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Coping with Variability and Uncertainty

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Variability and Uncertainty



Quite often, we use the word **Variability** with a general meaning of variation, but it can be divided in two aspects:

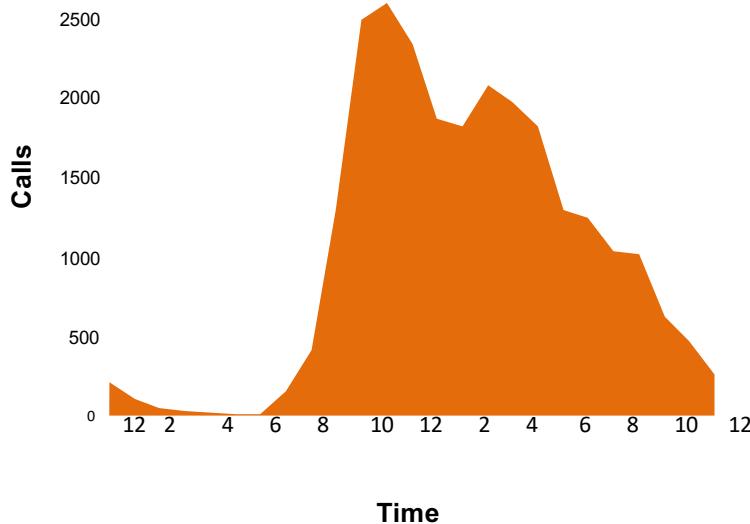
- Pure Variability
- Uncertainty

$$\text{Variability} = \text{Pure Variability} + \text{Uncertainty}$$

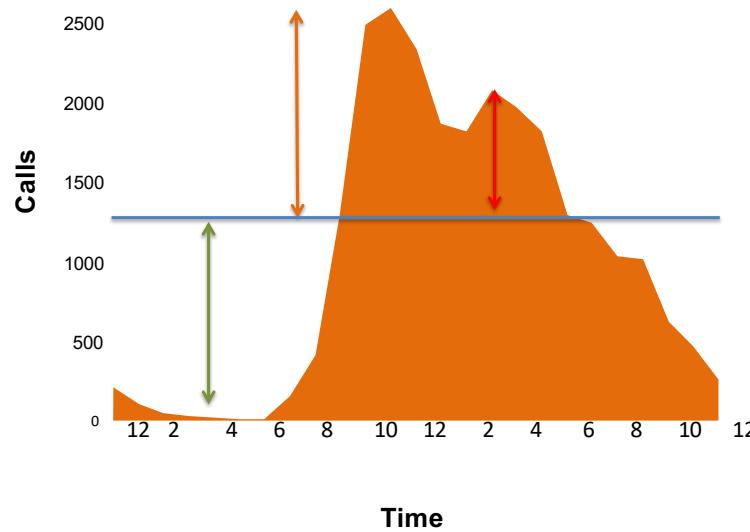


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Example of Customer demand over time



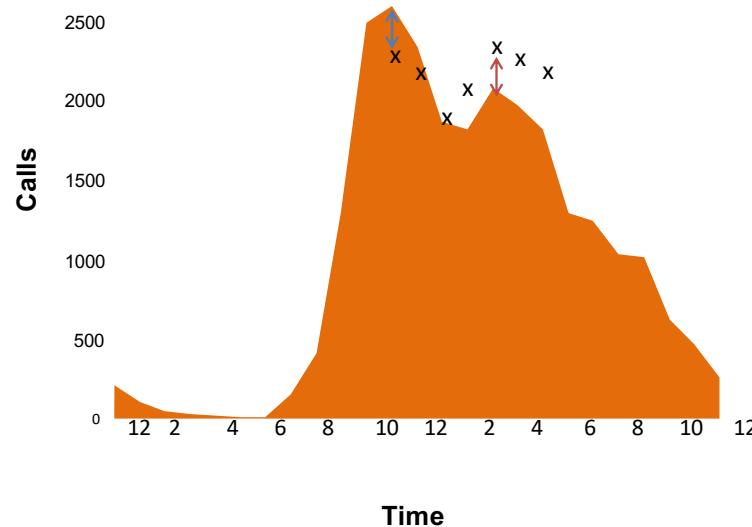
Variability



Variability refers to the variation of the actual demand compared to its average value



Uncertainty



Uncertainty refers to the difference between the actual value of the demand, and the forecasted one



Variability and Uncertainty



It is possible to have, among other combinations, a high (pure) **variability** and low **uncertainty**, or high **uncertainty** and low pure **variability**

Variability can be seen as the sum of **pure variability** and **uncertainty**

How can we cope with these situations?

Coping with Pure variability

Variability can be addressed (reduced) using 3 strategies

¹₁

Decoupling

demand and capacity
(Buffering)

2

Managing

capacity

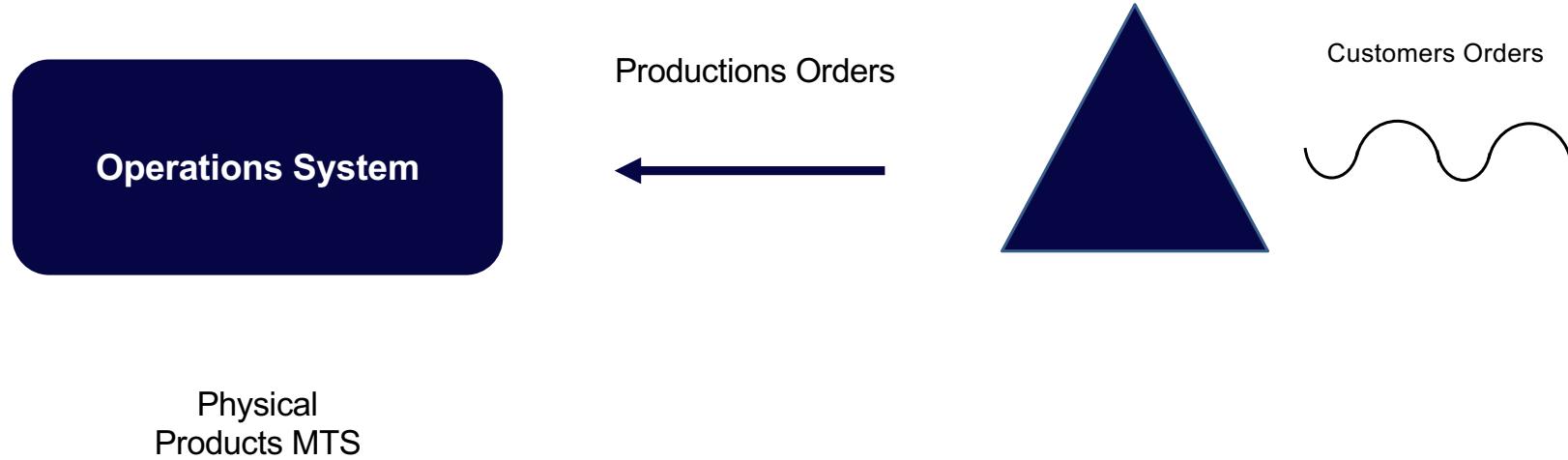
3

Managing

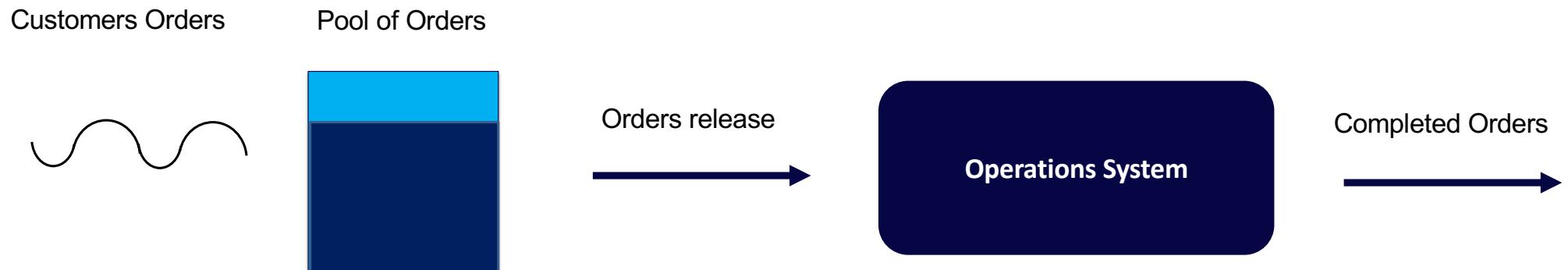
demand



Decoupling Capacity and Demand Downstream: Inventories



Decoupling Capacity and Demand Upstream: Pre-Shop Pool



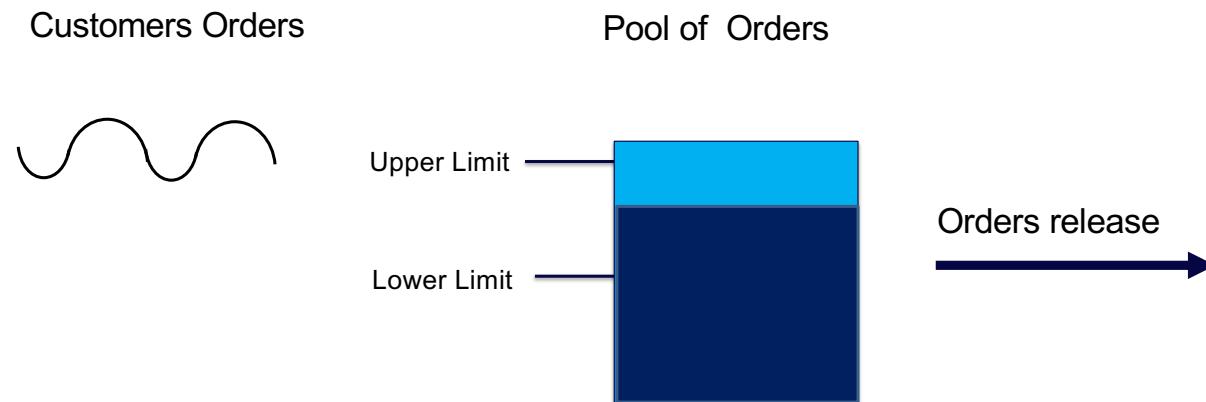
Average Demand Rate = Average Release Rate

Service Companies and MTO manufacturing companies



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System Regulation (temporary changes)



Exceeding Upper Limit

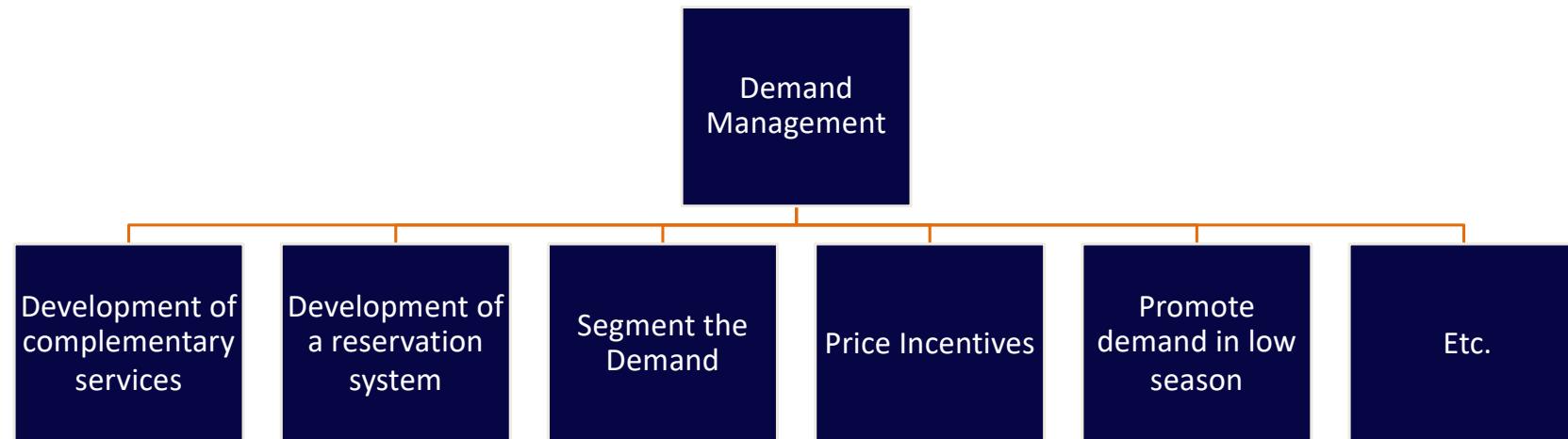
- Decrease orders intake
- Increase capacity (e.g. overtime) and release rate
- Promise longer delivery date

Below Lower Limit

- Foster sales (e.g. through advertising)
- Decrease capacity (e.g. close for 1 day)
- Promise shorter delivery date



Demand Management



Set Price Incentives

In periods of **low demand, lower prices** will be offered



This will move price sensitive customers to periods when demand is lower, thus leveling the request



E.g. Train operators make ticket prices that are differentiated by day of the week and time



Development of Complementary Services

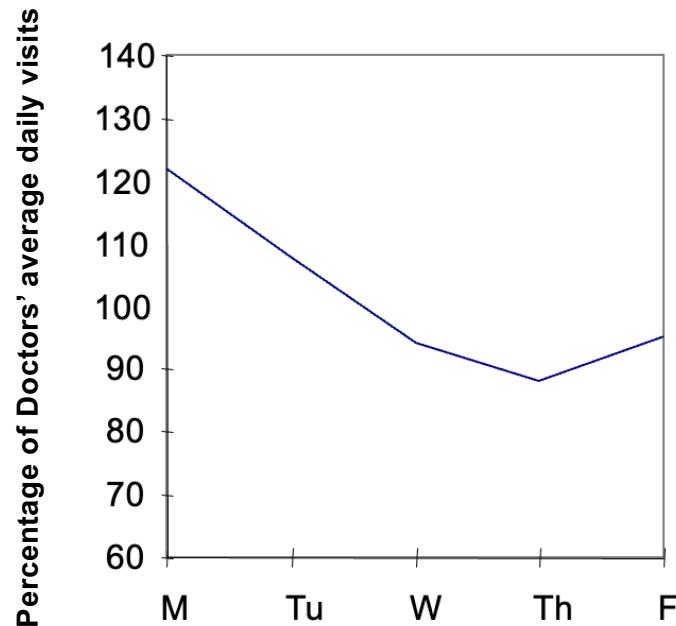


- Complementary to do more and better businesses
- Complementary for seasonality



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Demand Segmentation at Healthy Clinic and Development of a reservation system

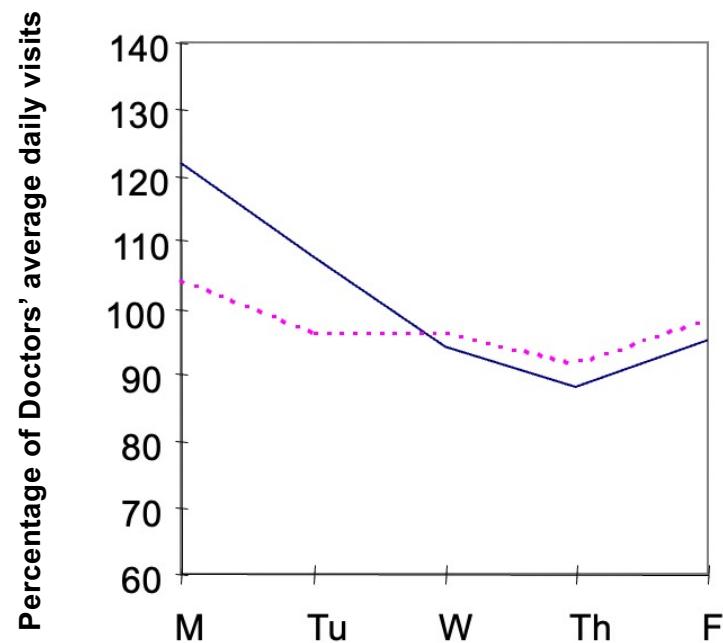


Reduce demand variability fixing
appointments in an appropriate way

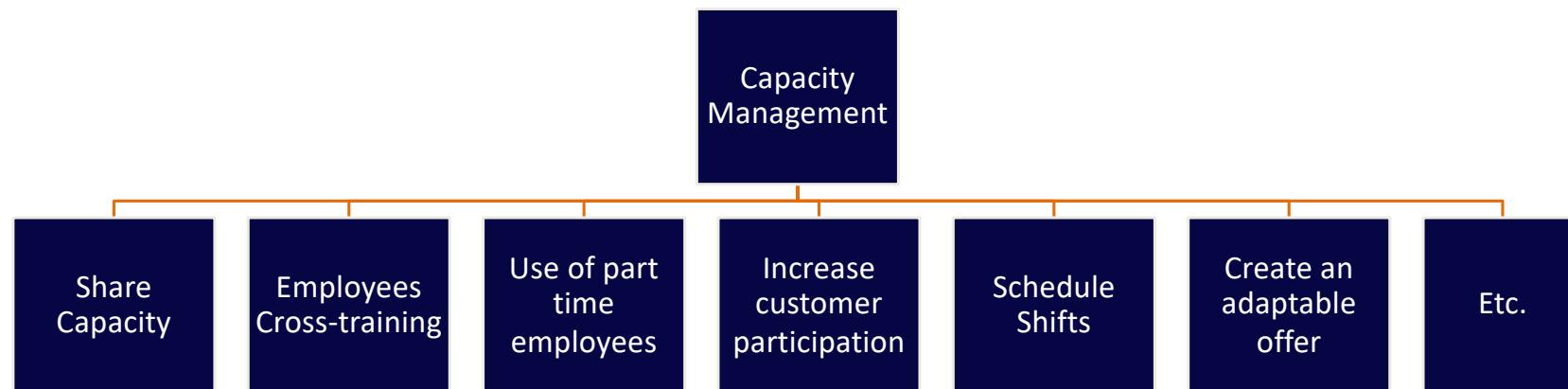
Day	Appointments
Monday	84
Tuesday	89
Wednesday	124
Thursday	129
Friday	114



Demand Segmentation at Healthy Clinic and Development of a reservation system



Capacity Management



Increase Customer Participation



- When demand increases, also capacity increases: therefore fewer resources are needed to deal with increase in demand.
- The degree of customer participation can be varied according to demand.



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Make a part of the capacity variable



1. Flexible solutions through outsourcing
2. First class - economy distribution



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Capacity Sharing



- Some airlines make their own aircrafts available to other companies in period of low demand (they also change the fuselage decorations)
- Multi property apartments
- Sharing of resources between branches



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Employees Cross-training



- Having a few operators with extensive expertise allows to answer local peaks of demand for specific activities
 - Supermarket (eg. TESCO)
 - Bank



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Use part-time employees



- If variability is predictable enough, you can use part-time staff
- In Italy, the use of part-time is still limited compared to other European countries even if it has great potential



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Critical Aspects

- Flexibility (time and cost) in moving the levers
- The Minimum SIZE of the change
- Minimum TIME the change lasts
- How much in advance the demand is known
(how much time do you have to change)



Managing Uncertainty

Uncertainty can be addressed using 3 (+1) strategies:

1

Additional Decoupling

between demand and
capacity

2

Capacity Buffer

(always available, or only
upon call. E.g. stand-by
medical doctor)

3

Manage delays

in delivery



Managing Uncertainty: additional decoupling

When decoupling capacity and demand due to pure variability, it is possible to increase the size of the decoupling to absorb the fact that the forecast of variability is not totally correct due to the presence of uncertainty

E.G if we sized the finished goods inventories to 10.000 to absorb the pure variability, we could increase that value to 11.000 to cope with the fact that the forecast has a 10% uncertainty



Managing Uncertainty: capacity buffer

When seizing an extra capacity to absorb pure variation, we can increase the size of the extra capacity to cope with the fact that the forecast of variability is not totally correct due to the presence of uncertainty

E.G if we have an average demand of 1000/week and we sized the capacity to 12.000 to absorbe the pure variability, we could increase that value to 13.200 to cope with the fact that the forecast has a 10% uncertainty



Additional Strategy

Attack the causes of Uncertainty: Analyse Uncertainty and find an explanations for the deviations from the forecasted value

Understand better the underlying phenomenon

Reduce pure Uncertainty so to transform Variability into pure Variability



Additional aspects of variability/uncertainty

Variability (pure variability + uncertainty) hides phenomena

2 types of Variability:

- Determined by the company → control/remove it
- Imported from outside → limit the effect (in the short term), and work on reducing it (in the middle term)

20% of the products/services generates 80% of variability (and of Uncertainty)

If it's not possible to remove variability/uncertainty, isolate it!



Service Variability (and Uncertainty)

- In a service system, variability has to be managed at the **front office**
- The greater the variability, the greater the competences and discretion needed by front office
- A system based on command and control is very inefficient (and often even ineffective) in managing variability





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Thank you!

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