(T022) – Level 3

Design economics and cost planning

The areas of competencies expected by RICS APC Pathway

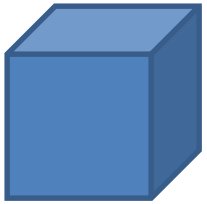
- **Economics of design** - site density, wall / floor ratio, storey heights, room sizes, letable / non-letable
- **Sources of cost data** - BCIS / in-house database / other external sources
- Inflation (tender / construction)
- **Location factors, regional variations**
- Currency fluctuations
- Estimating
- Cost Plans
- **Cost Planning**
- **Life cycle costing** - capital / running costs / replacement
- **Value Engineering**
- Value Management
- **Risk Management and Analysis** (contingency)
- State of the construction market
- State of the economy generally – locally and globally
- Interest rates

What are the factors affecting the cost of the building?

- Design Factors
- Site Factors
- Economic Factors

Simple Example

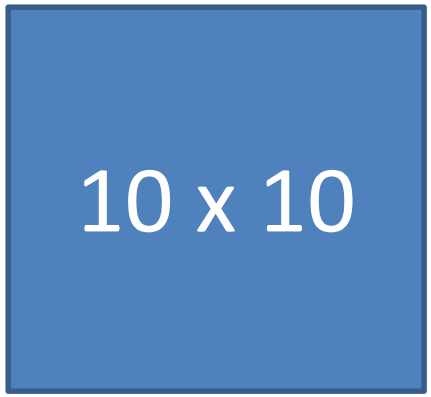
- Making a box of 1.5m3
- Easiest way 1.5m x 1m x 1m=1.5m3
- Sides 1.5mx1m- 4 Nos, 1mx1m – 2 Nos
- Size of plywood – 2.4mx1.2m. Need 5 sheets
- Alternative 1.2m x 1.2m x 1.2m= 1.73 m3
- or 1.2m x 1.2m x 1.0m=1.44 m3
- In both alternatives **need only 3 sheets**

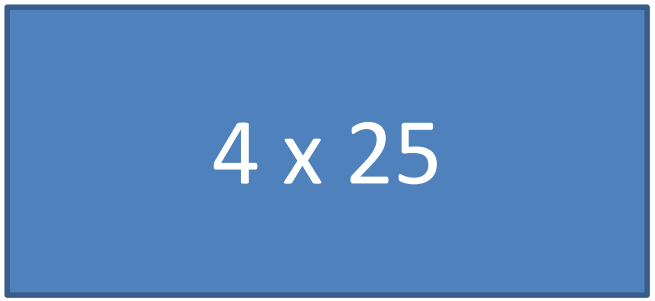


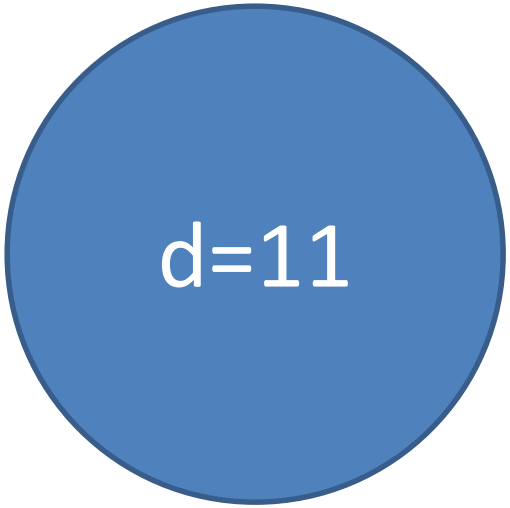
Design Factors

- shape/plan shape
- grouping of buildings,
- number of stories
- story height-
- size-
- circulation space
- internal layout
- Specifications
- working conditions

Effects with the plan shape







What are the effects ?

- Length of foundation
- External walls
- Eaves Gutters
- Drainage
- More paved areas
- Natural lighting, Easy to sub-divide
- Also; span of floors/roof, int. layout, service layout, ext. works.
- Irregular shapes what are the impacts ??

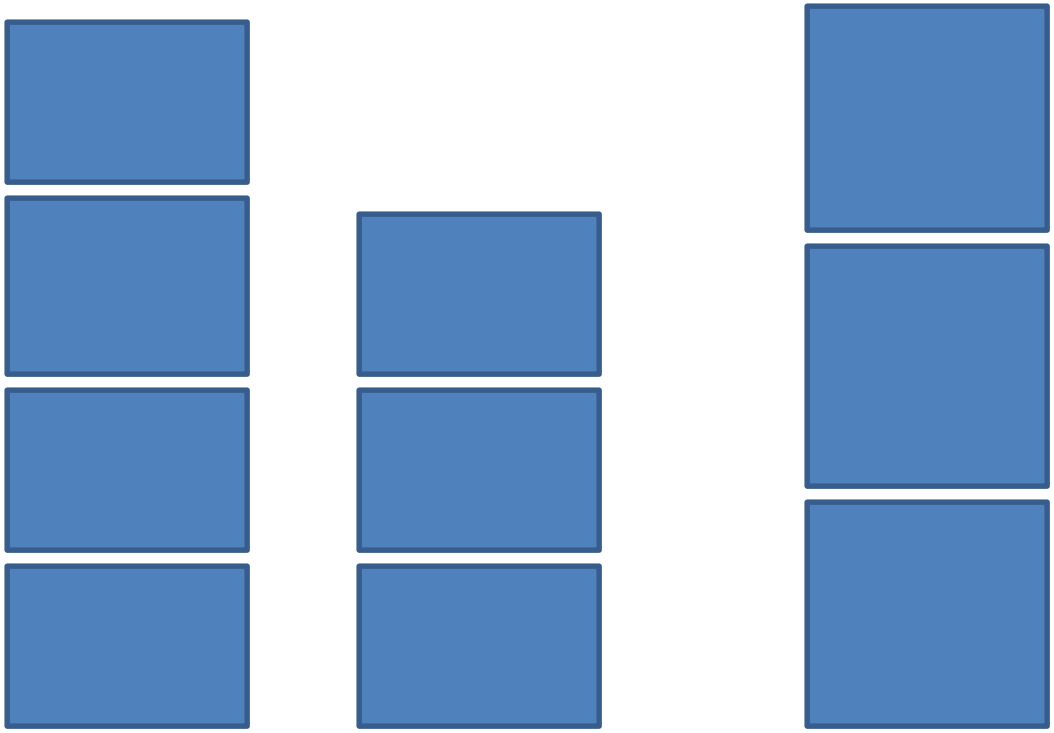
Grouping of buildings

Design Factors Cont,d

- Height- all elements with vert. comp.
- Size - increase may reduce m^2 rate, savings on plant rooms, kitchen bathroom
- circulation space,- affects to lettable area
- internal layout,
- specifications,- client, function, aesthetic, initial cost, future cost, Architects preference, life of the building
- working conditions (it is necessary to know what happens to the cost of different elements when part of the design is changed.)

- Work in the existing buildings- redesign of interior, refurbishment using existing interior, retention of some structures /features.
- Work in existing building is a big challenge which will have an impact on cost.

Number of stories and story height



Site Factors

- location, distance to the tip for disposal
- topography, - wind loading
- geology,- soil reuse, soil type for foundation,
- environmental,- tree preservation orders, protected species and animals, Eradication of Japanese knotweed, protection of reverbanks, flood protection
- access to site,
- existing services,
- existing site use,
- size of site,
- adjoining properties

Economic Factors

- amounts of works available
- availability of resources
- desirability of the project
- cost of borrowing
- micro-economics of the tendering firms-future workload, impact on tender price, profit to share holders, fixed costs, overheads

Cost Planning and Pre Contract Cost Control

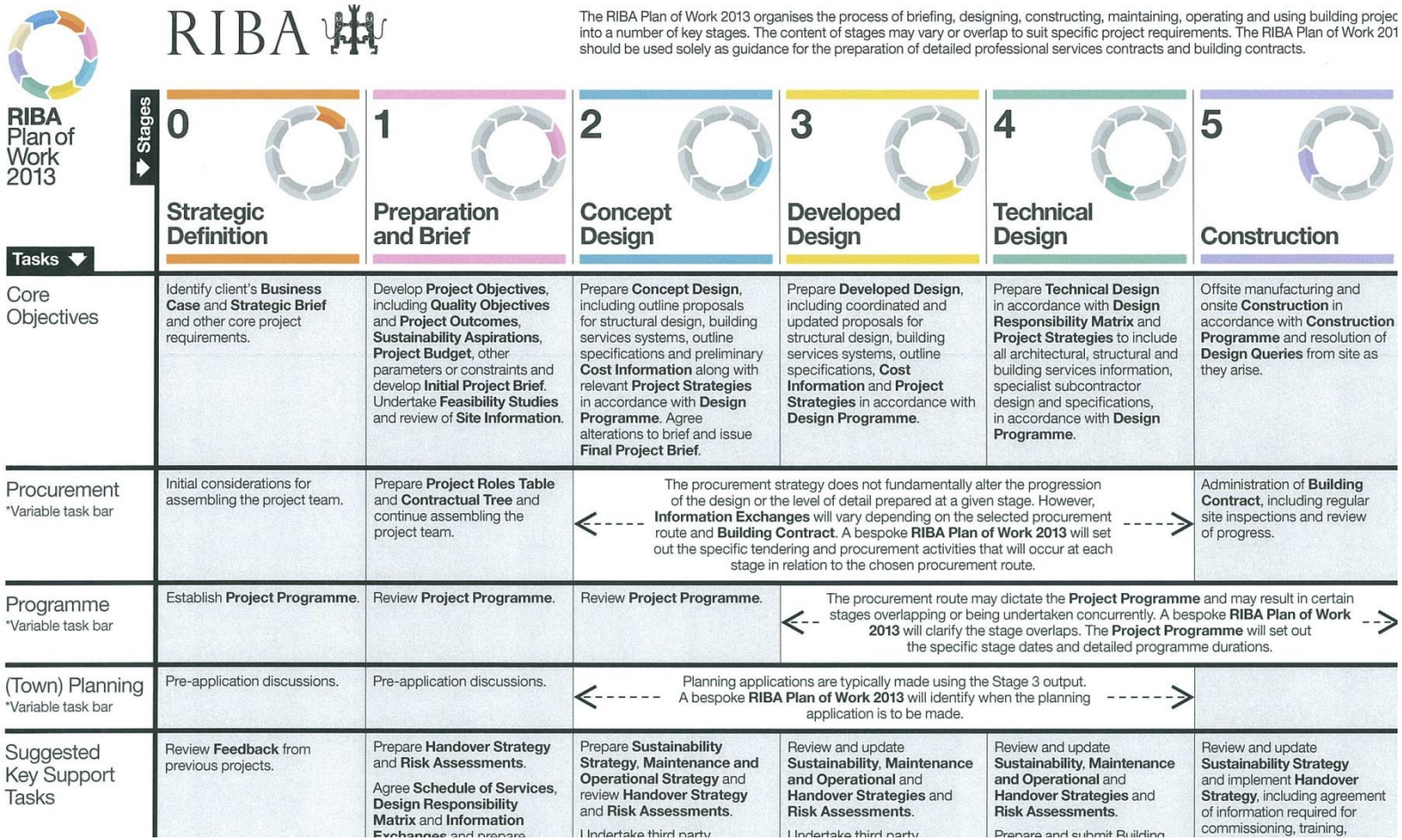
- **Aim;**
- To ensure Client obtains value for money by

1. Setting a realistic cost limits which represents a fair price for the project
2. Deciding how this money is to be spend
3. Checking that the money is being spent as intended

Outline Plan of works(Oman?)

- Inception
- Feasibility
- Preliminary Design- outline proposal, schematic design
- Detailed Design
- Production Information
- Bill of Quantities
- Tender Action
- Project Planning
- Operation on site -> Completion

RIBA work stages



RIBA

The RIBA Plan of Work 2013 organises the process of briefing, designing, constructing, maintaining, operating and using building projec into a number of key stages. The content of stages may vary or overlap to suit specific project requirements. The RIBA Plan of Work 201 should be used solely as guidance for the preparation of detailed professional services contracts and building contracts.

RIBA Plan of Work 2013

Tasks ▼	Stages ▼ 0 Strategic Definition	1 Preparation and Brief	2 Concept Design	3 Developed Design	4 Technical Design	5 Construction
Core Objectives	Identify client's **Business Case** and **Strategic Brief** and other core project requirements.	Develop **Project Objectives**, including **Quality Objectives** and **Project Outcomes**, **Sustainability Aspirations**, **Project Budget**, other parameters or constraints and develop **Initial Project Brief**. Undertake **Feasibility Studies** and review of **Site Information**.	Prepare **Concept Design**, including outline proposals for structural design, building services systems, outline specifications and preliminary **Cost Information** along with relevant **Project Strategies** in accordance with **Design Programme**. Agree alterations to brief and issue **Final Project Brief**.	Prepare **Developed Design**, including coordinated and updated proposals for structural design, building services systems, outline specifications, **Cost Information** and **Project Strategies** in accordance with **Design Programme**.	Prepare **Technical Design** in accordance with **Design Responsibility Matrix** and **Project Strategies** to include all architectural, structural and building services information, specialist subcontractor design and specifications, in accordance with **Design Programme**.	Offsite manufacturing and onsite **Construction** in accordance with **Construction Programme** and resolution of **Design Queries** from site as they arise.
Procurement *Variable task bar	Initial considerations for assembling the project team.	Prepare **Project Roles Table** and **Contractual Tree** and continue assembling the project team.	The procurement strategy does not fundamentally alter the progression of the design or the level of detail prepared at a given stage. However, **Information Exchanges** will vary depending on the selected procurement route and **Building Contract**. A bespoke **RIBA Plan of Work 2013** will set out the specific tendering and procurement activities that will occur at each stage in relation to the chosen procurement route.			Administration of **Building Contract**, including regular site inspections and review of progress.
Programme *Variable task bar	Establish **Project Programme**.	Review **Project Programme**.	Review **Project Programme**.	The procurement route may dictate the **Project Programme** and may result in certain stages overlapping or being undertaken concurrently. A bespoke **RIBA Plan of Work 2013** will clarify the stage overlaps. The **Project Programme** will set out the specific stage dates and detailed programme durations.		
(Town) Planning *Variable task bar	Pre-application discussions.	Pre-application discussions.	Planning applications are typically made using the Stage 3 output. A bespoke **RIBA Plan of Work 2013** will identify when the planning application is to be made.			
Suggested Key Support Tasks	Review **Feedback** from previous projects.	Prepare **Handover Strategy** and **Risk Assessments**. Agree **Schedule of Services**, **Design Responsibility Matrix** and **Information Exchanges** and prepare	Prepare **Sustainability Strategy**, **Maintenance and Operational Strategy** and review **Handover Strategy** and **Risk Assessments**. Undertake third party	Review and update **Sustainability**, **Maintenance and Operational** and **Handover Strategies** and **Risk Assessments**. Undertake third party	Review and update **Sustainability**, **Maintenance and Operational** and **Handover Strategies** and **Risk Assessments**. Prepare and submit Building	Review and update **Sustainability Strategy** and implement **Handover Strategy**, including agreement of information required for commissioning, training,

RIBA work stages

ORDER OF COST ESTIMATING AND ELEMENTAL COST PLANNING

	RIBA Work Stages	RICS formal cost estimating and elemental cost planning stages	OGC Gateways (Applicable to building projects)
Preparation	A Appraisal	Order of cost estimate	
Preparation	B Design Brief		1 Business Justification
Design	C Concept		2 Delivery Strategy
Design	D Design Development	Formal Cost Plan 1	3A Design Brief and Concept Approval (See note below)
Design	E Technical Design	Formal Cost Plan 2	
Pre-Construction	F Production Information	Formal Cost Plan 3 Pre-tender estimate	3B Detailed Design Approval (See note below)
Pre-Construction	G Tender Documentation		
Pre-Construction	H Tender Action	Post tender estimate	
Construction	J Mobilisation		3C Investment Decision (See note below)
Construction	K Construction to Practical Completion		4 Readiness for Service
Use	L Post Practical Completion		5 Operations Review and Benefits Realisation

RICS NRM-Definitions

There are lot of definitions you need to remember which can be questions in APC.

Ex. Base cost estimate, inflation, cost limit, cost checks, EUQ, EUR, PC sum,

Essentials of cost control system

- Set Targets (prepare cost estimate /cost plan)
- Monitor Progress (measure and compare)
- Report Findings
- Agree Adjustments (cost plan or design)

Details /data used for cost planning

Historical data

- Price Books
- Bills of Quantities for past projects
- Final Accounts for past projects
- Building cost information service (BCIS)
- Trade Journals

Historical Data

- Can historical data simply be transferred? Most unlikely;
- **Need adjustments for**

1. **Time**
2. **Location**
3. **Building Type etc.**

Methods of cost planning

- Floor Area Method
- **Elemental Method**
- Unit rates and element unit rates
- Updating unit rates and other costs to current estimate base date
- **Comparative**
- **Elemental approximate quantities**

Elemental Cost Planning

When preparing an elemental cost plan, the cost of the building is split up into the different "elements"

Elements

An Element is a part of a building which performs a specific function

- **Sub structure-** Piling, earth works, foundation etc.
- **Superstructure-** Frame, upper floors, Roof, Stair, External walls, Doors and windows, Internal walls and partitions
- **Internal Finishes-** walls, floors, ceilings
- **Fittings and furnishings**

Elements Cont'd

- **Services**- Sanitary Appliances, disposal installations, Water Installations, Space heating and AC, Ventilation system, Electrical installation, Gas/Fuel installation, Lifts, Fire Fighting, Telephones, medical gas

- **External Works-** site preparation, Roads and paths, landscaping, Drainage, External services

Comparative Cost Planning

- A process for comparing the cost of alternatives which perform the same function

Ex. Steel and Concrete frames

Different roof structures and finishes

sample

driver consult

ATKINS

3.6 Detailed Information

Detailed information includes key project information such as gross floor area (GFA), number of keys (rentable rooms) as well as a cost per square meter as compared to the GFA and a cost per key.

The **Salalah Development** detailed information is as follows:

DESCRIPTION	MOVENPICK HOTEL		CLUB MED HOTEL		18 HOLE GOLF COURSE		GOLF COURSE CLUB HOUSE	
	Low Level (OMR)	High Level (OMR)	Low Level (OMR)	High Level (OMR)	Low Level (OMR)	High Level (OMR)	Low Level (OMR)	High Level (OMR)
GFA (m^2)	59,526	59,526	68,671	68,671	316,006	316,006	2000	2000
Cost / m^2	1,238	1,441	957	1,111	23	26	550	800
Nr. Keys / Holes	400	400	395	395	18	18		
Cost / Key / Hole	184,236	214,513	166,298	193,107	400,881	460,556		

Table 2: Salalah Development Detailed Information

Not included in Cost Plan

- Land Cost
- Advertisement Cost
- Finance Cost
- Legal Fees
- Employer's operational cost
- Feasibility study cost
- Cost of future authority requirement changes
- Inflation/Price Fluctuation/Market Conditions

Value for Money?

Value for Money

Value for money will have different meanings for different clients. (see paper 1116 section 2)

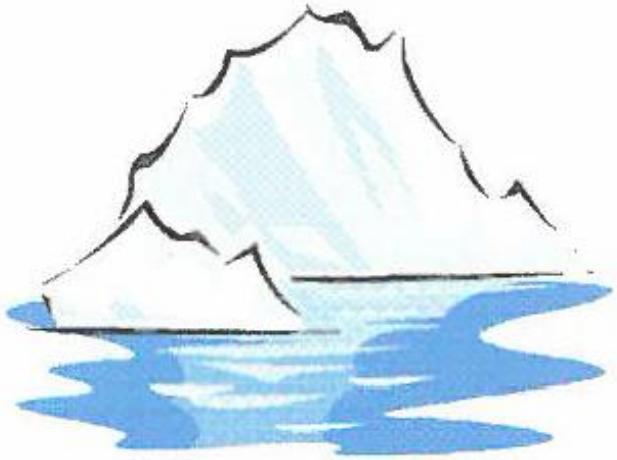
It does not necessarily mean the cheapest option

Some factors considered could be

- The building design should be economical.
- Standard of amenity, finish and equipment
- least initial cost, consistent with good design.
- Balance between initial and future costs
- Minimum disruption resulting from maintenance

Life Cycle Costing

Typically, only one ninth of the volume of an iceberg is above water, the remainder is underwater and cannot be seen (Wikipedia)



In buildings, future user costs are many times the initial cost of the building. Whole life costing considers both initial and future costs,

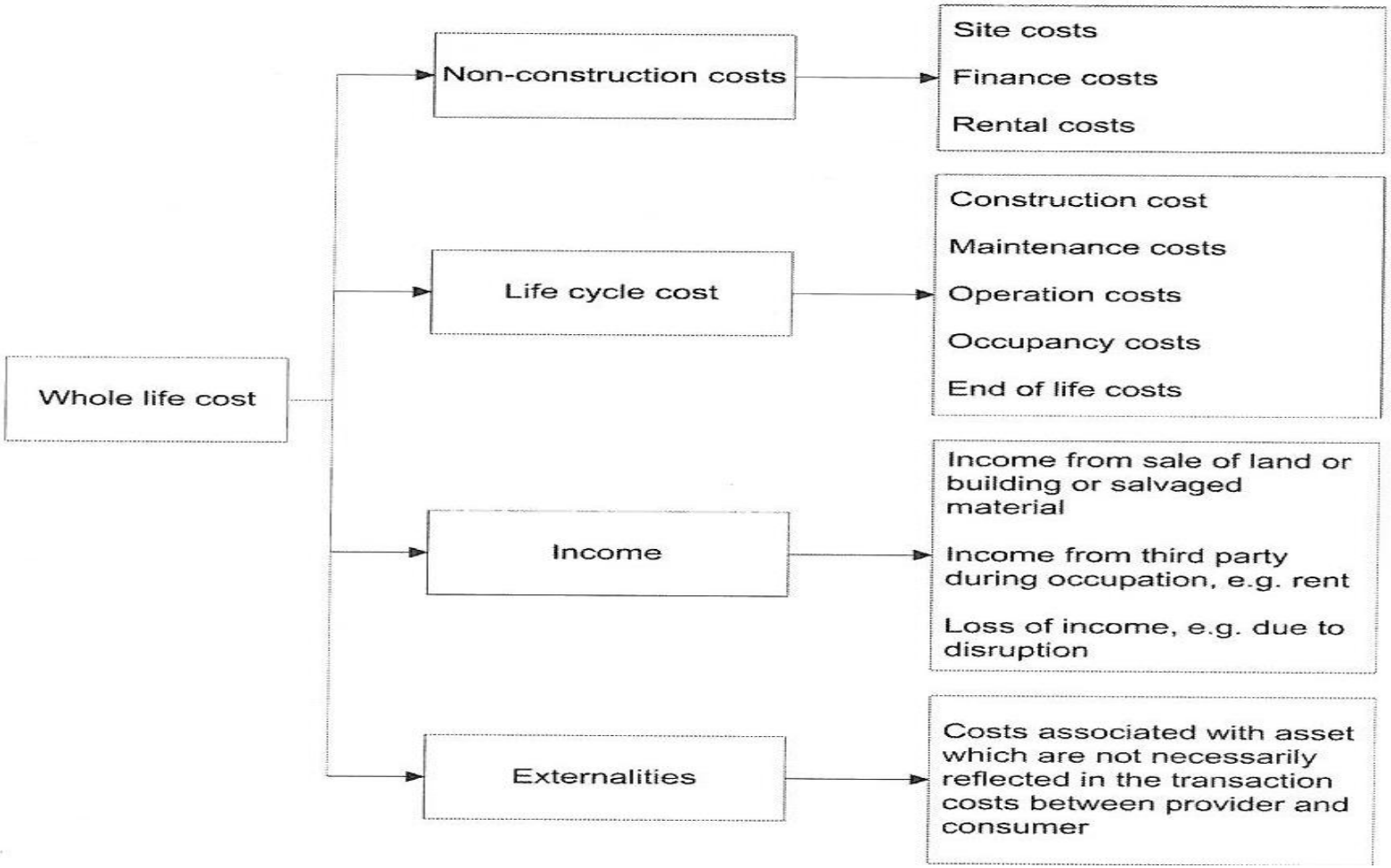
Definitions

Life cycle costing is sometimes called whole life costing. In this course, we differentiate between the two:

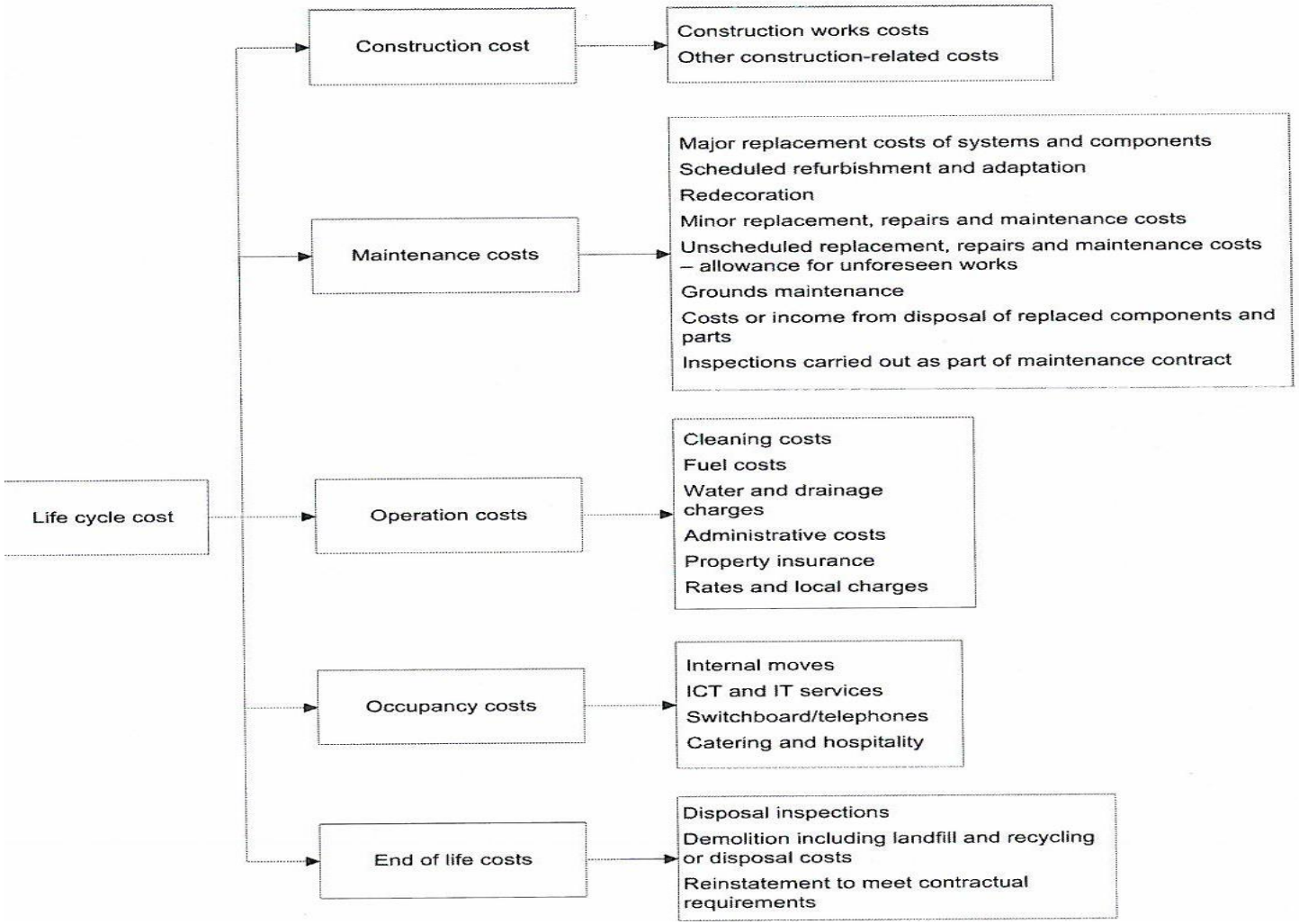
Life cycle costing relates to the cost of the building (or component) throughout its life.

Whole life costing includes other costs such as the cost of the site, financing costs etc ie the cost of the whole development.

Whole life cost



Life cycle cost



How do we choose between alternatives

e.g. how do we decide whether to :-

a) **Spend more in construction and thus reduce maintenance costs**

or

b) **Build more cheaply and have higher maintenance costs**

Life cycle costing provides a

- Comparison of alternative designs

- Comparison of alternative *CASH FLOW* streams as illustrated in the following graphs:

Life cycle costs – what is included?

- **Construction costs**
- **Maintenance costs**
  - Replacement, refurbishment, repairs, maintenance, adaptation, inspections etc
- **Operation costs**
  - Cleaning, fuel/energy costs, insurance etc
- **Occupancy costs**
  - Internal moves, IT services, switchboard etc
- **End of life costs**
  - Disposal inspections, demolition, reinstatement costs

Stages of Life cycle costing

- **Life cycle cost analysis**; collection and analysis historic date connected with actual costs
- **Life cycle cost management**; collecting data on other buildings, planning and controlling occupancy costs
- **Life cycle cost planning**; using cost analysis to predict future costs

Net Present Value

Life cycle costing

- We must adjust all payments to a common base which we call the present value.

- We do this by using a combined adjustment for interest and inflation called the

DISCOUNT RATE

Discount rate =
cost of borrowing minus rate of inflation
(all expressed as percentages)

Value Engineering/Management

"A systematic approach to achieve the required project functions at least cost without detriment to quality, performance and reliability "

Value Engineering is part of the overall value management process which should be carried out during the pre-contract process mainly during the design stage

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Value Management

- Value Planning
- Value Engineering
- Value Review

Risks in Construction Industry

Risks are unavoidable in any project and to be…

- Identified
- Analyzed
- Monitored and Controlled

Risk and Risk Allocation

Identification and recording;

- All possible factors well in advance to decide whether to proceed with the project or not
- Categorization of identified risks in logical manner for easiness of assessing and managing them.

Analysis/Assessment

(Magnitude, Probability and Occurrence). Management of risks depend on the accuracy of assessment.

- Quantification and qualitative techniques can be used.
- Probabilities and sensitivity analysis.
- Can categories as critical, major, minor

Risk and Risk Allocation

- Identification and recording
- Analysis (Magnitude, Probability and Occurrence)
- Response (Avoid, Reduce, Accept, Transfer, sharing, retention)
- Contingency