

Operational models for customer – specific variety

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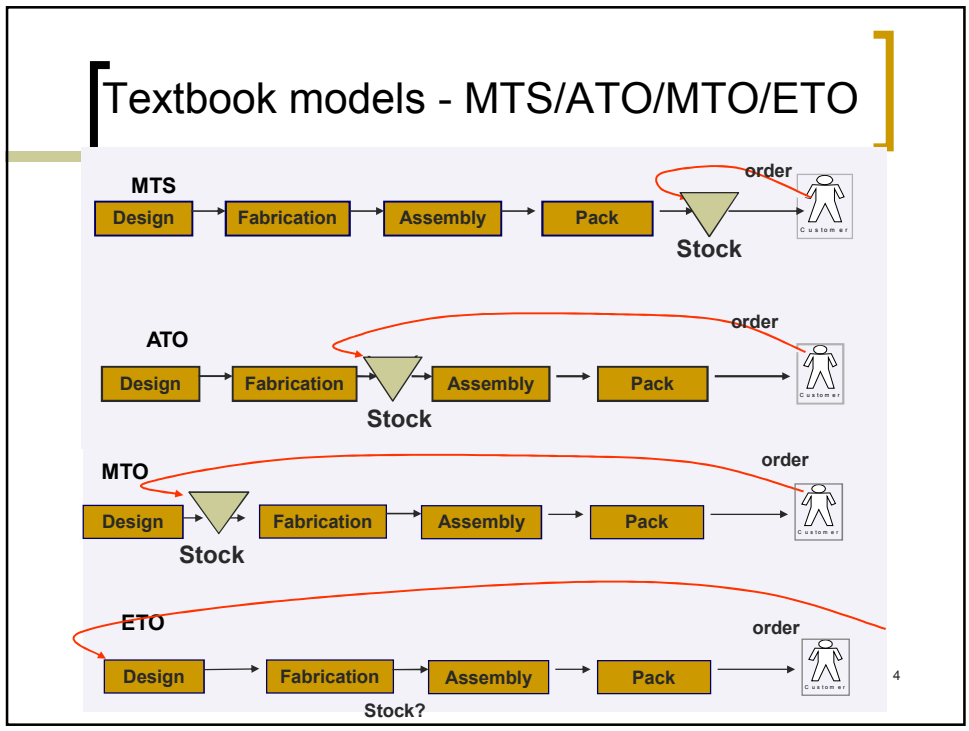
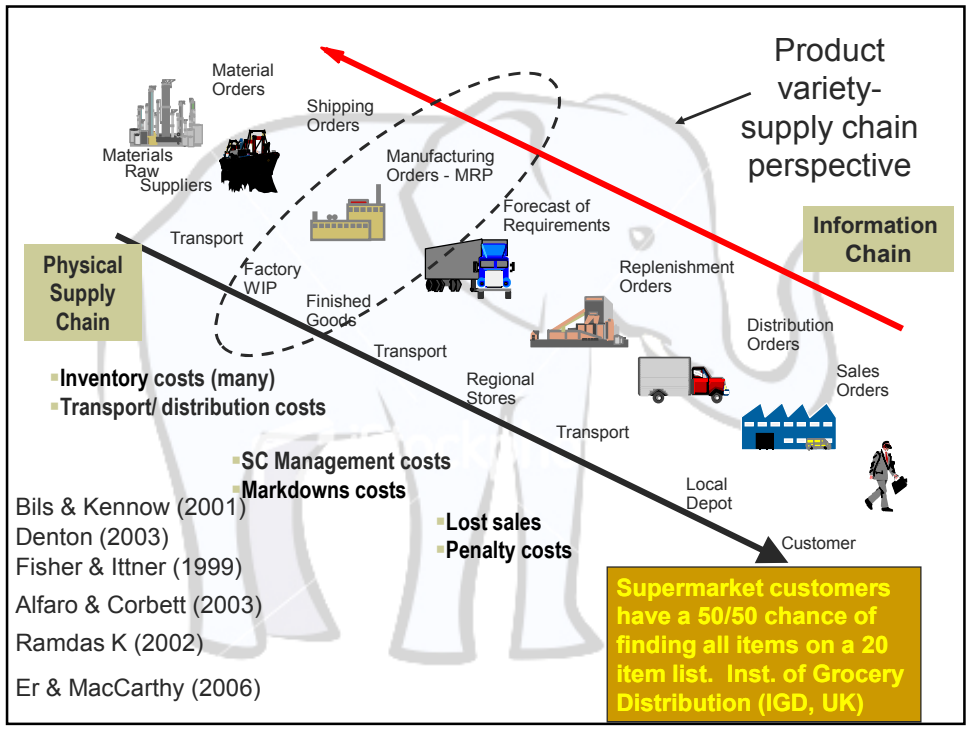
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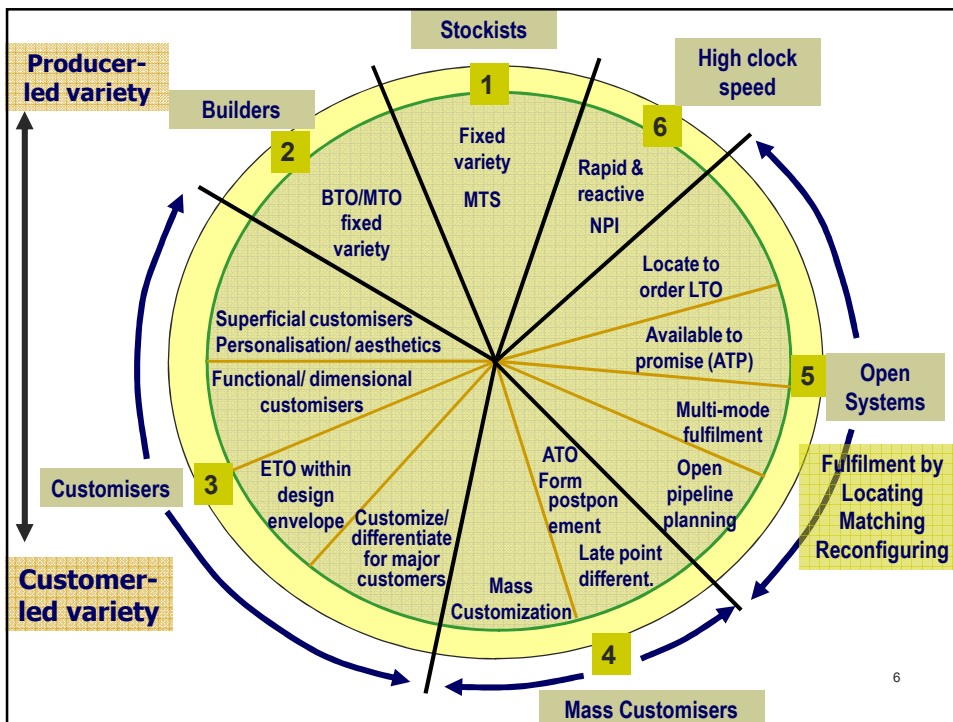
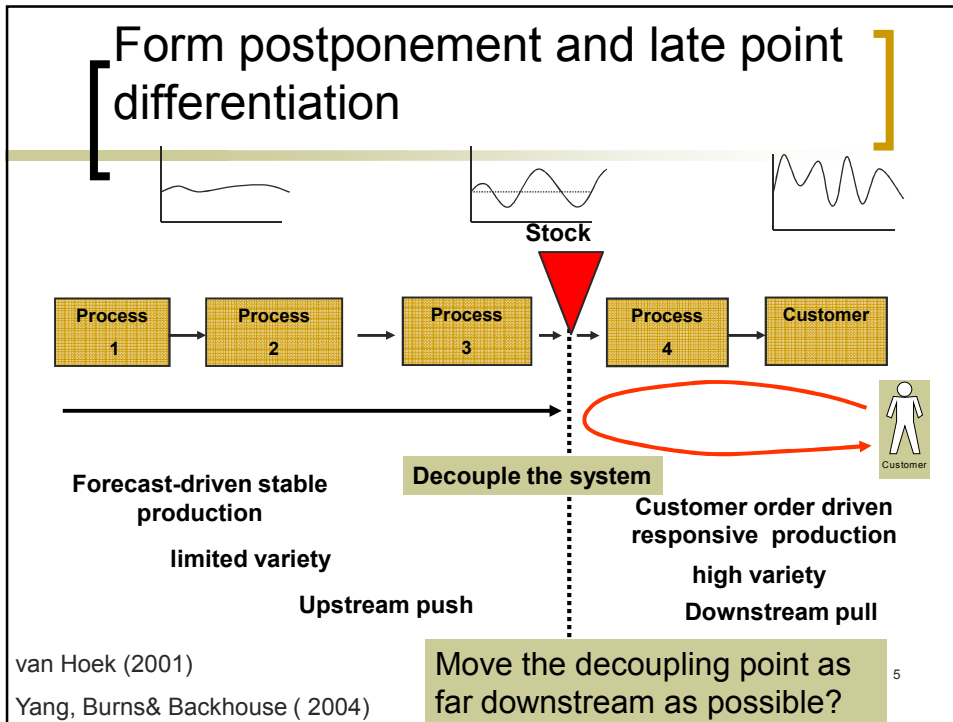


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Outline

1. Product variety in order fulfilment
2. A classification of fulfilment systems
3. Open pipeline approaches
–flexible and dynamic fulfilment strategies
4. When should we open the pipeline?





Operational models for customer-specific variety

- Classifications are approximate
- May be combined
 - different products
 - different markets
 - product lifecycles
- Open pipeline systems use different fulfilment mechanisms flexibly

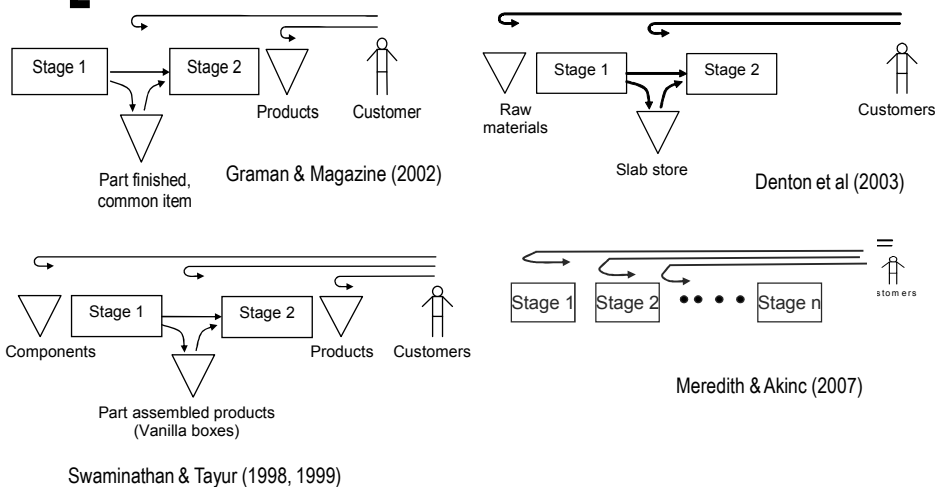
Amaro, Hendry, Kingsman (1999)

MacCarthy, Brabazon, Bramham (2003)

MacCarthy, Brabazon (2008) – *Order fulfilment models in high variety production environments* -Nottingham E-Print available

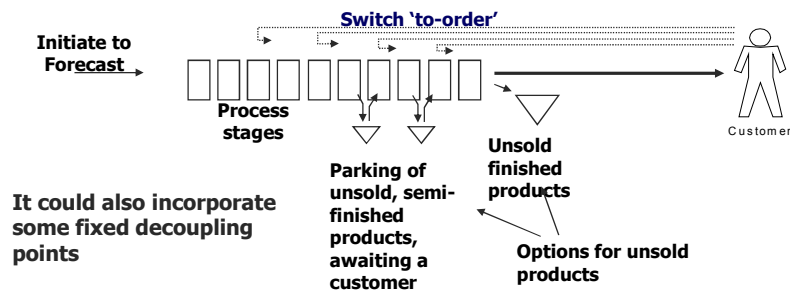
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Multi-mode fulfilment strategies



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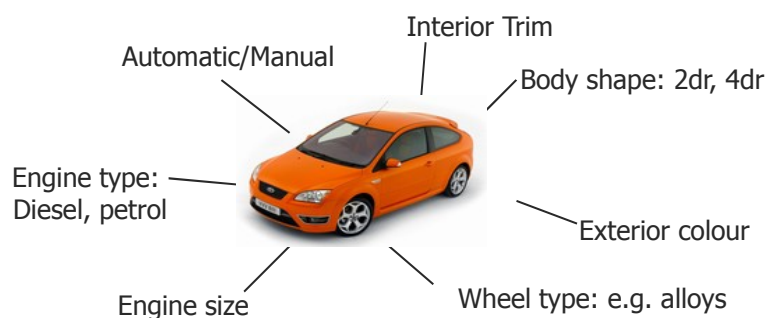
Open pipeline approach



Fulfil from anywhere in the system

- A generalisation of multi-mode fulfilment systems
- Combine Build-to-Forecast with some or all of Stock, ATO, planning pipeline allocation & BTO
- Introduce more flexibility – reconfigure product in the pipeline

Multi-featured product



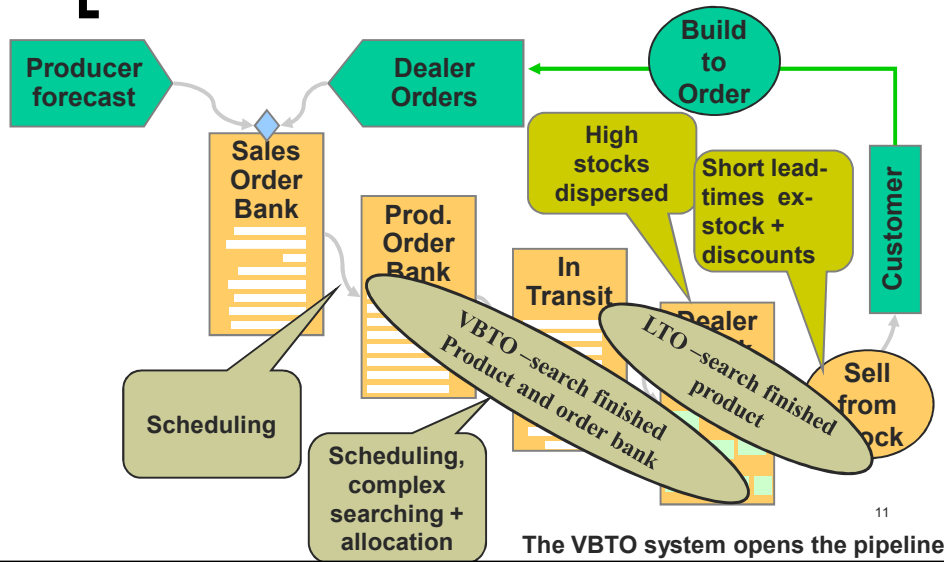
A **Feature** can have several **Options**

Variant: a unique combination of **Options**

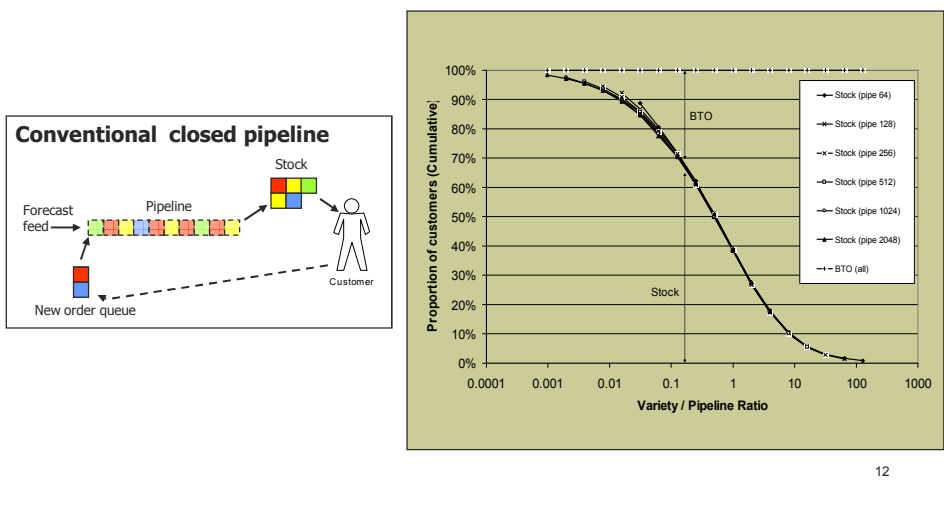
Why is an open pipeline attractive in automotive?

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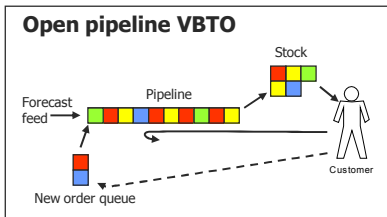
Automotive build strategies



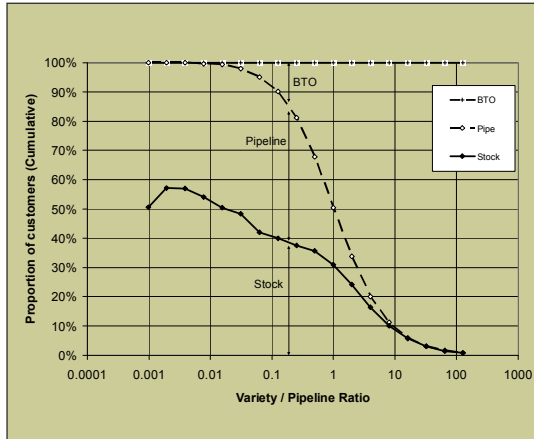
Behaviour of a conventional system



Behaviour of an open system (without reconfiguration)

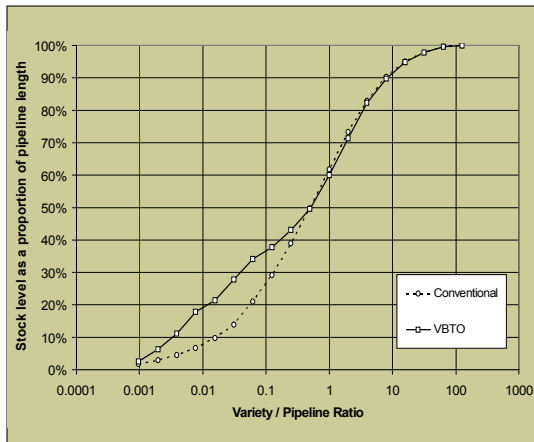
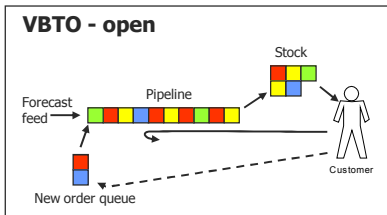
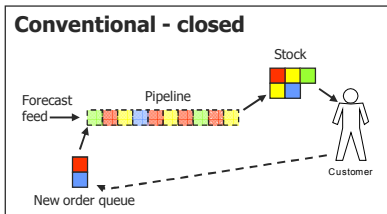


Brabazon and MacCarthy (2006), IJPE



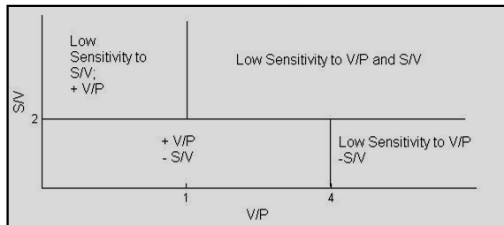
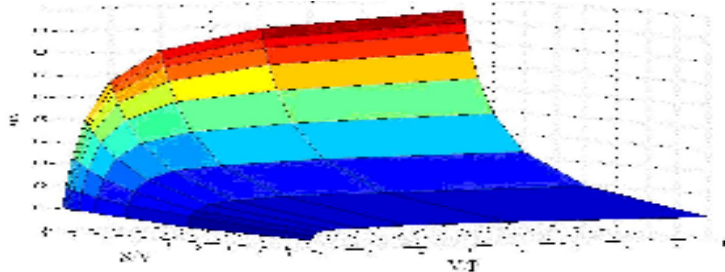
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Comparison of stock levels



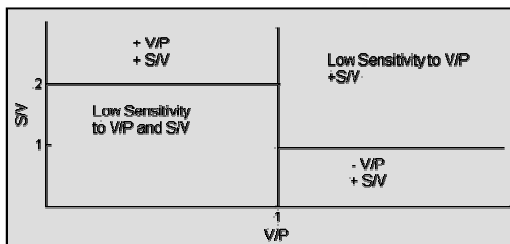
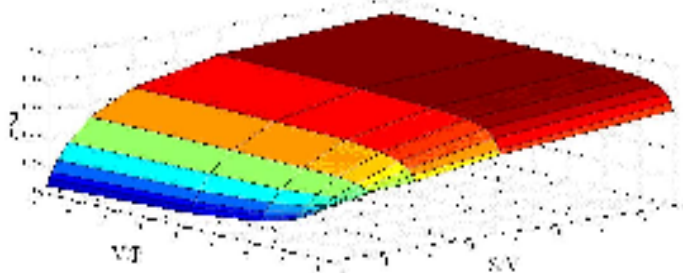
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The effect of V/P and S/V on BTO fulfilment



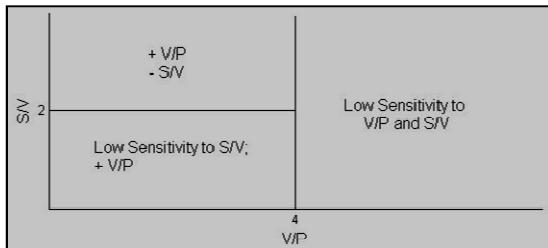
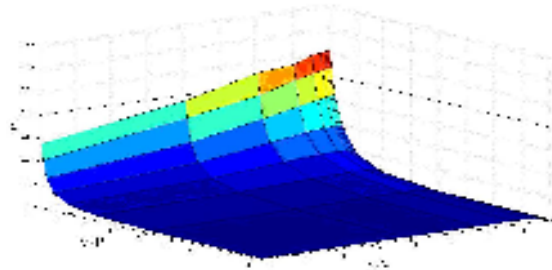
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The effect of V/P and S/V on stock fulfilment



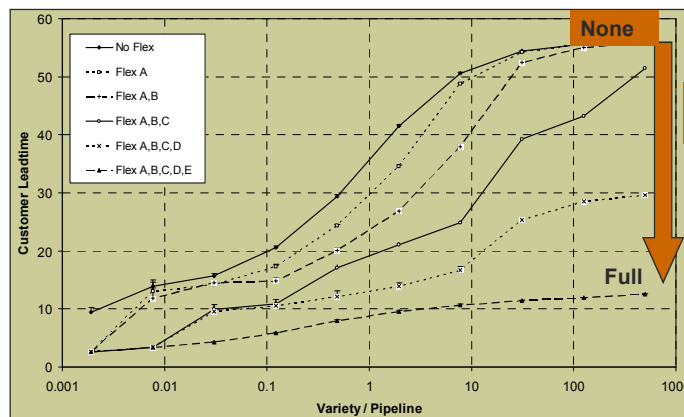
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The effect of V/P and S/V on pipeline fulfilment



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Pipeline reconfiguration flexibility



Effect of different levels of reconfiguration flexibility on lead time

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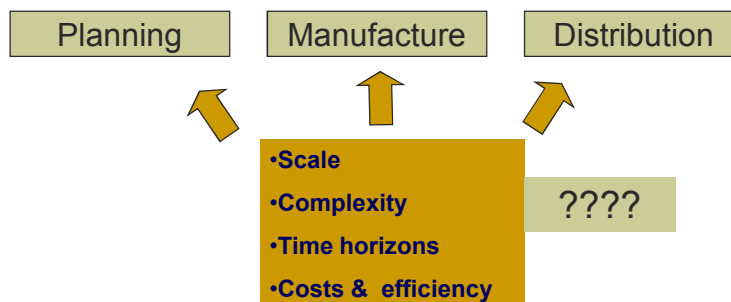
Designing and managing open pipeline systems

- Many issues in managing and controlling and open pipeline system
 - Intelligent release
 - Revenue management
 - Initial conditions
 - Reconfiguration in the pipeline
 - How does each stakeholder group fare ? producer, customers, dealers?
 - Operational constraints

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Opening the pipeline

- Exploits the variety in the pipeline to meet customer requirements more precisely



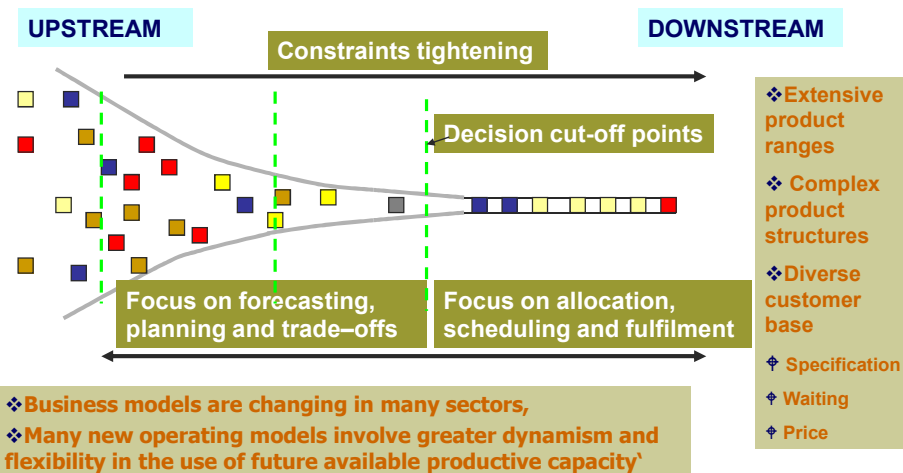
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Opening the pipeline – when should you do it?

- Valuable when
 - significant levels of variety, significant planning pipeline
 - heterogeneous customer base + a significant proportion require matched specifications
 - products can be allocated from the planning pipeline
 - flexible reconfiguration possible at reasonable costs
 - pure MTS or M/BTO unattractive - costs or response times
- Machinery, capital equipment, instrumentation, computer servers, automotive.....

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The dynamic open pipeline




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[In conclusion]

- Form postponement requires right combination of product architecture, manufacture and assembly + careful design
- Open systems exploit the variety in the planning pipeline to meet customer requirements more precisely
- Open systems may offer significant improvements in fulfilment levels in the presence of high variety, particularly when combined with flexible reconfiguration
- Waiting and stock characteristics are more complex than conventional systems

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- Thanks to the research team and our industrial collaborator, Ford 
- Questions?

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