is suggested by the discounted cash flow analysis, the project should be barely accepted, and it ignores the existence of a possible value of real option. If the company goes in for immediate implementation of the project, it gains the expected cash flow of Rs.0.108 crore but at the cost of the risk that is involved with the chances of its low demand. Nevertheless, accepting the project now

implies that it is also foregoing the option of waiting for some more time to gain more market information before it makes any commitments. So, the decision has to be made on whether the company would be sacrificing worth that is more or less than Rs.0.108 crore. If it is worth more, then it should not go in for immediate implementation of the project and defer it for some point of time later, and it would do just the opposite in case it is worth less than this value.

This brings us to another point of discussion: Should the company go ahead with the project now or wait for sometime? While considering this decision, one should note that the value of an option is higher if the current value of the underlying asset is high relative to its exercise price, other things remaining unchanged. Say, for example, a call option with an exercise cost of Rs.50 on a stock with the current price of Rs.50 is definitely worth more if its value were Rs.20. The DCF valuation is also suggestive of the fact that the underlying value of the asset will be closer to the exercise price, as a result the value of the option will be valuable.

It is also known that the value of the option increases with the increase in its time to expire. In our example, the option has life of one year, which is fairly a long time for an option. This too implies that the option is valuable. Finally, it is to be said that an option's value increases with the risk of an underlying asset. Here, it is seen that the project is quite risky, which again suggests that the option is valuable.

Thus based on this qualitative approach, it is advisable to delay the project, though the NPV would result in earning Rs.0.108 crore on immediate implementation.

Use of Decision Tree Analysis

Let us here take two ways of using the decision tree analysis. One being the "scenario analysis", and the other being the other "decision tree". The scenario analysis can be used in the following way.

Case 1

Scenario analysis – on immediate implementation of the project:

(` crore)

2019		2020	2021	2022	NPV of this Scenario	Prob	Prob x NPV
– 5	High	3.3	3.3	3.3	2.661	0.25	0.665
	Average	2.5	2.5	2.5	0.804	0.50	0.402
	Low	0.5	0.5	0.5	–3.839	0.25	–0.960
						1.00	

Expected NPV = (0.665) + (0.402) + (–0.960) = Rs.0.107 crore

In the above diagram, each possible outcome is shown as a branch on the tree. The branch resembles the cash flows and the probability of the individual scenarios. As is evident from the above example, in the high demand scenario, the NPV of the project is Rs.2.661 crore, for average demand scenario it is Rs.0.804 crore, whereas in case of low demand, the project yields a negative NPV of Rs.3.839 crore. So, the company will suffer a loss to this extent in case of low demand, and as there is a 25 percent chance of the demand being weak, the project can be considered to be a highly risky one. The expected NPV of the project is the weighted average of the three possible outcomes, with the weight for each outcome being its probability. The expected NPV comes to Rs.0.108 crore, same as one estimated using the DCF valuation. Let us now see the decision tree analysis in valuing the project.

Case 2

Decision tree analysis – project implementation in the next year if optimal.

(`crore)

2019	2020	2021	2022	2023	NPV of this Scenario	Prob.	Prob. x NPV
↗ High	–5	3.3	3.3	3.3	2.335	0.25	0.584
Wait → Average	–5	2.5	2.5	2.5	0.705	0.50	0.353
↘ Low	0	0	0	0	0	0.25	0
						1.00	

Expected NPV of the Project = (0.584) + (0.353) + (0) = Rs.0.937 crore.

The above diagram can be viewed similar to that of the scenario analysis, the only difference being that the company delays the decision and implements the project only if demand turns out to be high or average.

So, if the company delays the project, the expected NPV comes to 0.936 crore. This clearly shows that the expected value of the project will be much higher if the company delays the project than if it implements the project immediately. Added to this, as there is no possibility of losing money under the option to delay, this decision also lowers the project's risk. This clearly indicates that the option to wait is definitely volatile, so Opportunists India Ltd. should wait till 2020 before taking any decision to proceed with the investment.

Case 3

What if, a different discount rate is taken, other than 14 percent?

In both the cases (case 1 and case 2) above, we have used the same cost of capital i.e. 14 percent. But this may not be advisable and feasible to do so, mainly because of the following reasons:

a. As there seems to be any possibility of losing money if the company delays the project, the investment under the plan is clearly less risky than if it charges ahead today.

b. The cost of capital of 14 percent may be appropriate for the risky cash flows, yet the investment of the project in the year 2020 in case 2 is known with certainty. May be then one should discount it at the risk-free rate.

c. The cash inflows of the project are different in the second case because of the elimination of the low demand cash flows. This is suggestive of the fact that if 14 percent is the appropriate cost of capital in the first case, some lower rate may be appropriate in the latter one. So, let us take the discount rate to be 6 percent and estimate the expected NPV.

2019		2020	2021	2022	2023	NPV of this Scenario	Prob.	Prob. x NPV
Wait	↗ High	–5	3.3	3.3	3.3	3.821	0.25	0.955
	→ Average	–5	2.5	2.5	2.5	1.682	0.50	0.841
	↘ Low	0	0	0	0	0.00	0.25	0.00

Expected NPV = (0.955) + (0.841) + (0) = ` 1.796 crore

Activity 7.1

a. Narrate the examples of growth option.

……

……

……

b. How do you calculate the value of real option?

……

……

……..

Using the Black-Scholes Model

Till this point of time, one can safely say that the decision tree analysis, coupled with the sensitivity analysis, is to be a good provider of information for a good decision. But let us try to value the option using an option pricing model. In order to do this, one needs to identify a standard financial option that resembles the project's real option. The company's option to delay the project is comparable to a call option, hence the Black-Scholes option pricing model can be used. Following are the inputs required for the model:

i. Risk-free rate

ii. Time until the option expires

iii. Exercise price of the option

iv. Current stock price

v. Variance of the stock's rate of return.

The Investment Timing Option

Let us understand the investment timing option with an illustration

Illustration 2

Rushabh Innova Ltd. is considering a project for an innovative set up device that will enable the cable users to view satellite channels according to their wish from January 2023. The total estimated cost of the project is Rs. 50 crore. The future cash flows depend on the demand for the conditional access system (CAS), which is uncertain. The company feels that there lies a 30 percent chance that the demand for the new set up device is very high, in which case the project will be able to generate a cash flow of Rs.34 crore for each of the following three years. It also feels that there lies a 50 percent chance for the demand to be average with cash flows that will amount to Rs. 24 crore per year for the following three years. There is a 20 percent chance that the demand will be low, with the cash flows amounting to Rs.5 crore each year for the following three years. An analysis reveals that the project is riskier than any other average project and thus the cost of capital used to discount the cash flow is 14 percent.

The company enjoys the patent rights on the device's core module, so instead of implementing the project immediately, it can also choose to delay the decision till next year. The cost and cash flow of the project will remain same as stated earlier even in case of delay in implementation by one year. The company's option to delay the project is comparable to a call option. The rate on 91-day Treasury bill is 6% p.a.

Future Cash Flow

		2024	2025	2026	PV of this Scenario	Prob.	Prob. x PV
Wait	High	34	34	34	69.242	0.30	20.773
	Average	24	24	24	48.876	0.50	24.438
	Low	5	5	5	10.183	0.20	2.037
						1.00	

(Present value found out at 14% to find the current value as on January 2023 if the project is delayed.)

Expected value of the present values Jan (2023) = (20.773+ 24.438+ 2.037) = ₹ 47.248 crore.

So, if the project is implemented now the NPV would be = 47.248 x 1.14 – 50

= ₹ 3.863 crore

Calculation for Co-efficient of Variation (CV)

		2024	2025	2026	PV in 2007 in this Scenario	Prob	Prob x PV
Wait	High	34	34	34	78.935	0.30	23.681
	Average	24	24	24	55.719	0.50	27.860
	Low	5	5	5	11.608	0.20	2.322
						1.00	

(Present value found out at 14% as on January 2024 if the project is delayed.)

Expected Value of PV Jan (2007) = (23.681+ 27.860+ 2.322) = 53.863

Standard deviation of PV =

$$\sqrt{(78.935 - 53.863)^2\ (0.30) + (55.719 - 53.863)^2\ \ (0.50) + (11.608 - 53.863)^2\ (0.20)}$$

Standard Deviation of PV = 23.40

Co-efficient of Variation of PV = 0.4344

Variance of the Project's Return = In $(CV^2 + 1) / t$

Where, CV = Coefficient of Variation

T = Time of expiry of the project

Variance = In $(0.4344^2 + 1)/t = 0.1729 = 17.29$ percent^2

Calculation of the Value of the Investment Timing Option using a Standard Financial Option

KRF = Risk-free rate = 6 percent

(T – t) = Time (in years) until the option expires = 1

X = Cost of project implementation = Rs.50 crores

P = Current project's value = Rs. 47.248 crores

σ^2 = Variance of the project's return = 17.29 percent^2

d_1 = $\{\ln (P/X) + [KRF + (\sigma^2/2] (T - t)\} / (\sigma \times \sqrt{T - t})$

= $\{\ln (47.28/50) + [0.06 + (0.1729/2] (1)\}/ (0.4158 \times 1) = 0.2161$

d_2 = $d_1 - (\sigma \times \sqrt{T - t}) = -0.1997$

$N(d_1) = 0.5856$

$N(d_2) = 0.4247$

$V = P[N(d_1)] - X\ e^{-r(T)}\ [N(d2)]$

$= 47.248\ (0.5856) - 50\ e^{-(0.06)\ (1)}\ (0.4247)$

$= 27.6684 - 47.088\ (0.4247)$

$= 7.67$

As it is seen from the above calculations, the value of the option to defer investment in the project is Rs.7.67 crore. This is significantly higher than Rs.3.863 crore under immediate implementation, as the option should be forfeited. If the company implements it immediately, one can conclude that the company should defer the final decision until more information is gathered.

The Growth Option

Let us learn more about the growth option with an illustration

Illustration 3

Gemini Foods Ltd. is considering a proposal to introduce a new potato chip with higher protein and very low fat content in April 2023. The project will cost Rs.9 crore. The company's management believes that there is a 30% chance that the project will take off and generate operating cash flows of Rs.6.8 crore in each of the next 3 years. There is 50% chance of average demand for the product to materialize, in which case cash flows will be Rs.4 crore annually for 3 years. Finally there is 20% chance that the product won't be liked by the customers, in which case it will generate cash flows of only Rs.0.4 crore per year. The required rate of return for the typical potato chips projects is 20%.

Based on the experience with other projects, the company's head for the product, Mr. Manish Gupta, has a view that the product will unlock the opportunities for the next generation of potato chips, which are expected to be of zero fat content, if demand for the original product is average or above average. This second generation project will cost Rs.8 crore. The investment decision for this second generation project must be made in April 2026 Mr. Gupta also believes that given the success of the first-generation product, the second generation product will be just as successful as the first generation product. The rate on 91-day T-bill is 6.0% p. a.

NPV of the projects cash flow without considering the second generation product:

Expected cash flows = $0.30 \times 6.8 + 0.50 \times 4.0 + 0.20 \times 0.4$

= Rs.4.12 crore

NPV of the project = – Initial investment + PV of expected cash flows

= – Rs. 9 crore + [Rs.4.12 crore x $PVIFA_{(20\%,3)}$]

= – Rs. 9 crore + Rs.8.68 crore

= – Rs.0.32 crore

The fact that the first generation project has a negative NPV does not mean that the project should be rejected. The project given an opportunity to start a second generation project, which is a follow-on investment. The follow on project is a call option and has to be evaluated as such to take correct final decision.

X = Cost of implementing the project = Rs. 8 crore

Risk free rate = 6 %

Time to maturity = 3 year

P = current value of project's expected rate of return

σ^2 =Variance of project's cash flows

Current value of projects' future cash flows:

	2027	2028	2029	PV at the year 2007
High (0.30)	6.8	6.8	6.8	8.289
Average (0.50)	4.0	4.0	4.0	4.876
Low (0.20)	0.4	0.4	0.4	0.487

Therefore the current expected present value,

P = 0.30 × 8.289 + 0.50 × 4.876 + 0.20 × 0.487

= Rs.5.0221 crore

Variance of project's rate of return:

	2027	2028	2029	PV at the year 2010
High (0.30)	6.8	6.8	6.8	14.324
Average (0.50)	4.0	4.0	4.0	8.426
Low (0.20)	0.4	0.4	0.4	0.843

Expected value of PV 2026 = 0.30 × 14.324 + 0.50 × 8.426 + 0.20 × 0.843

= Rs.8.679 crore

Standard deviation of PV 20126 = Rs.4.677 crore

Coefficient of variation = S.D. / Expected value

= Rs.4.677 crore / Rs.8.679 crore

= 0.54

Variance of the project's expected rate of return = $\ln[CV^2 + 1]/T = \ln[0.54^2 + 1]/3$

= 0.0853

$V = P[N(d_1)] – X\, e^{-r(T)} [N(d_2)]$

$V = 5.02[N(d_1)] – 8\, e^{-(0.06)(3)} [N(d_2)]$

$d_1 = \{\ln (P/X) + [KRF + (\sigma^2/2)] (T – t)\} / (\sigma \times \sqrt{T – t})$

$$d_1 = \frac{\ln(5.02/8) + [0.06 + 0.0853/2](3)}{(0.0853)^{0.5}(3)^{0.5}}$$

$= -0.3125$

$d_2 = d_1 - (0.0853)^{0.5}(3)^{0.5}$

$= -0.3125 - 0.5057$

$= -0.8182$

$N(d_1) = N(-0.3125) = 0.3774$

$N(d_2) = N(-0.8182) = 0.2066$

Therefore,

$V = 5.02[0.3774] - 8\, e^{-(0.06)(3)}\, [0.2066]$

$= 1.8945 - 1.3805$

= Rs.0.5140 crore = Rs.0.51 crore.

The value of the option when added to the NPV of the project, gives a positive value for the project (–Rs.0.32 crore + Rs.0.51 crore = Rs.0.19 crore), therefore project should be accepted.

The growth option for the project resembles a call option on a stock, since it gives Gemini Foods the opportunity to "purchase" a successful follow-on project at a fixed cost if the value of the project is greater than the cost. Otherwise, it will let the option expire by not implementing the second-generation product.

Valuing A Call Option

The valuing of a call option is explained through this illustration

Illustration 4

An oil company was the target of a takeover in early 2023 at Rs.70 per share (it had 165.30 million shares outstanding and total debt of Rs.9.9 billion). It had estimated reserves of 3,038 million barrels of oil and the total cost of developing these reserves at that time was estimated to be Rs.30.38 billion (the development lag is approximately two years). The average relinquishment life of the reserves is 12 years. The price of oil was Rs.22.38 per barrel, and the production costs, taxes, and royalties were estimated at Rs.7 per barrel. The government bond rate at the time of the analysis was 9.00%. If the oil company were to choose to develop these reserves, it was expected to have cash flows next year of approximately 5% of the value of the developed reserves. The variance in oil prices is 0.03.

The value of undeveloped reserves can be thought of as a call option

Value of underlying asset i.e.

S = Value of estimated reserves discounted back for period

Development lag (S) =3,038 ×(Rs.22.38 - Rs.7)/1.05^2 = Rs.42, 380.44

Exercise price (X) = Estimated cost of developing reserves today = Rs.30,380 million

Time to expiration (t) = Average length of relinquishment option = 12 years

Variance in value of asset = Variance in oil prices = 0.03

Risk-less interest rate (r_f) = 9%

Dividend yield (q) = Net production revenue/ Value of developed reserves = 5%

According to Black –Scholes model

$$d_1 = \frac{\ln(S/X) + [(r - q) + \sigma^2/2]\, t}{\sigma\sqrt{t}}$$

$$= 0.33290 + [(0.09 - 0.05) + .03/2)]\ 12 / (.03x12)^{1/2} = 1.6548$$

$$d_2 = d_1 - (\sigma \times \sqrt{T - t})$$

$$= (1.6548 - 0.6) = 1.0548$$

Hence

d_1 = 1.6548

From the table

When $d_1 = 1.65$, $N(d_1) = 0.9505$

When $d_1 = 1.66$, $N(d_2) = 0.9515$

Through interpolation

$$= 0.9505 + \frac{1.6548\text{-}1.65}{1.66 - 1.65} \times (0.001) = 0.9510$$

$N(d_1) = 0.9510$.

Similarly $N(d_2)$ can be calculated.

$d_2 = 1.0548$ $N(d_2) = 0.8542$.

The call can be calculated using the following formulae

Call Value = $S \times \exp^{(\text{-dividend yield})(\text{time to expiration})} N(d_1)$

$- X \times \exp.^{(\text{-dividend yield})(\text{time to expiration})} N(d_2)$

Call value = 42,380.44 $\exp^{(-.05)(12)}$(0.951 0) - 30,380 $\exp^{(-0.09)(12)}$(0.8542)

= Rs.13,306 million.

The Abandonment Option

Let us now take up the abandonment option

Illustration 5

Futura Ltd. is considering a project for an innovative set up of an operating system that will enable the people who do not know the English, to use the computer in their own regional language. The total estimated cost of the project is Rs.7.5

crore, but the future cash flows of the project depend on the demand for the operating system, which is not certain. The company feels that there is 30% chance that the demand for the new setup system is very high, in which case the project will be able to generate high cash flows. There is 50% chance of moderate demand and average cash flows and 20% chance of weak demand and low cash flows. The table given below shows a detailed projection of operating cash flows over the four-year life of the project. The cost of capital for this project is 17%. However, the company can sell the project for Rs.3.9 crore after taxes in the year 2025, if the demand is low.

Expected operating cash flow from the project

(₹. in crore)

Demand	Probability	2025	20262	2027	2028
High	0.30	4.1	6.6	8.1	9.3
Moderate	0.50	2.28	2.1	2.4	2.7
Low	0.20	–2.1	–2.4	–2.7	–3.3

The rate on 91-day T-bill is 7.5% p.a.

The company's abandonment option is similar to a put option on a stock. We can use the Black-Scholes model for the value of a call option, V_{call}, in order to find out the value of a put option, V_{put}. In order, to find out the NPV of the project, along with the abandonment option embedded in it, we must break the original project in to two seprate projects plus an option to abandon the second project. The following table shows, project A, which is a one-year project that includes the initial cost and first year operating cash flows of the project.

DCF analysis of project 'A' that lasts one year

(₹. in crore)

Demand	Future cashflows		NPV of this scenario	Probability	Probability x NPV
	2024	2025			
High	-7.5	4.1	–4.00	0.30	-1.200
Moderate	-7.5	2.28	–5.55	0.50	-2.775
Low	-7.5	–2.1	–9.29	0.20	-1.858
					-5.833

Now, project B, begins in 2026, the year after project A ends. Project B has no cash flows in 2024 or 2025, but has the cable network project's operating cash flows in the subsequent year. The following table shows DCF analysis of project B

DCF analysis of project 'B' that starts in 2026 and project 'A' is already in place

(₹. in crore)

Demand	Future cash flows					PV of CF	Prob.	PV x Prob.
	2024	2025	2026	2027	2028			
High	-	-	6.6	8.1	9.3	14.84	0.30	4.452
Moderate	-	-	2.1	2.4	2.7	4.47	0.50	2.235
Low	-	-	-2.4	-2.7	-3.3	–5.20	0.20	-1.04
								5.647

The NPV of the overall project will be the total of NPVs of project 'A' and Project 'B' which comes to (-5.833 + 5.647) = -0.186. This shows that the project should be rejected as the NPV of the project is negative.

But, the company also has an option to abandon project 'B', which gives it right to sell project 'B' for Rs.3.9 crore. The time until the abandon option expires is one year.

PV of future cash flows at the time the option expires i.e. in year 2025.

(₹. in crore)

Demand	Future cash flows				PV in 2025	Prob.	PV x Prob.
	2025	2026	2027	2028			
High	-	6.6	8.1	9.3	17.36	0.30	5.208
Moderate	-	2.1	2.4	2.7	5.23	0.50	2.615
Low	-	-2.4	-2.7	-3.3	-6.08	0.20	-1.216
							6.607

Standard deviation of the above cash flows

PV of cash flows (X)	Probability	$(X - \overline{X})$	$(X - \overline{X})^2$ x Prob.
17.36	0.30	10.753	34.688
5.23	0.50	-1.377	0.948
-6.08	0.20	-12.687	32.192
			67.828

Standard deviation = $\sqrt{67.828}$ = 8.236

Coefficient of variation of PV 2025 = 8.236/6.607 = 1.247

Therefore, variance of project B's rate of return = ln $(CV^2 + 1)/t$ = ln $(1.247^2 + 1)/1$ = 93.81%

Value of put option:

Rf = Risk free interest rate = 7.5%

T = Time until the option expires = 1 year

X = Salvage value if abandoned = Rs.3.9 crore

S = Current value of project 'B' = Rs.5.647 crore

σ^2 = Variance of project B's rate of return = $93.81(\%)^2$

$d_1 = \{\ln (P/X) + [KRF + (\sigma^2/2] (T - t)\} / (\sigma \times \sqrt{T-t})$

$$d_1 = \frac{\ln(5.647/3.9)+[0.075+0.9381/2](1)}{(0.9381)^{0.5}(1)^{0.5}} = \frac{0.370+0.544}{0.9686} = 0.9436$$

$d_2 = d_1 - \sigma\sqrt{t} = 0.9436 - 0.9686 = -0.025$

$N(d_1) = 0.8264 + 0.36 (0.8289 - 0.8264) = 0.8273$

$N(d_2) = 0.4920 - 0.50 (0.4960 - 0.4920) = 0.4900$

$C = S.N(d_1) - Ke^{-rt} N(d_2)$

$= 5.647 (0.8273) - 3.9e^{-0.075 \times 1} (0.4900)$

$= 4.6718 - 1.7729$

$= 2.8989$

$P = C - S + Ke^{-rt}$

$= 2.8989 - 5.647 + 3.9e^{-0.075 \times 1}$

$= 0.870$

Thus, the total NPV of the project

= NPV of project A + NPV of project B + Value of the option

= – 5.833 + 5.647 + 0.870

= Rs.0.684 crore.

Given, the improvement in the NPV caused by the abandonment option, the company should undertake the project.

7.6 Applications of Real Options

The concept of real options is applicable in actual industry. The application process is explained here with oil industries.

Exploring for Oil

Reliance Petrochemicals has leased a large tract of land somewhere in the Southern India and was evaluating alternate exploration strategies. The Government of India were to provide additional information about the amount of oil in the ground, and the drilling would add information about the amount of oil reserves and could resolve whether the oil could be produced. Should Reliance begin the exploration? Which exploration investment strategy should they use?

Following are the risk elements that Reliance was aware of,

- Six to fifteen years' time is required to get an unexplored tract into production.
- There is huge involvement of money in the project, that will amount to crores.
- There lies a very small chance, say about 10 percent, for the project to successfully lead to oil production.

Several earlier attempts to carry out similar projects were futile because the estimated development costs were supposed to exceed the production profit or because the oil price fell too low so as to justify more expenditures.

The decision regarding the exploration of oil is made by valuing the tract under each initial exploration strategy, as well as the other contingent follow on strategies. The strategy that is able to deliver the highest valued tract is chosen. The tract value is dependent on three sources of uncertainty:

- Oil Prices
- Reserve Size
- Chance of Success (COS)

The current spot price of the oil is observed daily and the volatility of the oil prices is estimated as the volatility that is implied by the option contract on the oil. The initial level and the standard deviation of the companies are based on historical experiences in the region and also the experience with specific geological features. The market priced risk is easily tracked and the private risks are uncorrelated with any traded asset.

This ratio can be defined as the (Standard deviation after the exploration) /(Standard deviation before the exploration investment).

This ratio is always less than one, differs by the type of investments, and its value decreases with the stage of investment. The featuring ratios for the companies with drilling equals zero, because drilling fully resolves the companies uncertainty. At the end of the lease, the tract is either developed or abandoned.

The Findings

The first finding of the problem is the value of the tract that is under each first stage strategy. When the optional strategy is to delay the project, the same analysis is repeated after one year's time with the changed oil prices and a shorter time to the expiration of the lease. The optimal strategy will be immediate implementation in case the payoff resulting from producing oil is so high that the managers are willing to risk abandoning the tract after sizeable development expenditure.

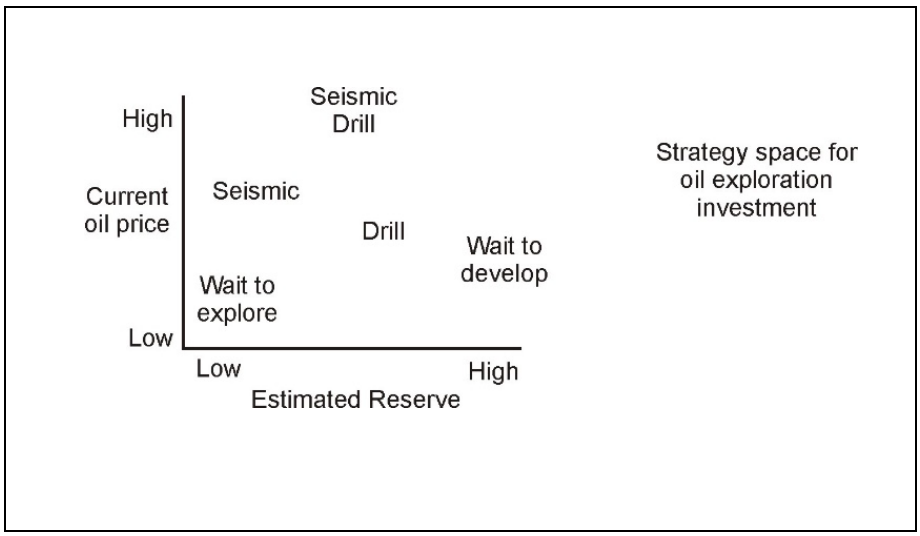
The following figure 1 shows the optimal first stage exploration investment strategy as a function of the current estimate of reserve size and of current oil prices, keeping the other inputs constant. The figure reveals two types of waiting – the lower left of the grid power of the optimal strategy calls for the condition of wait to explore. This is because the oil prices and the estimate of reserve size are low. The upper right of the grid suggests an optimal strategy to wait to develop as the estimated reserve size is high but the price of oil is a bit too low to justify the development.

The figure actually reflects a very interesting feature of the oil industry, an increase in the oil price brings tracts out of delay mode and into exploration, thus creating demand for oil services. This in turn enhances the cost of further exploration development, thereby reducing the value of the exploration option. The final deals with the value of the information that is proportionate to the extent of how much the oil company would be willing to pay to further resolve reserve size or company's uncertainty. The real option approach of valuing the project shows that the value of resolving uncertainty depends on the following factors.

- Future decision involving exploration
- Current value of oil prices
- Uncertainty type

Say for example, when the development costs are high, the value of resolving the company's uncertainty is high and the seismic investments are not very valuable as they are unable to supply the important piece of information. The use of the real option aligns the value of the information with financial market valuation.

Figure 7.1: Strategy Space for Oil Exploration Investment



Activity 7.2

a. What are the inputs required to value an option under the Black-Scholes option pricing model?

……

……

b. What are the findings in the application of real options concept to Petrochemicals industry?

……

……

7.7 Drawbacks of using Real Options Analysis

Though the use of real options had brought in considerable advantages in creating a project, still there exists some pitfalls in their usage. These pitfalls can broadly be categorized under the following:

– Using the real option analysis when one should not use them.

– Framing a wrong model for the purpose of valuation.

– Using incorrect data and biased judgments in the model.

– Miscalculation in the process of valuation.

Let us now try to discuss each of the drawbacks in brief:

a. Using real option analysis when one should not

Real option analysis takes into account a number of assumptions. One basic assumption of real option is that the relevant uncertainities are random walks and as a result are unforeseeable. Coupled with this, it also states that the consumer is the price taker, and decision taken by the consumer can change the future course of the random walk. Such assumptions are in fact violated if there exists a small number of leading competitors. In this case the decisions may not be random. Each player's action can influence the price of all the players who will take decisions with full knowledge of what the possible counter moves will be for every other player. The other assumption the option theory makes is that the risks of an option can be hedged away. If hedging is feasible the option will be priced as if it had been hedged, in which case the risk is risk-free. If it is given that hedging is indeed possible it does not matter whether any one option is actually hedged or not.

b. Using the wrong real option model

It is easy to wrongly assume that the actual decisions pertaining to the project is "Like" a given real option model while in reality it is "Unlike" so. Thus picking up a wrong model can be disastrous. Say for example, if one has assumed that the interest rates are fixed, should it change the decisions to a

large extent if the interest rates were truly variable. If one bases his assumption that the prices of oil and gas are independent of each other, how can it, in any way, influence the decision if they were linked by some economic mechanism.

c. Miscalculation in the data inputs

It is important to understand the drivers of the option value in any specific real option model. One needs to check the model for sensitivity to the associated variables, try to understand how the errors in the variables could result in based results. Say for example, the value of the call option is increased in the time to expiry and the volatility of the underlying asset is increased. As far as this is concerned it is important to note that one has over-estimated the length of the available time, or what could be the smallest possible estimate one could use for volatility?

Example: Where did the Microsoft's Option of Acquiring of Nokia go wrong?

In 2013, Microsoft paid over $7 billion to acquire Nokia's handset business with a vision to provide a third alternative to iPhone and Android handsets. It was considered a big flop as the assets purchased from Nokia were completely written off in 2015. Microsoft wasted at least $8 billion on its failed Nokia experiment, including the costs of restructuring and severance payments for thousands of employees. Though by 2022, HMD Global was still manufacturing handsets under the Nokia brand, its market share was meagre.

Whatever option analysis was done by Microsoft in acquiring Nokia proved to be wrong. It was not about the option models used but, the estimations of sales that the synergies could deliver and the uncertainties involved, on which option analysis was done were wrong and it resulted in the biggest acquisition failure in Microsoft's history.

Source: https://www.forbes.com/sites/barrycollins/2020/10/05/microsoft-in-the-frame-to-buy-nokia-again/?sh=24b973a27228 (Accessed on May 26, 2022)

d. Getting both the models of the data right, but making mistakes in the solution

It may sometimes happen that while using the complete mathematical algorithm, one can easily miss an important variable. While calculating the option value, one may notice that the calculated option values are exploding towards plus or minus infinity, or are oscillating between the two. The results of option valuation are sometimes in conflict with common sense approach. Nevertheless, it is important to make as many logical checks as possible to ensure that these results are commensurate with the economic rationality.

7.8 Check Your Progress Questions

1. The option to include complementary products and services to the existing product portfolio, when the market condition improves, can be dealt under which of the real option model?
   a. Investment timing option
   b. Growth option
   c. Rainbow option
   d. Compound option
   e. Flexibility option
2. Which of the following is the risk neutral approach of valuing real options?
   a. Sensitivity analysis
   b. Decision tree approach
   c. Simulation analysis
   d. Discounted – Cash Flow (DCF) model
   e. Black-Scholes model
3. An asset with future payoffs that is dependent on the result of an uncertain development is called:
   a. An option contract
   b. A convertible asset
   c. A contingent claim
   d. A riskless asset
   e. A risky asset
4. The difference between the current market value of an option and its intrinsic value is its
   a. Contingent value
   b. In-the-money value
   c. Option value
   d. Time value
   e. Out of the money value
5. The opportunity to defer investing to a later date may have value because
   a. The cost of capital may decline in the near future
   b. Uncertainty may be reduced in the future
   c. Investment costs fluctuate in time
   d. Market conditions may change and increase the NPV of the project
   e. A favorable change in the governmental policies is expected

7.9 Summary

- Opportunities to respond to changing circumstances are called managerial option as they give managers a chance to influence the outcome of the project. Such projects are also called as real options as they deal with real rather than financial assets.
- Many projects include a variety of 'embedded options' that can dramatically influence its NPV. These can be –
  a. Investment timing option – that allows the firm to delay the project.
  b. Growth option – that enable a firm to manage its capacity in response to changing market conditions.
  c. Abandonment option.
  d. Flexibility options – which give flexibility to a firm over its operations.
- There are five possible procedures for valuing real options:
  a. DCF only, ignoring the real option.
  b. DCF analysis and qualitative assessment of the real option value.
  c. Decision tree analysis.
  d. Analysis with a standard model for an existing financial option.
  e. Financial engineering technique.
- The various drawbacks of real option analysis include:
  – Using it where it is not applicable
  – Framing a wrong model for valuation
  – Using incorrect data and biased judgment
  – Miscalculation.

7.10 Glossary

A **Real Option** is an option that arises naturally in the course of business activities rather than one purchased on a financial market. A common example of a real option is early investment in a technology, which will enable a firm to exploit the new technology should it prove successful.

An **Option** is a contract that confers the right, but not an obligation to the holder to buy or sell an underlying asset like stock, currency, commodity, financial instrument or a futures contract at a price agreed on a specific date or by a specific expiry date.

Net Present Value or **NPV** is a method for evaluating investment proposals. NPV is defined as present value of benefits minus present value of costs.

Discounting is the process of finding the present value of a future cash flow or a series of future cash flows.

7.11 Suggested Readings / Reference Material

1. Richard Brealey and Stewart Myers and Franklin Allen and Alex Edmans (2023). Principles of Corporate Finance. 14th Edition, McGraw Hill India
2. Stephen A. Ross, Randolph Westerfield (Author), & Jordon (2018). Fundamentals of Corporate Finance. 12th edition, McGraw Hill College
3. Prasanna Chandra (2020). Strategic Financial Management: Managing for value creation. 2nd edition, McGraw Hill
4. Hubbard & Obrien (2022). Mony, Banking and Financial System. 4th edition, Pearson Education
5. Kalyani Karna (2019). Strategic Financial Management. 1st edition. Corporate Plus Publications Private Limited
6. Edward I Altman (2019). Corporate Financial Distress, Restructuring and Bankruptcy. 4th edition, Wiley
7. Rick Mann & David Tarrant (2020). Strategic Finance for Strategic Leaders: The First Five Tools. Clarion strategy publishing
8. Sheeba Kapil (2021). Financial Valuation and Modelling. Wiley

7.12 Suggested Answers

Self-Assessment Questions – 1

a. A growth option lets a company to increase its capacity of operation if the market conditions are better than expected. In one type of growth option, a company may resort to increase the capacity of an existing product line. Another type allows a company to expand into new geographic markets. The third type may deal with the opportunity to add new products that even includes the complementary products and successive generations of the original product.

b. The pure DCF value of the project can be calculated as follows:

$$\text{DCF value of the project} = \frac{\text{Cash flow}}{1+k_{RF}}$$

Where,

K_{RF} denotes the risk-free rate of return at which the cash flow is discounted.

The inputs are the cash flow and the risk-free rate that help in accurate estimation of the project's DCF.

In contrary, valuing real options calls for a greater level of judgments in areas of both formulating the model as well as in estimating the values of the inputs. This implies that the value of the project using real options will not be as accurate as it had been stated in a simpler DCF model for valuation. There can be five possible procedures that can be used in order to deal with real options. They are:

- Use of DCF valuation and ignoring any real option, with the assumption that their values are zero.
- Using the DCF valuation and including a qualitative recognition of any real options value.
- Use of decision tree analysis.
- Using a standard model for a financial option.
- Developing a unique, project specific model with the help of techniques in financial engineering.

Self-Assessment Questions – 2

a. To value an option under the Black-Scholes option pricing model, the following are the inputs required:
   i. Risk-free rate
   ii. Time until the option expires
   iii. Exercise price of the option
   iv. Current stock price
   v. Variance of the stock's rate of return.

b. The first finding of the problem is the value of the tract that is under each first stage strategy. When the optional strategy is to delay the project, the same analysis is repeated after one year's time with the changed oil prices and a shorter time to the expiration of the lease. The optimal strategy will be immediate implementation in case the payoff resulting from producing oil is so high that the managers are willing to risk abandoning the tract after a sizeable development expenditure.

7.13 Answers to Check Your Progress Questions

1. (b) Growth option

The option to include complementary products and services to the existing product portfolio, when the market condition improves, is called growth option

2. (d) Discounted – Cash Flow (DCF) model

It is a risk neutral approach of valuing real options

3. (c) Contingent claims

An asset with future payoffs that is dependent on the result of an uncertain development is called contingent claims

4. (c) Option value

The difference between the current market value of an option and its intrinsic value is its option value

5. (d) Market conditions may change and increase the NPV of the project

The opportunity to defer investing to a later date may have value because market conditions may change and increase the NPV of the project

Unit 8

Working Capital Management

Structure

"Working capital is like your diet; if you do not manage it, then it can kill you."

- Daniel Corredor

8.1 Introduction

Working capital management is concerned with the problems that arise in attempting to manage the current assets, the current liabilities, and the interrelationship that exists between them. Assets and liabilities of a company can be classified on the basis of duration. Assets can be classified into fixed assets and current assets, while liabilities are classified as long-term liabilities and current liabilities.

Working capital management is an attempt to decide the optimum level of the various components of working capital i.e., in tune with the risk-return profile acceptable to the management. In addition to the traditional tools employed in the determination of these optimum levels, the domain of working capital management has imbibed a number of techniques from fields like statistics, economics, etc.

The application of these techniques is wide-ranging. While some of them (like cash budget simulation) are more flexible versions of the traditional tools, others go beyond determination of optimum levels of working capital components. Various cash models help in determining the best use of free cash, while

discriminant analysis helps in choosing the customers to whom credit can be safely extended.

Example: Why are working capital drawdowns of corporates and MSME borrowers rising in May 2022?

Earlier 30-40% utilisation of working capital loans by highly rated large corporates was a big challenge. But in May 2022, these limits exhausted by up to 60-70%, raising hopes of fresh loans. This was attributed to the rise in input costs and growing inflation. Raw material costs and conversion costs directly affected the working capital needs of the firms. A rise in these costs resulted in greater utilisation of working capital drawdown loans from the banks by MSMEs.

Source:https://economictimes.indiatimes.com/industry/banking/finance/banking/ working-capital-drawdowns-of-corporates-and-msme-borrowers-rising-with-input-costs/articleshow/91626740.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst, dated May 18, 2022 (Accessed on May 27, 2022)

8.2 Objectives

After going through the unit, you should be able to:

- Explain Working Capital Leverage
- Prepare Weighted Operating Cycle
- Describe Cash Budget Simulation
- Discuss Discriminant Analysis
- Identify different Cash Management Models

8.3 Working Capital Leverage

If things could be predicted accurately, there would be a certain level of current assets which would be just enough to keep the production process rolling smoothly. There would be no lost sales on account of absence of finished goods and no held up production due to inadequate raw materials; the credit terms would be lenient enough to support the credit sales. Yet, there would not be any unnecessary investment in current assets beyond the required level, and hence, no unnecessary costs.

However, uncertainty is omnipresent, which rules out the possibility of a perfect level of current assets. In an uncertain scenario, the management of a company has to make an attempt to predict the level of current assets that will be required for future operations and maintain the assets at that level. In addition, a certain amount of buffer would be required to be maintained, to provide for the contingency of the actual requirements being higher than the predicted level. This buffer helps in reducing the risk of stock-out costs and other costs involved with a low level of current assets (like lost sales), thus reducing the level of risk the firm is exposed to. At the same time, the firm has to bear additional costs for

financing the additional investment in current assets, which reduces the firm's profitability. Hence, every firm faces a risk-return trade-off in managing its working capital.

Since a firm generally maintains a buffer stock in addition to the minimum level of current assets required, a small change in the amount of working capital employed can be expected not to have any effect on the EBIT. Hence, it is possible to increase the firm's return on investment by reducing the level of current assets. This is because the firm will be generating the same EBIT on a lower investment. The sensitivity of return on investment to changes in the level of current assets is referred to as working capital leverage. Working capital leverage can be calculated in the following manner:

If c denotes the existing level of current assets.

t denotes the existing level of total assets.

I denotes the existing level of EBIT.

Δc denotes the change in the level of current assets in absolute terms.

Then,

$$\text{Working capital leverage} = \frac{\text{Percentage change in ROI}}{\text{Percentage change in c}}$$

$$\text{Percentage change in ROI} = \frac{(I/t) - I/(t+\Delta c)}{(I/t)}$$

$$= 1 - \frac{t}{t+\Delta c} = \frac{\Delta c}{t+\Delta c}$$

$$\text{Percentage change in c} = \frac{\Delta c}{c}$$

Hence,

$$\text{Working Capital Leverage} = \frac{\Delta c}{t+\Delta c} \times \frac{c}{\Delta c} = \frac{c}{t+\Delta c}$$

Example: Working Capital Leverage of Bajaj Auto (FY 2021-22).

₹ (in Crores)

Year	Mar 22	Mar 21	Mar 20
Current Assets	9,994.47	14,175.13	6,596.96
Total Assets	31,921.94	31,530.20	24,773.30
EBIT	6198.71	5945.66	6583.36

Let's calculate the working capital leverage (taking figures of FY 2021-22 into consideration) assuming a 10% reduction in current assets.

Here

c = ₹ 9,994.47 crore

t = ₹ 31,921.94 crore

Contd. .....

Δc = ₹ 9,994.47 crore x 0.10 = ₹ 999.45 crore

For a 10% decrease in current assets

Working Capital Leverage $= \frac{c}{t+\Delta c}$

As working capital is reduced Δc has to be deducted (It becomes a minus value).

$$WCL = \frac{9,994.47}{31,921.94+(-\ 999.45)}$$

$$= \frac{9,994.47}{30,922.49} = 0.32$$

Now let's calculate working capital leverage (taking figures of FY 2021-22 into consideration) assuming a 10% increase in current assets.

Working Capital Leverage $= \frac{c}{t+\Delta c}$

As working capital is increased Δc has to be added (It becomes a positive value).

$$WCL = \frac{9,994.47}{31,921.94 + 999.45}$$

$$= \frac{9,994.47}{41,916.41} = 0.24$$

Sources: (i) https://www.moneycontrol.com/financials/bajajauto/balance-sheet VI/BA10 (Accessed on May 27, 2022)

(ii)https://economictimes.indiatimes.com/bajaj-auto-ltd/profitandlose/companyid-1430.cms (Accessed on May 27, 2022)

Illustration 1

M/s Complex Instruments Ltd., is engaged in the business of producing electronic instruments. At the end of the current year, its select financials were as follows:

	(₹. in crore)
Current Assets	86
Fixed Assets	150
EBIT	25

Assume that 15% of the current assets are a buffer, and hence a change in the level of current assets to the tune of 15% on either side will not have effect on the EBIT earned by the company. In that case, its working capital leverage can be calculated in the following manner.

c = Rs.86 crore

t = Rs.(86 + 150)cr. = Rs.236 crore

Δc = 86 × 0.15 = Rs.12.9 crore

For a 15% increase in current assets

$$WCL = \frac{86}{236+12.9} = 0.35$$

Here, a working capital leverage of 0.35 implies that at the existing level of current assets, a 15% increase in the level of current assets will result in a 3.5% decline in the ROI.

For a 15% decrease in current assets

$$\text{WCL} = \frac{86}{236 + (-12.9)} = 0.39$$

Here, a working capital leverage of 0.39 implies that at the existing level of current assets, a 15% decrease in the level of current assets will result in a 3.9% increase in the ROI.

It is generally observed that a company having a higher proportion of current assets in the total assets it employs, has a higher degree of working capital leverage as well. Compare the following data of M/s Ecstatic Ltd.

Particulars	(₹. in crore)
Current Assets	150
Fixed Assets	86
EBIT	25

For a 15% decrease in current assets, the working capital leverage will be

$$\text{WCL} = \frac{150}{236 + (-22.5)} = 0.70.$$

8.4 Weighted Operating Cycle

Operating cycle analysis helps us ascertain the duration for which funds are required for various stages of the working capital cycle. Weighted operating cycle is an extension of that concept, and helps in estimating the amount of funds that are required for the various stages of the cycle. It is a method of estimation of the working capital requirement.

Under this method, appropriate weights are attached to the durations of various stages of the operating cycle, and then these weighted durations are added up to arrive at the weighted operating cycle. The weights are the ratio of the funds per unit required at each stage, to the selling price per unit. The weighted operating cycle, multiplied by sales per day gives the working capital requirement. A certain degree of cash required may be added to this figure.

The weights attached to the various stages of the working capital cycle are calculated in the following manner:

Raw Material Stage:

$$W_r = \frac{\text{Raw material cost per unit}}{\text{Selling price per unit}}$$

Work-in-process Stage:

$$W_w = \frac{\text{Raw material cost per unit} + (0.5 \times \text{Processing cost per unit})}{\text{Selling price per unit}}$$

Finished Goods Stage:

$$W_f = \frac{\text{Cost of goods sold per unit}}{\text{Selling price per unit}}$$

Debtors Stage:

$$W_d = \frac{\text{Selling price per unit}}{\text{Selling price per unit}} = 1$$

Creditors Stage:

$$W_c = \frac{\text{Raw material cost per unit}}{\text{Selling price per unit}}$$

If the duration of the various stages of the operating cycle is denoted by the following symbols:

Duration of raw materials stage = D_r

Duration of work-in-process stage = D_w

Duration of finished goods stage = D_f

Duration of debtors stage = D_d

Duration of creditors stage = $D_{c,}$

Then weighted operating cycle is calculated as:

Weighted operating cycle

$$= (D_r \text{ x } W_r) + (D_w \text{ x } W_w) + (D_f \text{ x } W_f) + (D_d \text{ x } W_d) - (D_c \text{ x } W_c)$$

The weighted operating cycle can then be used to calculate the working capital requirement. Working capital requirement is given by

Working capital requirement

= (Amount of sales per day x Weighted operating cycle) + Required cash balance.

Illustration 2

M/s. Illumination Ltd. has the following data available:

Duration of raw materials stage = 30 days

Duration of work-in-process stage = 25 days

Duration of finished goods stage = 15 days

Duration of debtors' stage = 30 days

Duration of creditors stage = 20 days

Raw materials cost per unit = ₹ 100
Processing cost per unit = ₹ 50
Selling and administration cost per unit = ₹ 20
Financing cost per unit = ₹ 10
Selling price per unit = ₹ 250
Per day sales = ₹ 3,00,000
Required cash balance = ₹ 5,00,000

The weights will be

$$W_r = \frac{100}{250} = 0.4$$

$$W_w = \frac{100 + (0.5 \times 50)}{250} = 0.5$$

$$W_f = \frac{180}{250} = 0.72$$

$$W_d = 1$$

$$W_c = \frac{100}{250} = 0.4$$

Weighted operating cycle

$$= (D_r \times W_r) + (D_w \times W_w) + (D_f \times W_f) + (D_d \times W_d) - (D_c \times W_c)$$

$$= (30 \times 0.4) + (25 \times 0.5) + (15 \times 0.72) + (30 \times 1) - (20 \times 0.4)$$

= 57.3 days.

Working capital requirement

= (3,00,000 × 57.3) + 5,00,000 = Rs.176,90,000.

Example: Effect of Covid on Operating Cycle

A study of the top-500 listed companies conducted by EY India revealed that during the 12 months ending September 30, 2020, businesses in India registered an increase in the operating cycle by 6 days YOY. With the decrease in sales, the movement of inventory slowed down. Out of the 12 sectors, 9 including metals and mining, oil and gas and pharmaceuticals observed an increase in days of inventory. The late realisation of cash forced 69% of the companies to extend their payables to offset the effects of the pandemic on working capital.

Source: (i) https://www.business-standard.com/article/economy-policy/covid-hurts-working-cap-top-500-cos-cash-cycles-stretched-by-6-days-ey-121041900530_1.html, dated April 20, 2021 (Accessed on May 27, 2022)

(ii) https://www.ey.com/en_in/news/2021/04/india-inc-witnessed-6-days-increase-in-the-cash-to-cash-cycle-as-a-result-of-the-pandemic (Accessed on May 27, 2022)

Weighted Operating Cycle

Let us take an illustration to learn more about the traditional way of estimating working capital.

Illustration 3

Consider a year consisting of 365 days. From the given data, annual requirement/consumption for each working capital component is computed as under.

Item	% of annual sales	Annual Requirement
Raw Materials	40%	438
Work-in-process	20%	219
Finished Goods	72%	788.4
Debtors	100%	1095
Creditors	40%	438

Annual Sales: 3 lakhs per day * 365 days = 1095 Lacs

Raw Material consumption (Annual): 40% of annual sales: 438 Lacs

Processing Expenses (Annual): 20% of annual sales: 219 Lacs

SGA Expenses (Annual): 8% of annual sales: 87.6 Lacs

Interest Expenses (Annual): 4% of annual sales: 43.8 Lacs

Working capital requirement is calculated as under:

Item	Holding Period (Days)	Daily Requirement (Rs)	Working Capital Requirement for the holding period (Rs)	Remarks
Raw Materials	30	1,20,000	36,00,000	
Processing	25	1,50,000 (see remarks)	37,50,000	100% of RM cost + 50% of WIP (438+219*.5)/365
Finished Goods	15	2,16,000	32,40,000	
Debtors	30	3,00,000	90,00,000	
Creditors	20	1,20,000	24,00,000	
Cash			5,00,000	
Total			1,76,90,000	

We can summarize the working capital requirement and Net Operating Cycle (NOC) as under:

Item	Traditional Method	Weighted Calculation
Working Capital Requirement (In rupees)	176,90,000	176,90,000
Net Operating Cycle (NOC)	80	57.3

Illustration 4

Let us take a simple example of a luxury goods boutique, which procures luxury items and sells them at a profit after giving some value-addition to the items. The data are provided as under.

Firm	India Luxury Ltd	
Sale Price	100	Items sold per annum: 4500
Procurement Price	67	
Improvement Costs	7	

1. Procured items are held for 30 days for the purpose of improving the items.
2. Improvement to the items is done almost instantaneously. Thus there is no requirement for holding inventory for the purpose of improvement.
3. Finished goods are held for 15 days for meeting the customer demand.
4. The firm grants 21 days of credit to its customers and is granted a credit period of 18 days by its suppliers.

In traditional method, we can calculate the NOC and WC requirement as under.

	Number of items sold		4500	
	Sale Price		1000	
	Annual Sales		4500000	
	Item	Holding Period (days)	Working Capital Requirement (Annual)	Working Capital Requirement (Holding Period)
	Raw Material	30	3000000	246575
	Finished Goods	15	3700000	152055
	Receivables	21	4500000	258904
	Creditors	18	3000000	147945
	Net Operating Cycle	48	Days	
Working Capital Requirement		509589	Rupees	

The calculation of NOC and WC requirement in terms of weighted WC cycle method is as under.

Item	Weight	Holding Period (days)	Weighted Holding Period (days)
Raw Material	.6667	30	20
Finished Goods	.8222	15	12.33
Receivables	1	21	21
Creditors	.6667	18	12
		Weighted Operating Cycle	41.33
		Daily sales	₹12,329
		Working Capital Requirement	₹ 509,548

We can summarize the working capital requirement and Net Operating Cycle (NOC) as under:

Item	Traditional Method	Weighted Calculation
Working Capital Requirement (In rupees)	₹ 509,589	₹ 509,548
Net Operating Cycle (NOC)	48	41.33

Remarks: It could be seen that while the NOC is different between these methods, the working capital requirement of the firm is the same under both the methods. This is only to be expected. Otherwise, there would be friction and uncertainty between the firm and the lending bank with the firm clamouring for more working capital and the lender choosing the method of his choice to finance the firm.

An examination of both these methods of calculating operating cycle and working capital requirement indicates that the weighted operating approach does not have any additional advantages over the traditional method of calculating the same. For calculating the weighted OC too, we require all the inputs that are required for calculating traditional operating cycle. Hence, it's to be treated just as another method calculating the operating cycle, no more.

Working Capital Leverage

The concept of working capital leverage examines the effect of changes in working capital on the Return on Capital (ROI). We can intuitively feel that improving efficiency in managing working capital improves ROI, and vice versa. Working capital can be managed more efficiently by reducing the level of current assets or increasing current liabilities, or doing both together thereby bringing down the level of Net Working Capital (NWC). However, one should take care

to ensure that the operations of the firm do not suffer on account of our zeal to reduce the NWC. WCL gives a quick estimate of the gains in ROI for managing the WC more efficiently as well as the deterioration in ROI for stocking up on CA without commensurate increase in the operating income.

To get a better understanding of the concept of working capital leverage, we can examine the same vis-à-vis the operating leverage and financial leverage. When we state that a firm enjoys an operating leverage of, for example 5, we mean that the movement in operating income is five times more magnified compared to the change in sales revenues in both directions. An increase in sales results in increase in operating income, and a decrease in sales will result in a decrease in operating income by the same magnitude. The same character is exhibited by the financial leverage also.

Now we will see how to interpret the WCL.

	(₹ in crore)
Current Assets	150
Fixed Assets	86
EBIT	25
ROI	10.59%

A 20% increase in current assets results in a WCL of .564 = (150/(236+30)). This implies that a 1% increase in CA shall result in a decline of .564% in ROI. A 20% increase in CA shall result in a decrease in ROA to an extent of 11.28%. So, an increase of CA by Rs 30 crores should result in an ROI of 10.59 %*(100%-11.28%) = 9.40%; this is indeed the ROI after CA increased by Rs 30 crores. (25/266=9.40%).

Similarly a 20% decrease in current assets results in a WCL of .7282 = (150/(236-30)). This implies that a 1% decrease in CA shall result in an increase of .7282% in ROI. A 20% decrease in CA shall result in an increase in ROA to an extent of 14.56%. So, an increase of CA by Rs 30 crores should result in an ROI of 10.59 %*(100% + 14.56%) = 12.13%; this is indeed the ROI after CA decreased by Rs 30 crores. (25/206=12.13%).

These results can be summarized as follows. For the given composition of current and fixed assets, and EBIT:

Change in Current Assets	Working Capital Leverage	New ROI	Change in ROI
+10%	.60	9.95%	-6.00%
-10%	.68	11.31%	+6.80%
+ 20%	.564	9.40%	- 11.28%
- 20%	.7282	12.13%	+ 14.56%
+30%	.534	8.89%	-16.02%
-30%	.790	13.10%	+23.70%

So, it could be seen from the above table that an efficient use of the working capital results in relatively better gains to a firm compared to the losses arising out of less-than-efficient use of working capital. Thus a 20% reduction in CAs results in an improvement of ROI by 14.56% whereas a 20% increase in CAs results in deterioration of ROI only by 11.28% (less than the expected deterioration of 14.56%). The gains and losses in ROI are asymmetrical in opposite directions. Thus there is a real incentive for finance managers of firms to manage WC efficiently. This phenomenon can be contrasted with operating leverage and financial leverage of a firm which are symmetrical in both directions at a given level of operations.

Activity 8.2

a. What is meant by Weighted operating cycle?

……

……

b. The following information is available for Rashmika Limited. Current Assets: Rs.100 mln, Net Fixed Assets: Rs.60 mln, Total Assets: Rs.160 mln, EBIT: Rs.20 mln, ROI: 16%. If current assets are reduced by 15%, what will be the working capital leverage?

……

……

8.5 Cash Budget Simulation

Preparation of a cash budget involves estimation of a number of exogenous variables like the level of sales, the percentage of credit sales to total sales, the percentage of credit sales recoverable during a particular period, the various expenses to be incurred, etc. While the finance manager may arrive at such estimates with a reasonable degree of accuracy, these estimates may not always come true. As these variables are related to the future and are outside the firm's control, predicting them with 100% accuracy is not possible. The cash budget being only as good as the inputs that go into its preparation, it can only give us an estimation of the expected cash balance at the end of the budgeting period. This estimation may turn out to be quite far from the actual cash balance.

These facts make it preferable to take the various possible values of the different variables into consideration while preparing the cash budget. This is done by using the technique of simulation. First, a distinction is made between the parameters and the exogenous variables.

Parameters are the variables that are kept constant throughout the simulation exercise. These are generally those variables that affect the cash balance to a lesser extent than some other important variables.

Exogenous variables are those that are allowed to vary and the effect of whose variations on the cash balance is estimated using simulation. For example, the percentage of credit sales to total sales may be a parameter, while monthly cash expenses may be taken as an exogenous variable. The second step in the exercise is to arrive at a probability distribution for the various exogenous variables. The probability distribution can be either empirical or subjective.

The third step in the exercise is to undertake simulation runs. Each simulation run would give a certain value for each of the exogenous variables. These values are used to prepare the cash budget. A number of simulation runs are done to arrive at a large number of values for the cash balance at the end of the specified period. These values can then be used to arrive at the expected (mean) value of the cash balance and its expected variations. The larger the number of simulation runs, the more accurate the end result. However, as it was mentioned earlier, a cash budget will be only as good as the inputs. Hence, the result of simulation will only be as good as the probability distributions developed for the exogenous variables. Hence, the actual cash balance may still turn out to be different from that predicted using the technique of simulation. Yet, the estimates can be expected to be better than those arrived at without simulation.

Illustration 3

The following data is available for Exotica Limited.

1. The sales are expected to be

May Sales (₹)	Probability	June Sales (₹)	Probability
50,000	0.10	45,000	0.20
55,000	0.25	47,000	0.10
56,000	0.25	50,000	0.50
58,000	0.40	52,000	0.20

2. Credit sales will be 50% of total sales. The receivables are expected to be collected in the month after the sales.
3. Raw material costs will be 20% of sales. The payment is made in the month of purchase.
4. The monthly cash expenses are expected to be

May Expenses (₹)	Probability	June Expenses (₹)	Probability
10,000	0.50	5,000	0.10
15,000	0.50	20,000	0.90

5. The opening cash balance in May would be Rs.50,000.
6. Receivables expected to be realized in May are Rs.20,000.

Given the data, the cash balance for the two months can be estimated as under:

Let

B_m denotes the cash balance at the end of May

B_j denotes the cash balance at the end of June

S_m denotes sales for May

S_j denotes sales for June

C_m denotes the cash expenses for May

C_j denotes the cash expenses for June.

Then,

$B_m = 50,000 + (0.5 \times S_m) + 20,000 – (0.2 \times S_m) – C_m$

$B_j = B_m + (0.5 \times S_j) + (0.5 \times S_m) – (0.2 \times S_j) – C_j$

The first simulation run gives the following values:

S_m = ₹ 58,000

S_j = ₹ 45,000

C_m = ₹15,000

C_j = ₹ 20,000.

The cash balances will be

$B_m = 50,000 + (0.5 \times 58,000) + 20,000 – (0.2 \times 58,000) – 15,000$

= ₹ 72,400.

$B_j = 72,400 + (0.5 \times 45,000) + (0.5 \times 58,000) – (0.2 \times 45,000) – 20,000$

= ₹ 94,900.

The second simulation run gives the following values:

S_m = ₹ 58,000

S_j = ₹ 50,000

C_m = ₹ 10,000

C_j = ₹ 5,000.

The cash balances will be

B_m = 50,000 + (0.5 × 58,000) + 20,000 – (0.2 × 58,000) – 10,000

= ₹ 77,400.

B_j = 77,400 + (0.5 × 50,000) + (0.5 × 58,000) – (0.2 × 50,000) – 5,000

= ₹.1,01,400.

The third simulation run gives the following values:

S_m = ₹ 50,000

S_j = ₹ 47,000

C_m = ₹ 15,000

C_j = ₹ 20,000.

The cash balances will be

B_m = 50,000 + (0.5 × 50,000) + 20,000 – (0.2 × 50,000) – 15,000

= ₹ 70,000.

B_j = 70,000 + (0.5 × 47,000) + (0.5 × 50,000) – (0.2 × 47,000) – 20,000

= ₹ 89,100.

The fourth simulation run gives the following values:

S_m = ₹ 58,000

S_j = ₹ 50,000

C_m = ₹ 15,000

C_j = ₹ 20,000.

The cash balances will be

B_m = 50,000 + (0.5 × 58,000) + 20,000 – (0.2 × 58,000) – 15,000

= ₹ 72,400.

B_j = 72,400 + (0.5 × 50,000) + (0.5 × 58,000) – (0.2 × 50,000) – 20,000

= ₹ 96,400.

The fifth simulation run gives the following values:

S_m = ₹ 50,000

S_j = ₹ 47,000

C_m = ₹ 10,000

C_j = ₹ 20,000.

The cash balances will be

B_m = 50,000 + (0.5 × 50,000) + 20,000 – (0.2 × 50,000) – 10,000

$= ₹ 60,000.$

$B_j = 60,000 + (0.5 \times 47,000) + (0.5 \times 50,000) – (0.2 \times 47,000) – 20,000$

$= ₹ 79,100.$

Hence, the average cash balance would be

For May = (72,400 + 77,400 + 70,000 + 72,400 + 60,000)/5

= ₹ 70,440.

For June = (94,900 + 1,01,400 + 89,100 + 96,400 + 79,100)/5

= ₹ 92,180.

The standard deviation for cash balance comes out to

For May = ₹ 6,429

For June = ₹ 8,529

We know that the probability of the value of a normal variable being between the mean and +/– 3 standard deviation is 99.68%. So we can say that there is a 99.68% probability of the cash balances being

For May = Between ₹ 89,727 and ₹ 51,153.

For June = Between ₹ 1,17,758 and ₹ 66,602.

8.6 Discriminant Analysis

Discriminant analysis is a statistical tool used for receivables management. It helps classifying prospective debtors as good or bad. The decision of whether to lend or not can be made using this classification. Use of discriminant analysis helps minimize the possibility of a firm extending credit to prospective defaulters.

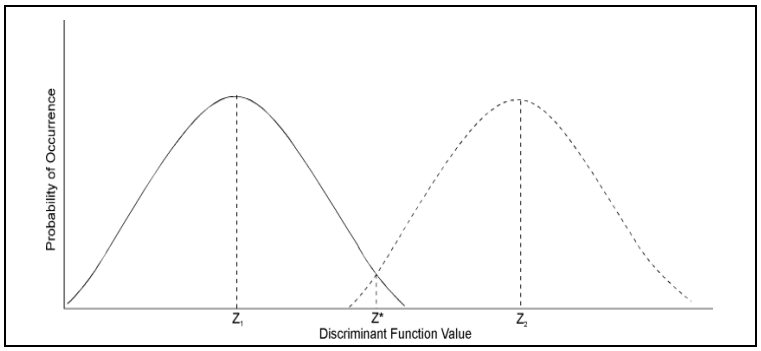
Discriminant analysis is a regression analysis on data taken from two different universes. For this purpose, any two factors considered relevant for the performance of a debtor are identified. Let us say these two factors are – the debtor's current ratio and net profit margin. Other variables like the quick ratio, the cash profit margin, etc. may also be identified as the key factors affecting the performance of a debtor.

The second step is to identify historical data of the receivables. The current ratio and net profit margin of these debtors are recorded. Then, on the basis of their actual performance, these debts are classified as good or bad. This exercise provides us with two sets of data – one consisting of the current ratio and the net profit margin for the good accounts, and the other consisting of the same information for the bad accounts.

With the current ratio and the net profit margin as independent variables, a linear discriminant analysis is undertaken to establish the relationship between the independent variables and the account's performance (i.e., whether the particular account pays up the dues or not). The model is then tested for the predictive

ability of the independent variables, before being used for classifying prospective accounts for making the credit decision.

Figure 8.1: Discriminant Analysis



Source: ICFAI Research Center

The following assumptions are made for the purpose of discriminant analysis:

There are two discrete groups – the good accounts and the bad accounts.

The two independent variables can be combined in a linear manner for discriminating between the two groups.

These variables represent multivariate normal populations. This means that the values of these variables are normally distributed. Also, the means of the two groups may be different, but their variance is similar, which makes the distributions similar. This assumption enhances the acceptability of the predictive ability of the discriminant function.

The linear relationship between the independent variables and the accounts' performance is described by the Z-score or the discriminant score. The Z-score for each account is calculated as:

$$Z_i = aX_i + bY_i$$

where,

Z_i is the Z-score for the ith account.

X_i is the value of the first independent variable for the ith account (current ratio in this case).

Y_i is the value of the second independent variable for the ith account (net profit margin in this case).

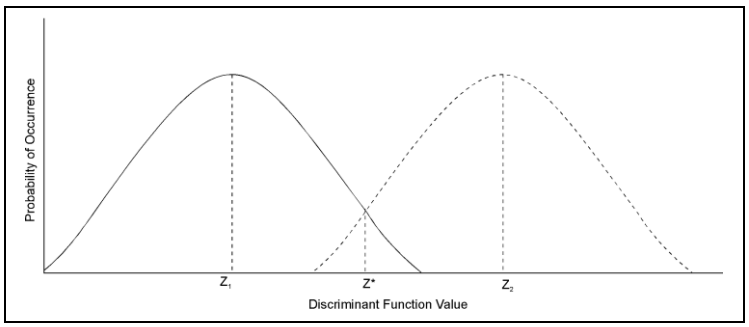
a and b are the parameter values that make the mean Z-score for group 1 significantly different from the mean Z-score for group 2.

The discriminant functions for the two groups can be illustrated in the following manner:

In the figure 1, the value of the discriminant function is shown along the X-axis, and the probability of occurrence along the Y-axis. Discriminant analysis starts with finding those values of a and b that maximize the distance between Z_1 and Z_2, where Z_1 and Z_2 are the mean Z-score values for groups 1 and 2 respectively. As we can see from the figure, the discriminant functions of the two universes overlap. This overlapping results in accounts being misclassified, i.e., good accounts being classified as bad accounts and vice versa.

The values of a and b are chosen in such a way that this overlapping is minimized. Using these values of a and b the value of Z* is found, which is the cut-off value for separating the two groups. The Z-score that minimizes misclassification is taken as Z*. The following figure, when compared to the previous figure, illustrates that the closer the mean Z-scores of the two groups, higher the overlapping, and higher the possibility of misclassification.

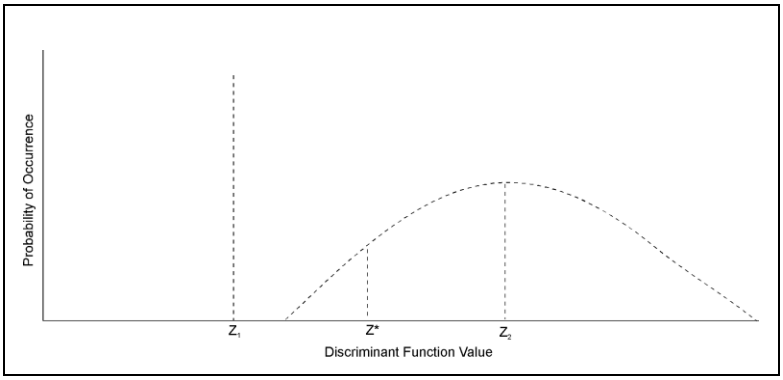
Figure 8.2: Discriminant Analysis of two Groups with Close Mean Score



Source: ICFAI Research Center

The following figure illustrates the significance of the two groups having similar variance. Different variances result in a higher probability of a misclassification.

Figure 8.3: Discriminant Analysis of two Groups with Higher deviation



Source: ICFAI Research Center

The higher the difference between the Z-scores of the two groups ($Z_1 – Z_2$), the lesser the misclassification. If the deviations of Z-scores within the individual groups is low, it will also help in reducing the misclassifications. If the deviations

within the individual groups be denoted by $(Z_i - Z_1)$ and $(Z_i - Z_2)$ for groups 1 and 2 respectively, the value of Z* can be found by maximizing the following function:

$$D = \frac{(Z_1 - Z_2)^2}{\sum_{i+1}^{n_1}(Z_i - Z_1)^2 + \sum_{i+1}^{n_2}(Z_i - Z_1)^2}$$

Where,

Z_1 is the mean Z-score value for group 1

Z_2 is the mean Z-score value for group 2

$\sum_{I=1}^{N_1}(z_i - z_1)^2$ is the sum of squared deviations of the Z-scores in group 1 from their mean

$\sum_{I=1}^{N_1}(z_i - z_1)^2$ is the sum of squared deviations of the Z-scores in group 2 from their mean. The function can be maximized by setting its partial derivatives with respect to 'a' and 'b' equal to zero. Solving for a and b, we get

$$a = \frac{\sigma_y^2.d_x - \sigma_{xy}.d_2}{\sigma_x^2.\sigma_y^2 - (\sigma_{xy})^2}$$

$$b = \frac{\sigma_x^2.d_y - \sigma_{xy}.d_x}{\sigma_x^2.\sigma_y^2 - (\sigma_{xy})^2}$$

Where,

σ_x^2 = Variance of X (across groups 1 and 2)

σ_{xy} = Covariance of X and Y (across groups 1 and 2)

σ_y^2 = Variance of Y (across groups 1 and 2)

d_x = Difference between the mean values of X for groups 1 and 2

d_y = Difference between the mean values of Y for groups 1 and 2.

Let us see an illustration to understand the application of discriminant analysis. The following data is available for M/s Sunshine Ltd.

Good Accounts			Bad Accounts		
Account Number	Current Ratio	Net Profit Margin (%)	Account Number	Current Ratio	Net Profit Margin (%)
1	1.3	25	11	0.8	15
2	1.5	28	12	0.4	13
3	1.2	25	13	0.7	18

Contd. .....

4	1.5	20	14	0.4	19
5	0.8	24	15	1.4	15
6	1.5	32	16	0.6	10
7	1.6	15	17	1.7	25
8	0.9	15	18	0.6	12
9	1.9	25	19	0.9	14
10	1.5	31	20	0.8	19

Source: ICFAI Research Center

The discriminant function is

$$Z_i = aX_i + bY_i$$

The values of a and b will be calculated in the following manner:

	Account Number	X_i	Y_i	$(X_i - \bar{X})$	$(Y_i - \bar{Y})$	$(X_i - \bar{X})^2$	$(Y_i - \bar{Y})^2$	$(X_i - \bar{X}) - (Y_i - \bar{Y})$
GOOD ACCOUNTS	1	1.3	25	0.2	5	0.04	25	1.0
	2	1.5	28	0.4	8	0.16	64	3.2
	3	1.2	25	0.1	5	0.01	25	0.5
	4	1.5	20	0.4	0	0.16	0	0.0
	5	0.8	24	–0.3	4	0.09	16	–1.2
	6	1.5	32	0.4	12	0.16	144	4.8
	7	1.6	15	0.5	–5	0.25	25	–2.5
	8	0.9	15	–0.2	–5	0.04	25	1.0
	9	1.9	25	0.8	5	0.64	25	4.0
	10	1.5	31	0.4	11	0.16	121	4.4
BAD ACCOUNTS	11	0.8	15	–0.3	–5	0.09	25	1.5
	12	0.4	13	–0.7	–7	0.49	49	4.9
	13	0.7	18	–0.4	–2	0.16	4	0.8
	14	0.4	19	–0.7	–1	0.49	1	0.7
	15	1.4	15	0.3	–5	0.09	25	–1.5
	16	0.6	10	–0.5	–10	0.25	100	5.0
	17	1.7	25	0.6	5	0.36	25	3.0
	18	0.6	12	–0.5	–8	0.25	64	4.0
	19	0.9	14	–0.2	–6	0.04	36	1.2
	20	0.8	19	–0.3	–1	0.09	1	0.3

$\bar{X}_1 = 1.37 \quad \bar{Y}_1 = 24$

$\bar{X}_2 = 0.83 \quad \bar{Y}_1 = 16$

$\bar{X} = 1.1 \quad \bar{Y} = 20$

$\sum_{i=1}^{20}(X-\bar{X})^2 = 4.02 \quad \sum_{i=1}^{20}(Y_i-\bar{Y})^2 = 800$

$\sum_{i=1}^{20}(X_i-\bar{X})(Y_t-\bar{Y}) = 35.1 = 35.1$

$\sigma_x^2 = \frac{1}{n-1}\sum_{i=1}^{n}(X_i-\bar{X})^2 = 0.212$

$\sigma_y^2 = \frac{1}{n-1}\sum_{i=1}^{n}(Y_i-\bar{Y})^2 = \frac{800}{19} = 42.105$

$\sigma_{xy} = \frac{1}{n-1}\sum_{i=1}^{n}(X_i-\bar{X})(Y_i=\bar{Y}) = \frac{35.1}{19} = 1.847$

$d_x = \bar{X}_1 - \bar{X}_2 = 1.37 - 0.83 = 0.54$

$d_y = \bar{Y}_1 - \bar{Y}_2 = 21 - 16 = 8$

Thus,

$$a = \frac{\sigma_y^2 d_x - \sigma_{xy}.d_y}{\sigma_x^2.\sigma_y^2 - (\sigma_{xy})^2} = \frac{(42.105\times 0.54)-(1.847\times 8)}{(0.212\times 42.105)-(1.847)^2} = 1.444$$

$$b = \frac{\sigma_x^2 d_y - \sigma_{xy}.d_x}{\sigma_x^2.\sigma_y^2 - (\sigma_{xy})^2} = 0.1267$$

Thus, the discriminant function is

$Z_i = 1.444X_i + 0.1267Y_i$

The next step in discriminant analysis is to use this function to calculate the Z-scores for all the accounts. The Z-scores are:

Account No.	Z-score	Account No.	Z-score
1	5.0441	11	3.0557
2	5.7136	12	2.2233
3	4.9003	13	3.2900
4	4.7000	14	2.9821
5	4.196	15	3.9242
6	6.2190	16	2.1335
7	4.2138	17	5.6233
8	3.2002	18	2.3868
9	5.9129	19	3.0738
10	6.0925	20	3.5625

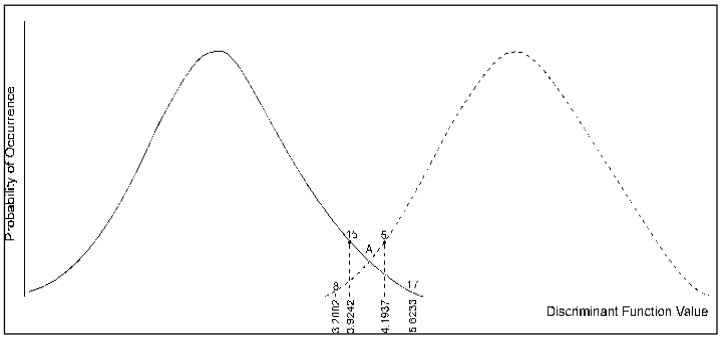
These Z-scores are then arranged in an ascending order:

Account No.	Z-score	Performance	Account No.	Z-score	Performance
16	2.1335	B	5	4.1937	G
12	2.2233	B	7	4.2138	G
18	2.3864	B	4	4.7014	G
14	2.9821	B	3	4.8993	G
11	3.0554	B	1	5.0441	G
19	3.0738	B	17	5.6233	B
8	3.2002	G	2	5.7131	G
13	3.2900	B	9	5.9129	G
20	3.5613	B	10	6.0925	G
15	3.9242	B	6	6.2190	G

The next step is to find out the cut-off value between the two groups, i.e., the value of Z*. This point represents the point of intersection between the two groups. The point chosen as the cut-off point minimizes misclassification of accounts.

For this purpose, we use the historical data to identify Z* value that minimized the misclassification. The value of Z* so identified can be used to decide whether a client should be extended credit or not. For arriving at Z*, the last points in the two groups, before the lines representing the groups intersect each other from the top, are identified. The average of the Z-scores of these two points is taken as Z*, as this mid-point is considered as the point of intersection between the two lines. Let us see the graph for our sample.

Figure 8.4: Mid-Point



Source: ICFAI Research Center

It can be observed from the graph that there is an overlap in the area between points 8 and 17. The points in the two groups, falling just before the lines representing the two groups intersect at point A, are account numbers 15 and 5,

which have the Z-score of 3.9242 and 4.1937 respectively. The average of these two Z-scores, i.e. 4.05895 is Z*. Hence, the cut-off point is a Z-score of 4.05895. This value of Z-score results in minimum misclassifications. There are only two misclassifications, namely account numbers 8 and 17.

This analysis can then be used for selecting prospective credit sales customers. Prospective customers whose ratios result in a Z-score of less than 4.05895 can be rejected, while credit can be extended to those whose ratios result in a Z-score higher than 4.05895. If the distance between the mean Z-scores of the two groups is quite big resulting in a small area of overlap, the entire area may be designated as an uncertain area. In such a case, a prospective debtor whose Z-score lies to the left of the area of overlap is rejected. Prospective credit sales customers whose Z-score lies to the right of the uncertain area are accepted. Further data is collected and analyzed for customers whose Z-score lies in the uncertain area, before they are accepted or rejected. If the additional data shows that there is a high chance of the customer paying his dues, and if the profit being generated from the sale is sufficient to cover any possible losses, credit may be extended.

The predictive value of a discriminant function will be high only if the basic characteristics of the prospective customers is significantly similar to those exhibited by the customers forming the sample. Such characteristics, like the importance of a financial ratio in predicting a customer's payment behavior, may change with time. Such a change may result in the function losing its predictive value. As a result, credit may be extended to a high number of defaulters, and a large number of good candidates may be rejected. Hence, it is imperative that the usefulness of the function be checked from time to time. This may be done by taking a sample of debtors from the latest available data, calculating their Z-score and finding out the percentage of correct predictions. A consistently occurring high percentage of wrong predictions may indicate a change in the underlying fundamentals of customers. This would require the discriminant function to be drawn up again.

Discriminant analysis can also be done using more than two independent variables. The basic methodology remains the same, though the actual process may require the use of a computer. Even where two independent variables are used, the use of computers is very common. Discriminant analysis can also be used to monitor existing debtors. Discriminant analysis can be used to concentrate on a few select accounts. These factors make the use of discriminant analysis very practical, flexible and less time consuming.

8.7 Cash Management Models

The function of cash management is generally considered as that of making sure that the firm has adequate cash at all times. There are times when a firm is faced with a cash surplus rather than a cash deficit. Cash management also includes

management of cash surpluses in an appropriate manner. The issues in front of the finance manager are:

- Whether to hold the cash surplus in the form of cash in anticipation of future needs, or invest it in interest earning short-term securities;
- If the surplus is to be held partly as cash and partly as securities, what should be the proportion; and
- How frequently and in what amounts should the securities be liquidated so as to minimize the overall costs.

The following section discusses two of the models that address these issues – the Baumol Model and the Miller and Orr Model.

Baumol Model

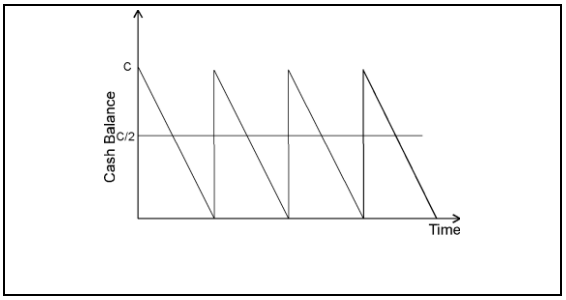
This model, proposed by William J. Baumol, assumes that all the cash surplus is initially parked in short-term securities. A part of these securities are liquidated at regular intervals to meet the cash requirements. When a part of the securities are liquidated, the proceeds are held as cash in hand till it is completely utilized. Once that happens, the next batch of securities are liquidated. The model makes a few assumptions.

Assumptions

- There are two costs involved – holding costs and transaction costs. Holding costs are in the form of interest foregone on cash balance held, and transaction costs are costs incurred in converting securities into cash.
- The cash requirement for the period under consideration is known in advance.
- Securities for a particular sum are converted into cash at a regular frequency.
- Cash expenses are incurred evenly over the planning period.
- The third and fourth assumptions can be interpreted to deduce the movements in the cash balance.

  In the beginning, the cash balance is equal to the amount of securities liquidated per batch. It reduces in a linear manner till it becomes nil, at which stage another batch of securities is converted into cash. On conversion, the balance again goes up to the original amount. The average cash balance, therefore, is half the original balance. The movements in cash balance gets reflected in the following figure:

Figure 8.5: Movements in cash balance

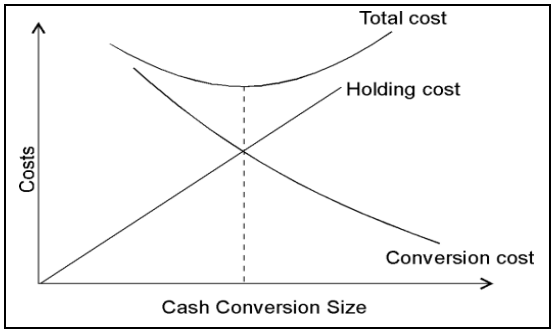


Source: ICFAI Research Center

In the figure, C denotes the amount of securities liquidated per batch.

The conversion cost is a fixed sum, irrespective of the amount of securities converted. As the total number of conversions during the planning period depend on the amount of securities liquidated per batch, the total conversion cost incurred during the period becomes a function of C. A higher C implies a higher holding cost and a lower transaction cost over the planning period. These costs have been depicted in the following figure.

Figure 8.6: Holding and Conversion Costs



Source: ICFAI Research Center

According to the model, the total costs are given by

$$TC = I (C/2) + b (T/C)$$

Where,

TC = Total costs (total conversion costs + total holding costs)

I = Interest rate on marketable securities per planning period

C = Amount of securities liquidated per batch

T = Estimated cash requirement over the planning period.

The point where the total costs are minimum can be arrived at by minimizing the above equation. Minimization gives us the following relationship:

$$C = \sqrt{\frac{2bT}{I}}$$

Example: Baumol Model

Jagadish Marine Exports requires ₹ 12 crore in cash for meeting its transaction needs over the next quarter, which is its planning horizon for liquidity decisions. It currently has the amount in the form of marketable securities that earn a 16% yield. The cash payments will be made evenly over the three months planning period. The conversion of marketable securities into cash entails a fixed cost of ₹ 5,000 per transaction. Let's calculate the optimal conversion size as per the Baumol model.

T= ₹ 12,00,00,000 I = 0.16 ÷ 4 = 0.04 b = ₹ 5,000

$$C = \sqrt{\frac{2bT}{I}} = \sqrt{\frac{2x5000x12,00,00,000}{0.04}} = ₹\ 54,77,225.58$$

Activity 8.2

a. Define Discriminant analysis.

……

……

b. The following data is available for M/s. Impressions Ltd.

Estimated cash requirement over a 6-month planning period = Rs.3,00,000

Fixed conversion costs = Rs.800 per batch

Annual interest rate on marketable securities = 10%.

How much amount of securities to be liquidated per batch?

……

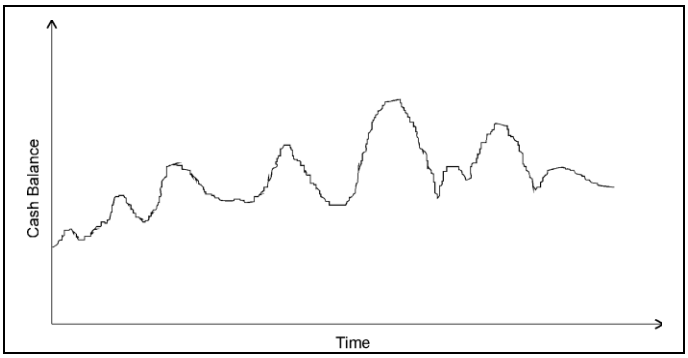
……

Miller and Orr Model

The model proposed by Miller and Orr does not make the restrictive assumptions of the Baumol model. It assumes that,

- There are two costs – holding costs and conversion costs. The conversion costs are fixed irrespective of the size of the conversion.
- Cash inflows and outflows over a period are random, and hence, the movements in cash balance are random, both in size and direction. As the period under consideration is longer, the movements form a normal distribution. The cash balance movements are shown in the following figure:

Figure 8.7: Miller and Orr Model

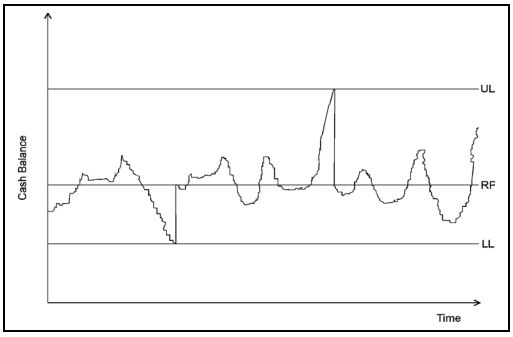


Source: ICFAI Research Center

The model does not fix either the amount of conversion of securities, or the timing. Instead, it specifies the levels at which securities need to be converted into cash (or vice versa), and the levels to which the cash balance is required to be brought at the time of such conversion. The model specifies an Upper Control Limit (UL), a Return Point (RP), and a Lower Control Limit (LL).

The RP lies somewhere between the UL and the LL. The cash balance is allowed to freely fluctuate between the UL and the LL. Conversion is required when the cash balance reaches either of these limits. When the cash balance reaches the lower control limit, enough securities are required to be liquidated to bring the cash balance to the return point. When the cash balance reaches the upper control limit, enough cash is required to be parked in marketable securities to bring the cash balance down to the return point. The following figure illustrates the resultant movements in the cash balance:

Figure 8.8: Upper Control Limit (UL), a Return Point (RP), and a Lower Control Limit (LL)



Source: ICFAI Research Center

According to this model, the LL is required to be decided by the management on the basis of their view on the minimum acceptable cash balance. The model further propounds that the total costs (i.e., the holding costs and the transaction costs) are minimized when

$$RP = \sqrt[3]{\frac{3b\sigma^2}{4I}} + LL \text{ and,}$$

$$UL = 3\,RP - 2\,LL$$

Where,

LL = Lower control limit

RP = Return point

UL = Upper control limit

b = Fixed conversion cost

I = Interest rate per day on marketable securities

σ^2 = Variance of daily changes in the expected cash balance.

Illustration 5

The following data is available for M/s. Rose Petals Ltd.

Lower limit of cash balance = ₹ 50,000

Annual yield on securities = 10%

Fixed transaction costs = ₹ 400

Variance of change in daily cash balance = ₹ 20,000.

Assuming a 360-day year, the daily interest rate will be 10/360 = 0.0278%

The return point will be

$$RP = \sqrt[3]{\frac{3\times 400\times 20,000}{4\times 0.000278}} + 50,000 = ₹\ 52,784$$

UL = 3 RP – 2 LL

= (3 x 52,784) – (2 x 50,000) = ₹ 58,352.

Thus, the firm's total costs for cash management will be minimum if it does the following. As long as the cash balance is between ₹ 58,352 and ₹ 50,000, the firm should neither buy nor sell securities. As soon as the firm's cash balance touches the upper limit of ₹ 58,352, the firm should buy securities and restore the balance to the return point, i.e. Rs.52,784. Whenever the cash balance touches the lower limit of ₹ 50,000, the firm should sell securities to bring the balance up to ₹ 52,784.

In the life of an organization, the frequency of decision-making involving capital expenditure is low. However, it is both necessary and possible to fine-tune decision-making in the context of working capital management so as to enhance the profitability. The various models described above focus on different segments of current assets and provide enabling mechanisms to enhance the efficiency levels in managing the working capital.

8.12 Check Your Progress Questions

1. Which of the following approaches will help in segregating debtors as good and bad?

   a. Discriminant analysis
   b. Cash budget simulation
   c. Weighted operating cycle
   d. Miller & Orr Model
   e. Baumol Model

2. Which of the following was not required for the calculation of working capital leverage?

   a. Level of current assets
   b. Change in level of current assets
   c. Change in EBIT
   d. Existing level of EBIT
   e. Existing total assets

3. A company has excess stock of raw material is being maintained, though the production process is efficient and fully utilised. This is on account of slow sales as compared to previous year. Which of the following components of working capital is adding to its high value?

   a. Raw material stage
   b. Work-in-progress stage
   c. Finished goods stage
   d. Debtors stage
   e. Creditors stage

4. Which of the following statistical tools was required to be used if credit is extended only to the customer who passes the score as calculated by the discriminant analysis.?

   a. Measure of dispersion
   b. Measure of Central Tendency
   c. Normal distribution
   d. Regression analysis
   e. Range

5. Which of the variables, if available, would allow the use of Miller and Orr Model over the Baumol Model?

   a. Holding cost
   b. Conversion cost
   c. Transaction cost
   d. Average cash balance
   e. Cash expenses incurred

8.8 Summary

- Working capital leverage reflects the sensitivity of return on investment to change in the level of current assets.
- Weighted operating cycle analysis is used to ascertain the duration for which funds are required for various stages of the working capital.

- Cash budget simulation consists of phases, which include model development, specification of probability distribution of exogenous variables and running the model.
- Discriminant analysis is a statistical tool helpful for classification purposes.
- Cash management model ensures that a firm has adequate cash at all times.
- Baumol model applies the economic order quantity concept to determine the cash conversion size.
- Miller and Orr model consider a stochastic generating process for periodic changes in cash balance.

8.9 Glossary

- The **Operating Cycle** of a firm begins with the acquisition of raw materials and ends with the collection of receivables.
- **Safety Stock** is the volume of inventories carried to protect against variations in sales rate, production rate and procurement time.
- **Technical Insolvency** is the situation in which the firm can no longer honor its financial obligations. Although its assets may exceed its total liabilities, thereby indicating a positive net worth, the company simply does not have sufficient liquidity to pay its debts.
- **Trade Credit** refers to the inter-firm credit arising from credit sales. It is recorded as an account receivable by the seller and an account payable by the buyer.
- There are two measures of **Working Capital** – Gross working capital and Net working capital. Gross working capital is the total of current assets and Net working capital is the difference between the total of current assets and the total of current liabilities.

8.10 Suggested Readings / Reference Material

1. Richard Brealey and Stewart Myers and Franklin Allen and Alex Edmans (2023). Principles of Corporate Finance. 14th Edition, McGraw Hill India
2. Stephen A. Ross, Randolph Westerfield (Author), & Jordon (2018). Fundamentals of Corporate Finance. 12th edition, McGraw Hill College
3. Prasanna Chandra (2020). Strategic Financial Management: Managing for value creation. 2nd edition, McGraw Hill
4. Hubbard & Obrien (2022). Mony, Banking and Financial System. 4th edition, Pearson Education
5. Kalyani Karna (2019). Strategic Financial Management. 1st edition. Corporate Plus Publications Private Limited

6. Edward I Altman (2019). Corporate Financial Distress, Restructuring and Bankruptcy. 4th edition, Wiley

7. Rick Mann & David Tarrant (2020). Strategic Finance for Strategic Leaders: The First Five Tools. Clarion strategy publishing

8. Sheeba Kapil (2021). Financial Valuation and Modelling. Wiley

8.11 Suggested Answers

Self-Assessment Questions – 1

a. Weighted operating cycle is an extension of that concept, and helps in estimating the amount of funds that are required for the various stages of the cycle. It is a method of estimation of the working capital requirement. Under this method, appropriate weights are attached to the durations of various stages of the operating cycle, and then these weighted durations are added up to arrive at the weighted operating cycle. The weights are the ratio of the funds per unit required at each stage, to the selling price per unit.

b. Working Capital Leverage $= \dfrac{\text{Current Assets}}{\text{Total Assets + Change in Current Assets}}$

$= \dfrac{100}{160+(-15)} = 0.69$

Self-Assessment Questions – 2

a. Discriminant analysis is a statistical tool used for receivables management. It helps classifying prospective debtors as good or bad. The decision of whether to lend or not can be made using this classification. Use of discriminant analysis helps minimize the possibility of a firm extending credit to prospective defaulters. It is a regression analysis on data taken from two different universes.

b. $C = \sqrt{\dfrac{2bT}{1}} = \sqrt{\dfrac{2\times 800\times 3,00,000}{0.05}} = \text{Rs.}97,980.$

Therefore, the company needs to convert Rs.97,980 worth of securities per batch.

8.13 Answers to Check Your Progress Questions

1. (a) Discriminant analysis

Discriminant analysis is a statistical tool that helps classify prospective debtors as good or bad.

2. (c) Change in EBIT

Working capital leverage is calculated using existing level of current assets, total assets and EBIT. Hence, change in EBIT is not required.

3. (c) Finished goods stage

Since the production processes are efficient and sales are slowed, the capital is locked up in finished goods inventory.

4. (d) Regression analysis

Regression analysis tool is required to be used in discriminant analysis.

5. (b) Conversion cost

Conversion costs are required by Miller & Orr Model in addition to holding costs.

Unit 9
Strategic Cost Management

Structure

You seldom improve quality by cutting costs, but you can often cut costs by improving quality.

- Karl Albrecht

9.1 Introduction

Cost analysis is traditionally viewed as the process of assessing the financial impact of alternative managerial decisions. But now it is very important to survive in the competitive business environment. One of the good ways to improve the profitability is to control cost of production. There are many costing methods available to control the cost of production. In this unit, you will study some costing methods like activity based costing, targeting costing, etc.

Example: Apple's Strategy of Cost Cutting

In 2020, Apple, claiming to cut down on e-waste and reduce carbon emissions, stopped shipping charging bricks and earphones with their smartphones. By removing the charger from the box of the iPhone, Apple reduced the size of the box thereby reducing the amount of packing material like paper and cardboard. Smaller iPhone boxes were easy to ship, and the company saved

Contd. .....

big on shipping. According to the Daily Mail, this move, by March 2022, helped Apple save around $ 6.5 billion. Customers were buying Apple authentic chargers and iPods from it, further augmenting its revenue.

Sources: (i) https://www.indiatimes.com/technology/news/apple-no-chargers-in-iphone-boxes-564793.html, dated March 18, 2022 (Accessed on May 31, 2022)
(ii) https://www.republicworld.com/technology-news/gadgets/apple-reportedly-saves-over-6-dollars-billion-by-not-providing-chargers-in-iphone-boxes-articleshow.html, dated 15th March, 2022 (Accessed on May 31, 2022)

9.2 Objectives

After going through the unit, you should be able to:

- Outline the Strategic Perspective of Cost Management
- Explain the Value Chain Analysis
- Identify Activity Based Costing
- Explain the Target Costing process
- Discuss the Quality Costing
- Describe Life Cycle Costing – Product and Project.

9.3 Strategic Perspective of Cost Management

Strategic Cost Management (SCM) is a cost analysis in a broader context, where the strategic elements become more explicit and formal. SCM involves usage of cost data to develop superior strategies to gain sustainable competitive advantage. Thus, SCM is the managerial use of cost information explicitly providing strategic perspectives.

The process of Strategic Cost Management encompasses the following:

- Value Chain Analysis
- Activity Based Costing
- Target Costing
- Quality Costing
- Life Cycle Costing.

Example: Xiaomi's strategy of Cost competitiveness and Hunger Marketing

Xiaomi was built on the belief that good specs can be delivered at low costs. Xiaomi used hunger marketing to make its advertisement costs almost zero. The flash sales brought the necessary publicity to the phones. Using online platforms, Xiaomi significantly reduced the dealer commissions. By utilizing

Contd. .....

its fan base Xiaomi remained in news one way or the other. High specs at low costs through cost optimization made it the largest selling brand in India and the company has its eyes for the no. 1 position internationally too.

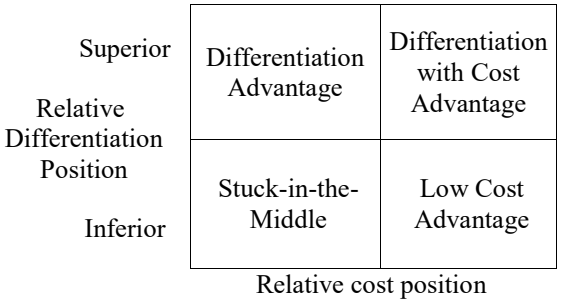
Source(i):https://research-methodology.net/xiaomi-business-strategy-competitive-costs-and-large-ecosysem/ (Accessed July 11, 2022)
(ii):https://www.indiatoday.in/technology/news/story/xiaomi-beats-samsung-to-become-number-1-smartphone-brand-in-the-world-for-first-time-ever-1837473-2021-08-06 (Accessed July 11, 2022)

9.4 Value Chain Analysis

Value chain is the linked set of value-creating activities beginning from the basic raw material sources from suppliers to the ultimate end-use product delivered into the final customer's hands. No individual firm is likely to span the entire value chain. Each firm must be understood in the context of the overall value chain of value-creating activities

According to Michael Porter, a business unit can develop a sustainable competitive advantage based on cost or on differentiation or on both, as shown in the following figure.

Figure 9.1: Developing Competitive Advantage



The primary focus of the low cost strategy is to achieve low cost relative to competitors. Cost leadership can be achieved through – economies of scale of production, learning curve effects, tight cost control etc. Examples of companies following the low cost strategy is Timex in wristwatches.

The differentiation strategy consists in differentiating the product by creating something perceived as unique. Product differentiation can be achieved through brand loyalty, superior customer service, dealer network etc. Examples of companies following the differentiation route are Hindustan Lever in detergents, and Titan in wristwatches.

Whether or not a firm can develop and sustain differentiation or cost advantage or differentiation with cost advantage, depends on how well the firm manages its value chain relative to the value chain of its competitors. Value chain analysis is essential to determine where in the chain exactly the customer value can be enhanced or costs lowered.

Note that no single firm spans the entire value chain in which it operates. Typically, a firm is only a part of the larger set of activities in the value delivery system. The value chain concept highlights four profit improvement areas:

- Linkages with suppliers
- Linkages with customers
- Process linkages within the value chain of a business unit
- Linkages across business unit value chain within the firm.

Example: The 'Ripple Effect' of Supply Chains due to COVID Pandemic

Most of Oakland (US) Port's business which depends on the Asia-US trade route received 69 vessel calls in April 2022, down 14% from a year ago when there were 81 calls. Shanghai's lockdown (during Q1 of 2022-23) delayed U.S.-bound shipments, causing a "ripple effect" and causing havoc on ocean carrier scheduling. During the peak of port congestion in 2021, there were 30 ships waiting to enter an Oakland berth. In May 2022, when Shanghai was under lockdown, there were one to a few ships waiting to do business at the Port of Oakland.

Source: https://www.supplychaindive.com/news/Port-of-Oakland-cargo-decline-amid-Shanghai-lockdowns/624327/, dated May 27, 2022 (Accessed on May 31, 2022)

9.5 Activity Based Costing

Applying overhead costs to each product or service, based on the extent of the overhead costs that product or service has incurred, is the primary objective of accounting for overhead costs. In many production processes overhead is applied to products using a single predetermined overhead rate based on a single activity measure. With Activity Based Costing (ABC), multiple activities are identified in the production processes that are associated with costs. The events within these activities that cause work (costs) are called cost drivers. Cost drivers are used to apply overheads to products and services when using ABC.

Steps in Activity Based Costing

The following five steps are used for applying costs to products under an ABC system:

- Choose appropriate activities
- Trace costs to activities
- Determine the cost drivers for each activity
- Estimate the application rate for each cost driver
- Apply costs to products.

Choose Appropriate Activities: The first step of ABC is to choose the activities that will be the intermediate cost objectives of overhead costs. The activities should support the production processes. More than one cost pool can be

established for each activity. A cost pool is an account to record the costs of an activity with a specific cost driver.

Trace Costs to Activities: Once the activities have been chosen, costs must be traced to the cost pools for different activities. Cost drivers are chosen for distributing costs. A predetermined rate is determined for each cost driver. Cost driver in combination with predetermined rate, determines the costs incurred for the activities.

Determine the Cost Drivers to each Activity: Cost drivers for activities are sometimes called activity drivers. Activity drivers represent the event that causes costs within an activity. For example, activity drivers for purchasing activity include negotiations with vendors, ordering materials, scheduling their arrival, and perhaps inspection. An activity driver is chosen for each cost pool. If two cost pools use the same cost driver, then the cost pools could be combined for product costing purposes.

Cooper has developed several criteria for choosing activity drivers. They are:

- The data on the cost driver must be easy to obtain.
- The consumption of the activity implied by the activity driver should be highly correlated with the actual consumption of the activity.
- The behavioral effects induced by the choice of the activity driver.

The judicious use of more activity drivers increases the accuracy of product costs. The application of overhead costs through cost drivers is the most accurate process. Any remaining overhead costs must be allocated in a somewhat arbitrary manner, which is less accurate.

Estimate the Application Rate for each Cost Driver: An application rate must be estimated for each activity driver. An actual rate is determined by dividing the actual costs of the cost pool by the actual level of activity of the activity driver. Standard costs could also be used to calculate a predetermined rate.

Applying Costs to Products: The application of costs to products is calculated by multiplying the application rate times the usage of the activity driver in manufacturing a product or providing a service.

Benefits of Activity Based Costing

ABC is valuable for planning, because the establishment of an ABC system requires a careful study of the total manufacturing or service process of an organization.

- It highlights the causes of costs. An analysis of these causes can identify activities that do not add to the value of the product.
- Recognition of how various activities affect costs helps to modify the planning of factory layouts and to design process stage etc.

- An analysis of activities can also lead to better performance measurement.
- At higher management levels, the activities can be aggregated to coincide with responsibility centers. Managers would be responsible for the costs of the activities associated with their responsibility centers.

Weaknesses of Activity Based Costing

- ABC is based on historical costs. For planning decisions, future costs are generally the relevant costs.
- ABC does not classify costs into variable and fixed costs. For many short run decisions, it is important to identify variable costs.
- ABC is only as accurate as the quality of the cost drivers. The distribution and application of costs becomes an arbitrary allocation process when the cost drivers are not associated with the factors that are the cause of the costs.
- ABC tends to be more costly than the more traditional methods of applying costs to products.

Example: Implementation of ABC during a structural change

Implementation of ABC at Xu Ji Electric Co. Ltd (Xu Ji), a large Chinese manufacturing company that is a state-owned enterprise (SOE), turned public limited company (PLC), turned out to be a herculean task. The implementation took place in phases accommodating the structural changes and implementation of ERP. For each department different cost drivers were identified. The implementation team met with resistance before it was finally implemented. It was realized that implanting ABC in an unstable environment was quite challenging.

Source: https://www.cimaglobal.com/Documents/Thought_leadership_docs/6Activity-based-costing-China.pdf (Accessed July 12, 2022)
(ii) https://www.studymode.com/essays/Abc-Model-Of-Cost-Accounting-Case-64210279.html, dated 10 Aug 2021 (Accessed July 12, 2022)

Illustration 1

X Ltd. manufactures two component parts for the motorcar industry.

A → Annual production and sales of 25,000 units at a selling price of Rs.22.50 per unit

B →Annual production and sales of 12,500 units at a selling price of Rs.30 per unit.

A includes all R&D design costs in engineering costs. There is no marketing, distribution, or customer-service costs.

The direct and indirect costs incurred by X on A and B are as follows:

		A	B	Total
Direct Materials Costs (Variable)	(Rs.)	4,25,000	3,00,000	7,25,000
Direct Labor Costs (Variable)	(Rs.)	1,50,000	1,00,000	2,50,000
Direct Machining Costs *	(Rs.)	75,000	50,000	1,75,000
Indirect Manufacturing Costs	(Rs.)			
Machine Set-up costs	(Rs.)			34,500
Testing Costs	(Rs.)			87,500
Engineering Costs	(Rs.)			2,25,000
Total Costs				14,97,000

* Direct Machining Costs represent the cost of machine capacity dedicated to the production of each product. These costs are fixed and are not expected to vary in the long run.

X's management identifies the following activity cost pools, cost drivers for each activity and the cost per unit of cost driver for each overhead cost pool:

Activity	Description of Activity	Cost Driver	Cost per unit of Cost Driver
Set up	Preparing machine to manufacture a new batch of products	Set up hours	Rs.12 per set up hour
Testing	Testing components and final products	Testing hours	Rs.1 per testing hour
Engineering	Designing products and process and ensuring their smooth functioning	Complexity of product and processes	Costs assigned to products by special study

Additional information is as follows:

Part	A	B
Production batch size	250 units	100 units
Set up time per batch	10 hrs.	15 hrs.
Testing and inspection time per unit of product produced	2 hrs.	3 hrs.
Engineering costs incurred on each product	Rs.85,000	Rs.1,40,000

From the above information calculate the full cost per unit for A and B using Activity Based Costing.

Solution

Computation of Indirect Costs for A and B

	A	B
a. Production/Sales Quantity (units)	25,000	12,500
b. Batch Size (units)	250	100
c. Number of Batches (a/b)	100	125
d. Set up time required at 10 and 15 hours per batch (hours)	1,000	1,875
e. Set up cost at Rs.12 per set up (Rs.12 x d)	12,000	22,500
f. Testing and Inspection time required per unit (hours)	2	3
g. Total testing hours (a x f)	50,000	37,500
h. Testing costs at Rs.1 per testing hour (Rs.1 x g)	50,000	37,500

Computation of Full Costs per unit for A and B

Particulars	A (25,000 units)		B (12,500 units)	
	Per Unit	Total	Per Unit	Total
Direct Materials (₹)	17.00	4,25,000	24.00	3,00,000
Direct Labor (₹)	6.00	1,50,000	8.00	1,00,000
Direct Machining Costs (₹)	3.00	75,000	4.00	50,000
Total Direct Costs (a) (₹)	26.00	6,50,000	36.00	4,50,000
Machine Set up Costs (₹)		12,000		22,500
Testing Costs (₹)		50,000		37,500
Engineering Costs (₹)		85,000		1,40,000
Total Indirect Costs (b) (₹)	5.88	1,47,000	16.00	2,00,000
Total Manufacturing Costs (c = a + b) (₹)		7,97,000		6,50,000
Production Quantity (d)		25,000		12,500
Full Cost per unit (c/d) or (a + b) (₹)	31.88	31.88	52.00	52.00

Activity 9.1

a. What are the areas included in the Strategic Cost Management?

……

……...

b. What is a cost driver?

……

……...

9.6 Target Costing

Target costing has recently received considerable attention. Computer Aided Manufacturing-International defines target cost as "a market-based cost that is calculated using a sales price necessary to capture a predetermined market share." In competitive industries, a unit sales price would be established independent of the initial product cost. If the target cost is below the initial forecast of product cost, the company drives the unit cost down to compete.

Target cost = Sales price (for the target market share) – Desired profit

Japanese cost management is known to be guided by the concept of target cost. Management decides, before the product is designed, what a product should cost, based on marketing (rather than manufacturing) factors.

Target costs are conceptually different from standard costs. Standard costs are predetermined costs built up from an internal analysis by industrial engineers. Target costs are based on external analysis of markets and competitors.

A target cost is the maximum manufactured cost for a product. It is arrived at by subtracting from its expected market price the required margin on sales.

Target costing is a market-driven design methodology. It estimates the cost for a product and then designs the product to meet that cost.

It is a cost management tool, which reduces a product's costs over its entire life cycle.

Target costing includes actions a management must take to establish reasonable target costs, develop methods for achieving those targets, and develop means by which to test the cost effectiveness of different cost-cutting scenarios.

Example: Target Costing of OnePlus's Nord CE Model

When OnePlus launched its mobiles in India, it followed the same principles as that of Xiaomi, 'Cost Optimization' and 'Hunger Marketing'. By 2020, Oneplus wanted to leverage its brand image and introduced the 'Nord series' to capture the lower midrange market. Assume that it was introducing a new model of the 'Nord series' at a predetermined price of ₹ 19,999 (target cost) and would be content with a target profit of 5%. If the manufacturing and distribution cost of that model was ₹ 19,000, then Oneplus can hardly spend anything on advertising. So, until the brand can negotiate for some bulk order discounts from its suppliers or cut its assembly or distribution costs, it had to rely on the press publicity and its influencer marketing strategy.

Sources (i) https://www.campaignindia.in/article/how-oneplus-nord-became-a-breakout-star-in-the-middle-of-a-pandemic/462716, dated July 31, 2020 (Accessed on June 1, 2022)
(ii) https://rdsdigital.in/how-oneplus-marketing-strategy-helped-the-brand-enter-the-premium-category/, 2021 (Accessed on June 1, 2022)
(iii) https://www.thehindubusinessline.com/info-tech/oneplus-to-focus-on-mid-premium-range/article32862303.ece, dated October 15, 2020 (Accessed on June 1, 2022)

Phases in Target Costing

The following are the different phases involved in the target costing:

Planning Phase

Based upon its strategic business plans, a company must first establish what type of product it wishes to manufacture.

Traditionally (before Target Costing) once the type of product was determined, its development was assigned to the product design department. Then the produced product was sent to the costing department. Costing department made adjustment and the product design was sent back and forth between the two departments until a consensus was reached. Then it is sent to the manufacturing department and there they may suggest some adjustments and again may sent it back to design department and so on. Thus, much time, money and effort were spent before the product reached the production stage. As a result, profit suffered.

But in Target Costing, a product's design begins at the opposite end. It first establishes a price at which the product can be competitive and then assigns a team to develop cost scenarios and search for ways to design and manufacture the product to meet those cost constraints.

Following steps must be taken in order to establish a reasonable target cost:

- Market research should be done to determine several factors like analyzing competitors' product with respect to price, quality etc.
- After preliminary testing, a company should be able to pinpoint a market niche it believes is undersupplied, and in which it believes it might have some competitive advantage. Only then can a company set a target cost close to competitors' products of similar functions and value. The target cost is bound to change in the development and design stages. However, the new target costs should only be allowed to decrease, unless the company can provide added features that add value to the product.

Development Phase

The company must find ways to attain the target cost. This involves a number of steps:

- First, an in-depth study of the most competitive product in the market must be conducted. Once a better understanding of the design has been achieved, the organization can target the costs against this 'best' design. It is necessary when performing comparative cost analysis, and trying to establish the competitor's cost structure.
- After trying to identify the cost structure of the competitor, the company should develop estimates for the internal cost structure of its own products.

- After preliminary analysis of the cost structures of both the competitor and itself, the company should further define these cost structures in terms of cost drivers.

When enough cost information is available, the product development team is able to generate cost estimates under different scenarios. After this, the designers, manufacturers, marketers, and engineers on the team should conduct a session of brainstorming to generate ideas on how to substantially reduce costs and also add a number of different features to the product without increasing target costs. In these brainstorming sessions, no idea is rejected, and the best ideas are integrated into the development of the product.

Production Phase

In this stage production is initiated. In these stages, target costing becomes a tool for reducing costs of existing products. It is highly unlikely that the design, manufacturing, and engineering groups will develop the optimal, cost-efficient process at the beginning of production. The search for better, less expensive products should continue in the framework of continuous improvement.

Benefits of Target Costing

- It provides detailed information on the costs involved in producing a new product, as well as a better way of testing different cost scenarios through the use of ABC.
- Target costing reduces the development cycle of a product.
- The internal costing model, using ABC, can provide an excellent understanding of the dynamics of production costs. It can also be used for measuring different cost scenarios to ensure that the best ideas available are incorporated from the outset into the production design.
- The profitability of new products is increased by target costing through promoting reduction in costs while maintaining or improving quality.
- It also helps in promoting consumers' requirements which leads to products that better reflect consumer needs and find better acceptance than existing products.
- Target costing is also used to forecast future costs and to provide motivation to meet future cost goals.
- Target costing is very attractive because it is used to control costs before the company even incurs any production costs, which save a great deal of time and money.

There is one major drawback to target costing. It is difficult to use with complex products that require many subassemblies, such as automobiles. This is because tracking costs becomes too complicated and tedious, and cost analysis must be performed at so many levels.

9.7 Quality Costing

A quality-costing system monitors and accumulates the costs incurred by a firm in maintaining or improving product quality

Measuring Quality Costs

Quality costs here means the costs associated with quality of conformance as opposed to costs associated with quality of design.

Quality of design refers to variations in products that have the same functional use. Quality of conformance refers to the degree with which the final product meets its specifications. In other words, quality of conformance refers to the product's fitness for use.

Types of Quality Costs

The costs associated with quality of conformance generally can be classified into four types: prevention costs, appraisal costs, internal failure costs, and external failure costs.

Prevention Costs are the costs incurred to reduce the number of defective units produced or the incidence of poor-quality service.

Appraisal Costs are the costs incurred to ensure that materials, products, and services meet quality standards.

Internal Failure Costs are the costs associated with materials and products that fail to meet quality standards and result in manufacturing losses. These defects are identified before they are shipped to customers.

External Failure Costs are the costs incurred when inferior-quality products or services are sold to customers. These costs begin with customer complaints.

Example: External Failure Costs of Volkswagen

A report by 'The National Highway Traffic Safety Administration' (US) mentioned that the faulty electrical wiring of VW Atlas and Atlas Cross Sport SUVs lead to airbags deploying way faster than they were designed to, causing injuries to passengers on board. So, in March 2022, Volkswagen AG issued a recall notice for 2,46,000 units of Atlas and Atlas Cross Sport SUVs manufactured in the US and Canada. Similarly, it was decided in April 2022 that 42,300 owners of Volkswagen Passats, Golfs, Tiguans, and Arteons and 24,400 Audis worldwide were notified of a recall to rectify the high fire risk at the connection of a conventional combustion engine to an electric drive. These kinds of external failure costs were not limited to only accounting numbers but will impact the brand image as well.

Source: https://auto.economictimes.indiatimes.com/news/passenger-vehicle/cars/volkswagen-to-recall-more-than-100000-cars-on-fire-risk/90581287 (Accessed on June 1, 2022)

The magnitude of quality costs has prompted many companies to install quality-costing systems to monitor and help reduce the costs in achieving high-quality production.

Although the concepts of quality costing are easy to understand, the cost measurement of many quality efforts is difficult. Many of the costs are not isolated in a traditional cost accounting system, and some costs are opportunity costs that are not part of a historical cost accounting system

Total Quality Control

Total Quality Control (TQC) is a management process based on the belief that quality costs are minimized with zero defects. The phrase *quality is free* is commonly advocated by proponents of TQC, who argue that the reduction of failure costs due to improved quality outweigh additional prevention and appraisal costs.

TQC begins with the design and engineering of the product. Designing a product to be resistant to workmanship defects may not be incrementally more costly than the present design process; but the reduction in other quality costs can be substantial.

TQC is often associated with Just-in-Time (JIT) manufacturing. Under JIT, each worker is trained to be a quality inspector. Therefore, teams specializing in quality inspection become unnecessary. With suppliers delivering high-quality parts and materials, a company can substantially reduce, if not, eliminate appraisal costs.

Total Quality Control is sometimes referred to as Total Quality Management (TQM) because a completely new orientation must be taken by management to make TQC successful.

Activity 9.2

a. What is Target Costing?

……

……

b. What is Total Quality Control?

……

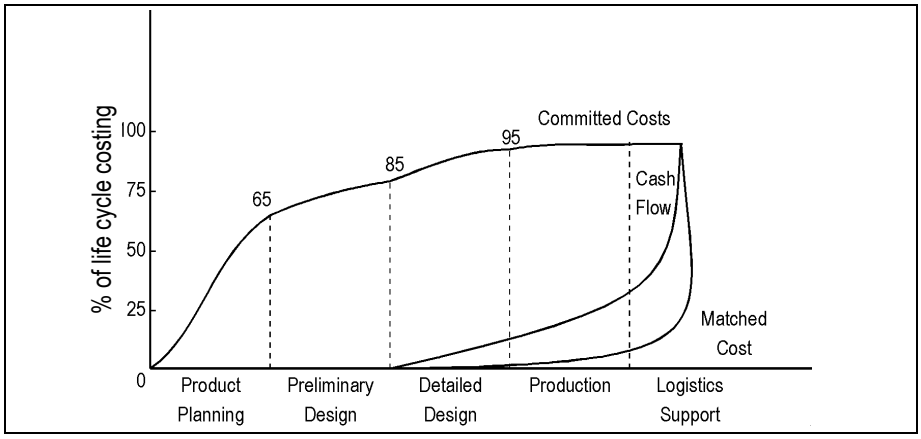
……

9.8 Life Cycle Costing – Product and Project

Life cycle costing can be defined as "the accumulation of costs for activities that occur over the entire life cycle of a product, from inception to abandonment by the manufacturer and the customer." Life cycle analysis provides a framework for managing the cost and performance of a product over the duration of its life. The life cycle commences with the initial identification of a consumer need and

extends through planning, research, design, development, production, logistics support in operation, retirement, and disposal. Life cycle is important to cost control because of the interdependencies of activities in different time periods.

Figure 9.2: Life Cycle of a Product



Source: ICFAI Research Center

The figure 2 shows how the great majority of manufacturing costs become locked in the early life cycle of the product. It may be noted that 95 percent of the costs are committed before production begins.

Life cycle costing and reporting provide management with a better picture of product profitability and help managers to gauge their planning activities.

Product Life Cycle Costing

The cycle begins with the identification of new consumer needs and the invention of a new product and is often followed by patent protection and further development to make it saleable. This is usually followed by a rapid expansion in its sales as the product gains market acceptance. Then competitors enter the field with imitation and rival products and the distinctiveness of the new product starts diminishing. The speed of degeneration differs from product to product. The innovation of a new product and its degeneration into a common product is termed as the 'life cycle of a product'.

Characteristics of Product Life Cycle

The major characteristics of product life cycle concepts are as follows:

- The products have finite lives and pass through the cycle of development, introduction, growth, maturity, decline and deletion at varying speeds.
- Product cost, revenue and profit patterns tend to follow predictable courses through the product life cycle. Profits first appear during the growth phase and after stabilizing during the maturity phase, decline thereafter to the point of deletion.

- Profit per unit varies as products move through their life cycles.
- Each phase of the product life cycle poses different threats and opportunities that give rise to different strategic actions.
- Products require different functional emphasis in each phase such as – an R&D emphasis in the development phase and a cost control emphasis in the decline phase.

Activities in Product Life Cycle

Typically, the life cycle of a manufactured product will consist the following activities:

- Market research
- Specification
- Design
- Prototype manufacture
- Development of the product
- Tooling
- Manufacturing
- Selling
- Distribution
- Product support through after sales-service
- Decommissioning or replacement.

Phases in Product Life Cycle

There are five distinct phases in the life cycle of a product as shown hereunder:

Introduction Phase

The research and engineering skills lead to product development and when the product is put on the market and its awareness and acceptance are minimal, promotional costs will be high, sales revenue low and profits probably negative. The introductory stage may last from a few months to a year for consumer goods and generally longer for industrial products.

Growth Phase

In the growth phase, product penetration into the market and sales will increase because of the cumulative effects of introductory promotion and distribution. Since costs will be lower than in the earlier phase, the product will start to make a profit contribution. To sustain growth, consumer satisfaction must be ensured at this stage. If the product is successful, growth usually accelerates at some point.

Profit margins peak during this stage as 'experience curve' effects lower unit costs and promotion costs are spread over a larger volume.

Maturity Phase

This stage begins after sales cease to rise exponentially. The causes of the declining percentage growth rate are – the market saturation where eventually most potential customers have tried the product and sales settle at a rate governed by population growth and the replacement rate of satisfied buyers.

This is usually the longest stage in the cycle, and most existing products are in this stage. The period over which sales are maintained depends upon the firm's ability to stretch the cycle by means of market segmentation and finding new uses for it.

In this phase, there will be stable prices and profits and the emergence of competitors. There is no improvement in the product but changes in selling efforts are common. Profit margin slips despite rising sales.

Profits decline in this stage because of the following reasons:

- The increasing number of competitive products.
- Innovators find market leadership under growing pressure.
- Potential cost economies are used up.
- Prices begin to soften as smaller competitors struggle to obtain market share in an increasingly saturated market.

Saturation Phase

As the market becomes saturated, pressure is exerted for a new product and sales along with profits begin to fall. Intensified marketing effort may prolong the period of maturity, but only by increasing costs disproportionately.

Decline Phase

Eventually most products and brands enter a period of declining sales. This may be caused by the following factors:

- Technical advances leading to product substitution.
- Fashion and changing tastes.
- The average length of the product life cycle tends to shorten as a result of economic, technological and social change.

Project Life Cycle Costing

The term 'project life cycle cost' has been defined as follows: 'It includes the costs associated with acquiring, using, caring for and disposing of physical assets, including the feasibility studies, research, design, development, production, maintenance, replacement and disposal, as well as support, training and operating costs generated by the acquisition, use, maintenance and replacement of permanent physical assets.'

Project Life Cycle Costs

Project life cycle costs are incurred for fixed assets, i.e., for capital equipment and so on. The component elements of a project's cost over its life cycle could include the following:

- Acquisition cost, i.e., costs of research, design, testing, production, construction, or purchase of capital equipment.
- Transportation and handling costs of capital equipment.
- Maintenance costs of capital equipment.
- Operations costs, i.e., the costs incurred in operations, such as energy costs, and various facility and other utility costs.
- Training costs, i.e., operator and maintenance training.
- Inventory costs, i.e., cost of holding spare parts, warehousing, etc.
- Technical data costs, i.e., costs of purchasing any technical data.
- Retirement and disposal costs at the end of life or the capital equipment life.

Example: Life Cycle Costing of Samsung

In April 2022, Samsung started working on introducing a manufacturer-certified recycled parts program through which customers were able to purchase recycled parts that were certified by the company to be functioning as well as factory-new parts. Using recycled parts in place of new parts was expected to reduce the cost of parts by 50% and helped to reduce e-waste. In April 2021, Samsung also decided that by 2025, it will use recycled material in all of its new mobile products to minimize environmental impact. Thus recycling which was thought to be an additional cost was turned into a cost cutting strategy.

Sources: (i) https://www.businessinsider.in/tech/news/samsungs-recycled-parts-program-might-make-your-phone-repairs-up-to-50-cheaper/articleshow/90824387.cms, dated April 13, 2022 (Accessed on June 1, 2022)

(ii) https://www.business-standard.com/article/technology/samsung-to-use-recycled-material-in-new-mobile-products-by-2025-121081200393_1.html, dated August 12, 2021 (Accessed on June 1, 2022)

Management Accountant's Role in Project Life Cycle Costing

Project life cycle costing is a new concept which places new demands upon the Management Accountant. The development of realistic project life cycle costing models will require the accountant to develop an effective working relationship with the operational researcher and the systems analyst, as well as with those involved in the complex technological system, particularly engineers. Engineers require a greater contribution from accountants in terms of effort and interest throughout the life of a physical asset. A key question for many accountants will be whether the costs of developing realistic life cycle costs will outweigh the benefits to be derived from their availability. Life cycle costing in the

management of physical assets, can obtain much value by thinking in life cycle costing concepts whenever a decision affecting the design and operation of a physical asset is to be made.

The concept project life cycle costing has become more widely accepted in recent years. Its philosophy is quite simple. It involves accounting for all costs over the life of the decision, which is influenced directly by the decision.

Uses of Project Life Cycle Costing

- Projects operating in capital intensive industries.
- Projects having a sizable, ongoing constructing program.
- Projects dependent on expensive or numerous items of plant with consequent substantial replacement programs.
- Projects considering major expansion.
- Projects contemplating the purchase/design/development of expensive new technology.
- Projects sensitive to disruption due to down time.

9.9 Check Your Progress Questions

1. Under what situations, target costing can be used?
    a. The customer can absorb any increase in price
    b. There is no competition for the product
    c. There is competition for the product
    d. There is a niche market to be serviced
    e. Both (c) and (d) above.
2. Which of the following is the main disadvantage(s) of activity based costing?
    a. It does not identify activities that do not add to the value of the product
    b. It is costly
    c. It fails to highlight relationships among overhead costs
    d. The managers are not responsible for the cost activities
    e. Analysis of activities lead to under performance of employees.
3. Which of the following is an example of the cost incurred to reduce defectives?
    a. Prevention costs
    b. Appraisal costs
    c. Internal failure costs
    d. External failure costs
    e. Predetermined costs.
4. Which of the following options depict cost drivers?
    a. Used to evaluate performance

b. Used to assign costs to activities
c. Used to control costs
d. Costs which are increased with the production
e. Linked to two or more other costs.

5. Penetration pricing is the initial product price and it is set _____.

a. Low and is kept constant
b. High giving short-term profits, after which it is gradually lowered
c. Low in order to gain a large market share
d. High and subsequently raised
e. High and is kept constant.

9.10 Summary

- Strategic Cost Management (SCM) is a cost analysis, which is more beneficial to management for strategic perspectives. It includes various techniques like Value Chain analysis, Activity Based Costing (ABC), Target Costing, etc.
- Value chain is the linked set of value-creating activities from the basic raw material sources from suppliers to the ultimate end-use product delivered into the final customers' hand.
- In ABC, multiple activities are identified in the production processes that are associated with costs. The events within these activities that cause work (costs) are called cost drivers. The cost drivers are used for applying overheads to products and services.
- ABC is very useful for planning, modification of factory layouts, and designing process stages. But this system is very costly than traditional methods.
- Target costing is a technique, which determines the cost, based on the market cost and competitor's cost. Manufacturing cost is irrelevant. Efforts are made to reduce the manufacturing cost to the desired cost level.
- Target costs are conceptually different from standard costs. Standard costs are predetermined costs built up from an internal analysis by industrial engineers. Target costs are based on external analysis of markets and competitors.
- A quality costing system monitors and accumulates the costs incurred by a firm in maintaining or improving product quality. Although the concepts of quality costing are easy to understand the cost measurement of many quality efforts is difficult.
- Life cycle analysis provides a framework for managing the cost and performance of a product over the duration of its life. The life cycle commences with the initial identification of a consumer need and extends

through planning, research, design, development, production, logistics support in operation, retirement, and disposal.

- Different stages in product life cycle are – introduction phase, growth phase, maturity phase, saturation phase, and decline phase.
- Project life cycle cost includes the costs associated with fixed assets, operating costs and research costs.
- Project life cycle costing is useful in capital intensive industries, ongoing construction programs, development of expensive new technology and projects considering major expansion.

9.11 Glossary

Activity	:	An event that causes the consumption of overhead resources in an organization.
Cost Driver	:	A term used to describe the events or forces that are the significant determinants of cost of the activities.
Cost Pool	:	A 'bucket' in which costs are accumulated that relate to a single activity in the activity-based costing system.
Life Cycle Costing	:	Analyses costs incurred throughout the life of a product from development through to full production.
Prevention Costs	:	Costs incurred to keep defects from occurring.
Quality Costs	:	Costs incurred to prevent defective products from falling into the hands of customers or that are incurred as a result of defective units.
Quality of Conformance	:	The degree to which a product or service meets or exceeds its design specifications and is free of defects or other problems like its appearance that degrades its performance.
Strategic Cost Management	:	The use of management accounting information to help managers choose where and how to compete.
Target Costing	:	The process of determining the maximum allowable cost for a new product and then developing a prototype that can be profitably manufactured and distributed for that maximum target cost figure.
Value Chain	:	The major business functions that add value to a company's products and services. These functions consist of research and development, product design, manufacturing, marketing, distribution, and customer service.

9.12 Suggested Readings / Reference Material

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8. Sheeba Kapil (2021). Financial Valuation and Modelling. Wiley

9.13 Suggested Answers

Self-Assessment Questions – 1

a. The process of Strategic Cost Management encompasses the following:
   i. Value Chain Analysis
   ii. Activity Based Costing
   iii. Target Costing
   iv. Quality Costing
   v. Life Cycle Costing

b. Cost drivers for activities are sometimes called activity drivers. Activity drivers represent the event that causes costs within an activity. For example, activity drivers for the purchasing activity include negotiations with vendors, ordering materials, scheduling their arrival, and perhaps inspection. Each of these activity drivers represents costly procedures that are performed in the purchasing activity. An activity driver is chosen for each cost pool. If two cost pools use the same cost driver, then the cost pools could be combined for product-costing purposes.

Self-Assessment Questions – 2

a. Target costing has recently received considerable attention. Computer Aided Manufacturing-International defines target cost as "a market-based cost that is calculated using a sales price necessary to capture a predetermined market share." In competitive industries a unit sale price would be established independent of the initial product cost. If the target cost is below the initial

forecast of product cost, the company drives the unit cost down over a designed period to compete.

Target cost = Sales price (for the target market share) – Desired profit

b. Total Quality Control (TQC) is a management process based on the belief that quality costs are minimized with zero defects. The phrase quality is free in commonly advocated by proponents of TQC, who argue that the reduction of failure costs due to improved quality outweigh additional prevention and appraisal costs. It is not surprising, then, that US Auto Manufacturers have become leaders in advocating TQC.

9.14 Answers to Check Your Progress Questions

1. (e) Both (c) and (d) above.
Target costing can be used when there is competition for the product and when there is a niche market to be serviced.

2. (b) It is costly
The main disadvantage(s) of activity based costing is that it is costly.

3. (a) Prevention costs
Prevention costs is an example of the cost incurred to reduce defectives.

4. (b) Used to assign costs to activities
Used to assign costs to activities depict cost drivers.

5. (c) Low in order to gain a large market share
Penetration pricing is the initial product price and it is set low in order to gain a large market share.

Strategic Finance and Corporate Restructuring

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