TOPIC 2: DECISION-MAKING TECHNIQUES

Decision-making refers to a process of estimating the consequences of alternative actions that the decision-maker may take.

Decision-making sets a direction/course of action for performance measurement. This, therefore, requires the necessary resources for enabling the achievement of performance targets.
Among the resources needed is having the relevant cost information and the use of suitable techniques/models to guide managers' decisions.

A relevant cost is a cost that is relevant to the decision being made. It is an incremental future cash flow arising as a direct consequence of a decision.

Fundamental features of relevant costs for decision making include some of the following;

- ***Cash flow****;* Only cash flow information is required for decision- making. This excludes items like depreciation, bad debts, and notional costs.
- ***Future cost****;* these must be forward-looking based on expected factor prices for the planning period. This, therefore, excludes past costs, sunk costs, and committed costs as irrelevant costs.
- ***Differential costs/Revenues****;* These differ among decision alternatives. These can include both incremental and opportunity costs.
- ***Opportunity cost:*** This is a benefit foregone by choosing one option instead of the next best alternative.
- ***Incremental cost****:* These are avoidable or escapable costs that are incurred only when the activity is extended beyond its present range. Hence, variable costs are incremental costs such as salaries, additional material prices, etc.

Summary of relevant costs for some cost elements

Cost Element	Relevant Cost	Irrelevant cost.
Materials	• Current replacement Cost/purchase cost. • current re-sale value • Opportunity cost/ Lost contribution i.e. when put to alternative use. • Lost scrap value/Disposal value	• Previous purchase Cost
Labor	• Replacement Cost • Incremental cost such as overtime. • Hiring cost • Lost contribution from labor transfer.	• Costs on permanent staff.

Overheads	• Directly attributable OHs • Cash overheads	• Fixed OHs • General OHs
Non-current assets(capital investments)	• Purchase price of any new assets • Scrap/disposal on new assets bought. • An opportunity cost equal to the lost Contribution (in case of asset transfer).	• Depreciation • Profit or loss on disposal • The original purchase price (Sunk Cost). • The NBV of existing (not a cash flow).

MULTI-LIMITING FACTORS

Under Throughput accounting, we examined how to deal with a limited resource (Key Factor Analysis & Throughput Accounting).

Limiting factors (constraints/bottlenecks) look at situations with **more than one** limited resource & the application of a technique known as **linear programming**.

Linear Programming

This is a mathematical technique for maximizing or minimizing a linear function of several variables, such as output, profit/ contribution or cost.

It is also called **linear optimization** as a method for achieving the best outcome in a mathematical model whose requirements and objectives are represented by linear relationships.

This technique is useful for guiding quantitative decisions in business planning and industrial engineering, and, to a lesser extent, in the social and physical sciences.

If there are **two or more scarce resources**, we cannot use the Key Factor approach. Instead, we must use linear programming.

The steps involved in using linear programming following the graphical approach are as follows:

1. Define the unknowns in terms of symbols.
2. Formulate equations for the constraints.
3. Formulate an equation for the objective.
4. Graph the constraints and the objective.
5. Find the optimum solution.

Example One:
Peter makes two types of chairs – the 'Executive' and the 'Standard'. The data relating to each is as follows;

Details	**Standard**	**Executive**
Materials	2 Kg	4 Kg
Labour	5 Hours	6 Hours
Contribution	$ 6	$ 9

A maximum of 80 Kg of materials and 180 labour hours are available each week. Demand for 'standard' chairs is unlimited, but maximum weekly demand for 'Executive' chairs is 10.

Required:
Find the optimal production plan and the maximum contribution that this will generate.

MAKE OR BUY DECISIONS
To overcome limited resources, a firm may buy in a product instead of making it itself.
Where the incremental costs of manufacture are less than those of buying in, the firm should make, assuming there are no resource limitations.
Where resources are limited, the firm should concentrate on making those products that give the greatest saving (over buying in) per unit of the scarce resource.
To decide which products should be made and which should be bought, we calculate the savings per unit of scarce resources from making the product rather than buying it.

Example Three
The availability of material B is limited to 8,000 Kg.

Product	**X**	**Y**	**Z**
Demand (Units)	2,000	2,500	4,000
Variable cost to make ($ per unit)	10	12	14
Buy-in prices ($ per unit)	13	17	16
Kg of B required per unit (Included in variable cost)	3	2	1

Required:
Which products should the company make and which should it buy?

Suggested Procedure

1- **Determine the savings per unit if items are made rather than bought**
   Buy-in price – cost of making = savings per unit for each product
2- **Calculate the total quantity of material B needed if all items are made**
   Demand * Kgs of Material B for each product
   This will help in determining the total Kgs or material required
3- Calculate savings per Kg of material B:
   Savings per unit/ Kgs of material per unit for each item
   As follows

Product	Savings per Unit	Total Kg of B required	Savings per Kg of B
X	13 - 10 = 3	2,000 × 3 = 6,000	3 / 3 = 1.00
Y	17 - 12 = 5	2,500 × 2 = 5,000	5 / 2 = 2.50
Z	16 - 14 = 2	4,000 × 1 = 4,000	2 / 1 = 2.00

4- **Rank the items according to savings per Kg of material B:** (The item with the highest saving per unit should be given priority when allocating Kgs of material B)

5- **Allocate material B according to the items** (to see which item would be fully or partially made and the balance bought from outsiders)

6- **Summary of Decision to make/buy**

Product	Quantity to make (units)	Quantity to buy (units)
X		
Y		
Z		

The optimal use of limited material B resources dictates prioritizing in production. This allocation maximizes cost savings given the constraint

PRICING DECISIONS

Factors to consider in the fixation of a selling price may include;

- Costs; these give a basis for the profit component to be charged.
- Competitors (in terms of their quality, selling prices)
- Customers (tastes & preferences, income levels).
- Price sensitivity
- Price perception.
- Quality.
- Intermediaries
- Suppliers
- Inflation
- Level/trend of incomes
- Government policy, etc

THE PRICING STRATEGIES

They include the following: full cost-plus, marginal cost-plus pricing, price skimming, penetration pricing, price discrimination, and relevant cost pricing.

a) COST PLUS PRICING STRATEGIES

The selling price is calculated by estimating the cost per unit of a product and adding an appropriate percentage markup. A primary consideration will be as to what is to be regarded as the **cost**: full cost, marginal cost, or opportunity cost.

- ***Full cost plus***

Full cost includes a share of overheads and also often includes non-production costs like administration, selling, and distribution.

- ***Marginal cost-plus pricing;***
  This involves adding a profit margin to the marginal cost of a product.

Advantages of cost-plus pricing

- Widely used and acceptable.
- Simple & easy to calculate if costs are known.
- May encourage price stability – if all competitors have similar cost structures and use similar mark-up.
- Selling price decisions can be delegated to management.

Disadvantages of cost-plus pricing

- Ignores the economic relationship between price and demand
- Different absorption methods give rise to different costs and hence different selling prices.
- Does not guarantee profit – if sales volumes are low fixed costs may not be recovered.

Example Four;
A new product is being launched, and the following costs have been estimated;

Materials	Ugx 35,000 per unit
Labour	Ugx 28,000 per unit
Variable overheads	Ugx 17,500 per unit
Fixed overheads	Ugx 175,000,000 per year
Production	10,000 units per year.

Required; calculate the selling price based on;
(a) Full cost plus 20%
(b) Marginal cost plus 20%.
(c) Which cost structure would you adopt & why?

b) MARKET –BASED PRICING STRATEGIES

These include the following;

(1) PRICE SKIMMING STRATEGY

This involves charging high prices when a product is first launched to maximize short-term profitability. Initially, high prices may be charged to take advantage of the newness appeal of a new product when demand is initially inelastic. Once the market becomes saturated, the price can be reduced to attract that part of the market that has not been exploited.

Conditions suitable for a market-skimming strategy

- Where the **product is new and different and has little direct competition**. This is the most common reason for using a market-skimming strategy.
- Where **products have a short life cycle**, and there is a need to recover their development costs quickly and make a profit.
- Where the strength of demand and the sensitivity of demand to price are unknown. From a psychological point of view, it is far better to begin with a high price, which can then be lowered if the demand for the product appears to be more price sensitive than at first thought.
- A firm with liquidity problems may use market-skimming to generate high cash flows earlier.

NB: With high prices being charged, potential competitors will be tempted to enter the market. For skimming to be sustained, one or more significant barriers to entry must be present to deter these potential competitors. For example, patent protection and strong brand loyalty.

(2) PENETRATION PRICING STRATEGY

Penetration pricing is the charging of low prices when a new product is initially launched in order to gain rapid acceptance of the product. Once market share is achieved, prices are increased. It is an alternative to market skimming when launching a new product.

Circumstances that favor a penetration policy

• If the firm wishes to increase market share.
• A firm wishes to discourage new entrants from entering the market.
• If there are significant economies of scale to be achieved from high volume output, then a quick penetration into the market is desirable.
• If demand is highly elastic, it would respond well to low prices

(3) PRICE-DISCRIMINATION STRATEGY

A price-discrimination strategy is where a company sells the same product or services at different prices in different markets, for reasons not associated with costs.

Conditions required for a price-discrimination strategy

- The seller must have some degree of monopoly power, or the price will be driven down. Customers can be segregated into different markets. Customers cannot buy at the lower price in one market and sell at the higher price in the other market.
- Price discrimination strategies are particularly effective for services.
- There must be different price elasticity of demand in each market so that prices can be raised in one and lowered in the other to increase revenue.
- Customers in one market should find it difficult to buy and sell the product in a low-priced market

Dangers of price-discrimination as a strategy

- A black market may develop, allowing those in a lower-priced segment to resell to those in a higher-priced segment.
- Competitors join the market and undercut the firm's prices.
- Customers in the higher-priced brackets look for alternatives, and demand becomes more elastic over time.

(4) Other market strategies may include;

a) DEMAND BASED PRICING

It is given by; ***P = a – bQ*** where;
P = selling price
Q = quantity demanded at that price
a = theoretical maximum price (if the price is set at 'a' or above, then the demand will be zero)
b = the change in price required to change demand by 1 unit (the gradient of the line)

b) OPTIMAL SELLING PRICE

This is the price that maximizes profit. It is at a point where MC = MR.

Example Five.

A company sells an article at $12 per unit and has a demand of 16,000 units at this price. If the selling price were to be increased by $1 per unit, it is estimated that demand will fall by 2,500 units.

Required: On the assumption that the price/demand relationship is linear, derive the equation relating the selling price to the demand.

Example Six.

A company currently has a demand for one of its products of 2000 units at a selling price of Ugx 30 per unit. It has been determined that a reduction in the selling price of Ugx 1 will result in additional sales of 100 units. The costs of production are Ugx 1000 (fixed), together with a variable cost of Ugx 20 per unit.

Required;

Calculate the selling price per unit at which the profit will be maximized**.**

RISK AND UNCERTAINTY IN DECISION MAKING

Risk; this is said to exist where a decision maker has knowledge that several possible outcomes are possible, usually due to experience of similar circumstances.

This experience enables the decision maker to estimate the probability or the likely occurrence of each potential future outcome.

Uncertainty exists when the future is unknown, and the decision maker has no experience on which to base predictions. Due to insufficient information, there are no probability estimates for the different possible outcomes.

NB: the approach taken to decide will normally depend on the decision-maker's attitude to risk/ risk preference, i.e.

- **A risk seeker (optimist);** Will be interested in the best possible outcome, no matter how small the chance that it may occur. They try to make decisions that balance risk and return.
- **A risk neutral;** Will be concerned with the most likely or 'average' outcome.
- **A risk avoider (pessimist);** Makes decisions based on the worst possible outcomes that may occur. This takes a decision the limits or minimize the risk.

The decision=making Rules;

1. **Maxi-min Rule**; here, a decision maker selects the alternative that offers the least unattractive worst outcomes, i.e., the alternative *that maximizes the minimum profits/outcome*. This rule is defensive and conservative since it avoids the worst outcomes without considering opportunities for maximizing profits.
2. **Maxi-maxi Rule**; this looks at the best possible results, i.e. maximize the maximum profits. Aims at the option that could provide the maximum outcome.
   This rule ignores the outcomes that are less than the best possible outcome. It's a decision for **risk seekers.**
3. **Mini max regre**t rule; this aims at minimizing the regret from making the wrong decision.
   Regret is an opportunity lost by making a wrong decision. It involves measuring the amount of regret for each decision option.
   It is the amount by which the profits are worse than if the best decision option had been taken.

These are normally recorded in a payoff table, such as below

Project Profit (return) in dollars

Season	A	B	C
Rainy	200	120	95
Windy	120	150	85
Sunshine	90	100	130

The regret (Opportunity Loss) table would be as below **(To be done in class)**

4. Expected values;

This is a weighted average value of different possible outcomes from a given decision, and such weightings are based on probability on the basis of historical experience of such other similar circumstances.

They are normally used to support a risk-neutral attitude that normally ignores any variability in the range of possible outcomes but focuses on EV of outcomes.

NB:

The EV decision will be the decision option with the highest EV of benefit or the lowest EV of cost.

Limitations of Expected Values;

- EV is a weighted average outcome that will occur in the long run if events occur many times over. It is a long-run average.
- The EV of a given decision may be a value that will never occur.
- Since it's an average value, it ignores the extreme outcomes.
- The expected value is not usually 'expected'.
- The expected value does not indicate the risk.
- The estimation of the probabilities is very unreliable.

Example Seven

a) Michael sells lunches and snacks in a cafeteria. The lunch menu is freshly prepared each morning, and he has to decide how many meals to supply each day. As the office block is located in the city Centre, there are several other places situated around the building where staff can buy their lunch, so the level of demand for lunches in the cafeteria is highly uncertain. Michael has analyzed daily sales over the previous six months and established four possible demand levels and their associated probabilities. He has produced the following payoff table to show the daily profits that could be earned from the lunch sales in the cafeteria.

Demand level (snacks)	**Probability**	**Supply level (snacks)**			
		450	620	775	960
		UShs	UShs	UShs	UShs
450	0.15	1,170,000	980,000	810,000	740,000
620	0.3	1,170,000	1,612,000	1,395,000	1,290,000
775	0.4	1,170,000	1,612,000	2,015,000	1,785,000
960	0.15	1,170,000	1,612,000	2,015,000	2,496,000

Required;

Advise Michael on which supply level to focus using the following decision criterion;

(i) Max-min
(ii) Expected value
(iii) Mini-max regret
(iv) Identify and discuss any three (3) qualitative techniques that Michael may adopt to reduce uncertainty in decision-making.

b) Upet Company Limited (UCL) sells a certain garment at UShs 45,000 per pack and has a demand of 300,000 packs at this price under usual business circumstances. If the selling price were to be increased by UShs 1, the customer demand would fall by 200 packs.

Required;

On the assumption that a linear price/demand relationship exists between the demand and price of this garment, derive a price function for this garment.

Example Eight

The Makindan Company has estimated that the demand for one of its products is either 100, 200 or 300 units a month. The product is sold for $ 15/item and total variable costs amount to $7 per item. If demand is less than supply, the product may be sold off cheaply for $ 5 per item.

There is no penalty cost for not meeting demand.

Required:

a) Prepare a payoff matrix to represent the above information concisely.

b) Determine what demand should be satisfied under each of the following decision rules;

ii) Maximin

iii) Maximax

iv) Minimax regret

v) Expected values if the probability is 0.3, 0.5, and 0.2 for demand of 100, 200, and 300 items, respectively.

Example Nine

John has a factory capacity of 1,200 units per month. Units cost him $6 each to make, and his normal selling price is $11 each. However, the demand per month is uncertain and is as follows:

Demand	**Probability**
400	0.2
500	0.3
700	0.4
900	0.1

He has been approached by a customer who is prepared to contract for a fixed quantity per month at $9 per unit. The customer is prepared to sign a contract to purchase 300, 500, 700, or 800 units per month. The company can vary production levels during the month up to the maximum capacity, but cannot carry forward any unsold units in inventory.

(a) Calculate all possible profits that could result

(b) Determine for what quantity John should sign the contract, under the following Criteria;

i) Expected value

ii) Maximin

iii) Maximax

iv) Minimax regret

Qualitative techniques to reduce risk and uncertainty in decision making
This is normally focused on customer habits, attitudes or intentions in the market.

Market Research Techniques (MRT)
This involves gathering, analyzing, and reporting data about markets so as to investigate, describe, measure, and explain a given situation facing a company. Specifically helps;

- Understanding the needs and opinions of customers and other stakeholders.
- Managerial information for further competitive advantage.
- To reduce risk and uncertainty and monitor the performance of products and services in those specific markets.

The research techniques may include the following;

- Focus Groups
- Desk research (secondary research).
- Field research (primary research). This includes Motivational and Measurement research.

Focus groups;
They are a common market research **tool involving small groups (typically eight to ten people) selected from the broader population**. **The group is interviewed through facilitator-led discussions in an informal environment in order to gather their opinions and reactions to a particular subject**.

E.g., a supermarket may use a focus group before a product launch decision is made in order to gather opinions on a new range of pizzas.

- They are normally used in the early stages of product development.
- The members of the group are based on similar demographics, lifestyles, buying attitudes, income levels, etc.
- They are normally part of the target market of a given product.
- Such groups also reduce uncertainty by providing information that influences decisions about designing and marketing a product.

Problems with focus groups

- Results are qualitative.
- The small sample size means that results may not be representative.
- Individuals may feel under pressure to agree with other members
- Their cost and logistical complexity are frequently cited as a barrier; online focus groups are becoming more popular and help to address this issue.

Desk research

Under this method, the **information is collected from secondary sources.**

• It obtains existing data by studying published and other available sources of information. E.g., press articles, published accounts, and census information.

• It can often eliminate the need for extensive field work

When using desk research, it is important to note the information obtained.

- May not be exactly what the researcher wants and may not be totally up to date or accurate.
- However, it is quicker and cheaper than field research

Main types of information that can be collected by desk Research

- **Economic intelligence** - information relating to the economic environment within which a company operates.

  It is concerned with such factors as gross national product (GNP), investment, expenditure, population, employment, productivity, and trade. It provides an organization with a picture of past and future trends in the environment and with an indication of the company's position in the economy as a whole.

  A great deal of information is freely available in this area from sources such as government ministries, the nationalized industries, universities, etc.

- **Market intelligence** - information about a company's present or possible future markets.

  Such information will be both commercial and technical, e.g., the level of sales of competitors' products recorded by the Business Monitor or Census of Production; the product range offered by existing or potential competitors; the number of outlets forming the distribution network for a company's products; the structure of that network by size, location and relation to the end user; and the best overseas markets for a company.

- **Internal company data** is perhaps the most neglected source of marketing information. Companies tend to record their sales information for accounting purposes or for the management of the sales force.

Field research
Information is **collected from primary sources** by direct contact with a targeted group.
Although it is **more expensive** and **time-consuming** than desk research, the **results should be more accurate**, **relevant, and up to date**.

There are two types of field research

- ✓ **motivational research,** whose objective is to understand factors that influence why consumers do or do not buy particular products.
- ✓ **measurement research**. The objective here is to build on the motivation research by trying to quantify the issues involved, and it's normally done through sample surveys.

Other methods of analyzing uncertainty in decisions can include;

- **Simulation models**: mathematical representations of real-world systems used to analyze, predict, and optimize performance without testing on physical, costly, or unsafe prototypes
  - ✓ It's a computer-based modeling used in inventory, queuing, scheduling, and forecasting problems.
  - ✓ It is often used in capital investment appraisal.

- **Sensitivity analysis;** this measures the effect of changes in the estimated value of a key factor on a given future outcome. i.e., **a technique that determines how different values of an independent variable affect a specific dependent variable**

Here, decision options are tested for their vulnerability to changes in any variable, such as sales volume, price, material cost, or labor cost.

NB: The above models use spreadsheets as a computerized package for checking the effect of changes in variables on overall company performance.

Strengths of sensitivity analysis

• There is no complicated theory to understand.
• Information will be presented to management in a form that facilitates subjective judgment to decide the likelihood of the various possible outcomes considered.
• It identifies areas that are crucial to the success of the project. If the project is chosen, those areas can be carefully monitored.

Weaknesses of sensitivity analysis

- ✓ It assumes that changes to variables can be made independently, e.g., material prices will change independently of other variables. Simulation allows us to change more than one variable at a time.
- ✓ It only identifies how far a variable need to change; it does not look at the probability of such a change.
- ✓ It provides information based on which decisions can be made, but it does not point to the correct decision directly.

THE END