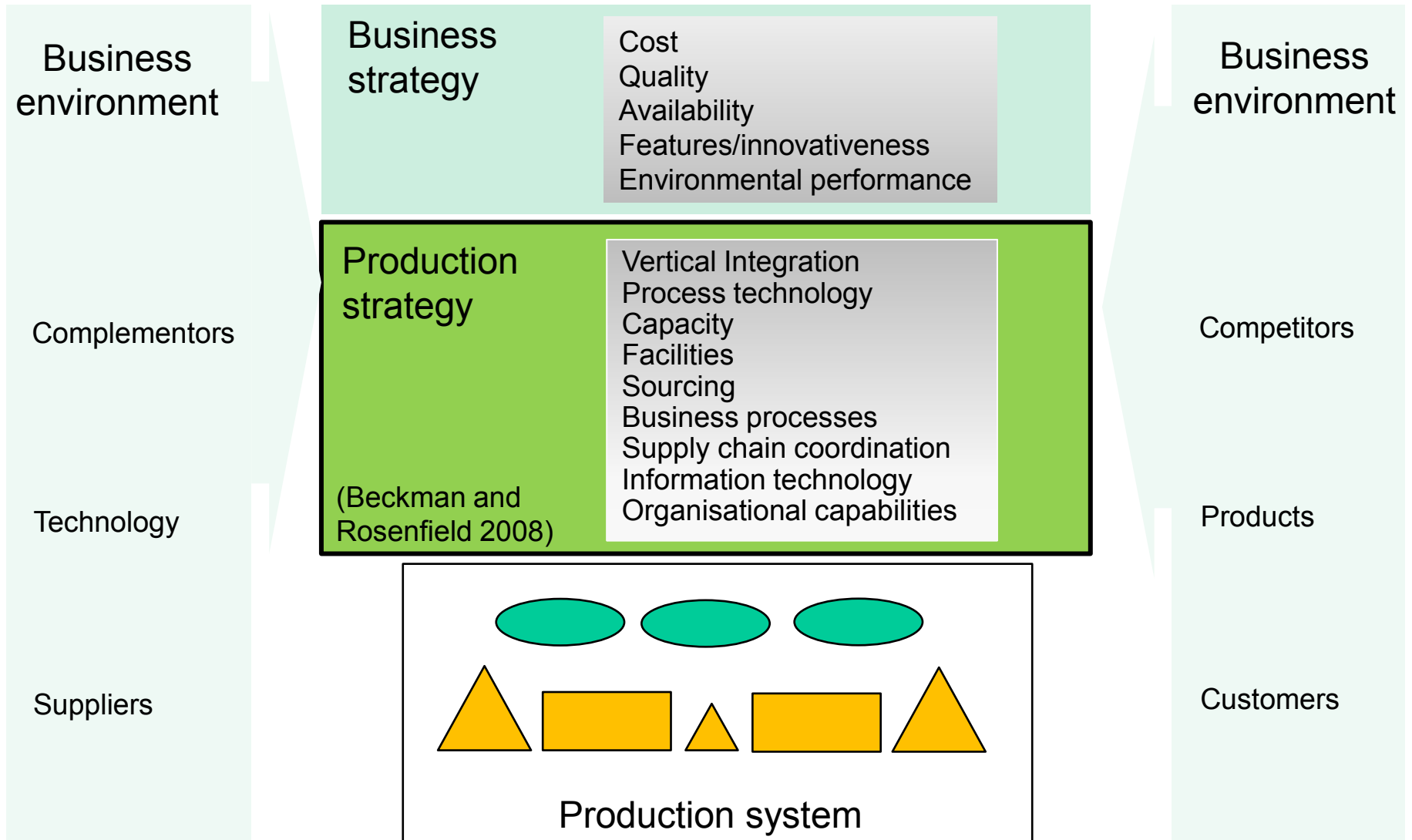


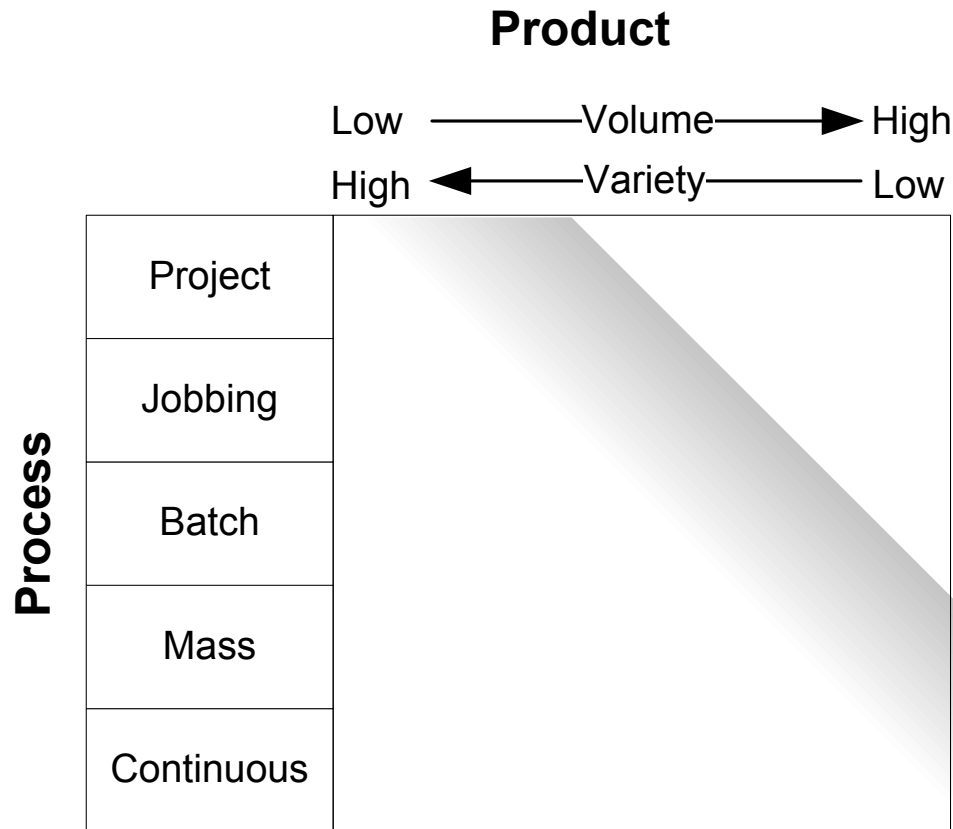
# Development of production strategy with focus on flexibility

Marco Semini, SINTEF

# Production strategy

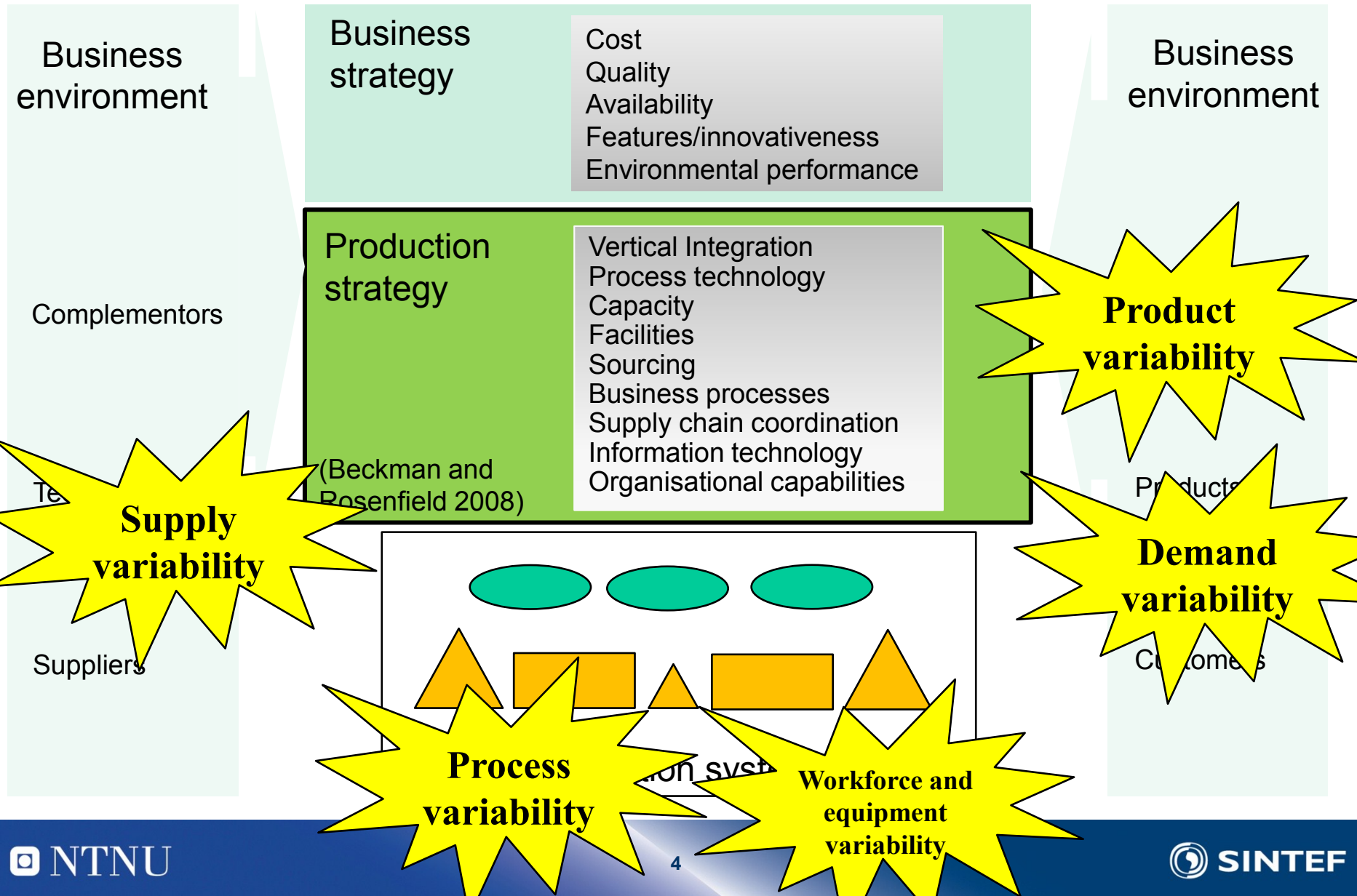


# Product-process matrix

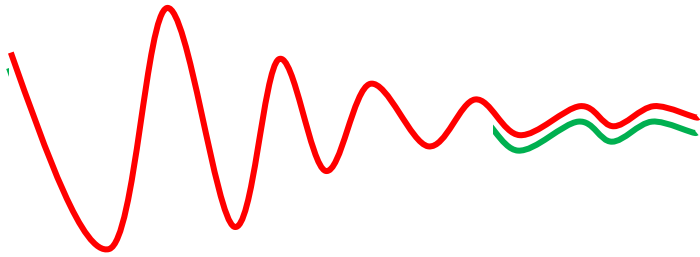


(Hayes and Wheelwright 1979)

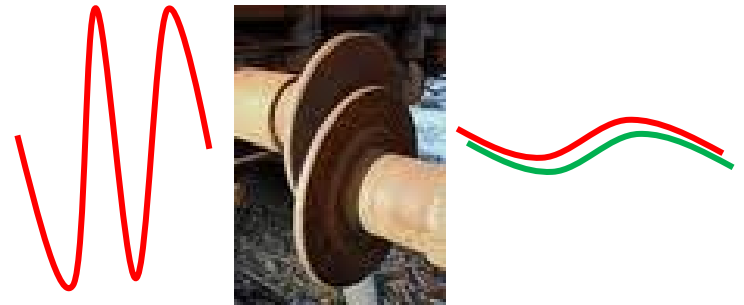
# Internal and external variability



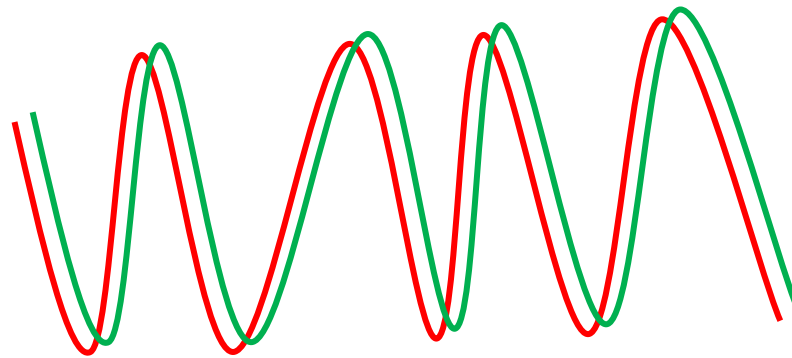
# How to respond to variability



Reduce variability itself

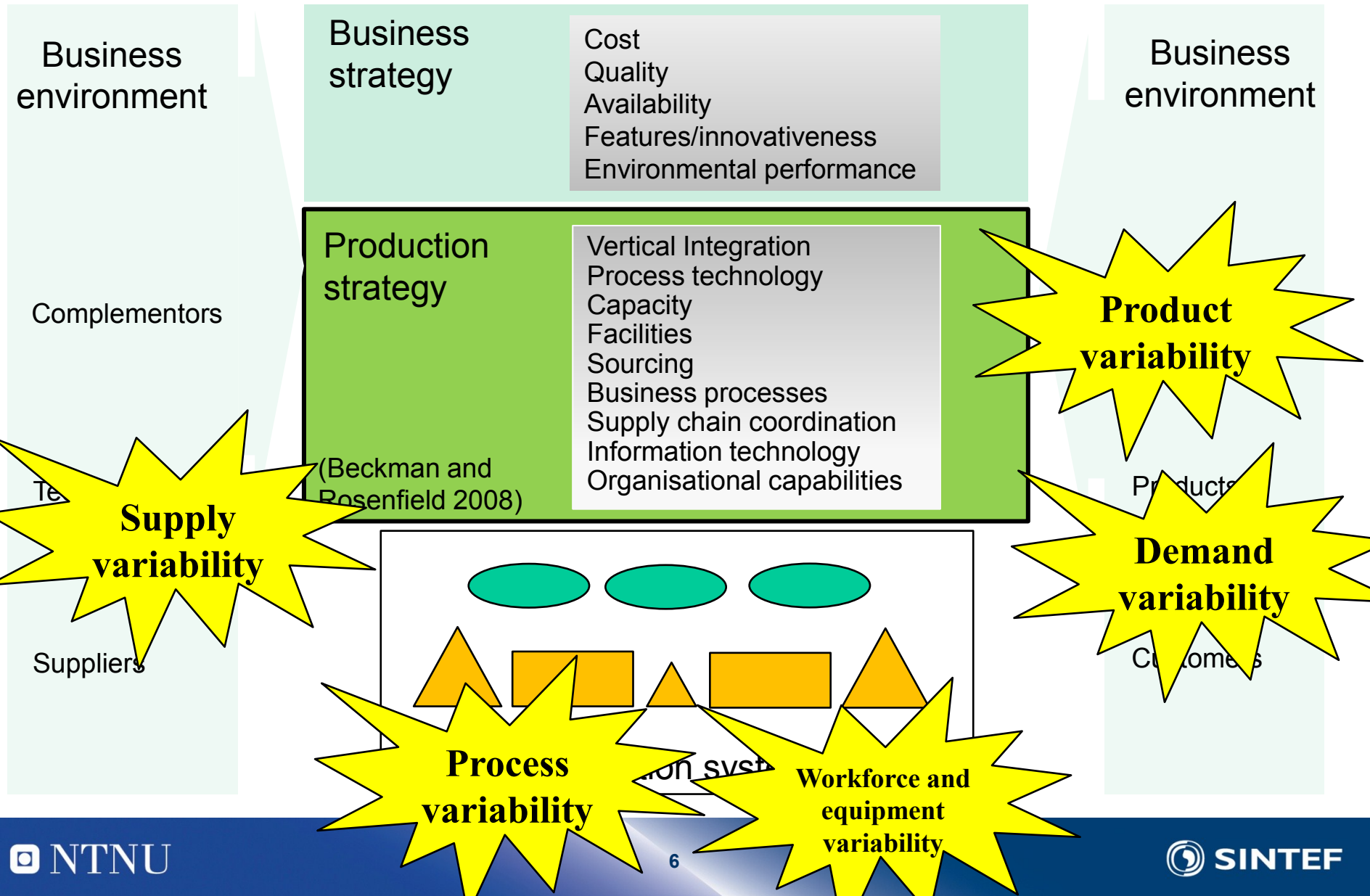


Buffer against variability



Develop flexible operations

# How to respond to variability



# Flexibility in manufacturing

**Capability to be responsive or readily-adjustable to changing conditions**

Product flexibility	Ability to introduce new or modified products
Mix flexibility	Ability to produce a wide range or mix of products
Volume flexibility	Ability to change the level of output
Delivery flexibility	Ability to change the delivery dates

(Slack 2010)

# How to develop flexible operations

- Flexible process type
- Flexible process technology, such as FMS
- Short setup and cycle times
- Postponement (Upstream position of the CODP)
- Extra capacity
- Flat organizational structure, with high level of autonomy and individual responsibility, team work
- Cross-trained workforce
- Accounting and information systems
- Appropriate supplier and customer relationships

Mass customization

Quick response manufacturing

Fisher's (1997) responsiveness

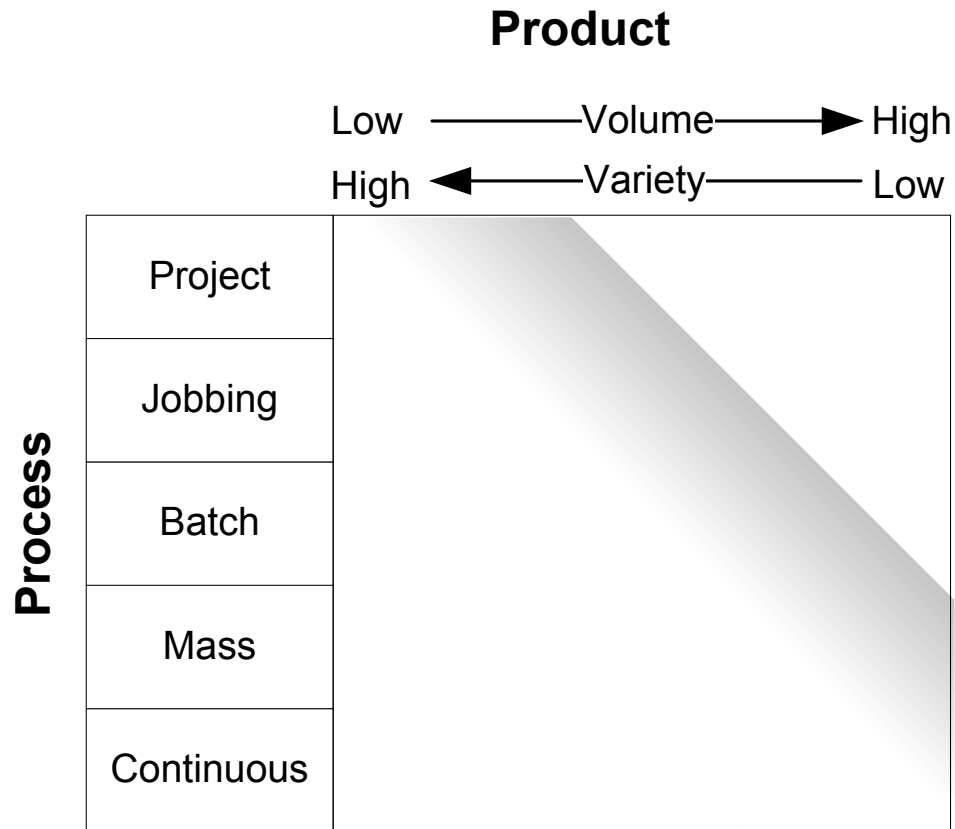
Agility

Lean

Total quality management



# Product-process matrix



(Hayes and Wheelwright 1979)

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# How to respond to variability

**5S**  
Supplier development  
Flow and takttime

Reduce variability itself

**Supermarkets**



Buffer against variability

**LEAN**

**SMED**  
Lead time reduction  
Quality circles  
Supplier integration

Develop flexible operations

# Flexibility: Why, what and how?

## WHY

### Variability

- Demand variability**
- Supply variability**
- Product variability**
- Process variability**
- Equipment and workforce variability**

## WHAT

### Flexibility types

- Product flexibility**
- Mix flexibility**
- Volume flexibility**
- Delivery flexibility**

## HOW

### Flexible production strategy

- Flexible process type**
- Flexible process technology**
- Short lead times**
- Postponement**
- Extra capacity**
- Flat organization and team work**
- Cross-trained work force**
- Activity-based costing**
- Effective use of IT**
- Appropriate supplier and customer relationships**

Company	Type(s) of flexibility (what)	Response mechanisms (how)
Volvo	Volume flexibility	Employee contracting Flexible, problem-solving work force
Glen Dimplex	Volume flexibility Mix flexibility	Team organization Flexible lines Process and lead time control
Benteler (spare parts business)	Mix flexibility Delivery flexibility	Lead-time reductions Focus Cost control Market understanding
Ulstein	Volume flexibility Product flexibility	Modularization and standardization Reduce investments in fixed assets Reduced planning efforts Individual and team responsibility Enter new segments
Tine	Volume flexibility (demand and supply) Mix flexibility Product flexibility Lead time flexibility	Differentiated production planning Assessment of uncertainty