الهيئة السعودية للمقيّمين المعتمدين
Saudi Authority for Accredited Valuers

تقييم
TAQEEM

FUNDAMENTALS OF MACHINERY & EQUIPMENT AND VALUATION APPROACHES

ME401

Quotes from *Richard A. Berkemeier*
Chair of Education, American Society of Appraisers ASA, for Machinery and Technical Specialties MTS.

"My general comments are you have a great set of classes. I think these classes and the Power Point evolve over time. As a starting point in the process, I must say these are as good as anything on the market today. Well done." May 3, 2018.

"These look great. As mentioned before, these are best in class courses." August, 3, 2018.

"Taqeem classes represent the industry best practices and provide the student with state of the art Machinery education." 18, September, 2018.

Best,

Richard A. Berkemeier Chair, Education,
ASA, MTS

Objective

These notes are for reference only by the TAQEEM trainees. The objective of this publication is to provide knowledge on fundamentals of machinery & equipment and valuation approaches

Disclaimer

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Session I

FUNDAMENTALS OF PLANT, MACHINERY AND EQUIPMENT

PART I

Introduction to Plant, Machinery and Equipment

PART II

Basis of Machinery and Equipment Valuation

PART I: INTRODUCTION TO PLANT, MACHINERY AND EQUIPMENT

1.0 DEFINITION

The term 'Plant, Machinery and Equipment', sometimes simply referred to as Plant and Machinery, does not have a precise or particular definition. However, there are several interpretations provided by various scholars, manuals and standards from different perspectives or professions.

According to Derry (2008), "*… other than land and buildings, motor vehicles, mobile plant, ships, locomotives, aeroplanes and similar assets (which are patently not physically fixed) will normally be considered to be plant and machinery…*".

Watts (1989) stated that "*... all fixed assets other than land and building…*".

Budhbhatti (1999) further stated that "*Plant and machinery are terms used to refer to installations and support facilities for manufacturing in industry design to perform a specific pre-determined function, whether used singly or in combination with other items to enhance the productivity or operating facility; and includes all devices in fixed or movable form, other than real estate, deployed in manufacturing, processing or assembling of products from the stage raw materials to finished goods*".

2.0 INTERPRETATIONS OF PLANT AND MACHINERY TERMS

To further describe plant and machinery, reference can be made to the following sources:

2.1 Definitions

According to Oxford Dictionary: Plant as defined as" fixtures, implements, machinery and apparatus used in carrying on any industrial process".

2.2 Professional Standards

There is a vast array of plant and machinery interpretations developed by various professional governing agencies, at both international and national levels. For the purpose of this course, reference is made to standards outlined by the International Valuation Standards Council (IVSC).

According to the IVS (2020), plant and equipment are tangible assets that are:

- Held by an entity for use in the production or supply of goods or services, for rental by others, or for administrative purposes; and
- Expected to be used over a period of time.

The categories of plant and equipment are plant, machinery and equipment.

- Plant
  Assets that are inextricably combined with others and that may include specialized buildings, machinery and equipment.

- Machinery
  Individual machines or a collection of machines. A machine is an apparatus used for a specific process in connection with the operation of the entity.

- Equipment
  Other assets that are used to assist the operation of the enterprise or entity

Different governing bodies or countries may have slightly different interpretations of PME. However, TAQEEM has adopted the PME definitions in the latest edition of the International Valuation Standards published by the IVSC.

Below are some of the PME definitions adopted by valuation governing bodies in different continents:

2.2.1 TAQEEM's Saudi Machinery and Equipment ("*M&E*") Valuation Manual

- Machinery
  Individual, or a collection or a fleet of machines that may be employed, installed or remotely operated in connection with a user's industrial or commercial processes, trade or business sector (a machine is an apparatus used for a specific process).

- Equipment
  An all-encompassing term for assets such as machinery, tooling, fixtures, furniture and furnishings, trade fixtures and fittings, vehicles and loose tools that are used to assist the operation of an enterprise or entity. It is also defined as ancillary assets that are used to assist in the function of the enterprise.

2.2.2 The International Valuation Standards Council (IVSC)

- Plant

The assemblage of assets that may include specialized non-permanent buildings, machinery and equipment.

- Machinery
  Individual machines or collections of machines using or applying mechanical power, having several parts each with a definite function and together performing certain kind of works.

- Equipment
  Ancillary assets that are used to assist in the function of the enterprise.

2.2.3 Royal Institution of Chartered Surveyors (RICS)

- Plant
  Assets that are combined with others and that may include items that form part of industrial infrastructure, utilities, building services installations, specialised buildings, and machinery and equipment forming a dedicated assemblage.

- Machinery
  Individual, or a collection or a fleet or system of, configured machines/technology (including mobile assets such as vehicles, rail, shipping and aircraft) that may be employed, installed or remotely operated in connection with a user's industrial or commercial processes, trade or business sector (a machine is an apparatus used for a specific process).

- Equipment
  An all-encompassing term for other assets such as sundry machinery, tooling, fixtures, furniture and furnishings, trade fixtures and fittings, sundry equipment and technology and loose tools that are used to assist the operation of the enterprise or entity.

2.3 Difference Between Plant, Machinery and Equipment

2.3.1 Plant

According to accountingcoach.com, property, plant and equipment are the long term or noncurrent asset section of the balance sheet. Included in this classification are land, buildings, machinery, office equipment, vehicles, furniture and fixtures used in a business. Also included in property, plant and equipment is the accumulated depreciation for these assets (except for land, which is not depreciated).

The assets reported as property, plant and equipment are described as long-lived, tangible assets. They are also described

as fixed assets or as plant assets. Generally, the property, plant and equipment assets are reported at their cost followed by a deduction for the accumulated depreciation that applies to all of these assets[1].

If refer to construction site, the term '**plant**' refers to machinery, equipment and apparatus used for an industrial activity. Typically, in **construction**, '**plant**' refers to heavy machinery and equipment used during **construction** works[2].

Plant are different depending on categories, purpose and environment. If we are in the construction industry, chances are we would benefit from investing in plant machinery and equipment, such as excavators, cranes and dumpers, to enable our work more effectively.

There are wide ranges of machineries, each is designed to carry out specific jobs to suit the business purposes and working environment.

2.3.2 Machinery

Machinery is a collection of machines that operate together to perform a single task. For instance, mining machinery would cover all the machines required to execute the activity of mining. The subtlety of difference with machine is that equipment does not inherently do anything.

A machine is a tool containing one or more parts that uses energy to perform an intended action. Machines are usually powered by mechanical, chemical, thermal, or electrical means, and are often motorized. Historically, a power tool also required moving parts to classify as a machine.

Considering the various applications of the machines, they are classified into three main types, these are:

(i) Machines generating mechanical energy

The machines generating mechanical energy are also called as prime movers. These machines convert some form of energy like heat, hydraulic, electrical, etc. into mechanical energy or work. The most popular example of these machines is the internal combustion engine in which the chemical energy of the fuel is converted into heat energy which in turn is converted into mechanical work in the form of the rotation of the wheels of the vehicle. Some other examples of this group of machines are gas turbines, water turbines, steam engine etc.

1 (Source : https://www.accountingcoach.com/blog/property-plant-equipment).

2 Source : https://www.designingbuildings.co.uk/wiki/Construction_plant).

(ii) Machines transforming mechanical energy

These machines are called converting machines because they convert mechanical energy into other form of energy like electricity, hydraulic energy etc. Some examples of these machines are electric generator in which the rotation of the shaft is converted into electrical energy, and hydraulic pump in which the rotation energy of the rotors is converted into the hydraulic energy of the fluid.

(iii) Machines utilizing mechanical energy

These machines receive mechanical energy and utilize it for various applications. Some examples of these machines are lathe machine that utilizes the mechanical energy to cut metals and washing machine that utilizes the rotation of the rotor for washing the clothes.

2.3.3 Equipment

Equipment is defined as an equipping or being equipped. Whether it is a person, group, or thing it is equipped with; or the special things needed for some purposes; supplies, furnishings, apparatus and others. It may also define as goods used in providing service, especially in transportation, such as in the rolling stock of a railroad. Equipment forms part of assets that support a company's activities or operations.

2.4 Others (Fixtures Implements, Fittings, Chattels etc.)

Chattel is an item of tangible movable or immovable property except real estate and things (such as buildings) connected with real property. The word "chattel" comes from the Middle English word for "cattle", which, during feudal times, were the most valuable property someone could own, aside from land.

Fixtures are tangible assets attached or affixed to the real estate that have become part of the real estate. Once attached to the real estate, removing the fixtures would damage part of the real estate. Such fixtures sometimes include certain building components such as lighting, gas, ventilation and plumbing fixtures.

IVS 300 paragraph 20.8 recognizes plant and machinery installed to provide building services as part of the real estate. In event that these plant and machinery were to be valued separately, the scope of work must state that the value of these assets would normally be included in the real estate valuation and may not be separately realizable. The valuer must consult the client regarding the separation of such assets right at the inception of the assignment. In the case of a joint property,

plant and machinery valuation exercise, the valuers consult each other to avoid either omissions or double counting.

3.0 TYPICAL EXAMPLES OF PLANT, MACHINERY AND EQUIPMENT

For better understanding of plant, machinery and equipment, listed below are some typical examples of PMEs.

3.1 Plant

Here are some of the common production plants available around the world:

- Automobile plant
- Bottle manufacturing plant
- Cement plant
- Chemical plant
- Dairy plant
- Ferro alloy plant
- Gases plant
- Pharmaceutical plant
- Power plants - thermal plants, hydro-electricity plants, nuclear power plant/atomic energy plants and tidal power wind energy plants
- Oil Refinery plant
- Steel plant
- Ship building plants and integrated steel plants
- Hot and cold rolling mills plant

Figure 1: Power Plant

Figure 2: Oil Refinery Process Plant

3.2 Machinery and Equipment

A machine is a tool containing one or more parts that uses energy to perform an intended action. Machines are usually powered by chemical, thermal, or electrical means, and are often motorized. Historically, a power tool also required moving parts to classify as a machine. However, the advent of electronics has led to the development of power tools without moving parts that are considered machines.

A simple machine is a device that simply transforms the direction or magnitude of a force, but a large number of more complex machines exist. Examples include vehicles, electronic systems, molecular machines, computers, televisions and radios.

Furthermore, machines can be divided into two categories as below:

a. Main Machine
Main machines are constructed one or more parts is needed to achieve a particular goal or products.

b. Support machine
Support machine are:

- Machine that can be used with the main machine
- Machine that can help complete the main machine/plant. (e.g. motor control centre - MCC, Constant Current Regulator - CCR)
- Machine that can increase production capacity and generate a better product. (e.g. scrap grinder)

A. Production Machinery

Represent a relatively large percentage of the total value of a plant e.g. food packaging, dairy production equipment.

Figure 3: Vertical Bagging Machine

Figure 4: Stainless Steel Tanks

Figure 5: Aseptic Packaging System

Figure 6: Milking Equipment

B. Support Equipment

Support equipment are machineries that maintain or increase the ability and capacity of the production equipment.

Examples of a support machine - scrap grinder ~ the injection machine can process plastic without the grinder, but the injection process is less efficient. The scrap grinder grinds or cuts the excess plastic for reuse.

Figure 7: Plastic Injection Molding Machine

Figure 8: Scrap Grinder

C. Motor Control Centre (MCC) and Switch Gear

The MCC is usually the largest electrical distribution Centre in the plant unless the plant has main electrical substations. Other acronyms to be familiar with ~ PLC, AC, DC, Single or Three-Phase electricity.

Figure 9: Switch Gear

Figure 10: Motor Control Centre

D. Power Wiring

The plant power wiring connects the plant equipment to MCC. The equipment is strung together with wiring, controls and switches.

“The valuer will estimate the size, number of lineal meter or feet of conduit and wire, number of motors, supply boxes and switching between the equipment and the MCC.”

Figure 11: Power Wiring

E. Process Piping

Process piping means piping systems and their component parts, that are not building services or power piping systems, and that may be installed in petroleum refineries, chemical, pharmaceutical, textile, paper, semiconductor, and cryogenic plants, and related processing plants and terminals. The process piping is including piping, valves, fittings, pumps and process controls:

Figure 12: Process Piping

F. Foundation

Some massive machinery requires special pits or heavy foundation.

Figure 13: Equipment Foundation

G. Structural Support

Installed machinery may require structural steel, catwalks, ladders or platforms.

Figure 14: Equipment Structural Support

H. Material Handling and Storage Equipment

i.e. forklifts, loaders, conveyors, cranes, hoists, pallet movers, programmable inventory systems etc.

Figure 15: Overhead Cranes

I. General Plant Equipment

Located in Manufacturing Instead of Office Areas. Namely benches, racks, lockers, scales, hand trucks, time recorders, fire extinguishers and similar assets.

Figure 16: General Plant Equipment

J. Rolling Stock

Two sub-classes:

- Plant vehicles
  Trucks, cranes, tractors, and mobile equipment not licensed for road use.

Figure 17: Plant Vehicles

- Licensed/Title vehicles
  Automobiles, trucks, tractors, trailers and other vehicles licensed for road use.

Figure 18: Licensed/Title Vehicles

K. Laboratory and Test Equipment

Items necessary for the operation of a laboratory or test facility. Typical equipment would include microscopes, clean tables, fume hoods, ventilating system, spectrographs, ovens, water stills, glassware and similar assets.

Figure 19: Laboratory and Test Equipment

L. Office Furniture, Fixtures and Equipment

The valuer may include office furniture, fixtures and equipment. Desks, tables, chairs, credenzas, filing cabinets, portable partitions, calculators, photocopy machine, fax machines, check writers, typewriters.

Figure 20: Office Furniture

Frequently values as a "lot", that is, valued as quantities in total rather than valued as individual assets.

M. Computer Equipment

This class includes various computer (personal, network and mainframe), monitors, printers, plotters, modems, scanners and similar assets, if they are not included in office furniture, fixtures and equipment. Software should also be considered, and the distinction made between operating software (which usually comes with the device) and application software (which typically is not owned but is licensed).

Figure 21: Computer Equipment

N. Tools

Divided into 3 subclasses;

- Permanent Tools ~ portable electric and air tools, anvils, vices, gauges, chucks and similar items.
- Perishable Tools ~ drills, chisels, reamers, taps and other assets.
- Special Tools - Sometimes called “tools, dies, jigs and fixtures”. Built for specific operation or application - “dies, jigs, moulds, pattern, template and similar assets.”

O. Construction In-Progress

Includes project under construction that have not been completed and capitalized. It is a temporary, special classification utilized until construction is complete; it is valued by the valuer at the recorded book value.

P. Special Classes

Aircrafts, bottles and cases (beverage industry), screens (bakery), ships and similar assets

Q. Inventories

Include raw materials, work-in-process and finished goods. Typically, not part of a machinery and equipment valuation. Inventory valuation is a specialized field and requires advanced training.

4.0 STANDARD OF MEASUREMENTS FOR MACHINERY AND EQUIPMENT

There is need to have a basis or standard by which capacity, utility, functionality, capability or quality of machinery and equipment is measured or compared during the valuation analysis. Machinery and equipment are different in terms of design, capacity or function. Even if they are of the same function, machinery tend to have different extent of capabilities. Given this scenario, valuers need to be aware of the standard reference points which they can use to measure the capacity or capability of the machinery or equipment for conclusive and logical valuation analysis.

Below are some of the examples of the standard measures or factors to consider in order to come up with relevant information about the machinery and equipment for valuation assignment.

4.1 Capacity

Type of Machine / Equipment	Standard / Unit Measurement	Photographic Example
Oil Storage Tank	• Tonnage • Litres • Barrels • Cubic metres • Gallons	
Pumps	• Litres per hour • litres per minute • Gallons per minute • Cubic metres per hour	

Type of Machine / Equipment	Standard / Unit Measurement	Photographic Example
Generator Set	• KiloWatt (kW) • KVA	
Boiler	• Kg per hour • Ton per hour	
Concrete Block Making Machine	• Blocks per hour (bph)	
Concrete Batch Mixing Plant	• tons per hour	
Water Bottle Filling Line	• bottles per hour (bph)	

Type of Machine / Equipment	Standard / Unit Measurement	Photographic Example
Hoist	• Tonnage	
Press	• Tonnage	
Cutter/ Guillotine/ Shear	• Thickness and length of steel	
Off Highway Truck	• Tonnage	

Type of Machine / Equipment	Standard / Unit Measurement	Photographic Example
Silos	• Tonnage • Cubic metres	
Air Compressor	• Kilopascal (kPa) • cfm • l/min • kW/Bar	
Transformer	• KiloWatts • KiloVolts	

4.2 Date Identification (Make Year)

Type of Machine / Equipment	Standard / Unit Measurement	Photographic Example
Print Machine	• Machine Plate Details • Serial Number	
Vehicle	• Machine Plate Details • VIN	
Machinery	• Plate number • Manufacturer Tag • Serial Number Tag	
Printers	• Paper per minute (ppm) • Pieces output	

4.3 Usage Identification

Type of Machine / Equipment	Standard / Unit Measurement	Photographic Example
Vehicles	• Odometer	
Tractors	• Hour meter	

Type of Machine / Equipment	Standard / Unit Measurement	Photographic Example
Generator Set	• Hour meter	 
Airplane	• Flying records - cycles - takeoffs, landings; usage-based replacement; time based replacement	
Mobile Crane	• Hour meter • Kilometers on the carrier	

4.4 Conversion of Unit Measurement

From kiloWatt to horsepower	:	Power
From meter to feet	:	Length
Celsius to Fahrenheit	:	Temperature
Kilometers per hour to miles per hour	:	Speed

- Length – inches to centimeters, feet to meters
- Area = length x width; circle = Pi x R squared
- Volume = length x width x height
- Velocity = change in position/change in time
- Density = mass/volume
- Force = mass x acceleration
- Pressure = force/area

PART II: BASIS OF MACHINERY AND EQUIPMENT VALUATION

1.0 BASIC UNDERSTANDING OF VALUATION

The science and art of valuation is ramified over a wide range of topics and each enrooted in concepts varied in nature. As a machinery and equipment valuer, the following concepts need an in-depth understanding:

1.1 Price

Price is a fact while value is an opinion of value or an estimate by a valuer or appraiser. Price can be the amount of money a purchaser actually pays, or a seller receives. Price is what is asked to be paid whereas cost is what is primarily intended to be covered by price; they may or may not be the same. Price is the mechanism through which scarce resources are distributed is an open market over space and time. Different individuals may receive different measures of utility from the same goods.

Depending on wealth and alternative purchase possibilities, each individual determines the highest price he is prepared to pay for the goods. The prices individuals are willing to pay or receive may never appear in the marketplace because they are too high or too low for a transaction to occur.

Economics define price as the monetary exchange value of a product or service. For a consumer, the price is an expected agreement between seller and buyer concerning what each to receive. Price is the mechanism or device for translating into quantitative terms (Saudi Arabia Riyal), the perceived value of the product to the consumer at a point of time.

Based on the definition from Business Dictionary, price can be defined as value that will be used to purchase a finite quantity, weight or other measure of good or service.

As the consideration given in exchange for transfer of ownership, price forms the essential basis of commercial transactions. It may be fixed by a contract, left to be determined by an agreed upon formula at a future date, or discovered or negotiated during the course of dealings between the parties involved.

In commerce, price is determined by:

- The amount a buyer is willing to pay;
- The amount a seller is willing to accept; and
- Market environment where goods may be traded between buyers and sellers through price mechanism. The concept of market

implies goods may be traded among buyer/seller without undue restrictions in their activities (open market).

Price is defined as the amount a particular purchaser agrees to pay and a particular seller agrees to accept under the circumstances surrounding their transaction. Price implies an exchange and is an accomplished fact. The price paid for a particular asset may be higher or lower than, or equal to, the asset's value.

1.2 Cost

An amount that has to be paid or given up in order to get something.

In business, cost is usually a monetary valuation of:

- Effort
- Material
- Resources
- Time and utilities consumed
- Risks incurred, and
- Opportunity

Forgone in production and delivery of a good or service. All expenses are costs, but not all costs (such as those incurred in acquisition of an income-generating asset) are expenses.

The term "cost" admits of a wide variety of application and assumes different senses in different uses or contexts as hereinafter explained. It represents the actual expenditure to manufacture.

The term cost is used by valuers in relation to production, not exchange. Cost may be either an accomplished fact or a current estimate. It is defined as the total money expenditure for any asset. The cost in particular asset may be higher than, lower than, or equal to the asset's value.

In machinery and equipment, the cost of raw material, labour used in manufacture, payments for know-how are included into the product cost. It is a measurement of the expenditure required to produce the product. Thus "cost" is a term used in relation to production and not exchange.

Cost consist of:

Fixed Cost	The cost which remains fixed irrespective of consideration whether the quantity of product is increased or decreased.
Labour Cost	Cost of paying workers employed to make a product.
Manufacturing Cost	Manufacturing cost in the cost of making a product. This sometimes includes burden assigned to itemized cost. Burden is general overhead. E.g., administration cost, rent, utilities, etc.
Marginal Cost	Cost of making a single extra unit above the number already planned.
Operating Cost/ Running Costs	Costs of the day-to-day working of a company.
Variable Costs	Production costs which increase with the quantity of the product made.
Cost Analysis	Calculating in advance what a product or item will cost.
Cost and Freight	Estimate of price, which includes cost of goods and the transport charges.
Cost Centre	This apply to large factory where there are several departments - cost may be applied to each department as products move through them. This may also be referred to as profit centre.
Cost Insurance Freight (CIF)	Cost of goods plus Insurance plus Freight.
Cost of Sales	All the costs of a product sold including manufacturing cost and staff costs.
Costs Decreed	Expenses involved in court case as decreed by the court.
To Cost a Product	To calculate how much money will be needed to make a product, and to work out a selling price.
Cost Plus	System of calculating price from actual cost of production including a percent of that cost to cover overhead and profit.
Direct Cost	It means expenditure for the labour and materials necessary to construct a new improvement. Direct costs are also called the hard costs. A contractor's overhead and profit are generally considered hard costs.
Indirect Cost	It means expenditure for items other than labour and material. Indirect costs include administrative costs

1.3 Value

The concept of value comprises many influences and the variety of such influences is so great that no classification of them would be definite. Thus, physical things may have an economic value or social value or aesthetical value or natural value. Similarly, a concept may have an intellectual value or moral value or religious value or recreational value. For a machinery and equipment valuer, the term is used in based on the qualified and accounted sense. One is concerned here with the relationship of value to the asset from the owner perspective.

It is owner's measurement of the anticipated sum of future value services that the thing will procure. It is in the nature of an estimation that forms the owner's decision to exercise his right with regard to the thing transacted. Since value is an estimate of the anticipated future utility of the thing owned, the concept of value is linked to a knowledge of the past that is projected into the future but measured in the present.

The essential elements of value are utility, scarcity, demand and transferability. Broad forces influencing value are as follow:

Physical	Type, make, model, capacity
Social	Taste and preference of consumers utilizing products manufactures by the machine
Economic	Demand and supply, availability of money and credit, interest rate
Legal	Zoning, environment protection laws, taxation policy and regulation of industry

2.0 Purpose of Valuation

The word "*purpose*" refers to the reason(s) a valuation is performed. Common *purposes* include (but are not limited to) financial reporting, tax reporting, litigation support, transaction support, and to support secured lending decisions.

Valuation for the purpose of:

- Acquisition and merger
- Asset Disposal
- Bank Collateral Finance
- Lease/Sale Lease back
- Financial reporting
- Insurance
- Legal Disputes
- Liquidation
- Taxation, Rating

3.0 Basis of Valuation

Basis of valuation describe the fundamental premises on which the reported values will be based. It is critical that the basis (or bases) of value be appropriate to the terms and purpose of the valuation assignment, as a basis of value may influence or dictate a valuer's selection of methods, inputs and assumptions, and the ultimate opinion of value.

A valuer may be required to use bases of value that are defined by statute, regulation, private contract or other documents.

International Valuation Standards (IVS) 2020 establish Bases of Value as part of General Standard IVS 104 and Asset Standard IVS 300 Plant and Equipment.

IVS Bases of Value important to the Machinery and Equipment Valuer include:

- Market Value
- Equitable Value
- Investment Value
- Synergistic Value
- Liquidation Value
- Fair Value (IFRS, OECD, IRS and Legal/Statutory)

Under the following Premises of Value:

- Highest and Best Use
- Current Use/Existing Use
- Orderly Liquidation
- Forced Sale

3.1 Market Value

Market Value is the estimated amount for which an asset ought to exchange on the date of valuation between a willing buyer and a willing seller in an arm's length transaction after proper marketing wherein the parties had each acted knowledgeably, prudently and without compulsion.

"The estimated amount…"	Means a price, normally expressed in terms of money, payable for the asset in an arm's length market transaction. Market Value is measured as the best or most probable price reasonably obtainable in the market at the date of valuation in keeping with the "Market Value" definition. The estimate specifically excludes an estimated price inflated or deflated by special terms or circumstances such as typical financing, sale and leaseback arrangements, special considerations or concessions granted by anyone associated with the sale, or any element of special value.

"…an asset ought to exchange…"	Means the fact that the value of an asset is an estimated amount rather than a predetermined or actual sale price. It is the price at which the market experts a transaction should be completed on the date of valuation, meeting all other elements of the "Market Value" definition.
"…on the date of valuation…"	Indicates that the estimated Market Value is time specific as of a given date. Because markets and market conditions may change, the estimated value may be incorrect or inappropriate at another time. The valuation amount will reflect the actual market state and circumstances as on the valuation date, not as of either a past or future date.
"…a willing buyer…."	Means one who is motivated, but not compelled to buy. This buyer is neither overeager nor determined to buy at any price. This buyer is also one who purchases in accordance with the realities of the current market, and with current market expectations, rather than an imaginary or hypothetical market that cannot be demonstrated to exist or to be anticipated by the market. The assumed buyer would not pay a higher price than the market requires. The present asset owner is included among those who constitute "the market". A valuer must not make unrealistic assumptions about market conditions nor assume a level of market value above that obtainable.
"…a willing seller…."	Means one who is neither an overeager nor a forced seller prepared to sell at any price, nor one prepared to hold out for a price not considered reasonable in the current market. The seller is motivated to sell the asset at market terms for the best price attainable in the open market, and after proper marketing, whatever that price may be. The factual circumstances of the actual asset owner are not a part of this consideration because the" willing seller" is a hypothetical owner.

"…in an arm's length transaction….."	Means one between parties who do not have a particular or special relationship (for example – parent and subsidiary companies, or landlord and tenant) that may make the price level atypical of the market. The Market Value transaction is presumed to be between unrelated parties, each acting independently.
"…after proper marketing….."	Means that the asset would be marketed in the most appropriate manner to affect its sale at the best price reasonable in accordance with the Market Value definition. The length of marketing time varies with market conditions but must be sufficient to allow the asset to be brought to the attention of an adequate number of potential purchasers. The marketing period occurs prior to the valuation date.
"…wherein the parties had each acted knowledgeably, prudently….."	Presumes that both the buyer and the seller are well informed about the nature and characteristics of the asset, its actual and potential uses and the state of the market as on the date of valuation. Each is further presumed to act for self-interest with that knowledge, and prudently as to seek the best for their respective positions in the transaction. Prudence is assessed by

	referring to the state of the market at the date of valuation, not with benefit of hindsight at some later date.
"…and without compulsion.…"	Establishes that each party is motivated to undertake the transaction, but neither is under compulsion unduly coerced to complete it.

Other than market value, there are occasions where the valuation is required based on the highest and best use of an asset. Highest and best use (HBU) means the most probable use of an asset which is physically possible, appropriately justified, legally permissible, financially feasible and which results in the highest value of that asset. There is an inherent factor in determination of highest and best use of real estate such as time, location, market demand, legal right to develop, topography, technological feasibility, financial or economic feasibility and public utilities.

HBU as applicable to ME is defined as that use of the plant and machinery which may reasonably be expected to produce the greatest net return over a given period of time and legal use which will yield the highest present value.

HBU of any individual unit or total operating facility may not be its present use. Hence an analysis must be made to determine the highest and best use of ME being valued. The factors to be considered pertinently are permissibility (legal), feasibility (financial), possibility (physical) and profitability (economic).

3.1.1 Market Value – In Situ

Market value of machinery and equipment to remain in situ is:

- The worth of the equipment, as a whole, to remain in its working place, with no unreasonable time limit imposed on the completion of the transaction.

- Reflect the prices that a purchaser would pay to acquire the manufacturing facility, wired up, plumbed in and bolted to the floor, together with all ancillary loose plant, equipment and plant services, located in the premises which the purchaser will occupy.
- The installation and commissioning costs of the plant (where applicable) are **included** in the valuation. Plant services (whichoften have negligible value once removed) would usually be included with the valuation).

In-situ Methodology

- DRC for specialised assets (subject to adequate profitability or service potential)
- Comparable sales for non-specialised assets

When do we do in-situ valuations?

- Exchange as part of a going concern
- Financial Reporting
- Lending

3.1.2 Market Value – Ex Situ

Market value of machinery and equipment ex situ is:

- Market value of machinery and equipment as a whole for removal from the premises.
- Market value of machinery and equipment as individual items for removal from the premises.

The concept;

- Ex-situ assumes that the assets would be sold for removal from the existing location.
- Usually the comparable sales approach is more appropriate. (if there is any market evidence)
- If no evidence…judgement, estimation, scrap value.
- Therefore, the installation and commissioning costs of the plant (where applicable) are excluded from the valuation. Plant services (which often have negligible value on an ex-situ basis, due to the difficulty of removing them) may have to be excluded or heavily discounted to reflect removal and reinstallation costs).

When do we do Ex Situ valuations?

- Liquidation
- Receivership
- Assets for sale as disposal
- Benchmarking
- Finance companies exit risk assessment
- Lease on premises expires

Ex-Situ Assumptions:

- Who pays for the decommissioning, removal?
- How will it go from the mountings and how and when is the disconnection from services?

- Who pays for removal costs (transport) from existing site to new site, plus installation?

3.1.3 Market Value In-Situ vs Ex-Situ

Concept of Ex-Situ vs In-Situ:

- In Situ and Ex Situ values might be the same for non-specialised assets which have no or insignificant installation/commissioning costs.
- They are usually very different for specialised assets that have high installation commissioning costs.
- This fact requires disclosure.

Additional consideration of the market value may be given in the following situation:

- **Market value of machinery forming part of the continuing business**

  Valuation is carried out to assess the market value of the machinery and equipment assets of an ongoing business which is to change hands.

  The market value is determined on the assumption that the machinery and equipment will continue in its present existing use in the business of the company – in other words existing use value.

- **Market value of machinery and equipment to remain in situ.**

  The worth of the equipment, as a whole, to remain in its working place, with no unreasonable time limit imposed on the completion of the transaction.

  The value that is required is equivalent to the price that a purchaser would pay to acquire the manufacturing facility, wired up, plumbed in and bolted to the floor, together with all ancillary loose plant, equipment and plant services, located in the premises which the purchaser will occupy.

- **Market value of machinery and equipment as individual items for removal from the premises.**

  The price that each individual asset would realize, where it is to be sold by private treaty, auction or tender, as may be most appropriate under the prevailing circumstances and assuming that there is a reasonable period of time for completing the transaction. The maximum amount that a purchaser would be prepared to pay to have

a similar machine, in his own factory, fully installed and commissioned for production.

3.2 Replacement Value

The estimated amount to replace a machinery and equipment with identical delivery service with regards to both quality and quantity. It must be distinguished between Replacement Cost New and Reproduction Cost. The replacement Cost New look for similar specification and utility but not identical machinery whilst Reproduction Cost is based on the exact replica of the same machinery to be developed.

3.3 Liquidation value

The net amount that can be realized if the business isterminated and the assets sold piecemeal. In doing so it assumes that all equipment would be sold on as-is-where-is basis with buyers being responsible for removal of any piece at their own risk and expense. While computing liquidation value it is customary to recognize the cost of liquidation like commissions, administration cost of keeping the company alive till liquidation, taxes, legal and other professional fees which enter into the value. It is not uncommon to find that some machinery or equipment have no liquidation value at all, inasmuch as the cost to dismantle and remove often becomes greater than the value realizable in resale. This happens usually at public auction when defined as forced liquidation value.

In an orderly liquidation, the machinery and equuipment are sold over a given period of time in negotiations to obtain the best available price and the sale takes place as quickly as possible. This is typically without the use of public auction but considering a compelled seller.

3.4 Other Bases of Value

a. Value in Exchange

The price that would tend to prevail in a free, open and competitive market based on an equilibrium set by the forces of supply and demand. This may be true if an item to be moved from one place to another or an entire plant is in place. This is sometime referred to as objective value because it is based on observable economic forces. A common form of value–in- exchange is market value.

b. Value in Use

The worth of a machinery and equipment to a specific user or set of users. As value-in-use is related to specific user's needs, it is often referred to as subjective value.

Value-in-use in the real on machinery and equipment may arise as a replacement concept under situation of specialty e.g., a company hopes to revive its position by switching over to a technique that requires a purchase of typical equipment which is generally not available in the investor's market. In such situation the company may bargain to offer much above the market price to improve its situation. Such subjective price shall measure the value-in-use of the particular equipment. The additional price may be considered intangible.

c. Value in Existing use

A variant from of value-in-use. Sometimes it happens that the company hold onto some major equipment which has assumed a special level of importance owing to its proved efficiency over a long period of time with a good promise for the future; so much so that the company is not ready to replace it even by new purchase. In such situation the value of the machine attains a margin of prefer ability over its value-in-exchange which is termed as value of its existing use. The value, if not above installed replacement cost, can be tangible to the company but may have intangible attributes as value in-exchange.

d. Value in Alternative use

A concept that arises in a situation when the existing use of a particular equipment has become uneconomic or non-functional for its original use e.g., computerized numerically controlled (CNC) machines are known for high accuracy. Over a period of time the level of accuracy goes down and it becomes unsuitable for the purpose for which it was originally installed. But nevertheless, it can be used where so much precision is not required. To such alternative use the machine still retains a value, the measure of which is the value in its alternative use. Value in alternative use assumes significance in the backdrop of fast changing technologies all around the globe.

e. Market Value for Removal Purpose

The price that each individual asset woudl realise, were it to be sold by privalte treaty, auction or tender, as may be most appropriate under the prevailing circumstances and assuming that there is a reasonable period of time for completing the transaction.

f. Fair Market Value Installed

The estimated amount expressed in terms of money that may reasonably be expected for an installed property in an exchange between a willing buyer and a willing seller, with equity to both, neither under any compulsion to buy or sell and both fully aware of all relevant facts, including installation as of a specific date. This amount includes all normal direct and indirect costs, such as installation and other assemblage costs necessary to make the property fully operational.

g. Fair Market Value in Continued Use

The estimated amount, expressed in terms of money, that may reasonably be expected for a property in an exchange between a wiliing buyer and a willing seller, with equity to both, neither under any compulsion to buy or sell, and both fully aware of all relevant facts, inscluding installation, as of a specific date and assuming that the business earnings support the value reported. This amount includes all normal direct and indirect costs, such as installation and other assemblage costs to the make the property fully operational.

h. Fair Market Value for Removal

The estimated amount, expressed in terms of money, that may reasonably be expected for an item of property in an exchange between a willing buyer and a wiling seller, with equity to both, neither under any compulsion to buy or sell and both fully aware of all relevant facts, considering removal of the property to another location, as of a specific date.

i. Liquidation Value in Place

The estimated gross amount, expressed in terms of money that could typically be realized from a failed facility, assuming that the entire facility would be sole intact with a limited time to complete the sale, as of a specific date.

j. Orderly Liquidation Value

The estimate gross amount expressed in terms of money, that could be typically realized from a liquidation sale, given a reasonable period of time to find a purchaser(s) with the seller being compelled to sell on an as-is, where-is basis as of a specific date.

k. Forced Liquidation Value

The estimated gross amount, expressed in terms of money, that could typically be realized from a properly advertised and conducted public auction, with the seller being compelled to sell with a sense of immediacy on an as-is, where-is basis, as of a specific date.

3.5 Overview Valuation Professional Organizations on Basis of Valuation

The following table provides the ME Valuer with an overview of how Valuation Professional Organizations like TAQEEM and the American Society of Appraisers would blend the proper level of trade for an asset with those drafted under IVS.

IVS gives the ME Valuer room to be more specific with what has occurred as of the Valuation Date that impacts value, whether it is to replace an asset with like for like new replica or reproduction asset, for an arms' length transaction

with equity to both the buyer and seller, or under a compelled or duress situation for the seller where exposure time is of key importance.

The window of time allowed to properly market the Subject Asset also determines which level of value definition is most appropriate.

IVS	TAQEEM	ASA
Replacement Cost New	Reproduction Cost New / Reinstatement New	Replacement Cost New
Market Value – Nature of Source	Market Value	Fair Market Value in Continued Use with or without Assumed Earnings
Market Value – Nature of Source	Market Value In-Situ	Fair Market Value – Installed
Market Value – Nature of Source	Market Value Ex-Situ or Removal	Fair Market Value – Removed
Liquidation – Nature of Source	Liquidation – Nature of Source	Liquidation Value in Place
Liquidation – Nature of Source	Liquidation – Nature of Source	Orderly Liquidation Value
Liquidation – Forced Sale	Liquidation – Nature of Source	Forced Liquidation Value

4.0 Insurance Valuation

A valuation is carried out in order to provide the insured party with an accurate assessment of the value at risk in respect of the plant and other equipment for which he is responsible, arrived at with due reference to the terms and conditions of his insurance policy.

There are 3 bases in Insurance Valuation:

4.1 Reinstatement Value

Reinstatement with new (cost new-replication or new- replacement) - The cost of replacing the existing asset with a substantially similar new asset. It is calculated by establishing the current ex – works cost of a new replacement asset, making any adjustment that may be necessary to reflect obsolescence in the existing item and adding to it costs of transport, costs of installation and, where appropriate, duties and taxes.

This occurs in two situations:

- Where property is destroyed, the rebuilding of the property if a building, or, in case of other property, its replacement by similar property, in either case in a condition equal to, nit not better or more extensive than its condition when new.
- Where property is damaged, the repair of the damage and the restoration of the damaged portion of the property to a condition substantially, the same as, but not better or more extensive than its condition when new

Consideration in reinstatement cost new (Insurance):

a) Estimated cost at the date of assessment to replace or repair the insured plant and machinery to a condition substantially the same as, but no better or more extensive than, its condition when new;

b) Should include all insurable contingencies such as transportation, installation, commissioning, and non- recoverable taxes together with fees and debris removal cost.

4.2 Indemnity Valuation

Indemnity (Market value depreciated) - An Indemnity valuation should reflect the intrinsic monetary worth of the machinery and equipment. (Cost as at date of valuation to place insured back in same financial position prior to a loss).

4.3 Debris Removal Cost

Debris Removal Cost - The costs necessarily incurred by the insured in the removal of the machinery, equipment and/or chattels, whether damaged or undamaged, from the building following damage to or destruction of the building or machinery, equipment and/or chattels.

5.0 EXERCISE QUESTIONS

1. What is the definition of Plant?

2. What is the definition of Machinery?

3. What is the definition of Equipment?

4. What is the difference between Plant, Machinery and Equipment?

5. What is the definition of Chattel?

6. What is the definition of Fixtures?

7. What is a Main Machine and Support Machine? Give examples.

8. What is the unit of measurement used in dertermining the capacity of machinery below?

   a) Pumps
   b) Generator set
   c) Boiler
   d) Hoist

9. What is the unit of measurement used in usage identification of machinery below?

   a) Tractors
   b) Generator set
   c) Airplane
   d) Mobile Crane

10. is it important for a valuer to collect serial numbers of machinery?

11. What is the difference between price and value?

12. What is the basis of valuation to be used in machinery and equipment valuation?

13. What is Market Value?

14. What is Market Value In-Situ?

15. What is Market Value Ex-Situ?

16. What is Liquidation Value?

17. What is Replacement Value?

18. What is the basis of value in Insurance Valuation for Machinery and Equipment?

Note: All exercise questions above are for review purposes only. It is not a format for exam questions.

1. Plant - The assemblage of assets that may include specialized non-permanent buildings, machinery and equipment.

The statement above refers to_____.

A. International Valuation Standards Council (IVSC)

B. Board of Valuers, Appraisers and Estate Agents (BOVAEA), Malaysia

C. The Royal Institution of Chartered Surveyors (RICS), United Kingdom.

D. Court judgment.

2. Equipment –An all-encompassing term for other assets such as sundry machinery, tooling, fixtures, furniture and furnishings, trade fixtures and fittings, sundry equipment and technology and loose tools that are used to assist the operation of the enterprise or entity.

The statement above refers to the definition of_____.

A. International Valuation Standards Council (IVSC)

B. Board of Valuers, Appraisers and Estate Agents (BOVAEA), Malaysia

C. The Royal Institution of Chartered Surveyors (RICS)

D. Court judgment.

3. Machinery – Individual machines or collections of machines using or applying mechanical power, having several parts each with a definite function and together performing certain kind of works.

The statement above refers to the definition of_____.

A. International Valuation Standards Council (IVSC)

B. Board of Valuers, Appraisers and Estate Agents (BOVAEA), Malaysia

C. The Royal Institution of Chartered Surveyors (RICS), United Kingdom.

D. English Law.

4. Which of the following **DOES NOT** relate to definition of Plant, Machinery and Equipment valuation?

A. The author of the book – Derry, Watts and Budhbhatti.

B. Professional Standard from Governing Body – IVSC, BOVEA, RICS.

C. Oxford Dictionary

D. Bulletin and magazines.

5. 

Photograph above shows an example of a _____.

A. Plant.

B. Machine.

C. Machinery.

D. Equipment.

6.

Photograph above shows an example of a _____.

A. Busbar
B. Motor control center
C. Switch gear
D. Control panel

7.

Photograph above shows an example of a _____.

A. Busbar
B. Motor control center
C. Switch gear
D. Control panel

8.

Photograph above shows an example of _____.

A. Power wiring
B. Structural support
C. General plant equipment
D. Office furniture, fixture and equipment

9.

Photograph above shows an example of _____.

A. Computer equipment
B. Structural support
C. General plant equipment
D. Office furniture and equipment

10.

Photograph above shows examples of_____.

A. Computer equipment
B. Structural support
C. General plant equipment
D. Office furniture, fixture and equipment

11. Inventories can be defined as _____

A. Aircraft, bottles and cases, screens and ship.
B. Raw materials, work in progress and finished goods.
C. Portable electric, anvils, vises and gauges.
D. Office furniture, fixtures and equipment.

12. Liters/minute is used for_____.

A. Genset
B. Tank
C. Pumps
D. Boiler

13. 

Photograph above shows an example of a _____.

A. Busbar
B. Motor control center
C. Switch gear
D. Transformer

14. 

The above photograph is usage identification of_____.

A. Vehicles
B. Tractors
C. Boiler
D. Genset

15. Which of the listing below is the conversion of unit measurement for motors?

A. Kilowatts (kW) to horsepower (hp)
B. Meters to feet
C. Celsius to Fahrenheit
D. Kilometers per hour to miles per hour

16. Which is the conversion of unit measurement for temperature?

A. Kilowatts to horsepower
B. Meters to feet
C. Celsius to Fahrenheit
D. Kilometers per hour to miles per hour

17. Tools can be divided into three (3) sub-classes **EXCEPT**_____.

A. Permanent tools
B. Perishable tools
C. Mechanical components
D. Special tooling

18. Reason for valuation is to determine_____.

A. Date of valuation
B. Principle of valuation
C. Basic of valuation
D. Basis of valuation

19. Reinstatement, indemnity and debris removal costs are the basis of _____ valuation.

A. Finance
B. Market
C. Insurance
D. Existing use

20. _____is the amount a particular purchaser agrees to pay and a particular seller agrees to accept.

A. Cost

B. Value

C. Price

D. Market Value

21.
- Market value of machinery forming part of the continuing business.
- Market value of machinery and equipment to remain in situ.
- Market value of machinery and equipment as individual items for removal from the premises (Ex-situ).

The statements above describe_____.

A. Insurance Value

B. Market Value

C. Existing Use Value

D. Indemnity Value

22. The cost necessarily incurred by the insured in the removal of the plants, machinery, equipment and/or chattels, whether damaged or undamaged, from the building following damage to or destruction of the building or machinery, equipment and/ or chattels.

The statement above refers to_____.

A. Indemnity Valuation

B. Market Value

C. Debris Removal Cost

D. Reinstatement Value

23. The cost of replacing the existing asset with a substantially similar new asset. It is calculated by establishing the current ex – works cost of a new replacement asset, making any adjustment that may be necessary to reflect obsolescence in the existing item and adding to it costs of transport, costs of installation and, where appropriate, duties and taxes.

The statement above refers to_____.

A. Indemnity Valuation

B. Market Value

C. Debris Removal Cost

D. Reinstatement Value

24. The basis of insurance valuation is as follows_____.

I. Reinstatement Value

II. Market Value

III. Indemnity value

iv. Debris Removal Cost

A. I and II only

B. I, II and III only

C. I, III and IV only

D. All of the above

25.

Which of the following statements is correct about Price?

A. Price is an opinion of value

B. Price is an estimate by a valuer

C. Price is used by valuers in relation to production, not exchange

D. Price can be the amount of money a purchaser actually pays, or a seller receives

26. Two (2) main reasons market value is needed are_____.

I. When machinery and equipment transferable without involving existing business connections.

II. When the property is damaged.

III. For the purposes of securities (collateral).

IV. For the purpose of sale as a going concern.

A. I and II only.

B. I and III only.

C. I, III and IV only.

D. All of the above.

27. Which of the following statements is a description of an **arms length transaction** in the definition of market value?

A. One between parties who do not have a particular or special relationship (for example – parent and subsidiary companies, or landlord and tenant) that may make the price level atypical of the market. The Market Value transaction is presumed to be between unrelated parties, each acting independently.

B. Establishes that each party is motivated to undertake the transaction, but neither is under compulsion unduly coerced to complete it.

C. Presumes that both the buyer and the seller are well informed about the nature and characteristics of the asset, its actual and potential uses and the state of the market as on the date of valuation.

D. Indicates that the estimated Market Value is time specific as of a given date.

28. The explanation of **the estimated amount** in the Market Value Definition is?

A. One between parties who do not have a particular or special relationship (for example – parent and subsidiary companies, or landlord and tenant) that may make the price level atypical of the market. The Market Value transaction is presumed to be between unrelated parties, each acting independently.

B. Establishes that each party is motivated to undertake the transaction, but neither is under compulsion or unduly coerced to complete it.

C. Presumes that both the buyer and the seller are well informed about the nature and characteristics of the asset, its actual and potential uses and the state of the market as on the date of valuation

D. A price, normally expressed in terms of money, payable for the asset in an arm's length market transaction

29. Which of the following are not drivers in influencing broad forces?

A. Physical – type,make, model, capacity.

B. Social – taste and preference of consumers utilising products manufactured by the machine.

C. Economic – demand and supply, zoning, environment and interest rate.

D. Legal – zoning, environment protection laws, taxation policy and regulation of industry.

30. Which of the following is not basis of value?.

A. Market value.

B. Fair value.

C. Impaired value.

D. Liquidation value.

31. Following are other basis of value **EXCEPT**_____.

A. Value in Use
B. Liquidation Value in Place
C. Book Value
D. Value in Exchange

Question 32 - 36 refer to Figure below. Fill in the blank with an appropriate answer.

Automobile	Cement	Dairy
Food Packaging Equipment	Dairy Production Equipment	

Types of plant are_____(32),_____(33) and_____(34), whereas _____(35) and_____(36) are example of production machinery.

Question 37 - 40 refer to Figure below. Fill in the blank with an appropriate answer.

Oxford Dictionary	Writers
Professional standards	Machine
Market value	Insured value
Existing use value	Simple machine

Explanation of machinery and equipment can be derived from_____(37),_____ (38) and_____(39).

Several basis of valuation for machinery and equipment valuation are_____(40) and _____(41).

Session II

MACHINERY AND EQUIPMENT VALUATION APPROACHES

SESSION 2: MACHINERY AND EQUIPMENT VALUATION APPROACHES

1.0 INTRODUCTION

The terminology of “approach” and “method” demand a careful differentiation as we apply the concepts in realm of valuation. The Webster’s New Twentieth Century Dictionary defines the terms ‘approach’ and ‘method’ as follows:

- *Approach:*
  To draw near; to advance near to a point aimed at; to approximate; a way of coming forward or reaching a person or place, access.

- *Method:*
  A way of doing anything; mode; procedure; process; a regular orderly definite procedure.

Referring to Kirit Budhbhatti “Approach” is the broader of the two concepts. An approach is a way of coming towards value, whereas method is the actual process or orderly procedure step by step for obtaining a specific value.

2.0 OVERVIEW OF VALUATION APPROACHES

Similar to conventional real estate valuation, the valuation of ME involves three basic approaches:

2.1 Market Approach

The market approach is particularly applied with regards to property that has established markets for buying and selling. Where there is a limited market indicated by lack of transactions it will obviously be difficult to measure value by the market approach, there may be sufficient sale transactions taking place. Thus, market data is an essential prerequisite for application of the market approach to valuation. It means that a market approach becomes relevant in changing situations that lead to the development of market data of analysis. Thus, using a sale which occurred during dull economic activities is not valid in a thriving economic period. Usually properties of non-investment character but having marketability as its attribute are valued by this approach.

The market approach considers prices recently paid for similar assets in the used market, with adjustments made to the indicated market prices to reflect condition and utility of the appraised asset relative to the market comparative.

The logic behind the market approach is that a prudent investor can go to a market place and purchase an existing facility or purchase individual pieces of equipment in the used market to assemble an operating package.

Application of market approach is via the following methods:

- Direct sales comparison method
- Comparable Match Method
- Percentage of Cost Method
- Rule of thumb method – General guidance, based on experience. Not a scientific valuation method but can provide a reference point for practical purposes

2.2 Cost Approach

The cost approach is applied primarily with regard to service property which are not frequently exchanged in the market or do not generate revenue by themselves. It is also useful for new or special purpose properties. The logic behind the cost approach is that a prudent investor would pay no more for a tangible personal property than the cost of producing a substitute property with the same utility.

The cost approach generally furnishes the most reliable indication of value for assets without a known used market.

Application of cost approach is via the following methods:

- Replacement cost new method
  - Replacement cost is the current of similar new PME having the nearest equivalent utility as the machine being valued.
- Book value method
  - Sometimes resorted to in the cost approach of valuation, this method is purely based on experience of the valuer. Similar to the "Rule of Thumb"

The general premise of the cost approach in machinery and equipment appraisals is the principle of substitution. The principle of substitution means that someone will not pay more for the asset being appraised than what the individual can purchase a substitute asset that performs the same function or service.

The cost approach to machinery and equipment appraisal involves the appraiser coming up with the replacement cost of the asset and then subtracting any value that has been lost due to economic obsolescence, functional obsolescence, or physical deterioration. The best starting point of determining the cost approach value is to identify the replacement cost new costing.

2.3 Income Approach

The income approach in its simplest form is the estimation of the present worth of the future benefit accruing to the owner of the plant and machinery or to the specific interests or rights one enjoys in the property. This approach is relevant for investment properties having utility, marketability and self-liquidity. The cost and market approaches may not measure the full effect of obsolescence which the income approach may demonstrate. The business enterprise is valued on the basis of its future income potential. This collection of assets is commonly known as the business enterprise and consists of all components of the business-working capital, fixed asset and intangible assets. The amount supportable by the business is derived from the income as determined for all the assets of the business, working in combination. It is the income that established the value of the business and it is worked out through a series of calculations that take into account all factors that affect the yield or return.

Application of income approach is via capitalization of earnings method using capitalization rates. This method determines the present worth of future benefit (income to ownership).

IT IS NOT USUALLY APPLIED TO INDIVIDUAL ITEMS OF MACHINERY AND EQUIPMENT UNLESS THEY ARE LEASED.

This method is frequently used to value a group of assets or individual machine units that are utilized together to produce a marketable product and that, in aggregate, generate an income stream.

3.0 DEPRECIATION AND OBSOLESCENCE

According to Kirit Budhbatti (valuation of plant machinery), depreciation is defined as:

"… an attribute of all physical objects that they are subject to wear and tear, whether in use or not in use…"

Meanwhile, obsolescence is defined as:

"…. obsolescence on the other hand is stimulated by exogenous factors, be it technological, functional or economic…."

3.1 The Depreciation Factor

The Federal Communications Commission, USA has defined 'depreciation' as follows:

Depreciation as applied to depreciable telephone plants, means the loss in service value not restored by current maintenance, incurred in connection with the consumption or prospective retirement of a telephone plant in the course of service from causes which are known to be in current operation, against which the company is not protected by insurance and the effect can be forecast with a reasonable approach to accuracy. Among the causes to be given consideration are wear and tear, decay, and action of elements, inadequacy, obsolescence, changes in the art, changes in the demand and requirements of public authorities.

The National Association of Railroad and Utilities Commissioners Committee on Depreciation 1943 stated:

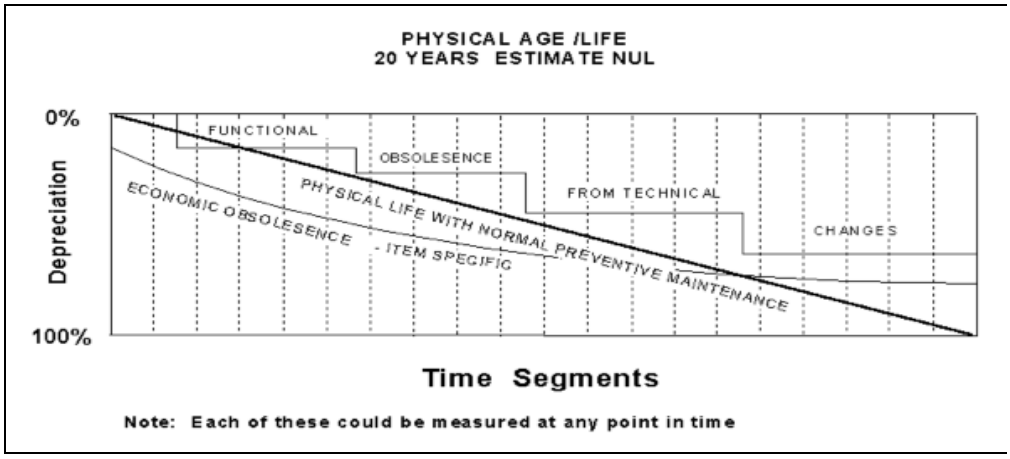
Depreciation is the expiration or consumption in whole or in part of service life or utility of property resulting from the action of one or more of the forces operating to bring about the retirement of such property from service, the forces so operating include wear and tear, decay, action of the elements like adequacy, obsolescence and public requirements; depreciation results in a cost of service.

The European Group of Valuers of Assets (TGOVOA) under Guidance Note No. GN4A published in 1988 has defined depreciation as:

The measure of wearing out consumption or other permanent loss of value of fixed asset whether arising from use, effluxion of time or obsolescence through technology and market changes.The Royal Institution of Chartered Surveyors U.K. has published a Manual of Valuation and Guidance Notes (March 1994) defined 'depreciation' as the measure of wearing out by consumption or other reduction in the useful economic life of a fixed asset, whether arising from use, effluxion of time or obsolescence through technological or other changes.

The valuer has to consider depreciation and obsolescence as a separate phenomenon and must assess value of assets by separately considering physical deterioration and obsolescence. This is because the deterioration is due to actual wear and tear to the plant and machinery whereas obsolescence is due to technological, functional and economic factors which are internal as well as external to the plant and machinery under consideration.

Each element of depreciation has different characteristics.



3.1.1 Physical Deterioration

Physical deterioration is the loss of value due to wear and tear on machinery and equipment. Machinery and equipment are manufactured with a useful life in mind. As the machine is operated, the machine experiences physical stress and exposure to the elements of the environment. Over time, the performance of the machine may require additional maintenance expenditures to keep it running. Lack of maintaining equipment may lead to faster deterioration. It is usually estimated as a percentage with a brand-new piece of equipment having 0% physical deterioration while a machine that has used up all of its life 100% physical deterioration. Measuring physical deterioration is often subjective and the appraiser will rely on similar assets and how they have performed in the past as the basis of calculating the percentage.

3.1.2 Actual vs Perceived Appearance

A valuer has to make a routine observation about condition. There are two types of conditions with actual and perceived (appearance). Actual and perceived (appearance) conditions are different due to the following reasons:

- The machine is recently painted. It may appear new, though it may not be so.
- In oil extraction plants, plates can be manufactured from second-hand plates which makes it difficult to ascertain the actual state of the item.
- It is not an easy or possible to assess real performance of a machine and its deterioration in working condition due to excellent upkeep.

3.1.3 Factors Affecting Equipment Condition

A valuer has to consider three major factors to arrive at the condition of the equipment:

a. Environment

What is the state of surrounding area housing the equipment? Surrounding weather conditions also contribute to balance life and performance of machinery whether nearness to salt water or nearness to corrosive atmosphere.

b. Usage

Is the equipment used strictly as per manufacturer's recommended capacity? This question must have answered in the context of usage.

c. Maintenance

There are the pertinent questions within the realm of maintenance which will lead to a determination of whether the equipment is under normal wear and tear or abnormal wear and tear. The example of questionnaires are as follows:

- What is the system of maintenance?
- Is it routine breakdown maintenance or preventive maintenance?

3.1.4 Methods of Computing Depreciation

Methods of computing depreciation used in practice are:

a. Observed Deterioration (also known as the 0-100% method)

In this method, each piece of equipment is inspected in running condition in order to estimate Deterioration. This is based on the valuer's judgement and lot of subjectivity is involved. Lump sum figure of depreciation as per codification given earlier can be adopted as:

Condition	Explanation	Depreciation (%)
New	Brand New	0-5
Excellent	Excellent, just like brand new	6-10
Very Good	Very good with no repairs required in foreseable future. Longer time than average before any maintenance required	11-20
Good	Good condition requiring standard routine maintenance	21-50
Fair	Fair condition, below average but can be operated continuous repairs and maintenance for limited use	51-60
Poor	Poor condition may or may not work, needs immediate repairs and may or may not work or even may require maintenance for limited use	61-90
Scrap	Scrap conidtion and cannot be used for intended use	91-100

Source: Kirit Budhbhatti

b. Straight Line

In this method, scrap value is estimated first. When it is considered to be 10% of replacement cost; the balance 90% is depreciated to estimated total economic life of the equipment.

i. Approach 1: Straight Line Method

Example:

Cost new ME	-	SAR100,000.00
Economic Life	-	5 years
Scrap value	-	10%
Therefore:		
ME Cost (new)	-	SAR100,000.00
(-) Scrap Value	-	SAR 10,000.00
Balance	-	SAR 90,000.00

Depreciation:

(Cost - Residual value) ÷ Years of useful life		
(SAR100,000 – SAR10,000) = SAR 90,000 SAR 90,000 ÷ 5 = 18,000		
Year 1 depreciation	:	SAR 18,000
Year 2 depreciation	:	SAR 18,000
Year 3 depreciation	:	SAR 18,000
Year 4 depreciation	:	SAR 18,000
Year 5 depreciation	:	SAR 18,000
Total depreciation	:	SAR 90,000

Book value:

Book Value Year End		
Initial Cost: SAR 100,000		
Year 1	:	0.82
Year 2	:	0.64
Year 3	:	0.46
Year 4	:	0.28
Year 5	:	0.10
Refer to Rushton's Table Top figure		

ii. Approach 2: Residual Balance Method

New ME	-	SAR100,000.00
Economic Life	-	5 years
Therefore:		
Annual Depreciation	=	SAR100,000.00 ÷ 5
	=	SAR 20,000.00
		20%

Depreciation:

Rate of Depreciation: 20%		
Year 0 (New)	:	100,000
Year 1 (0.2)(SAR100,000)= 20,000	:	80,000
Year 2 (0.2)(SAR80,000) = 16,000	:	64,000
Year 3 (0.2)(SAR64,000) = 12,800	:	51,200
Year 4 (0.2)(SAR51,200) = 10,240	:	40,960
Year 5 (0.2)(SAR40,960) = 8,190	:	32,768
Where as using SLM, Residue balance SAR10,000		

Adjustment of differences
SAR 32,768.00 vs SAR 10,000.00
Book Value(Bt) = (1-R)^n*K n=year K=Initial Cost

Adjustment of differences
SAR 32,768.00 vs SAR 10,000.00
R=1-(Bt/K)^1/5 n=year Bt=Book Value, K= Initial Cost R = 1- (10,000/100,000) ^1/5 R = 1- (0.1)^0.2 R=1-0.631 = 36.9%

Rate of Depreciation: 20%		
Year 0 (New)	:	100,000
Year 1 (0.369)(SAR100,000)= 36,900	:	63,100
Year 2 (0.369)(SAR63,100) = 23,284	:	39,816
Year 3 (0.369)(SAR39,816) = 14,692	:	25,124
Year 4 (0.369)(SAR25,124) = 9,270	:	15,853
Year 5 (0.369)(SAR15,853) = 5,850	:	10,000
% of multiplier		
Initial Cost : SAR 100,000		
Year 1	:	0.6310
Year 2	:	0.3982
Year 3	:	0.2512
Year 4	:	0.1585
Year 5	:	0.1000
Refer to Rushton's Table Top figure		

Note: The method above is also known as decline and diminishing balance)

3.2 The Obsolescence Factor

Webster's Third New International Dictionary (Unabridged 1961) defines 'obsolescence' as:

A factor included in depreciation to cover decline in value of assets due to invention of new and better processes or machines, changes in demand, in design or in the art, and other technical or legal changes, but not to cover physical depreciation.

Obsolescence can be divided into three (3) types:

a. Technological Obsolescence

Is due to change in design and materials of construction of the plant and machinery under consideration. Latest sophisticated equipment with reduced occupancy, improved efficiency or optimum energy consumption is common in plant and machinery. Technological obsolescence may arise out of development of new technology which brings in changes in rate of production or reduction of operating cost.

b. Functional Obsolescence

Functional obsolescence is the loss of value of machinery and equipment due to not meeting the standards of more efficient and less costly replacements. Equipment appraisers often see functional obsolescence when assets have seen technological advancements.

Arises when a machine already in function loses its optimum capacity owing to a decline in co-operation from its operating counterparts. It is also may arise due to faulty design or wrong location of industrial undertaking. It is a comparison to its more current replacement.

Functional obsolescence is also known as decrease in value due to non-availability of spares or accessories, or any other allied factors. Operating obsolescence is known as the present worth of the future excess operating cost of machine.

c. Economic Obsolescence

Economic obsolescence is the loss of value of an asset due to outside factors. These factors may include law or ordinance changes, increased cost of raw materials, labor, or utilities, financing ability, or changes in the industry. These economic obsolescence factors may affect the value of the machine or piece of equipment.

This is due to factors external to the plant and machinery itself. This could be due to change in demand of the product manufactured or shrinkage in supply of raw materials and labour, legislation affecting taxes or duties, environmental or zoning controls etc.

Factors that attribute to economic obsolescence:

i. Reduce demand for company's product
ii. Overcapacity in the industry
iii. Dislocation of raw material supplies
iv. Increasing cost of raw materials, labour, utilities, or transportation, while the selling price of the product remains fixed or increases at a much lower rate

3.3 Common Terminology Related to Depreciation and Obsolescence

The following are some terminologies commonly used in discussing depreciation and obsolescence:

NUL - Normal Useful life	…some consider that normal life is its physical life, whereas to others it's total economic life…. Variations of these two are numerous but to name a few • Physical life before overhaul • Physical life before it can no longer be economically rebuilt • Economic life which considers all forms of depreciation (accrued) • Economic life without consideration for its current physical condition, but rather functional and economic factors only
Curable	Curable physical deterioration is that which is caused by wear and tear which can be economically repaired and replaced.
Incurable	Incurable physical deterioration is that which cannot be economically corrected.
Economic age life	…is the period of time over which a piece of equipment can economically contribute to VALUE…..

Physical life	…..is the total period that the machinery and equipment will last up to a rebuild using standard preventive maintenance? At the end of an asset's NUL, it is considered an average point of time at which it must be idled or rebuilt…
Effective age	"….also known as exhausted life is that time or age indicated by the condition and utility of an item…."

3.4 Codes on Depreciation

The following are commonly used codes to describe the condition of a machine:

Condition	Explanation	Depreciation (%)
New	Brand New	0-5
Excellent	Excellent, just like brand new	6-10
Ver Good	Very good with no repairs required in foreseable future. Longer time than average before any maintenance required	11-20
Good	Good condition requiring standard routine maintenance	21-50
Fair	Fair condition, below average but can be operated continuous repairs and maintenance for limited use	51-60
Poor	Poor condition may or may not work, needs immediate repairs and may or may not work or even may require maintenance for limited use	61-90
Scrap	Scrap conidtion and cannot be used for intended use	91-100

Source: Kirit Budhbhatti

3.5 Using Rushton Table

Usage of Rushton Tables will be further explained under Cost Approach.

4.0 MARKET APPROACH

The market approach utilizes a direct sales comparison of ME with similar characteristics, but adjustments will need to be made in case of dissimilarity.

For example, valuation of a motor car may find a direct match in the manufacturer, model, age and accessories the price of which is readily available in published material.

4.1 Definition and Interpretation

Market approach is defined as “the value of plant and equipment being based on the evidence gathered in the marketplace where similar assets have been sold in an open market scenario”.

Applied with regards to property that have established markets for buying and selling. Limited market-indication: lack of transactions- difficult to measure by this approach.

Often lack sufficient knowledge regarding sales, although there may be sufficient sales transaction taking place. Even when there are sufficient sales, we may not have access to the facts of those sales.

Market Data – Essential prerequisite for application of the approach. Relevant in changing situations that lead to the development of market data for analysis. Sale within dull economic activities-not valid in thriving economic period.

Usually this method used on ME of non-investment character but having marketability.

4.2 Market Value as Basis of Valuation

Machinery and equipment is generally transacted at its market value. This is the amount a property would bring if offered for sale in the open market at the date of valuation under circumstances that meet the requirements of the Market Value definition. The use of the ME could be of the continuity of the asset in use or for some economic life after it retired. These determinations of asset use arise the market evidences.

The market approach is mainly used in determining the market value of machinery. However, for process plant it depends on the types of process plants. It uses recent sales of machinery in the same year and having similar characteristics as the subject asset. The sales have to be first verified and deemed valid before they can be used. The valuer uses these sales to determine the market value of the asset. The process of determining the market value requires the valuer to match the asset with recently transacted machinery that have the most similar characteristics or features.

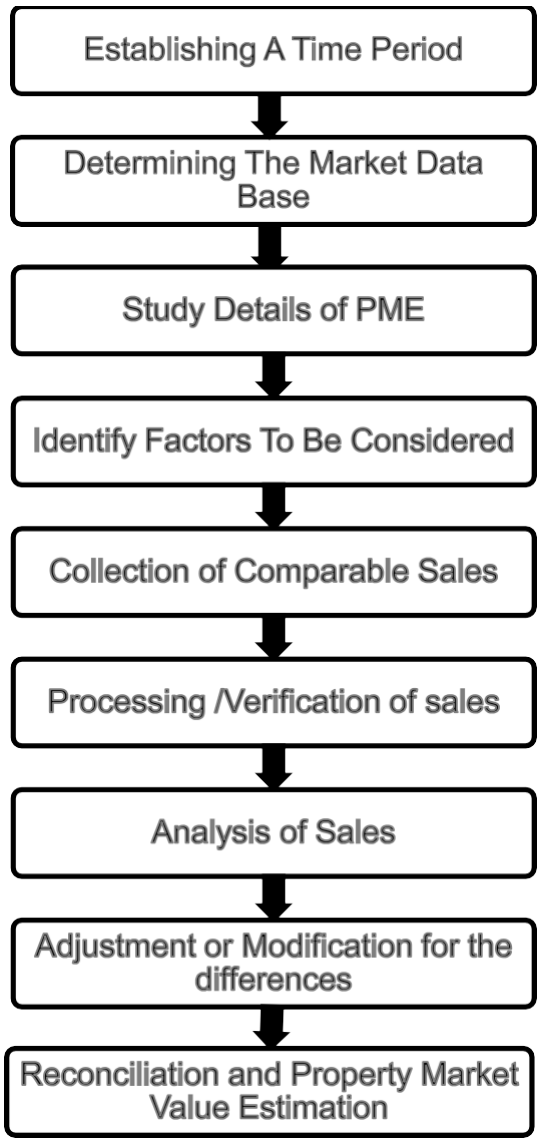
Usually this method used on ME of non-investment character but having marketability.

The market approach utilizes a direct sales comparison of ME with similar characteristics, but adjustments will need to be made in case of dissimilarity.

For example, valuation of a motor car may find a direct match in the manufacturer, model, age and accessories the price of which is readily available in published material.

4.3 Application of Market Approach

Application of the market approach is best described by the following set of steps:



4.3.1 Establishing a Time Period

While there are no set rules as to how long a period of time should be considered, it is obvious that sales made close to the date of valuations should be given the most consideration. Sales dating back over a long period of time while helpful as a guide to value trends, may encompass different economic level, and this may cause them to have doubtful value in current market conditions. If there are sufficient sales (3-5 sales) within a one-year period or a reasonable duration, then certain adjustment should be given on these sales. It may be necessary to go back in time as much as five or ten years, but this can be done safely only if there have been no radical swings in the economic climate over that period. ME indexing may be the right solution to encounter this scenario. Consider Market Exposure – the length of time that the property interest being valued woudl have been offered on the market prior to the theoretical consumation of a sale on the effective date of the valuation. Consider Level of Trade – determine what level of trade is most appropriate to the assignment – Liquidation, sale for Removal, Continued Use, "Other".

4.3.2 Determining Market Database

Over the years, with the nature of continuous number of assets to be valued, it is likely and helpful if proper Data Base that store information of trends, values and historical facts can be established. However, there is no particular advantage in incorporating plenty of Data unless it contains reasonably classification of asset that can match the subject asset to be valued.

4.3.3 Study Details of Subject ME Assets

The subject asset needs to be studied in terms of specification (model, make, serial number, capacity, accessories etc.) and legal requirement (by law, environmental requirement, permit, rights, etc.). Information on registration of an asset, may be available from International Registry of Shipping association, Airlines Organization requirement, Department of Safety and Health, Metrology Corporation etc. Other information such as detail specification of the ME can be obtained from Maintenance Manual.

4.3.4 Identify Factors to be Considered for Adjustment

The following are some factors affecting value that are considered for adjustment in the ME value analysis:

a. Factors Affecting Value

i. Time factor

- Time factor may be very significant during which cost of material increases due to the shortage in supply. If market conditions have not changed, no adjustment is required even though a considerable period of time may have lapsed.

- Changes in market condition may result from changes in supply of raw material, shortage of production and fluctuations in supply and demand. Sometimes several factors may cause a change in market conditions. A recession tends to deflate all ME prices, but specific type of ME will be affected differently. A decline in demand may affect only certain category of ME.

- Sales and re-sales of the same ME often provide the best indication of the changes in market conditions over time. If data on re- sales are unavailable, sales or price quotation of ME from the supplier or manufacturer can be used. In either case, the sale transactions must be examined thoroughly.

ii. Country of Origin

- ME from different country of origin affects the value of almost all types of asset. An asset known to be from Europe would normally fetches a higher value than ME from other part of the world. Therefore, country of origin can be a crucial factor. However, this may be change as most country within the globe have come out with innovation and advance technology equipment.

iii. Transaction Date

- Most markets are subject to price fluctuation which can be extremely rapid. Comparable evidence must therefore be as up to date as possible to avoid unnecessary adjustment.

- This should filter into the Appraisal Report Date and the Effective Date of the Appraisal.

iv. Definition of Report Date and Effective Date
The British English term for Report Date and Effective Date is material date of valuation.

v. Physical Characteristics
Important physical characteristics that might influence ME values include:
- Special foundation
- Support structure and special cladding
- Shelter and Temperature control room
- Sound proof wall
- Others

vi. Capacity
- Comparable ME should be of similar capacity. In the production plant sector capacity of a Mill will differ the size of equipment need to be installed and needed to run the factory. For example, 20 tons per hours Palm Oil Mill equipment installed may be different from 30 tons per hours Palm Oil Mill.

vii. Depreciation
- Straight line depreciation; or
- Decline or written down value of depreciation; or
- Diminishing balance of depreciation; or
- Observed deterioration

viii. Physical Condition
- Accident, explosion, fire, collapse etc.
- Catastrophe, collision, falls etc.
- Deterioration due to sudden causes like breakdown, mishandling etc.
- Wear and tear from use

ix. Functional
- Inadequacy due to misjudgement
- Faulty design

x. Economical
- Change in demand of the product
- Zoning controls
- Environmental issues
- Low supply of raw materials
- Labour shortages

xi. Technological
- Change in design and material
- New invention

b. Factors Influencing Estimation of Life

i. Condition
ii. Standard of maintenance
iii. Usage
iv. Finite sources
v. Market trend

c. Factors for Adjustment of Variable Factors

There are a number of variable factors that can have significant impact on the market value of plant and equipment:

i. Costs of installation and commissioning
ii. De-commissioning and removal (who pays?)
iii. Finite sources of raw materials
iv. Limited life of building, land tenure
v. Legislation changes (i.e: taxes)
vi. Intangible assets associated with plant

d. Trade Terms

The following are some commonly used trade terms in ME valuation:

Ex works	Requires the seller to deliver goods at his own place of business. All other transportation costs and risks are assumed by the buyer.
FOB – Freight on board	Requires the seller to deliver goods on board a vessel designated by the buyer. The seller fulfils its obligations when the goods have passed the ship's rail.
CIF – Cost, Insurance and Freight	Requires the seller to arrange for the carriage of goods by sea to a port of destination and provide the buyer with the documents necessary to obtain the goods from the carrier.

4.3.5 Collection of Comparable Sales

Having decided upon the time and ME to be value, the valuer proceeds to collect and collate the sales. Sales that are normally gathered mainly from previous record and data base. Sales offers to buy or sell on internet are generally unreliable. "Comparable" means collection of recent sales of ME similar to the subject ME being valued.

Similarly, a valuer must investigate the market data to determine whether they are factually correct and accurate. Only **reliable quotations from manufacturer and supplier** may be used in the valuation and determination of a ME value, as they represented the most accurate source of information in the market.

Sources of comparable data include manufacturer publications, magazines, buyers guide, yellow and green pages, trade shows, classified advertisement etc. Important details of each comparable sale are described in the valuation report. An appendix of micro description contained all description of items to be valued.

The Market Approach uses suitable comparable asset of similar physical and utility characteristic in determining market value. Thus, the following rules apply:

a. Priority must be given to the latest transaction on the similar ME.
b. Latest manufacturer price quotation.
c. Similarities of comparable with respect to time factor specifications, physical and legal characteristics.
d. Adjustments shall be made for any dissimilarity.

4.3.6 Processing/Verification of Market Data

- **Data Validity**
  Prior to the analysis and interpretation of the valid market data, valuer need to verify and confirm that all sales data are reliable and derive from trusted source. The determination of whether the market data is a valid one or not is primarily a process of elimination.

- **Verification**
  Market Data must be verified before it can be used as a comparison. The following verifications are normally required:

  a. The Market Data is on the basis of market price.

b. It has been investigated and verified to ensure the information is reliable.
c. The details of the sale are correct, for example price, model, make, type, capacity, etc.
d. Status of the sale.

4.3.7 Source of the information on the sale.

After data evidences have been gathered and verified, systematic analysis begins. The invalid data must be discarded while the bona fide sales must be verified. Each sale price should be stated in terms of appropriate units of comparison. The units of comparison selected depend on the type of ME.

Analysis of Sales Data
Typical units of comparison include:

Unit of Comparison	Application
Tonnage/liter	Tank, storage cylinder
Gallon per hour	Pumps,
Tons per hour	digester, screw press
Tonnage	Hoist, press
Kilowatts (kW)	Generator Set
Bar/ Psi/cfm	Air Compressor
Tonnage	Chiller
Tons per hour	Sterilizer

4.3.8 Adjustment/Modification for Subject Asset – Comparison Data Differences

Since comparable of Market Data may not be identical to the subject ME, adjustments may be made for date of sale, model, type, capacity, preparation of sites, accessories, year make, country of origin, etc. The main idea is to simulate the price that would have been paid if each comparable were identical to the ME. If the comparable is superior to the subject in a factor or aspect, then a downward adjustment is needed for that factor. Likewise, if the comparable is inferior to the subject in an aspect, then an upward adjustment for that aspect is needed. The adjustment is somewhat subjective and relies on the valuer's training and experience. From the analysis of the group of adjusted market data of the comparable, the valuer selects an indicator of value that is representative of the subject ME. It is possible for valuers to choose different indicator of value which ultimately will provide different property values.

Finally, reconcile the multiple value indications that result from the adjustment (upward or downward) of the comparable into a single value indication

- **Steps for Adjustments**

  Adjustments for differences are made to the price of each comparable ME to make the comparable equal to the subject machine. In order to ensure the adjustments are accurately done the following steps need to be carried out:

  a. Identify the factors that affect the value of the ME being valued.
  b. Compare the attributes of each comparable with those of the subject ME and determine the difference in each factor of comparison between the comparable and the subject ME.
  c. Adjustment is made for each and every of the dissimilar factors.
  d. Derive a net adjustment for each comparable and apply it to the unit price of the comparable to arrive at a range of adjusted unit prices for the subject ME.
  e. From this range of adjusted unit prices, the valuer shall decide the most reasonable unit price for the subject ME. The adjusted unit price from the best comparable is normally chosen as the most reasonable unit price for the subject ME.

- **Factors for Adjustment**

  Market of similar ME are analysed and adjusted for differences between the subject ME and the comparables. The amount of adjustment needed in sales analysis will vary with type of ME being valued. Recent sales of any ME will probably be the most favourable to be chosen if it meets the criteria.

  Some of the major factors which would require adjustments includes the type, model, capacity, foundation, manufacturer, year make, special foundation, insurance, transportation etc.

- **Technique of Adjustment**

  a. All adjustments made must be reasonable.
  b. The comparable used should not entail too many adjustments.
  c. The amount adjusted for each factor should not also be excessive. Generally, adjustments should not involve more than four factors and each

adjustment should not be more than thirty (30) percent. Any variance of more than thirty (30) percent needs justification.

d. Each adjustment must be adequately explained and substantiated. Adjustments for differences between a comparable ME and a subject property are frequently expressed in percentage or monetary value.
e. Where the differences can be quantified for example special foundation and pit which includes costs of site preparation.

4.4 Theory and Principles of Comparison Method

The underlying principle used in the Market approach is based primarily on the principle of substitution. This approach assumes a prudent (or rational) individual will pay no more for a property than it would cost to purchase a comparable substitute property. The approach recognizes that a typical buyer will compare asking prices and seek to purchase the asset that meets his or her wants and needs for the lowest cost. In developing the market approach, the valuer attempts to interpret and measure the actions of parties involved in the marketplace, including buyers, sellers, and investors.

Comparable evidences are widely used in the valuation of ME despite the fact that, by nature, asset transactions frequently do not fully meet the criteria required to provide good evidences. The amount of comparable evidence will be further reduced because it is actually very rare for two properties to be identical. Even the same brand of identical design ME in a same production plant, or in a factory, may have differences of aspect and condition that can make a significant difference to their value.

The complex nature of most assets is another factor which affects the use of comparable evidence. An individual machine shop is a combination of a very large number of items, ranging from small to large and aspects through the type, size, make, model and capacity. In an ideal world, each of these elements in a factory being valued should match those of the comparable – an unlikely occurrence in practice. A further significant factor affecting the use of comparable evidence in ME valuation is that transaction markets lack of details information. Details of transaction are often publicly available in classified advertisement and even when they are published, they may be out of date and lack of details. This situation is encountered worldwide but transactional evidence is particularly difficult to be obtained correctly.

For all these reasons, it is unlikely that comparable evidences will be a perfect match for the ME to be valued. The valuer will need to analyze and interpret available data and use it to provide guidance, rather than concrete evidences, towards the final figure reported. In a weak or rapidly moving market, or for certain types of ME, good evidences may be very limited, and it may therefore be difficult or impossible to provide a figure in which the valuer has complete evidence.

Most reliable when there is an active market providing a sufficient number of sales of comparable MEs that can be independently verified through reliable source.

The market approach considers prices recently paid for similar assets in the used market, with adjustments made to the indicated market prices to reflect condition and utility of the appraised asset relative to the market comparable. The logic behind the market approach is that a prudent investor can go to a marketplace and purchase an existing facility or purchase individual pieces of equipment in the used market to assemble an operating package.

The following are the three most commonly used techniques in sales comparison or market approach:

i. Direct Match
ii. Comparable Match
iii. Percent of Cost

The market approach is applied as per the following:

a. Direct Match

i. This technique establishes value based on a direct match of the subject to the sales of identical assets or comparable.
ii. Preferred when valuing plant and machinery for which there is a known and active *secondary market*.
iii. In applying it under the ‘in-use’ premise, an allowance then is made to reflect the costs of delivery, installation, taxes, fees and duties. In some countries, it is known as 'additional cost’.
iv. Differences in the premise of value require different identification of additional cost.

Example:
Blue/Black "575M Maranello F1" Ferrari (2004 year built, 50,000km)

Specifications	Comparable 1	Comparable 2	Comparable 3
Year	2004	2004	2004
Mileage	60,000 km	51,000 km	55,000 km
Colour	Yellow/Black	Blue/Black	Red/Biege
Market Price	SAR 280,000	SAR 290,000	SAR 285,000
Opinion of Value	**SAR 290,000**		

The comparable No. 2 is used as comparable to value the Ferrari Car due to the similarity on year built, colour and mileage.

b. Comparable Match

i. This technique establishes value based on analysis of similar (but not identical) assets using some measure of utilities (size, capacity, etc) as the basis of comparison.
ii. The main differences from the direct sales comparison method is that the comparisons may not be similar in terms of model and year built, but has other similarities such as capacity, brand acceptance in the market or same country of origin.
iii. Some adjustments have to be made on the comparable before the value of the asset can be derived.

Example: 1981 Built, 5106 Gross Registered Tonnage (GRT) Cargo Vessel

Specifications	Comparable 1	Comparable 2	Comparable 3
Year	1983	1980	1986
GRT	6,200	4,300	4,800
Market Value	SAR2.5 mln	SAR2.2 mln	SAR2.6 mln
Age/Condition	-5%	0%	-10%
Size Factor	- 10%	+ 10%	+ 5%
Total Adjusted	**-15%**	**+10%**	**-5%**
Adjusted MV	SAR2.13 mil	SAR2.42 mil	SAR2.47 mil
Opinion of Value	**SAR 2.42 mil**		

Note:
Comparable match technique needs valuer to identify the difference factors to be accelerated. The valuer should conduct his own review on the adjustment factors to be applied based on the machinery to be value and source of data.

Elements of Comparability

- Vintage & Effective Age
- Condition
- Capacity
- Features (accessories)
- Location
- Manufacturer
- Motivation of PartiesPrice
- Quality
- Quantity
- Time of Sale
- Type of Sale

c. Percent of Cost

i. This technique establishes value by first developing a ratio of the selling price of used transacted comparable to the Cost of Replacement as a New asset at the time of sale.
ii. Recent market prices for items of machinery and equipment in a particular asset class that has an active ***secondary market*** are reviewed with respect to age and condition.
iii. Then they are ***compared with a benchmark price***, such as the duplication (reproduction) cost new. The ratios of the market prices top benchmark amounts are applied to similar assets in the class if the specific secondary market is too thin to exhibit sufficient, appropriate and direct comparability.

Example: 1998 model M550C "Meiki" Injection Moulding Machine

Specifications	Subject	Comparable 1	Comparable 2
Year/Model	1998/M550C	1998/M350C	1998/M450C
Replacement Cost New	SAR267,000	SAR171,000	SAR210,000
Used Market Price	?	SAR43,000	SAR53,000
Percent Cost	(25%)	25.15%	25.24%
Opinion of Value	**SAR67,000**		

4.5 How to Calculate Depreciation/Obsolescence

4.5.1 Using Rushton's Table

- Provide multiplier for both straight-line and diminishing balance depreciation
- Requires
  a. Economic life
  b. Age

4.5.2 Depends on purpose of valuation

- Insurance
  Straight line method – (Refer to top figure of the Rushton table)
- Market Value
  Diminishing value method (Refer to bottom figures of Rushton table)

4.6 Strengths and Weaknesses of Market Approach

4.6.1 Strengths

- Most reliable indicator of market value for individual item
- Direct measures of depreciation for individual items of plant and machinery

4.6.2 Weaknesses

- Lack of comparable sales
- Subjectivity of comparison
- Timeliness of data
- Specilised equipment or equipment that has been modified.

5.0 COST APPROACH

5.1 Introduction

Budhbhatti (1999) indicates that the cost approach is based on the principle that assets decrease in value (or depreciate) through aging, changes in function utility, as well as from negative external influences. The underlying assumption is that an informed purchaser would not pay more for an item than the cost of a substitute with the same utility and functionality. Methods under this approach generally provide a meaningful indication of value for specialised items associated with a viable business or justified by economic demand (Derry, 2008).

5.2 Theory and Principles of Cost Approaches

According to IVS2020, the cost approach provides an indication of value the economic principle that a buyer will pay no more for an asset than the cost to obtain an asset of equal utility, whether by purchase or by construction, unless undue time, inconvenience, risk or other factors are involved. The approach provides an indication of value by calculating the current replacement or reproduction cost of an asset and making deductions for physical deterioration and all other relevant forms of obsolescence.

The cost approach should be applied and afforded significant weight under the following circumstances:

(a) Participants would be able to recreate an asset with substantially the same utility as the subject asset, without regulatory or legal restrictions, and the asset could be recreated quickly enough that a participant would not be willing to pay a significant premium for the ability to use the subject asset immediately,

(b) The asset is not directly income-generating and the unique nature of the asset makes using an income approach or market approach unfeasible, and/or

(c) The basis of value being used is fundamentally based on replacement cost, such as replacement value.

5.3 Implementation of Cost Method

Korner (2009) stated that the cost approach offers the only applicable method when valuing property that is not traded, market transactions of comparable items are not available, data cannot be extrapolated from larger transactions, transactions are non-existent and there is lack of financial data concerning the subject property or item. It should be noted that application of the cost approach is not without problems. The major difficulties are measuring economic obsolescence and avoiding dependence on the valuer's subjective judgements.

In the cost approach, the starting point is the determination of the duplication (reproduction) cost new or the replacement cost new (RCN) (IVSC, 2010; Korner, 2009; Derry, 2008 and Budhbhatti, 1999). The cost to reproduce or replace the subject with a new asset, either identical (reproduction) or having the same utility (replacement), establishes the highest amount a prudent investor is likely to pay for new and unused property. This will include both direct and indirect costs, including fees (Maninggo, 2010; Mohd Khairudin, 2008 and Budhbhatti, 1999).

Korner (2009) have elaborated on the three (3) methodologies under cost approach as follows:

a) ***Replacement Cost Method***: a method that indicates value by calculating the cost of a similar asset offering equivalent utility,

b) ***Reproduction Cost Method***: a method under the cost that indicates value by calculating the cost to recreating a replica of an asset, and

c) ***Summation Method***: a method that calculates the value of an asset by the addition of the separate values of its component parts.

5.3.1 Replacement Cost Method

Generally, replacement cost is the cost that is relevant to determining the price that a participant would pay as it is based on replicating the utility of the asset, not the exact physical properties of the asset.

Usually replacement cost is adjusted for physical deterioration and all relevant forms of obsolescence. After such adjustments, this can be referred to as depreciated replacement cost.

The key steps in the replacement cost method are:

(a) Calculate all of the costs that would be incurred by a typical participant seeking to create or obtain an asset providing equivalent utility,

(b) Determine whether there is any deprecation related to physical, functional and external obsolescence associated with the subject asset, and

(c) Deduct total deprecation from the total costs to arrive at a value for the subject asset.

The replacement cost is generally that of a modern equivalent asset, which is one that provides similar function and equivalent utility to the asset being valued, but which is of a current design and constructed or made using current cost-effective materials and techniques.

5.3.2 Reproduction Cost Method

Reproduction cost is appropriate in circumstances such as the following:

(a) The cost of a modern equivalent asset is greater than the cost of recreating a replica of the subject asset, or
(b) The utility offered by the subject asset could only be provided by a replica rather than a modern equivalent.

The key steps in the reproduction cost method are:

(a) Calculate all of the costs that would be incurred by a typical participant seeking to create an exact replica of the subject asset,

(b) Determine whether there is any deprecation related to physical, functional and external obsolescence associated with the subject asset, and

(c) Deduct total deprecation from the total costs to arrive at a value for the subject asset.

(d) The difference between Reproduction Cost and Replacement Cost is called excess capital cost, representing the lower capital investment required to obtain the most economical new asset to perform the same service as the subject. Excess capital cost is a measure of functional obsolescence.

In addition to the direct cost approach to establish Reproduction Cost there is another technique called Trending or Indexing

- Indexing is a method of pricing
- Index factors are applied to historical cost to estimate current cost
- An index will derive reproduction cost and not replacement cost

There are limitations to the use of trending or indexing

- The purpose for which the index was developed
- The weightings or the mix used in developing the index
- Sometimes referred to as the “tool of last resort”

Index application

- Use Cost indices which are specific to the type of assets being valued
- Understand how the index was developed
- Know the mix within an index
- Classifications

- Industries
- Categories
- Trend Factor must only be applied to historical costs
- Historical Cost = Cost of a property when it was first placed into service by its *first owner*.
- Do not apply trend factors to cost resulting from prior allocation of purchase price or used costs

Historical Cost versus Original Cost

- Historical cost is the cost of a property when it was first placed into service by its first owner
- Original cost is the initial cost of a property in the hands of its present owner
- May not be the first owner and who may have purchased at a price greater or less than the historical cost
- May be the used cost of the property, whereas historical cost can never be a used cost
- Historical cost and original cost may be the same
- The terms historical cost and original costs have different definitions within different professional communities.
- When using the indirect costing or trending method only historical costs can be utilized

A Sample PPI for illustration purposes only

Year	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2005												100	100
2006	102.2	102.1	101.8	101.6	102.8	101.9	100.9	100.8	101.9	98.6	99.3	103.1	**101.4**
2007	101.5	101.6	101.3	102.5	102.3	103.5	102.7	99.8	99.8	99.6	99.9	101.3	**101.3**
2008	101.9	104.0	104.2	103.2	103.8	105.2	104.4	101.0	101.9	102.1	104.2	103.9	**103.3**
2009	103.3	105.1	104.8	105.3	104.5	105.7	105.6	104.0	104.2	104.2	104.7	105.2	**104.7**
2010	106.4	109.7	111.0	110.7	114.4	114.2	114.6	107.4	109.3	109.3	110.9	111.8	**110.8**
2011	109.6	109.7	112.4	113.0	114.8	112.6	114.7	116.5	112.3	112.3	109.8	112.0	**112.5**
2012	1128	116.9	114.5	116.6	115.1	116.6	118.6	118.0	117.3	117.3	118.1	122.3	**201.6**
2013	122.6	125.1	128.8	125.9	122.5	122.7	120.7	120.7	124.7	124.7	125.0	123.6	**123.9**
2014	123.6	125.8	125.7	124.2	123.1	124.3	125.1	125.1	128.1	128.1	127.8	127.5	**125.7**
2015	131.5	135.3	134.8	133.5	132.1	134.5	136.6	136.6	141.1	141.1	139.2	137.2	**136.1**
2016	142.2	143.9	142.6	147.0	145.4	150.1	149.5	149.7	148.3	148.3	147.0	145.5	**146.6**
2017	150.7	152.5	151.8	151.8	151.1	151.2	152.7	153.4	157.4	157.4	155.4	155.1	**153.4**
2018	159.2	159.4	157.1	157.2	153.8	154.5	157.5	157.8	158.7	158.7	158.4	157.8	**157.5**
2019	159.2	158.5	158.6	160.6	159.7	163.4	164.5	164.1	162.0	162.0	163.1	161.9	**161.5**
2020	166.5	169.6	170.5	166.3	169.3	167.8	167.2	167.2	167.1	167.1	166.3	166.5	**167.6**
All indexes are subject to revision four months after original publication.													

How are trend factors derived?
Divide the subject year by the base year ($B$1)

	A	B	C	D
	Year	**Index**	**Trend Factor**	**Formula**
1	2005	100.0	1.00	=B1/$B$1
2	2013	123.9	1.24	=B2/$B$1
3	2014	125.7	1.26	=B3/$B$1
4	2015	136.1	1.36	=B4/$B$1
5	2016	146.6	1.47	=B5/$B$1
6	2017	153.4	1.53	=B6/$B$1
7	2018	157.5	1.58	=B7/$B$1
8	2019	161.5	1.62	=B8/$B$1
9	2020	167.6	1.68	=B9/$B$1

Example of Trending or Indexing

To estimate the current reproduction cost new in 2020 of a machine that had a historical cost in 2005 of SAR 1,000, a 2020 index of 167.6, and a 2005 index of 100 the calculation would be as follows:

Current Reproduction Cost New =	Current Index / Base Year Index	x Historical Cost
Then by Substitution:		
Current Reproduction Cost New =	2020 Index / 2005 Index	x Historical Cost
Current Reproduction Cost New =	167.6 / 100	x SAR1,000
Current Reproduction Cost New =	1.68	x SAR1,000 = SAR 1,680

5.3.3 Valuation Example

Below is a valuation calculation example for Indemnity Value and Market Value Ex-Situ:

2 megawatts of electrical power station made in Japan was installed 5 years ago at a cost of SAR 3,500,000. Information that reveals the cost of electrical power to the same his capacity now

involves the cost of purchase of SAR 4,000,000. Other costs involved are:

- Transportation cost: SAR 150,000
- Insurance: SAR 40,000
- Installation cost: SAR 100,000
- Commissioning cost: SAR 100,000
- Consultants fees: SAR 100,000
- Imports duties/taxes: SAR 200,000.

a) Indemnity Value

If the machinery and equipment has assumed economic life span of 20 years and 5 years old, Indemnity Value calculation is as follows:

Replacement Cost New	SAR 4,690,000(*)
Effective multiplier (depreciation @ 22%)	x 0.78 (**)
Indemnity Value	SAR 3,658,200

Note:
(*) Calculation of Replacement Cost New - SAR 4,690,000

Cost of Purchase:	SAR 4,000,000
Plus (+) :	
(1) Transportation cost:	SAR 150,000
(2) Insurance:	SAR 40,000
(3) Installation cost:	SAR 100,000
(4) Commissioning cost:	SAR 100,000
(5) Consultants fees:	SAR 100,000
(6) Imports duties/taxes :	SAR 200,000
Total	SAR 4,690,000

(**) Refer Rushton Table – top figure – Straight Line (Indemnity)

b) Market Value Ex-Situ

If the plant and machinery has assumed economic life span of 20 years and 5 years old, Market Value Ex-Situ calculation is as follows:

Replacement Cost New		SAR 4,690,000
Effective multiplier (depreciation @ 44%)		x 0.56 (**)
Market Value		SAR 2,626,400
Less		
Dismantling Cost	SAR 50,000	
Transportation	SAR 150,000	SAR 200,000 (***)
Market value (ex-situ)		SAR 2,426,400

Note:
(*) Calculation of Replacement Cost New - SAR 4,690,000
Cost of Purchase: SAR 4,000,000
Plus (+) :
(1) Transportation cost: SAR 150,000
(2) Insurance: SAR 40,000
(3) Installation cost: SAR 100,000
(4) Commissioning cost: SAR 100,000
(5) Consultants fees: SAR 100,000
(6) Imports duties/taxes: SAR 200,000

(**) Refer Rushton Table – bottom figures – Diminishing Value
(***) The dismantling cost and transportation for market value ex-situ will be less due to the transfer of the machine to a new place.

5.3.4 Summation Method

The summation method, also referred to as the underlying asset method, is typically used for investment companies or other types of assets or entities for which value is primarily a factor of the values of their holdings.

The key steps in the summation method are:

a) Value each of the component assets that are part of the subject asset using the appropriate valuation approaches and methods, and
b) Add the value of the component assets together to reach the value of the subject asset.

5.3.5 Costs to be Considered

The cost approach should capture all the costs that would be incurred by a typical machinery and equipment.

The cost elements may differ depending on the type of the asset and should include the direct and indirect costs that would be required to replace/recreate the asset as of the valuation date. Some common items to consider include:

a) Direct costs

1. Materials
2. Labour

b) Indirect costs

Indirect Cost may or may not be in the Value proposition depending on who the work is being done for. The Intended Users. Example of some indirect cost are as follows:

1. Transport costs
2. Installation costs
3. Professional fees (design, permit, architectural, legal, etc)
4. Other fees (commissions, etc)
5. Overheads
6. Taxes
7. Finance costs (e.g., interest on debt financing), and
8. Profit margin/entrepreneurial profit to the creator of the asset (e.g., return to investors).

An asset acquired from a third party would presumably reflect their costs associated with creating the asset as well as some form of profit margin to provide a return on their investment. As such, under bases of value that assume a hypothetical transaction, it may be appropriate to include an assumed profit margin on certain costs which can be expressed as a target profit, either a lump sum or a percentage return on cost or value.

However, financing costs, if included, may already reflect investors' return on capital deployed. Therefore, valuers should be cautious when including both financing costs and profit margins.

When costs are derived from actual, quoted or estimated prices by third party suppliers or contractors, these costs will already include a third parties' desired level of profit.

The actual costs incurred in creating the subject asset (or a comparable reference asset) may be available and provide a relevant indicator of the cost of the asset. However, adjustments may need to be made to reflect the following:

(a) Cost fluctuations between the date on which this cost was incurred and the valuation date, and

(b) Any typical or exceptional costs, or savings, that are reflected in the cost data.

Some of the added value to be considered and added when determining the cost of machinery and equipment are as follows:

1. Purchase price add on
2. Transportation charges
3. Insurance in transit

4. Sales and other taxes
5. Purchase commission
6. Installation costs
7. Expenditures to test the asset
8. Special platforms

Example – Valuing a Conveyor


Figure 1: Channel Frame


Figure 2: Belt


Figure 3: Motor Drive


Figure 4: Sprocket & Chain


Figure 5: Lattice Frame


Figure 6: Channel Frame


Figure 7: Tail Drum

Figure 8: Idler

Figure 9: Roll of Belting

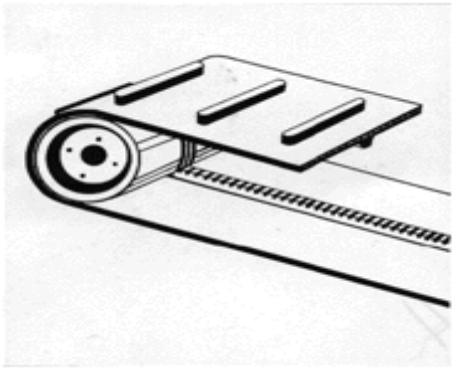


Figure 10: Tail Drum: Note Belt

Figure 11: Drives and motors

Observations
101.5 cm long center to center, 10 cm wide
2.5 cm wide formed 308 stainless steel frame
50 mm diameter by 10 cm long plastic rollers, 5-cm on center
Roller bed has 50-mm diameter ´ 10 cm long plastic roller return idlers, 20 cm on center
4 cm diameter by 10 cm long rubber lagged head drum
2.5 cm diameter ´ 10 cm galvanized tail drum
10 cm wide 6 ply sanitary rubber belting
3-cm diameter sprocket (one required)
100-mm diameter sprocket with set collar (one required)
25 mm roller chain drive (14 cm long)
Angle gear motor drive, 1HP/48rpm, 220/440 volt AC
Six pairs of 50 mm square pipe galvanized saddle legs average 12 cm high
Wiring
15 lineal cm 13 mm seal tight flexible connection
60 lineal cm 13 mm conduit with three strands of 14 gauge wire
Safety switch, 30 amp, 240 volts
Other
Labor: estimated to construct in place is 2 workers for 8 hours each
Engineering: estimated time is one worker for 16 hours

Conveyor Pricing Information	SAR Cost	Unit of Measure
2.5 cm dia. Formed 308 stainless steel frame	15.40	Per cm
50 mm diameter x 10 cm long plastic rollers	24.15	Each
10 cm wide six-ply sanitary rubber belting	1.50	Per cm
3 cm sprocket	15.35	Each
100 mm sprocket with set collar	9.55	Each
4 cm dia. x 10 cm long rubber lagged head drum, with pillow blocks and bearings	93.45	Each
2.5 cm diameter galvanized tail drum assembly complete	26.75	Each
25 mm roller chain	2.63	Per cm
1 motor, 1 horsepower, 48 RPM	765.50	Each
1 pair 50 mmsquare pipe saddle legs adjustable height	15.40	Each
13 mm seal-tight flexible conduit and wire	30.00	Per 5 cm
13 mm conduit and wire	20.00	Per 5 cm
30 amp 220 volt safety switch	197.65	Each
Labor for fabrication	33.68	Per hour
Enineering	38.35	Per hour

Component	SAR	Component	SAR
203 cm frame material (2 sides of 101.5 cm), 15.40 per cm	3,126.20	100 mm sprocket w/set collar	40.00
19 Plastic rollers (101.5- 2 (4 cm head dia. x .5) - 1.25 (2.5 cm dia. Tail x .5)) = 98.25, 98.25/5 (rollers on 5 cm centers) = 19.65 = 19 rollers required, spacing on last roller to tail will be less than 5 cm	458.85	25 mm roller chain, 14 cm long	36.82
4 Return rollers ((101.5- 2 (4 cm head dia. x .5) - 1.25 (2.5 cm dia. Tail x .5)) = 98.25, 98.25/20 (rollers on 20 cm centers) = 4.9 = 4 rollers required, spacing on last roller to tail will be less than 20 cm	96.60	1 HP motor	3,000.00
Belting, 213.2 cm (see calculation below)	319.80	6 pairs of 50 mm square legs	360.00
Head Drum	375.00	15 cm of 13 mm dia. seal tight conduit	90.00
Tail Drum	110.00	5 cm of 13 mm dia. conduit with 14 gauge wire	20.00
3 cm sprocket	60.00	1 30 amp 220 volt safety switch	197.65
Subtotal	4,546.45	16 hours labor @ 33.68	538.88
		Subtotal above	4,283.35
Belting		Subtotal left column	4,546.45
Head drum is 4 cm, 4 x 3.14=12.56 x .5 = 6.28	6.28	Total Direct Costs	8,829.80
Tail drum is 2.5 cm, 2.5 x 3.14=7.85 x .5 =3.93	3.93	16 hours engineering @ 38.35	613.60
top and bottom are 101.5 cm each, 101.5 x 2	203.00	Total Cost	9,443.40
Total belt cm	213.21		
Say	213.2		

Circumference =pD

Pi = 3.14

5.4 Depreciation and Obsolescence

Once the cost new is determined, it must be adjusted to reflect any form of depreciation. This is defined by IAS (2010) as “the systematic allocation of depreciable amount of an asset over its useful life” (IAS 16.6 and IAS 36.6).

In the context of valuation, “depreciation” refers to adjustments made to the estimated cost of creating an asset of equal utility to reflect the impact on value of any obsolescence affecting the subject asset. This differs from the understanding of financial practitioners such as accountants

Where it generally refers to a method for systematically expensing capital expenditure over time.

Depreciation adjustments are normally considered for the following types of obsolescence, which may be further divided into subcategories when making adjustments:

5.4.1 Physical Deterioration

Physical deterioration for plant and machinery is any loss of utility due to the physical deterioration of the asset or its components resulting from its age and usage. (IVSC, 2017). The term

“Physical deterioration” is treated as synonymous with “depreciation”, especially when there is no functional obsolescence. Friction, impact, vibration, fatigue, deformation or distortion due to stress or force may cause physical deterioration, and may arise from the passage of time, exposure to natural elements, or the impact of the operating environment (Korner, 2009). Some indication of machinery physical deterioration includes product rejection, waste of material, excessive maintenance needs and repair costs running far above similar machine.

In theory, physical deterioration can be measured objectively such as a machine can produce X number of parts in its lifetime or a pump will lift Y cubic meters, and the physical deterioration can be easily calculated. Unfortunately, such conditions do not exist in the real world. A valuer must rely on how similar assets have performed in the past to make a judgement of the physical condition of the subject. Therefore, determination of physical deterioration may be rather subjective. Improvements and modifications made to the plant and machinery over time could increase the value or extend the life of the item (Korner, 2009).

The physical condition observed during inspection can be verified by conducting discussions with operating, maintenance and

engineering staff, review past and present replacement, maintenance, analysing production records and consulting industrial experts (Maninggo, 2010 and Mohd Khairudin, 2008). An important fact to be considered is that two machines of the same type, performing the same function but from different suppliers may differ not only in price and quality of output but also in their ability to withstand use (Korner, 2009 and Derry, 2008). To depreciate them at the similar rates, based on the age and units produced, may lead to an incorrect conclusion of value.

Most authors agree that physical depreciation can be measured using straight line depreciation (Maninggo, 2010; Abdul Rahman,

2010; Derry, 2008, Mohd Khairudin, 2008 and Budhbhatti, 1999). In practice, physical deterioration is most commonly estimated by the economic or actual life/age methods; both are based on an accounting-like straight-line depreciation model developed by dividing the actual or effective age by an estimate of the normal useful life. The problem is that the depreciation rate is not derived from market evidence, and it assumes that all elements, parts, components or subsystems within the piece of equipment depreciate at the same, constant, average rate (Korner, 2009; Mohd Khairudin, 2008 and Budhbhatti, 1999).

Korner (2009) highlights the basic equation of the age/life method that is:

$$\textit{Total depreciation rate} = \frac{\textit{Effective age of property}}{\textit{Normal useful life}}$$

Some modifications that take into consideration the salvage value (if the property is sold for the materials it contains or for an alternative use), at the end of useful life are (Korner, 2009):

$$Total\ Depreciation\ Rate = \frac{Effective\ Age\ of\ Property \times (1 - Net\ salvage\ value\ at\ the\ end\ of\ useful\ life)}{Normal\ Useful\ Life}$$

5.4.2 Normal Useful Life

Normal Useful Life = Effective Age plus Remaining Useful Life.

NUL= EA+RUL
or by transposition
NUL-RUL = EA
or by transposition
NUL-EA = RUL

In determining the normal useful life of the property, particularly plant and machinery, authors have different opinions. However, all agreed that the inherent relationship between maintenance and depreciation must be considered (Maninggo, 2010; Abdul Rahman, 2010; Korner, 2009; Derry, 2008; Mohd Khairudin, 2008 and Budhbhatti, 1999).

By increasing maintenance, often the useful life may be prolonged, thereby reducing annual depreciation. Whilst no exact measure of this relationship is possible (Korner, 2009), it is advisable to consider the general level of maintenance when reviewing plant and machinery's depreciation.

In valuation, the term "useful life" has many interpretations regarding definition and usage. Some practitioners consider it to be the physical life (Bhudbhatti, 1999 and Derry, 1992), whereas current practitioners regard it as the economic or normal useful

Life (Maninggo, 2010; Abdul Rahman, 2010; Mohd Khairudin, 2008).

RICS (2006) defines physical life as "how long the asset, ignoring any potential for refurbishment or reconstruction, could be used for any purpose." It is the period during which a property can be operated using normal preventive maintenance, as recommended by the manufacturer. Although the physical life often reasonably indicates an item's useful life, Korner (2009) identified several issues that should be considered by the valuers namely:

a. Overhaul or rebuild can renew a plant and machinery's life, this may be undertaken several times until no longer economical.
b. Functional obsolescence factors, such as technological substitution, deregulation, increased competition and rising market demands, may have a profound impact on the life of a plant, machinery or equipment.

IVSC (2017) defines economic life as the "period in which an asset is expected to be economically useable by one or more users." It

is the estimated number of years that a new plant, machinery or equipment can be used before it would pay for the owner to replace it with the most economical replacement that could perform equivalent services. As agreed by Korner (2009), it considers the time from when operations begin to the point at which the subject becomes uneconomical.

According to Korner (2009) and Mohd Khairudin (2008), the obvious advantage of this life concept is that it considers, in addition to external economic factors, the benefit utilisation from the owner's perspective. Governmental regulations may be imposed, and market conditions or industry economics may change. At current, economic obsolescence factors change so quickly that many assets can suddenly become uneconomical.

The drawback is that it requires the valuer to analyse the utilisation of the asset from an economic point of view, and this task is not always possible due to the complexity of such analyses and general lack of appropriate data (Maninggo, 2010).

However, the American Society of Appraisers (2001) has a different definition of normal useful life that is "the physical life, usually in terms of years, that a new property will actually be used before it is retired from service. A property's normal useful life relates to how long similar properties actually tend to be used, as opposed to the more theoretical economic life calculation of how long a property can profitably be used". Typically, this definition is used for valuations as it considers market-based experience in the industry, allows for normal wear and tear, anticipates functional and economic obsolescence, as well as other factors that might result in an early retirement (Korner, 2009).

It is ultimately the valuer's decision whether the remaining useful life is derived from normal useful life, economic life or physical life concept. The valuer must, however, provide a credible justification of the method chosen that can be explained, quantified and defended.

Sources of information on Normal Useful Lives:

- Manufacturers
- Marshall Valuation Service – *Life Expectancy Guidelines*
- IRS Publication 173 *Tables of Useful Lives of Depreciable Property*
- American Hospital Association – *Estimated Useful Lives of Depreciable Hospital Assets*
- Dealer observations
- User observations and experience
- Valuer observations of aging, use, and value of equipment over time

Weighted Effective Age Calculation

When an asset has been repaired, rebuilt, or had additions made to it at various times, using the historical age as the effective age will not be correct. The repairs, rebuilds or additional will bring additional life to the asset

Year	Time	Cause	Cost	Index Factor	2013 Trended Cost	Weighted Trended Cost
1972	41	Cost new	SAR 203,000	1.91		
1977	36	Repairs	SAR 35,000	1.85		
1980	33	Rebuild	SAR 81,000	1.68		
1985	28	Additions	SAR 61,200	1.61		
1990	23	Partial rebuild	SAR 63,700	1.46		
1995	18	Repairs	SAR 52,800	1.38		
2001	12	Electrical Rework	SAR 103,000	1.25		
2006	7	New Computer Controls	SAR 81,700	1.21		
2011	2	Rebuild	SAR 139,300	1.05		
1/2013	1	Addition	SAR 22,300	1.00		
				Total		

Year	Time	Cause	Cost	Index Factor	2013 Trended Cost	Weighted Trended Cost
1972	41	Cost new	SAR 203,000	1.91	SAR 387,730	SAR 15,896,930
1977	36	Repairs	SAR 35,000	1.85	SAR 64,750	SAR 2,331,000
1980	33	Rebuild	SAR 81,000	1.68	SAR 136,080	SAR 4,490,640
1985	28	Additions	SAR 61,200	1.61	SAR 98,532	SAR 2,758,896
1990	23	Partial rebuild	SAR 63,700	1.46	SAR 93,002	SAR 2,139,046
1995	18	Repairs	SAR 52,800	1.38	SAR 72,864	SAR 1,311,552
2001	12	Electrical Rework	SAR 103,000	1.25	SAR 128,750	SAR 1,545,000
2006	7	New Computer Controls	SAR 81,700	1.21	SAR 98,857	SAR 691,999
2011	2	Rebuild	SAR 139,300	1.05	SAR 146,265	SAR 292,530
1/2013	1	Addition	SAR 22,300	1.00	SAR 22,300	SAR 22,300
				Total	**SAR 1,249,130**	**SAR 31,479,893**

The Cost x the given Index Factor equals the Trended Cost in current SAR
2013 Trended Cost x Time (Age) equals the Weighted Trended Cost
Total Weighted Trended Costs divided by the Sum of all current SAR Trended Costs will derive the Effective Age:
31,479,893 / 1,249,130 = 25.2 Years

5.4.3 Functional Obsolescence

In relation to the functional obsolescence, Korner (2009) defines it as "a form of depreciation resulting in a loss in value caused by conditions within the property, such as changes in design, material or process, and resulting in inadequacy, overcapacity, excess construction, lack of utility, or excess operating costs.

Other forms of obsolescence are technological and economical obsolescence. Technological obsolescence happened due to change in design and materials of construction of the plant and machinery under consideration. Latest sophisticated equipment with reduced occupancy, improved efficiency or optimum energy consumption are common in plant and machinery.

5.4.4 Economic Obsolescence

Economic obsolescence (sometimes called "external obsolescence") is the loss in value or usefulness of an asset caused by external factors such as increased cost of raw materials, labour, supply and demand, increased competition, environmental or other government regulations, and others. Major reasons for this type of obsolescence is change in demand of the product manufactured or shrinkage in supply of raw materials and labour, legislative affecting taxes or duties, environmental or zoning control and others.

5.5 Methods to Quantify Depreciation

With all of the rules and regulations governing depreciation, and the various methods of depreciation, one may find it difficult to actually calculate depreciation. Depreciate can be calculated based on the following:

5.5.1 Straight-Line Method:

The formula is:

$$\textit{Annual Depreciation Expense} = \frac{\textit{(Cost of Asset – Salvage Value)}}{\textit{Estimated Useful Life}}$$

Example: A machine costs SAR75,000 to purchase and has estimated useful life of five years, upon which time it will have an estimated salvage value of SAR5,000. Using the formula above, we can determine that annual depreciation will be SAR14,000 per year. (SAR75,000-SAR5,000)/5 Years = SAR14,000.

The effect of the half year averaging convention is to reduce the first-year depreciation by 1/2. Therefore, the 1st year's

depreciation of SAR14,000 will be reduced to SAR7,000. The simplicity of this calculation is why many prefer to use this method.

Market Value = *(Cost – Salvage value)/Recovery Period*
= (SAR75,000 – SAR5,000)/5
= SAR14,000 with half year convention.

Note: SAR14,000 in this example is normal annual depreciation.

Based on the following assumptions, the allowable depreciation is:

- Tax/accounting year end of 31 December
- Annual depreciation of SAR14,000
- With half year convention, 1/2 or SAR7,000 is allowed.

Therefore:

- Acquired in January = SAR14,000/12=SAR1,166.66 per month allowed
- Acquired in March = SAR14,000/10=SAR1,400 per month allowed
- Acquired in August = SAR14,000/5=SAR2,800 per month allowed
- Acquired in December = SAR14,000/1=SAR14,000 for the month of December

5.5.2 Diminishing Balance Methods:

(Book value at beginning of year) X (Depreciation Rate)
Book Value = Cost of asset – accumulated depreciation

Using the same example as before, let's calculate the annual depreciation using the double diminishing balance method. The straight-line depreciation rate would be 20%. (100% / 5 years = 20%). Under the double diminishing balance method, the rate would be 40% (20% x 2). Below are years 1-10 and their corresponding depreciation values. Assume that the machine was bought and placed in service July 1.

Note:
For 200% Diminishing Balance: (1/Recovery Period) X 2 i.e. 1/5=.20–> 0.20 x 2 = 0.40
For 150% Diminishing Balance: (1/Recovery Period) X 1.5 i.e. 1/5=.20–> 0.2 X 1.5 =0.30

- Year 1: SAR75,000 X 40%=SAR30,000** To reflect the half-year convention divide SAR30,000 by 2 to get SAR15,000 as the amount of depreciation for the first year.
- Year 2: (SAR75,000 – SAR15,000) X 40% = SAR24,000 of depreciation.
- Year 3: (SAR75,000 – SAR39,000) X 40% = SAR14,400 of depreciation.
- Year 4: Here there is a switch back to the straight-line method as the amount depreciated under the double diminishing balance would be less compared to the figure of the same year in straight-line method. Thus, depreciation is SAR8,640
- Year 5: Depreciation will be SAR7,960 to maintain a book value equal to the salvage value of SAR5,000.

5.5.3 Sum of Year Digit Method (SYD)

The sum of the years' digits method is used to accelerate the recognition of depreciation. Doing so means that most of the depreciation associated with an asset is recognized in the first few years of its useful life. This method is also called the SYD method.

The method is more appropriate than the commonly- used straight-line depreciation if an asset depreciates quicker or has greater production capacity in the earlier years than it does as it ages. The total amount of depreciation is identical no matter which depreciation method is used - the choice of depreciation method only alters the timing of depreciation recognition.

The problem with using this or any other accelerated depreciation method is that it artificially reduces the reported profit of a business over the near term. The result is excessively low profits in the near term, followed by excessively high profits in later reporting periods.

Use of this method can have an indirect impact on cash flows, since accelerated depreciation can reduce the amount of taxable income, thereby deferring income tax payments into later periods. Use the following formula to calculate it:

$$\text{Applicable Percentage} = \frac{\text{Number of years of estimated life remaining at the beginning of the year}}{\text{SYD}}$$

$$\text{SYD} = \frac{n\,(n+1)}{2} \quad \text{where } n = \text{estimated useful life}$$

5.5.4 Unit of Activity Method

The activity method of depreciation (also called the variable charge approach) assumes that depreciation is a function of use or productivity instead of the passage of time. The life of the asset is considered in terms of either the output it provides (units of produces), or an input measure such as the number of hours worked.

Conceptually, the proper cost association is established in terms of output instead of hours used, but often the output is not easily measurable. In such cases, an output measure such as machine hours is a more appropriate method of measuring the dollar amount of depreciation charges for a given accounting period.

The following formula is used for the calculation of depreciation charge under activity method:

$$\frac{\text{(Cost less salvage value)} \times \text{Hours this year}}{\text{Total estimated hours}} = \text{Depreciation charge}$$

Example:
Assume that a company purchased a crane for digging purposes. Pertinently data concerning the purchase of the crane are:

Cost of crane	SAR500,000
Estimated useful life	5 years
Estimated salvage value	SAR50,000
Productive life in hours	30,000hours

If the crane is used 4,000 hours the first year, the depreciation charge is:

$$\frac{\text{(Cost less salvage value)} \times \text{Hours this year}}{\text{Total estimated hours}} = \text{Depreciation Charge}$$

$$\frac{\text{(SAR500,000 - SAR50,000)} \times \text{4,000 hours}}{\text{30,000 hours}} = \text{SAR60,000}$$

5.5.5 Quantification Using Rushton Table

Rushton Table provides multiplier for both straight-line and diminishing balance depreciation.

The Ruston Depreciation Table originated from a now defunct UK company, called Ëdward Rushton Son & Kenyon" way back in the 1960.

Rushton's Table is similar to Parry's Valuation Table. It is simplified format for quick and easy reference when the valuer forgets the depreciation formula.

The table was constructed based on straight line method and diminishing balance method with a scrap value @ 10%.

Example for Straight Line Method:

$$= 1 - \frac{(100\% - 10\%)}{\text{Actual age} + (\text{Economic Life} - \text{Actual Age})} \times \text{Actual Age}$$

If,

Economic life = 20 year
Age of machine = 6 year

The calculation;

$$= 1 - \frac{90\%}{6+(20-6)} \times 6$$

= 1- (0.045) x 6
= 1-0.27
= 0.73

A look up from Ruston Table indicated a figure of 73.

Example for Diminishing Value Method.

Diminishing value (Market Value – Going Concern)

= [Scrap value ^ (Actual Life/Economic Life)]

If,

Economic life = 20 year
Age of machine = 6 year

= 0.1 ^(0.3)
= 0.50

A look up from Ruston Table indicated a figure of 50.

Example:

Define the depreciation of a 5-year-old plant that has an economic life of 20 years.

i. Rushton Table consists of **first line** showing the **age** of the plant and machinery from 1 to 100 years and the **first column** shows the **economic life** of the plant and machinery from 1 to 100 years. Multiplier found in point of intersection formed from the intersection age and economic life is appropriate with age multiplier and economic life of the plant and machinery.

ii. Multiplier for straight line is obtained by reference to the point of intersection between the lines where economic life of the plant and machinery is 20 years old and from the column where the age of the plant and machinery is 5 years. Point of intersection has 2 multipliers. Use the top multiplier, which is 0.78.

iii. The multiplier for Reduced Balance obtained by reference to multiplier the bottom, which is 0.56.

Needs to be emphasized that the multiplier obtained from Rushton Table only refers to physical depreciation because of obsolescence only. Rushton Table does not take depreciation resulting from obsolescence functionality and economy into account. For plant and machinery, which receives a significant effect, for example obsolescence functions such as computers, high depreciation should be used relative to the multiplier obtained from Rushton Table.

YEARS	1 actual age	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	32	34	36	38	40	45	50	55	60	75	80
4 Economic life	78	55	32	10																																					
	56	31	18	10																																					
5	82	64	46	28	10																																				
	63	40	25	16	10																																				
6	85	70	55	40	25	10																																			
	68	46	31	21	15	10																																			
8	89	78	66	55	44	33	21	10																																	
	75	57	43	30	25	20	15	10																																	
10	91	82	73	64	55	46	37	28	19	10																															
	80	63	50	40	32	25	20	16	13	10																															
12	93	85	78	70	63	55	48	40	33	25	18	10																													
	82	67	55	45	37	30	25	20	17	14	11	10																													
15	94	88	82	76	70	64	58	52	46	40	34	28	22	16	10																										
	86	74	64	55	47	40	35	30	26	22	19	16	14	12	10																										
20	96	91	87	82	78	73	69	64	60	55	51	46	42	37	33	28	24	19	15	10																					
	89	79	70	63	56	50	44	39	35	31	28	25	22	19	17	15	14	12	11	10																					
25	96	93	89	86	82	78	75	71	68	64	60	57	53	50	46	42	39	35	32	28	24	21	17	14	10																
	91	83	75	69	62	57	52	47	43	39	35	32	29	27	24	22	20	18	17	15	14	13	12	11	10																
30	97	94	91	88	85	82	79	76	73	70	67	64	61	58	55	52	49	46	43	40	37	34	31	28	25	22	19	16	13	10											
	93	86	79	73	68	63	58	54	50	46	42	39	36	34	31	29	28	26	23	21	19	18	17	16	15	14	13	12	11	10											
35	97	95	92	90	86	85	82	80	77	75	72	70	67	65	62	60	57	55	52	50	47	45	42	40	37	35	32	30	27	25	19	13	9								
	94	89	81	77	71	67	62	58	55	51	48	45	42	39	37	35	33	31	29	27	25	23	22	21	20	19	16	17	16	15	13	11	9								
40	98	96	93	91	89	87	84	82	80	78	75	73	71	69	66	64	62	60	57	55	53	51	48	46	44	42	39	37	35	33	28	23	18	13	10						
	95	89	84	80	75	71	67	63	60	57	54	51	48	45	43	40	38	36	34	32	30	29	27	26	24	23	22	21	19	16	16	15	13	12	10						
50	98	96	95	93	91	89	87	86	84	82	80	78	77	75	73	71	69	68	64	64	62	60	59	57	55	53	51	50	48	46	42	39	36	32	28	19	10				
	95	91	87	83	79	75	72	69	65	62	60	57	54	52	49	47	45	43	41	39	37	35	34	32	31	29	28	27	26	24	22	20	18	17	15	12	10				
60	99	97	96	94	93	91	90	88	87	85	84	82	81	79	78	76	75	73	72	70	69	67	66	64	63	61	60	58	57	55	52	49	46	43	40	33	25	19	10		
	96	93	89	86	82	79	76	73	71	68	65	63	60	58	56	54	52	50	48	46	44	43	41	39	38	37	35	34	33	31	29	27	25	23	21	18	14	12	10		
75	99	98	96	95	94	93	92	90	89	88	87	86	84	83	82	81	80	78	77	76	75	74	72	71	70	69	68	66	65	64	62	59	57	54	52	45	40	34	28	10	
	96	92	90	88	86	83	80	78	75	73	71	69	66	64	62	60	59	57	55	54	52	50	49	47	45	44	43	41	40	39	37	34	32	30	28	24	20	16	13	10	
100	99	98	97	96	96	95	94	93	92	91	90	89	88	87	87	86	85	84	82	82	81	80	79	78	78	77	76	75	74	73	71	69	68	66	64	60	55	51	46	33	28
	97	95	93	91	89	87	85	83	81	80	78	75	74	72	70	69	67	65	64	63	61	60	58	57	56	54	53	52	51	50	47	45	43	41	39	35	32	28	25	18	16

TOP FIGURES = STRAIGHT LINE (INDEMNITY)

BOTTOM FIGURES = DIMINISHING VALUE (MV-GOING CONCERN)

RUSHTON TABLE

5.6 Application to Cost Method to Real Case Study

Please refer to the example on the next page.

The calculation of the machinery and equipment are following the basic principle as follows:

Reproduction Cost New or Replacement Cost New

(+) Cost of freight
(+) Cost of installation
(+) Cost of commissioning

Value of The Asset

Example of Cost estimation using Reproduction Cost Method

Valuation Example

Below is a valuation calculation example for Reproduction Cost New or Replacement Cost New:
A lathe machine made in Japan was installed 5 years ago at a cost of SAR 300,000. Others information for the lathe machine: Brand: Taian Yuzhuo, Japan
Model: CK6136
Year Manufacturing: 2015
Max. Swing Diameter: 320 mm

The comparison information obtained is as follows:

Comparison 1 (Used Lathe Asking Price)	Comparison 2 (Supplier Quotation):
Brand: Baishun, China	Brand: Taian Yuzhuo, Japan
Model: TV3689	Model: CK6536
Year Manufacturing: 2016	Year Manufacturing: 2020
Max. Swing Diameter: 250 mm	Max. Swing Diameter: 350 mm
Asking Price: SAR200,000	Selling Price: SAR360,000

Date of Valuation: 1 January 2020

Item	Subject PME	Comparison					
		Comparison 1		Comparison 2 (New Price Supplier)		Comparison 3 Contract Cost (Original Price)	
Lathe Machine		SAR 200,000		SAR 360,000		SAR 300,000	
Adjustment:							
a) Time	2015	2016	10%	2020	0%	2015	10%
b) Brand	Taian Yuzhuo	Baishun	-10%	Taian Yuzhuo	0%	Taian Yuzhuo	0%
c) Capacity	320 mm	250 mm	10%	350 mm	-5%	320 mm	0%
Total			10%		-5%		10%
Adjusted Figure:		SAR 220,000		SAR 342,000		SAR330,000	
Say		**SAR 220,000**		**SAR 340,000**		**SAR330,000**	

Based on comparison above, the best comparison is Comparison 2 which is the new price provided by supplier.

Reproduction Cost New or Replacement Cost New: SAR 340,000

(+) Cost of freight : SAR 10,000

(+) Cost of installation: SAR 5,000

(+) Cost of commissioning SAR 5,000

Value of the Asset: SAR 360,000

Application of Cost Approach to Real Case Study

Valuation Exercise 1:
Model 1 with ten-horsepower motor, serial number 34746
Plant records indicate that the subject milling machine was purchased new and installed 30 years ago for a total installed cost of SAR 16,000. The serial number of this machine indicates that it was built 30 years ago.

Model A. Manufactured between 25 and 35 years ago

- Table size 63" X 15"
- Height from spindle to table 20"
- Weight8,800 pounds
- Table travel 34"
- Spindle speeds 21
- Motor size 10 horsepower
- Price, 30 years ago, FOB factory was SAR 14,460

Model B. Manufactured from 25 years ago until today

- Table size 65" X 14"
- Height from spindle to table 20"
- Weight18,000 kilograms
- Table travel 34"

- Spindle speeds 24
- Motor size 10 horsepower
- Current price FOB manufacturer is SAR 74,300.

Additional Data

Accounting records show that

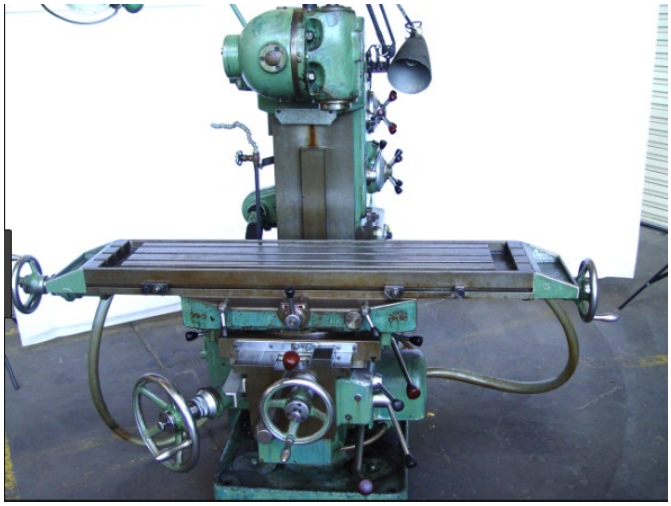
- historical installation cost 30 years ago for 100 man-hours was SAR 300.
- The normal useful life of the machine has been established at 25 years.
- Current Producer Price Index for subject milling machines is 230. Producer Price Index 30 years ago (at time of installation) was 23.
- Weight is 18,000 kilograms.
- FOB means free on board (at point of manufacture). Freight costs are currently SAR 25/200 kilograms.
- Machine was rebuilt five years ago. Remember that rebuilding will not restore total normal life. For this unit, the useful life probably will not exceed 85% of total normal life after rebuild is completed.
- Functional obsolescence is estimated to be approximately 4% per spindle speed. Table size differences are estimated to be insignificant in this analysis. There is no economic obsolescence to be considered.

Reproduction cost new calculation

Historical cost new	SAR
Trend factor ( ) from 30 years ago (from index)	X
Reproduction cost new	SAR

Reproduction cost new calculation

Historical cost new	SAR16,000
Trend factor (230 ÷ 23) from 30 years ago (from index)	x 10
Reproduction cost new	SAR 160,000



Replacement Cost New (of Obsolete Machine)

Current Replacement Cost New		SAR
Installation figured at (man-hours at SAR /hour)	SAR	
Freight (kilograms x /25/200kg)	SAR	
Replacement Cost New, Installed		SAR

Replacement Cost New (of Obsolete Machine)

Current Replacement Cost New		SAR 74,300
Installation figured at (100 man-hours at SAR 30/hour)	SAR 3,000	
Freight (18,000 kilograms x 25/200 kg)	SAR 2,250	
Replacement Cost New, Installed		SAR 86,237
Rounded off		**SAR 86,000**

Depreciated Replacement Cost New

Replacement Cost New, Installed			SAR
Less: Physical Deterioration at %	=	SAR	
Less: Functional Obsolescence at %	=	SAR	
(rounded off)			
Depreciated Replacement Cost			SAR
(Rounded off to SAR 1,000)			

Depreciated Replacement Cost New

Replacement Cost New, Installed	SAR 86,200
Less; Physical Deterioration at 36% =	SAR (31,032)
	SAR 55,168
Less: Functional Obsolescence at 12% =	SAR (6,620)
(rounded off)	
Depreciated Replacement Cost	SAR 48,548
Rounded off to	**SAR 48,500**

Depreciated Replacement Cost New

Physical deterioration is determined by doing an age/life analysis. The normal useful life ws established at 25 years. However, it is 30 years old and had been rebuilt completely 5 years ago. Using the 85% factor (25 x .85 = 21 less the 5 year expired life since rebuild yields 16 years.) Therefore, it has an effective age of 9 years / 25 year NUL or 36% deterioration.

Functional obsolscence is determined by measuring the differences between spindle speeds from comarable specifications, i.e. 24-21 = 3 x 4% = 12%

5.7 Strengths and Weaknesses of Cost Approach

5.7.1 Strengths

Most of the time, people would think that the limitations of the cost approach are apparent, frequently it is the only available approach to value plant and machinery. Hence the limitations must be reviewed relative to alternative valuation approaches. If sales data are deficient and plant and machinery may not be appraised under the market approach or income approach, the cost approach provides the most accurate method of valuation. Certain specific advantages of the cost approach may recommend reliance on this valuation approach.

First, the cost approach tends to be favoured for the valuer of new constructed plant. If the structure is designed with typical features, workmanship, and materials, there is usually a close approximation to new construction cost and market value. The cost approach tends to lose accuracy for plant and machinery showing substantial depreciation.

Second, the cost approach furnishes the best evidence of value for asset having little marketability, namely, public buildings, power plant, and highly specialized industrial structures. While the cost methods are highly subjective, in these instances the valuer has few alternatives to guide the market value estimate.

Third, the cost approach is appropriately used to estimate the cost of plant and machinery rehabilitation, modernization, refurbishment or remodelling. Here, the capitalization of net income and the market approach supplement the cost approach to value ME.

Fourth, the cost approach tends to be reasonably accurate if (1) the plant and machinery shows a minimum of depreciation and (2) the site is developed to, its highest and best use of plant and machinery.

5.7.2 Weaknesses

The cost approach system has many limitations in practice. The method assumes that the buyer could find the suitable site to build an identical plant and machinery and that's not always the case. Higher cost of land on another lot or no suitability of similar land might drive the price up even if plant and machinery cost are reasonable. Construction costs on plant and machinery development are another vital factor. Would similar construction

methods be used to build a new plant - or would the construction be functionally equivalent but with hidden expenses – or using latest technology for development? One example of a plant and machinery cost would be the additional cost to build similar plant. What are the costs of installation, commissioning and testing incurred? Is it higher than previous cost or lower because of advance in technology?

Additionally, the local political or economic environment might not be friendly to new plant construction. The area could already be fully developed. Local planning authorities might be so restrictive that new construction is not worth the trouble. Unfortunately, these factors aren't considered in the cost approach.

Another consideration is that older plant and machinery can have major depreciation. It might be difficult to accurately account for this. What if a certain plant and machinery or method to construct the plant and machinery is no longer used? Sometimes making adjustments for depreciation is a challenging process. The valuer has room for a lot of subjectivity.

6.0 INCOME APPROACH

6.1 Introduction

The income approach provides an indication of value by converting future cash flow to a single current value. Under the income approach, the value of an asset is determined by reference to the value of income, cash flow or cost savings generated by the asset.

The income approach should be applied and afforded significant weight under the following circumstances:

(a) The income-producing ability of the asset is the critical element affecting value from a participant perspective, and/or

(b) Reasonable projections of the amount and timing of future income are available for the subject asset, but there are several, if any, relevant market comparable.

Although the above circumstances would indicate that the income approach should be applied and afforded significant weight, the following are additional circumstances where the income approach may be applied and afforded significant weight. When using the income approach under the following circumstances, a valuer should consider

whether any other approaches could be applied and weighted to corroborate the value indication from the income approach:

(a) The income-producing ability of the subject asset is only one of several factors affecting value from a participant perspective,

(b) There is significant uncertainty regarding the amount and timing of future income-related to the subject asset,

(c) There is a lack of access to information related to the subject asset (for example, a minority owner may have access to historical financial statements but not forecasts/budgets), and/or

(d) The subject asset has not yet begun generating income but is projected to do so.

6.2 The Concept and Main Principle

A fundamental basis for the income approach is that investors expect to receive a return on their investments and that such a return should reflect the perceived level of risk in the investment.

Generally, investors can only expect to be compensated for systematic risk (also known as “market risk” or “undiversifiable risk”).

The main principle behind this approach is that an informed buyer would pay no more for a property or asset than an amount equal to the present worth of anticipated future benefits (income) from the same or equivalent property with similar risk (IVSC, 2010; Korner, 2009; Derry, 2008 and Budhbhatti, 1999).

- Hence, the formula is stated as follows:

$$\frac{Income}{Price} = Capitalisation\ Rate$$

After reviewing the comparable rates obtained from the market investigation and adjusting them to the subjects(s) asset, a capitalization is developed. The rate then can be applied to the income projection for the subject asset(s) as follows:

$$\frac{Subject\ income\ projection}{Capitalisation\ Rate} = Income\ Indicator\ of\ Value$$

6.3 Discounted Future Cash Flow Method

The most convenient and applicable method in this approach is discounted future cash flow. This method applies to investment and general-use properties where there is an established and identifiable rental market or where a specific measurable stream of benefits may be attributed to the subject.

In applying this method to plant and machinery, consideration is given to either the income-generating or the cost-savings potential of the item and the associated risks and uncertainties. The income approach is suitable to be used if the plant and machinery economic life span can be determined or the terminal value in the end of useful life is known. The benefit / income capitalisation method presents several obstacles. Some notable obstacles are as follows:

i. For most plant, machinery and equipment, the potential earnings (benefits) cannot be reasonably separated from those of overall business and often the information regarding their respective operating costs is unavailable (Korner, 2009).

ii. It is difficult to develop one of the most critical factors: The discount rate (Korner, 2009 and Derry, 2008).

iii. The risks of specialised items or those involving unique technologies are typically higher than for unit's alternative uses because of plant and machinery is not as liquid as current assets and lacks comparable market data (Budhbhatti, 1999). Therefore, the risks and returns associated with plant and machinery are higher than those for current assets.

Ideally, the best source of required returns comes from investors who directly participate in various markets. However, this information is usually confidential. Therefore, indirect methods should be applied to determine supportable rates of return. Below are some suggested indirect methods that can be applied (Korner, 2009):

a. Market Price Method
With this, the selling prices of comparable investments are compared to anticipated future benefits to derive an indication of the implicit rates of return. However, the problem is a general lack of market-based data.

b. Comparison of Quality Attributes Method
The desirability of the subject is compared to those alternatives having known rates of return.

c. Build-up Method
Starts from a known risk-free rate to which factors area added for additional risks, the burdens of management and the lack of liquidity to derive a suitable rate of return.

d. The Weighted Average Return on Assets (WARA) Method
This method is based on assumption that a business is a portfolio of financial, physical and intangible assets. The fair value of the long-term debt plus that of the equity is equal to the sum of the fair values of net working capital and fixed and intangible assets. WARA is the rate of return of each category weighted by its fair value.

6.4 Profit Method

This method is sometimes known as the accounts method. It is based on assumption that values of some properties are related to the profits which can be made from their use.

For definition, the principle of this method derives from the ability of the property to bring an income to the tenant from his occupation which will compensate him sufficiently for operating the concern and, in addition, provide a surplus which the tenant would be prepared to pay for the right to occupy the property.

It is also mean that it is the ability of property to provide profit to the tenant which will compensate him sufficiently for operating the concern and, in addition, provide a surplus which the tenant would be prepared to pay as rent for the right to occupy the property. The method is used in the absence of rental evidence or price comparison and the tenant's accounts provide a reasonable guide. There could be a monopolistic element in the property.

This method attempts to estimate the rental value of the property. It is from the rental value that the investment method is then applied to obtain the capital value. The difficulty of this method lies in obtaining reliable figures and deciding the share of net profit attributable to rent.

When analysing the accounts, it needs to be examined critically, in determining:

a) Whether they represent the performance of a reasonably capable operator.

b) Whether the expenses are all properly allowable.

c) Whether adequate allowances have been made for various expenses.

d) Whether any unusual items or conditions have affected the accounts for the year under consideration.

Normally, the use for profit method is sufficient:

(1) In the absence of sales/ rental evidences;

(2) Where there is sufficient element of legal or factual monopoly of businesses; and

(3) Normally used in PME valuation of quarry, railway industry, ferry or ship and others

The formula are as follows:

Average Gross Revenue		p.a.	SAR
Less: Cost of Sales		p.a.	SAR
Gross Operating Profit		**p.a.**	**SAR**
a) Less: Business Operating Expenditure		p.a	SAR
Net Profit (Divisible Balance)		**p.a.**	**SAR**
Less: Operator's/ Tenant's Share		p.a.	
Interest on Working Capital	@ 10%		
Profit and risk	@ 20%		
Operator's Remuneration	@ 10%		SAR
Gross Rent		**p.a.**	**SAR**
a) Less: Outgoings		p.a.	SAR
Net Rent		**p.a.**	**SAR**
YP in perpetuity*	@ %		
CAPITAL VALUE			**SAR**

Steps in applying the profit method are as follows:

1. Determine gross profit by analysing audited accounts for the last 3 years
2. Determine operating expenses incurred only in running the business involving the subject property excluding outgoings expenses spent on the subject property
3. Calculate net profit or divisible balance

4. Determine tenant's share by calculating
5. Return on working capital
6. Tenant's remuneration
7. Tenant's/operator's business risk
8. Calculate gross rent payable for the property

*Investment Method also known as Income Capitalization Approach

Years Purchase in Perpetuity (YP)
This is the present value of the right to receive SAR1 at the end of each year in perpetuity at i compound interest.

The formula is :

$$\text{YP in perpetuity} = \frac{1}{i}$$

Example:

A is the owner o a freehold interest in a shop yielding a net income of SAR250 per annum. Assuming 7% compound interest calculate the capital value of A's interest.

Net income per annum = SAR 250

$$\text{YP in perpetuity at 7\%} = \frac{1}{i} = \frac{1}{0.07} = 14.286 \times 250 =$$

Capital value = SAR 3,571

EXAMPLE 1 (SHIPLINE) (SAR'000)

Stage 1
Recent accounts

Income
Gross Receipts:

Tickets	SAR 38,250
Restaurant Outside	SAR 54,650
catering Members'	SAR 5,200
subscriptions Rooms	SAR 2,250
Others	SAR 3,650
	SAR 1,750

Expenditures:

Purchases of food and drink	SAR 34,675
Wages and national insurance	SAR 16,300
Office expenses	SAR 8,200
Drawings	SAR 9,635

Loan Interest	SAR 1,400
Bank Charges	SAR 225
Accountancy fees	SAR 600
Telephone	SAR 325
Electricity	SAR 5,325
General Rate	SAR 5,115
Water and sewerage charges	SAR 635
Repairs to land and buildings	SAR 250
Vehicle servicing	SAR 300
Petrol	SAR 970
Licensing	SAR 70
Insurance	
- premises	SAR 187
- contents	SAR 152
Other liability	SAR 50
Bad debts	SAR 110
Laundry	SAR 500
Advertising	SAR 1,250
New furnishing	SAR 2,900
	SAR 89,174

Stock in hand at cost SAR2,300

Stage 2
Examine the accounts, comparing year by year

Gross Receipts
These were down from the previous year and reflected generally poorer economic conditions. However, membership is rising, and having regard to past results, future gross receipts are estimated at SAR12,500 at current prices.

Expenditure

Purchases:		
For a more typical trading there would increase to say		SAR 40,000
Wages:		
Allow for Mrs Simm's service		SAR 6,000
Drawings represent part of the owner's remuneration		Exclude
Loan interest		Exclude
Repairs:		
Average annual allowance required, estimated at		SAR 1,200
Insurance:		
Adequate cover estimated for buildings		SAR 300
Bad debts:		
Most sales are from cash, but allow say		SAR 350
New furnishings:		
This a capital sum, and as such is not typical		Exclude
Depreciation:		
Service vehicle, say	SAR 1,900	
Furniture, fittings etc @ 20%	SAR 4,000	SAR 5,900
Adjusted total expenditure will be found to be		**SAR 93,767**

Inflation is assumed neither on receipts or costs for this example

Stage 3
Calculation of net profit, apportionment and valuation

Estimated Gross Sales		SAR 125,000.00
Less: Expenditures		SAR 93,767.00
Net Profit		**SAR 31,233.00**
Interest on Tenant's Capital: Do not understand what this is - feels like BV		
a) Fixtures and fittings valued at	SAR 20,000.00	
b) Normal stock	SAR 2,500.00	
c) Cash float	SAR 2,500.00	
Total	SAR 25,000.00	
Interest on Tenant's Capital @ 10%		SAR 2,500.00
Divisible Balance		**SAR 28,733.00**
Trader's remuneration @ 50% of balance		SAR 14,366.50
Rental Value		**SAR 14,366.50**
Say		**SAR 14,500.00**
YP in perpetuity @12%		8.00
		SAR 116,000.00
Less outstanding repairs, costed at		SAR 6,000.00
CAPITAL VALUE OF SHIP		**SAR 110,000.00**

In our case the formula is 1/.12 or 8.333 rounded to 8.

The main restriction in applying the income approach is sometimes the value is overstated. This happens when an income method is applied to plant and machinery using an earnings stream based on a proportion of the overall entity (not a market rental). In this case, normally the valuer must subtract returns on contributory assets. Those include net working capital, real property, operational knowhow, trademarks and trade names, customer relationships, an assembled workforce, and other inherent intangible assets. A value using this method includes elements of goodwill and such, is overstated (Korner, 2009 and Budhbhatti, 1999).

Based on the above discussion, the application of income approach is limited to plant and machinery which may be leased out at a specific market rent or to assets that are by nature cash generating, such as power or process plants being valued as a whole or games machinery and equipment in a modern theme park.

6.5 Strengths and Weaknesses of the Income/Profit Approach

Primary Strengths

a) Best measurement of total depreciation of all assets
b) Recognition of economics
c) Reflection of the logic and rational used in virtually all business decisions

Primary Weaknesses

a) Cannot segregate specific assets
b) Subjectivity of income projections and rates of return

7.0 CONCLUSION

As the conclusion for valuation methodologies, the logic underlying the understanding and use of multiple methods is that different types of information are available for the variety of factors that influence fair value. Since valuing plant and machinery depends frequently on subjective measures and interpretation of both qualitative and quantitative data, the valuer skills are a key factor.

In all situations, all approaches to value must be considered, as one or more may be applicable to the subject asset. In some situations, elements of the three approaches may be combined to reach a value conclusion. However, the relative strength, applicability, and significance of the approaches and their resulting values must be analyzed and reconciled.

8.0 EXERCISE QUESTIONS

1. How many approaches are considered in the valuation machinery and equipment? Explain them.

2. What is the method of valuation that can be applied in Market Approach?

3. What is the method of valuation that can be applied in Cost Approach?

4. What is Depreciation Factor? Explain three major factors to arrive the condition of the equipment.

5. Obsolescence Factor can be divided into three types. Explain each type of Obsolescence Factor.

6. What is Normal Useful Life (NUL)?

7. What is Effective Age (EA)?

8. In Application of Market Approach to value machinery and equipment, what are the factors affecting value to be considered for adjustment?

9. What are the factors influencing the estimation of Useful Life for Machinery and Equipment?

10. What is the difference between Replacement Cost and Reproduction Cost?

11. What is the formula for depreciation using Straight-Line Method?

12. If you were asked to prepare a valuation of machinery and equipment for the Insurable Reinstatement Cost New and assuming the policy does not call for any exclusions, which of the following costs would NOT be applicable?

    i) Cost of Machinery
    ii) Motors and Controls
    iii) Finance Charges
    iv) Foundation
    v) Freight
    vi) Taxes
    vii) Installation cost / Millwrighting
    viii) Run in or debugging

Note: All exercise questions above are for review purposes only. It is not a format for exam questions.

1. "*A method that indicates value by calculating the cost of a similar asset offering equivalent utility*"

The statement above refers to_____.

A. Reinstatement Cost

B. Replacement Cost

C. Reproduction Cost

D. Market Value

2. If machinery is valued considering the elements of dismantling cost and transportation cost, it is valued on_basis.

A. Market Value Indemnity

B. Market Value In-Situ

C. Market Value Ex-Situ

D. Market Value for Going Concern

3. Which of the following is **NOT** a component in Indirect Cost using the Depreciated Replacement Cost method.

   A. Transportation costs

   B. Installation costs

   C. Finance costs

   D. Labour

4. _____is an adjustment made to the estimated cost of creating an asset of equal utility to reflect the impact on value of any obsolescence and physical deterioration affecting the subject asset.

   A. Market Value

   B. Transportation costs

   C. Normal useful life

   D. Depreciation

5. Name the method that depreciation is a function of use or productivity instead of the passage of time.

   A. Straight-Line Method

   B. Diminishing Balance Method

   C. Sum of Year Digit Method

   D. Unit of Activity Method

6. All of the following are methodologies under cost approach **EXCEPT** _____.

A. Replacement Cost Method

B. Market Value

C. Reproduction Cost Method

D. Summation Method

Question 7 – 8 refer to Figure below.

Functional Obsolescence	Economic Obsolescence	Physical Obsolescence/Deterioration

7. _____ is a form of depreciation resulting in a loss in value caused by conditions within the property, such as changes in design, material or process, and resulting in inadequacy, overcapacity, excess construction, lack of utility, or excess operating costs.

8. _____ is the loss in value or usefulness of an asset caused by external factors such as increased cost of raw materials, labor, supply and demand, increased competition, environmental or other government regulations, and others.

9. Opportunity Cost to the operator is also known as_____.

   A. Current Assets

   B. Return on capital

   C. Capital value

   D. Years' purchase

10. Net Rental of a Lathe Machine is SAR1,450,000 per annum and the Years Purchase in Perpetuity (YP) is 12%. Calculate the Capital Value of the Lathe Machine.

   A. SAR 17,400,020

   B. SAR 12,083,000

   C. SAR 13,500,500

   D. SAR 14,500,000

11. _____ is a percentage of the Divisible Balance and Annual Gross Earning.

   A. Tenant share

   B. Net profit

   C. Interest on capital

   D. Return to operator

Question 12 refer to Figure below.

Capital rental	Net rental	Gross profit

Gross Earnings

(Less) Purchasing

= **X**

(Less) Operating Expenses

= **Divisible Balance**

12. **"X"** refers to_____.

13. "*A method under the cost approach that indicates value by calculating the cost to recreating a replica of an asset"*

The statement above refers to_____.

A. Reinstatement Cost

B. Replacement Cost

C. Reproduction Cost

D. Market Value

14. Name the method that provides multipliers for both straight-line and diminishing balance depreciation.

    A. Straight-Line Method

    B. Rushton Table

    C. Sum of Year Digit Method

    D. Unit of Activity Method

15. Which of the following is **NOT** a component in calculation using Reproduction Cost? New or Replacement Cost New.

    A. Cost of freight

    B. Cost of installation

    C. Cost of finance

    D. Cost of commissioning

16. All of the following are the types of obsolescence **EXCEPT**_____.

    A. Functional Obsolescence

    B. Finance Obsolescence

    C. Economic Obsolescence

    D. Physical Deterioration

17. The elements of the Rushton's Table require_____.

A. Material and labour

B. Design and material

C. Economic life and age

D. Wear and tear from use

18. Profit Method is normally used in the valuation of the following properties **EXCEPT.**

A. Ferry

B. Shopping mall

C. Ship

D. Quarry

Question 19 & 20 refer to Figure below.

Diminishing Balance Method	Straight-Line Method	Unit of Activity Method

19.

$$\text{Annual Depreciation Expense} = \frac{(\text{Cost of Asset} - \text{Salvage Value})}{\text{Estimate Useful Life}}$$

The formula above refers to_____.

20.

(Book value at beginning of year) X (Depreciation Rate)
Book Value = Cost of asset – accumulated depreciation

The formula above refers to_____.

21. All of the following are the primary strengths of the income approach EXCEPT: .

A. Best measurement of total or the full effects of obsolescence

B. Reflection of the logic and the rational used in virtually all business decisions.

C. Subjectivity of income projections and rates of return due to uncertainties

D. Recognition of future income potential

22. Existing use value is the value on the assumption that the plant and machinery will continue in its present existing use in the business of the company and is known as_____.

A. Market Value In-Situ.

B. Market Value Ex-Situ.

C. Market Value as a whole.

D. Market Value as individual item for removal.

23. Ahmad is the owner of a freehold interest in a manufacturing factory yielding a net income of SAR 250,000 per annum. Assuming 8% rate of return calculate the capital value of Ahmad's interest..

A. SAR 2,000,000.

B. SAR 3,450,000

C. SAR 20,000.

D. SAR 3,125,000

24. You understand that Normal Useful Life (NUL) = Effective Age (EA) plus Remaining Useful Life (RUL). Given that a packaing machinery has a normal useful life of 15 years and effective age of 7 years. What is the remaining useful life of the machinery?

A. 7 years

B. 22 years

C. 8 years

D. 15 years

25. You understand that Normal Useful Life (NUL) = Effective Age (EA) plus Remaining Useful Life (RUL). Given that a packaing machinery has a normal useful life of 15 years and effective age of 7 years. The machinery was built in 2011. What is the chronological age of the machinery in 2021?

A. 8 years

B. 10 years

C. 15years

D. 22 years

EXERCISE ANSWERS

Fundamentals of Plant, Machinery and Equipment

1. A
2. C
3. A
4. D
5. A
6. B
7. C
8. C
9. D
10. A
11. B
12. C
13. D
14. A
15. A
16. C
17. C
18. D
19. C
20. C
21. B
22. C
23. D
24. C
25. D
26. B
27. A
28. D
29. C
30. C
31. C
32. AUTOMOBILE PLANT
33. CEMENT PLANT
34. DAIRY PLANT
35. FOOD PACKAGING EQUIPMENT
36. DAIRY PRODUCTION EQUIPMENT
37. PROFESSIONAL STANDARDS
38. WRITERS
39. OXFORD DICTIONARY
40. MARKET VALUE
41. INSURED VALUE

EXERCISE ANSWERS

Machinery and Equipment Valuation Approaches

1. B
2. C
3. D
4. D
5. D
6. B
7. FUNCTIONAL OBSOLESCENCE
8. ECONOMIC OBSOLESCENCE
9. B
10. B
11. A
12. GROSS PROFIT
13. C
14. B
15. C
16. B
17. C
18. B
19. STRAIGHT LINE METHOD
20. DIMINISHING BALANCE METHOD
21. A
22. A
23. D
24. C
25. B

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