

BUSI4496

**Supply Chain
Planning &
Management**

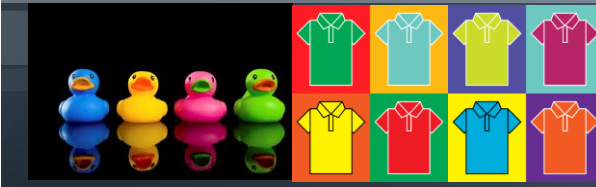
Prof Bart MacCarthy
Division of Operations
Management and
Information Systems

Lecture 9 – Self-Study Session 2


4. Mass Customization

5 Quick Response Initiatives

Exam preparation



29.11.2024



Nottingham University
Business School

UNITED KINGDOM • CHINA • MALAYSIA

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Outline

1. Kanban, JIT and Lean - implications for planning and control
2. Theory of Constraints (TOC)
3. Product variety and postponement strategies
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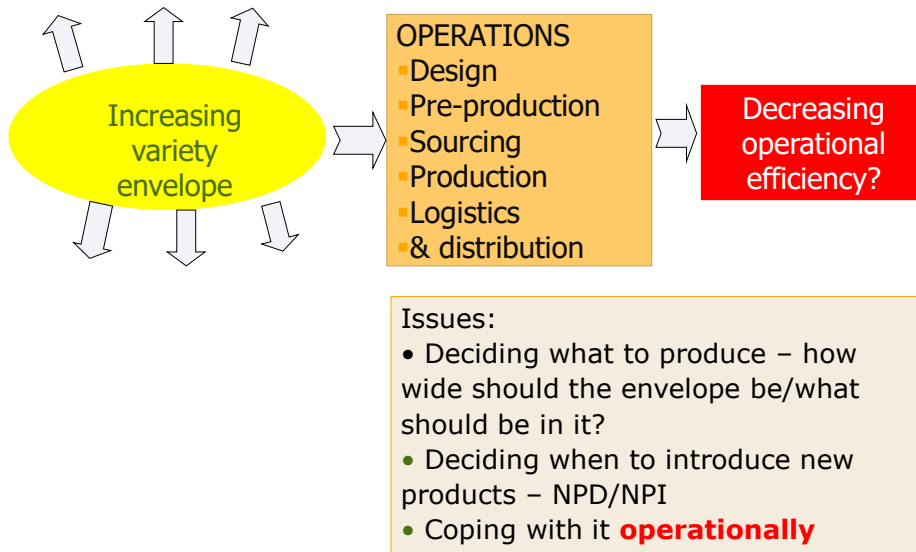
Pre-Recorded Self Study Session on Moodle

4. Mass Customization
5. Quick Response Initiatives

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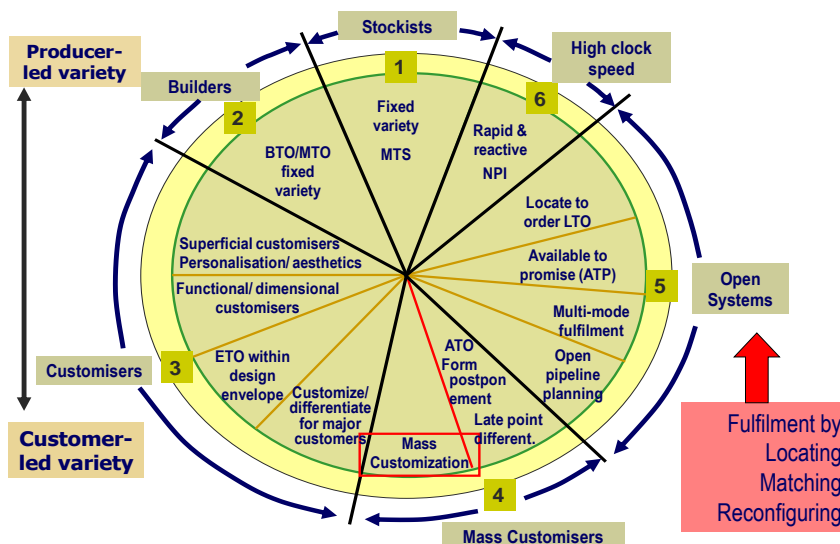
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Product variety and operations



3

A continuum of strategies for high variety and customization



MacCarthy, IJPR (2013)

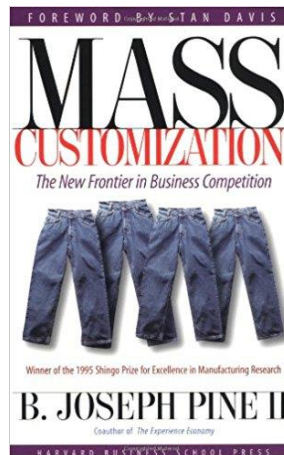
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4. Mass Customization

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Mass Customization (MC)

- Terms originated by **Davis (1987)**
‘Could a shirt factory produce 5,000 individual shirts rather than 5,000 identical shirts?’
- Definition: The production of **customized** products and/or services on a **mass scale** with **mass production efficiencies (MC)**



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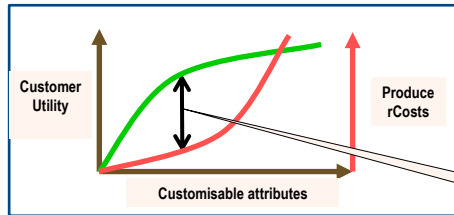
Mass Production v Mass Customization



Mass Production - **profitability premised on volume**

Mass Customization - **profit from customer differences** but with mass production efficiencies

A new paradigm?



Can we find the sweetspot?

What kinds of product are claimed to be mass customized?



www.dell.com



www.andersenwindows.com



www.yorkon.com



www.bmw.com



www.landsend.com



www.shirts-custom.com

A traditional sector – bespoke furniture

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DESIGN WITHOUT COMPROMISE



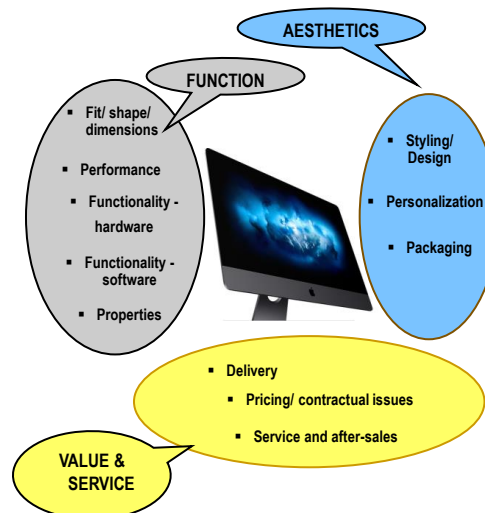
'For over 20 years we have been designing unique fitted furniture for our clients, their style and the way they live. Whether you are looking for an innovative study, a sumptuous bedroom, a striking lounge, a library or state of the art home cinema room we can create your perfect bespoke furniture.'

Could this be considered as MC?

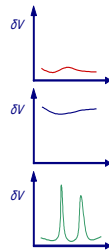
NEVILLE JOHNSON
DESIGN WITHOUT COMPROMISE

What is 'Customization'?

- Which **attributes** should be '**customizable**' and what **does this mean**?
- Broadly three categories
 - **Function, Aesthetics, Value and service**
- The **customization potential** of a product may be **unbounded** !



Which attributes should be customizable?



Low level of value difference – little benefit from customisation

High level of value difference – great benefit from customisation

Hot spots of value difference – some benefit from customisation



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iMacPro

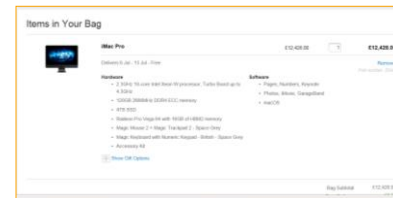
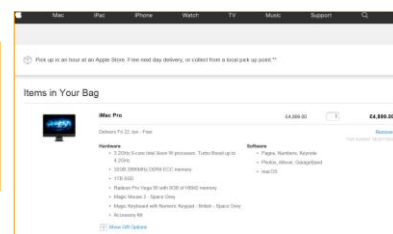


Recommended Configurations	
Standard Configuration	
10-Core, Vega 64 graphics, 64GB memory, 2TB storage	
10-Core, Vega 64 graphics, 128GB memory, 2TB storage	

<https://www.apple.com/uk/>

Customise your iMac Pro.

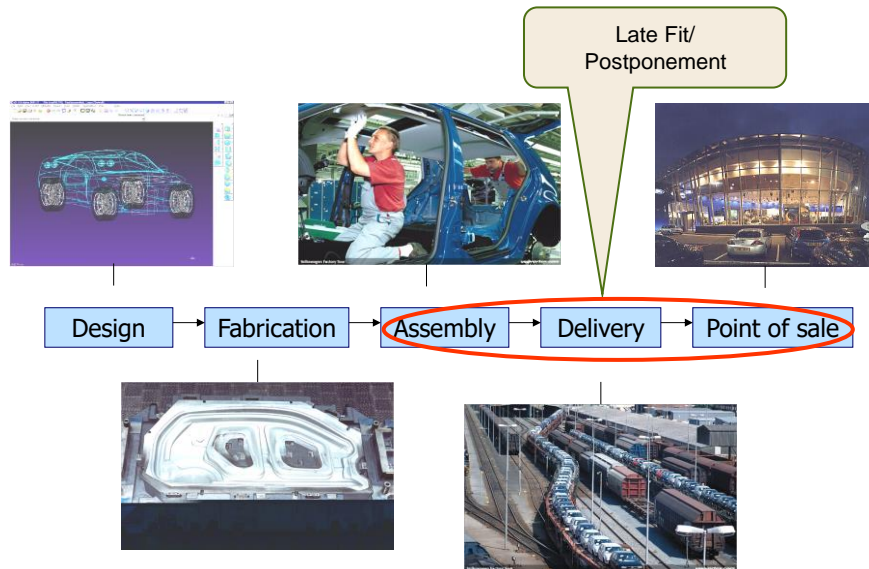
3.2GHz 8-core Intel Xeon W processor, Turbo Boost up to 4.2GHz
32GB 2666MHz DDR4 ECC memory
1TB SSD
Radeon Pro Vega 56 with 8GB of HBM2 memory
Magic Mouse 2 - Space Grey
Magic Keyboard with Numeric Keypad - British - Space Grey



£12,428!

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Perspectives on MC in automotive



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Types of Mass Customization

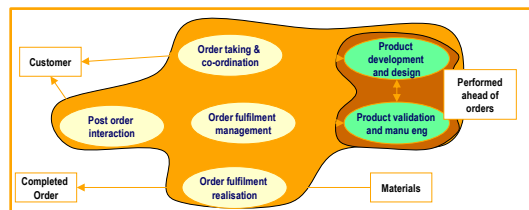
■ Different types/levels of Mass Customization

- Lampel & Mintzberg 1996, MacCarthy et al., 2003
- *Pure standardization, segmented standardization, customized standardization, tailored customization and pure customization (Lampel & Mintzberg 1996)*

■ Different **operational modes**

MacCarthy et al. (2003)
A taxonomy - five fundamental MC modes

- **Catalogue MC**
- Fixed resource design-per-order MC
- Flexible resource design-per-order MC
- Fixed resource call-off MC
- Flexible resource call-off MC

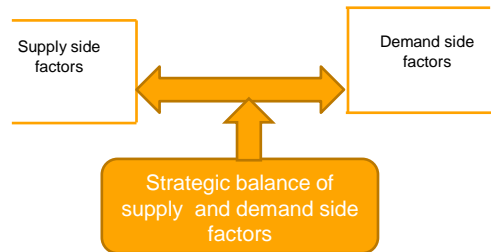


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Mass Customization in perspective

- Having an impact in some B2B contexts
- Still major challenges in many consumer product sectors
- Fast NPI, relevant preconfigured variety and fast order response may be more important than offering customization



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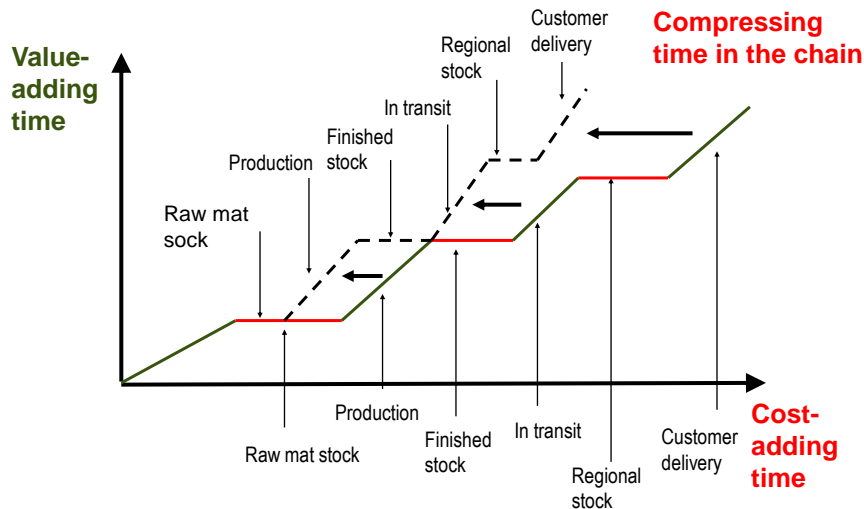
5. Quick Response

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Increasing the speed of flow

Increase the speed of materials and information



Source: Christopher, M. (2012). *Logistics and supply chain management*. Pearson UK.

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Quick Response (QR) initiatives

- Quick Response (QR) initiatives have been studied in a number of sectors – consumer/grocery, clothing etc.
 1. Strive for fast and accurate information transmission
 2. Develop flexible production resources
 3. Invest in/utilise technology and automation where appropriate
 4. Develop fast logistics
 5. Exploit all opportunities for lead time compression
 6. QR must be a key part of an organisation's strategy with a supportive organisational culture



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Key Learning points ₁

1. **Kanban is a building block** of JIT, which is a building block of JIT and lean production operations
2. **Kanban** control can be **introduced into many operations** if the circumstances are appropriate
3. **JIT is difficult achieve** and may still need MRP-control at some level
4. **Theory of Constraints (TOC) is based on managing bottleneck operations** to ensure maximum 'continuous' throughput – has implications for the whole of the operation
5. **Drum-Buffer-Rope (DBR) is way of scheduling** a set of operation where control is **dictated by the bottleneck**
6. Workload control (WLC) tries to ensure optimum release of work into a shop to avoid overload (not covered 2024)

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Key Learning points ₂

7. Increases in **product variety** cause many operational **problems**
 8. **Postponement** may in some circumstances be used to produce customer-focused variety efficiently
 - Place, **Form**, and Time postponement
 - Form postponement the most common – may need **modular products**
- Pre-Recorded Self Study Session on Moodle.....**
- **Mass Customization** uses mass production principles to produce customized products – may gain **high rewards** without increasing costs but is **difficult to do**
 - A **spectrum of methods** to deliver variety and customization depending on supply and demand factors
 - **Quick Response (QR)** requires a combination of good production, information, and decision practices

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7. Review questions for Session 9

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Review questions for Session 9

These questions and answers should help you to think about, revise and consolidate the material covered in the lecture.

- 1. Explain how a Kanban system operates.**
- 2. What are the key principles in JIT from a planning and control point of view?**
- 3. JIT/Lean approaches advocate PULL control – explain why it may be difficult to implement pull systems in some contexts.**
- 4. Explain the five focussing steps in TOC.**
- 5. The BEST COLOUR Textile factory has three processing stages – 1. fabric washing, 2. fabric colouration, 3. fabric finishing. All fabric production goes through each of these stages in sequence. The factory has only one colouration machine which operates in batch mode, i.e., when it is loaded, the colouring process runs for a set period of time. The machine is then unloaded, and the coloured fabric proceeds to finishing. The next batch of fabric then commences on the fabric colouration machine.**

If the colouration machine's output is too low to meet the current high demand, why should BEST COLOUR consider a TOC approach to maximise output ?

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Review questions for Session 9 contd

6. Outline how BEST COLOUR (in Q5) could apply a TOC approach using Drum-Buffer-Rope (DBR) principles to increase output from the formulation machine.
7. Why does high product variety cause operational problems in production and supply chain systems?
8. What is form postponement and how can it be achieved in an operational system?
9. What does Mass Customization seek to achieve?
10. What best practices help to achieve Quick Response (QR)?

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A scenario question

5. The BEST COLOUR Textile factory has **three processing stages** – 1. fabric washing, 2. fabric colouration, 3. fabric finishing. All fabric production goes through each of these stages in sequence. The factory has **only one fabric colouration machine** which operates in **batch mode**, i.e., when it is loaded, the colouring process runs for a set period of time. The machine is then unloaded, and the coloured fabric proceeds to finishing. The next batch of fabric then commences on the colouration machine. If the **colouration machine's output is too low** to meet the current high demand, **why should BEST COLOUR consider a TOC approach to maximise output ?**
6. Outline how BEST COLOUR (in Q5) could apply a TOC approach using **Drum-Buffer-Rope (DBR)** principles to **increase output** from the colouration machine.

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Q5&6. Sample answer

5. BEST COLOUR could benefit from using a Theory of Constraints (TOC) approach to examine the constraints on capacity in each of its processes and what is limiting overall throughput of fabric in the factory. The five focusing steps of TOC allow the identification of constraints, the exploitation of constraints to maximise output, and the subordination of constraints through techniques such as Drum-Buffer-Rope (DBR). Given that the colouration machine has been identified as not having sufficient capacity to meet demand, then BEST COLOUR may benefit from a TOC study on the colouration machine, its capacity and how its output could be maximised.

6. Assuming that the colouration machine is the dominant constraint, then the focus should be on Exploitation of its capacity (Step 2 in TOC) and Subordinating to it (Step 3 in TOC). Drum-Buffer-Rope (DBR) will seek to get maximum use of the available colouration process capacity to achieve maximum output. A desired rate of production (drumbeat - D) should be established for the this machine, e.g., the throughput rate per hour/shift/day for the colouration machine.

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Q5&6. Sample answer cont'd

Exploitation is the critical stage to maximise machine use.

Mention should be made of having a buffer (B) with the right mix of products waiting to go to the colouration stage to ensure it is never 'starved' of work.

Could the machine work for a longer period than the rest of the facility? Is there an opportunity to minimise lost time in machine set ups and changeovers from one colour to the next? Is there an optimal colouration sequence that reduces overall set up time losses? Can some preparation be done so that changeovers can be done quickly?

The sub-ordinate stage ensures the flow and sequencing of orders to the colouration machine buffer is regulated so that queue of work waiting to go into colouration reflects the required relative proportions of demand. There is no point in preparation fabric for which there is limited demand when a fabric with high demand should be in the buffer. This is achieved by the Rope (R), which controls the release of fabric for preparation to ensure the queue of fabric in the buffer reflects actual demand in the right proportions.

A diagram could be used to support your answer.

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**Now try some of the questions for
yourself, for instance the first
three Kanban/JIT questions.**