Yield Management (OM) Introduction (English only)

Ing.J.Skorkovský, CSc,

Department of Corporate Economy

FACULTY OF ECONOMICS AND ADMINISTRATION

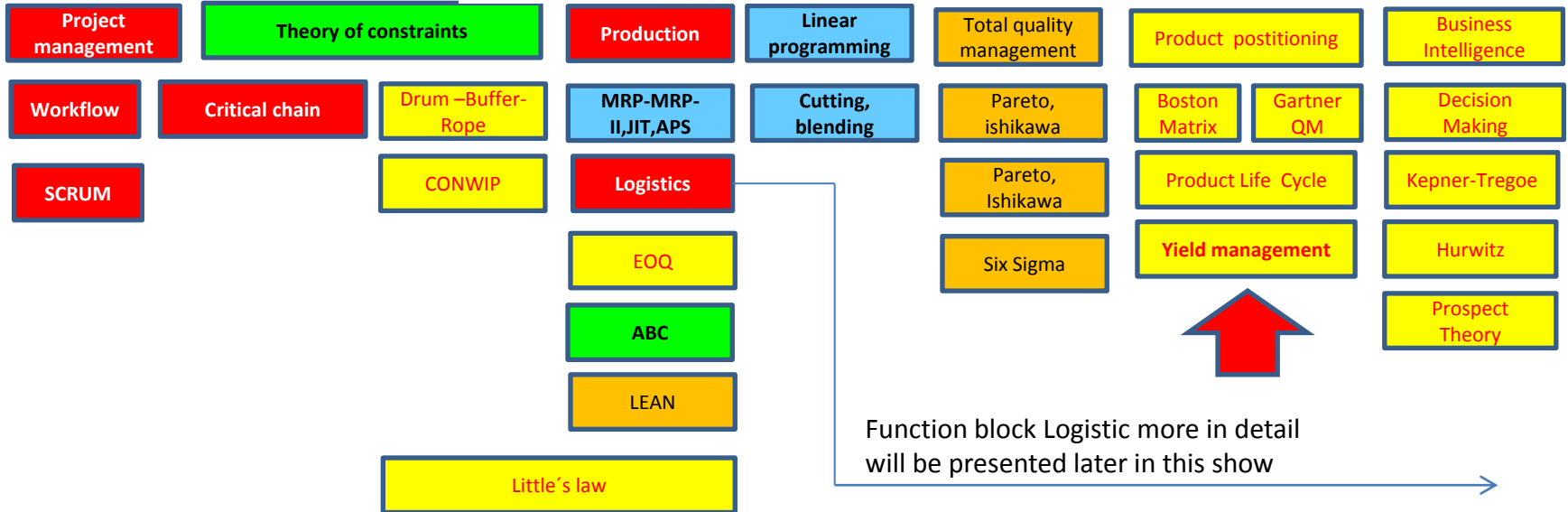Masaryk University Brno

Czech Republic

Some OM methods

- Theory of Constraints
- Balanced Scorecard
- Project Management methods (Critical Chain, SCRUM,…)
- Material Requirement Planning and Just-in-Time
- CONWIP
- Drum-Buffer-Rope
- 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)
- Decision trees
- Prospect theory

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 **time-sensitive products** and services.

- 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 behavior (to ultimately maximize revenue!)

- **reflective**- jasně vypovídající

- f**orward-looking**- plánující /do budoucnosti), dynamický

Single Order Quantity

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 !!!

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.
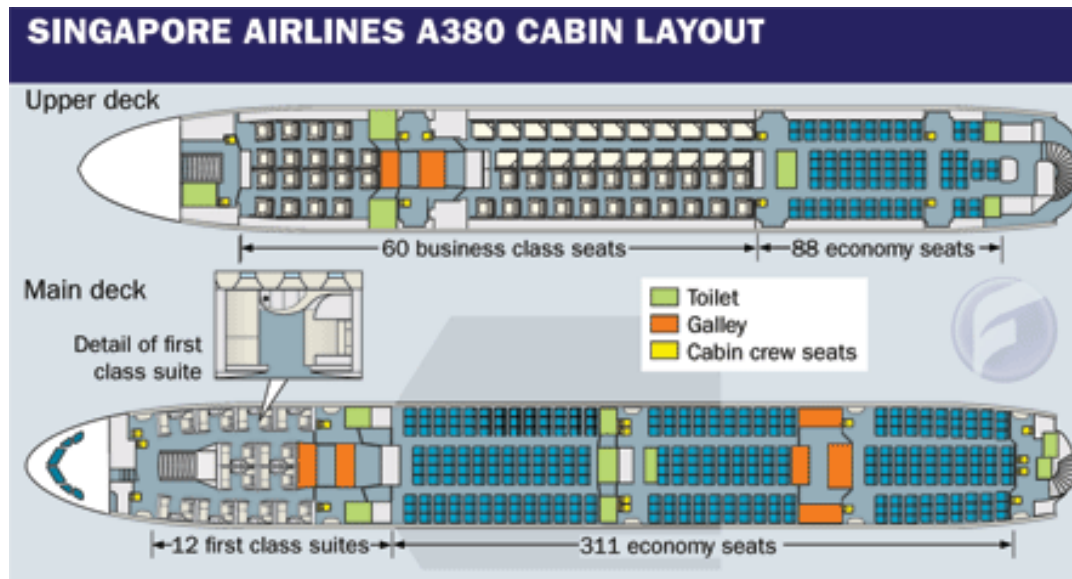
Prices and demand (Ceny a poptávka)

- **Prices can be determined by:**
  - Type of service (typ služby)
  - Group of services (skupina služeb)
  - Market (consumer type or geographical area) or
  - a combination of the above

- **And the demand side is characterized with:**
  - Variability of demand (variabilita poptávky v čase)
  - Variability of value (variabilita hodnoty)

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
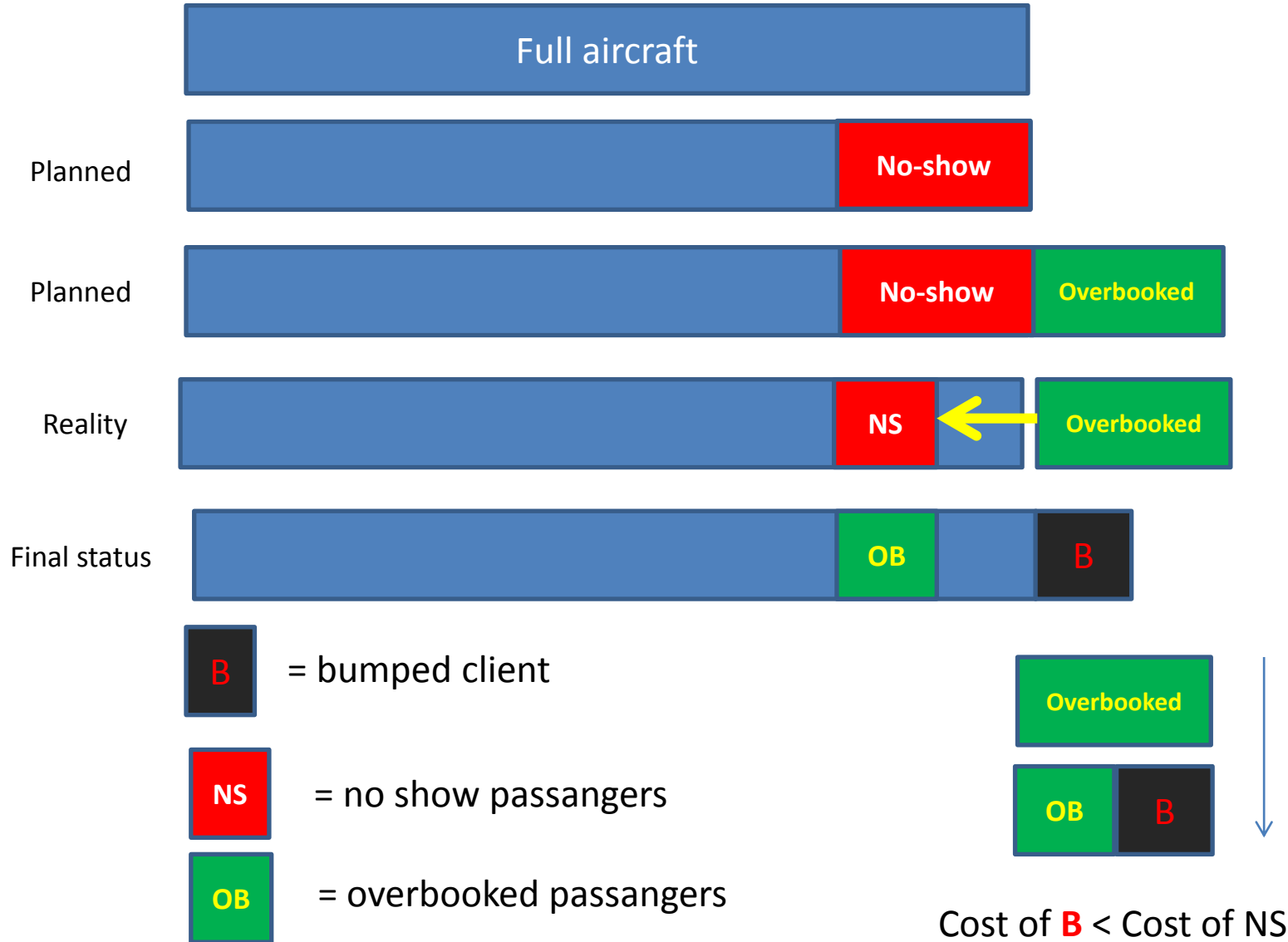
311+31=341
341 -22=319
319-311=**9**

10%-30 % of **no-show** (traveler reserved ticket, but cancel it at the last minute).
So airline companies **overbook** their capacities. The no-show ratio is sometimes
lower than overbooking 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 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 the loss of not sold 31 places.
You have to calculate loss of 31 places -22 sold tickets =amount which must cover expenses for 9 bumped clients

Ovebooking<->No-show

Full aircraft

Planned
No-show

Planned
No-show | Overbooked

Reality
NS | Overbooked

Final status
OB | B

B = bumped client

NS = no show passangers

OB = overbooked passangers

Overbooked

OB | B

Cost of **B** < Cost of NS

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).
collusion = tajná domluva mezi stranami
do not settle! = nenechte se opít rohlíkem ! Můžete dostat více !!!

Single order quantities

- Newspapers

- Magazines

- Florists

- Bakeries

- Fresh fishes

Single order quantities

- **N** = number of items that can be sold (počet zboží, které může být prodáno)
- **X** = number of items ordered (počet objednaného zboží)
- **C_0** = Cost of overestimating demand **(rest of the flowers faded and are not sold)** – co se neprodalo a už se neprodá
- **C_u** = Cost of underestimating demand **(customers like to buy more and you do not have enough of roses)** –už nemáme!!
- **$C_u \geq C_0$**
- $P(N<X)$ = probability of overestimating demand or no-show
- $P(X \geq N)$ = probability of underestimating demand or no-show

$P(X \geq N)*C_u \geq P(N<X)*C_0$

$P(X \geq N) + P(N<X) = 1 \rightarrow P(X \geq N) = 1-P(X<N)$

$(1-P(X<N)) * C_u \geq P(N<X) * C_0$ -> **OPTIMUM PROBABILITY**

$$P(N<X) \leq \frac{C_u}{C_u + C_0}$$

Final formula for overestimating demand

Example ->Single Order Quantity (hotel industry)

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

C_u = **100** USD-**25** USD =75 USD - cost of underestimating demand

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

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 !!!**

0,15+0,25=0,40 and 0,40+0,30=0,70…

Example ->Single Order Quantity (Airlines) - **Home study**

- **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 standard fare 169 USD, but only for 7-days advance purchases and for a 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

50+50 = 55+45=60+40=65+35...

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