3TU. School for Technological Design

STAN ACKERMANS INSTITUTE

# Engineering Doctorates in the Netherlands

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# Agenda

1. Role of 3e Cycle Engineering Programmes
   - Differences between PhD and EngD
2. The Dutch Programmes
   - History
   - Value propositions
   - Programmes Today
   - Quality Control
3. Comparison of Engineering Doctorates

# 1. Role of 3e Cycle Engineering Programmes

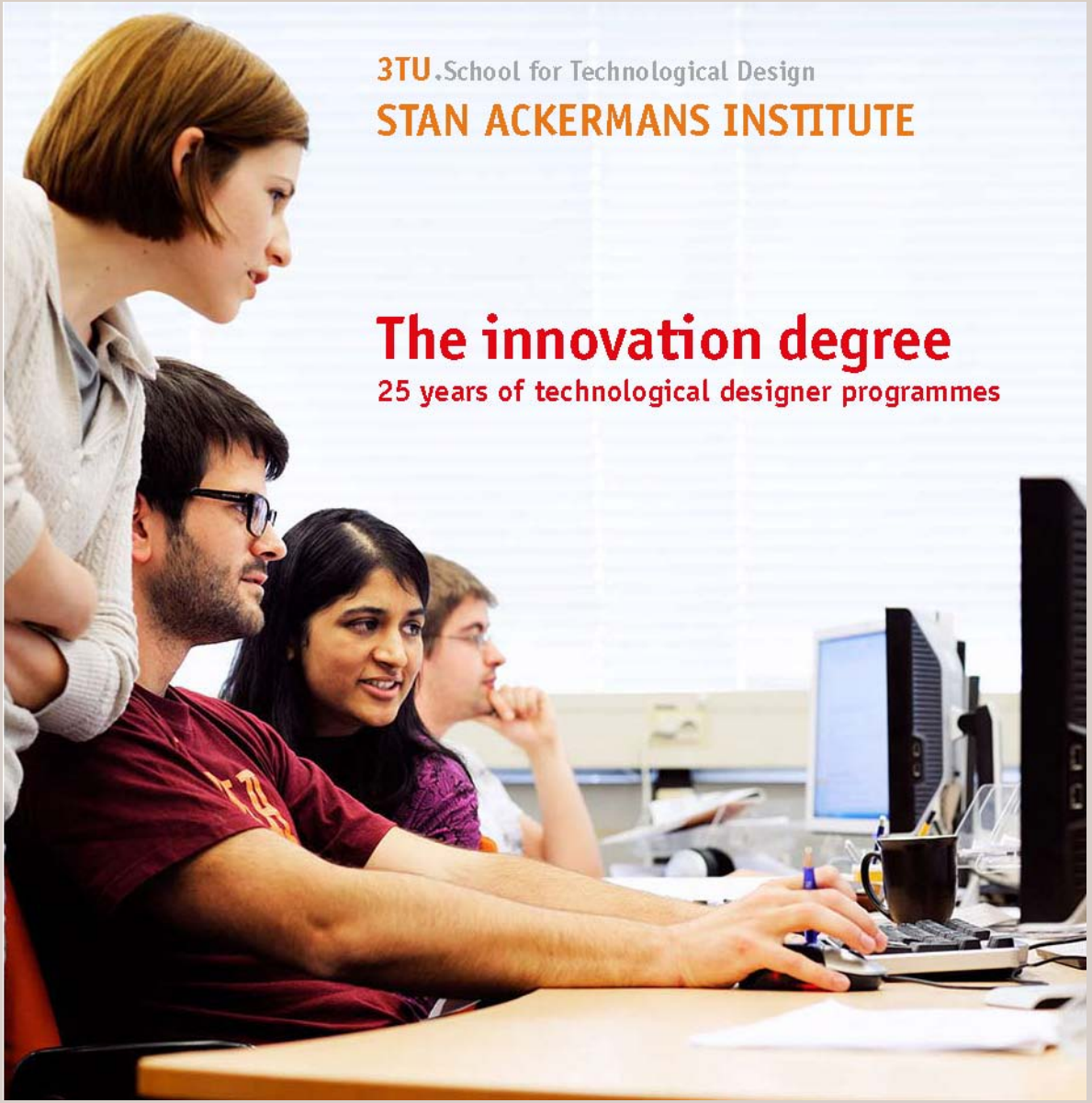
- 1e and 2e cycle of Bologna focus on *learning*
- 3e cycle focus on a *contribution* to the 'body of knowledge'
- PhD: the contribution is the *scientific result*
- EngD: contribution is an *innovative artefact*
- Artefact is a product, process or system. Either tangible or intangible
- Artefact is the 'solution' to a 'problem'
- The artefact should be designed using scientific methods

# Differences between PhD and EngD

| | **Scientific Research (PhD)** | **Engineering Research (EngD)** |
|---|---|---|
| **Starting point** | Empirical data or Hypothesis | Requirements or Technical Problem |
| **Looking for** | Truth | To fulfill Purpose |
| **Outcomes** | Theory or Knowledge | Valuable Artefact |

# 2. History of Dutch Programmes

- Started in 1986, because BSc+MSc became 4 years
- In 1997 again BSc=3 and MSc=2
- Students obtain a Professional Doctorate in Engineering Degree (PDEng). Title used since 2004.
- Up to now: 3100 graduates delivered!
- Programmes in the 3 Technical Universities of Delft, Eindhoven and Twente




http://www.3tu.nl/en/education/sai/the_innovation_degree/

# The PDEng formula

- Strongly selected master students
- PDEng students are called trainees
- PDEng trainees are employees
- Two year programme:
  - year 1: training in engineering methods and skills
  - year 2: design project in industry supervised by University staff
- Companies are paying for the innovation project (€ 5.000 per month or € 60.000 in total)
- We train top-level engineers to perform an excellent *innovation project* using state-of-the-art knowledge of the University

# Value Proposition for Companies

- If you need a new *product, process or system*, let it be designed by a PDEng-trainee under supervision of a professor!
- Top-design trainees are selected from the best graduates with a masters in engineering.
- Design projects are selected carefully: they must really *make a difference* to the company and they should be sufficiently *innovative* for the University.

# Value Proposition for Students

- Become a top-designer by '*learning and earning*'
- After graduation trainees get many job offers and have better career opportunities
- The programme gives you a career speed up
- PhD is for an academic career and PDEng for an industrial career (CTO is the ultimate goal)

# Value Proposition for Universities

- The perfect way for industrial *innovation*
- Knowledge *transfer* “on the job”
- *Inspiration* from actual industrial problems
- Source of *income* !

# Dutch PDEng programmes

- **Eindhoven**
  - Architectural Design Management Systems
  - Automotive Systems Design
  - Design and Technology of Instrumentation
  - Information and Communication Technology
  - Logistics Management Systems
  - Mathematics for Industry
  - Process and Product Design
  - Software Technology
  - User System Interaction
  - Smart Energy Buildings and Cities
  - Healthcare Systems Design
- **Delft**
  - BioProcess Engineering
  - BioProduct Design
  - Chemical Product Design
  - Comprehensive Design in Civil Engineering
  - Process and Equipment Design
- **Twente**
  - Civil Engineering
  - Energy and Process Technology
  - Robotics

# Curriculum preparation year

- Personal skills including:
  - Project management
  - Presentation techniques
  - Social skills
  - Entrepreneurship (also ‘intrapreneurship’)
- Generic engineering methods:
  - Design theory
  - Mathematical modeling
  - Testing
- Advanced domain specific design techniques

# Quality control

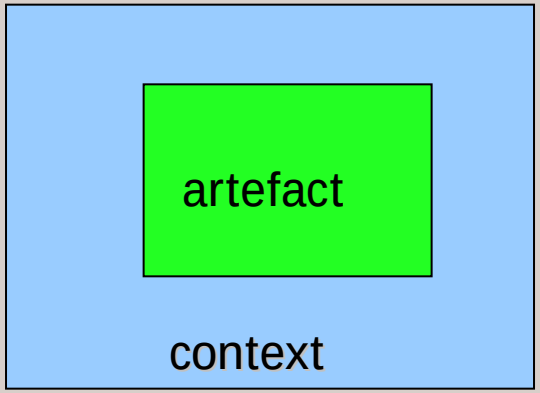
- Quality of the design *result*
  More difficult than evaluation of research!!
- Quality of the design *process*

- For both *criteria* grouped per aspect were defined
- For each criterion one or more *indicators* with an *ordinal* scale were defined
- No straight jacket, but a help for evaluation committees

# Aspects for Assessing Technological Design

1. Functionality
2. Construction
3. Realizability
4. Impact
5. Presentation

greenfield

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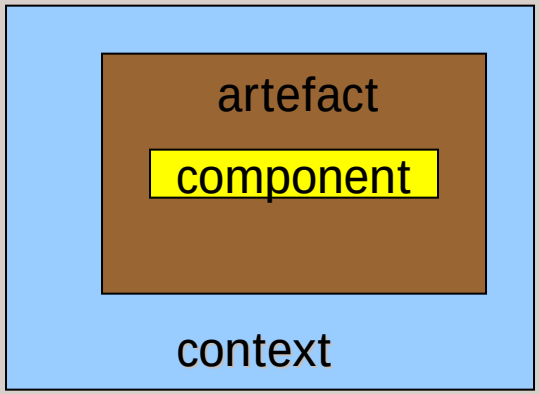

# Aspects for assessing Design Process

1. Organization and planning
2. Problem analysis and solution
3. Communication and social skills
4. Structure and attitude

# 3. Comparison with other countries

1. UK: EngD programs:
   - 4 years after (3 year) BSc; total time: 7 years
   - May be a MSc is obtained during project
   - Doctoral Training Centers 28 universities
   - Industry pays!
   - In total now ca 3500 degrees
2. France: CIFRE doctorate:
   - 3 years after (1 year) MSc+ (3 year) BSc: total: 7years
   - In an enterprise, that pays ca € 2K per month:
     total cost: € 142K

# Comparison…

3. Sweden: licentiate:
   - 2 years program after (2 year) MSc+(3 year BSc); total: 7 years
4. The Netherlands: PDEng
   - 2 years program after (2 year) MSc +(3 year) BSc, total: 7 years
   - Second year paid by industry ca € 60K

In all cases: total study takes 7 years!

# Towards European Quality Standard

- Common criteria, but different programmes; avoid ‘one-size-fits-all’
- Academic criteria:
  - Problem description
  - State-of-the-art
  - Evidence of scientific engagement (publications)
  - Detailed description of the outcome
  - Theoretical or empirical verification
- Industrial criteria:
  - Description of industrial context
  - Analysis of impact of the projected outcome
  - Description of embedding in context
  - Evidence that outcome is innovative
  - Demonstration that outcome is fit for purpose

# EngD's: THE Innovation Degrees