

Capacity planning and its planning

# What is service capacity?

**“..defined as the *maximum* level of *value-added activity* over a period of time that a service process *can consistently achieve* under *normal operating conditions*”** (Johnston et al., p.285); e.g.

- No of calls customer service agents can handle over the course of a shift
- No of meals served by a restaurant during the lunchtime period
- No of repair calls made by a computer service engineer during an 8-hour day

**“..ensuring the service process has ‘sufficient resources’ to deal with the anticipated levels of customer demand **in such a way that quality of service meets pre-set targets in the most cost effective way**”**

Restaurant may encourage customers to leave their table when they have completed their meal,, but customers may feel service is ‘rushed’ and has deteriorated ... Is increased productivity and desired service concept maintained?

# The coping zone

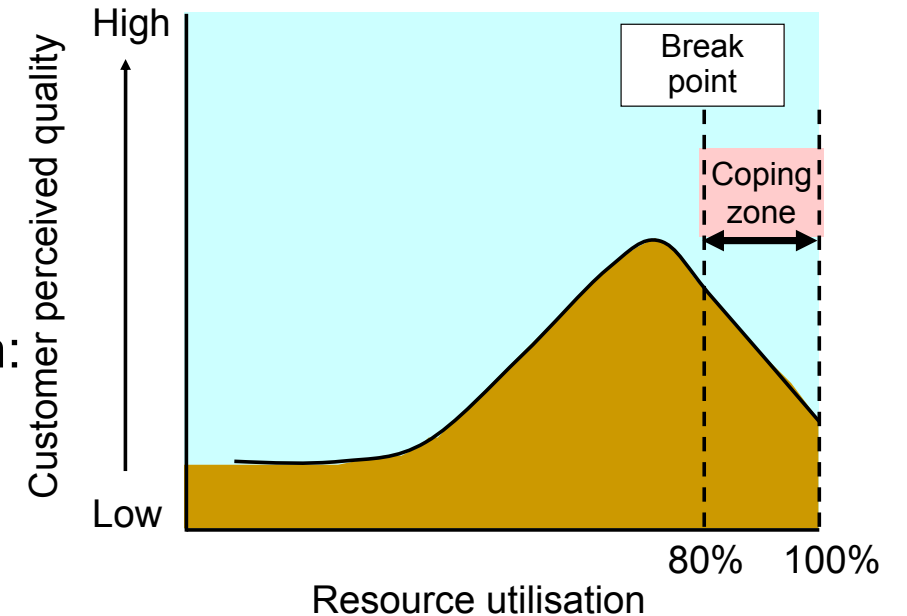
The coping zone is a point where managers find it difficult to cope with increasing demand. At these levels of resource utilization, things get too busy:

- Staff gets stressed
- Everything becomes a problem
- Perceived quality (customer satisfaction) declines

This breakpoint is usually reached before 100% utilization:

1. It is not possible to run a resource to 100% (at least not human)
2. Several resources may be involved

Also, too low levels of utilization affect staff and customer satisfaction.



# Difficulties in the assessment of service capacity

- a) service mix
- b) the impact of location
- c) the extent of intangibility in the service
- d) The ease of identification of resource constraints



(Johnston et al., p.287)

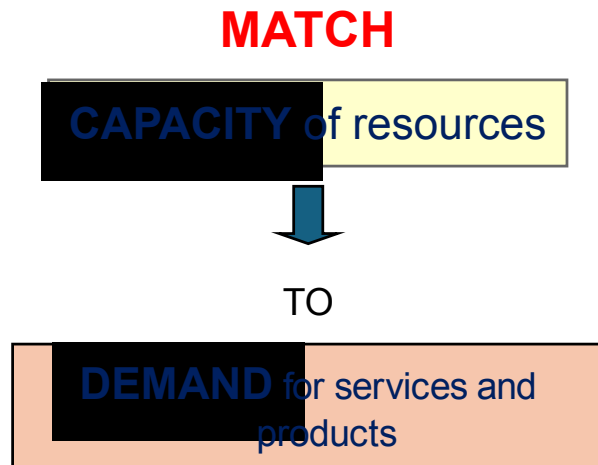


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# Difficulties in the assessment of service capacity

- a) service mix (*if mix contains fluctuate in volumes of repeaters and strangers, routine versus complex calls in the call centre*)
- b) the impact of location (*a service engineer operating in the city and in countryside*)
- c) the extent of intangibility in the service (*knowledge workers differ in their abilities. so managers cannot easily assess their capacity*)
- d) The ease of identification of resource constraints (in complex tasks, the identification of key resource constraint may not be seen from the beginning)

# Predictable Demand Patterns and Their Underlying Causes



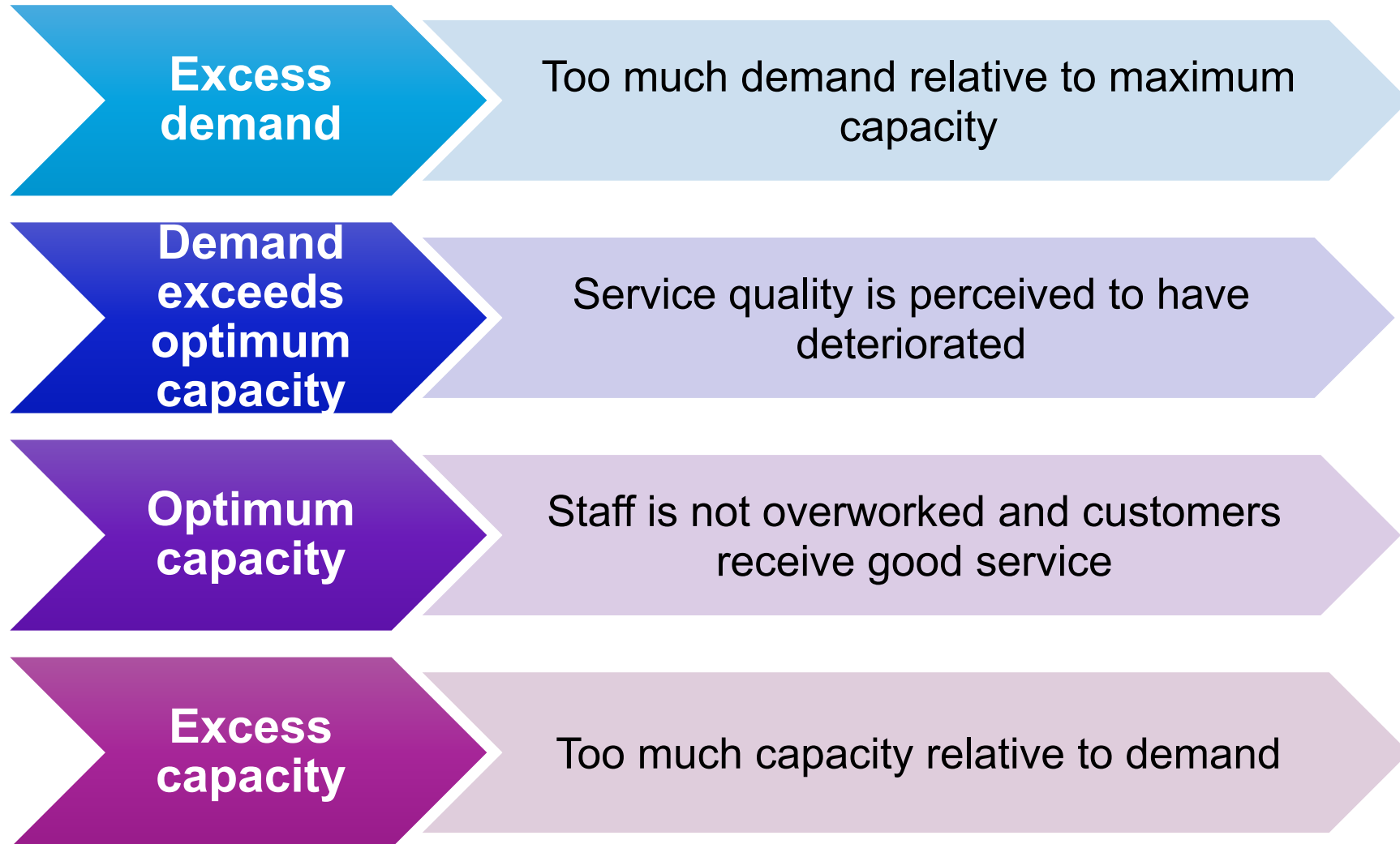
## Predictable Cycles of Demand Levels

- day
- week
- month
- year
- other

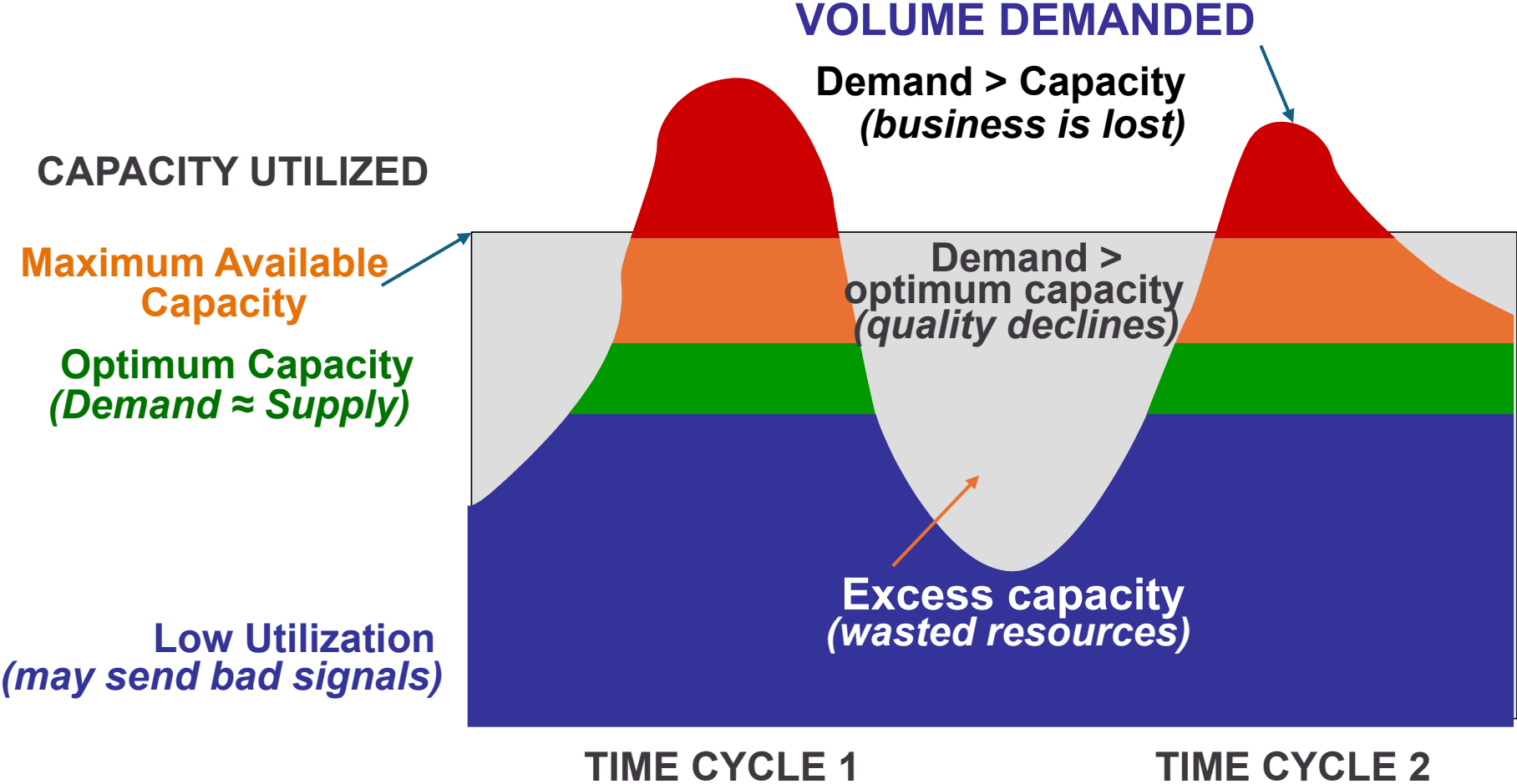
## Underlying Causes of Cyclical Variations

- employment
- billing or tax payments/refunds
- pay days
- school hours/holidays
- seasonal climate changes
- public/religious holidays
- natural cycles (e.g., coastal tides)

# From Excess Demand to Excess Capacity

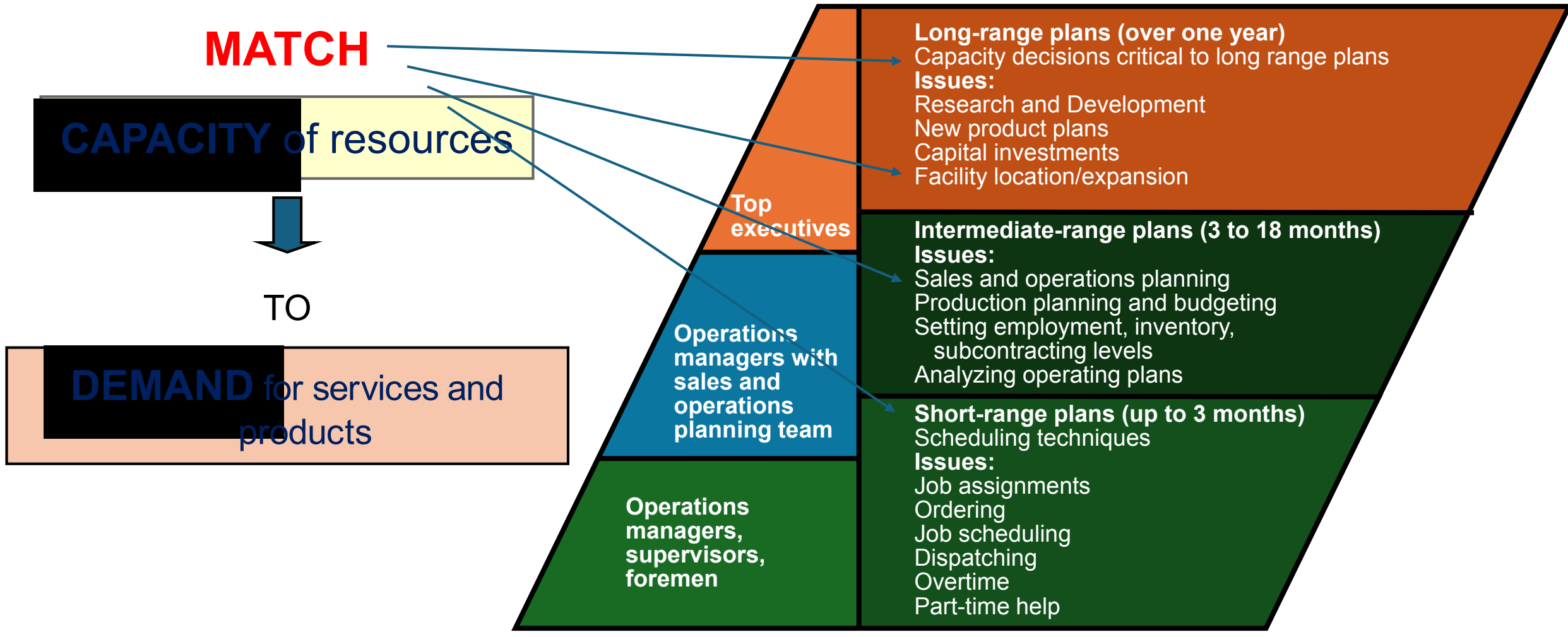


# Variations in Demand Relative to Capacity



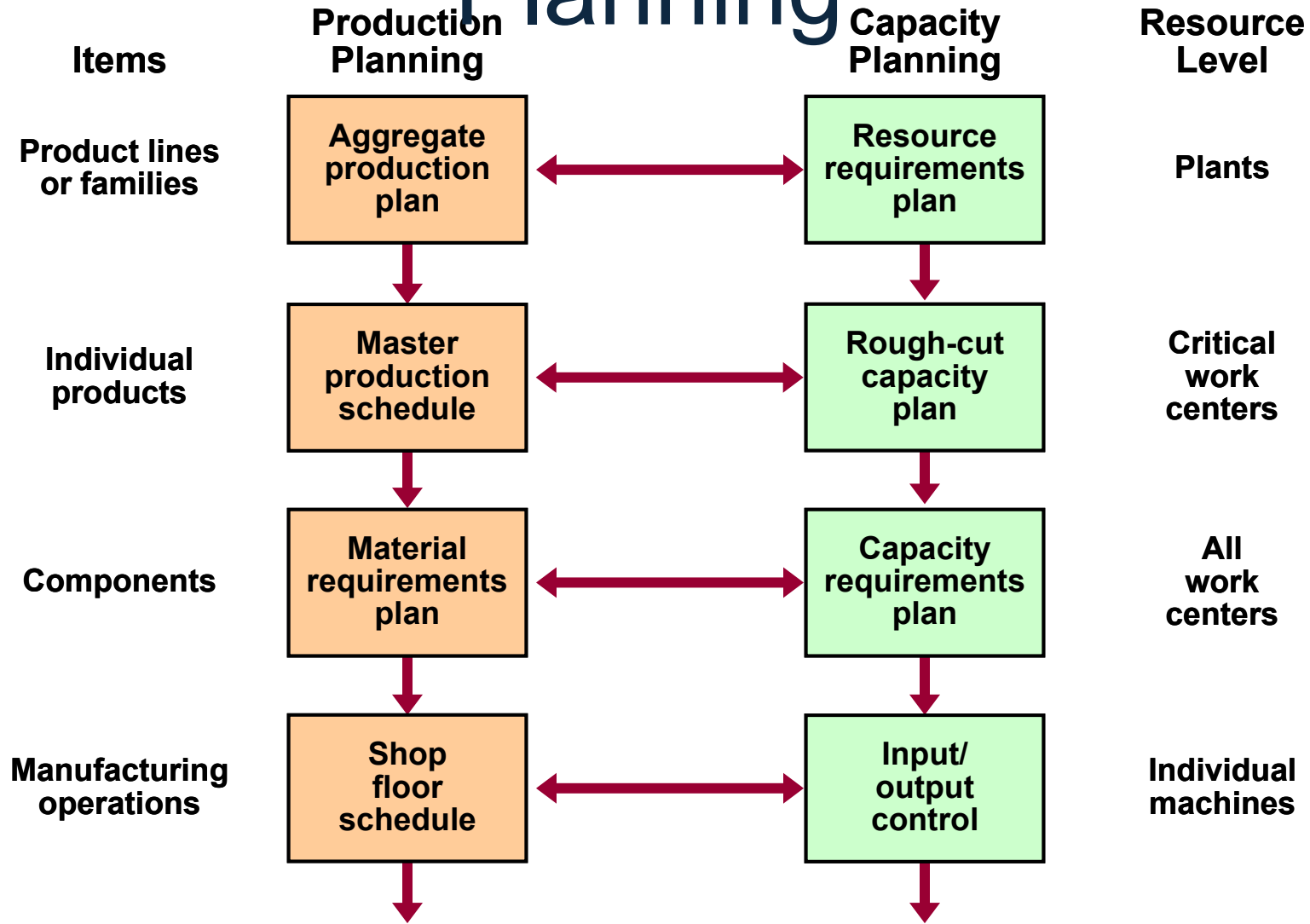


# Purpose of capacity planning & control



# Hierarchical Nature of

# Planning



Short- to medium-term term decisions taken to ensure sufficient capacity of the right type is available at the right time to meet demand

It involves:

- Measuring demand
- Measuring capacity
- Reconciling capacity and demand

# Aggregate Planning

Determine the resource capacity needed to meet demand over an intermediate time horizon

- *Aggregate* refers to product lines or families
- Aggregate planning matches supply and demand

## Objectives

- Establish a company wide game plan for allocating resources
- Develop an economic strategy for meeting demand

## Objectives - examples

Restaurants - Aggregate planning is directed toward smoothing production rate and finding the size of workforce to be employed

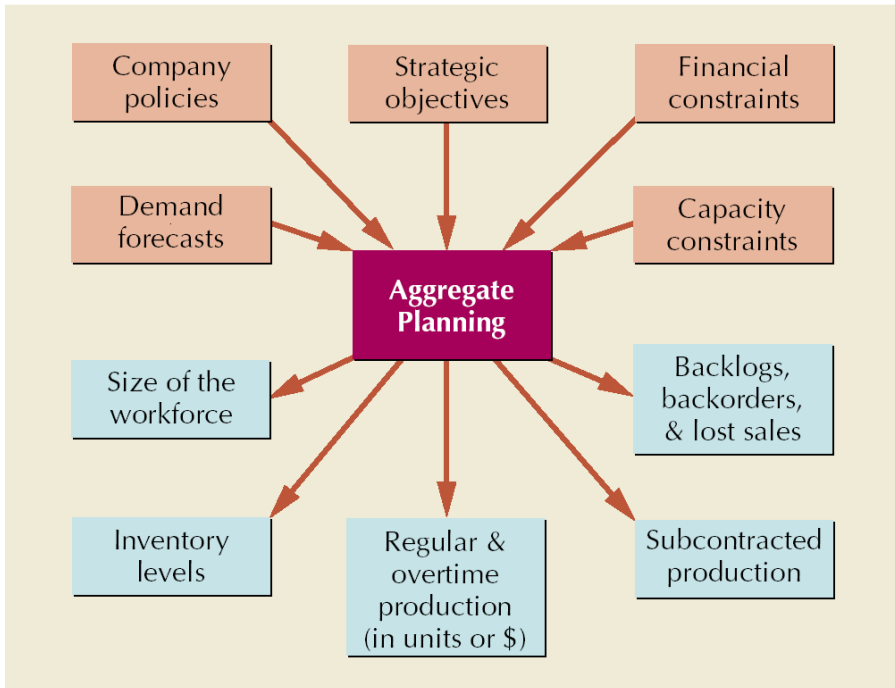
Airline industry - Aggregate planning consists of schedules for number of flights in and out of each city, number of flights on all routes, number of passengers and number of personnel at each airport

# Aggregate Planning in Services

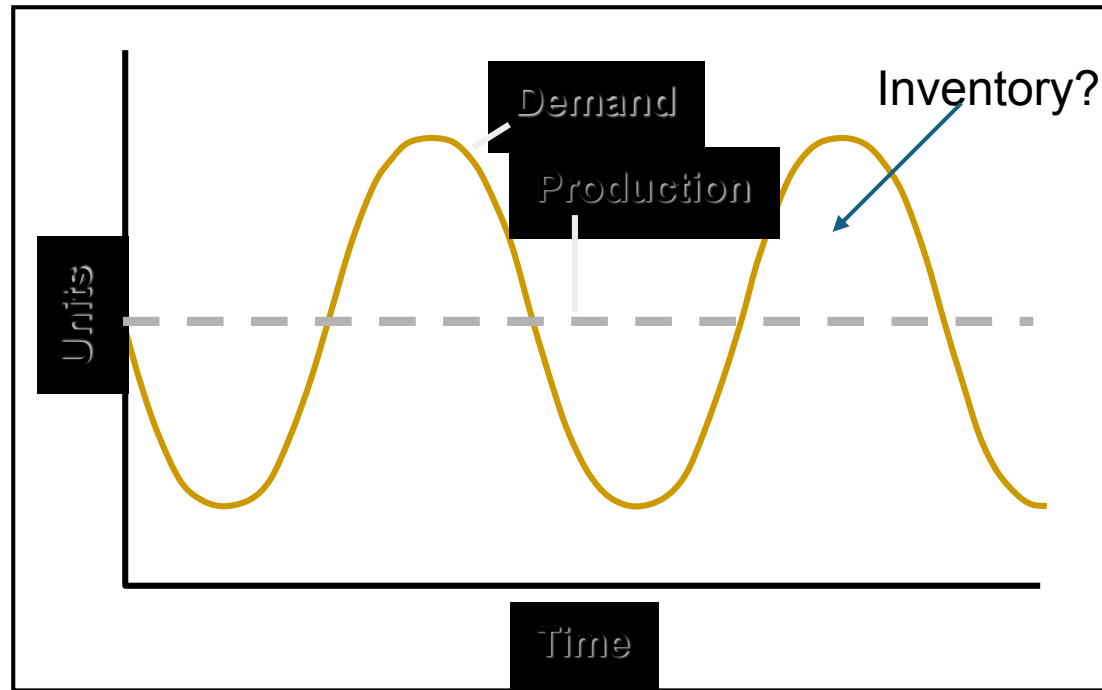
Most services use combination strategies and mixed plans

Controlling the cost of labor is critical

1. Accurate scheduling of labor-hours to assure quick response to customer demand
2. An on-call labor resource to cover unexpected demand
3. Flexibility of individual worker skills
4. Flexibility in rate of output or hours of work



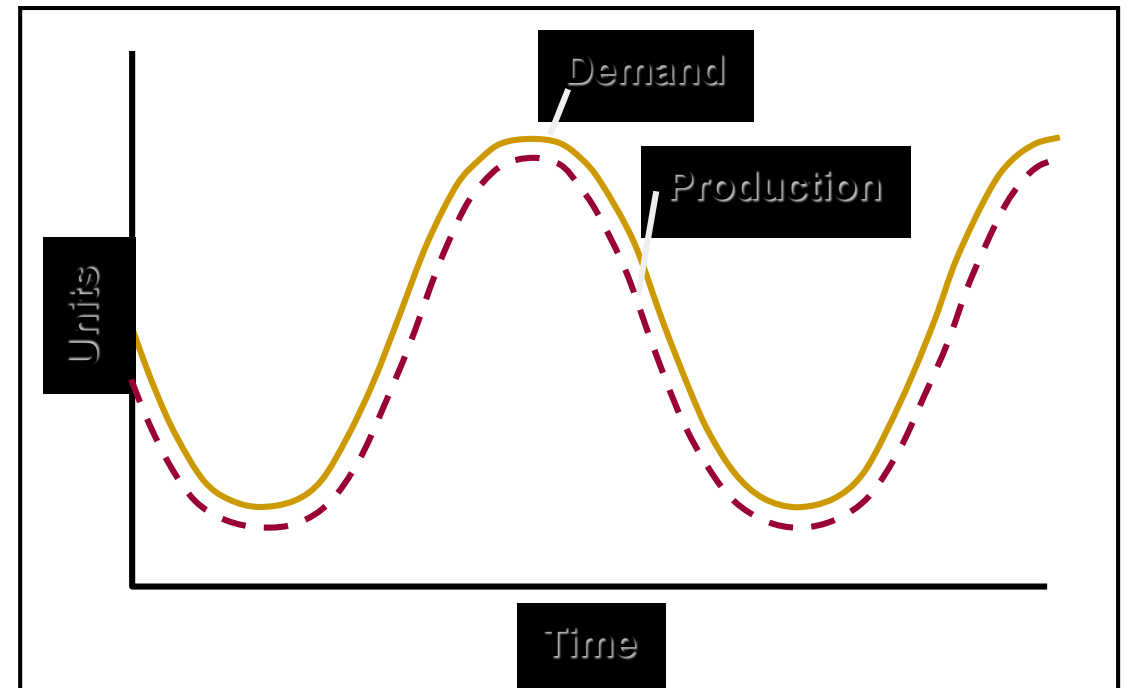
# Level Production vs. Chase Demand vs. Demand management



Absorb demand

↑  
Change demand

Adjust output to match demand



# Short-to medium-term capacity strategies

- **LEVEL CAPACITY (also PEEK DEMAND)**

Scarce or expensive resources are maintained at a constant level

- **CHASE STRATEGY**

match supply to demand as much as possible by building flexibility into the operating system, AND

maintain fast response times/avoid Queues

- **DEMAND MANAGEMENT**

Rather than change capacity of the service operation, encourage customers to alter their demand patterns to take the pressure off the resources.

# Level Strategy

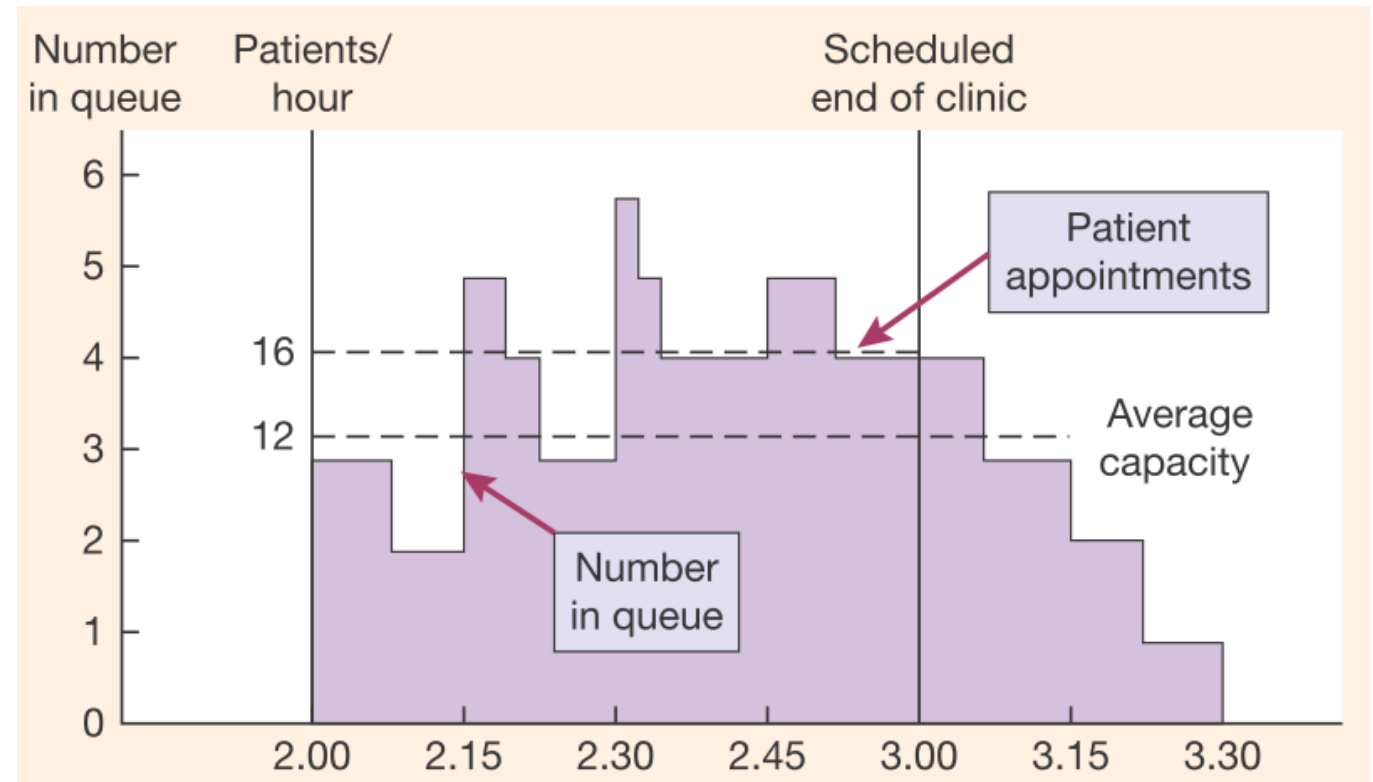
Aims to set processing capacity at a uniform level (usually to meet average demand levels) regardless of fluctuations in demand

- In manufacturing, inventory (stock) is used to absorb variations in demand
- In services, queue management is used to absorb variations in demand



# Level strategy example (Johnston et al., p.291)

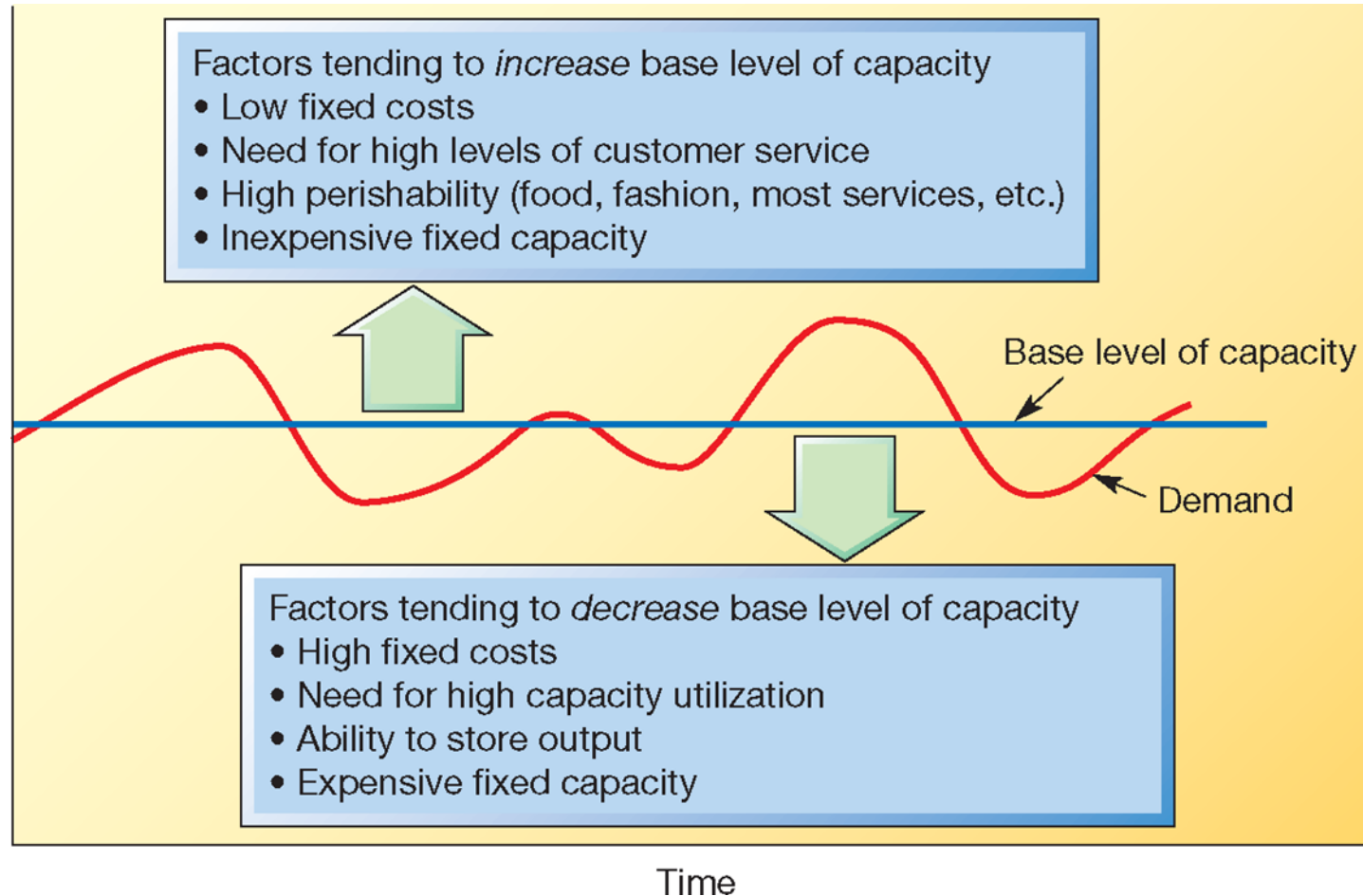
- Resource utilisation goals are frequently achieved at the expense of customer satisfaction
- Customers may receive inconsistent service levels
- Customers (patients) accept (or suffer) this poor level of service because the service is valuable to them and there may be no or few alternatives
- There is a danger that the service provider may become complacent and not make attempts to cut the emotional cost of waiting for the customer, making it potentially vulnerable to competition (in this case private healthcare).



Solution: queue management/yield management



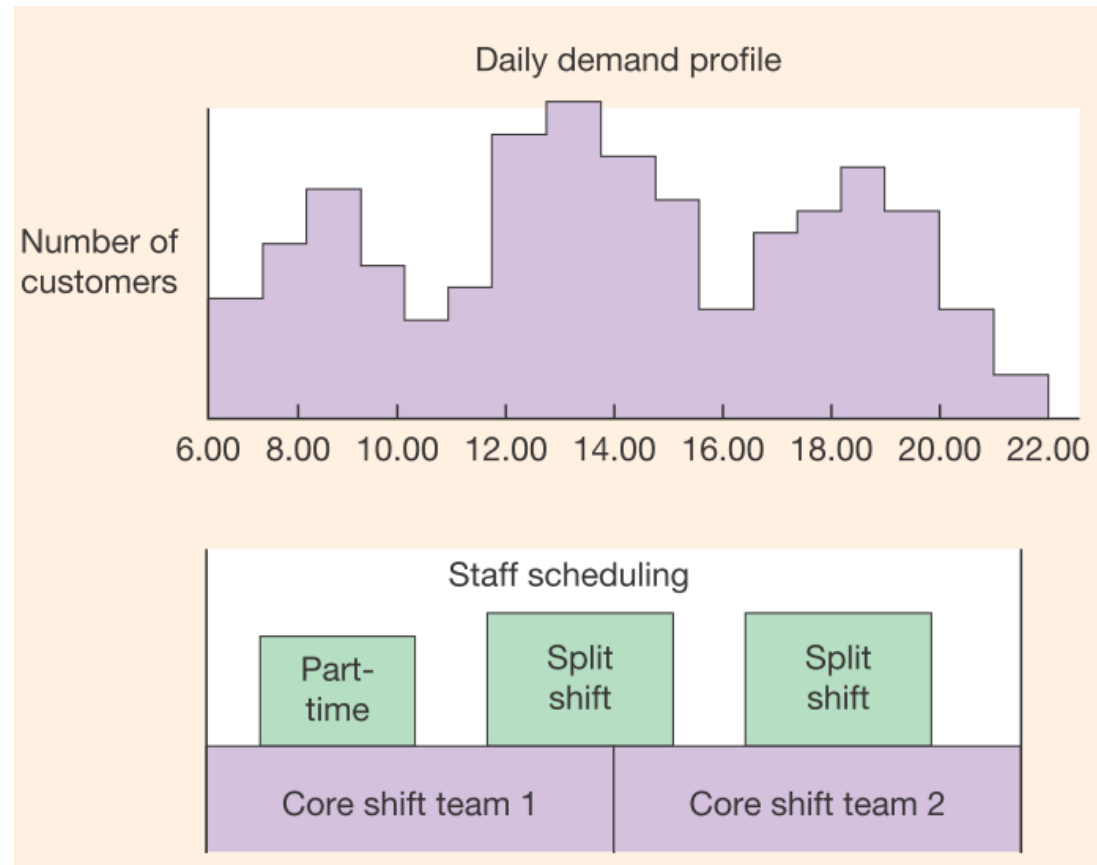
# Base level of capacity should reflect the relative importance of the operations' performance objectives



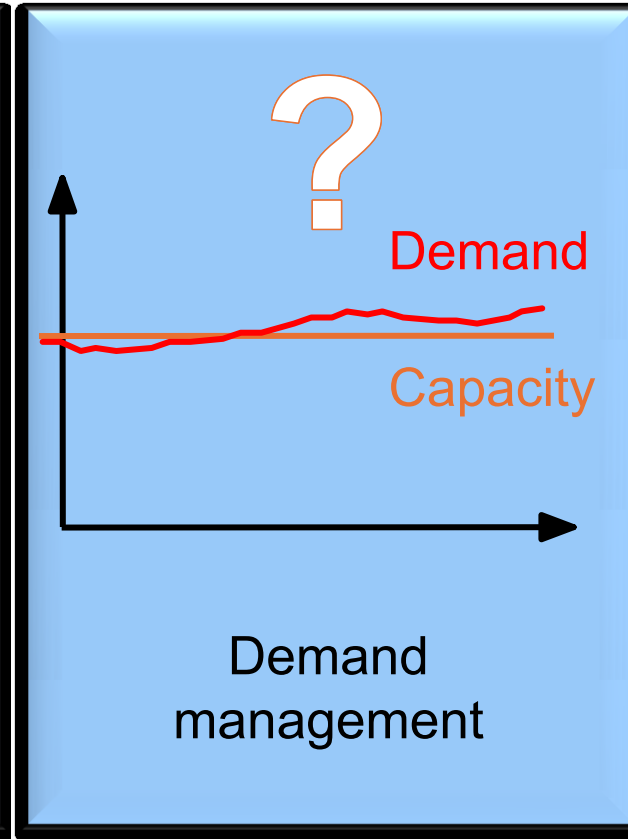
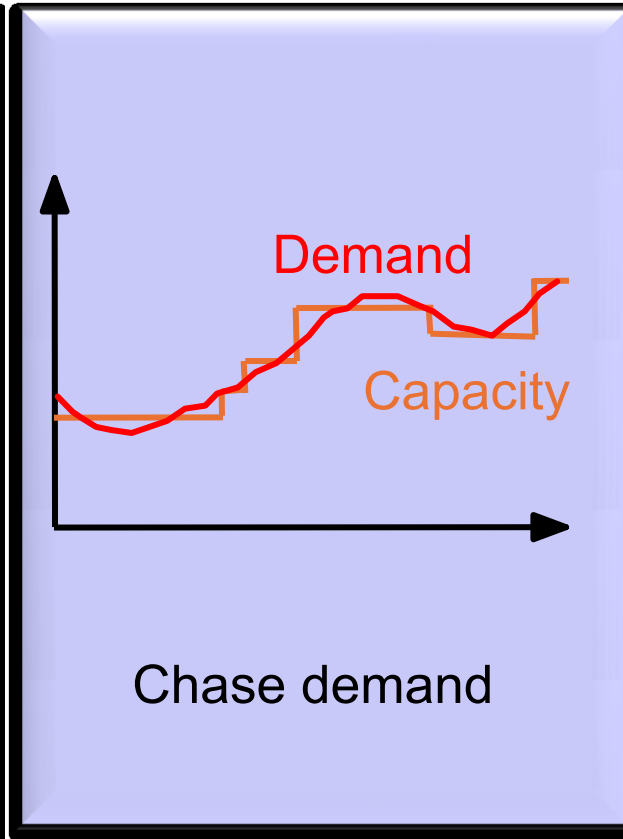
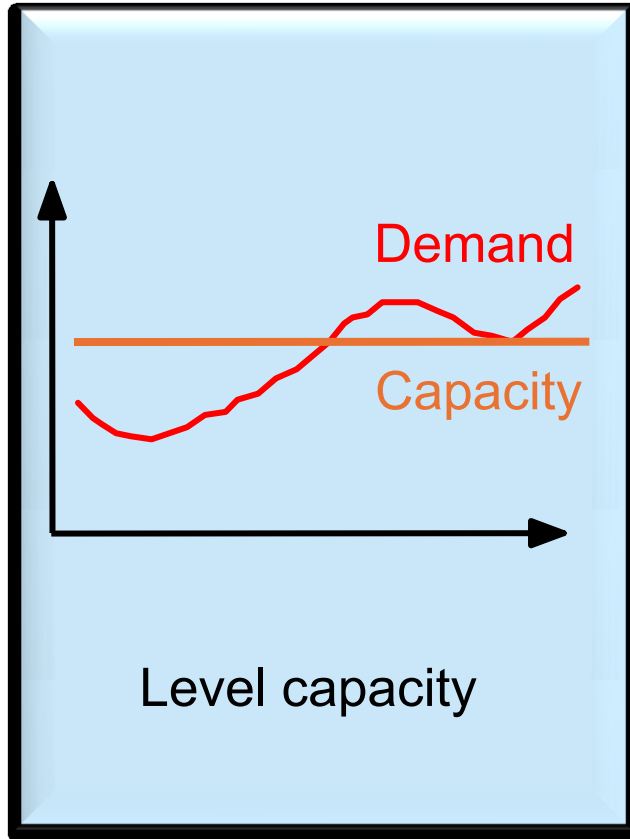
# Chase - Adjust output to match demand

- **Stretch and shrink:**
  - Offer inferior extra capacity at peaks (e.g., bus/train standees)
  - Use facilities for longer/shorter periods
  - Reduce amount of time spent in process by minimizing slack time
- **Adjusting capacity to match demand**
  - Rest during low demand
  - Cross-train employees
  - Use part-time employees
  - Customers perform self-service
  - Ask customers to share
  - Create flexible capacity
  - Rent/share facilities and equipment

# Chase strategy – example (Johnston et al., p.293)



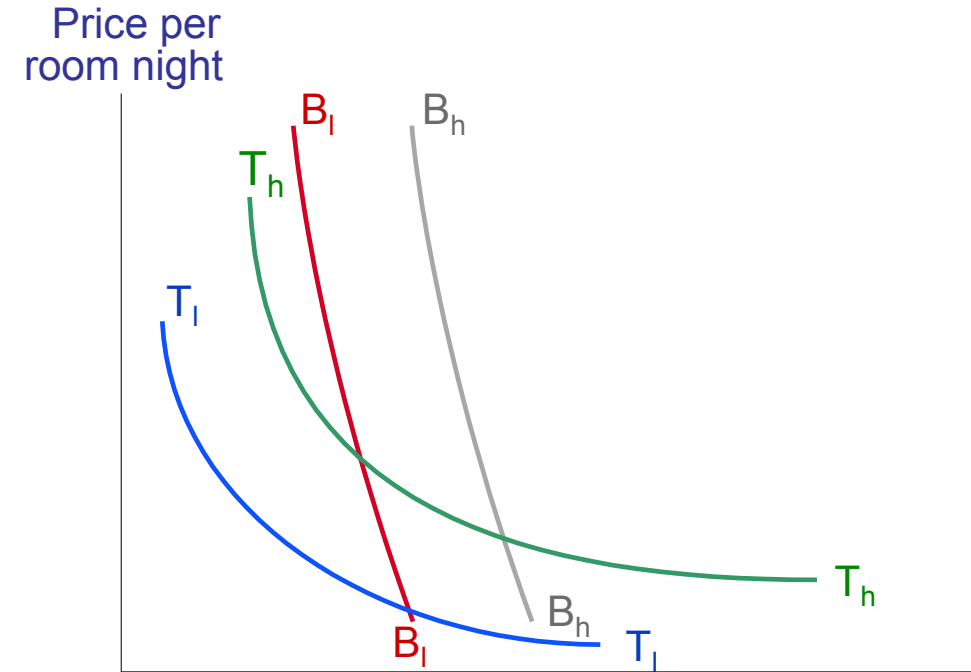
# Ways of reconciling capacity and demand



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# Managing Demand

- **Interventionist approach**
  - Reduce demand in peak periods / Increase demand when there is excess capacity (change in price and other nonmonetary costs )
  - Restricted service at peak times
  - Specialist service channels
  - Advertising and promotion
- **Inventorying demand until capacity becomes available**
  - Formal wait and queuing system
  - Reservation system
- **Produce products with complementary demand patterns**



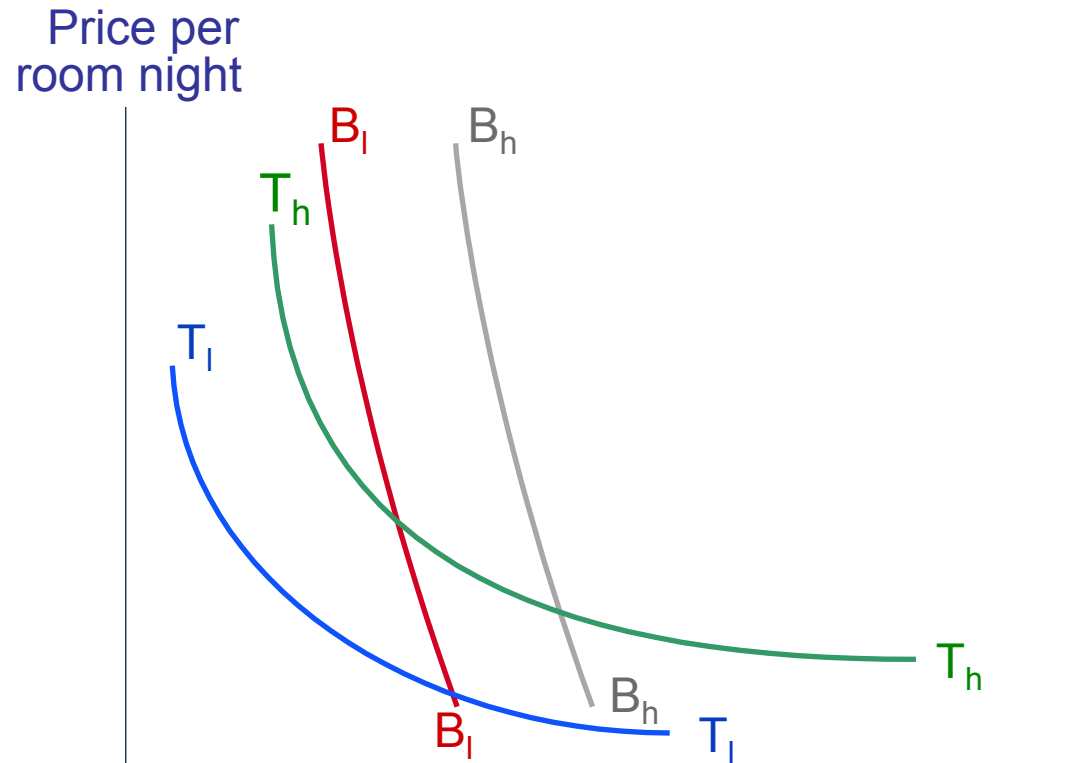
Quantity of rooms demanded at each price by travelers in each segment in each season

$B_h$  = business travelers in high season

$B_l$  = business travelers in low season

$T_h$  = tourist in high season

$T_l$  = tourist in low season



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Note: hypothetical example

# Sequencing and allocation of capacity

Most organizations have rules or policies for allocation of capacity, either informal or formal. It is impossible to satisfy all possible customer demands and remain a viable organization. To deal with this issue, sequencing rules are created to manage the prioritization of allocation:



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# Queue management – perceptions

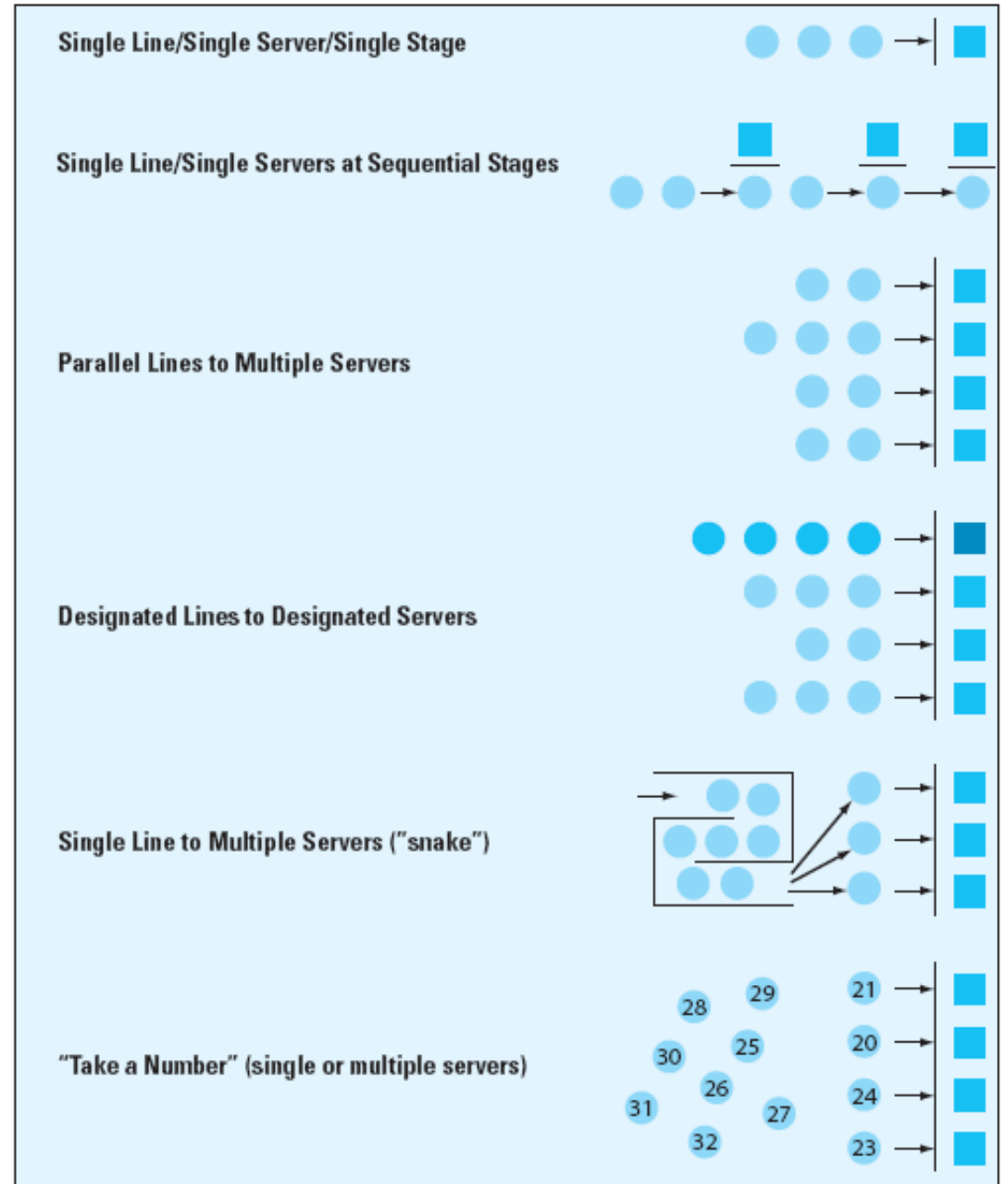
*Good /bad real life examples, experience?*

1. Unoccupied time feels longer than occupied time
2. Pre-process waits feel longer than in-process waits
3. Anxiety makes the wait feel longer
4. Uncertain waits are longer than known, finite waits
5. Unexplained waits seem longer than explained
6. Unfair waits are longer than equitable waits
7. The more valuable the service, the longer will the customer wait
8. Solo waiting feels longer than group waiting
9. Uncomfortable waits feel longer than comfortable waits
10. New/infrequent users feel they wait longer than frequent user



# Managing Waiting Lines

- Rethink design of queuing system
- Install a reservations system
- Tailoring the queuing system to different market segments
- Manage customer behavior and perceptions of wait
- Redesign processes to shorten transaction time



# Queuing Systems can be Tailored to Market Segments

- **Urgency of job**
  - Emergencies vs. non-emergencies
- **Duration of service transaction**
  - Number of items to transact
  - Complexity of task
- **Payment of premium price**
- **Importance of customer**
  - Frequent users/high volume purchasers vs. others

# Improving resource utilization

Yield/Revenue management

Building flexibility

Reducing capacity leakage

Getting organizational support for resource utilization (Many issues need to be resolved by the organization as a whole)

# Building flexibility

New product flexibility

Product mix flexibility

Delivery flexibility

Volume flexibility

Things to consider

- Range –how much flexibility is required
- Response –how quickly must the change be made
- Effectiveness across the range –most processes have an optimum range
- Cost of providing the flexibility

Approaches to building flexibility:

Flexible employee contracts

Overtime

Short-term outsourcing

Menu-driven service (standardization)

Creation of runner activities so “Dell” approach

Teamwork/ Multi-functional teams

# Reducing capacity leakage - reasons

## Absenteeism

Due to overload?

## Labor underperformance

Insufficient training?

Employee “churn” –employees leaving just when they are becoming effective

## Scheduling losses - Overutilization/underutilization from time to time because:

Demand profiles not fully understood

Demand profiles too volatile

Staff preferences for work patterns do not fit with the business needs

## Cost of complexity

The more “unusual” tasks, the more inefficiencies and rework

## Quality failures

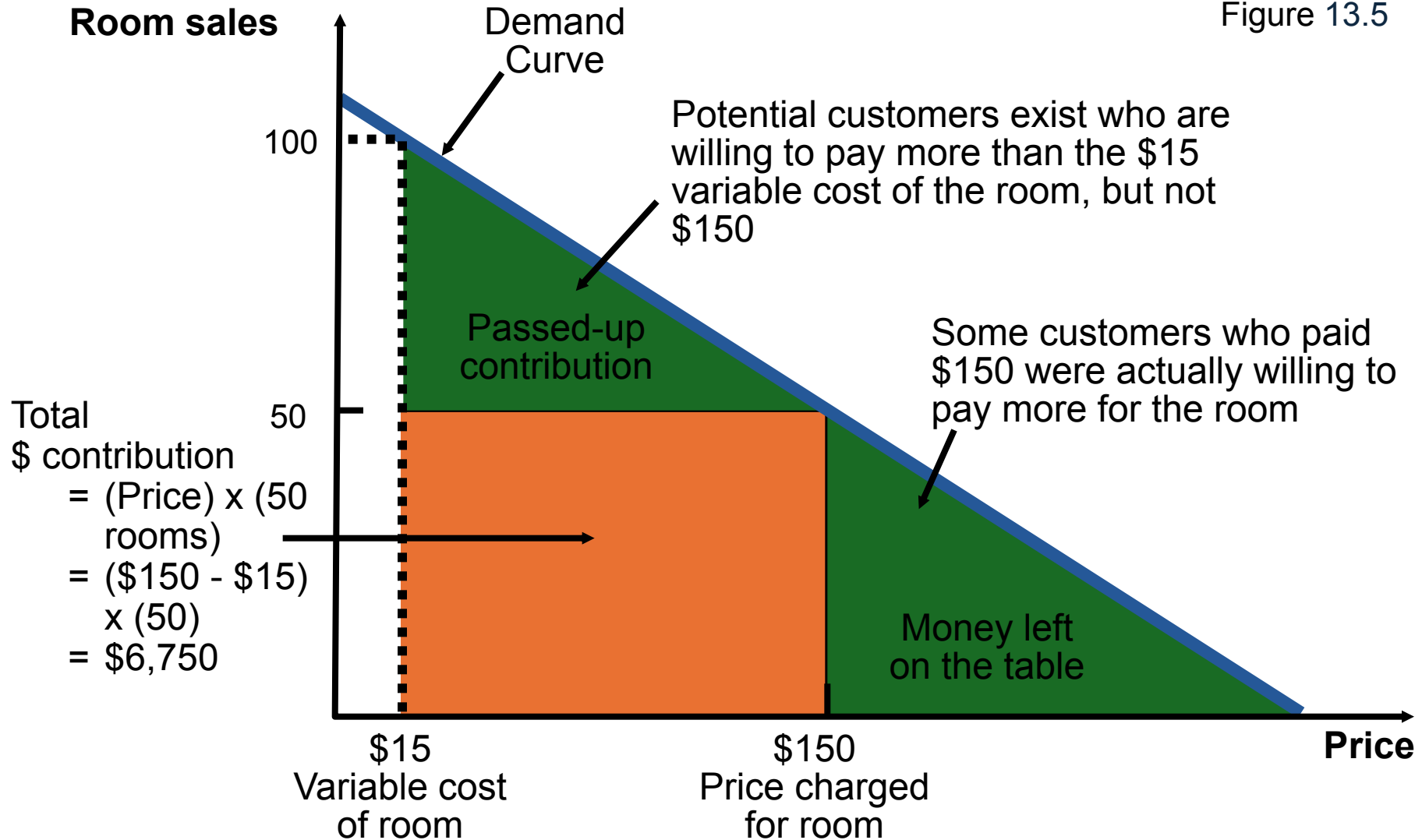
Having to deal with poor quality is loss of resources

# Revenue Management

- Allocating resources to customers at prices that will maximize revenue
  1. Service or product can be sold in advance of consumption
  2. Demand fluctuates
  3. Capacity is relatively fixed
  4. Demand can be fairly clearly segmented
  5. The service cannot be stored in any way
  6. Variable costs are low and fixed costs are high/ the marginal cost of making a sale is relatively low.

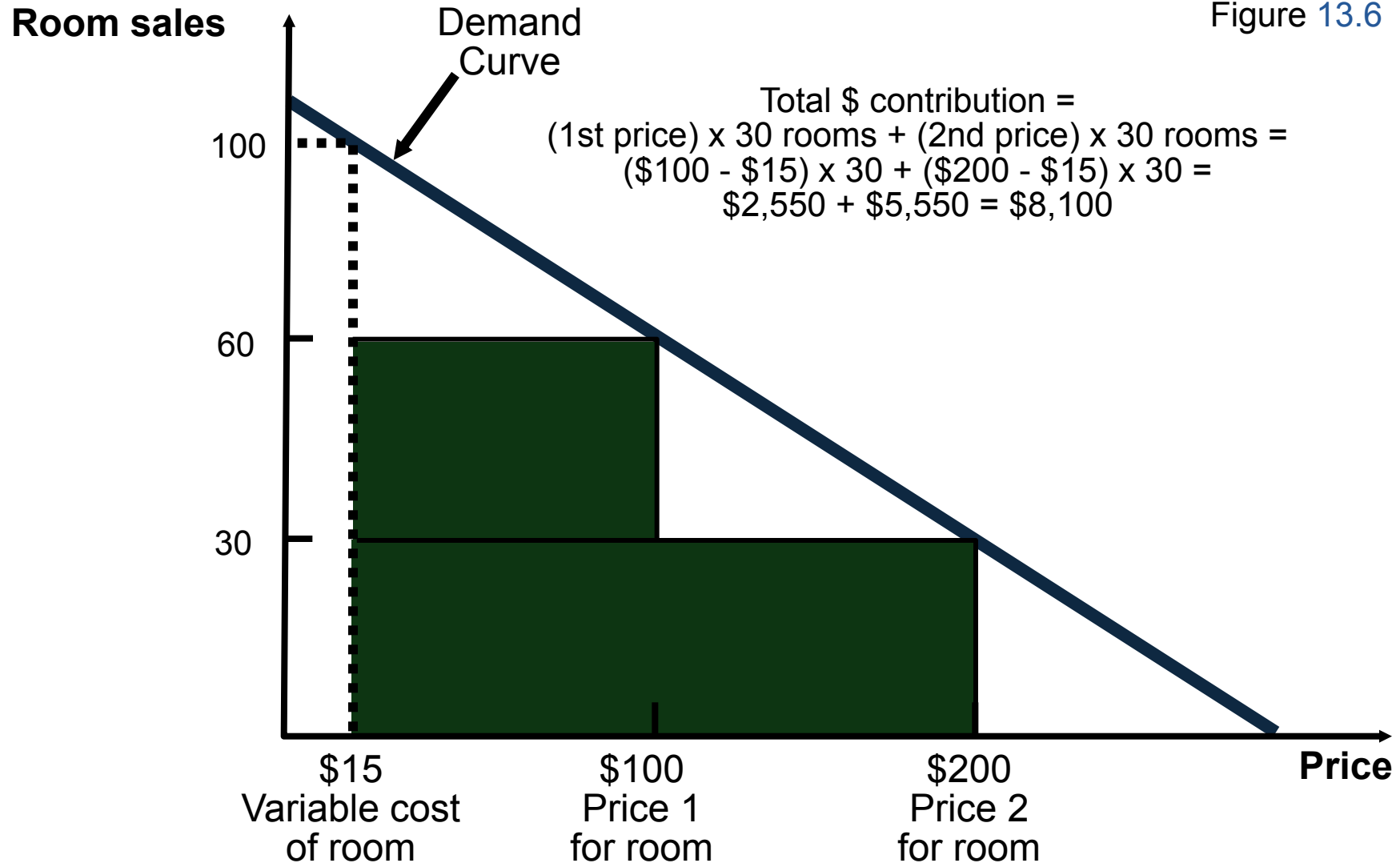
# Revenue Management Example

Figure 13.5



# Revenue Management Example

Figure 13.6





# Revenue Management Approaches

- Airlines, hotels, rental cars, etc.
  - Tend to have predictable duration of service and use variable pricing to control availability and revenue
- Movies, stadiums, performing arts centers
  - Tend to have predictable duration and fixed prices but use seating locations and times to manage revenue
- Restaurants, golf courses, ISPs
  - Generally have unpredictable duration of customer use and fixed prices, may use “off-peak” rates to shift demand and manage revenue
- Health care businesses, etc.
  - Tend to have unpredictable duration of service and variable pricing, often attempt to control duration of service

# Making Revenue Management Work

1. Multiple pricing structures must be feasible and appear logical to the customer
2. Forecasts of the use and duration of use
3. Changes in demand