Technology, Policy and Management

Faculty Overview
“Comprehensive Engineering in pursuit of breakthroughs”

Today’s world is facing grand challenges in the fields of energy, sustainability, mobility and security. Grand challenges need grand innovations. At the faculty of Technology, Policy and Management we combine insights from the engineering sciences with insights from the humanities and the social sciences. Our mission is to develop robust models and designs in order to solve the complex challenges of today’s networked, urbanized knowledge society. Our three closely collaborating departments address these societal challenges each with a different perspective: systems, governance and values. The smart combination of these three perspectives is at the core of Comprehensive Engineering.

Departments

The department of Engineering Systems and Services studies, models and shapes complex infrastructural systems and its systems integration. The department of Multi-Actor Systems focuses on all actors involved and the deep uncertainties they are faced with. What strategy and what information is needed to align actors and help them to make good decisions? The department of Values, Technology and Innovation assesses the moral implications.

Comprehensive Engineering

The faculty of Technology, Policy and Management was founded in 1997 and offers academically grounded perspectives for innovative solutions for large societal problems by drawing from and contributing to various sources of knowledge and turning that into systems (re)designs, institutional and process designs, and management strategies.

Systems engineering, managerial and economic expertise are key here, and more specifically the interrelatedness of these disciplines. Combining various skills and methods in a multidisciplinary approach is central to all of our teaching programmes and research. At TPM we work simultaneously as engineers, social and behavioural scientists, economists and philosophers.
The Faculty is comprised of three closely collaborating departments, ESS, MAS and VTI. The main application domains of the Faculty, in which the majority of its research projects can be clustered, are: energy, climate, mobility, ICT, water, and cyber.

ESS

The department of Engineering Systems and Services (ESS) operates on the interface where complex systems meet engineering. Energy, mobility, and ICT systems and services are continuously converging.

The Department therefore contributes to Comprehensive Engineering from a systems integration perspective.

ESS analyses, models and shapes these complex systems, using cutting-edge tools such as Agent Based Simulation and Modelling, ICT-architecting, Choice Behaviour Modelling and Cost Benefit Analysis. Human behaviour, economic theories and models, laws and regulation and the fact that systems recurrently impact behaviour are all taken into account in the research.

ESS truly integrates the social sciences into systems engineering. We design system architectures and market mechanisms that enable the transition to renewable energy, sustainable mobility and ubiquitous computing.

MAS

The department of Multi Actor Systems (MAS) focuses on the governance dimension of Comprehensive Engineering. When it comes to solving complex technological problems, many actors are involved. Actors are often faced with uncertainty, ambiguity and conflicting interests in a dynamic world characterised by decentralized, non-hierarchical, hyper-connected systems.

MAS analyses and models these systems and develop methods to deal with their complexity. MAS focuses on actor behaviour and design interventions for decision makers in multi-actor systems - incentive schemes, rules, simulations and games, strategies and frameworks for effective, high-impact decision making.

MAS work spans the entire range of technology-driven domains including water management, smart grids, logistics systems, global warming, circular economics, large infrastructural projects, crisis management and cyber security. MAS’ expertise enables the alignment of systems design and governance to solve complex societal challenges.

VTI

The department of Values, Technology and Innovation (VTI) focuses on the value dimension of comprehensive engineering. Its central research theme is responsible innovation: how do we see to it that innovations in the 21st century respect values like safety, security, justice, privacy, responsibility and sustainability? This is crucial to meet the grand societal challenges and in order to develop innovations that are morally acceptable and socially accepted.

In our research, we combine analytical, empirical descriptive, predictive and normative investigations into the value dimension of sociotechnical systems. An example are big data. What are the ethical and security implications of collecting enormous amounts of data? How do we safeguard our privacy?

We also research how entrepreneurs can embed responsible innovation in their business models. We further explore responsible innovation by focusing on three more specific themes: 1) Design for Values, 2) Responsible innovation in sociotechnical systems and 3) Dealing with risks responsibly.

Research Highlights

- Random regret minimization: A model to analyse and forecast choice behaviour
- Open data infrastructure for FP Engage project to bridge the gap between open data and applications
- EMLab-Generation: Modeling policy effects in energy and CO₂ markets
- Adaptive Delta Management: Designing climate adaptation strategies
- Governance of Cyber security: Analysing large-scale Internet measurement and incident data to identify how markets for Internet services deal with security risks
- Prorail Gaming and Simulation Suite: Developing gaming simulations for various dilemmas in the railway sector
- Design for Values: Integrating moral values into the design of new technology
- Bayesian Belief Networks: to develop proactive and reactive measures to improve safety - and security levels while respecting other conflicting values and uncertainties
- Frugal Innovations: Design and marketing strategies that bring products, services and systems within the reach of the less wealthy world population
The Faculty of Technology, Policy and Management offers one three year bachelor programme and three two-year master programmes. It also offers interfaculty MSc programmes and several online education programmes. All Master programmes and online education are taught in English. All programmes combine insights from the engineering sciences with insights from the humanities and the social sciences.

**BSc**

The BSc programme Technische Bestuurskunde (‘Socio-Technical Systems Analysis’) teaches students to analyse systems that are technically, socio-economically and politically complex. Examples are large-scale infrastructures for telecom, transport and energy, or medium-scale systems such as business information systems or wind farms. BSc students study subjects ranging from calculus, computational modelling and technology to economics, law and governance. They are trained to communicate with those who develop technology, as well as with those in government or business who take decisions regarding implementation.

Students choose one of the following technology domains to specialise in:
- Built Environment & Spatial Development
- Energy & Industry
- Information & Communication
- Transport & Logistics

**MSc**

The interdisciplinary MSc programme Systems Engineering, Policy Analysis and Management (SEPAM) aims at designing interventions in a complex socio-technical environment and tackling large-scale problems in a highly interconnected world. Typical SEPAM problems are the energy transition, smart information society, smart and sustainable cities, intelligent transport systems & logistics, smart regulation & compliance. The foundations of the programme comprise complex systems engineering, institutional economics, law and managing multi-actor decision making.

By choosing a track:
- Built environment & Spatial development
- Energy
- Information & Communication or
- Transport & Logistics

students become an expert in a specific technical domain.

**SEPAM**

**EPA**

The MSc Engineering and Policy Analysis (EPA) is an internationally oriented master programme, which focuses on grand challenges related to energy, mobility, water, climate, safety and security, development and health. EPA students develop their analytical and managerial skills to become strategic advisors and consultants to policymakers in public and private companies.

The core of the programme consists of policy analysis, systems modelling, economics and management. The EPA programme is taught in the city of The Hague from the second semester in the academic year 2016-2017 onwards, where it will be in the vicinity of many multinationals, government agencies, international consulting companies and non-governmental organisations.
MOT

The MSc Management of Technology (MOT) is an international master programme which highlights the numerous aspects of technology and innovation management. This MSc programme educates students with a bachelor degree in engineering as responsible decision makers, professionals and future leaders in technology-based internationally-oriented competitive business environments. MOT engineers work as scientists, consultants or also as entrepreneurs in such environments. The programme deliberately aims at an international and diverse group of students.

The programme puts a specific emphasis on commercialisation, engineering economics, and research and reflection.

Ernst ten Heuvelhof, Director of Education:
“The relevance and effectiveness of our educational programmes is reflected by the fact that more than 90% of TPM graduates is employed within 6 months after graduation. The average time it takes to find the first job after graduation is less than two months.”

TPM also collaborates with other TU Delft faculties in offering various interfaculty MSc programmes:
- MSc Construction Management Engineering
- MSc Industrial Ecology (with Leiden University)
- MSc Geomatics
- MSc Sustainable Energy Technology
- MSc Transport, Infrastructure & Logistics

Online MSc courses (EPA)
- Technology Development & Impact Assessment
- Policy Analysis and Multi-Actor Systems
- Systems Modelling

MOOC’s
- Responsible Innovation: Ethics, Safety and Technology
- Open Government
- Framing: How Politicians Debate
- Sustainable Urban Development: Discover Advanced Metropolitan Solutions
- Creative Problem Solving and Decision Making
- Leadership for Engineers
- Next Generation Infrastructures

ProfEd
- The Economics of Cybersecurity
- Text Mining and Analytics
- Open Data Governance and Use

An overview of all online education can be found at https://online-learning.tudelft.nl/courses
Faculty in numbers 2015

Research

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<tr>
<th>Departments</th>
<th>Sections</th>
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<tbody>
<tr>
<td>ESS</td>
<td>Energy and Industry</td>
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<td></td>
<td>Transport and Logistics</td>
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<td></td>
<td>Information and Communication Technology</td>
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<td>MAS</td>
<td>Policy Analysis</td>
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<td>Policy, Organisation, Law and Gaming</td>
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<td>Systems Engineering and Simulation</td>
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<td>VTI</td>
<td>Safety and Security Science</td>
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<td>Ethics/Philosophy of Technology</td>
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<td>Economics of Technology and Innovation</td>
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<tr>
<th>Publications</th>
<th>Number of external research projects</th>
<th>PhD defenses per year</th>
<th>Scientific staff (fte)</th>
<th>Support staff (fte)</th>
<th>Graduate school (fte)</th>
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<tbody>
<tr>
<td>247 refereed articles</td>
<td>138</td>
<td>28</td>
<td>259</td>
<td>60</td>
<td>132</td>
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Education

<table>
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<tr>
<th>MSc</th>
<th>Total students</th>
<th>Student intake</th>
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<tbody>
<tr>
<td></td>
<td>1296 BSc students</td>
<td>377 BSc</td>
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<td></td>
<td>796 MSc students</td>
<td>144 MSc</td>
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Financial statement

Year-end 2015 (in mln. €)

<table>
<thead>
<tr>
<th>Total funding</th>
<th>I Government funding</th>
<th>II External funding</th>
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<td>28,4</td>
<td>19,4</td>
<td>9,0</td>
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Tvilight was founded in 2012 in the Netherlands. One of the founders is MoT graduate Chintan Shah. Tvilight develops adaptive street lighting which can reduce energy consumption by up to 80 percent and maintenance costs by up to 50%. The company currently runs projects in more than 30 cities in The Netherlands, and in more than ten countries around the world.

4FOLD

4FOLD is a foldable container, which significantly reduces the economic and environmental cost of empty container shipment. Holland Container Innovations is the company behind the 4FOLD design and was founded in 2008 by SEPAM graduate Simon Bosschieter and three of his former fellow students.

TBA

TBA was founded by TPM graduates Klaas Pieter van Til and Yvo Saanen in 1996. TBA supplies intelligent solutions and services for the port and logistics sector world-wide, with specialisation in port automation. The company has offices in the Netherlands, Germany and Romania, and through 2 acquisitions, 2 offices in the UK, bringing the total number of employees to 200.

Kwink Group

KWINK is a consultancy firm which develops and executes policy and is specialised in evaluating organisations, subsidies and law. The firm advises on a range of issues in the public sector such as public health, education, telecom operations and energy and is specialised in performance measurement and risk analysis. KWINK mainly operates in the Netherlands and was founded by TPM graduates Annelies Dijkzeul, Bill van Mil and Maarten Noordink in 2007.