# Yield Management (OM) Introduction

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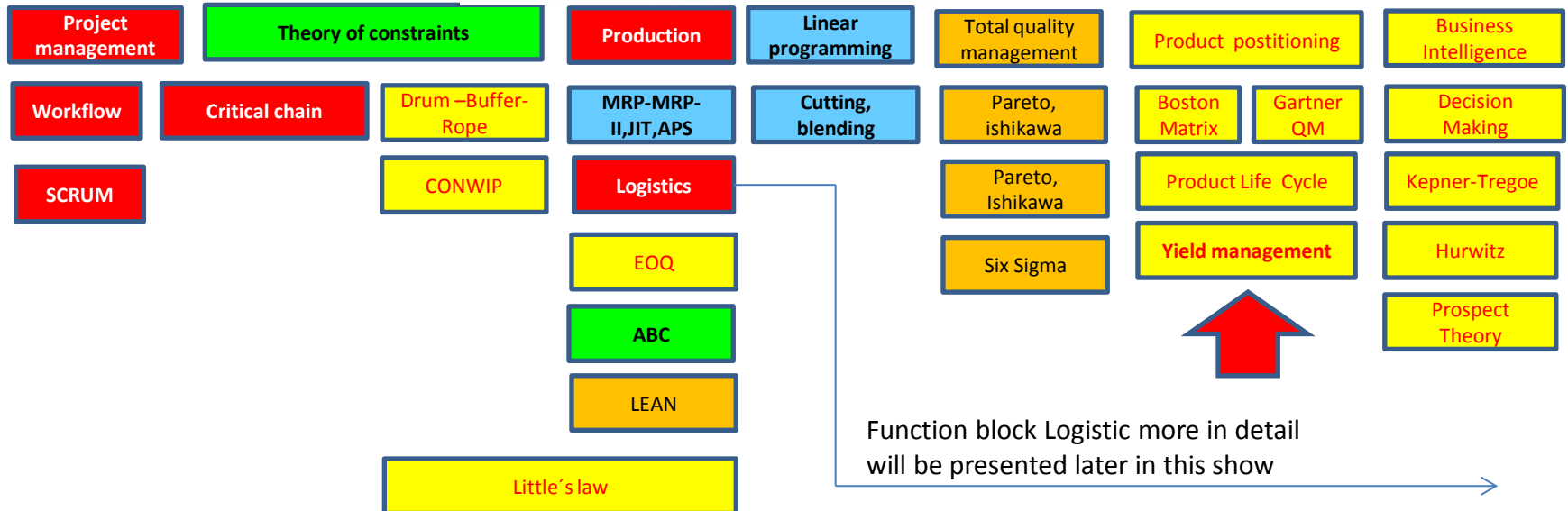
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# Some OM methods

- Theory of Constraints
- Balanced Scorecard
- Project Management methods (Critical Chain, SCRUM,…)
- Material Requirement Planning and Just-in-Time
- Advanced Planning and Scheduling
- Six Sigma – quality management
- Boston, SWOT and Magic Quadrant Matrices
- Little´s Law (relations between WIP, Throughput and Cycle time)
- Linear programming
- **Yield Management**
- Kepner-Tregoe (support of decision making)-was presented

# Another point of view



This will be modified in following **South African** project show (use of Balanced Score Card)

| | | | | | | |
|---|---|---|---|---|---|---|
| Project management | Theory of constraints | | Production | Linear programming | Total quality management | Product postitioning | Business Intelligence |
| Workflow | Critical chain | Drum –Buffer-Rope | MRP-MRP-II,JIT,APS | Cutting, blending | Pareto, ishikawa | Boston Matrix | Gartner QM | Decision Making |
| SCRUM | | CONWIP | Logistics | | Pareto, Ishikawa | Product Life Cycle | Kepner-Tregoe |
| | | | EOQ | | Six Sigma | Yield management | Hurwitz |
| | | | ABC | | | | Prospect Theory |
| | | | LEAN | | | | |
| | | | Little´s law | | | | |

Function block Logistic more in detail will be presented later in this show

**Used abbreviations** : QM– Quadrant Matrix; **CONWIP –** Constant Work in Progress; **EOQ** – Economic Order Quantity ; **MRP  -** Material  Requirement Planning

# Yield Management (YM)-definition

- **YM** seeks to maximize yield or profit from <span style="color:red">time-sensitive products and services.</span>

- Used in industries with flexible and expensive capacities, perishable products and uncertain demand. It is part of **revenue management**.

- **Type of problems** :
    - overbooking (airlines, hotel industry,..)
    - partitioning demand into fare classes
    - single order quantities

YIELD : to produce or furnish (payment, profit, or interest): a trust fund that yields ten percent interest annually; That investment will yield a handsome return.

# Yield Management (YM)-definition

- Simply put, the purpose of Yield Management  is to achieve **maximum revenue/profit**.

- To do this, a yield management strategy needs to be both **reflective** and **forward-looking**. That is, yield managers should attain a clear yet detailed understanding of what has happened before, and what is happening now.

- The most efficient way to do this is to draw from **historical data** to predict what may then happen in the future. So, the process of effective yield management involves understanding, anticipating and reacting to consumer behaviour (to ultimately maximise revenue!).

- **reflective**= přemýšlivý, hloubavý

# Single order quantity (home study)

The single order is concerned with the planning and control of inventory items that are either purchased only once during a time period or for only one production run. The familiar inventory models (EOQ, EOI, and EPQ) do not readily apply to the single order because (1) demand is not a continuous event (2) the demand level may change drastically from time period to time period, or (3) the product's market life may be very short due to obsolescence or perishability. The single order quantity problem is frequently referred to in the literature as the Christmas tree problem or the newsboy problem.

**Newsboy problem – see next slide and slide number 11 as well !!!**

**EOI=Economic Order Interval**
**EPQ = Economic Production Quantity**

# Newsboy problem

Often managers have to make decisions about inventory level over a very limited period, This is the case, for example with seasonal goods such as Christmas cards that should satisfy all demand in December, but any cards left in January have almost no value. These single-period decision models are phrased as the Newsboy Problem. For a newsboy who sells papers on a street corner, the demand is uncertain, and the newsboy must decide how many papers to buy from his supplier. If he buys too many papers he is left with unsold papers that have no value at the end of the day; if he buys too few papers he has lost the opportunity of making a higher profit.
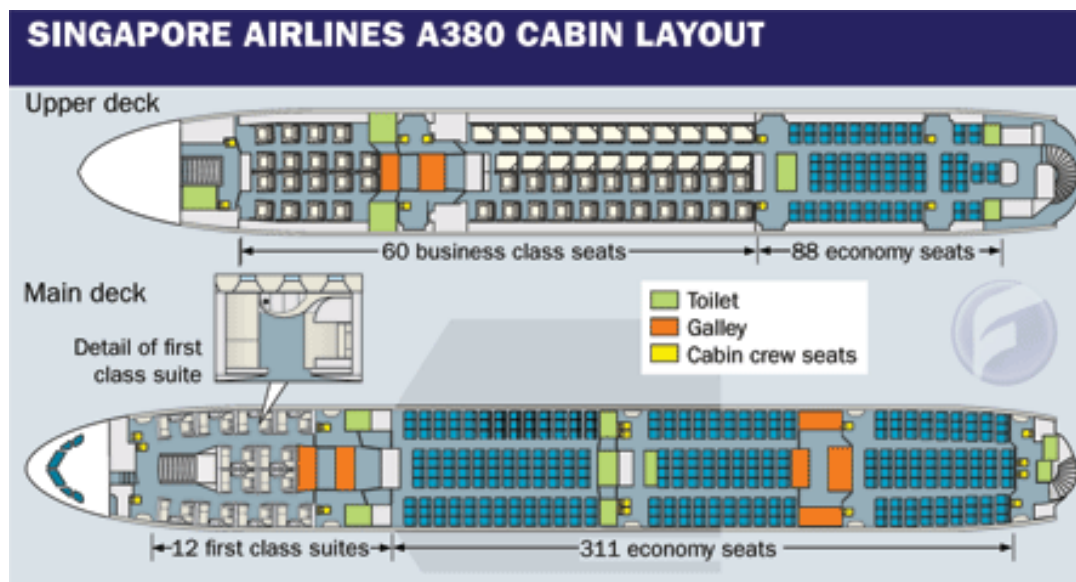
# Prices and demand

- **Prices can be determined by:**
  - Service
  - Group of services
  - Market (consumer type or geographical), or
  - A combination of the above

- **And the demand side is characterized with**:
  - Variability of demand
  - Variability of value

# Overbooking (hotels, airlines,..)



**SINGAPORE AIRLINES A380 CABIN LAYOUT**

Upper deck

60 business class seats — 88 economy seats

Main deck

Detail of first class suite

- Toilet
- Galley
- Cabin crew seats

12 first class suites — 311 economy seats

10%-30 % of **no-show** (traveller reserved ticket but cancel it at the last minute)
So airline companies **overbook** their capacities. No-show ratio is sometimes
lower than overbook ratio, so „bumped" client will be compensated by providing
the free of charge service at another time or place.  They are so called „offloaded" to other routes .
**Example :**
311 economy seats, estimation of 10 % no-show-> 31 places would be lost (only 311-30=**280** seats occupied).
If overbooked  by 10 % (**31** more tickets offered)  and no-show ratio on reality is only 7 %->only 22 clients
cancelled - > 311-22=289 free seats->289 + **31**=320->320-311=9 clients have to be „bumped"
and provided by  free air tickets, which is better than loss of not sold 31 places.
You have to calculate loss of 31 places -22 sold tickets =amount, which must cover expenses fo 9 bumped clients

# Overbooking - claims

- Do not settle. Instead get up to €600 +hotel +meals +expenses +new ticket !!



Delta Air Lines has increased the amounts passengers can be offered to give up their seats to up to almost US$10,000 in extreme cases — something passengers can take advantage of if they act in collusion (secret deal).

# Single order quantities

- Newspapers

- Magazines

- Florists

- Bakeries

- Fresh fishes

# Single order quantities

- N = number of items that can be sold (expected sales and available in the stock)
- X = number of items ordered
- $C_0$ = Cost of <span style="color:red">overestimating</span> demand <span style="color:blue">(rest of the flowers faded and are not sold)</span>
- $C_u$ = Cost of <span style="color:green">underestimating</span> demand <span style="color:blue">(customers like to buy more and you do not have enough of roses)</span>
- $C_u >= C_0$
- $P(N<X)$ = probability of <span style="color:red">overestimating</span> demand or no-show
- $P(X>=N)$ = probability of <span style="color:green">underestimating</span> demand or no-show

$P(X>=N)*C_u >= P(N<X)*C_0$

$P(X>=N) + P(N<X) =1 \rightarrow P(X>=N) = $ <span style="color:red">$1-P(X<N)$</span>

<span style="color:red">$(1-P(X<N))$</span> $* C_u >= P(N<X) * C_0$ -> **OPTIMUM PROBABILITY**

$$P(N<X) <= \frac{Cu}{Cu + C_0}$$

Final formula

# Example ->Single Order Quantity (hotel industry)

Manager Simon Stein of the Best Western in Lase Vegas is tired o customers who make reservation and do not show up. Rooms rent is **100** USD/night and cost **25** USD to maintain per day. Overflow („bumped") customers can be sent to Motel 7 for 70 USD/night.

Simon´s records of no-show over past six months are given below. Should Best Western start overbooking ? If so, how many rooms should be overbooked ?

| No-Show | Probability |
|---------|-------------|
| 0 | 0,15 |
| 1 | 0,25 |
| 2 | 0,30 |
| 3 | 0,30 |

Solution :  $C_0$ = 70 USD

$C_u$ = 100 USD-25 USD =75 USD

$$P(N<X) <= \frac{C_u}{C_u + C_0} = 75/(75+70)=75/145 = \mathbf{0{,}517}$$

| No-Show | Probability | P(N<X) |
|---------|-------------|--------|
| 0 | 0,15 | 0,00 |
| 1 | 0,25 | 0,15 |
| 2 | 0,30 | 0,40 |
| 3 | 0,30 | 0,70 |

Probabilities are cumulating and choice in 0,40->0,517
Optimal probability of no-show falls between
0,40 and 0,70. So if we take less of equal to 0,517,
so next lower value is 0,40. **So two rooms have to be overbooked !!!**

# Example ->Single Order Quantity ( Airlines )

- **FlyUS** Airlines is unhappy with the number of empty seats (same with hotel rooms) on its NY-Miami flights. To remedy the problem, the airline is offering a special discounted rate of 89 USD instead of normal fare 169 USD, but only for 7-days advance purchases and for limited number of seats per flight. The aircraft flown from NY to Miami holds max **100** passengers. Last month´s distribution of full-fare passengers is shown below. How many seats **FlyUS** reserve for full –fare passengers ?

| Aircraft capacity | | | **100** | |
|---|---|---|---|---|
| | | | | |
| | | | | |
| Full fare | No-Show | Frequency | Probability | P(N<X) |
| 50 | 50 | 15 | 0,15 | 0,00 |
| 55 | 45 | 20 | 0,20 | 0,15 |
| 60 | 40 | 35 | 0,35 | 0,35 |
| 65 | 35 | 20 | 0,20 | 0,55 |
| 70 | 30 | 10 | 0,10 | 0,65 |
| | | | | |
| | | | | |

Cu = 169-89=80,Co =89
P(N<X) <=Cu/(Cu+Co)=80/169=0,473

**So 60 full-fare passengers have to be reserved**