Engineering and Policy Analysis: intertwining math and models with political and strategic decision-making

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Revamping a master programme:
- opening up for STEM BSc's
- engineering AND policy
- in The Hague

- Introduction NL; TU Delft; TPM
- EPA
- Curriculum design
- Teaching the international classroom
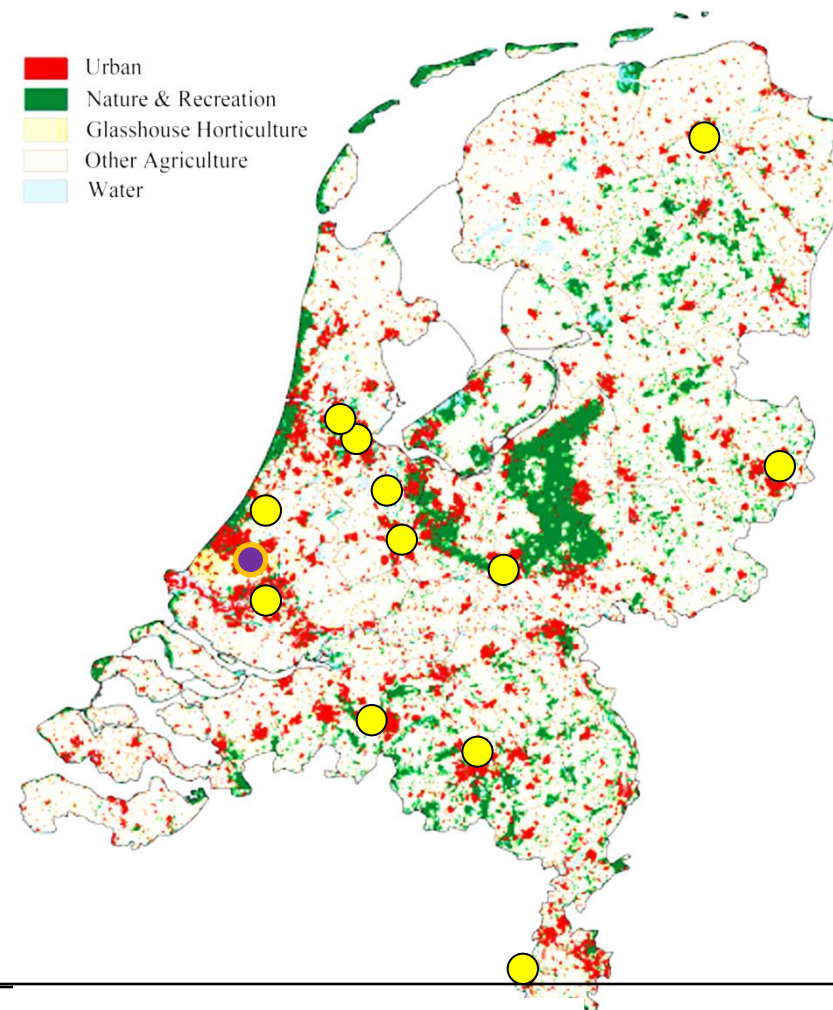- The Hague
- Outlook & Challenges

Universities in the Netherlands
TU Delft is the largest university of technology

- 13 Universities – all top 200
- 4 Universities of Technology: 4TU

Urban
Nature & Recreation
Glasshouse Horticulture
Other Agriculture
Water

TUDelft

Delft University of Technology
Some figures

- Established in 1842 by King William Ⅱ
- Largest tech univ in the Netherlands
- #54 QS World ranking

- 8 Faculties
- 2800 scientific staff (incl. 1000 PhD students)
- 21600 Ba + MSc students
- 50/50% Ba/MSc
- 50% MSc = 'foreign'

Delft University of Technology
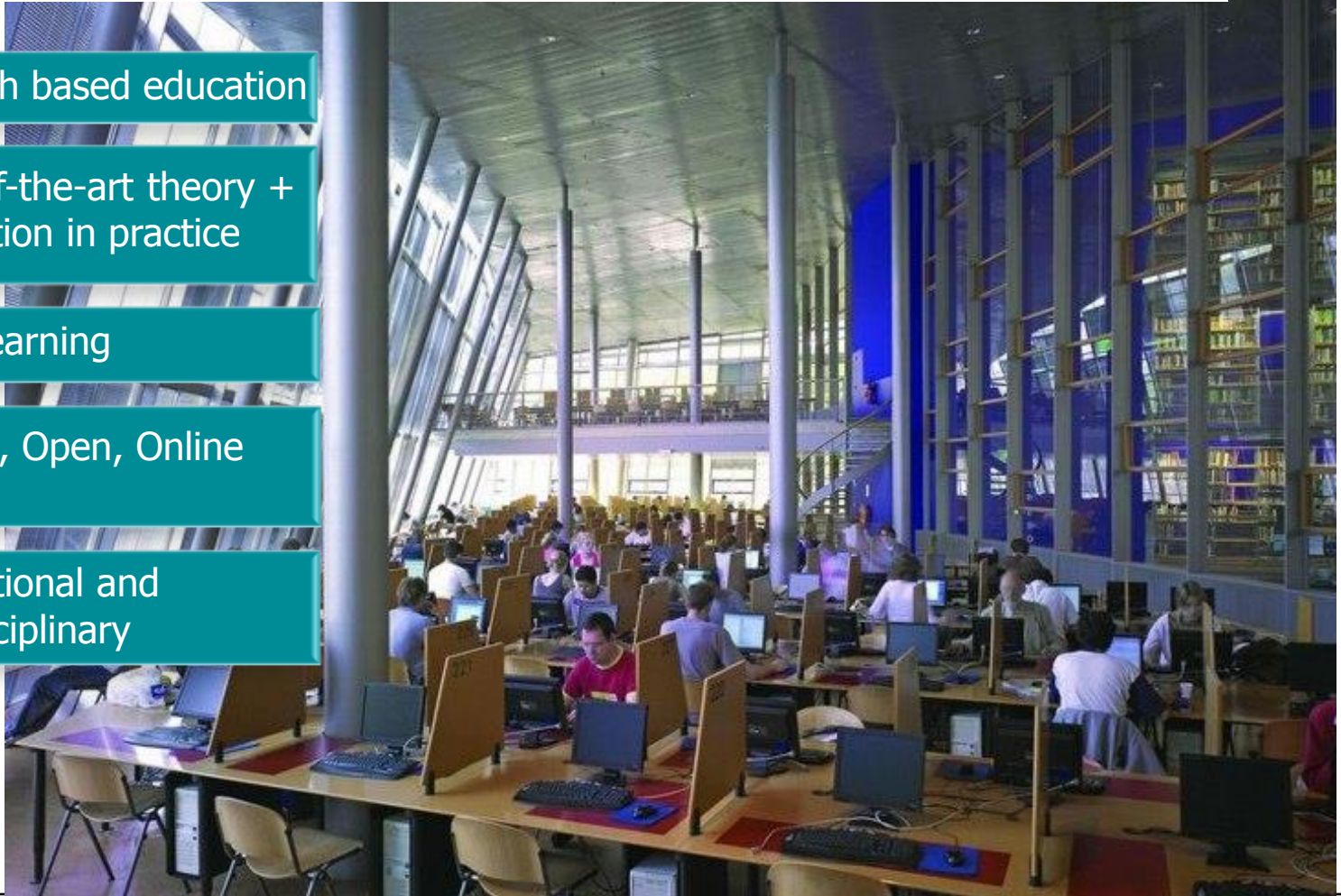## Challenging the Future – strategic outlook (12/2017)

- Research based education

- State-of-the-art theory + application in practice

- Active learning

- Blended, Open, Online

- International and interdisciplinary

Facultyy of Technology, Policy and Management - Research

- Values, Technology and Innovation

- Engineering Systems and Services

- Multi-Actor Systems

Technology, Policy and Management
Facts and Figures

TPM staff

- Academic staff   350 (of which 125 PhDs)
- Support staff   50

Total number of employees (fte)   400

Student Intake 2017

- Bachelor SEPAM (TB)   250
- Master EPA, MoT, CoSEM, IE   250

Total annual intake   **500**

Total active students: ca. 1500

Total PhD students: 125

The degree programmes of TPM

- Bsc 'Technische Bestuurskunde' (Systems Engineering, Policy Analysis and Management) (N=1000)

- MSc Systems Engineering, Policy Analysis and Management (N=150)

- MSc Management of Technology (N=150)

- MSc Engineering and Policy Analysis (N=150)

- MSc Industrial Ecology (N=70, joint with LU)

- MSc Artificial Intelligence (N= ?, joint with Amath)

- TPM Graduate School = PhD (N=125)

Msc Engineerng and Policy Analysis
intertwining math and models with political and strategic decision-making

- Analyzing and solving complex problems that involve many parties with conflicting interests
- International Grand Challenges
  - UN Sustainable Development Goals
- Blended, case-based approach to teaching
  - Leading in Open and Online Education (EdX)
- Real and actual cases
- Focus on modelling and simulation
  - Hackatons, international student competitions
- Located in The Hague
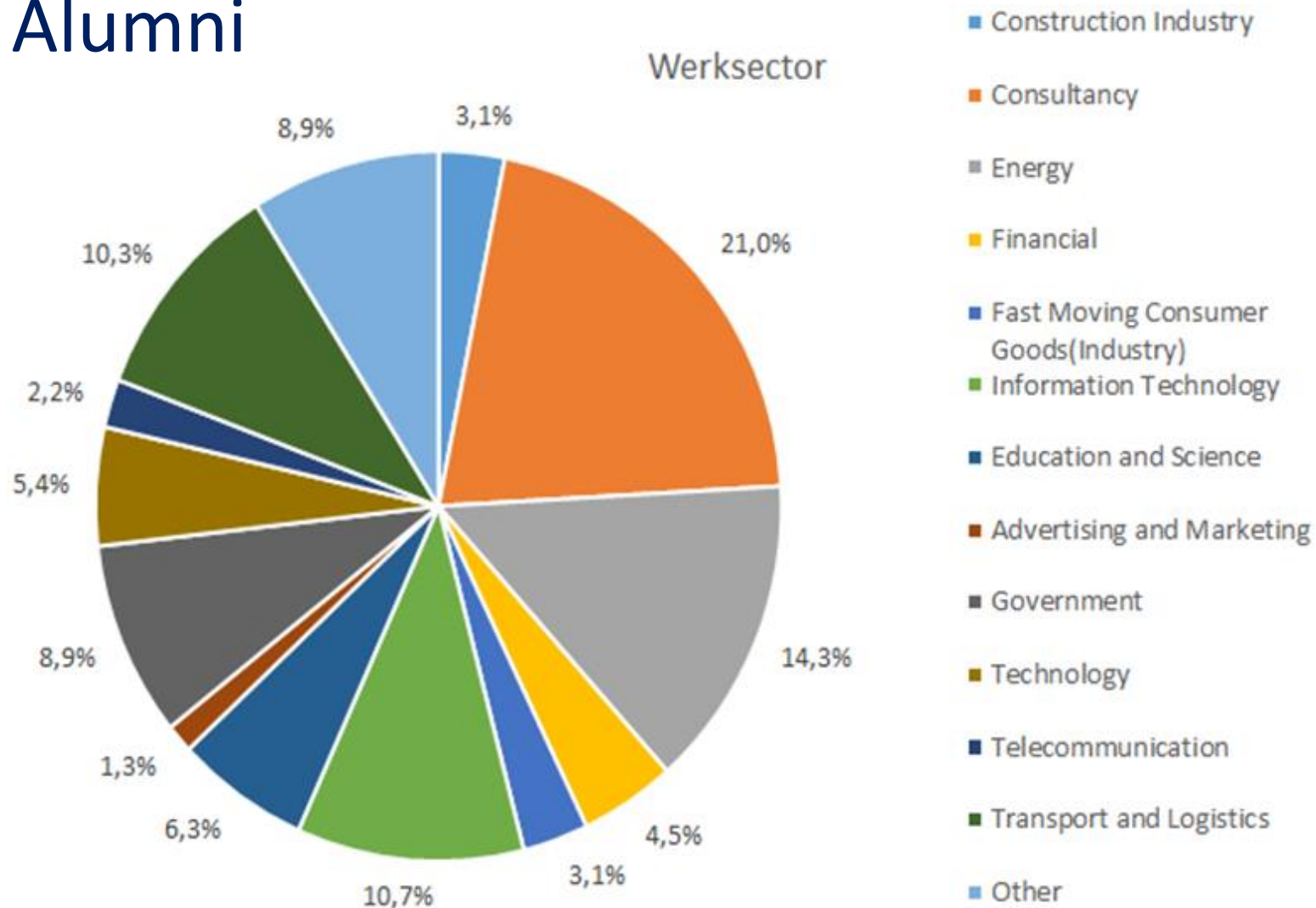 - Real world problems and politics in our classroom

Why EPA?

- Analytics/modeling AND social/political competencies
- Interdisciplinary AND Intercultural = great career start
- Impact and Relevance: Focus on Grand Challenges

- Attractive future employee for the world's leading companies, ngo's, consultancies, governments and international organizations

- 90% job within 6 months; average is 2 months
- 98% of EPA alumni will advise you to take EPA
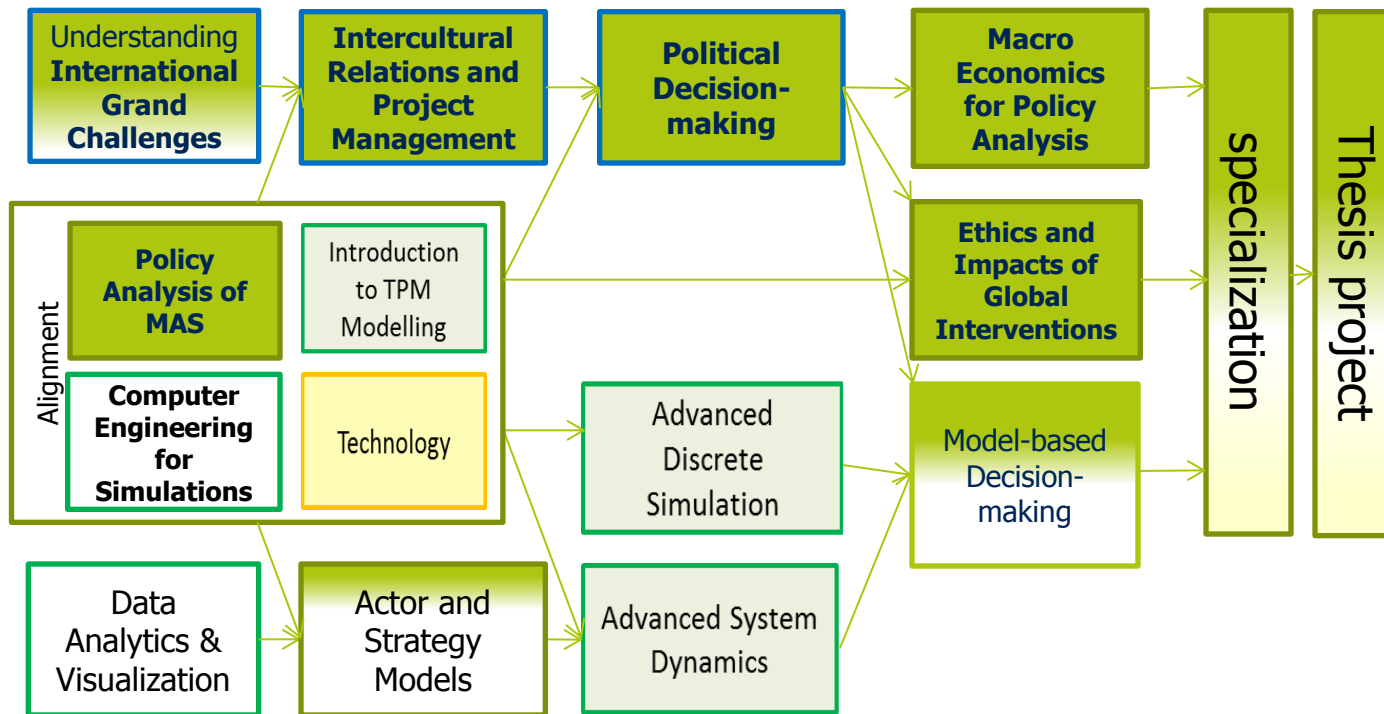- Accredited (2016) as a "GOOD" program

accredited "GOOD" by NVAO

TUDelft

EPA Alumni

Werksector

- Construction Industry
- Consultancy
- Energy
- Financial
- Fast Moving Consumer Goods(Industry)
- Information Technology
- Education and Science
- Advertising and Marketing
- Government
- Technology
- Telecommunication
- Transport and Logistics
- Other

Source: Engineering & Policy Analysis Alumni tracking February 2016

Sequence and interconnections of EPA 1st year courses

First semester		Second semester	
First period	Second period	Third period	Fourth period
EPA1314 **Data Analytics & Visualization** *Cunningham*	**EPA1144** **Actor and Strategy Models** *Hermans et al*	**EPA 1341** **Advanced System Dynamics** *Pruyt*	**EPA1361** **Model-based Decision-making** *Kwakkel*
EPA 1101 **Understanding International Grand Challenges** *Broekhans*	**EPA1433** **Intercultural Relations and Project management** *Enserink & de Vries* EPA7020 Academic Writing	**EPA1424** **Political Decision-Making** *de Jong* EPA7030 Interview techniques	**EPA1133** **Ethics and Impacts of Global Interventions** *Taebi*
alignment · **EPA1124 Policy Analysis of Multi-actor Systems** *Bots* EPA7010 Oral Presentation **EPA1331 Computer Engineering for Scientific Computing** *Lefter*	**EPA1323 Introduction to TPM Modelling** *Pruyt & Verbraeck* or **Technology** · alignment	**EPA 1351** **Advanced Discrete Simulation** *Verbraeck*	**EPA1223** **Macro Economics for Policy Analysis** *Storm*

Third semester		Fourth semester	
First period	Second period	Third period	Fourth period
Specialization Elective Professional networking skills	**EPA2934** **Preparation Master Thesis** *Vd Voort*	**EPA 2942** **EPA Master Thesis 30 EC**	
Specialization Elective	**Specialization Elective**		
EPA2111 **Societal Challenge Project** (or electives) *Mulder*			

TU**Delft**

3rd semester EPA: study abroad or Choice of specializations

- Emerging Technology-based Innovation and Entrepreneurship + Annotation

- Economics and Finance

- Advanced Modelling, Simulation and Game Design

- Supply Chain Management

- Infrastructure and Environmental Governance + Annotation

- Cyber Security

- ICT Design & Management

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Recent EPA Thesis Projects

- Impact of Large-Scale Integration of *RES in Electric Power Systems*: *Exploration* of the future European Electricity Market Design

- *Water Management* as a Peace Mechanism: a *policy framework* for water management *in military stabilisation operations*.

- *Decision support* framework for a sustainable *waste management* system in Ahmedabad, India

- *Uncertainties* in Building with Nature: sand nourishment in Ystad, Sweden

- Accelerating the urban *energy transition by data analytics*

- Exploring Factors for Establishing an Aviation *Biofuel Supply* Chain: An *Agent Based Modelling* Approach
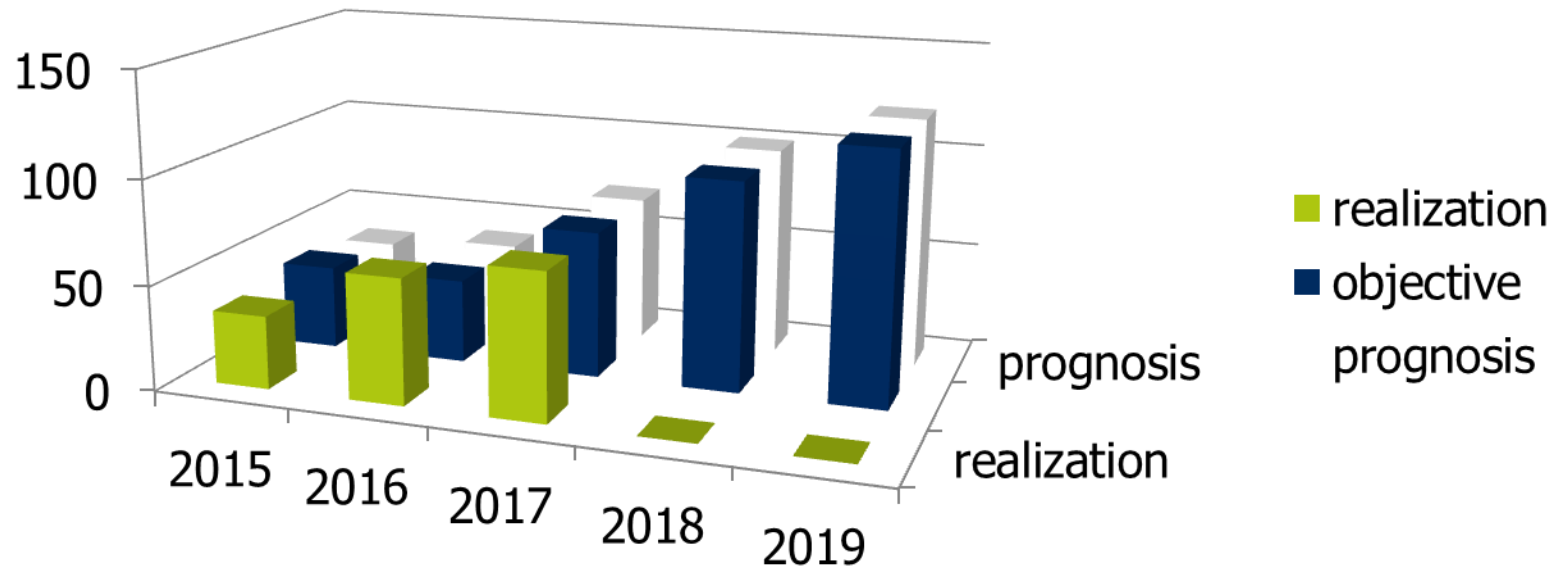
TUDelft

We are TUDelft in the Hague!

Engineering, Policy Analysis

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Why The Hague?

- Location, location, location

- We are unique: the **β**'s amongst the **α** and **γ** disciplines in The Hague

- 4th UN city of the World: UN OCHA
- Government agencies, Ministries, Lobby Groups, International Consultancy, Multi-national's HQ's
- The Hague Security Delta, The Hague Resilient City, Central Innovation District, International Court of Justice, Europol, European Patent Office
- 525k inhabitants; 180 nationalities; 30.000 students of which 3750 internationals

- It happens next door, in class, commissioners, projects
- Need for evidence-based policy-making
- It is Delft University but in a vibrant international environment

Outlook?

Student numbers
50/50 Dutch/international

Engineering, Policy Analysis

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Challenges

- Scholarships

- Student/Staff ratio

- Quality of education and support

- Cntd intensive networking effort

- Connection to The Hague

- Added value? (Bi-location = high cost)

- Uniqueness? Peers?

- International Cooperation

Check us out on:

https://www.tudelft.nl/en/education/programmes/masters/engineering-and-policy-analysis/msc-engineering-and-policy-analysis/

https://www.facebook.com/TUDelftTPM/

E-mail: b.enserink@tudelft.nl

International Cooperation

- TPM-Consortium
  (MIT, George Mason University, Carnegie Mellon University, Instituto Superior Técnico Lisboa)
- Global Technology of Management Consortium
  (University of Maryland, CERAM Sophia Antipolis, Asian Institute of Technology, Korea Advanced Institute of Science and Technology, National Tsing Hua University, Beijing)
- Shell Project Academy, (Shell Global Solutions, University of Cranfield (GB), University of Texas at Austin (USA), Queensland University of Technology at Brisbane (Aus)
- CESUN Council of Engineering Systems UNiversities
- IDEA League
- UNITECH Partners
- Etcetera...

Locus:
Focus:

Energy, resources, distributed infrastructures

Mobility, logistics, supply chains

Climate, water, urbanized delta's

Emerging technologies, crossovers, innovations

Engineering Systems & Services

Methods: agent-based simulation and
modelling, choice modelling, big data analytics,

Governance: policy, networks, actors & agents

Methods: exploratory modelling, big data analytics,
serious gaming, multi-agent modelling

Values: ethics, economics, reliability

Methods: Bayesian belief networks, probabilistic / risk modelling,
socio-technological logic modelling,

TPM for Technology with Policy!

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