SERVICES SCIENCE AND SERVICE OPERATIONAL MANAGEMENT

UNIT 04

LECTURE 07

Unit-4 Strategies

4.1	Strategies for Managing Service Demand and Service Capacity
4.2	Forecasting Service Demand
4.3	Forecasting Models – Subjective Models
4.4	Forecasting Models – Causal Models
4.5	Forecasting Models – Time-Series Models

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21MGH402T SERVICES SCIENCE AND SERVICE OPERATIONS MANAGEMENT
SYLLABUS

Unit-1 - Service – Definition	***9 Hour***
Characteristics, Stages of economic development, Role of services in economy, Experience economy, Service science, Service dominant logic, Service systems, Service operations, Open system view of service operations, Service package, Strategic service vision, Competitive service strategies, Strategic analysis, Sustainability in services, Competitive role of information in services	
Unit-2 - New Service Development	***9 Hour***
Innovation in services, Service blueprinting, Service process design, Service system design, Service facility design and layout, Strategic location considerations, Service process analysis, Service encounter triad - Service organization, Contact personnel and Customer, Service profit chain, Technology in service encounter	
Unit-3 - Service Quality Dimensions	***9 Hour***
Measuring service quality – SERVQUAL gap model, walk through audit, Service quality by design, achieving service quality, Quality and productivity improvement process, Quality tools, Benchmarking, Improvement programs	
Unit-4 - Strategies	***9 Hour***
Strategies for managing service demand and service capacity, Forecasting service demand, Forecasting models – Subjective models, Causal models and Time-series models, Yield management and its application, Queuing systems, Essential features of queuing systems	
Unit-5 - Managing Service Projects	***9 Hour***
Characteristics of project, Project management – Principles, Process, and Building team, Selecting the project manager, Roles and responsibilities of project manager, Techniques for project management – PERT, CPM and Gantt charts, Monitoring project performance, Globalization of services, Global service strategies, Domestic growth and expansion strategies, Franchising	

SSSOM Syllabus

Unit-1 Service – Definition

1.1	Characteristics
1.2	Stages of Economic Development
1.3	Role of Services in Economy
1.4	Experience Economy
1.5	Service Science
1.6	Service Dominant Logic
1.7	Service Systems
1.8	Service Operations
1.9	Open System View of Service Operations
1.1	Service Package
1.11	Strategic Service Vision
1.12	Competitive Service Strategies
1.13	Strategic Analysis
1.14	Sustainability in Services
1.15	Competitive Role of Information in Services

Unit-2 New Service Development

2.1	Innovation in Services
2.2	Service Blueprinting
2.3	Service Process Design
2.4	Service System Design
2.5	Service Facility Design and Layout
2.6	Strategic Location Considerations
2.7	Service Process Analysis
2.8	Service Encounter Triad – Service Organization, Contact Personnel and Customer
2.9	Service Profit Chain
2.10	Technology in Service Encounter

Unit-3 Service Quality Dimensions

3.1	Measuring Service Quality
3.2	SERVQUAL Gap Model
3.3	Walk Through Audit
3.4	Service Quality by Design
3.5	Achieving Service Quality
3.6	Quality and Productivity Improvement Process
3.7	Quality Tools
3.8	Benchmarking
3.9	Improvement Programs

Unit-4 Strategies

4.1	Strategies for Managing Service Demand and Service Capacity
4.2	Forecasting Service Demand
4.3	Forecasting Models – Subjective Models
4.4	Forecasting Models – Causal Models
4.5	Forecasting Models – Time-Series Models
4.6	Yield Management and its Application
4.7	Queuing Systems
4.8	Essential Features of Queuing Systems

Unit-5 Managing Service Projects

5.1	Characteristics of Project
5.2	Project Management – Principles, Process and Building Team
5.3	Selecting the Project Manager
5.4	Roles and Responsibilities of Project Manager
5.5	Techniques for Project Management – PERT
5.6	Techniques for Project Management – CPM
5.7	Techniques for Project Management – Gantt Charts
5.8	Monitoring Project Performance
5.9	Globalization of Services
5.1	Global Service Strategies
5.11	Domestic Growth and Expansion Strategies
5.12	Franchising

Lecture 07 Topics

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	Process and Building Team
	ct Manager
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	nt – CPM
	nt – Gantt Charts
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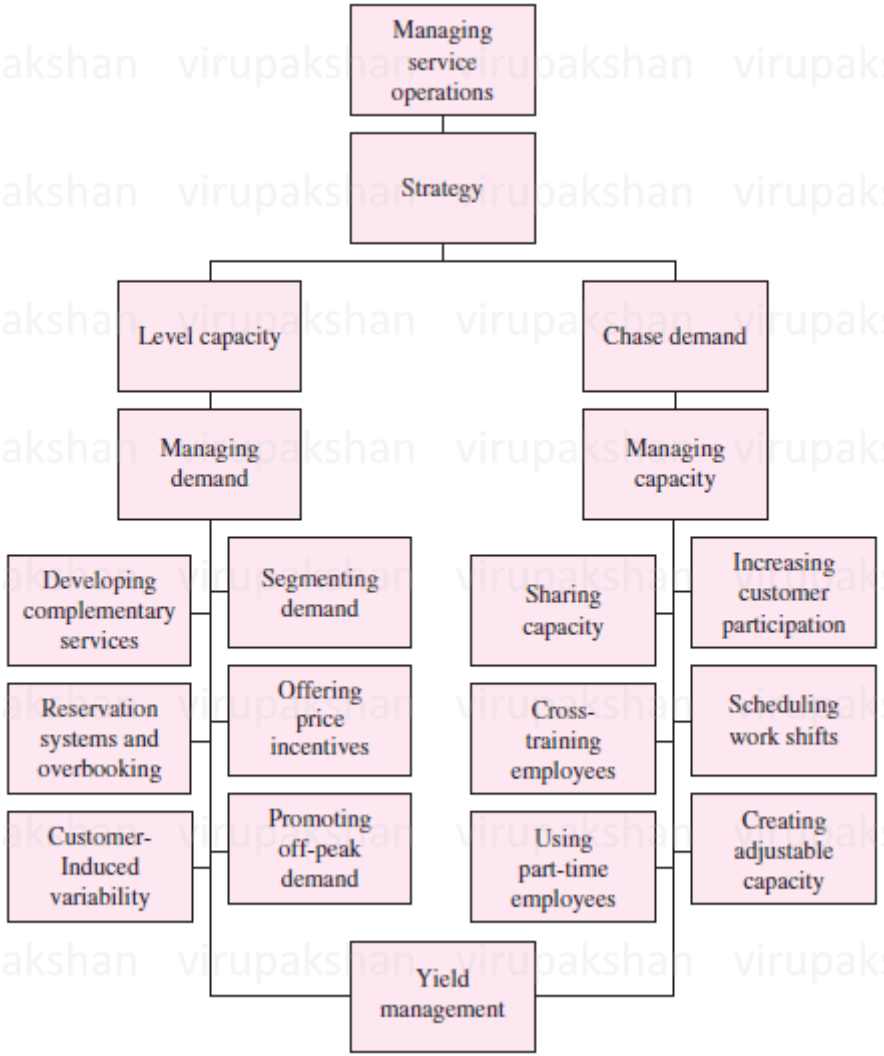
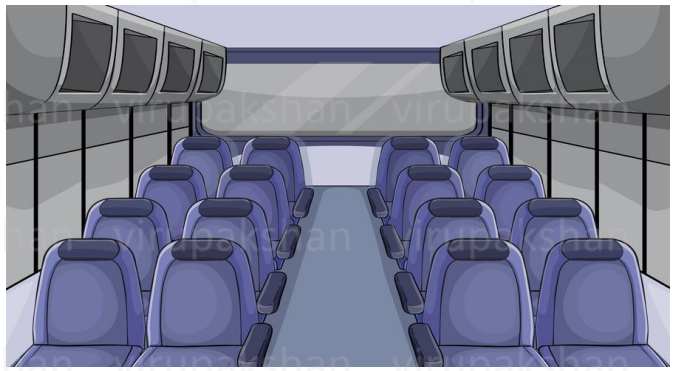
4.1. Strategies for Managing Service Demand and Service Capacity



4.1.A.1 CAPACITY PLANNING

Assume that you own a private bus and want to make profit.

How would you want: all seats sold or only a few seats sold for every trip?



(The subject of this Unit 3 is the challenge that is faced by managers of matching service capacity with customer demand on a daily basis in a dynamic environment)

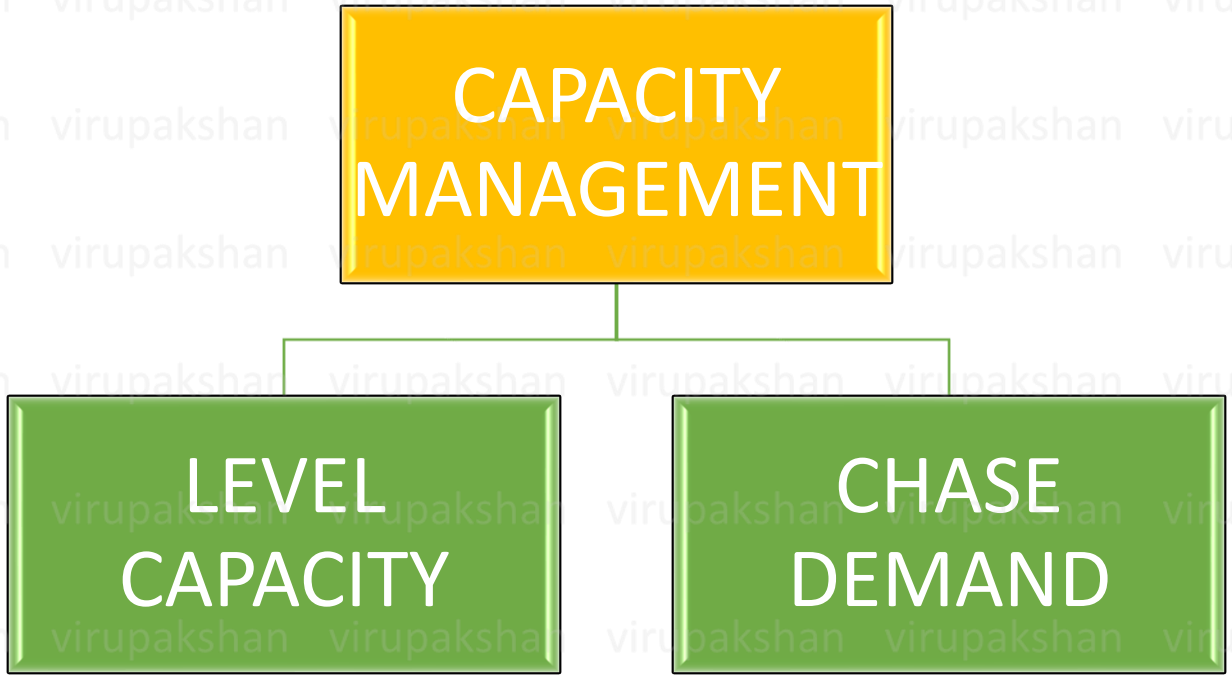
4.1.A.2 CAPACITY PLANNING

- Service capacity is a perishable commodity.
- Whenever demand for a service falls short of the capacity to serve, the results are idle servers and facilities.
- The natural variations in service demand create periods of idle service at some times and of consumer waiting at others.

Capacity planning is the act of balancing available resources to satisfy customer demand or project capacity needs.

4.1.A.3 CAPACITY MANAGEMENT STRATEGIES

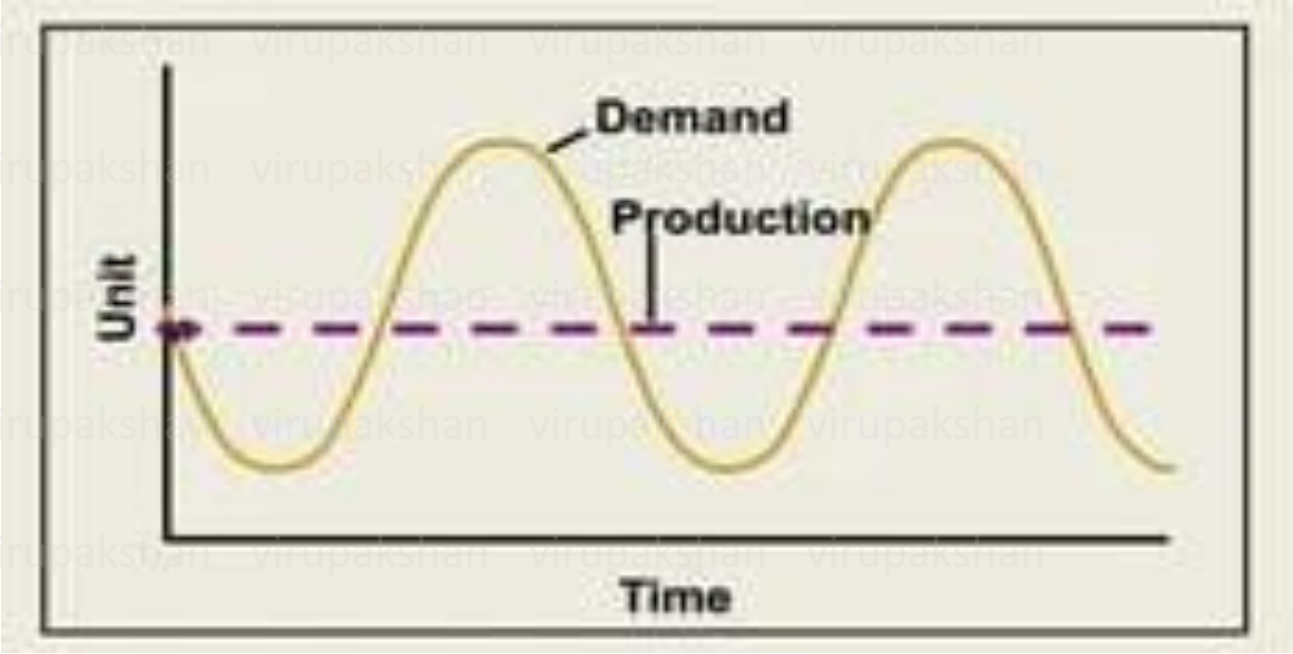
There are two generic **strategies for capacity management, level capacity** and chase demand.



4.1.A.4 Leveling Capacity

Leveling capacity means fixing capacity (production) at a constant level (generally the average demand) throughout a period regardless of fluctuations in forecast demand.

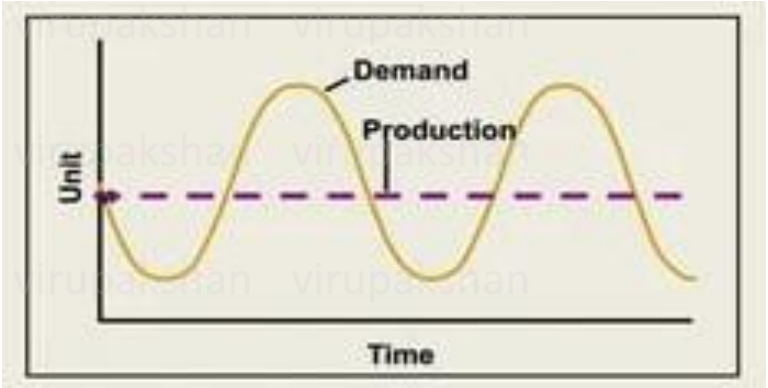
The use of a level strategy means that a company will produce at a constant rate regardless of the demand level.



4.1.A.4b Leveling Capacity - Example

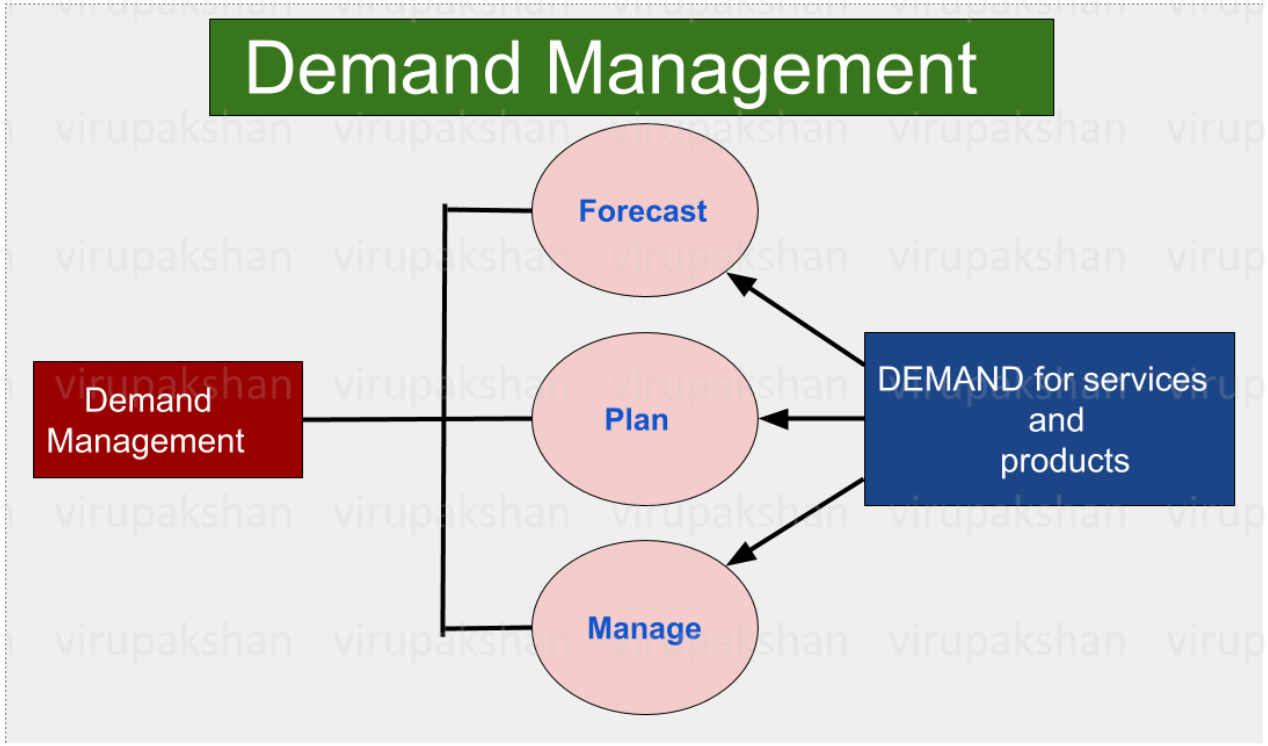
If you have a bakery shop, **how many breads per day** would you produce?

Ans: Irrespective of the demand, a bakery would produce a standard number of breads per day. This is "**Leveling Capacity**"



4.1.A.5 Demand Management

It is a **planning methodology** used to forecast, plan for and manage the demand for products and services.



4.1.A.5b Demand Management – Example

If Deepavali is on 24th October, Demand for Crackers would start from August.

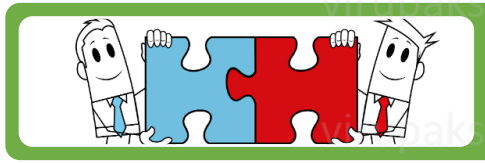
4.1.B.0 Demand Management Strategies

Customer-Induced Variability

Segmenting Demand

Offering Price Incentives

Promoting Off-Peak Demand



Developing Complementary Services

Reservation Systems and Overbooking

4.1.B.1a Customer-Induced Variability – 5 Sources

Customer-induced variability refers to the diverse needs and demands that different customers bring to a service process.

Frances Frei describes **five sources** of **customer-induced variability** in **service operations**.

The common **arrival variability** results in either idle servers or waiting customers because independent decisions of customers seeking service are not evenly spaced in time.

The level of customer knowledge, physical ability, and skill creates **capability variability** because some customers can perform tasks easily while others require hand-holding.

Request variability results from the unique demands of customers that create uneven service times, for example, a bank customer who wants to purchase a DD and another customer who wants to cash a check.

When customers are expected to perform a role in a service interaction (e.g., return a shopping cart to its corral), the level of commitment results in **effort variability**.

Finally, the expectation of what it means to be treated well varies among customers and results in **subjective preference variability**. For example, one diner might appreciate the warmth of a waiter's first name introduction while another resents the presumption of intimacy. Personal preferences introduce an unpredictability that makes it difficult to serve a broad base of customers uniformly.

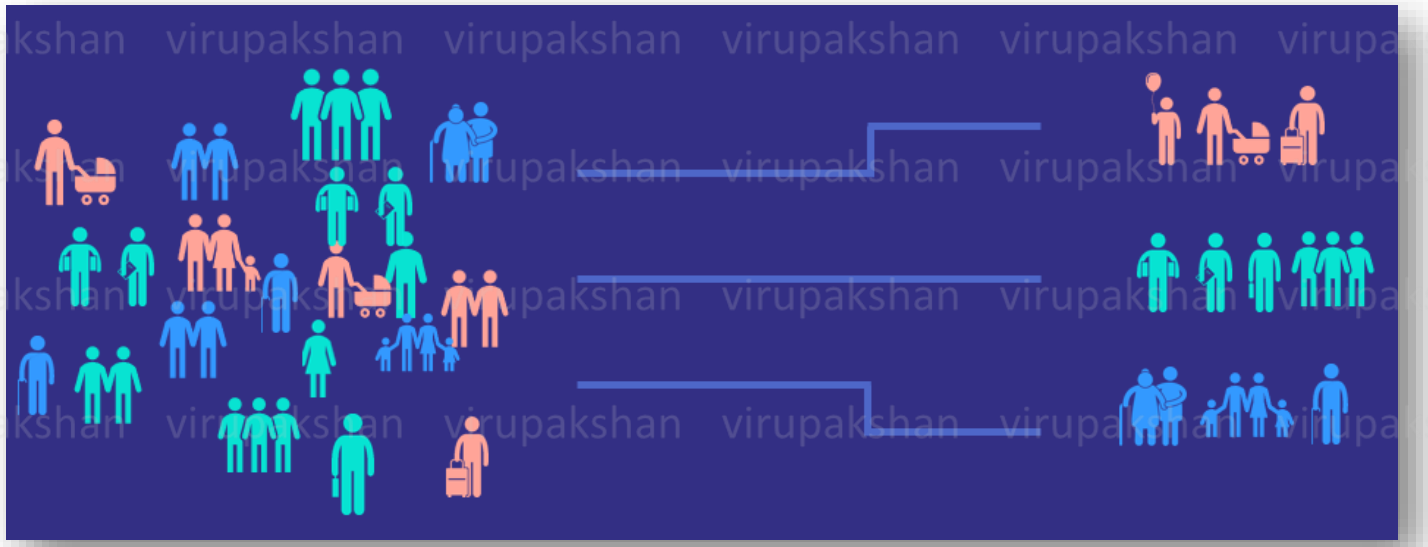
4.1.B.1b Customer-Induced Variability – Strategies to Manage

The **accommodation strategy** favors customer experience over operational efficiency.
The **reduction strategy** favors operational simplicity over service experience.

Type of Variability	Accommodation	Reduction
Arrival	Provide generous staffing	Require reservations
Capability	Adapt to customer skill levels	Target customers based on capability
Request	Cross-train employees	Limit service breadth
Effort	Do work for customers	Reward increased effort
Subjective Preference	Diagnose expectations and adapt	Persuade customers to adjust expectations

4.1.B.2 Segmenting Demand

Demand segmentation is a way of understanding and categorizing your customers based on their demand patterns, such as their order frequency, volume, variability, lead time, service level and price sensitivity.



4.1.B.3 Offering Price Incentives

Implementing **price incentives** is a powerful strategy to motivate both customers and employees and achieve desired goals.

There are many examples of differential pricing.

- CT Scan – Day Rs.1500 & Night Rs.1000
- Off-season hotel rates at resort locations.
- Shopping Mall parking charges on Weekends and Weekdays

4.1.B.4 Promoting Off-Peak Demand

Creative use of **off-peak capacity** results from seeking different sources of demand.

One example is use of a resort hotel during the off-season as a retreat location for business or professional groups.

Tamil Nadu
"AADI SALE".

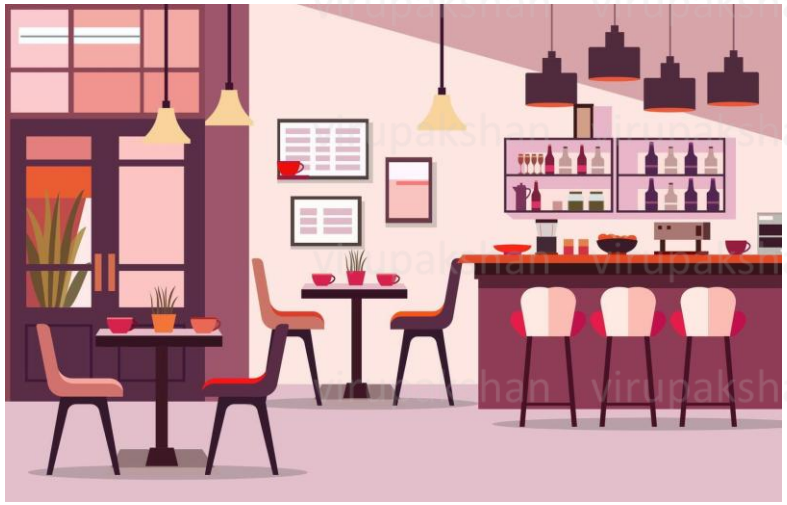
CT Scan
Day Rs.1500 & Night Rs.1000

India
"A/C SALE" during winter.

4.1.B.5 Developing Complementary Services

Developing complementary services is a natural way to **expand one's market**, and it is particularly attractive if the new demands for service are contracyclical (i.e., when the new service demand is high, the original service demand is low).

e.g. Restaurants have discovered the benefits of complementary services by adding a bar.



e.g. Cinema Halls having Popcorn counters.

4.1.B.6 Reservation Systems and Overbooking

Taking reservations **presells** the potential service.

As reservations are made, additional demand is deflected to other time slots at the same facility or to other facilities within the same organization. e.g. Movie tickets

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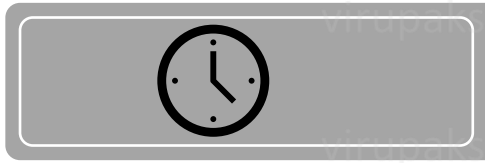
Faced with flying empty seats because of the no-shows, airlines adopted a strategy of **overbooking** i.e.by accepting reservations for more than the available seats.

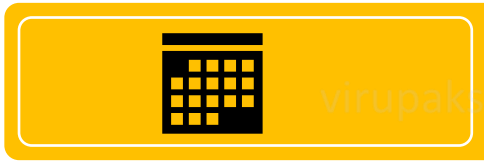
RISK OF OVERBOOKING: A negative impact on your brand, decreased customer loyalty, frustration on behalf of the guests, and lower staff morale.

4.1.C.0 Strategies for Managing Capacity

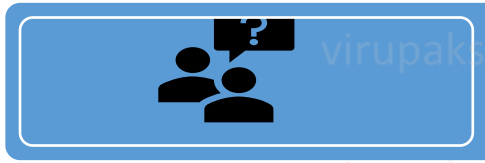
Defining Service Capacity



Daily Workshift Scheduling



Daily Workshift with constraints



Increasing Customer Participation

Creating Adjustable Capacity

Sharing Capacity

4.1.C.1 Defining Service Capacity

Service Capacity is defined in terms of an achievable level of output per unit time.

Example 1: Transactions per day for a busy Bank teller.

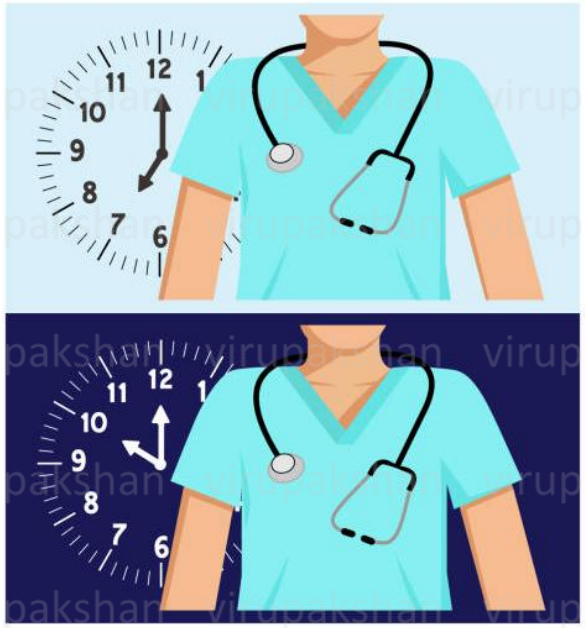
Example 2: Number of Answer Sheets corrected by a Teacher per Day.

Notice that for **service providers** the measure of capacity is based on a busy employee and not on observed output that must always be less than capacity.

4.1.C.2a Daily Workshift Scheduling

By scheduling workshifts carefully during the day, the profile of service capacity can be made to approximate demand.

Workshift scheduling is an important staffing problem for many service organizations that face cyclical demand, such as telephone companies, hospitals, BPOs, and police departments.



Doctors & Nurses

Call Center & BPO Employees

4.1.C.2b Daily Workshift Scheduling

The general approach begins with a **forecast of demand** by hour, which is **converted to hourly service staffing requirements**. The time interval could be less than an hour; for example, 15-minute intervals are used by fast-food restaurants to schedule work during meal periods. Next, a **schedule of shifts** is developed to match the staffing requirements profile as closely as possible. Finally, specific **service personnel are assigned** to shifts.

4.1.C.3a Daily Workshift with constraints

- Many public services such as police, fire protection and emergency hospital care must be available 24 hours a day, every day of the week.
- For these organizations, a typical employee works 5 days a week with 2 consecutive days off each week, but not necessarily Saturday and Sunday.

❖ Management is interested in developing work schedules and meeting the varying employee requirements for weekdays and weekends with the smallest number of staff members possible.

- This problem can be formulated as an **Integer Linear Programming (ILP) Model**

4.1.C.3b Daily Workshift with constraints – Example (ref)

Variable definitions:

x_i = number of employees assigned to tour i, where day i begins 2 consecutive days off (e.g., employees assigned to tour 1 have Sunday and Monday off)

b_j = desired staffing level for day j

Objective function:

Minimize $x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7$

Constraints:

Sunday	$x_2 + x_3 + x_4 + x_5 + x_6$	$\geq b_1$
Monday	$x_3 + x_4 + x_5 + x_6 + x_7$	$\geq b_2$
Tuesday	$x_1 + x_4 + x_5 + x_6 + x_7$	$\geq b_3$
Wednesday	$x_1 + x_2 + x_5 + x_6 + x_7$	$\geq b_4$
Thursday	$x_1 + x_2 + x_3 + x_6 + x_7$	$\geq b_5$
Friday	$x_1 + x_2 + x_3 + x_4 + x_7$	$\geq b_6$
Saturday	$x_1 + x_2 + x_3 + x_4 + x_5$	$\geq b_7$

$x_i \geq 0$ and integer

The emergency room is operated on a 24-hour, 7-days-per-week schedule. The day is divided into three eight-hour shifts. The total number of nurses required during the day shift is:

Day	Su	M	Tu	W	Th	F	Sa
Nurses	3	6	5	6	5	5	5

The emergency room director is interested in developing a workforce schedule that will minimize the number of nurses required to staff the facility. Nurses work 5 days a week and are entitled to 2 consecutive days off each week.

The ILP model above is formulated with the appropriate right-hand-side constraint values (i.e., $b_1 = 3$, $b_2 = 6$, . . . , $b_6 = 5$, $b_7 = 5$), and the solution yields the following results: $x_1 = 1$, $x_2 = 1$, $x_3 = 2$, $x_4 = 0$, $x_5 = 3$, $x_6 = 0$, $x_7 = 1$. This means we have one tour with Sunday and Monday off, one tour with Monday and Tuesday off, two tours with Tuesday and Wednesday off, three tours with Thursday and Friday off, and one tour with Saturday and Sunday off. The corresponding staffing schedule is shown in Table 11.8 with excess staff occurring only on Sunday and Saturday.

These scheduling problems typically result in multiple optimal solutions. For example, in this case, the solution $x_1 = 1$, $x_2 = 1$, $x_3 = 1$, $x_4 = 1$, $x_5 = 1$, $x_6 = 1$, $x_7 = 2$ is feasible and also requires eight nurses. Why might this second solution be preferred to the schedule shown in Table 11.8?

Nurse	Su	M	Tu	W	Th	F	Sa
A	...	...	x	x	x	x	x
B	x	...	...	x	x	x	x
C	x	x	...	...	x	x	x
D	x	x	...	...	x	x	x
E	x	x	x	x	...	...	x
F	x	x	x	x	...	...	x
G	x	x	x	x	...	...	x
H	...	x	x	x	x	x	...
Total	6	6	5	6	5	5	7
Required	3	6	5	6	5	5	5
Excess	3	0	0	0	0	0	2

4.1.C.4 Increasing Customer Participation

- The strategy of **increasing customer participation** is illustrated best by the fast-food **restaurants** that have **eliminated personnel who serve food** and clear tables.
- The customer (now a coproducer) not only places the order directly from a limited menu but also clears the table after the meal.
- Naturally, the customer expects faster service and less-expensive meals to compensate for this help; however, the **service provider** benefits in many subtle ways.

4.1.C.5 Creating Adjustable Capacity

Through design, a portion of capacity can be made variable.

For example: Airlines routinely move the partition between first class and coach to meet the changing mix of passengers.

Capacity at peak periods **can be expanded** by the effective **use of slack times.**

Performing supportive tasks during slower periods of demand allows employees to concentrate on essential tasks during rush periods. This strategy requires some cross-training of employees to allow performance of noncustomer-contact tasks during slow-demand periods.

For example: Servers at a restaurant can wrap silverware in napkins or clean the premises when demand is low; thus, they are free of these tasks during the rush period.

4.1.C.6 Sharing Capacity

- A service delivery system often **requires a large investment** in equipment and facilities.
- During periods of underutilization, it may be possible to find other uses for this capacity.

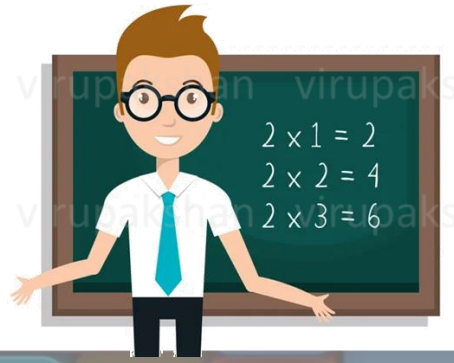
Example: At small airports, airlines share the same gates, ramps, baggage-handling equipment and ground personnel.

4.1.C.7 Part-time Employees

When **peaks of activity are persistent and predictable**, such as at mealtimes in restaurants or paydays in banks, **part-time help can supplement** regular employees.

If the required skills and training are minimal, then **a ready part-time labor pool is available** from high school and college students as well as others who **are interested in supplementing their primary source of income**.

EXAMPLE: **Visiting Faculty** in your college



4.2.1 Forecasting Service Demand

Definition

Forecasting is the process of estimating future demand for services using historical data, current trends, and expert judgment.

Simply,

Forecasting = Predicting future customer demand before it actually occurs.

Forecasts help managers answer questions such as:

- How many customers will arrive tomorrow?
- How many employees should be scheduled?
- How much inventory should be stocked?
- Will additional facilities be needed?

4.2.2 Forecasting Service Demand

2. Why Forecasting is Important in Service Management

Unlike manufacturing, services **cannot** usually be **stored**.

Examples:

- Empty airline seats cannot be stored.
- Hotel rooms not occupied today cannot be sold tomorrow.
- Doctor's unused appointment time is permanently lost.

Therefore forecasting becomes critical.

4.2.3 Forecasting Service Demand

3. Characteristics of Service Demand

Service demand is generally

- Variable
- Seasonal
- Perishable
- Time-dependent
- Sensitive to external factors

4.2.4 Forecasting Service Demand

4. Sources of Forecasting Information

Forecasts use

Internal Data

- Sales history
- Customer records
- Appointment logs
- Website visits
- Reservation data

External Data

- Weather
- Economy
- Tourism
- Festivals
- Competitors
- Government policy
- Population growth

4.2.5 Forecasting Service Demand

5. Types of Forecasting

Short-Term Forecast

Duration

Days to 3 months

Used for

- Staff scheduling
- Inventory
- Daily operations

Example

Predict customers tomorrow.

Medium-Term Forecast

3 months to 2 years

Used for

- Hiring
- Marketing
- Budgeting

Example

Forecast admissions next semester.

Long-Term Forecast

More than 2 years

Used for

- New hospitals
- Airports
- Hotels
- Expansion

4.2.6 Forecasting Service Demand

6. Forecasting Methods

A. Qualitative Methods

Used when

- Historical data unavailable
- New service launched
- Expert knowledge required

1. Delphi Method
Experts answer questionnaires anonymously.
Several rounds continue until consensus.

2. Executive Opinion
Senior managers discuss and forecast demand.

3. Market Survey
Customers are directly asked.

4. Sales Force Composite
Salespersons estimate regional demand.

B. Quantitative Methods

Use historical numerical data.

A. Time Series Forecasting Methods
These methods assume that future demand follows patterns observed in past demand.

B. Causal (Associative) Forecasting Methods
These methods assume that demand is influenced by one or more external variables.

C. Statistical and Advanced Forecasting Methods
Used when dealing with large datasets or complex demand patterns.

4.2.7 Forecasting Service Demand

Method	Data Required	Relative Cost	Forecast Horizon	Application
Subjective models:				
Delphi method	Survey results	High	Long term	Technological forecasting
Cross-impact analysis	Correlations between events	High	Long term	Technological forecasting
Historical analogy	Several years of data for a similar situation	High	Medium to long term	Life cycle demand projection
Causal models:				
Regression	All past data for all variables	Moderate	Medium term	Demand forecasting
Econometric	All past data for all variables	Moderate to high	Medium to long term	Economic conditions
Time series models:				
Moving average	*N* most recent observations	Very low	Short term	Demand forecasting
Exponential smoothing	Previous smoothed value and most recent observation	Very low	Short term	Demand forecasting

4.3.1 Forecasting Models – Subjective Models

Definition: Subjective forecasting is the process of predicting future demand **based** on expert knowledge, market insights, and informed judgment instead of mathematical or statistical methods.

When are Subjective Models Used?

Subjective forecasting is useful when:

- A new service or product is being introduced.
- Historical demand data is unavailable or insufficient.
- Market conditions are changing rapidly.
- Long-term strategic planning is required.
- Technological or economic changes make past data less reliable.

4.3.2.1 Forecasting Models – Subjective Models

Common Subjective Forecasting Models

1. Delphi Method

A panel of experts independently provides forecasts through multiple rounds of questionnaires. After each round, responses are summarized and shared anonymously until a consensus is reached.

Example: Estimating future demand for AI-powered healthcare services.

Advantages:

- Reduces personal bias.
- Encourages independent thinking.
- Useful for long-term forecasting.

4.3.2.2 Forecasting Models – Subjective Models

2. Executive Opinion (Jury of Executive Opinion)

A group of experienced managers or executives discusses market conditions and collectively estimates future demand.

Example: Bank executives forecasting loan demand for the next financial year.

Advantages:

- Quick and inexpensive.
- Uses practical business experience.

Limitation:

- May be influenced by dominant personalities.

4.3.2.3 Forecasting Models – Subjective Models

3. Market Research (Customer Survey)

Potential customers are surveyed to understand their future purchasing intentions and preferences.

Example: A hotel chain surveys travelers before opening a new resort.

Advantages:

- Reflects customer expectations.
- Useful for new service launches.

4.3.2.4 Forecasting Models – Subjective Models

4. Sales Force Composite

Sales representatives estimate demand in their respective regions. These estimates are combined to produce an overall forecast.

Example: An insurance company asks its agents to estimate the number of policies expected next quarter.

Advantages:

- Based on local market knowledge.
- Useful for regional demand forecasting.

4.3.2.5 Forecasting Models – Subjective Models

5. Historical Analogy

Demand for a new service is estimated by comparing it with the growth pattern of a similar existing service.

Example: Forecasting demand for electric buses using the adoption pattern of electric cars.

4.3.3 Forecasting Models – Subjective Models

Advantages of Subjective Models

- Can be used when historical data is unavailable.
- Flexible and easy to apply.
- Incorporates expert knowledge and market experience.
- Suitable for forecasting new products and services.
- Helps in long-term strategic planning.

Limitations

- Results may be biased by personal opinions.
- Accuracy depends on the expertise of participants.
- Difficult to validate mathematically.
- Different experts may provide different forecasts.

4.3.4 Forecasting Models – Subjective Models

Real-World Example

A **hospital** plans to introduce a **telemedicine service**. Since no historical demand data exists, the management:

- Consults healthcare experts.
- Surveys patients about their willingness to use online consultations.
- Discusses expected demand with senior doctors.

Using these expert opinions, the hospital estimates approximately **500 online consultations per month** during the first year.

4.4.1 Forecasting Models – Causal Models

Definition: A **causal forecasting model** estimates future demand by **analyzing how external factors** such as price, income, advertising, weather, population, or economic conditions influence **demand**.

Basic Concept

A causal model assumes that demand is affected by measurable factors.

Demand = f (Price, Income, Advertising, Weather, Population, etc.)

For example:

- Higher advertising → More customers
- Heavy rainfall → More taxi bookings
- Higher temperature → More ice cream sales
- Festival season → Higher hotel occupancy

4.4.2 Forecasting Models – Causal Models

Components of a Causal Model

Component	Description
Dependent Variable (Y)	Variable to be forecast (e.g., service demand, sales, number of customers)
Independent Variable(s) (X)	Factors influencing demand (e.g., price, income, weather, advertising)
Relationship	Mathematical equation showing how X affects Y

4.4.3a Forecasting Models – Causal Models

Common Causal Forecasting Models

1. Simple Linear Regression

This is the simplest causal forecasting method.

It uses **one independent variable** to predict demand.

Equation

$$Y = a + bX$$

where

- **Y** = Forecasted demand
- **X** = Independent variable
- **a** = Intercept
- **b** = Slope (change in demand for every unit increase in X)

4.4.3b Forecasting Models – Causal Models

Example for Simple Linear Regression:

A restaurant observes that customer visits increase as advertising expenditure increases.

Advertising (₹1000)	Customers
10	120
20	160
30	200

Suppose the regression equation is:

$$Y = 80 + 4X$$

If advertising is ₹40,000 (X = 40),

$$Y = 80 + 4(40) = 240$$

Forecast: 240 customers

4.4.4 Forecasting Models – Causal Models

2. Multiple Regression Analysis

Demand often depends on several factors rather than just one.

Equation

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \cdots$$

where

- X_1= Advertising
- X_2= Price
- X_3= Income
- etc.

Example

Hotel occupancy depends on:

- Room price
- Tourist arrivals
- Holiday season
- Weather

4.4.5 Forecasting Models – Causal Models

3. Econometric Models

Econometric models use multiple economic variables to forecast demand.

Common variables include:

- GDP growth
- Inflation
- Interest rates
- Consumer confidence
- Employment level

Example

An airline forecasts passenger demand using:

- GDP growth
- Fuel prices
- Ticket prices
- Tourism growth

4.4.6 Forecasting Models – Causal Models

4. Leading Indicator Method

Certain variables change **before** demand changes. These are called **leading indicators**.

Examples:

- Increase in building permits → Future demand for construction services
- Increase in tourist visa applications → Future hotel demand
- Increase in college applications → Future hostel demand

Managers use these indicators to forecast future service demand.

4.4.7 Forecasting Models – Causal Models

Advantages of Causal Models

- Explains **why** demand changes.
- Generally more accurate when influencing factors are known.
- Useful for long-term planning.
- Helps managers evaluate the impact of policy or marketing changes.
- Supports "what-if" analysis (e.g., *What happens if advertising increases by 20%?*).

Limitations

- Requires reliable historical data for all variables.
- Selecting the correct influencing variables can be difficult.
- Relationships between variables may change over time.
- More complex than simple time-series methods.
- Requires statistical software and expertise for large datasets.

4.4.8 Forecasting Models – Causal Models

Difference Between Time Series and Causal Models

Feature	Time Series Models	Causal Models
Basis	Past demand patterns	Cause-and-effect relationships
Data Required	Historical demand only	Demand and influencing variables
Explains why demand changes?	No	Yes
Complexity	Simple	Moderate to High
Typical Methods	Moving Average, Exponential Smoothing	Regression, Multiple Regression, Econometric Models
Best Used When	Demand follows stable patterns	Demand is strongly affected by external factors

4.5.1 Forecasting Models – Time-Series Models

Definition

Time-Series Forecasting Models are quantitative forecasting methods that predict future demand by analyzing **historical demand data collected over regular intervals of time** (daily, weekly, monthly, quarterly, or yearly).
These models assume that **past demand patterns will continue into the future**.

Basic Concept

Time-series forecasting is based on the assumption:
"History tends to repeat itself."
Unlike **causal models**, time-series models **do not consider external factors** (such as price, weather, or advertising). They rely only on **past demand values**.

4.5.2 Forecasting Models – Time-Series Models

Components of a Time Series

A time series generally consists of four components.

1. Trend (T)

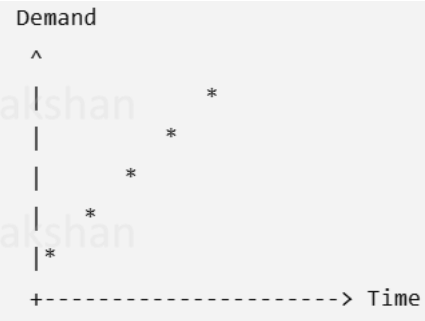
A **trend** is the long-term movement of demand over time.

It may be:

- Increasing
- Decreasing
- Constant

Example

The number of online banking users increases every year.



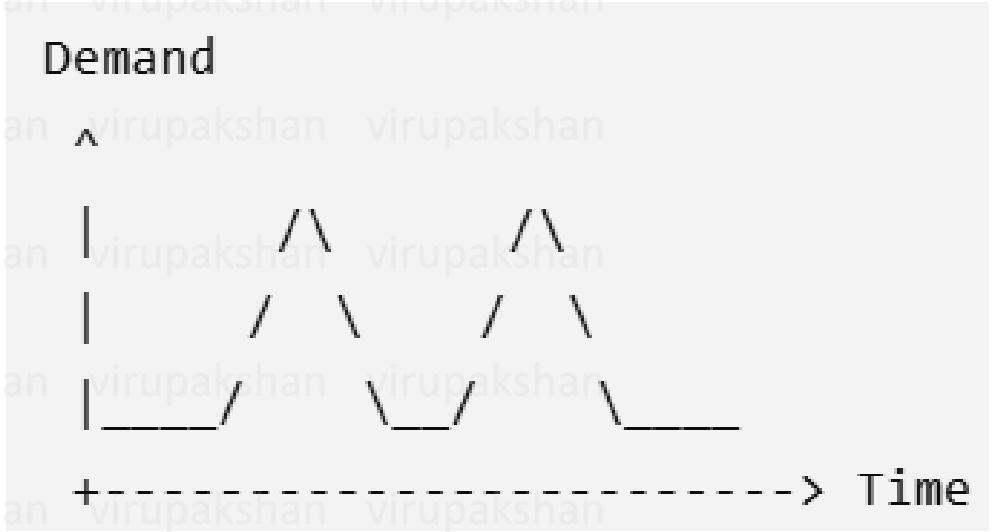
4.5.3 Forecasting Models – Time-Series Models

2. Seasonal Variation (S)

Seasonal variation refers to **regular patterns that repeat within a year**.

Examples:

- Hotel bookings increase during holidays.
- Ice cream sales rise during summer.
- Retail sales increase during festivals.



4.5.4 Forecasting Models – Time-Series Models

3. Cyclical Variation (C)

Cyclical variations occur over **several years** and are usually caused by economic conditions.

Examples:

- Economic boom
- Recession
- Business cycles

These patterns are less regular than seasonal variations.

4.5.5 Forecasting Models – Time-Series Models

4. Random Variation (R)

Random variations are **unpredictable fluctuations** caused by unexpected events.

Examples:

- Pandemic
- Natural disasters
- Strikes
- Power failures

These cannot be forecast accurately.

4.5.6 Forecasting Models – Time-Series Models

Types of Time-Series Forecasting Models

The most commonly used time-series models are:

1. Naïve Forecasting
2. Simple Moving Average
3. Weighted Moving Average
4. Exponential Smoothing
5. Trend Projection (Least Squares)
6. Trend-Adjusted Exponential Smoothing (Holt's Method)
7. Seasonal Forecasting
8. Decomposition Method

4.5.7 Forecasting Models – Time-Series Models

Applications of Time-Series Forecasting

Hospital

Forecast:

- Daily patient arrivals
- Emergency visits
- Bed occupancy

Hotel

Forecast:

- Room occupancy
- Seasonal bookings

Restaurant

Forecast:

- Lunch and dinner customers
- Weekend demand

Airlines

Forecast:

- Passenger bookings
- Flight occupancy

Banking

Forecast:

- ATM cash requirements
- Daily customer visits

Retail Stores

Forecast:

- Product sales
- Inventory requirements

4.5.8 Forecasting Models – Time-Series Models

Advantages of Time-Series Models

- Easy to understand and implement.
- Uses readily available historical data.
- Effective for short- and medium-term forecasting.
- Useful when demand patterns are stable.
- Helps in workforce scheduling and capacity planning.

Limitations

- Assumes past patterns will continue.
- Does not explain *why* demand changes.
- Ignores external influences such as weather, promotions, or economic conditions.
- Less accurate when sudden market changes occur.

Difference Between Subjective, Time-Series, and Causal Models

Feature	Subjective Models	Time-Series Models	Causal Models
Basis	Expert judgment	Historical demand data	Cause-and-effect relationship
Data Required	Little or no historical data	Historical demand only	Historical demand + influencing variables
Uses Mathematical Models	No	Yes	Yes
Considers External Factors	Yes (through expert opinion)	No	Yes
Examples	Delphi, Executive Opinion, Market Survey	Moving Average, Exponential Smoothing, Trend Projection	Regression, Multiple Regression, Econometric Models
Best Used For	New services or uncertain markets	Stable demand patterns	Demand influenced by measurable external factors

Lecture 07 Topics

Unit-1 Service – Definition

1.1	Characteristics
1.2	Stages of Economic Development
1.3	Role of Services in Economy
1.4	Experience Economy
1.5	Service Science
1.6	Service Dominant Logic
1.7	Service Systems
1.8	Service Operations
1.9	Open System View of Service Ope
1.1	Serv
1.11	Strat
1.12	Com
1.13	Strat
1.14	Sust
1.15	Com Serv

Unit-2 New Service Development

2.1	Innovation in Services
2.2	Service Blueprinting
2.3	Service Process Design
2.4	Service System Design
2.5	Service Facility Design and Layout
2.6	Strategic Location Considerations
2.7	Service Process Analysis
	Service Encounter Triad – Service Organization, Contact Personnel and
	Quality and Productivity Improvement
3.6	Process
3.7	Quality Tools
3.8	Benchmarking
3.9	Improvement Programs

Unit-4 Strategies

4.1	Strategies for Managing Service Demand and Service Capacity
4.2	Forecasting Service Demand
4.3	Forecasting Models – Subjective Models
4.4	Forecasting Models – Causal Models
4.5	Forecasting Models – Time-Series Models
4.6	Yield Management and its Application
4.7	Queuing Systems
4.8	Essential Features of Queuing Systems

4.1	Strategies for Managing Service Demand and Service Capacity
4.2	Forecasting Service Demand
4.3	Forecasting Models – Subjective Models
4.4	Forecasting Models – Causal Models
4.5	Forecasting Models – Time-Series Models

	Process and Building Team
	ct Manager
	nt – PERT
	nt – CPM
	nt – Gantt Charts
5.8	Monitoring Project Performance
5.9	Globalization of Services
5.1	Global Service Strategies
5.11	Domestic Growth and Expansion Strategies
5.12	Franchising

SERVICES SCIENCE AND SERVICE OPERATIONAL MANAGEMENT

UNIT 04 **LECTURE 07**

Doubts?

THANK YOU!

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