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Optimization of the flexibility – efficiency trade-off in engineer-to-order industries

Cannas Violetta Giada
Agenda

Area of investigation

State of the art

Future research directions
Agenda

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- State of the art
- Future research directions
Area of investigation
Product development – Supply chain management alignment in Engineer-to-order industries

Product development (PD)

Product features

Supply Chain management (SCM)

Supply chain practices

According to: Naylor et al. (1999); Rahim and Baksh (2003); Ben et al. (2004); Rudberg and Wikner (2004); Wikner and Rudberg (2005); Chen (2006); Dekkers (2006); Powell et al. (2014); Pero et al., 2010a; Gan and Grunow, 2015; Gosling et al. 2015
Area of investigation
Product development – Supply chain management alignment in Engineer-to-order industries

Traditionally ETO competed on customization level:
- Quality and technology level were the main sources of competitive advantage
- Production adapted to dynamic change of the business context

Globalization brings new competitors and changes in the competitive ecosystem
- Huge time compression and high pressure
- Need for additional competitive sources of advantage

Customers require faster and reliable deliveries of high customized products
- Critical success factors become time and variety
- Trade-off among efficiency and flexibility

According to: Cameron and Braiden, 2004; Xie and Tu (2006); Chen et al. (2010); Gosling et al. (2015); Birkie and Trucco (2016)
Area of investigation
Product development – Supply chain management alignment in Engineer-to-order industries

Concurrent engineering
Design for X

Mass customization
Postponement

Modularity

PD-SCM Alignment
Agenda

- Area of investigation
- State of the art
- Future research directions
State of the art  Traditional ETO concept – One dimensional CODP

- **Customization and flexibility**
- **Standardization and productivity**

Manufacturing systems based on CODP position (adapted from Wortmann, 1992)

**Make To Stock**
- Forecast driven activities (FDA)
- Customer order driven activities (CODA)

**Assembly to order**
- FDA
- CODA

**Make to order**
- FDA
- CODA

**Engineer to order**
- Customer order driven activities (CODA)

**Beginning of engineering**
- Engineering phase
- Production phase
- Assembly phase
- Delivery

**Time**
State of the art
New ETO concept – Two dimensional CODP

The two-dimensional CODP space (source: Rudberg and Wikner, 2004)
## State of the art

New ETO concept – Two dimensional CODP

<table>
<thead>
<tr>
<th>Engineering dimension</th>
<th>Production dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineer to order ((ETO_{ED}))</td>
<td>(ETO_{ED} \rightarrow MTO_{PD})</td>
</tr>
<tr>
<td>Adapt to order ((ATO_{ED}))</td>
<td>(ATO_{ED} \rightarrow MTO_{PD})</td>
</tr>
<tr>
<td>Engineer to stock ((ETS_{ED}))</td>
<td>(ETS_{ED} \rightarrow MTO_{PD})</td>
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</tbody>
</table>

The two-dimensional CODP space (adapted from Rudberg and Wikner, 2004)
State of the art
CODP positioning

Conceptual impact model framework (source: Olhager, 2003)

- Identification of the main factors affecting the CODP positioning based on the P:D ratio
- Definition of the role of the CODP in a manufacturing strategy
- Identification of the reasons and effect of the CODP forward and backward shifting

**Engineering characteristics?**

- Market characteristics
- Product characteristics
- Production characteristics

**Engineering lead time?**

- Delivery lead time
- Production lead time
- Order penetration point

**Reasons and effects for the engineering dimensions?**

- Manufacturing efficiency
- Product customization
- Risk of obsolescence
- Long delivery lead times
Agenda

Area of investigation

State of the art

Future research directions
Future research directions

How to position the customer order decoupling point considering both engineering and production dimensions, in order to enhance both PD and SCM performance and balance the trade-off among flexibility and efficiency?

**RQ1:** What are the PD and SCM performance affected by the positioning of the two-dimensional customer order decoupling point?

**RQ2:** How are the PD and SCM performance affected by the positioning of the two-dimensional customer order decoupling point? Which is the trade-off dictated by the forward or backward shifting of the two-dimensional customer order decoupling point?

**RQ3:** What are the main factors that affect the positioning of the two-dimensional customer order decoupling point?

**RQ4:** How do the factors affect the positioning of the two-dimensional customer order decoupling point?
THANK YOU VERY MUCH FOR YOUR ATTENTION

Cannas Violetta Giada