TU Delft Delft University of Technology

TU/e Eindhoven University of Technology

University of Twente.

Wageningen University & Research

4TU.

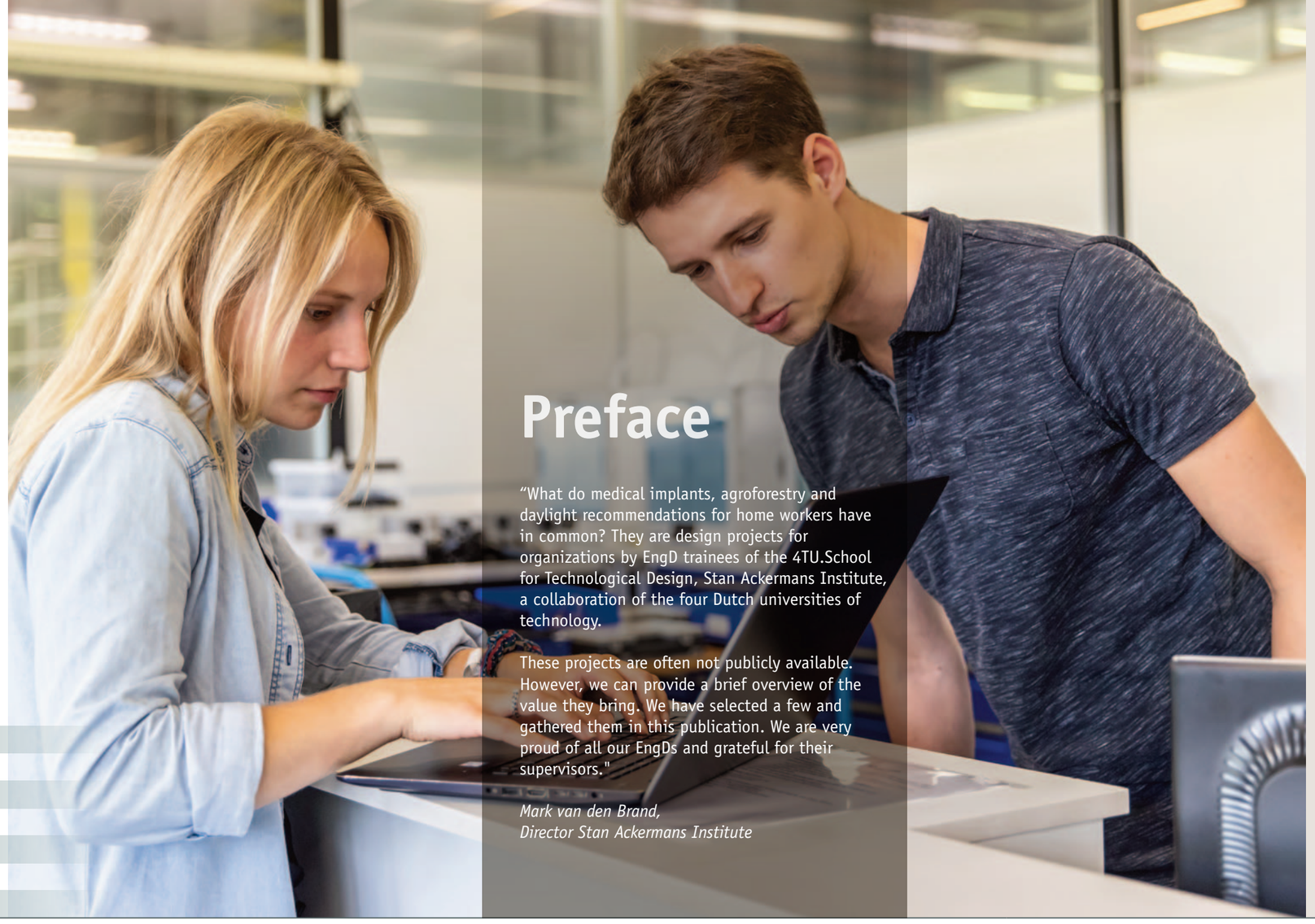
university of groningen

2025 Innovative solutions designed by EngD trainees

a selection of projects

4TU.SAI

4TU. School for Technological Design STAN ACKERMANS INSTITUTE



Preface

"What do medical implants, agroforestry and daylight recommendations for home workers have in common? They are design projects for organizations by EngD trainees of the 4TU.School for Technological Design, Stan Ackermans Institute, a collaboration of the four Dutch universities of technology.

These projects are often not publicly available. However, we can provide a brief overview of the value they bring. We have selected a few and gathered them in this publication. We are very proud of all our EngDs and grateful for their supervisors."

Mark van den Brand,
Director Stan Ackermans Institute

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Introduction

As part of an increasingly intensive collaboration, the four Dutch universities of technology (Eindhoven University of Technology, University of Twente, Delft University of Technology, and Wageningen University & Research) decided in 2006 to combine their technological design programs into the 4TU.School for Technological Design, Stan Ackermans Institute. Started on 1 September 2024, the University of Groningen has added two more Engineering Doctorate (EngD) programs, bringing the total number of programs within the Stan Ackermans Institute to nineteen.

One of the main goals is to educate and train outstanding engineers and technological designers who can meet the needs of society. Through the EngD programs, joined in the Stan Ackermans Institute, we have been successfully delivering technological designers for many years. We are very proud of this collaboration and look forward to further increasing to deliver excellent technological designers.

Engineering Doctorate

EngD trainees are selected from highly qualified MSc graduates and complete a full-time, two-year traineeship to become technological designers, ready to tackle the complex challenges in industry or public organizations. Upon completing the program, they are awarded the Engineering Doctorate (EngD) degree, an academic degree at a level equivalent to a PhD.

Putting theory into practice

Our trainees receive one year of training according to a well-designed curriculum that involves courses, interactive workshops, and group and practical assignments. They frequently collaborate with industrial, public, and healthcare partners, and undertake a one-year in-company design project.

University experts act as supervisors, offering access to state-of-the-art technology, providing guidance on project structure and execution, and ensuring the project's goals are met. Throughout the design project, trainees demonstrate their ability to turn theoretical knowledge into innovative solutions for the high-tech industry or the public and health-care sectors. This brochure features recent projects successfully completed by EngD trainees within the 4TU collaboration.

After their degree

Our graduates quickly begin working for leading companies, as well as public organizations, hospitals, and other healthcare institutions. This demonstrates the relevance of our programs to both industry and society.

More information

For more information about our EngD programs, please visit *www.4tu.nl/sai*.

With best regards,

prof.dr. Mark van den Brand
Director 4TU.School for Technological Design,
Stan Ackermans Institute

Programs and tracks

TU Delft

Designer in Bioprocess Engineering (BPE)

The two-year Designer in Bioprocess Engineering program develops MSc graduates in (Bio-) chemical Engineering or related academic backgrounds into multidisciplinary specialists with a strong background in Biosciences and Engineering subjects required for innovative bioprocess design, in preparation for their career in the industry. In this way, students can boost their career by following deepening and broadening courses in the area of bioprocess design in close relation to industry. As a result, the EngD trainees become a valuable asset for biotech industry by translating academic knowledge into industrial application.

Civil and Environmental Engineering (CEE)

Track: Sanitary & Environmental Engineering (SEE)
Sanitary & Environmental Engineering focuses on water management challenges related to, amongst others, water collection and conveyance, water treatment, and resource recovery from watery streams and sludges.

Track: Structural & Railway Engineering (SRE)
The section of Railway Engineering deals with the physical assets of the railway system, including track, embankment, rolling stock and catenary, as well as the interfaces and dynamic interactions between them. The research, innovation, development and education of the section concern the whole life cycle of the assets, from design, construction, degradation, monitoring, maintenance to retrofit, as well as the data-driven intelligent management of the assets, taking into consideration of the performance of the whole railway system.

Track: Subsurface Construction & Engineering (SCE)
Subsurface Engineering focuses on every aspect concerning the use of underground space. This includes infrastructure for traffic as well as utility systems, underground storage, multiple use of land and space, safety, legal aspects, trenchless technologies for the construction of utility systems and various building techniques (for example boring techniques, immersed tubes and trenchless techniques).

Process & Equipment Design (PED)

Will be discontinued as of September 2026

The PED program trains MSc graduates to become qualified designers capable of designing 'fit for purpose' and 'first of a kind' sustainable (chemical) products, processes, equipment and systems. These innovations are of high demand in the chemical, energy, food, health and wider industries for the energy transition, circular chemistry, and novel food and health products. Industrial partners co-operate with this EngD program by providing real-life challenges that will be addressed by the EngD trainees supported by TU Delft scientific and design experts. The EngD trainees are trained to apply appropriate design methodologies and tools, in an inter-national setting, and with ample attention for developing their business, personal and teamworking skills.

Eindhoven University of Technology

Automotive Systems Design (ASD) / Mechatronic Systems Design (MSD)

ASD focuses on systems architecture and design for modern high-tech automotive systems in the context of Smart and Sustainable Mobility. The program aims at a systems approach to problems around mobility and fuel efficient automotive systems, including communication systems and electrical driving, with emphasis on the multidisciplinary design aspects of project based research and engineering and the challenges that are faced by the automotive industry.

The **MSD** program aims at system synthesis and design of complex equipment, instruments, robotic and manufacturing systems and systems-of-systems, by combining in-depth understanding of the classical engineering fields, with multi-disciplinary, model-based systems engineering to conceive, predict and verify cutting-edge system functionalities and architecture.
The program is closely connected to the TU/e High Tech Systems Center. Officially, MSD is positioned as a sub-track of ASD. After success-fully completing the program, the awarded EngD

ASD-diploma will mention a specialization in MSD.

Clinical Informatics (CI)
The Clinical Informatics program is geared towards the design and implementation of information systems in healthcare. IT knowledge, but also knowledge of clinical and business processes is crucial to the design of optimal solutions, which really support the professionals in healthcare. The program is provided by the School of Medical Physics and Engineering (SMPE/e) and the department of Industrial Engineering & Innovation Sciences (IE&IS). It is carried out in close cooperation with hospitals and other care institutions all over the Netherlands. All trainees in the program are required to be fluent in Dutch.

Data Science (DS)
The EngD program Data Science prepares engineers to tackle complex industrial and business challenges by combining expertise in statistics, mathematics, and computer science with practical design thinking. Trainees learn to develop advanced data science tools and solutions, with a focus on real-world application. The program also emphasizes working in multidisciplinary teams, fostering professional growth, and ensuring ethical and legal awareness. Graduates are equipped to deliver impactful data-driven solutions in dynamic, ever-evolving environments. The EngD program Data Science is located at Jeronimus Academy of Data Science in 's-Hertogenbosch.

Design of Electrical Engineering Systems (DEES)
The DEES program trains designers in specifying, designing, building, testing and evaluating complex multidisciplinary systems in the discipline of electrical engineering. More recently, we have also taken the trainees from applied physics on board, and we have welcomed the occasional trainee from mechanical engineering. Our trainees develop an in-depth understanding of the technical, stakeholder and user requirements so as to bridge the gap between state-of the art techno-logy and commercial (or societal) applications.

A DEES trainee carries out a 15-month industrial design/development project that runs concurrently with a tailor-made 9-month curricular training program. DEES trainees work on projects in such diverse fields as healthcare systems, well-being devices, wireless and electro-optical communication, embedded software, integrated (opto-)electronic circuits, flexible electronics, optical and electromagnetic sensing, molecular biosensing, AI-assisted image analysis, pulsed-power plasma generation and plasma cleaning, EV charging, electric motor design, nano-scale wear particle generation, automotive radar systems, antenna array design, material characterization, electromagnetic compatibility, and control systems.

Designing Human-System Interaction (HSI)
The mission of the new HSI program is to train engineers to develop competences in designing and evaluating interactive intelligent and innovative systems, services, and products. The HSI program pays special attention to the frontier of the complex systems enabled by artificial intelligence, data science and other emerging technologies in high-tech systems, health applications and smart mobility, and its impact on individuals, organizations, and society. The goal is to ensure positive user experiences that support their values and needs.

Qualified Medical Engineer (QME)
The Qualified Medical Engineer program trains engineers to become effective designers in a clinical/ healthcare environment. Of course, engineering skills and clinical knowledge are relevant. But also adequate communication with both healthcare professionals and medical technology professionals is crucial to really get clear what the needs in healthcare are and to determine how design and implementation of existing and new technologies can improve patient care. The program is provided by the School of Medical Physics and Engineering Eindhoven (SMPE/e) and carried out in close cooperation with healthcare institutions and medical companies all over the Netherlands. All trainees in the program are required to be fluent in Dutch.

Smart Buildings & Cities (SBC)
The Smart Buildings & Cities program is educating engineers with different backgrounds (architecture, mechanical engineering, electrical engineering, building physics and services and ICT) to become technological designers, who excel in their own discipline and who can work in multidisciplinary design teams. SBC trainees contribute to the development of intelligent and energy efficient building components and concepts, renewable energy generation and storage in the built environment, designing buildings and cities that mitigate the effects of climate change, are based on the principles of circular economy, promote healthy living and improve quality of life in the built environment.

Software Technology (ST)
The development of software for advanced systems has many different aspects. The ST program focuses on the project-based design and development of software for software-and data-intensive systems from the high-tech industry. The trainees get acquainted with the important concepts from diverse knowledge domains such as System Design, AI, Model Driven Engineering and Networked Embedded Systems, and learn how to use these to solve the actual industrial problems that our industry partners present to us.

University of Twente

Business & IT (BIT)
The Business and IT program aims to raise the level of competence in IT of professionals to empower them to deal with the opportunities and challenges posed by IT-based innovations. Technology is changing fast, and professionals need to keep themselves up to date. At the same time, some of the problems of business-IT misalignment, legacy software and global cooperation remain relevant, so that modern IT professionals need to work in multidisciplinary teams to manage these problems. The mission of this program is to deliver professionals who are able to understand and design robust and economically sustainable IT-enabled networks, such as social networks, online markets, business networks and public service networks, which balance economic opportunities and online IT risks to attain business goals.

Civil Engineering (CE)
The civil engineering industry requires highly skilled designers with expertise in technical areas like design, construction, and maintenance, as well as non-technical fields such as project management, economics, policy, and business. As the profession evolves with new technologies, sustainability demands, and more complex projects, future civil engineers will need a broad range of skills to succeed. They must be prepared to tackle modern challenges and work effectively in multidisciplinary teams, playing key roles in solving complex problems that involve both technical and management aspects.

Energy and Process Technology (EPT)
The Energy and Process Technology program shapes the innovative technological future for energy, process, and material industry by applying multidisciplinary and intersectoral approach. The EngD trainees skilled within the EPT program deliver high quality designs with in-depth understanding of the requirements given by the professional market and impact to the society. Functionality of the solutions, their quality, innovative and groundbreaking character combined with environmental friendliness, sustainability, and recyclability are the key features of designs implemented within the EPT.

Maintenance (MT)
The program Maintenance educates designers who create efficient and effective maintenance processes from a multi-disciplinary perspective. The design has to comply to technical, financial, logistics and organizational specifications. A sound understanding of the physical mechanisms is key, as the basis for failing systems and components is in nature physical. By addressing both technical and operations aspects during the program, a necessary link is established between these two fields of expertise.

Robotics (ROB)
The technological designer in Robotics creates innovative robotic solutions for medical, industrial and safety purposes. The program focuses on mechatronics and control design aspects of robots (for example rehabilitation, welding or inspection robotics) as well as system-level design of industrial robotics and automation environments. Therefore, a multi-disciplinary approach is required with components from mechanical, electrical, computer and control engineering. The EngD program in Robotics allows the trainee to deepen and broaden their knowledge and to gain advanced application experience through a challenging assignment in industry.

Wageningen University & Research

Design for AgriFood and Ecological Systems (DAES)
DAES trainees will be able to create high-value, creative, and innovative designs to improve sustainability in an independent and multi/ interdisciplinary way under the supervision of the university and experts outside academia. At WUR, the EngD program is tailor made, so DAES trainees select most of the courses themselves, fitting their individual background and specific design assignment. The final result will be a design that will, directly or indirectly, contribute to increasing the sustainability of agri- or horticulture, livestock farming, or the living environment in general.

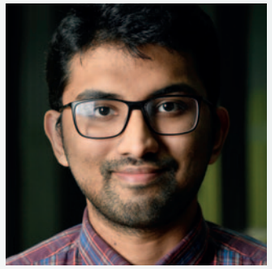
University of Groningen

Autonomous Systems (AS)
The EngD program Autonomous Systems focuses on the integration of technologies and classic techniques of model-based engineering to create autonomous systems. This includes areas of mechanical engineering, robotics, computing science, AI, among others. It aims to strengthen the design methods and tools for development of high-tech software-intensive systems (such as mechatronics, smart manufacturing systems, Internet of Things (IoT) and robotics systems).

Sustainable Process Design (SPD)
Sustainable Process Design describes concepts or strategies for the replacement of non-efficient and non-renewable production processes. The goal of this EngD program is to develop sustainable solutions for the industry, such as new process techniques and/ or materials that significantly minimise the ecological footprint (transition to sustainable production).

Company: ASML
Project: Concept design and analysis of a linear axis system for lithography machines
EngD trainee: Aditya R. Kuncolienkar, Eindhoven University of Technology

Automotive Systems Design



ASML, a global leader in semiconductor manufacturing equipment, specializes in designing and producing lithography machines, critical for chip production. One of ASML's key objectives is to improve wafer throughput - the rate at which chips are produced - to lower the overall wafer cost. Achieving this requires increasing the speed and acceleration of the wafer stage in lithography machines, which necessitates a redesign of several components.

One crucial subsystem that must be redesigned is the Linear Axis (LA), a long-stroke, linearly actuated shuttle. The current LA design cannot meet the higher speed and acceleration demands, making a new design essential. The upgraded LA must not only achieve these performance goals but also fit within the existing volume and interface constraints, operate with the same power and temperature limits, and reduce vibrations.

This thesis work proposes a conceptual design for a high-acceleration Linear Axis intended for ASML's next generation lithography machines. After evaluating various actuator and shuttle architectures, a new long-stroke linear actuator concept was developed, along with a complementary shuttle and guide beam design. Extensive simulations demonstrated that the proposed design meets the stringent performance requirements while addressing technical risks to ensure feasibility.

Company: ECOLOGIC project (various companies)
Project: Emission control and logistics optimization for green infrastructure construction
EngD trainee: Arda Satici, University of Twente

Business & IT

The ECOLOGIC (Emission Control and Logistics Optimization for Green Infrastructure Construction) Project, launched in September 2023, aims to reduce construction emissions by 15 percent, optimize logistics, and provide real-time monitoring using IoT and AI technologies. BauWatch, CAPE Groep, Datacadabra, Dura-Vermeer, Hegeman-Nijverdal, Pioneering, and the University of Twente are partners in this project.

I am Arda Satici, and I hold a bachelor's degree in computer science and a master's degree in business administration. Currently, I'm working on two different aspects of this project as an EngD candidate. In the first aspect, I aim to classify vehicles located on (or entering) construction sites using object detection. I also aim to display vehicle emissions to stakeholders through a dashboard, using license plates that I can read after image processing. During vehicle classification, the precision and recall of the AI models I am developing are critical to system accuracy. Furthermore, the dashboard I am developing (both backend and frontend) simplifies tracking of emissions by construction site personnel, enabling them to take immediate action if necessary. In my opinion, this system will also lay the foundation for larger industrial applications in the future.

The second aspect is slightly different from the first. I aim to detect and classify living organisms in the area using video-recording cameras located at construction sites (or in areas that will become construction sites in the future). This way, I can monitor the biodiversity in that area and, if an endangered organism is detected, I aim to issue a warning so that construction in that area can be stopped. Thus, through the ECOLOGIC project, I contribute to the protection of sensitive ecosystems in nature by designing a system like this.

Through these two aspects of my work, I design systems that reduce the environmental impact of construction and monitor this process. Using my system, stakeholders can monitor the results (almost) in real-time and create Green Infrastructure Construction.

Company: FrieslandCampina
Project: Microfiltration for dairy streams purification
EngD trainee: Karolina Szalkowska, TU Delft

Bioprocess Engineering

Sustainability and energy efficiency are key priorities in modern dairy processing. FrieslandCampina, a leading dairy company in the Netherlands, advances milk preservation technology through the use of microfiltration.

The project aimed to reduce energy consumption and operational costs, while maintaining product quality and microbial safety. To achieve this, a combined methodology was applied, integrating pilot-scale experimentation, process modelling, and full-scale system evaluation.

During pilot trials, membrane performance was assessed under a range of operating conditions, allowing identification of critical process parameters. These insights formed the basis for a predictive process model developed in gPROMS, which after validation successfully replicated key trends in system behavior. Building on these results, an optimized membrane configuration was designed, demonstrating both improved performance and reduced energy consumption.

The developed model will now be implemented as a decision-support tool, supporting process optimization in FrieslandCampina factories and operators training.

Company: PACER (Processes to Achieve Circular and Emission-Free Renovation) by Dutch Research Council (NWO)
Project: Developing an urban mining design methodology and parametric matchmaking tool
EngD trainee: Nikita Dhavale, University of Twente

Civil Engineering

The construction sector contributes more than one-third of global carbon emissions but also holds immense potential for change. As one of the world's largest sources of material waste, it consumes vast natural resources yet discards enormous volumes of recoverable components, making the shift toward a circular economy both urgent and inevitable. Across Europe, the new building demolition practices are transforming how building materials are tracked, valued and reused. The conscious deconstruction practices, digital documentation, and online marketplaces already generate extensive data on reusable components.

However, this information rarely reaches the design phase of new construction, where decisions about structure, materiality, and form determine a building's long-term environmental impact. While most innovation has targeted supply-side logistics, design workflows remain largely disconnected. Architects often lack reliable ways to translate demolition datasets like irregular in size, condition, and availability into usable, specification-ready options. As a result, reuse remains the exception rather than standard practice.

This EngD project develops a design-led urban-mining methodology and a parametric matchmaking tool to bridge the information gap between demolition and design sides. The tool functions as a plug-in within early design environments, enabling architects to access the reclaimed-material data such as geometry, condition and availability directly within their workflows. By integrating iterative, practice-based testing, it supports flexible and informed design decisions grounded in real reclaimed resources rather than abstract datasets.

The broader aim is to make reuse a default design strategy, aligning creative practice, circular policy, and digital intelligence. By connecting demolition data with design thinking, the project contributes to a construction industry that designs with what already exists, advancing Europe's transition toward a regenerative and circular built environment.

Company: FieldFactors
Project: GreenLED: Integrating UV-C LED into FieldFactors' urban water buffer-ASR
EngD trainee: Till Engelhardt, TU Delft

Civil and Environmental Engineering

Urban water managers in the Netherlands increasingly face droughts and flooding because of shifting climate patterns. This requires a new way of approaching our water systems, as retention of rainwater locally becomes an important tool to bridge the longer dry summers. However, this water is often contaminated with pathogens, making the use case for rainwater limited.

In this EngD, Till designed an urban water buffer which combines natural and high-tech treatment processes to deliver safe water for a wide array of uses in the city. Additionally, the rainfall is stored in aquifers under the city, utilizing the natural storage capacity of the soil, allowing large quantities of water to be stored in the winter months (when demand is low and supply is high) to be recovered in dry summer periods.

Till evaluated his design through extensive impact modelling, focusing on water quantity, quality but most importantly the impact of both on the health of those that come in contact with the provided water, concluding that the treatment barriers can effectively reduce health issues. The installations designed during the EngD are being built in the Netherlands and Spain, directly translating the EngD project to real impact in local communities.

Company: Geestelijke Gezondheidszorg Eindhoven (GGzE)
Project: How technology improves medication safety
EngD trainee: Sander van den Borne, Eindhoven University of Technology

Clinical Informatics

My name is Sander van den Borne, a 34-year-old professional, happily married and a proud father of a 5-year-old daughter and a 3-year-old son. I graduated from the Department of Biomedical Engineering, specializing in Clinical Informatics.

My EngD project focused on enhancing medication safety by automating patient monitoring based on physician medication records. This monitoring is crucial as many psychiatric medications can be harmful. Research showed that monitoring was often inadequate due to complex processes, leading to avoidable medication incidents. My solution ensures patients are monitored according to Dutch healthcare standards.

The motivation for my research was my sister, Robin. She suffered from complex psychiatric issues and passed away in 2009 at the age of 19. She was on specialized psychiatric medication. Although her death was not directly related to medication safety incidents, it was clear to me that the healthcare system at the time did not adequately address her needs. It is my hope and belief that my system will contribute to better addressing the healthcare needs of others.

Company: Wageningen University
Project: Designing complex agroforestry systems
EngD trainee: Jordy van Eijk, Wageningen University & Research

Design for Agrifood & Ecological Systems

Agroforestry is a form of agriculture using trees and shrubs to provide food production. The more complex the system, the higher the ecological value. Partly due to increasing attention to the environmental impact of agriculture and the growing demand for local and seasonal food, more and more farmers are making the transition to complex agroforestry systems. In developing a sustainable and financially profitable complex agroforestry system, farmers face several challenges. For instance, an agroforestry system takes years to mature and not every subsoil is suitable for every type of tree or shrub.

Achieving a working agroforestry system within the local context requires good research and a step-by-step approach. During his EngD at the Forest Ecology and Forest Management Group of Wageningen University & Research, Jordy van Eijk developed a framework that supports farms throughout the process. Using an analysis of the local soil and water system, financial calculations and a focus on social components, the framework helps turn goals into concrete designs. Decision tools help to make choices on, for example, the appropriate trees, shrubs and plants.

In collaboration with the ReGeneration Foundation – which he co-founded – Jordy applied the framework to five pilot farms. For each farm, they made a number of design scenarios together with the entrepreneurs using the framework. With the help of an implementation, planting and management scheme, they will put these into practice over the next few years.

Company: Wageningen Marine Research
Project: Software design for automatic discards survival prediction
EngD trainee: Theodoor Akkerboom, Wageningen University & Research

Design for Agrifood and Ecological Systems

One of the major challenges in beam trawl fisheries is the high number of unwanted bycatches. Under the Common Fisheries Policy (CFP), discarding of bycatch from quota-regulated species such as plaice, sole and turbot is prohibited, unless research shows high survival rates post-release. These survival rates are determined using captive observation studies, which are logistically complex, labor-intensive, and costly, while sample sizes remain small.

To address this, Theodoor Akkerboom, in collaboration with Wageningen Marine Research, developed an automated system to predict survival rates. The EngD design consists of three components:

(1) a waterproof camera system that captures images of individual flatfish on board vessels,
(2) a Deep Learning network, trained with ground truth data from survival studies, that predicts survival of each individual, and
(3) a Graphical User Interface that displays these predictions and highlights how the model made its prediction.

For Theodoor, his EngD provided an opportunity to combine technical innovation with societal impact. When fully implemented, the automated system allows bycatch survival to be predicted for much larger samples, with a relative error in the survival rate of approximately 5%, eliminating the need for complex and costly monitoring experiments. The project has taken steps toward more efficient fisheries monitoring, which will be continued by Wageningen University and Wageningen Marine Research.

Company: VDL Enabling Technology Group
Project: Toward understanding wear particle generation on silicon wafers
EngD trainee: Tom Bertens, Eindhoven University of Technology

Design of Electrical Engineering Systems

In the quest to make Integrated Circuits (ICs) smaller, semiconductor manufacturers are exploring advanced techniques to create tiny components. This effort is closely tied to the challenge of contamination, which significantly affects both the manufacturing process and the reliability of ICs. As a result, there is a growing focus on identifying contamination sources during manufacturing.

Through extensive tests, we studied how silicon behaves under different loading conditions and validated a numerical material scratch model. The validation showed strong agreement between the simulated scratch responses and the experimentally measured behavior of silicon (S.O. Sperling et al., 2024). Scratch tests showed how different pressures affect plastic deformation, with measurements confirming more material loss at higher pressures. Comparing experimental scratch patterns with numerical models validated our findings. We found that silicon loses its crystal structure under lower pressures, while higher pressures cause it to re-crystallize and crack beneath the surface, leading to material detachment.

The project met its goals, combining experimental and numerical results to provide insights into contamination. These findings not only improve our understanding of how silicon interacts with manufacturing equipment but also promise future advancements in semiconductor manufacturing.

Company: ‘s-Hertogenbosch Municipality and LOKET programme (Logistic Chain Coordination for Urban Construction)
Project: Design and development of urban digital twins and data pipeline for enhancing data analytics in construction sites for environmental and sustainability goals
EngD trainee: Daniel Wondyifraw, Eindhoven University of Technology

Data Science

Cities in the Netherlands face the challenge of accommodating large-scale urban construction while reducing environmental impact, limiting nuisance for residents, and managing complex logistics. Construction activities significantly contribute to CO_2 emissions, noise, congestion, and poor air quality, particularly in dense urban areas. Addressing these issues requires data-driven approaches that support informed decision-making by multiple stakeholders.

This EngD project, conducted within the LOKET programme (Logistic Chain Coordination for Urban Construction), focused on developing an Urban Digital Twin (UDT) for the Innovation Quarter in ‘s-Hertogenbosch, in close collaboration with the municipality. The objective was to create a future-proof digital platform to support sustainable urban planning, construction logistics coordination, and environmental monitoring.

The developed Urban Digital Twin goes beyond traditional static 3D city models by integrating real-time and near real-time data on traffic, air quality, noise, weather, and greenhouse gas emissions. This enables continuous monitoring of urban conditions and timely intervention. The project delivered a fully functional prototype based on open standards and a modular architecture, combining a 3D city model, real-time data pipelines, interactive dashboards, alerts, and ODIN - an AI-powered chat-bot that allows users to query urban data in natural language.

Designed to work with a mix of open data, live feeds, and simulated data, the platform is ready to incorporate sensor data as it becomes available. The UDT demonstrates clear value for municipalities by improving construction logistics coordination, environmental monitoring, data-driven planning, and stakeholder communication. It provides a strong foundation for more sustainable, transparent, and liveable cities.

Company: Various biomedical companies
Project: OPTIMA: Design optimization for additively manufactured medical implants
EngD trainee: Milan ten Voorde, University of Twente

Energy and Process Technology

Nowadays, the biomedical industry is showing an increasing interest in the application of additive manufacturing in, for example, the fabrication of artificial implants. One of the frontiers in this field is BAAT Medical Products BV (Hengelo, the Netherlands). The company employs the metal laser powder bed fusion process with bio-grade titanium alloys, which enables them to design and fabricate implants with integrated lattice structures that facilitate bone ingrowth, while simultaneously reducing the implant's weight. Furthermore, their design engineers can leverage the beneficial characteristics of additive manufacturing, such as the capability of designing and fabricating complex, tailored products or the potential of consolidating assemblies.

In this Engineering Doctorate project, BAAT Medical Products partnered with the University of Twente, Fraunhofer Innovation Platform for Advanced Manufacturing (Enschede, the Netherlands), Ingpuls (Bochem, Germany), and the University Medical Centre of Groningen (Groningen, the Netherlands) for the design optimization for additively manufactured medical implants (OPTIMA). OPTIMA focuses on the development of a design tool that integrates software and equipment dedicated to both design and manufacturing processes. The goal is to establish a circular framework that channels feedback from simulation and manufacturing back into the early design stages, thereby reducing rework and iterations throughout the implant's process chain. OPTIMA should enable BAAT Medical Products to mitigate their bottlenecks and manufacturing defects, thereby streamlining the product development process.

Company: Hummin' Inc.
Project: Caring for Caregivers: monitoring mental well-being in healthcare workers and teachers through AI
EngD trainee: Anniek Jansen, Eindhoven University of Technology

Designing Human-System Interaction

Healthcare workers and teachers are invaluable to our society. However, these professions face severe understaffing and overwhelming workloads, leading to significant stress and burn-out. One-third to half of the employees show signs of burnout. Unfortunately, current methods to monitor mental well-being are used infrequently and often rely on cumbersome questionnaires, providing only occasional snapshots of employees' mental well-being.

With the Caring for Caregivers project, we used the Hummin' system to monitor mental well-being. With Hummin', users can report feelings of gratitude or vulnerability through a clickable button or app, helping them become more aware of their emotional state. The system was tested and evaluated at a school and a care facility, showing that Hummin' can boost self-awareness and psychological safety. We also trained machine learning models on the data collected through Hummin', along with demographic information, to predict burnout and stress using AI, with mixed results.

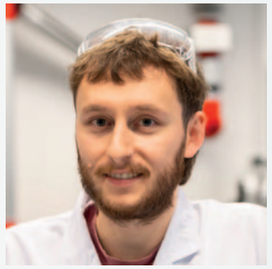
This project contributes to ongoing, near real-time monitoring of mental well-being, which could help detect and prevent burnout at an earlier stage.

Company: IQIP
Project: Designing a system for detection and localization of cavitation events in hydraulic systems
EngD trainee: Alberto Galletti, University of Twente

Maintenance

In high-pressure hydraulic systems, rapid changes in fluid dynamics can lead to the formation of cavitation bubbles. Cavitation is a phenomenon where tiny vapour pockets form and collapse due to sudden pressure changes. These implosions release energy and produce high-frequency sound waves, which can damage internal surfaces and reduce the strength and lifespan of critical components. Over time, this damage can accumulate, affecting system reliability and increasing maintenance costs.

This project focuses on designing a sensor based system to detect and locate cavitation events. By capturing the acoustic signals produced during bubble collapse, the system can estimate the severity and position of potential damage. This information helps engineers monitor wear in real time, assess risk, and predict when maintenance is needed - ultimately supporting more informed decision-making.



The project includes building a lab-scale prototype to test the concept, followed by integration into actual IQIP equipment. The system will be validated in both controlled and real-world environments. Ultimately, this technology will support smarter maintenance strategies, extend equipment life, and improve safety and efficiency in demanding industrial environments where hydraulic systems play a critical role.

Company: Royal Cosun
Project: Airless drying technologies
EngD trainee: Shachi Marthu Shanbhag, TU Delft

Process & Equipment Design

Drying is one of the most energy-intensive operations in food production, and at Cosun it represents a significant share of the total energy demand. Improving the efficiency of these processes is therefore essential for meeting long-term sustainability ambitions and contributing to the 2050 CO_2 reduction goals. Conventional dryers rely on large volumes of air to remove moisture, but recovering energy from the resulting air vapour exhaust is technically challenging and often inefficient.

Airless drying technologies offer a promising alternative. By removing air from the process, evaporated moisture can be recovered in nearly pure form, enabling effective heat recovery and significantly lowering energy use. In this project, several airless concepts were evaluated, including superheated steam drying, enclosed and vacuum drum drying, agitated thin-film drying, and conductive hydro drying. A structured assessment was conducted to compare the operating principles, energy recovery potential, technical readiness, and applicability to two representative Cosun products: potato flakes and a plant-based protein.

The study shows that enclosed drum drying is a strong candidate for potato flakes, offering substantial energy-recovery potential and attractive economic performance, with further pilot testing recommended. For plant-based proteins, superheated steam drying appears promising, although additional work is required to understand its impact on product functionality. Conductive technologies also show potential, but uncertainties in product quality and capital costs warrant further investigation.

About the KIVI EngD Award

Overall, this project provides a clear framework for transitioning toward low-carbon drying operations. The findings highlight practical pathways to significantly reduce energy consumption, support climate-neutral production, and strengthen the sustainability of food manufacturing across a broad product portfolio.

Shachi Marthu Shanbhag received the audience vote for the 2025 KIVI EngD Award, which recognises the outstanding achievements of EngD graduates 2025 who combine scientific rigour with real-world impact.

Company: R&D Cardiology at Catharina Hospital Eindhoven
Project: Streamlining clinical data management
EngD trainee: Marloes de Winter, Eindhoven University of Technology

Qualified Medical Engineer

An abundance of data is created but not always used to its full potential. Coupling different multimodal data and analysing their time-evolving trends might unravel new, useful insight. Currently, identifying post-myocardial infarction (MI) patients who are at risk for ventricular tachycardia (VT) and life threatening arrhythmias is based on symptoms and general measurements. However, these measurements barely encompass the VT development complexity. This complexity might be better interpreted by visualizing and analysing the different routinely obtained data of MI patients.

The availability of this data however is not straight forward. In this EngD project, a workflow was designed to gather, clean, filter and analyse multimodal data. The developed workflow consists of six components:

1. Patient selection and VT classification;
2. Importing data from different hospital databases;
3. Creating a structured, cleaned and pseudonymized database
4. Analysing metadata with statistical tools;
5. Sharing data while considering privacy risks, laws and regulations;
6. Providing a dashboard for interactive analysis of multimodal data with context.

The workflow was applied successfully in two subsequent retrospective studies on VT prediction, comprising almost 3000 post-MI patients, with data covering the period between 1995-2022. The developed (automated) methods are generalizable to other research studies, improving research efficiency and the use of hospital data.

Company: Tembo TDC & AMDA
Project: Towards robust pouch sealing: analysis, modeling and validation
EngD trainee: Florian Vandepoel, University of Twente

Robotics

To fill and seal small pouches with liquids is a hard production process to control 100%. The consensus is that monitoring and modelling the behavior of the foil during the sealing process will increase the understanding about the physics involved. Improved understanding in turn will lead to better future designs and improved parameter selection on currently producing systems. A test setup will be built which mimics the production methods and settings of the current pouch filling machines.

The setup is to host a variety of additional sensors to track and qualitatively evaluate the process. Next, large volumes of data relating to the seal quality as function of its configurable parameters, as well as environmental variables will be collected. This data will be used for modelling the system and its uncertainty will be evaluated. Finally, a model describing the expected seal quality under uncertainty as a function of process parameters will be built. The model will be validated on a test production line.

Company: VELUX A/S
Project: DaylightGuide: A tool for personalized daylight recommendations for the home office
EngD trainee: Verena de Kok, Eindhoven University of Technology

Smart Buildings & Cities

The COVID-19 pandemic significantly increased remote work, highlighting the importance of home office environments on employee health and well-being. Light is a crucial factor in indoor environmental quality, impacting both visual tasks and physical and mental health. Adequate lighting ensures good visual performance, comfort, and regulates our biological clock, affecting sleep-wake cycles and overall well-being. Despite existing standards for office lighting, there are no official guidelines for home offices, which are often designed by the workers themselves.

To address this gap, DaylightGuide was developed. This tool provides personalized daylight recommendations for home office workers. It was created by examining the current state of home office design in the Netherlands through a questionnaire study, daylight simulations and several rounds of user testing. These studies identified adjustments that can improve daylight exposure, stimulate the biological clock, minimize visual discomfort, and provide sufficient light for office tasks. This Engineering Doctorate project helps remote workers create home office environments with optimal daylighting conditions, promoting both productivity and well-being.

Company: ASML
Project: Synthetic data generation for digital verification of ASML solutions
EngD trainee: Giusi di Paolo, Eindhoven University of Technology

Software Technology

ASML is a leader in lithography systems for the semiconductor industry, with its TWINSCAN machines and software products helping manufacturers produce chips. By virtualizing its products, ASML and chip manufacturers can simulate chip configurations to avoid production errors. However, these simulations require large amounts of data, which customers are often reluctant to share. ASML developers have created synthetic data generation tools, though these vary by department and are complex to use.

The goal of this project was to unify ASML's synthetic data generation tools from the Virtual Fab and Holistic Digital Integration teams into a single system accessible via a platform. A study of ASML's infrastructure was conducted to determine the best deployment platform. Based on this, a web-based system was designed to automate synthetic data generation by connecting to a Lithography System Simulator. The system was designed for integration into a Kubernetes-based platform, but full deployment was delayed due to confidentiality concerns around ASML's toolboxes.

The prototype was functionally and load tested, with further testing recommended once full deployment is achieved.

The programs in brief

	Diplomas 2025	Influx 2025
TU/e		
Automotive Systems Design (ASD)	14	10
Clinical Informatics (CI)	12	11
Data Science (DS)	14	15
Design of Electrical Engineering Systems (DEES)	9	8
Human-System Interaction (HSI)	1	5
Qualified Medical Engineer (QME)	12	7
Smart Buildings & Cities (SBC)	7	1
Software Technology (ST)	16	11
Total	**85**	**68**
TU Delft		
Bioprocess Engineering (BPE)	6	6
Process and Equipment Design (PED)	11	0*
Civil & Environmental Engineering (CEE)	5	5
Total	**22**	**13**
UTwente		
Energy and Process Technology (EPT)	4	8
Maintenance (MT)	1	5
Robotics (ROB)	0	0
Civil Engineering (CE)	4	5
Business & IT (BIT)	1	5
Total	**10**	**23**
WUR		
Design for Agrifood & Ecological Systems (DAES)	6	14
Total	**6**	**14**
RUG		
Autonomous Systems (AS)	0	5
Sustainable Process Design (SPD)	0	5
Total	**0**	**10**
Total 4TU.SAI	**123**	**128**

** PED will be discontinued as of September 2026*

Our partners

To illustrate the companies EngD trainees work for after their degree, the top 10 employers for alumni of TU/e in the last 10 years are:

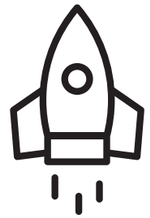
1. **ASML**
2. **Philips**
3. **TU/e***
4. **Thermo Fisher Scientific**
4. **DAF trucks**
5. **TNO**
6. **Corbion**
7. **SABIC**
8. **Punch Powertrain**
9. **Stamicarbon**
10. **Valeo**

*(mostly EngD)

4TU.SAI is a collaborative initiative involving the four Dutch universities of technology. As per September 2025, two more EngD programs have started at University of Groningen.

Our EngD programs provide trainees with the opportunity to expand their knowledge and experience through a personal, practical design assignment in collaboration with and for industry, under the supervision of experienced scientific design professionals. These positions are paid, and there are no tuition fees applicable.

Kick-start your career!



Fast-track career path

The EngD programs serve as a stepping stone to accelerate career growth with both national and international companies, as well as healthcare institutions. Over the past 25 years, more than 4500 of our graduates have secured challenging and rewarding jobs with leading (multi)national companies, such as Philips, ASML, and Thermo Fisher Scientific.

Earning while learning

EngD trainees are appointed for a two-year term, the duration of the program. They will also become staff members at one of the participating universities and receive a salary.

Currently, there are 19 different programs to choose from, offered across the four Dutch universities of technology, as well as the University of Groningen. Some examples include: Civil and Environmental Engineering, Software Technology, Business & IT, Design for Agrifood & Ecological Systems, and Sustainable Process Design.

EngD in brief

- A 2-year post-master's program
- A combination of theoretical and practical learning
- Expanding technical expertise and professional skills
- Kick-start for a career in the industry or healthcare
- Paid position with no tuition fees

How to apply for an EngD position

EngD vacancies are available year-round!
Visit the websites of the participating universities for all available positions:

- Delft University of Technology
  www.tudelft.nl
- Eindhoven University of Technology
  www.tue.nl
- University of Twente
  www.utwente.nl
- Wageningen University and Research
  www.wur.nl
- University of Groningen
  www.rug.nl

TU Delft
TU/e Eindhoven University of Technology
University of Twente.
Wageningen University & Research
4TU.
university of groningen

Ready for the next step after your Master?

The 4TU.School for Technological Design, Stan Ackermans Institute offers a total of 19 two-year post-master technological designer programs.

4TU.SAI is a joint initiative of the four universities of technology in the Netherlands: TU Delft, Eindhoven University of Technology, University of Twente and Wageningen University & Research. 4TU.SAI collaborates with University of Groningen.

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