

# Development of flexible products in context of uncertainty

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## objective

- Flexibility is often suggested as a useful tool to keep companies competitive in rapidly changing markets and to react fast on the numerous changes in customer requirements. This flexibility includes flexible production technologies, adaptable processes as well as flexible products.
- While production and process flexibility is widely accepted the idea of designing flexible products is less common. There are no adequate ways to measure the products' flexibility and to design flexible products. It is still uncertain, if product flexibility is a useful tool to handle uncertainty and fast changing requirements.

## methodology

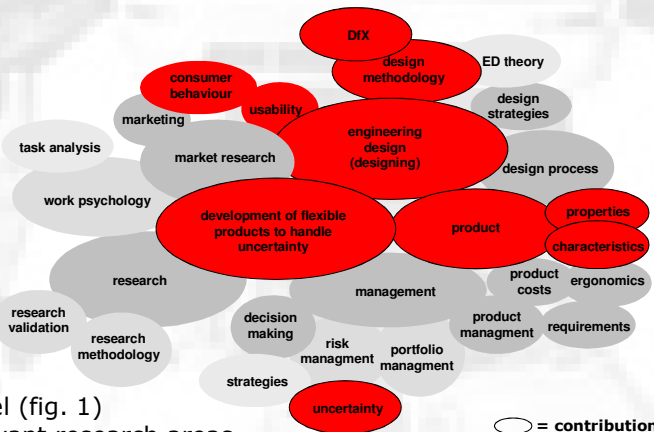


figure 1

- Define ARC model (fig. 1) to recognize relevant research areas
- Collect data with literature research
- Formulate reference model and impact model (fig. 2)
- Specify research questions
- Get additional data through participation research
- Get additional data through product analysis
- Formulate hypothesis
- Make additional test with students and professional engineers to proof or disproof hypothesis
- Answer research questions
- Conclude

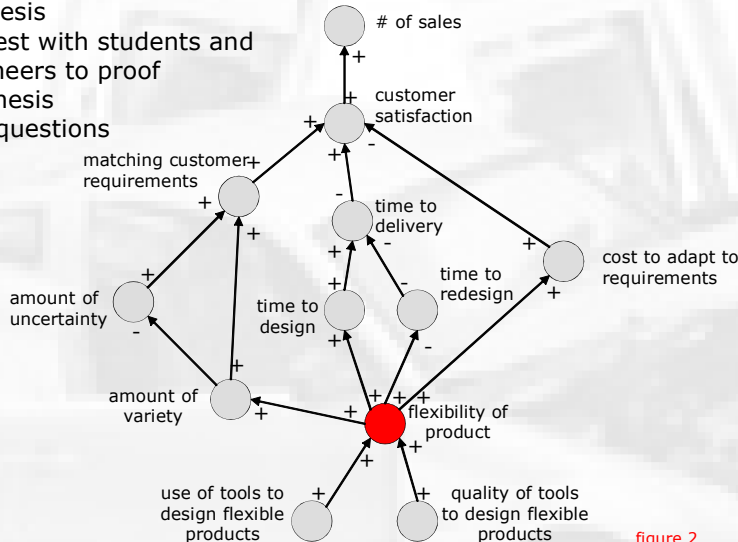


figure 2

## research questions

- What are flexible products?
- How can flexibility be measured?
- How can flexible products be developed in a systematic way?
- What are the tradeoffs between flexibility, costs, usability, manufacturability and complexity?
- Are flexible products a way to handle uncertainty and changing requirements?

## examples

### three views on the product's flexibility

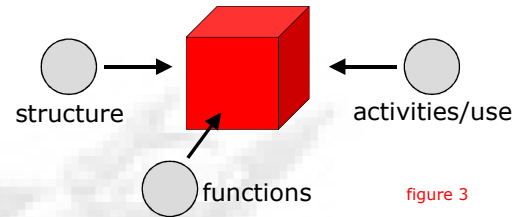


figure 3

### structural flexibility



fig. 4 a

### functional flexibility



fig. 4 b

### flexibility of use



fig. 4 c

## aims

- Define "flexible products"
- Create a measurement for product flexibility
- Generate a method, methodology and/or tool to support the design process of flexible products
- Define tradeoffs between:
  - flexibility - costs
  - flexibility - usability
  - flexibility - manufacturability
  - flexibility - complexity
- Answer, if product flexibility is a valid tool to handle uncertainty
- Get a PhD

## prospect

- Literature research
- Add good references to the reference model
- See connections where no references can be found. Find ways to proof assumptions
- Start writing the basic chapters
- Derive measurement for flexibility form related literature and own ideas
- Start working on tradeoff aspects

## contact

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