# Research Self-Assessment 2017-2022

TU/e
EINDHOVEN UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF INDUSTRIAL ENGINEERING & INNOVATION SCIENCES

# Research Self-Assessment 2017-2022

# Department of Industrial Engineering & Innovation Sciences

# We create meaningful technology-based impact for a better world

# Preface

In this report, we present the self-assessment of the research strategy, activities and performance of the department of Industrial Engineering & Innovation Sciences (IE&IS) at Eindhoven University of Technology (TU/e). Our department's mission is to integrate social sciences and humanities with engineering research in such a way that it results in high-quality scientific output and in excellent educational programs with which we create meaningful technology-based impact for a better world. To this end, we aim to cultivate disciplinary excellence, and to combine it in multidisciplinary collaborations geared toward addressing relevant societal, governmental, and industrial challenges.

In this report, we review our strategy and the resulting achievements with respect to research quality and societal relevance for the period 2017-2022, and reflect on these achievements to identify future strategies and directions. The format of the report follows the Standard Evaluation Protocol (SEP; 2021-2027) used by all Dutch universities for assessing their research. First, we outline the department's research mission and organization (Chapter 1), as well as our strategies to pursue this mission (Chapter 2). The strategic actions carried out in the evaluation period and the Key Performance Indicators that we chose to monitor our research achievements are described in Chapters 3 and 4, respectively. In Chapter 5, the largest part of the report, we present our achievements with respect to research quality and societal relevance. In Chapter 6, we evaluate our performance, in the form of a SWOT analysis, and identify future directions for the department. Chapter 7 summarizes.

Writing the report made us proud of the many achievements of our motivated and dedicated staff. We are confident that this report gives a comprehensive review of our strategy, achievements, and aspirations, and that it shows our commitment to be a leading research institute creating technology-based impact for a better world. We hope that you will find reading the report illuminating and inspirational!

Ingrid Heynderickx, dean
Eric van der Geer-Rutten-Rijswijk, managing director
Geert-Jan van Houtum, vice-dean
Yvonne de Kort, vice-dean

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# Chapter 1. Introduction

Research and innovation agendas, at the national, European, and global level, are increasingly focused on addressing grand societal challenges: building resilient infrastructure, fostering healthy lives and personal well-being for everyone, creating sustainable industrial innovation, and developing affordable and sustainable energy solutions – to name but a few. Research at Eindhoven University of Technology (TU/e) follows suit. It aims to contribute directly to tackling many of these challenges, in close collaboration with partners in industry, government, and society. Central to these efforts is the development of Key Enabling Technologies (KETs) such as robotics, artificial intelligence and digitization, renewable energy systems, and high-tech systems. Yet technological innovations can only produce societal benefits if they are accompanied by transformation of government policies, organizational structures and processes, and individual behavior.

**Vision and mission**

We, the department of Industrial Engineering & Innovation Sciences (IE&IS), are uniquely equipped to facilitate the meaningful and successful adoption and implementation of KETs by industry, government and society. To this end, we integrate our strong expertise in the social sciences and humanities in the design of innovative technological solutions and attune KETs to the real-life context of individuals and organizations. Our vision is that:

*we play a leading role in supporting industry, government and society in their* ***responsible adoption and effective implementation of Key Enabling Technologies*** *to address grand societal challenges.*

For realizing that leadership role, we integrate our strong expertise in the social sciences and humanities with engineering research. In doing so, we take a socio-technical-systems perspective on the design of innovative technological solutions and attune KETs to the real-life context of industry, government and society.

**Our mission**

*To integrate social sciences and humanities with engineering research, resulting in high-quality scientific output and in excellent educational programs, that create meaningful technology-based impact for the contemporary challenges of industry, government, and society.*

**Departmental organization**

Creating integral socio-technical solutions requires multidisciplinary collaborations that build on a solid basis of disciplinary excellence. For this reason, the department of IE&IS is primarily organized along disciplinary lines, in seven groups (see also Figure 1.1). Each group covers a different set of disciplinary expertise in the STEM fields (Science, Technology, Engineering, and Mathematics), social sciences, and/or humanities. We briefly introduce them here, in alphabetical order (more details can be found in Appendix A):

- *Human Performance Management* (HPM) uses methods and knowledge from *work and organizational psychology* to optimize the effectiveness, collaboration, and well-being of human capital in operational and innovation processes using KETs in industrial and non-profit contexts.

- *Human-Technology Interaction* (HTI) applies methods and knowledge from *social, cognitive and environmental psychology* to understand and facilitate effective and responsible interaction of individuals and groups with KETs.
- *Information Systems* (IS) implements algorithms from *computer science* in business information systems to increase the effectiveness of operational, new business, and product development processes within and between organizations.
- *Innovation, Technology Entrepreneurship & Marketing* (ITEM) uses knowledge and methods from *engineering*, *business economics and management* to understand and improve the effective implementation of KETs in new high-tech ventures as well as in established high-tech firms and organizations.
- *Operations, Planning, Accounting & Control* (OPAC) uses methods and algorithms from *mathematics and computer science* to investigate and design smart control of operational business processes, addressing decisions at strategic, tactical, and operational levels.
- *Philosophy & Ethics* (P&E) performs research in *philosophy of science and technology* and in *ethics of technology* to support the responsible introduction of KETs in society.
- *Technology, Innovation and Society* (TIS) performs research on innovation and social-technical transitions from an *economic*, *transitions studies* and *history of technology* perspective to understand (the governance of) socio-technical transitions from a systems perspective.

Through collaborations, our seven research groups have the joint expertise to generate knowledge, innovations and designs that address the many challenges currently faced by industry, government, and society. To focus these collaborative efforts, we have identified four areas where we can, on the one hand, capitalize most on our disciplinary expertise and, on the other hand, use and forge direct connections to the relevant stakeholder networks inside and outside academia. We believe that, within these areas, we can create the largest impact on grand societal challenges, leverage our expertise, and use the unique opportunities offered by the high-tech 'Brainport' area which surrounds the city of Eindhoven. We call these focus areas our 'departmental research themes' (also see Figure 1.1). We briefly introduce each theme here, in alphabetical order (more details are found in Appendix B):

- *Humans and Technology (H&T)* is concerned with the responsible development, introduction and use of KETs, focusing on its interface with humans, its successful deployment in organizations, and its transformative effects on society.
- *Supply Chain Management (SCM)* focuses on the many KET-related implementation challenges at the interface between logistics/operations and related functions such as supply chain management, transport management, maintenance, manufacturing, and service.
- *Sustainability and Circularity (S&C)* aims at practical implementations of KETs for circular, sustainable, and socially innovative industries and societies, focusing on green companies, smart and sustainable energy, smart and sustainable mobility, and sustainable employability.
- *Value from Data-Driven Intelligence (VoDDI)* aims at extracting value from the proliferation of data in diverse contexts as industrial processes, (preventive) health and well-being, and smart cities. Privacy, safety, and human values play an essential role in designing artificially intelligent systems using these data.

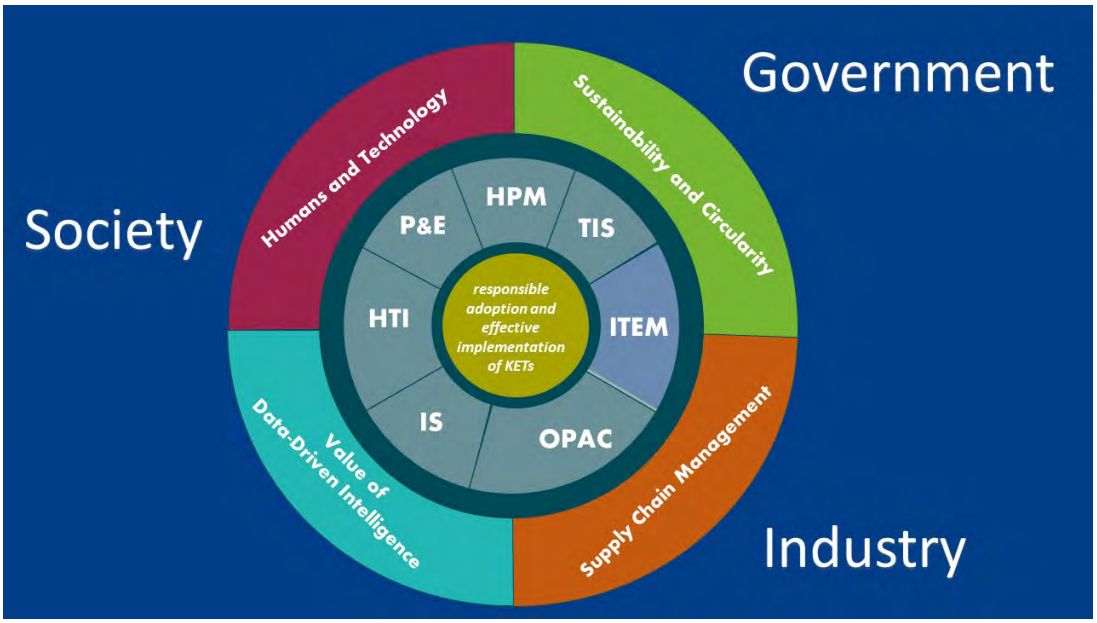



**Figure 1.1. Organization of the department of IE&IS, in groups (inner ring) and themes (outer ring) around the department vision.**

**Departmental governance**

The department is governed by a Departmental Board, which consists of dean Ingrid Heynderickx, vice-dean Geert-Jan van Houtum (responsible for valorization and impact), vice-dean Yvonne de Kort (responsible for research quality), and managing director Eric van der Geer-Rutten-Rijswijk. The weekly board meetings are also attended by the education director, Tom Van Woensel, and by two students who represent our two study associations. Every month, the board meets with the chairs of all seven research groups to discuss the strategy and implementation of education, research and valorization, including financial consequences. Every second month, the dean meets with the four research theme leaders to discuss the strategy and progress within the themes. The Departmental Board is accountable to the Departmental Council for its policy and budget, and meets every month with this participatory body. The yearly budget available to the department is detailed in Appendix C (Table C1) as is the research staff within IE&IS over the period 2017-2022 (Table C2).


**Yvonne de Kort, Tom Van Woensel, Ingrid Heynderickx, Eric van der Geer-Rutten-Rijswijk, Geert-Jan van Houtum**

To consult the external network of scientific, industrial, governmental, and societal partners, the department has a Scientific Council and a Societal Council, with which the board meets two to three times a year. The members of these councils are listed in Appendix D.

**University context**

The Departmental Board reports directly to the University Executive Board, and aligns its strategy with the TU/e strategy through biweekly meetings of the University Consultative Council (meeting of deans) and the Managing Directors Council.

In addition, the department significantly contributes to the strategy and policy of the TU/e through:

- The appointment of Anthonie Meijers as University Professor (until his retirement in 2019). Thus far, the university has appointed five University Professors, whose role is to discuss strategy and policy directly with the Executive Board.
- The appointment of Evangelia Demerouti as Chief Diversity Officer of the TU/e. She advises the Executive Board on policy regarding diversity and inclusion, and supports departments and services to implement such policy.
- The appointment of Sjoerd Romme as the university's Ambassador for Entrepreneurship. His role is to cultivate the TU/e's amenities and conditions for academic and student entrepreneurship, and to stimulate all other forms of entrepreneurial activities and behaviors.

- The appointment of Anna Wieczorek as the university's Sustainability Ambassador. Her role is to coordinate the university's transition to a sustainable university and help faculty and students live up to the university's sustainability goals.
- The appointment of several researchers as members of the Eindhoven Young Academy of Engineers. We currently have five members: Johanna Höffken, Tugce Martagan, Maryam Razavian, Karin Smolders, and Bob Walrave. In the current assessment period also Daniël Lakens and Krist Vaesen were members of this Academy. Their role is to regularly discuss strategy and policy at TU/e with the rector.


**Evangelia Demerouti presents TU/e Diversity Fund Award to Wendy Olsder**

# We cultivate both disciplinary excellence and close multidisciplinary collaboration

# Chapter 2. Aims and strategy

## 2.1. STRATEGIC AIMS AND ACTIONS

In striving towards realizing our mission and vision, we prioritize the following strategic aims:
1. To achieve disciplinary excellence and be recognized for it by our academic peers.
2. To generate impact on relevant societal, governmental, and industrial challenges through multidisciplinary collaborations.

To play a leading role in the adoption and implementation of Key Enabling Technologies (KETs) in industry, government or society, we strive to make our department's impact visible to multiple stakeholders. This includes researchers in all disciplines represented at IE&IS as well as key partners in industry and societal and governmental institutions. **Disciplinary excellence** is central to our mission and vision: it forms the basis for research-driven impact. To generate real impact for industry and society on this basis, we take a systems approach and combine multiple perspectives in **multidisciplinary** projects.

We took the following actions to achieve our strategic aims. Each of these actions, and its implementation, will be described in more detail in a dedicated section of Chapter 3:
1. To attract and retain talented researchers who can contribute to our mission, we revised our HR policies for recruitment, mentorship, and promotion, including increased attention for diversity and inclusiveness (Section 3.1).
2. To show our excellence and create more visibility for our research output, we developed an explicit publication strategy, also focusing on Open Science (Section 3.2).
3. To align our academic research structurally with industrial, governmental, and societal challenges, we formulated a valorization strategy (Section 3.3).
4. To enhance fundraising success, we established a professionalized Project Development Office (PDO) (Section 3.4).
5. To realize ambitions of excellence, quality and growth of the research portfolio, faculty needs sufficient research time. For many years, our department has been faced with a high teaching load. We therefore considered it crucial to secure a healthier balance between research and education tasks (Section 3.5).
6. To realize more impact of our research in the implementation of Key Enabling Technologies (KETs), we stimulated multidisciplinary collaborations not only within, but also outside the department (Section 3.6).

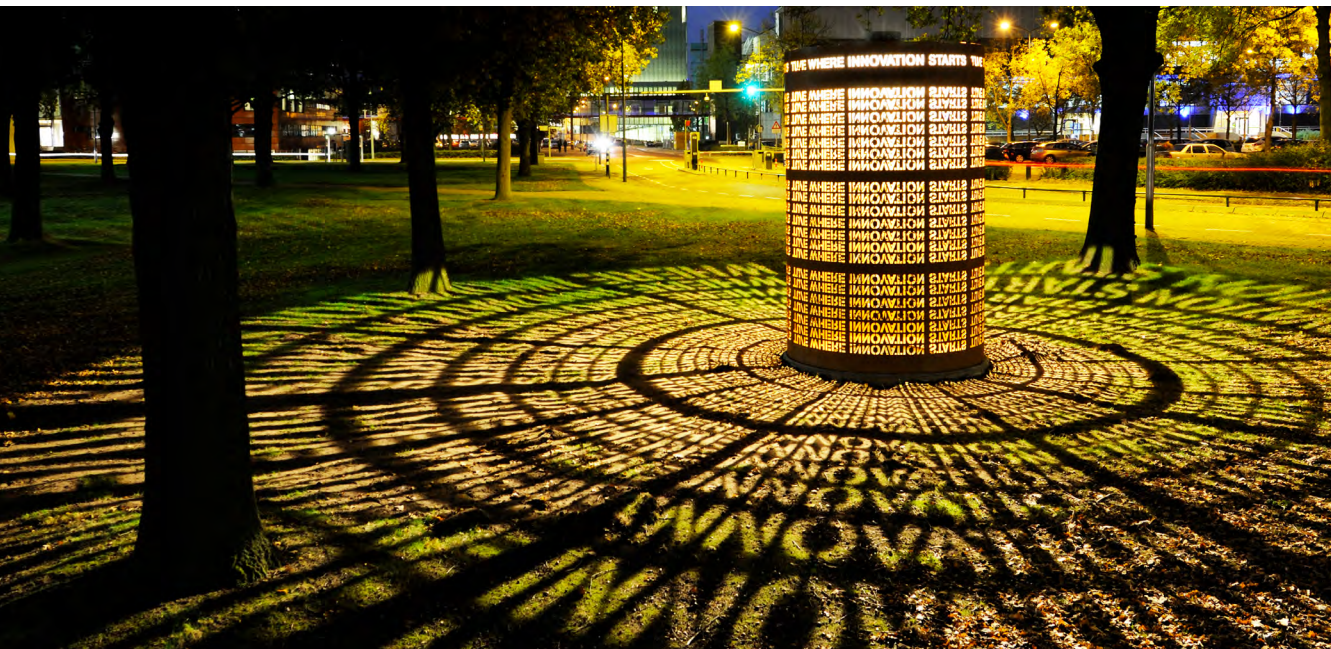
The first three actions are essential for achieving our strategic aims: researchers who are committed to our strategic aims, and clear strategies for publishing and valorizing the research output are crucial to pursue these aims. Significant steps have been made in each of them, resulting in clear and broadly supported policies. The last three actions are more instrumental. They comprise a more focused effort, specific to the assessment period.

## 2.2. PROCESS TOWARDS THE STRATEGIC AIMS AND ACTIONS

To set strategic aims and identify and implement strategic actions, the Departmental Board invested significantly in consulting internal and external stakeholders. In this way, a diversity of perspectives (e.g., on disciplinary publication cultures or suitable funding opportunities) could be integrated into policies and strategies. For this, the governance mechanisms described in Chapter 1 were used, in a multi-step process that was coordinated by the Departmental Board.

As an example of this process, we use the identification and implementation of the publication and valorization strategies. The need for more explicit strategies was identified early in the assessment period, by the Departmental Board in close consultation with the chairs of the seven research groups and the theme leaders; and it was checked with the Scientific and Societal Councils for the publication and valorization strategy respectively. After this, taskforces – each chaired by a member of the Departmental Board – were formed that arrived at first formulations of the strategies. These were discussed by the Board, internally and with the group chairs, who in turn consulted the research groups, and with the theme leaders. For this, regular meetings as well as dedicated, longer strategy meetings were used. This round of consultation resulted in amending, further clarifying, and then establishing both strategies, again checking them with the Scientific and Societal Council respectively. Consecutively, some elements of the strategies – such as the IE&IS Valorization Prize – could be directly implemented. The publication strategy, in particular, required an additional process: apart from the general guidelines, it contains specific lists of target journals for each disciplinary research group (see Section 3.2). These lists were, based on the guidelines, compiled within the research group, coordinated by the group chair. Then, they were combined, approved by the Departmental Board, and the final version was communicated to all our researchers.

Processes as described above are necessarily intensive. They require careful coordination by the Departmental Board to ensure progress and convergence, while still safeguarding a diversity of perspectives and interests. That we arrived at broadly supported and effective strategies, and implemented all strategic actions successfully, shows the strength of our departmental culture: we strive for excellence through close collaboration and a shared vision.



# Chapter 3. Strategic actions

In the previous chapter, we described our aims and six strategic actions taken in pursuit of them. In this chapter, we discuss how we have implemented these actions. We first review each of these actions, as they were listed in Section 2.1. These actions express our academic culture, which is described in Section 3.7, together with our vision on PhD supervision.

## 3.1. HR POLICY

The cornerstone of our HR policy for scientific faculty is the **tenure-track model**. Through it, we can offer each excellent and ambitious early-career researcher who we recruit a career path towards Associate Professor, and in some cases even to Full Professor. Recruitment and promotion of our scientific faculty is based on the advice of a nomination committee. This consists of researchers from different research groups (including the group in which a candidate is or will be embedded) and one or two interdepartmental committee (IFC) members. At least two – but usually more – committee members are female. In particular, the IFC members, who have been specifically trained to recognize implicit biases, ensure fair and unbiased judgments across disciplines, genders, and cultural backgrounds.

Recruiting, retaining, and promoting talented researchers requires **appropriate, effective and fair HR processes**. In recruitment, the committee evaluates a candidate's track record and potential with respect to four central task categories: education, research, valorization, and organization/management; candidates are invited to reflect on each category in their application and during the recruitment interview. Similarly, tenure-trackers are provided with a framework of criteria for tenure and promotion to the various levels of an academic career. This defines required performance levels regarding the task categories (education, research, valorization, and management), and also considers professional, interpersonal relationships and academic citizenship. This framework, which also serves as the basis for tenure and promotion committees, ensures that candidates are not assessed on a narrow definition of scientific excellence, but on a broad mix of qualities. We believe this serves to cultivate an academic climate of diversity and research excellence.

Retaining talented researchers also requires **adequate support structures**. To introduce tenure-trackers to our research culture, allow them to flourish, and realize their full potential, we have set up a *mentorship program*. In this program, tenure trackers are supported by a second senior scientific faculty other than their supervisor or group chair. The program consists of several elements, many of which were (re-) shaped during the assessment period:

- formulation and periodic review of a personal development plan, with the support of a senior scientific faculty member acting as mentor;
- open and socially safe discussions within a small group of newly appointed tenure trackers;
- informal discussions of this small group with the Departmental Board on promotion criteria, and the publication, valorization education strategy;

- coaching of talented researchers by an internal committee of grant-writing experts on preparing personal grant applications at the Dutch (e.g., The Netherlands Organization for Scientific Research (NWO) or European level (e.g., European Research Council (ERC)).

The department actively strives for diversity of gender and cultural background, and for an **inclusive, collaborative, and multi-perspective academic culture**. We foster diversity by recruiting all research positions internationally, by using English as the default working language in documents and meetings, by having selection and promotion committees that are well-balanced in terms of gender and culture, and by actively scouting for female employees. In this, we are supported by university-wide policies, including arrangements for dual-career options, childcare, and recruitment funds for women. Partly as a result, the percentage of female (41%) and international faculty members (44%) of our department is well above the TU/e-average (24% and 35%, respectively). Gender diversity is also reflected in our governance structures: the chairs of the research groups, and the Departmental Board. The latter currently consists of two females (i.e., the dean and one of the vice-deans) and two males (i.e., the other vice-dean and the managing director). Table 3.1 presents the gender distribution within our department.

**Table 3.1. The gender distribution in the research groups (reference date 31-12-2022)**

| Group | Full Professors | | | Associate Professors | | | Assistant Professor | | |
|---|---|---|---|---|---|---|---|---|---|
| | Female | Male | Other | Female | Male | Other | Female | Male | Other |
| HPM | 2 | 1 | 0 | 2 | 0 | 0 | 1 | 4 | 0 |
| HTI | 2 | 2 | 0 | 0 | 4 | 1 | 6 | 3 | 0 |
| IS | 0 | 1 | 0 | 1 | 3 | 0 | 6 | 4 | 0 |
| ITEM | 1 | 4 | 0 | 2 | 2 | 0 | 6 | 5 | 0 |
| OPAC | 0 | 4 | 0 | 2 | 5 | 0 | 6 | 9 | 0 |
| P&E | 0 | 2 | 0 | 0 | 2 | 0 | 4 | 4 | 0 |
| TIS | 3 | 2 | 0 | 3 | 1 | 0 | 3 | 6 | 0 |
| Total | 8 | 16 | 0 | 10 | 17 | 1 | 32 | 35 | 0 |

## 3.2. PUBLICATION AND OPEN SCIENCE STRATEGY

Since the previous research assessment (covering the assessment period 2010-2016), we have formulated a departmental publication strategy (see Appendix E), which was introduced in 2019. This promotes research quality, creates visibility, and provides guidance to (junior) researchers in their choice of publication outlets. The publication strategy reflects our ambitions on both disciplinary and multidisciplinary excellence, our commitment to create visibility for our research, our dedication to Open Science approaches where possible, and to the DORA declaration (https://sfdora.org). Our strategy explicitly places quality and visibility over quantity to alleviate publication pressure on our staff. This **emphasis on quality over quantity** is extremely important considering both staff well-being and scientific integrity.

Our publication strategy aims to promote research quality and visibility by our academic peers by identifying highly relevant outlets. Such outlets are not limited to mono-disciplinary top journals but, given our research mission, also include multidisciplinary outlets. The strategy starts with a generic guideline for the whole department, followed by corresponding strategies formulated by each of the seven groups. Each group has defined a **list of specific target outlets**, referring to relevant aspects in their disciplinary publication cultures.[1] Importantly, however, individual researchers do not need to limit themselves to their group's list. Instead, we encourage them to tailor their personal publication strategy to their personal ambitions, while at the same time promoting the general gist of our departmental vision and strategy. This also implies that in tenure and promotion evaluations and decisions, a candidate's publication list is assessed on quality and impact in light of their academic profile rather than solely on the basis of the research group's target list. Thus, our publication strategy creates room for diversity between disciplines and individual researchers within a single shared research mission.

Quality and impact of research output are partly measured with traditional numeric criteria. We favor the Web of Science (WoS) based Article Influence Score (AIS) over the impact factor as an *ex ante* indicator of journal ranking, and the number of citations as a *post hoc* article-based metric.

[1] NWO, 2018. Study into Publication Cultures Social Sciences and Humanities. The Hague.

Our ambition is to publish frequently in first-quartile (Q1), and preferably top 10%, ranked journals, as measured by the AIS. Nevertheless, we acknowledge that scientific quality and impact are also reflected in more qualitative indicators, and that the peer-reviewed journals covered by WoS may not be the only relevant outlets. For instance, in some disciplines represented in our research groups, top publications can appear in selective conference series (e.g., in the Information Systems group) or take the form of a book or monograph from an esteemed scientific publisher (e.g., in the Philosophy & Ethics group).

Effectively connecting to fellow academic experts requires **advancing Open Science practices beyond publishing in Open Access journals**. The TU/e repository supports Green Open Access for any publication that is not featured in a Gold Open Access journal, facilitating easy and free dissemination of our research findings. As a department, we pay increased attention to transparency, data sharing, and research integrity. To this end, researchers are expected to adopt high ethical and quality standards and encouraged to continuously improve their research practices. We also play a key role in the TU/e's Ethical Review Board, which reviews all research involving human subjects before it is executed: our department provides the chair of the Ethical Review Board (Daniël Lakens) and two of the fourteen contributing members (Philip Nickel and Leander van der Meij). In addition, a group of researchers of the department (including Wybo Houkes, Krist Vaesen and Daniël Lakens) joined forces to conduct research on good science practice. They contribute nationally and internationally to the development and implementation of better ethical and quality standards and procedures in science. Finally, the department hired a data steward, who supports our staff with data management, data transparency, and data privacy.

## 3.3. VALORIZATION STRATEGY

Valorization comprises all activities that help to create value from scientific research for non-scientific stakeholders such as policy makers, industry partners, professional organizations, the general public, students, and life-long learners. Collaborating with these partners to co-create valuable work is crucial to realizing our mission and vision. It helps us to better understand specific challenges encountered by stakeholders, to define relevant research projects that address these challenges, and to identify funding opportunities for that research as well as opportunities to implement research results in society. Valorization, in sum, is not an add-on to or distraction from our research, but an integral part of it.

Our department has a long history of successful collaboration with many partners outside academia. To build systematically on existing strengths and prior successes, and to enable our researchers to integrate valorization in their own research activities without overly adding to their workload, we have specified our valorization strategy in 2019 and have identified and created the means, outlined below, to implement it. The text box to the right lists the key elements of this strategy.

**VALORIZATION STRATEGY: KEY ELEMENTS**

Goals:

- Integration into research projects
- Leadership of large, valorization-oriented projects

Means:

- Individual incentives: hiring and promotion policy; IE&IS Valorization Prize
- Internal organization: departmental themes with coordinating core teams
- External organization: long-term collaborations in valorization communities
- Institutional support: PDO, communication policy, replacement budget
- Future-oriented topic roadmaps

The **goal** of our valorization strategy is to incorporate valorization in all suitable research programs. More specifically, we formulated as subgoals: (1) when and where possible, we complement our research projects with dedicated activities to translate insights into added value for non-academic stakeholders; (2) we increase our visibility and relevance by creating eye-catching highlights and leading large projects with impactful valorization activities (see Section 5.2 for our achievements). Our valorization strategy comprises various **means** for pursuing these goals: we incentivize individual researchers, have organized ourselves internally and externally to facilitate valorization and to provide institutional support, and have formulated topic roadmaps. Below, we briefly discuss each one of these means.

**Individual incentives**

Our researchers are the main resource for our valorization strategy: we pursue added value for non-academic stakeholders through our research activities. Researchers of all ranks (from PhD candidates to Full Professors) are partly selected for their intrinsic motivation to collaborate with companies or other societal organizations, and they are continuously incentivized to create value from their research. Valorization is one of the **criteria in hiring and promotion**, on a par with excellence in teaching and research: we recognize it as a separate domain in which researchers may excel. To make valorization activities visible, all researchers register their valorization output and activities in Pure (TU/e's current research information system). Societally relevant output, in all forms represented in our Key Performance Indicators (see Chapter 4) and plans for valorization activities are explicitly addressed in every researcher's yearly evaluation. Finally, since 2019, we award the annual IE&IS Valorization Prize to exceptional valorization efforts of teams of researchers. Through this prize, winners are recognized for their achievements, they provide models of such achievements for other researchers in our department, and they create eye-catching examples for our emphasis on valorization. More information about this prize can be found in Appendix F and for the cases see Appendix N.

**Internal organization**

Researchers are embedded in our seven groups. A central element of our valorization strategy is therefore the internal organization that should coordinate efforts across research groups and foster the multidisciplinary work that is key to addressing complex societal challenges. For this purpose, we have defined **four departmental research themes** (see Chapter 1): topics for which we have sufficient critical mass to leverage research synergies for highly impactful efforts, and for which we provide institutional support. For each theme, valorization activities are coordinated by a *core team*, installed as of 2019. The core team consists of a theme leader, and three to seven additional core members from different research groups, supported by a project development officer from the PDO (see Appendix B). This core team is the steering, initiating, and coordinating force for the departmental theme.

**External organization**

Valorization also requires effective external organization. Per departmental theme, we develop and maintain **valorization communities of stakeholders**. These communities facilitate a structural two-way interaction between our researchers and relevant non-academic stakeholders, and they afford resilient, long-term collaborations that do not depend on individual researchers. In addition, they are a basis for forming consortia of partners for large research projects. The oldest established valorization community that is coordinated by the department, the European Supply Chain Forum (ESCF), has a history of more than twenty-five years. It is directly associated with our departmental

themes 'Supply Chain Management' and 'Value of Data-Driven Intelligence'. Another large valorization community that is coordinated by the department is the TU/e Center for Humans and Technology (CH&T), associated with the 'Humans and Technology' theme. Further, our department is strongly involved in the Eindhoven Artificial Intelligent Systems Institute and Eindhoven Institute for Renewable Energy Systems (EAISI and EIRES respectively, see Section 3.6). EAISI offers a community for the themes 'Value of Data-Driven Intelligence', 'Supply Chain Management', and 'Humans and Technology'; EIRIS for the theme 'Sustainability and Circularity'. In addition, we also join forces with other organizations at the national and European level (e.g., European Technology Platforms (ETP's)). An overview of all valorization communities is given in Appendix G.

**Institutional support**
The departmental themes coordinate efforts of individual researchers and are also avenues for providing institutional support for these efforts. The Departmental Board has allocated substantial means to this support. Most importantly, the **Project Development Office** (see 3.4 for details) has been installed. Of each core team coordinating the departmental theme, one project development officer is also a member. Moreover, we have developed a **communication policy**, for which we have hired a communications officer. This allows us to communicate valorization output in a timely and clear way with the relevant stakeholders, and to maintain a repository of valorization products, so that these products are and remain discoverable and accessible. Last, since 2021, we have made available **extra budget for researchers** who lead the development of a large research proposal. This budget can be used to balance the workload of the leading researcher, thus allowing them to make the effort needed to establish the necessary consortium and produce a competitive proposal. Throughout the application process, researchers are also supported by a project development officer.

**Future-oriented topic roadmaps**
A final element of our valorization strategy has been to construct topic roadmaps. These have been defined for each departmental theme by the responsible core team. Each roadmap has a horizon of five to ten years and forms the basis for developing and coordinating impactful projects in collaboration with the relevant stakeholders. The longer-term perspective embodied in these roadmaps enables the theme members to anticipate upcoming research calls at national and European level, and to take early steps to respond successfully to these calls. The first versions of the roadmaps were completed in 2021. Since then, they have played an important role in developing large projects (see Appendix B on the departmental themes).

## 3.4. FUNDING ACQUISITION AND PROJECT DEVELOPMENT OFFICE

Success in fundraising is crucial for realizing our research mission, partly because like in most Dutch universities of technology, research goes hand in hand with educating (externally funded) PhD candidates and Postdocs. This creates a constant need to maintain, diversify and where possible extend our fundraising activities. Simultaneously, the national and European funding landscape is becoming ever more complex. To support the efforts of our researchers and focus their attention on promising opportunities, we started the Project Development Office (PDO) in 2016, with one project officer for each departmental research theme. Project development officers have a range of tasks: they monitor all upcoming calls by funding agencies, proactively contribute to the formulation of future calls, organize meetings with researchers on specific call topics, present our expertise and

topic roadmaps to the outside world, build networks of possible project partners, and support the development and writing of research proposals. In the fall of 2018, we hired an additional senior director for the PDO, in charge of strategic roadmapping and establishing and maintaining related strategic contacts.

Establishment of the PDO has contributed significantly to our acquisition capacity. Since the time the PDO started, we have seen a **significant increase in grants awarded** (25% to 30% in accumulated budget) **as well as in success rate** (e.g., from 7% to 12% at NWO, and from 6% to 16% at Horizon Europe). In the coming years, we want to focus more on leading roles in larger projects (2-10 million euro). To this end, we developed topic roadmaps for each research theme (also mentioned in Section 3.3, see also Appendix B).

## 3.5. SAFEGUARDING BALANCE BETWEEN RESEARCH AND EDUCATION

The substantial growth in our student intake resulted in increased teaching responsibilities. By 2015, this started to pose a serious threat to faculty members' research time. At the start of the assessment period, the student-faculty ratio was high, at 23:1, and our teaching load ranked well above the TU/e's average. In 2017, on average, our faculty members taught 1,000 credit points, corresponding roughly to 1,000 work hours (and hence corresponding to more than 60% of a fulltime contract, whereas the TU/e average and standardly accepted education load is between 40% and 50% of a fulltime contract).

**Teaching in the Atlas building**

To reduce this excessive educational burden, the university and department secured extra funds for educational support and teaching assistants. These measures have gradually **reduced our teaching load** to the TU/e's average and the standard allocated time for teaching tasks. This allowed the groups to reinstall a healthier balance between research, teaching, valorization, and management time for their people.

## 3.6. COLLABORATIONS

Collaboration is a prerequisite for cultivating academic excellence and creating valorization impact. We took various actions to facilitate and stimulate collaboration not only within but also outside the department.

We strengthened multidisciplinary collaboration across our groups and focused them further on the four departmental research themes. We supported this collaboration financially with three rounds of internally funded PhD-positions, 15 positions in total, granted to new and promising research collaborations across research groups.

In addition to the departmental research themes, national and university-wide centers (see Table 3.2) provide platforms for generating research quality and societal impact. The department therefore actively supports and promotes participation in such initiatives. This resulted in a large number of such participations, strengthening our roles in relevant research centers and institutes at the TU/e, national, and international level.

**Table 3.2. Examples of collaborations**

| | TU/e | National | International |
|---|---|---|---|
| Research | EAISI<br>EIRES | 4TU | Eurotech<br>ILI<br>Beta |
| Valorization | ESCF<br>CH&T | TKI Dinalog | ETP |

Three of our departmental research themes ('Humans and Technology', 'Value of Data-Driven Intelligence', and 'Supply Chain Management') are strongly embedded in EAISI, the TU/e institute for developing AI technology for autonomous decision-making in engineering systems that interact with and support humans. EAISI brings together all AI-related research within the university and focuses on the application domains of high-tech, health and mobility. Likewise, the energy-related research within the 'Sustainability and Circularity' theme is well-connected to the EIRES. This TU/e institute takes a broad, multidisciplinary perspective on the energy transition with a focus on energy storage and conversion. It facilitates collaboration on materials, systems and processes for the development of new technologies and devices, focusing not only on fundamental innovations, but also on rapid upscaling and market penetration.

At the national and international level, several department members have taken on a participating, coordinating or managerial role in research centers, such as the Intelligent Lighting Institute (e.g., Ingrid Heynderickx and Yvonne de Kort), the 4TU Centre for Resilience Engineering (e.g., Geert-Jan van Houtum), the 4TU Centre for Ethics and Technology (e.g., Vincent Müller and Andreas Spahn).

We also used the national and international collaboration with 4TU and EuroTech to benchmark our performance. Within 4TU, we exchanged KPI results and best practices with the department of Technology, Policy and Management of Delft University of Technology and with the department of Behavioral, Management and Social Sciences of the University of Twente. Similarly, within EuroTech, we discussed performance and best practices with the department of Technology, Management and Economics of Denmark Technology University, and with the School of Management of the Technical University of Munich.

We also took a leading or central role in relevant valorization networks (see also Section 3.3): European Supply Chain Forum (e.g., Tom Van Woensel), the Center for Humans & Technology (e.g., Wijnand IJsselsteijn) and TKI Dinalog (e.g., Geert-Jan van Houtum). For more details see Appendices G and H.

## 3.7. ACADEMIC CULTURE

The six sets of actions described above were performed to realize our mission and vision. They also build on and add to our departmental culture. This is best summarized as **cultivating academic excellence through close collaboration**. We reject the view that excellence can only be achieved and sustained through mutual competition between researchers who focus purely on their personal interests. Instead, we encourage our faculty to co-supervise PhD candidates, to publish together, to collaborate in departmental research themes, and to jointly apply for research grants.

**Cortege during MomenTUm, the academic celebration of TU/e**

We strongly believe that our people flourish through teamwork, that they can do high-quality and impactful research, and in this way build a stronger CV. Both mono- and multidisciplinary collaborative projects offer abundant opportunities for researchers to contribute from their disciplinary expertise and to develop their own profile.

The mentorship program reflects this academic culture, and also enables tenure-trackers to join a research environment in which research ideas and projects are openly shared and discussed in order to improve their quality, and to explore and establish collaboration. Tenure-trackers choose their own mentor(s) for academic and personal guidance and are encouraged not to choose their direct supervisor. They are motivated to define their own research profile and academic trajectory with the aid of the mentor and in conversation with, but definitely not restricted by or dependent on their research group chair. Senior faculty – including the mentor and the group chair – support new faculty in all aspects that are important for their career towards Associate or Full Professor, but also to some extent specific to Dutch academia or the TU/e: grant acquisition, setting up a stakeholder network, and PhD supervision.

The department's diversity in terms of seniority, gender, culture and discipline facilitates an open, inclusive and pluriform climate. There is ample room for discussion and reflection on all aspects of our academic culture: we seek constant improvement in these respects. Open discussions are also actively stimulated through e.g., lectures on Erin Meyer's *The Culture Map*, visiting the theater play Mindlab, and having regular lunch meetings with junior or senior faculty to discuss topics related to academic culture and citizenship. In addition, the university provides support services for faculty including counselors on scientific integrity, social safety, and mental well-being. These counselors support faculty in their discussion with the Departmental Board concerning issues related to openness, inclusiveness, or personal unease.

**PhD supervision**

Supervision of PhD candidates is a central task of our researchers. Several procedures are in place to safeguard quality and progress in PhD trajectories. PhD candidates are recruited by a committee of researchers involved in and independent from the dissertation project. Once hired, PhD candidates are supervised by at least two faculty members. In the first months of their project, they write an education and supervision plan, which is assessed internally for feasibility. After nine months, a larger committee, including at least one faculty member external to the project and one HR advisor, assesses whether the PhD candidate is sufficiently qualified in setting up research and writing reports; the candidate provides information for this assessment, which determines continuation of the project and employment contract. For further quality assurance of the PhD project, input is given by an independent internal research committee, existing of experienced staff with the same as well as different disciplinary background. This committee assesses the content of the project as well as its viability and potential for successful completion within four years, the typical timeframe for PhD projects in the Netherlands. Moreover, progress is formally reviewed yearly in a dedicated meeting of the PhD candidate with the supervision team.

Quality assurance is not only a matter of assessing PhD candidates. It also involves building and improving supervision skills and expertise among faculty. For this, the department has developed and implemented an intensive, tailor-made training program for everyone who supervises PhD candidates. To guarantee a high-quality training program and a dedicated research network for our PhD candidates, the department takes crucial responsibility in the Beta Research School for Operations Management & Logistics, currently chaired by Ivo Adan. This Beta Research School offers specialized in-depth PhD courses on Operations Management & Logistics to PhD candidates from different universities via the Graduate Program Operations Management & Logistics (GP-OML). Finally, we have implemented Hora Finita, a software application that aims to further facilitate the monitoring of progress and quality of PhD trajectories.

Appendix I contains a detailed description of our PhD program, including the success rates.

# We encourage and guide our researchers via our publication and valorization strategies

# Chapter 4. Key Performance Indicators

In line with our two strategic aims (see Section 2.1) we formulated a set of Key Performance Indicators (KPIs) that monitor (i) our achievements and recognition in terms of academic excellence as well as (ii) the impact of our research for industry, government, and society. We focus on this particular set of KPIs because they best match our strategic aims. They are not, however, comprehensive: both the quality of our research and its impact manifest in different – and highly appreciated – ways.

Below, we give an overview of the selected KPIs (Table 4.1), followed by brief explanations. Performance according to the listed KPIs is discussed in Chapter 5.

**Table 4.1. Key Performance Indicators for research quality and relevance to society**

| | Research quality | Relevance to society |
|---|---|---|
| Demonstrable products | **1. Research products for peers**<br>*Publications in line with publication strategy*<br>*Editorships*<br>*Doctoral dissertations* | **4. Research products for societal target groups**<br>*Outreach activities (round tables, presentations specialist events and conferences)*<br>*Dissemination results to stakeholders*<br>*Dissemination results to the general public* |
| Demonstrable use of products | **2. Use of research products by peers**<br>*Citations* | **5. Use of research products by societal target groups**<br>*Use of outreach products by stakeholders*<br>*Altmetrics* |
| Demonstrable marks of recognition | **3. Marks of recognition by peers**<br>*Scientific awards and prizes*<br>*Grants awarded by national and international science foundations*<br>*Keynote lectures and invited talks at prestigious institutes and conferences* | **6. Marks of recognition by societal target groups**<br>*Public awards and prizes*<br>*Research funding from industry and third parties*<br>*Membership of civil supervisory and advisory bodies* |

**KPIs for research quality**

Publications are a generally accepted and almost irreplaceable means of achieving academic excellence and gaining recognition from one's peers. Our publication strategy (see Section 3.2) emphasizes quality over quantity; we formulated it to encourage and guide researchers to find the best possible outlet for their work. On a collective level, we want a substantial volume of the research done in the department to be published in high-quality journals and in journals

considered highly relevant by our research groups. To operationalize the KPI 'Publications in line with publication strategy', we use the following two measures:
1. the percentage of publications in the list of target journals that were defined by the seven research groups;
2. the percentage of publications in the top 10% and 10-25% (Q1) journals according to their Article Influence Score (AIS) in Web of Science.

A second KPI in the same category (Cell 1 in Table 4.1) is acting as editor (lead, associate or guest), in particular for one of our target outlets. Finally, at a university of technology such as ours, research is often carried out through successful PhD projects. The number of completed dissertations is therefore also a relevant measure of our achievements in this respect.

Turning to the use of research products by peers (Cell 2), the primary gauging mechanism are citations. There are many citation metrics, at the level of individual authors or of organization units, all with well-documented flaws. Still, these measures provide insight into the academic impact of our research. We use the Field-Weighted Citation Index (FWCI) to compare ourselves to others. The FWCI is one of the fairer indicators available, since it is sufficiently sensitive to differences between disciplines and publication cultures; and reflects quality rather than quantity. In addition, we evaluate the Hirsch-index (H-index) of our faculty (taking into account their academic rank and disciplinary background) and using both Web of Science and Scopus (since not all disciplines in our department are represented equally well in either one database).

Finally (Cell 3), prizes and awards granted by peers are important marks of recognition of our research excellence. The same holds for important grants from national and international science foundations, which generally rely heavily on independent peer-review. In addition, only excellent researchers are invited for keynote lectures at big and/or leading conferences, and therefore, such invitations are included as a third KPI in the category 'marks of recognition by peers'.

**KPIs for relevance to society**

Our second strategic aim is to generate impact on relevant societal, governmental and industrial challenges. This has – in line with our valorization strategy (see Section 3.3) – two components: (1) when and where possible, we seek to translate research insights into added value for industry, government, and society, and (2) we collaborate with industrial, governmental, and societal partners in complex and impactful research projects. The KPIs reflect both aims.

Firstly, we stimulate a variety of activities that generate demonstrable research output (Cell 4) for our networks of stakeholders. These networks include:
1. globally operating companies and SMEs from the high-tech industry (Brainport area) and other industries;
2. local, regional and national governments and governmental organizations;
3. hospitals, clinics, nonprofit organizations, and dedicated patient communities;
4. the general public.

We encourage our faculty to build and engage in these networks through a variety of outreach activities, including the organization of events, the production of dedicated reports and publications, the distribution of (software) tools, the dissemination of informative lectures to the general public and communication through (social) media.

Secondly, as detailed in the description of our valorization strategy, we seek impact through close collaboration with stakeholders, co-creating added value. We measure the use of our research products by our stakeholders (Cell 5) primarily by looking at the fruits of these collaborations. By providing research output they can use, stakeholders get a better understanding of the added value that our research may have for them. This added value often is a starting point for discussing next steps in the research challenge and collaboration, adding to the second component of our valorization objective. Furthermore, measuring the broader impact and societal relevance of research output calls for alternatives to traditional metrics based on citations. Our commitment to impact outside academia is reflected in including Altmetric scores as a KPI in this category. These assign significant weight to mentions and social-media scores, giving insight into such forms of impact. We do acknowledge the principled problems in any such composite indicator.[2]

Finally, we consider the amount of funding from the industry and third parties for our research a mark of recognition for the societal relevance of our research (Cell 6). Of course, memberships of advisory boards and awards granted by industry or societal institutions also add to the recognition of having created impact with our research.

[2] Gumpenberger et al., *Scientometrics*, 2016. https://doi.org/10.1007/s11192-016-1991-5

**We translate high-quality research into added value for industry, government, and society**

# Chapter 5. Achievements during the past six years

## 5.1. RESEARCH QUALITY

Disciplinary excellence is a cornerstone of our mission (Chapter 1) and one of our strategic aims (Chapter 2). The current section reflects on the quality of our research, with separate discussions of each of the relevant sets of Key Performance Indicators identified in Chapter 4. These discussions, in Sections 5.1.1 to 5.1.3, are not meant to be comprehensive (see appendices for full details), but rather show the high level and diversity in the recognition that our research receives from our peers. As a case study for our research quality, we have chosen to highlight one distinctive strength of our department: our research-driven efforts at improving Open Science and research practices (Section 5.1.4). The text box below displays what we regard as our key achievements.

**KEY ACHIEVEMENTS 'RESEARCH QUALITY'**

- The relative number of publications in target journals has steadily increased over the past six years.
- Almost 60% of our work is published in outlets of high quality by the standards of our publication strategy.
- Our scientific excellence is recognized by the outstanding reputation of our top researchers and highly cited journal publications based on the FWC-index.
- Scientific awards for researchers at all career stages, from PhD thesis awards through personal research grants to career awards.
- The pioneering work of researchers in our department on research integrity provided the blueprint for the workflow of the TU/e Ethical Review Board.

### 5.1.1. CELL 1: DEMONSTRABLE PRODUCTS

Our quintessential scientific products are scientific publications, editorships, and dissertations. Manuscript-based citations are perhaps the fairest mark of quality and visibility but can only be measured after publication. Our publication strategy, introduced in 2019, provides guidance to our researchers and a shared framework for assessing research quality with sufficient attention for differences between publication cultures (see Appendix E).

We have chosen a journal's article influence score (AIS) as an important proxy for quality when selecting an outlet in the submission phase. The AIS is a normalized journal-based metric that indicates the average influence of articles over the first five years after publication and excludes self-citations. A downside of the AIS is that it is available only for Web of Science (WoS) indexed journals and excludes a number of relevant journals for our domain.

Our ambition is to publish frequently in first quartile (Q1), preferably even top 10% ranked journals, based on the AIS. However, in line with our publication strategy we respect that publication cultures differ between disciplines. Where WoS does not cover the scientific outlets relevant to individual

disciplines, our groups' target outlets reflect domain-specific considerations of both rigor (i.e., quality) and relevance (e.g., important audience, status and prestige in the specific domain). These domain-specific lists include journals, important peer-reviewed conferences, and widely respected publishers of books.

**A. Publications in line with publication strategy**

A full count of publications is listed in Table J1 in Appendix J. Here, we discuss the two ways (introduced in Chapter 4) in which we demonstrate that our publications are in line with the publication strategy: (i) the percentage of publications in target journals; and (ii) the percentage of publications in the top 10% and Q1 journals according to their Article Influence Score (AIS) in Web of Science (WoS).

i. As illustrated in Figure 5.1, since the introduction of our publication strategy, **the relative number of publications in target journals has steadily increased**. This includes all peer reviewed scientific articles. Also, although our publication strategy emphasizes quality over quantity, we do publish more in target journals (160 articles in 2022, 105 in 2019) as well as overall, if we compare the start and end of the assessment period (370 articles in 2022, 301 in 2017).

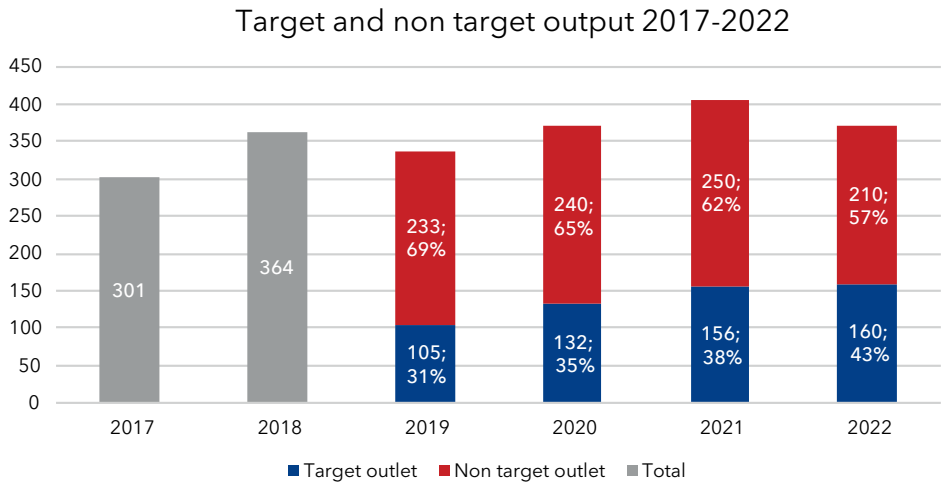



**Figure 5.1. Target vs. other publications over the assessment period**

ii. Figure 5.2 zooms in on target and WoS indexed publications. Of these articles, 16% was published in top 10% ranked journals. Furthermore, almost half (48%) of our research output is published in Q1 journals. The green segment indicates the additional proportion (9%) of articles published in non-Q1 WoS journals, which are still included as target journals because of the reasons outlined in our publication strategy. Summing up these categories, **almost 60% of our work is published in outlets of high quality by the standards of our publication strategy**. Note that our publication strategy acknowledges that high-quality work (particularly in some disciplines) may be published in formats others than journal papers and outlets not or poorly covered by WoS – such as research monographs, conference proceedings, and edited volumes.

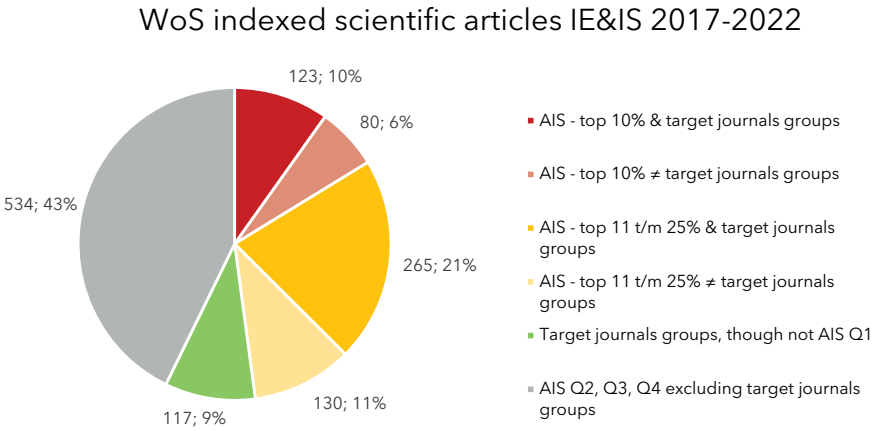



**Figure 5.2. AIS and target publications (WoS data)**

In addition, we want to give a more qualitative, content-based idea of how our research output matches our strategy. For this, we have selected articles that clearly illustrate the recognition that our scientific excellence receives. Table 5.1 contains brief descriptions of four articles of which we are particularly proud.

**Table 5.1. Examples of highly cited journal publications**

***Bakker, A. B., & Demerouti, E. (2017). Job demands–resources theory: Taking stock and looking forward. Journal of occupational health psychology, 22(3), 273-285.***
https://doi.org/10.1037/ocp0000056
A highly cited (1693 citations) paper in which the authors look back on the first 10 years of the JD-R model (2001–2010), and discuss how the model matured into JD-R theory (2011–2016). They also look at the future of the theory and outline a research agenda.

***Lakens, D. (2017) Equivalence Tests: A Practical Primer for t Tests, Correlations, and Meta-Analyses. Social Psychological and Personality Science, 8(4), 355-362.***
https://doi.org/10.1177/1948550617697177
A key example of open science (797 citations), this highly cited practical primer with accompanying spreadsheet and R package enables psychologists to easily perform equivalence tests (and power analyses) by setting equivalence bounds based on standardized effect sizes and provides recommendations to prespecify equivalence bounds.

***Peeters, J.F.W., Basten, R.J.I., Tinga, T. (2018). Improving failure analysis efficiency by combining FTA and FMEA in a recursive manner, Reliability Engineering & System Safety, 172, 36-44.***
https://doi.org/10.1016/j.ress.2017.11.024
This paper (140 citations) presents a novel method for maintenance of capital goods. The paper is not only well cited but also a great example of how our research leads to real world impact.

***Köhler, J., Geels, F. W., Kern, F., Markard, J., Wieczorek, A., Alkemade, F., ... Wells, P. (2019). An agenda for sustainability transitions research: state of the art and future directions. Environmental Innovation and Societal Transitions, 31, 1-32.*** https://doi.org/10.1016/j.eist.2019.01.004
This paper with more than 800 citations presents the research agenda for sustainability transitions research. The invitation for Anna Wieczorek and Floor Alkemade to participate in this agenda setting process underlines the pivotal role of the TIS group in the sustainability transitions field. Several substantive responses to the agenda have also been formulated and published.

**B. Editorships**
We consider editorships in general, but particularly those for target and high-quality outlets, another important mark of quality and a means to further increase visibility (for a complete list see Appendix K). Over the past six years, our faculty have acted as (associate) editor, editor-in-chief or guest editor for more than 50 journals, including 18 Q1 (target) journals, and for eight special issues. These numbers are not only an important mark of recognition by our peers; we are also proud that our researchers show outstanding academic citizenship by investing time and effort in these crucial roles for the profession.

**C. Dissertations**
Table 5.2 presents the PhD dissertations defended in our department during the assessment period. Comparing 2017 and 2022, this shows a steady increase of the number of PhD theses per year (including a marked drop in 2020, when some 15 foreseen defenses experienced delay mainly due to the COVID-19 pandemic). The number of newly started PhD thesis projects promises that this increase will be structural.


**Maaike Kompier**

The PhD theses are also of high quality, as can be deduced from the comments of committee members. In 2022, we were especially proud that two PhD candidates, Maaike Kompier and Ginevra Sanvitale, graduated **cum laude**: at the TU/e, this distinction is only given to the top 5% theses in their respective fields. Appendix I gives full details about the PhD success rates.

**Table 5.2. Dissertations 2017-2022**

| PhD theses | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|
| Theses defended | 10 | 19 | 21 | 13 | 27 | 23 |
| Projects started | 29 | 20 | 24 | 26 | 46 | 28 |

The quality of our PhD candidates, and the recognition for their work, is of course not demonstrated only by a successful defense. Virtually all PhD candidates (97%) who graduated in the past six years have taken new positions elsewhere. A large number of former PhD students have found positions at reputed universities such as Oxford University, Utrecht University, Ghent University, University of Geneva, VU Amsterdam and Technical University of Denmark. Overall, 46% continued their career in academia. An almost equal (45%) percentage of our PhD graduates transition to industry, taking positions at Brainport industry partners like ASML or large companies such as Shell and DAF. This is a direct sign of recognition and value for this sector.

### 5.1.2. CELL 2: DEMONSTRABLE USE OF PRODUCTS

The actual use of our scientific products is primarily measured with citations. For this purpose, in Table 5.3 we report H-indices of our Full, Associate and Assistant Professors, based on Scopus and Web of Science metrics, respectively. We also report Field-Weighted Citation indices as quantitative indicators of usage of our work. The average indices underline the strong reputation of our research staff. A more detailed list with H-indices per Full Professor is given in Appendix L. These illustrate the obvious differences between domains (e.g., between ethics and psychology), but also show the **outstanding reputation of some of our top senior researchers**, such as Evangelia Demerouti, Wijnand IJsselsteijn and Jan de Jonge. Moreover, two of our researchers, namely Daniël Lakens (2022) and Marcel Bogers (2021, 2022), are listed on 'Clarivate's Highly Cited Researchers' ranking.

**Table 5.3. FWC-index Scival and H-indices Scopus and WoS (average, *median*, (range)), 2017-2022**

| | H-index Scopus | H-index Web of Science | FWC-index Scival |
|---|---|---|---|
| Full Professor | **28.28**, *29*, (10-77) | **24.00**, *24*, (8-67) | **2.00**, *1.48* (0.68-8.85) |
| Associate Professor | **15.93**, *15*, (6-36) | **13.86**, *14*, (5-34) | **1.97**, *1.22* (0.47-8.32) |
| Assistant Professor | **7.03**, *6*, (1-21) | **6.12**, *6*, (0-17) | **1.87**, *1.22* (0.06-8.90) |

The Field Weighted Citation Index, which – unlike the H-index – is sensitive to differences between publication cultures has been impressively high throughout the assessment period and across all ranks for our department. In 2022 it even was 2.33 across all ranks, indicating that **our publications have been cited 133% more than expected for output in their domains**, putting us in the same range as the current top 20 research universities.[3] We score higher on this index than all Dutch universities of technology and EuroTech universities.

[3] Lancho-Barrantes and Cantu-Ortiz, *Scientometrics*, 2021. https://doi.org/10.1007/s11192-020-03790-1


**Evangelia Demerouti receives TU/e Leadership in Excellence Award 2022**


**Tugce Martagan - 2022 INFORMS Franz Edelman Laureate**

**Table 5.4. Citation analysis of articles published in recent years (based on Scopus analysis)**

| Publication year | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|
| Average number of citations (Median) | 29.3 (10) | 20.5 (8) | 16.2 (6) | 11.5 (6) | 6.9 (3) | 2.0 (0) |
| # publications cited ≥ 50 times | 29 | 31 | 24 | 14 | 5 | 1 |
| # publications cited ≥ 20 times | 100 | 104 | 66 | 62 | 24 | 5 |
| Base (N) | 325 | 361 | 348 | 408 | 410 | 400 |

A citation analysis was performed on our articles over the period 2017-2022 (see Table 5.4). This illustrates that our work is well appreciated for its quality and content. The average number of citations after five years for our articles (Scopus database) published in 2017 was 29.3; more recent publications score lower, as expected. Among our publications in the assessment period, 38 articles already have more than 100 citations.

### 5.1.3. CELL 3: RECOGNITION BY PEERS

**A. Scientific awards and prizes**

Our researchers regularly win scientific awards and prizes granted by their peer communities. Definite highlights in recent years were career awards for Sjoerd Romme (2019), who was the first European recipient of the Distinguished Scholar-Practitioner career achievement award of the Academy of Management (AOM), and for Armin Kohlrausch (2017), who received the Helmholtz medal, the highest award of the German Acoustical Society (DEGA). Two **exceptional marks of honor** were extended to Anthonie Meijers. He received the TU/e honorary medal and became Officer in the Order of Orange-Nassau, for his invaluable contribution to the domain of ethics and technology (see text box). Another highlight was the leadership in excellence award that Evangelia Demerouti received on the very first TU/e Research Day in 2022 for her internationally renowned research on the well-being and performance of employees. Another highlight is that Tugce Martagan is a 2022 INFORMS Franz Edelman Laureate. Laureates are recognized for their significant contribution to work that is selected as representative of the best applications of analytical decision making in the world. Two last highlights in this category are prestigious awards that were announced very recently: Wijnand IJsselsteijn was awarded the Distinguished NIAS-Lorentz fellowship 2024/2025 and Daniel Lakens was awarded the AMMODO Science Award for fundamental research 2023.

Anthonie Meijers was honored with a royal ribbon for his important contributions to the domain of philosophy and ethics of technology. Among others, Anthonie is co-founder and since 2005 editor in chief of the international journal Philosophical Explorations. He initiated the NWO program 'Socially Responsible Innovation', founded the national '4TU Centre for Ethics and Technology' and is the editor of the handbook Philosophy of Technological Sciences. This handbook is part of a 14 volume series in the philosophy of science, published by Elsevier Science. The TU/e also awarded him with the university's medal of honor for his foundational work on the development of ACQA method and his educational vision, which formed the foundation for the current TU/e Bachelor College and Graduate School.

A different noteworthy category of awards is that of **PhD thesis awards** in which academic rigor and quality are explicit criteria of evaluation. Several researchers in our department have won such awards, for research done at IE&IS or for their work prior to joining us (see Table 5.5).

**Table 5.5. Winners dissertation awards**

| Winner | Award | Year |
|---|---|---|
| Tugce Martagan | INFORMS TIMES Best Dissertation Award | 2017 |
| Laura Genga | Ing. Salvatore Valenti award | 2017 |
| Loe Schlicher | Beta PhD Award | 2019 |
| Paul Wiegmann | ISPIM Dissertation award | 2020 |
| Layla Martin | German OR Society Dissertation award | 2021 |

Other examples of recognition are appointments of our staff by influential science bodies. In this category, Paul Wiegmann was recently appointed Chairman of the European Academy for Standardisation (EURAS), which aims to promote progress in the academic treatment of standardization research. Another example, of which we are exceptionally proud, the KIN proposal that a committee of 23 climate researchers, chaired by Heleen de Coninck, wrote last year, as a direct assignment from NWO and KNAW. The proposal describes a radically innovative plan to establish a new network institute for broad, integrative, and collaborative scientific climate research, geared towards making a substantial contribution to the acceleration of the transitions required to create a sustainable, climate-neutral society.

**B. Scientific grants awarded by science foundations**

Producing high-quality research in Dutch academia is impossible without a strong institutional capacity for attracting external funding. As a token of recognition by peers, we are particularly proud of grants awarded by national and international science foundations.

During the assessment period, we have further intensified our efforts to better support our researchers in preparing grant proposals. Besides the activities of the PDO (see Section 3.4), we have set up a tailor-made coaching program in which junior faculty prepare strong applications for personal grants, especially within the Social Sciences and Humanities domain (e.g., NWO Talent program and ERC). In this program, grant-writing experts and former laureates offer support for all stages of the application process: they explain procedures and evaluation criteria, go through several rounds of feedback on draft proposals, help in preparing rebuttals, and organize mock interviews (after interview training by an external coach). Besides, the TU/e personal grants team provides general support to researchers preparing an application (e.g., budget, guidelines with regard to open access and open science). This has resulted in increased submissions, interview invitations and also granted projects.

Table 5.6 provides an overview of grants that science foundations awarded to our staff. We are extremely proud of our **staff members who received personal research grants**: a Vidi grant was awarded to Daniël Lakens in 2017 and Veni grants were awarded to Tugce Martagan (2017), Elizabeth O'Neill (2018), Emily Sullivan (2020), Loe Schlicher (2020), and Albert Schrotenboer (2022). Last but not least, Floor Alkemade was awarded an ERC Consolidator grant last year. Under the European Horizon Excellent Science Scheme, a Marie Skłodowska-Curie Actions (MSCA) European training network grant (4.5M€) was awarded to Yvonne de Kort, coordinator of the

'*LIGHTCAP - LIGHT, Cognition, Attention, Perception*' project, training 15 PhD candidates to become the light researchers of the future.

**Table 5.6. Highlighted projects in funding schemes selecting for scientific excellence**

| Grant | Assigned to | Year | Title project |
|---|---|---|---|
| NWO-Veni | Tugce Martagan | 2017 | *Optimization Models for Faster and Affordable Access to Rare Disease Therapeutics* |
| NWO-Veni | Elizabeth O'Neill | 2018 | *The Artificial Ethicists* |
| NWO-Veni | Emily Sullivan | 2020 | *Explain Yourself! The Scope of Understanding and Explanation from Machine Learning Models* |
| NWO-Veni | Loe Schlicher | 2020 | *Better Protection against Terrorism: Identification of Optimal Locations for Protective Resources* |
| NWO-Veni | Albert Schrotenboer | 2022 | *Learning the Future of Complex Decisions: A new Mathematical Approach* |
| NWO-Vidi | Daniël Lakens | 2017 | *Increasing the Reliability and Efficiency of Psychological Science* |
| ERC-Consolidator | Floor Alkemade | 2022 | *Fostering Social Tipping dynamics to Accelerate Sustainability Transitions* |
| Marie Skłodowska-Curie Actions | Yvonne de Kort | 2020 | *LIGHTCAP: Light, Cognition, Attention, Perception* |
| NWO-Gravitation | Wijnand IJsselsteijn | 2019 | *Ethics of Socially Disruptive Technologies* |
| NWO-Crossover | Floor Alkemade | 2019 | *NEON: New Energy and mobility Outlook for the Netherlands* |

An exceptional mark of recognition in this category is the 10-year long NWO Gravitation project 'Ethics of Socially Disruptive Technologies' (17.5M€), for which Wijnand IJsselsteijn is one of the principal investigators and in which many researchers from the Philosophy & Ethics and Human-Technology Interaction groups participate. A second very large project, for which Floor Alkemade is one of the principal investigators, is the NWO Crossover project 'NEON - New Energy and mobility Outlook for the Netherlands' (12.5M€). Both projects, briefly described in the table below (Table 5.7), are more than tokens of recognition for the outstanding quality of our research: they are also exemplary illustrations for how we generate societal impact through high-quality research, since outreach activities are integral to both projects.

**Table 5.7. Descriptions NWO Gravitation project 'Ethics of Socially Disruptive Technologies' and NWO Crossover project 'New Energy and mobility Outlook for the Netherlands'**

**Gravitation Research programme: Ethics of socially disruptive technologies**

New generations of technology, as diverse as artificial intelligence, robotics, synthetic biology, nanomedicine, genomics, neurotechnology and geo-engineering have been identified as socially disruptive. Their implementation and use present important challenges to the very concepts and values that we normally appeal to in our moral thinking, such as the distinction between nature and artifact or our conceptions of freedom and responsibility. The overall aim of this Gravitation Research programme is to develop a comprehensive philosophical understanding of the socially disruptive technologies (SDTs) of the 21st century.

With Wijnand IJsselsteijn as one of the PI's, IE&IS plays a major role in this programme. Our P&E and HTI groups focus on the investigation of the extent to which socially disruptive technologies have implications with regard to humans, humanity and the human condition. In addition, they develop synthesizing perspectives on normative frameworks, and on how these should find a place in the construction of new technologies and the development of regulatory frameworks.

Gravitation consortia are recognized as the world's top in their field of research. In this prestigious and ambitious ten-year programme, the consortium aims to realize a reflective turn in the ethics of technology, to help every individual and society at large in living responsibly and successfully with socially disruptive technologies, also in the context of responding to pressing global problems such as climate change and depletion of natural resources.

**NWO Crossover project NEON - New Energy and mobility Outlook for the Netherlands**

Humankind is destabilizing the world's ecosystem, yet in spite of global and national awareness, numerous technological innovations, and clear economic benefits, the change to sustainable energy and mobility is faltering, not in the least in the Netherlands. The NEON NWO Crossover project addresses three interrelated societal challenges: climate action, renewable energy, and intelligent green transport and focuses on the development of new methods and techniques to give the energy transition a significant boost.

The NEON Consortium is a unique combination of researchers in the exact/engineering sciences, social sciences, and humanities, led by Eindhoven University of Technology. IE&IS researchers lead four work packages within NEON, focusing on standards and sustainability (Rudi Bekkers), sustainable logistics (Tom Van Woensel), future market models (Floor Alkemade) and the core NEON model (Floor Alkemade). The core model brings together the different disciplinary contributions from all partners in a systems context. Here we also assess the environmental impact of NEON solutions (Heleen de Coninck and Arjan Kirkels). NEON is thereby firmly embedded in the department's Sustainability and Circularity theme and closely cooperates with EIRES.

### C. Keynote lectures and invited talks at prestigious institutes and conferences

Another relevant indicator for the prominence of our faculty in various academic networks are keynote speeches and lectures at important academic conferences, renowned institutes and for large audiences of peers. Illustrative examples are Evangelia Demerouti's 2019 keynote 'The Work-life Interface from a Contemporary Perspective' at the EAWOP congress for an audience of 2,500 occupational scientists and Sjoerd Romme's 2019 keynote 'Mixing oil with water: thriving at the interface between engineering, social sciences and humanities' for all faculty members of the Technology Management & Economics department of Chalmers University of Technology. Also notable is Yvonne de Kort's invited talk at the 2021 Conference of the CIE, the International Commission on Illumination, which is the global expertise and standardization body for the lighting domain. These and additional examples are listed in Table 5.8 (for more examples, see Appendix M).

**Table 5.8. Examples of prestigious keynote lectures, in chronological order**

| |
|---|
| Rudi Bekkers: "Discrimination against Foreigners in the Patent System: Evidence from Standard-Essential Patents" at The Future of Open and Collaborative Standard Setting: LCII -TILEC Conference, May 30, 2017, Brussels, Belgium |
| Anna Wieczorek: "Unpacking sustainabilities in various transition contexts" at Africa-Europe Dialogue Symposium on Innovation for Sustainable Development, December 1, 2017, Pretoria, South Africa |
| Sjoerd Romme: "Mixing oil with water: thriving at the interface between engineering, social sciences and humanities" at workshop for faculty & doctoral students, Technology Management & Economics department, Chalmers University of Technology, March 22, 2019, Göteborg, Sweden |
| Evangelia Demerouti: "The work-life Interface from a contemporary perspective" at EAWOP 2019 - European Association of Work and Organizational Psychology, May 31, 2019, Turin, Italy |
| Daniël Lakens: "The reproducibility crisis in research: Methodological issues and proposed remedies" at Annual Conference International Society of Psychoneuroendocrinology, August 30, 2019, Milan, Italy |
| Wijnand IJsselsteijn: "Warm Technology and co-design with People with Dementia", Alzheimer Europe, October 24, 2019, The Hague, The Netherlands |
| Yvonne de Kort: "An integrative perspective on dynamic lighting, and how it should be studied" CIE Conference 2021, September 27, 2021, Kuala Lumpur, Malaysia |
| Willem van Jaarsveld: "The impact of committing to customer orders in online retail" at International Symposium for Inventory Research, August 25, 2022, Budapest, Hungary |
| Pascale Le Blanc: "A human-centered approach of technologization in organizations" at the Conferencia de Competitividad del País Vasco 2022, November 17, 2022, Bilbao, Spain |

### 5.1.4. CASE STUDY: OPEN SCIENCE AND RESEARCH INTEGRITY

Our qualities as researchers do not manifest only in high-quality output. They are also revealed by our ability to reflect on our research practices, to identify the potential for improvements, and to gain recognition for our efforts to improve our own practices and those of others. As a case study for our research quality, we have chosen to highlight these efforts, because we believe that they constitute a distinctive strength of our department. We have devoted substantial time and effort to open science and research integrity for many years, and currently play a leading role in national and international efforts regarding these topics, contributing to improving research quality everywhere.

**Open Science**

The movement towards Open Science is undeniably gaining in strength, and rightly so. Reliable and efficient research requires transparency of methods, as well as sharing of data and research output. Our publication strategy strongly emphasizes the importance of open access publications. Currently about 90% of our publications are open access: their final, published versions are available via repositories worldwide or via the TU/e research portal (see Figure 5.3). As a next step, we are increasingly emphasizing the importance of sharing data, scripts and algorithms and we are discussing how these often time-consuming efforts should be stimulated and recognized.

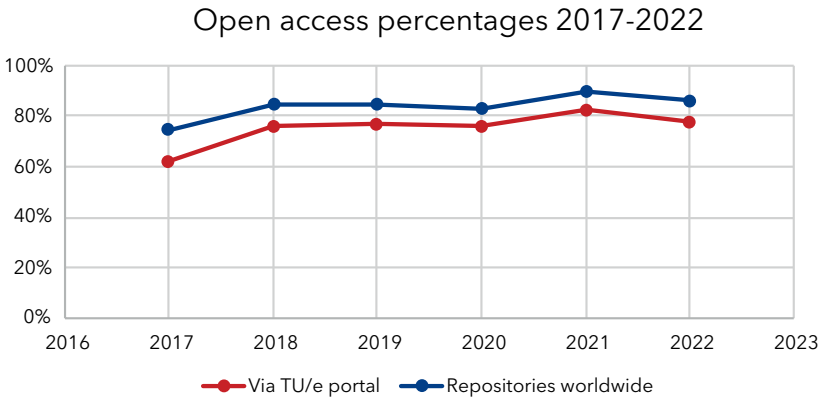



**Figure 5.3. Open access publications 2017-2022**

**Research integrity**

A prime illustration of our long-standing commitment to best research practices is the ARCHIE system, developed by the HTI group in 2013. ARCHIE is an experiment-management and data-archiving system, through which researchers submit research proposals for internal approval, and securely upload and save experimental data (mandatory and unalterable after the initial upload). Notably, in 2014, a review of 50 top technical universities concluded that "unless the law required it, even top technical universities generally do not use ethics committees" (Koepsell, Brinkman & Pont, 2014). We were therefore, even then, at the forefront of adopting such practices. In the past decade, we have gradually adopted more rigorous reviewing of proposals and a stronger emphasis on well-powered studies.

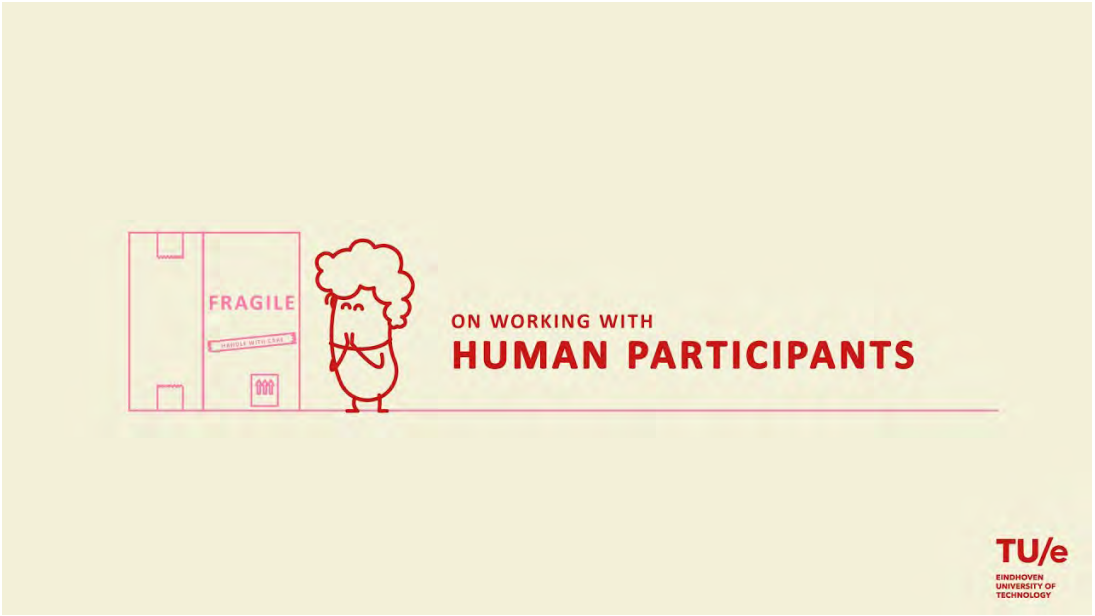
The **pioneering work of researchers in our department provided a blueprint for the workflow of the TU/e-wide Ethical Review Board** that started in 2019. Our department provides the chair (Daniël Lakens) and two of the fourteen contributing members (Philip Nickel and Leander van der Meij). Many members of the P&E group provide research ethics training to all PhD students and EngD trainees of the TU/e; recently, Krist Vaesen substantially redesigned this training, which receives consistently high praise from participants. Wybo Houkes and Anthonie Meijers have also campaigned for a university course program on moral leadership for senior researchers, and increased attention for integrity aspects in HR policies. A very different, but equally relevant example is Pieter Van Gorp's active facilitation of open science practices and reproducible research, for instance by maintaining the SHARE20.eu cloud, a web portal that enables academics to create, share, and access remote virtual machines that can be cited from research papers, and aims at disseminating the use of systems that provide reviewers and fellow researchers a convenient way to reproduce computational results of research papers.

Many of our faculty are actively contributing to the national and global discussion and adoption of open science practices and research integrity, based on their own theoretical and empirical research. Daniël Lakens focuses on how to design and interpret studies, on how to apply (meta)-statistics and reward structures in science, and he formed a group of junior researchers around this theme with his Vidi grant. He and his group (Anne Scheel and Peder Isager, among others) have written numerous influential papers on this theme, developed MOOCs and workshops to educate scholars around the world, and are developing advanced tools and methodologies to improve reliability and efficiency of psychological science. Their research on replicability in the behavioral

and social sciences led NWO to launch a pilot program on replication studies with calls in 2017, 2018 and 2019.

There are many other examples of this research-driven approach to integrity issues. Krist Vaesen examines a range of meta-scientific questions. His research on the fair distribution of research triggered extensive debate, and led to an advice by the Dutch Academy for the Sciences (KNAW) that endorses a basic research income for all Dutch researchers. Dunja Šešelja studies formal models of scientific inquiry to learn how scientific dissemination, awards, funding and collaboration practices can be improved. Elena Mas Tur studies scientific practices and collaboration through network analyses, mathematical and simulation models of diffusion based on scientific metadata. The efforts of these researchers are further supported by an internally funded PhD candidate, Andrea Kis, who examines similarities between adopting open science practices and adopting practices of pro-environmental behavior. This project has resulted in a recent publication reflecting on PhD attrition and unhealthy research environments[4]. Maryam Razavian offers a closely related perspective, by focusing on engineers rather than researchers. Through social-aware software development, she tries to facilitate their engaging with ethics and human values at every stage of the development phase. In a collaboration with Elizabeth O'Neill and Anthonie Meijers, a first-tier funded PhD candidate, Chirag Arora, investigated the roles and responsibilities of software engineers in developing datafied health software.

Promoting and safeguarding open science and research integrity is complex and relies heavily on the development of new tools, advanced data analyses and software, as well as on the successful acceptance of ethical standards, cultural transition, and behavior change. Our multidisciplinary staff is uniquely equipped to improve research practices despite this complexity.




[4] Kis et al., *PLOS ONE*, 2022. https://doi.org/10.1371/journal.pone.0274976

## 5.2. RELEVANCE TO SOCIETY

Creating impact on relevant industrial, governmental, and societal challenges in multidisciplinary collaborations is another cornerstone of our mission (Chapter 1) and the second of our strategic aims (Chapter 2). In this section, we discuss the impact of our research, reflecting on the Key Performance Indicators listed in Cells 4 to 6 of Table 4.1 (Chapter 4).

Our main aim is not to be comprehensive in all respects, but to demonstrate the success of our valorization strategy (Section 3.3). For this, we use a combination of highlights (cases listed in the right text box below, described in more detail in Appendix N), selected other examples, and where possible, suitable quantitative measures. The left-hand text box below displays what we regard as our key achievements.

**KEY ACHIEVEMENTS 'RELEVANCE TO SOCIETY'**

Coordination of large-scale projects, such as cVPP, with and for societal target groups

Collaborative research on societal problems with industry partners such as ASML, MSD Health; governmental bodies; and NGOs

Leadership in valorization communities such as the European Supply Chain Forum (ESCF) and the Center for Humans & Technology (CH&T)

94 publications in Top 5% Altmetric score

132 second-tier and third-tier funded research projects, 63 co-funded by industry

**CASES (with research theme)**

BIOMANUFACTURING (SCM / VoDDI)

CLIMATE POLICY (S&C)

DEMENTIA (H&T)*

ENERGY TRANSITION (S&C)*

FOOD WASTE (SCM)*

PATENTS

SEMICONDUCTOR PRODUCTION (SCM)*

* Winner of IE&IS Valorization Prize

### 5.2.1. CELL 4: RESEARCH PRODUCTS FOR STAKEHOLDERS

**A. Outreach activities**

We organize a wide variety of activities that involve non-academic stakeholders at the initial, intermediate, and final stage of research projects. These activities are meant to identify societally and industrially impactful research topics and external project partners, and to co-create and disseminate research results.

Many of these activities take place in **valorization communities**. The development, coordination and maintenance of these communities are key activities in our valorization strategy. Therefore, besides describing specific activities, we highlight these more persistent, enabling activities – both for existing communities and for establishing new long-term collaborations with specific stakeholders during the evaluation period.

Two such communities, which have been established long before the present evaluation period, but which continue to serve as benchmarks for our efforts are:
1. the European Supply Chain Forum (ESCF)
2. the Center for Humans and Technology (CH&T)

Each of these communities (see Appendix G for longer descriptions) organizes workshops and events on a regular basis. These have a specific thematic focus, and are attended by academic partners outside our department as well as non-academic stakeholders.

**Activity highlights**
One highlight has been the launch of the Expertise Center Dementia & Technology (ECDT), early summer 2021 (case DEMENTIA in Appendix N). This center was founded together with Alzheimer Nederland, the principal charitable NGO in the Netherlands representing and serving the needs of people with dementia. It directly builds on an earlier outreach activity, organized by the CH&T in April 2018: the yearly Alzheimer NL public outreach day, which was organized together with Alzheimer Nederland. Organization of this day and later establishment of the ECDT shows our willingness to invest in large-scale outreach activities for primary stakeholders, and our ability to establish long-term research collaborations on the basis of successful activities.

A second highlight in this category is directly related to the valorization efforts in large-scale research projects coordinated from our department. This concerns the community-based Virtual Power Plant (cVPP) project that studied how renewable energy production can be organized and owned by a community (case ENERGY TRANSITION in Appendix N). Activities include implementations in immediate collaboration with local stakeholders, empowering them in management of the energy transition. This shows our commitment to leadership of international research projects of which valorization is an integral part, as well as our commitment to valorization that goes beyond traditional ideas of knowledge dissemination.

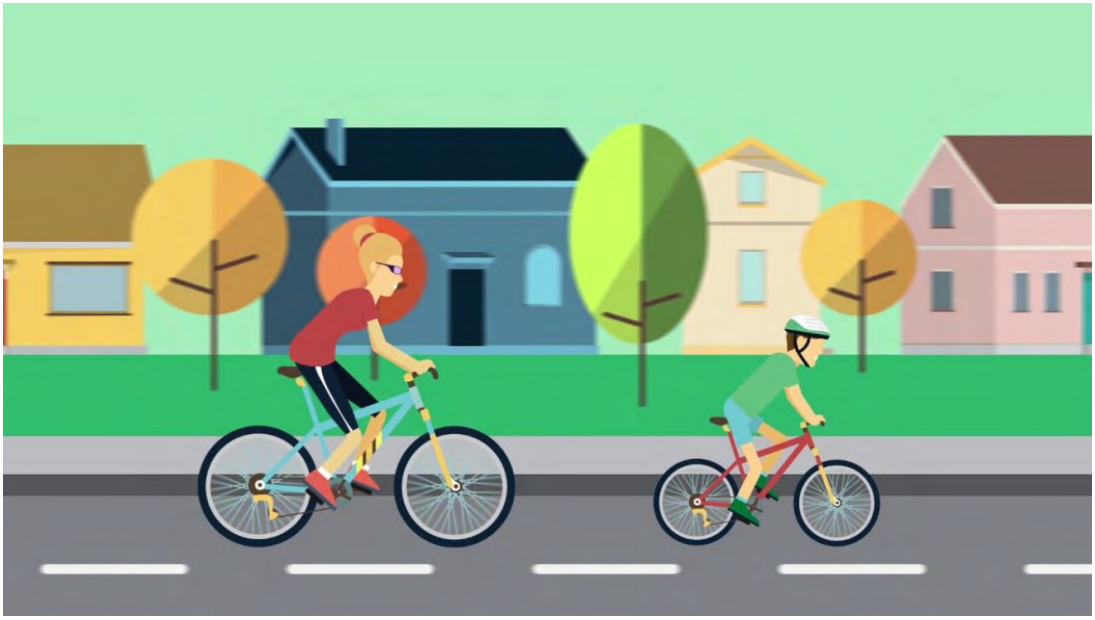
**Other examples**
Many other outreach activities have been organized in the context of large research-oriented and/or externally funded projects. Typically, such activities are central deliverables of these projects, to which significant project resources are allocated, as in the cVPP project described immediately above. Another example of this kind, the BRIDGES project, involves workshops in electrical engineering and renewable energy services for staff of universities in Somalia/Somaliland. Our track record of successfully organizing such activities puts us in an excellent position for funding schemes that require viable plans for societal outreach (see 'Research funding' under 5.2.3 below).

Some outreach activities are not immediately related to research-oriented projects, but nonetheless serve to bring together scholars and various non-academic stakeholders. Particularly high-profile activities of this kind were the 2021 and 2022 World Open Innovation Conferences, organized by the ITEM group at the High Tech Campus Eindhoven. Moreover, we actively participate in stakeholder activities organized by local or national research centers, such as the Data Science Summits at TU/e, or events organized by stakeholder organizations, such as the European Automotive Partners Association (EARPA). This has led to participation in events on a large variety of topics, such as the role of data science and AI in healthcare, smart mobility, and smart maintenance. The pages of our research groups provide more specific examples of this kind.


**Marcel Bogers at the World Open Innovation Conference 2022**

**B. Publications and tools for stakeholders**

Many research projects of the department aim to develop products directly for, and in close collaboration with, stakeholders outside academia. Products take a wide variety of forms, both traditional ones (e.g., policy reports, expert opinions) and exclusively digital ones (e.g., serious games such as GameBus, or online business tools such as the Fuzzy Self-Tuning PSO).



Screenshot GameBus app

Publications and tools for stakeholders are typically produced in combination with outreach activities (see Section 5.2.1.A) and various forms of co-creation. This improves their potential for real impact, or minimally guarantees accessibility and utility of information. Often, this requires intensive, long-term collaborations to ensure that the interests of stakeholders are aligned and products have added value. These aspects are brought out in the following two highlights.

**Stakeholder-product highlights**

The 'Sell More, Waste Less' project demonstrates our capacity to develop a suite of tools in close collaboration with stakeholders, to facilitate meeting a societally meaningful goal. In this project, this concerned the reduction of food waste, and a collaboration with a large group of retailers (Case FOOD WASTE in Appendix N). Among other things, the project developed a tool to make trade-offs between the cost of more waste and the benefits of higher on-shelf availability, indicators of food waste, and methods for reducing waste caused by consumers squeezing products in supermarkets. These tools have been tested and implemented by retailers in the Netherlands and abroad.

Where the first highlight involves a set of tools developed in on-going collaboration, a second highlight demonstrates our ability to collaborate directly with stakeholders on a highly complex product. The research done on the Essentiality Assessment system for the European Commission (Case PATENTS in Appendix N) resulted in a widely shared report, a public hearing at the European Parliament, and multiple presentations of the results to stakeholders. That it built on the long-term network and collaborations with, among others, patent offices and patent owners enabled doing this research. Because of its quality and broad support, the study's recommendations will be followed up by the European Commission.

**Other examples**

In addition to these highlights, we more briefly describe four specific examples here. These illustrate the scope of our outreach, regarding forms and societal target groups. All examples were featured among the key output of the seven research groups; more examples of outreach products can be found in Appendix A.

- The policy report *Urgent Upgrade* on safeguarding public values in the digital society, produced by Lambèr Royakkers and Rinie van Est in close collaboration with the Rathenau Institute by request of the Dutch Senate (Kool, Timmer, Royakkers and Van Est 2017). It describes how the far-reaching digitization of society challenges central public rights and values such as privacy and human dignity. It reveals that governments, regulators, industry and society are not yet fully equipped to deal with this new set of challenges.
- The MOOC "Improving your statistical inferences" (2017) – and its follow-up "Improving your statistical questions" (2019) – by Daniël Lakens. Both are available via Coursera. They build directly on Lakens' research on meta-science, are aimed at helping researchers to interpret the results of statistical analyses and to design experiments, through hands-on assignments. They emphasize the importance of various Open Science principles and replication studies.
- The "Ecosystem Pie Model" developed by Madis Talmar, Bob Walrave, Ksenia Podoynitsyna, Sjoerd Romme and Jan Holmström (Aalto University, Finland). This business tool for mapping, designing, and analyzing innovation ecosystems has been co-created with societal stakeholders and was published in Long Range Planning (2020) and in the 4TU Entrepreneurship for Engineers MOOC.
- The Job Crafting Intervention tool, developed by Evangelia Demerouti, Pascale Le Blanc and others, is aimed at increasing sustainable employment of employees by teaching them how to adjust job characteristics in line with their work goals. Interventions have been found to improve employee well-being (e.g., work engagement, burnout, health) and functioning (e.g., task and contextual performance, innovative work behavior, safety behavior, adaptation to change, service orientation).

**C. Dissemination results to the general public**

In addition to developing products for selected non-academic stakeholders, our staff actively and successfully engage in reaching out to the general public. Such outreach is an integral part of our mission in researching societal challenges rather than being an afterthought or by-product. More in particular, our valorization policy is to value the capacity for impactful outreach in hiring and promotion decisions, and to facilitate such activities in task distributions (e.g., by reducing teaching tasks). The implementation and success of this policy – with regard to dissemination to the general public as well as to professional stakeholders – is shown in the following highlight.

**Dissemination highlight**

In April 2020, Heleen de Coninck was appointed as a Full Professor of socio-technical innovation and climate change (case CLIMATE POLICY in Appendix N). Prior to her appointment, she had established herself as coordinating lead author in the reports of the Intergovernmental Panel on Climate Change (IPCC). Following publication of IPCC's Sixth Assessment Report, a deliberate decision to reduce her teaching load enabled her to coordinate media efforts of all Dutch authors of the report, leading to a huge set of dissemination results, increasing our reputation as a center for research on the topic, and leading to acquiring extra research funding and attracting extra research talent. Our record of dissemination products by Heleen de Coninck features **140 unique items** (op-eds, radio interviews, television interviews) from June 2020 to December 2022.


**Interview Heleen de Coninck at Dutch TV program Khalid & Sophie**

**Other examples**

Our efforts have resulted in a very large number of dissemination products relevant to this performance indicator, on a wide range of current societal challenges: over 950 have been registered in Pure (TU/e's current research information system) for the evaluation period.

These dissemination products include short articles written by our researchers as well as interviews in various news media, related to established research strengths and particular research products. Examples – some of which concern the activities and products discussed earlier in this section – include:

- Radio interviews and expert opinions on the digital society, robotics and AI ethics (Peter Ruijten, Wijnand IJsselsteijn; Jan Smits; Emily Sullivan, Vincent Müller, Lambèr Royakkers)
  Examples: episode of US public radio show "Why?" on machine learning with Emily Sullivan (September 2021); episode of Dutch national TV show 'Tegenlicht' on digital agents with Vincent Müller (July 2020); interview with Peter Ruijten for news website nu.nl on household robots (20 October 2018).
- Op-eds and interviews on open science and meta-science (Daniël Lakens; Tim van der Zee; Krist Vaesen)
  Examples: interviews on basic research income in *Times Higher Education* and on NWO's "Replication Studies" scheme in *Science*.
- Interviews and reports on job crafting, burnout and job search (Evangelia Demerouti; Leander van der Meij; Pascale Le Blanc; Inge Hulshof)
  Examples: interviews on job-search stress in national newspaper NRC; "British pilots score high on burnout scale" (*Daily Mail*, 19 April 2018).

- Interviews and reports on runner's addiction and running injuries (Josette Gevers, Luuk van Iperen, Jan de Jonge, Steven Vos)
  Example: "Running addiction: How Exercise Can Become an Unhealthy Obsession" (*Healthline*, 21 March 2020); "How the power of the mind can help reduce injuries during long-distance running" (Medical Xpress, July 2022)
- Coverage of operations research into biomanufacturing (Tugce Martagan)
  Example: "Reducing costs and lead times in biomanufacturing" (IFORS News, March 2020)
- Interviews and reports on lighting research (Yvonne de Kort; Maurice Donners (Philips Lighting); Antal Haans; Daniël Lakens; Luc Schlangen)
  Example: "Calling Bat Fans", on bat-friendly road lighting

These examples show the broad scope of national and international dissemination and coverage of our research. They also highlight how researchers at every career stage, from PhD candidates to Full Professors, are committed to this form of outreach.

### 5.2.2. CELL 5: USE OF RESEARCH PRODUCTS BY SOCIETAL TARGET GROUPS

**A. Use of research products by stakeholders**
As outlined above, research products for stakeholders take many different forms, tailored to a wide variety of target groups. Two examples which demonstrate substantial and lasting success are provided by the following two highlights.

**Use highlights**
A portfolio of optimization models and decision-support tools, developed by a multidisciplinary team from our department and industry, led to great productivity improvements at MSD Animal Health (case BIOMANUFACTURING in Appendix N). It has so far generated over 200 million euro of revenue, reduced output variability, and reduced energy consumption and carbon emissions by 40% and 468 tons respectively. The results have quickly gained considerable recognition both inside and outside of academia (see Cell 6 below) and will be extended to other production sites in industry in the coming years.

Similarly, a collaboration between our department and the leading lithography-machine manufacturer ASML resulted in a new method for the inventory planning of spare parts and service tools (case SEMICONDUCTOR PRODUCTION in Appendix N). Implementation of this method in ASML's entire service network in 2020 has led to a reduction of extreme downtime events by 20% and a resulting estimated yearly benefit of 1.5 billion euro for the semiconductor industry. Also here, results gained recognition inside and outside of academia, and have facilitated the start of new projects with ASML on topics studied in different groups of the department.

**Other examples**
Other research products for stakeholders have seen successful use by entirely different measures. This is best captured by discussion of a variety of examples, which also characterize a variety of suitable measures of success. Below, we return to the activities and products described in Section 5.2.1 and now focus on the use of them, where we add more examples that are successful by the same measure:

- The policy report *Urgent Upgrade* inspired many initiatives in policy, politics, science and society in the field of digitization, such as the Dutch digitalisation strategy (2018), the Temporary

Committee on the Digital Future (TCDT) of the House of Representatives of The Netherlands (2019), the NWO call for proposals Digital Society – The Informed Citizen (2019), and two stakeholder workshops with over 100 key players in the field organized by the SER (the Social and Economic Council of the Netherlands). Similarly, as described above (Section 5.2.B – Stakeholder-product highlight), research done on the Essentiality Assessment system will be followed up by the European Commission, leading to substantial improvements in the patent system.

- The MOOC "Improving your statistical inferences" has more than 68,000 learners, who rated it 4.9 (out of 5). 40% of learners already have a Master's degree. For this course, Daniël Lakens received the Leamer-Rosenthal Prize for Open Social Science in the category 'Leader in Education' in 2017.
  More broadly, the results of our research-driven approach to integrity issues have triggered debates on improving research practices and funding policies. Daniël Lakens' research on replicability in the behavioral and social sciences led NWO to launch a pilot program on replication studies with calls in 2017, 2018 and 2019. Krist Vaesen's research on the fair distribution of research triggered extensive debate, including a response from the chairman of NWO. An advice by the Dutch Academy for the Sciences (KNAW) on a 'rolling-grant fund' endorses a basic research income for all Dutch researchers as advocated in the work of Krist Vaesen (also see Section 5.1.4).
- The "Ecosystem Pie Model" is used at organizations such as Red Eléctrica de España, where the Grid2030 innovation program included over 180 industrial partners and led to more than 2M€ investments, at RWE Generation (GER) for new business development, at Accenture and EIT InnoEnergy in consulting on ecosystem strategy. Other applications are at Swedegas (SWE) and Bosch (GER).
- The Job Crafting Intervention tool has been applied at two local hospitals (Elkerliek and Diaconessenhuis), at UPS, Friesland Campina and ASML, at the UWV (the Dutch Employee Insurance Agency), at TU/e, and specifically for implementing safety protocols at IKEA. A self-training module has been developed in which employees watch short videos and are guided to learn job crafting behavior by keeping a diary booklet.

**B. Altmetrics**

Altmetric scores, which assign significant weight to mentions and social-media scores, measure the broader impact and societal relevance of research output. In this respect, our success becomes apparent by our researchers' large number of publications with exceptionally high scores. Appendix O lists **94 publications** produced in the evaluation period that currently belong to the **Top 5% of all items with an Altmetric score**. Of these, 42 have Altmetric scores over 100. These Altmetric scores reflect our ability to attract attention on a broad range of topics, well beyond academia alone. Among our Top 5% publications, there are items on such topics as diverse as:

- competitive research funding (Vaesen and Katzav 2017; score 629)
- lighting research (te Kulve et al. 2019; score 208)
- mobility protests (Bruno et al. 2021; score 320)
- Pleistocene fire use (MacDonald et al. 2021; score 399)
- replication studies (Klein et al. 2018; score 194)
- sex robots (Frank and Nyholm 2017; score 105)
- sportsmanship (Demerouti and Cropanzano 2017; score 160)
- thermal comfort (Luo et al. 2022; score 220)
- work breaks (De Jonge 2020; score 205).

### 5.2.3. CELL 6: MARKS OF RECOGNITION BY SOCIETAL TARGET GROUPS

**A. Public awards and prizes**

Public awards and prizes are the most directly visible marks of recognition by societal target groups. The awards and prizes listed in the table below highlight both the high level of recognition and the diversity of this recognition.

**Table 5.9. Public awards and prizes**

| |
|---|
| A team led by Anna Wieczorek won the 2020 EU Citizens Award for Sustainable Energy Innovation, organized by the European Commission, for the contribution that the cVPP project makes to a cleaner and more sustainable future for all EU citizens. |
| Isabelle Reymen has been recognized for six years running (2017-2022) as one of the fifty most influential women in the Eindhoven area for her leading role in TU/e innovation Space. |
| Arjan van Weele received a royal decoration for lifetime achievements in educating professionals both nationally and internationally in Purchasing and Supply Management, e.g. by chairing the Supervisory Board of the International Trade Centre in Geneva that coordinated professional education in more than 40 countries. |

A category of public award and prizes worth mentioning separately is that of PhD thesis awards in which relevance to non-academic stakeholders and society as a whole are explicit criteria of evaluation. Several researchers in our department have won such awards, which demonstrate our commitment to integrating societal relevance into research already at an early career stage.

**Table 5.10. PhD awards**

| Winner | Award | Year |
|---|---|---|
| Denise Tönissen | World Class Maintenance award | 2018 |
| Bram Westerweel | World Class Maintenance award | 2019 |
| Douniel Lamghari-Idrissi | World Class Maintenance award | 2022 |

**B. Research funding from industry and third parties**

A central element of our valorization policy is establishing and maintaining valorization circles coordinated by the department. This is meant to strengthen our reputation of successful collaboration with external parties and to signal our interest in engaging in further collaborative projects.

A particularly promising large-scale project is 'AI Planner of the Future' (2021-2026). This project focuses on the increasing intertwining of technology and human aspects in AI planning for supply chains and logistics. It brings together all seven research groups within the department, other AI researchers in EAISI and industry partners via ESCF and the Logistics Community Brabant. Currently, it comprises twelve research projects, on topics such as sustainable last-mile delivery, digital twins, and enhancing trust in AI systems. For more information, see AI Planner of the Future - ESCF.

Tables P2 and P3 in Appendix P contain a full list of all **132 second-tier and third-tier funded projects** with a budget higher than 50k€ that were acquired and/or executed during the evaluation period. Of these projects, **63 are funded with in-cash and/or in-kind contributions from industry** (columns 'Value share industry'). The total value of these projects is over 350 million euro; in-cash contributions from industry comprise over 13%, with almost 48 million euro. The total

contract value for IE&IS is over 36 million euro, excluding membership contributions of more than 60 companies to ESCF to support grant acquisition. In addition, several PhD projects are directly – and exclusively – funded by the industry, such as projects funded by Nexperia, KMWE, ORTEC, ASML and Lely.

**C. Membership of civil supervisory and advisory bodies**

Memberships of civil supervisory and advisory bodies are direct recognitions of the expertise of individuals and/or of established or emerging research strengths of the department. Furthermore, such memberships enable the broader societal impact of our research efforts. During the evaluation period, several researchers of the department have been or have become members of supervisory and advisory bodies. Examples include memberships of:

- the European Commission's High-Level Forum on Standardization (Rudi Bekkers, together with Robert-Jan Smits as the only university representatives)
- the Climate Expert Group of the Council of State – an advisory council to the Dutch government (Heleen de Coninck)
- the board of TKI Dinalog – a partnership between business, government, and knowledge institutes (Albert Veenstra, scientific director)
- the board of the Logistics Community Brabant – a partnership to bring business (especially SME-s), education, research and government together in the province of Noord-Brabant (Eric van der Geer, board member)
- the Board of Governance of Tilburg University (Evangelia Demerouti)
- the IEEE Standards Association and International Committee on Illumination – both independent non-profit organizations (Rudi Bekkers and Luc Schlangen)
- the scientific advisory board of Aalto University – School of Science (Sjoerd Romme)
- the TNO panel (Toets Nieuwe Opleiding (meet requirements new education program) of the Accreditation Organisation of the Netherlands and Flanders (NVAO) for the initial accreditation of the master Next Level Engineering of The Hague University of Applied Sciences (Ivo Adan, chair)
- the medical ethical review boards of the Máxima Medical Center in Veldhoven and Catharina Hospital in Eindhoven (Philip Nickel)
- the board of The Sociocracy Group (TSG) – a private company (Sjoerd Romme).

**We are proud of our achievements in research quality and relevance for society, and confident about the coming years**

# Chapter 6. SWOT analysis and future strategy

We formulated our strategic aims and associated actions in Chapters 2 and 3, defined related KPIs in Chapter 4 and described and analyzed our performance in Chapter 5. Now, we review our department's strengths and weaknesses, and the opportunities and threats we observe, considering the institutional, national, European and global level, as shown in Table 6.1. Below the table we first reflect on these insights, in relation to the strategic actions taken. Then, we discuss our future strategy.

**Table 6.1. Insights from SWOT analysis**

| **Strengths** | **Weaknesses** |
|---|---|
| • Clear career paths for young researchers and possibility to build their own research group.<br>• Growing reputation in our fields of research through a dedicated publication strategy.<br>• Increase in industrial and societal relevance through a dedicated valorization strategy.<br>• Close and frequent collaboration with industry and societal partners, resulting in valuable impact from each of the four departmental themes.<br>• Good alignment of the departmental strategy with the university's strategy. | • Our external research funding is growing, but new tenure-track assistant professors need more support to start building their own research group.<br>• PhD-trajectories are in general too long.<br>• We can further increase the number of personal grants and coordinator roles in large projects tuned to our departmental themes. |
| **Opportunities** | **Threats** |
| • Growing awareness that societal challenges need to be addressed from a systems perspective, including the social sciences and humanities.<br>• Via the new interdisciplinary TU/e institutes (in particular EAISI and EIRIS), we can create an even wider and stronger societal impact.<br>• Journals with high impact increasingly accept practice-based research.<br>• Rapid expansion of the Brainport region, for which our research and students are becoming increasingly relevant.<br>• The Dutch government currently invests extra in universities through 'sectorplans', creating opportunities to extend and strengthen key research areas. | • The current 'war for talent' among Dutch universities makes it difficult to recruit and retain talented researchers. Internationally the competition for talent is also growing.<br>• Open science approaches can complicate collaborations with industry and societal partners. |

**Reflection on the SWOT analysis**

We are proud of our strengths. We are globally recognized as an important partner in the innovation of technology to the benefit of industry, government, and society. Our more senior researchers are internationally acknowledged as experts in their discipline, and we have multiple top researchers. The publication strategy introduced in the assessment period has been a clear success in promoting research quality, creating visibility, and providing guidance to (junior) researchers in their choice of publication outlets. Across all disciplines spanned by our research, our academic output is of high quality, as is evidenced by the high FWCI and the large and increasing number of publications in line with our publication strategy. Next to this, we successfully carry out collaborative multidisciplinary research with industry and societal partners to solve complex problems. Our valorization strategy has been crucial in creating significant impact with our research in each of the four departmental themes, and in further strengthening our reputation in this aspect. Research funding has increased with the support of the Project Development Office (PDO), and we connect to and have impact on research agendas at the institutional, national, and international level.

We acknowledge that PhD trajectories are, on average, still too long. In the assessment period, the department invested considerable time and effort in reviewing its PhD supervision processes and identifying ways to achieve more efficient, yet effective PhD trajectories. The adverse effects of the COVID-19 pandemic make it hard to assess how successful these efforts at improvement have been. Therefore, we plan to sustain these efforts, monitor their success, and take additional actions if needed.

The war for talent is the biggest threat we see. The Dutch government currently invests in additional positions at all universities through so-called 'sector plans'. As a result, all universities are fishing in the same pond for Dutch and international talent. Furthermore, to recruit and retain talented researchers who can build bridges between their disciplines and the engineering sciences, we compete with more traditional social sciences and humanities departments and with business schools at general universities. These often use different criteria for promoting scholars to Associate or Full Professor level from ours; in particular, they put less focus on acquiring external funding and on the number of PhD candidates supervised. Consequently, we regularly lose talented researchers, regardless of efforts at improving our HR policies.

The awareness that grand industrial and societal challenges require a multidisciplinary perspective is not only growing among students, but also in the national and European funding landscape. Together with the growth in the Brainport region and with the investments of the Dutch government in new university positions, this offers the department exciting opportunities to expand its research agenda.

**Future outlook: vision, aims, and strategic actions**

Our vision for the future is to strengthen our leadership position in supporting industry, government and society in their responsible adoption and effective implementation of the Key Enabling Technologies that address grand societal challenges. To realize this vision, our strategic aims remain unchanged. We strive:

1. To achieve disciplinary excellence and be recognized for it by our academic peers.
2. To generate impact on relevant societal, governmental, and industrial challenges through multidisciplinary collaborations.

We described above how several **instrumental** strategic actions (i.e., establishing the PDO; safeguarding research-teaching balance; and forming new research collaborations, see Section 2.1 and Sections 3.4 to 3.6) were successfully carried out, and are now in place. They will require continued monitoring but are no longer on the list of strategic actions. Towards our **central** strategic actions, significant steps were taken as well. We will build further on these in the coming years:

1. We will retain our current **publication strategy**, upholding and periodically refreshing it, to make sure that our future publications will be optimally visible for our academic peers.
2. We will keep investing in our **valorization strategy**, implementing its key elements (such as internal and external organization and institutional support), and capitalizing on our strengths in multidisciplinary collaboration with various stakeholders.
3. We will continuously review our **HR policy**, to remain an attractive employer for young talent. For this, we are fully committed to implementing the TU/e's new reward-and-recognition policy, which ties in with our academic culture and the diverse talents and tasks of our faculty. It rewards faculty for strengths beyond a rigidly defined research profile and – where possible within the composition of a group – invites faculty to develop a more personalized academic profile that also emphasizes strengths in education and valorization.

In addition, we have identified two sets of strategic actions for the coming period:

4. We need to continue **increasing research funding and diversifying our project portfolio, while retaining clear focus points**. Our mentorship program for personal grants is strong and successful, and the PDO offers valuable support to our faculty in preparing competitive applications. Both offer tenure-track junior faculty strong institutional support to develop their own project portfolios. These efforts will continue.
   We want more often to play an initiating and leading role in large-scale projects that contribute directly to realizing our research vision. For this, the **roadmaps for the four departmental research themes** will be updated every two years, to retain focus on the strategically most relevant topics. Those topics should build on our existing research strengths, successful multidisciplinary collaborations, and our unique position in various valorization circles, including the expanding high-tech industry in the Brainport region. Examples of trends that we expect to gain interest in the coming years are Smart Industry, Sustainable Supply Chains, and Preventive Health. The (updated) roadmaps will be used by the theme leaders and the PDO to proclaim our research agenda to the outside world, and as such attracting collaborative partners for national or European funding programs.
   Anticipating the abovementioned new trends, we are currently hiring junior faculty to develop these research areas, using the funding provided within the 'sector plans'. These hires will also allow us to safeguard the balance between research and teaching, while adding to our portfolio of research strengths.
5. A distinctive strength of our department is our research-driven approach to integrity issues, which has led to several successful efforts at improving research practices. This will remain high on our agenda in the coming years, in several ways.
   We aim at intensifying our contributions to debating, developing, and implementing best research practices – locally, nationally, and internationally. For this, we will better connect ongoing research efforts on best research practices and **make these more visible as a leading, multidisciplinary research center**.
   Specifically, we intend to develop an open-science strategy that aims at effectively safeguarding industries' competitive advantage as well as academic and societal needs for transparency and

open innovation. Here, we can combine our acknowledged high-quality research on integrity issues with that on intellectual property and open innovation, creating a unique center of expertise. Moreover, like the pioneering work of researchers in our department led directly to the TU/e-wide Ethical Review Board, this open-science/open-innovation strategy could play a significant role in shaping policies at other departments or the TU/e generally.


**Erik van der Vleuten**

# Chapter 7. Summary

In the period 2017-2022, our department has made significant steps towards realizing its vision: to play a leading role in supporting industry, government and society in their responsible adoption and effective implementation of the Key Enabling Technologies to address grand societal challenges.

To strengthen research quality in all our disciplines and gain recognition from our academic peers, we have formulated and implemented a department-wide publication strategy. This reflects our ambitions on both disciplinary and multidisciplinary excellence, our commitment to create visibility for our research, and our dedication to Open Science approaches where possible. It also reflects the strength of our departmental culture: striving for excellence through close collaboration and a shared vision. As a result of the strategy, the relative number of publications in target journals has increased: most (60%) of our work is now published in outlets of high quality by the standards of our publication strategy. Recognition from our peers is shown by highly cited journal publications, as well as personal research grants and other scientific awards.

To generate impact on relevant societal, governmental, and industrial challenges through multidisciplinary collaborations, we have formulated and implemented a valorization strategy. This aims at incorporating valorization in all suitable research programs through clear individual incentives (such as the IE&IS Valorization Prize), internal and external organization, and institutional support. We have consolidated our four multidisciplinary research themes by strengthening the Project Development Office, by forming core teams and by defining roadmaps for each theme. We have invested in building and strengthening valorization communities: strategic networks of industrial and societal stakeholders, with whom we collaborate on the responsible adoption and effective implementation of KETs, and with whom we initiate new collaborative research projects. These initiatives have resulted in a substantial growth of our project funding, in coordinating roles of large-scale projects, in prestigious appointments of our staff, and in increased media attention for our research.

Fundamental to our quest for research quality and relevance for society are our researchers. We strive for appropriate, effective, and fair HR processes in recruiting, retaining, and promoting talented researchers. Diversity and inclusiveness get significant attention since they support the multi-perspective approach and mutual collaboration that the department considers essential. We assess people broadly, in terms of research, education, valorization, and management; and we offer institutional support, through a mentorship program for junior faculty in their path towards tenure. Finally, we took significant efforts to safeguard the balance between research and teaching tasks, which was restored during the assessment period.

We see opportunities to adjust strategies and build on existing and emerging strengths, for instance on open science and open innovation, and to further increase research funding and diversify our project portfolio. In sum: we are proud of our achievements in research quality and relevance for society, and confident about the coming years.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1956>2021
TU/e
EINDHOVEN UNIVERSITY OF TECHNOLOGY
1956/1976
THE EARLY YEARS OF THE TU/e CAMPUS
2010/2020
THE REVITALIZATION OF THE TU/e CAMPUS

# Appendices

## APPENDIX A – RESEARCH GROUPS

This appendix describes all research groups in more detail in the same order in which they are presented in Chapter 1. As a start Table A1 gives an indication of the size of each group, where we make a distinction between scientific faculty (including Full, Associate and Assistant Professors, and those still in a tenure track) and temporary research faculty (including PhD candidates and Postdocs). Scientific faculty members dedicate on average 40% of their time to research. The remaining 60% of their time is allocated to education, management tasks and valorization. Postdocs dedicate around 80% of their time to research, while the research and training time of doctoral candidates is on average 85% of their contract time.

**Table A1. Number of research faculty disciplinary groups (Reference date: 31 December 2022)**

| Group | Full Professors | Associate Professors | Assistant Professors | Postdocs | PhD candidates* |
|---|---|---|---|---|---|
| Human Performance Management | 3 | 2 | 5 | 0 | 10 |
| Human-Technology Interaction | 4 | 5 | 9 | 3 | 16 |
| Information Systems | 1 | 4 | 10 | 1 | 12 |
| Innovation, Technology Entrepreneurship & Marketing | 5 | 4 | 11 | 1 | 14 |
| Operations, Planning, Accounting & Control | 4 | 7 | 15 | 2 | 27 |
| Philosophy & Ethics | 2 | 2 | 8 | 8 | 6 |
| Technology, Innovation and Society | 5 | 4 | 9 | 4 | 26 |

* PhD candidates on pay-roll

## APPENDIX A.1: HUMAN PERFORMANCE MANAGEMENT

**Group leaders**
Pascale Le Blanc & Josette Gevers: as of 2019
Evangelia Demerouti: 2017 – 2019

**Scientific faculty**

| Faculty member | Full Professor | Associate Professor | Assistant Professor |
|---|---|---|---|
| Demerouti, E. | 2017 – 2022 | | |
| Jonge, J. de | 2017 – 2022 | | |
| Le Blanc, P.M. | 2020 – 2022 | 2017 – 2020 | |
| Gevers, J.M.P. | | 2017 – 2022 | |
| Rispens, S. | | 2021 – 2022 | 2017 – 2021 |
| Calseyde, P.P.F.M. van de* | | | 2017 – 2022 |
| Kleingeld, P.A.M. | | | 2017 – 2022 |
| Meij, L. van der* | | | 2017 – 2022 |
| Ulfert-Blank, A.S.* | | | 2021 – 2022 |
| Zyl, L.E. van* | | | 2018 – 2022 |
| *Li, J.* | | | *2017 – 2019* |
| *Oerlemans, W.G.M.* | | | *2017 – 2017* |

Names of former faculty members are in *italics*.
(*) faculty members currently in a track from Assistant to Associate Professor or from Associate to Full Professor.

Scientific faculty not on payroll: M.C.W. Peeters (Full Professor, 0.2 fte, 2017-2022)

**Keywords:** employee health and vitality, employee performance, teamwork, collaboration, organizational decision making, sustainable (organizational) innovation

**Research area**
Human Performance Management (HPM) at TU/e develops scientific knowledge and tests theories that uncover and explain psychological processes contributing to organizational outcomes at the employee, team and company level. With our focus on the 'people factor' in operational and innovation processes, mainly in the high-tech industry, we aim to ensure that employees can contribute to bringing organizational strategies to fruition in the most rewarding and efficient way possible.

The research in our group is both human- and process-oriented. We focus on how people regulate their behavior towards (work) goal accomplishment (i.e., performance optimization) rather than on the measurement and control of performance (i.e., risk management). We aim at a (re)design of socio-technical systems in which organizational, work(task) and employee aspects are optimally aligned and integrated with technological ones. Our expertise can contribute significantly to making people's working lives healthier, safer, and more engaging and to better functioning organizations.

We engage in interdisciplinary and multidisciplinary research with fellow scholars from the engineering sciences and humanities, both inside and outside the department of IE&IS. Amongst others, we study innovative technologies and technology-related problems within an organizational context with the aim to contribute to a human-centered implementation and use of these technologies. As such, HPM provides indispensable knowledge on how to implement and use technological innovations in organizations in a socially responsible way.

At the same time, fundamental and applied psychological research is an essential part of what we do and what we are known for. For example, our research on job (re)design has substantially contributed to the work- and organizational psychology literature and has even led to the development of entirely new theoretical frameworks, such as the JDR-model and the DISC-model, as well as to new job (re)design approaches, such as job crafting. This has resulted in several highly cited papers over the past years, some of which have also caught the attention of the popular media.

Our research has clear relationships with the departmental research themes: 'Supply Chain Management' (e.g., research on the people factor in logistics and supply chain collaborations), 'Value of Data-Driven Intelligence' (e.g., application of wearable technology for improving employee health and vitality and team coordination), and 'Sustainability and Circularity' (e.g., workplace (technological) innovation implementation and adoption for a more sustainable workforce).

At departmental and TU/e level, we participate actively in several research institutes, in particular the Eindhoven Artificial Intelligence Systems Institute (EAISI), Center for Humans and Technology, the Research School for Operations Management and Logistics (Beta), and the European Supply Chain Forum (ESCF). Outside TU/e HPM has ties with the 4TU Center for Resilience Engineering, Werkgemeenschap van onderzoekers in de Arbeids- en Organisatie Psychology (WAOP), Nederlandse Stichting voor Psychotechniek (NSVP), Eindhoven Engine, and TKI Dinalog.

**Key scientific output**
*The 5 most important scientific output in the period 2017-2022*

Efendic, E., **van de Calseyde, P.P.F.M.** & Evans. A.M. (2020). Slow response times undermine trust in algorithmic (but not human) predictions, *Organizational Behavior and Human Decision Processes, 157*, 103-114. (AIS top 10%). This research shows how people's trust in algorithmic predictions and human predictions is affected by response time, indicating opposing effects for algorithmic and human predictions. These results underscore the complex processes and dynamics underlying people's trust in algorithmic (and human) predictions and the cues that people use to evaluate their quality.
(**KPI:** Publications in line with **publication strategy**)

Berkers, H.A., **Rispens, S.** & **Le Blanc, P.M.** (2022). The role of robotization in work design: a comparative case study among logistic warehouses, *The International Journal of Human Resource Management* (E-pub ahead of print). This study shows how robotization changed the work design of order pickers and order packers in logistic warehouses. It was found that warehouses that lack attention to the quality of work may risk ending up with negative effects for employees, such as simplification and intensification of work, and reduced autonomy. Understanding the consequences of robots for work design supports HR professionals to help managing this transition by both giving relevant input on a strategic level about the importance of work design and advocating for employees and their involvement.
(**KPI:** Publications in line with **publication strategy**)

Petrou, P., **Demerouti, E.** & Schaufeli, W.B. (2018). Crafting the change: the role of employee job crafting behaviors for successful organizational change*, Journal of Management, 44*(5), 1766-1792. (AIS top 10%). In this research in a police organization, we examined how organizational changes can be implemented successfully with a longitudinal study design. We found that an interplay between the characteristics of the change itself, how it was communicated by the organization, and employees' job crafting behavior predicted employees' adaptation to change as well as their work engagement.
(**KPI:** Publications in line with **publication strategy**)

Van Erp, K.J.P.M., **Gevers, J.M.P., Rispens, S. & Demerouti, E.** (2018). Empowering public service workers to face bystander conflict: Enhancing resources through a training intervention. *Journal of Occupational and Organizational Psychology, 91*(1), 84-109. (AIS Q1 and target journal). In this research, we developed and tested a resource-enhancement intervention for securing paramedics' effective functioning and well-being in situations with hostile bystanders. The findings indicated that the intervention could serve as an important means to protect public service employees against deleterious effects of bystander conflict.
(**KPI:** Publications in line with **publication strategy**)

**Ulfert, A.S.**, Antoni, C.H. & Ellwart, T. (2022). The role of agent autonomy in using decision support systems at work. *Computers in Human Behavior, 126*, 106987. (AIS top 10% and target journal). Agent-based decision support systems (DSS) can assist employees in information processing tasks and decrease processing requirements. With increasing system capabilities, agency between the user and the system shifts, with high autonomy DSS being able to take over complete information processing tasks. Results of two vignette studies suggest that, while being beneficial for decreasing information load, high DSS autonomy may negatively impact employee technostress and intentions to use it. It is suggested that training in technological and job skills may improve user reactions. (**KPI:** Publications in line with **publication strategy**)

**Key societal output**
*The 5 most important societal output in the period 2017-2022*

The (job) crafting intervention: Crafting is an effective strategy to increase people's engagement with an activity (or task) by increasing person-activity fit and thereby their well-being and performance. Over the past decade, various **members of the HPM group** have been developing (job) crafting interventions to enhance, e.g., adaptive (organizational change) performance, academic (university) performance, sustainable (supply chain) performance, and job search performance. These interventions have been applied by, amongst others, UWV Werkbedrijf and their customers, the Elkerliek Hospital in Helmond, the Police organization and IKEA. Examples can be found on: Crafting research projects HPM.
(**KPI: Outreach** products for **stakeholders**)

Talent Development Center: Another major achievement is the establishment of an online Talent Development Center by **Llewellyn van Zyl** (in collaboration with PsychAI Talent Group) that has been officially recognized as one of the best executive coaching initiatives in the Middle East for 2019/2020 by the Chartered Institute of Personnel Development.
(**KPI: Outreach** products for **stakeholders**)

Small Group Meeting on New Technologies and AI at work: **Pascale Le Blanc, Maria Peeters, Sonja Rispens and Anna-Sophie Ulfert** were granted a subsidy by the European Society for Work and Organizational Psychology for a Small (expert) Group Meeting on the role of human/social context factors in the implementation of new technologies and AI in the workplace (originally planned for May 2020, but eventually took place in an online format 21-22 January 2021 because of COVID-19).
(**KPI: Outreach** activities)

COVID-19 Research Initiatives: **Evangelia Demerouti** was awarded a personal grant to do research on the development of an online intervention to support successful teleworking in times of COVID whereas **Evangelia Demerouti, Pascale Le Blanc and Keri Pekaar** were awarded a grant to study strategies to uphold self-employed people's mental health and financial well-being in these exacting times.
(**KPI**: **Outreach** activities)

## APPENDIX A.2: HUMAN-TECHNOLOGY INTERACTION

**Group leader**
Chris Snijders: as of 2017

**Scientific faculty**

| Faculty member | Part-time factor** | Full Professor | Associate Professor | Assistant Professor |
|---|---|---|---|---|
| Heynderickx, I.E.J. | 0.2 fte*** | 2017 – 2022 | | |
| IJsselsteijn, W.A. | | 2017 – 2022 | | |
| Kort, Y.A.W. de | | 2017 – 2022 | | |
| Snijders, C.C.P. | | 2017 – 2022 | | |
| *Kohlrausch, A.G.* | *0.4 fte* | *2017 – 2020* | | |
| Cuijpers, R.H. | | | 2017 – 2022 | |
| Haans, A. | | | 2021 – 2022 | 2017 – 2021 |
| Ham, J.R.C. | 0.5 fte | | 2017 – 2022 | |
| Lakens, D. | | | 2019 – 2022 | 2017 – 2019 |
| Rooks, G. | | | 2021 – 2022 | 2017 – 2021 |
| Willemsen, M.C. | | | 2017 – 2022 | |
| Chamilothori, K.* | | | | 2019 – 2022 |
| Conijn, M.A.* | | | | 2020 – 2022 |
| Matzat, U.* | | | | 2017 – 2022 |
| Perugia, G.* | | | | 2021 – 2022 |
| Plaisier, M.A.* | 0.8 fte | | | 2022 – 2022 |
| Ruijten Dodoiu, P.A.M.* | | | | 2017 – 2022 |
| Schoenmakers, S.* | | | | 2019 – 2022 |
| Smolders, K.C.H.J.* | 0.8 fte | | | 2017 – 2022 |
| Zhang, C.* | | | | 2021 – 2022 |
| *Barendregt, W.* | *0.8 fte* | | | *2019 – 2021* |
| *Kersten, E.T. van Dijk* | | | | *2018 – 2020* |

Names of former faculty members are in *italics*.
(*) faculty members currently in a track from Assistant to Associate Professor or from Associate to Full Professor.
(**) indicated part-time factor is per end 2022.
(***) 0.2 fte in group due to appointment as dean of the department.

Researcher on payroll: L.J.M. Schlangen (2019-2022)

Scientific faculty not on payroll: J.H.D.M. Westerink (Full Professor, 0.2 fte, 2017-2022), A.G. Kohlrausch (Full Professor, 0.1 fte, 2020-2022)

**Keywords:** psychology, cognition, perception, human factors, human-computer-interaction, open science

**Research area**
The Human-Technology Interaction (HTI) group contributes to the understanding of the role of humans in interaction with technology. We build our research on a disciplinary foundation in the social sciences and contribute to four main areas. Human-computer interaction research focuses on the conceptualization and measurement of the human experience in relation to technological media. How can technology be seamlessly connected to human perceptions, cognitions, emotions, and actions? Research on (online) decision-making and human-data interaction focuses on how human interaction leaves traces in and is affected by massive amounts of (online) information and on how humans can be aided to make decisions that are in line with their own and collective preferences. Research on person-environment interaction investigates how spatial design and lighting can be used to optimize sleep, alertness, wellbeing, mood, and the cognitive performance of people. Research on human perception centers on how people see, hear, and feel, and how this is related to and can be incorporated in the design and use of technology.

We are guided by a conviction that the social sciences can create value for a society suffused with technology, but only when based on sound theoretical and careful methodological approaches. As a group, we therefore reflect on disciplinary methodology and interventions, and attempt to improve both, particularly – though not necessarily only – through the use of technology.

The four areas of research are closely intertwined, and many projects involve researchers in more than just one area. For instance, research on recommender systems needs knowledge about social psychology, persuasion, and human-computer interaction. Research on the effects of light on well-being needs knowledge about perception and affect, to name just a couple of examples. By its nature, our research lies at the heart of the department's research theme 'Humans and Technology', but likewise contributes in natural ways to 'Sustainability and Circularity' (e.g., research about energy recommender systems) or 'Value of Data-Driven Intelligence' (e.g., research about Human-AI interaction).

HTI research benefits from the availability of its lab facilities (the "H&T-lab"), which include opportunities to run studies on virtual reality (VirTUE/e lab), auditory perception (AudLab), gaming (GameXPLab), lighting (LightingLab), and general psychological experiments. We also host our own panel of participants and have implemented a dedicated system (ARCHIE, see also section 5.1.4) that streamlines the process of experimenting, including a check by the experiment committee on ethics, design and general appropriateness of the experiment, and safe storage of experimental and other results afterwards.

We are well-embedded in the research of the department and TU/e as a whole. Whenever appropriate, we seek synergy with neighboring groups in the department and a sizeable part of our research is carried out with or in consultation with researchers from other research groups and departments. Furthermore, HTI plays a key role in several institutionalized collaborations. Wijnand IJsselsteijn is scientific director of the Center for Humans and Technology, one of TU/e's research areas and the single-point of entry for all humans and technology related research at TU/e. Many of the researchers are also part of the Eindhoven Artificial Intelligence Systems Institute (EAISI), in which they bring in the human interaction aspect in multiple research program lines and co-create AI that has an open eye to the human need.

**Key scientific output**
*The 5 most important scientific output in the period 2017-2022*

**Feijt, M.A., de Kort, Y.A.W.**, Bongers, I.M.B. & **IJsselsteijn, W.A.** (2018). Perceived drivers and barriers to the adoption of eMental health by psychologists: the construction of the levels of adoption of eMental health model, *Journal of Medical Internet Research*, 20(4), [e153]. (AIS Q1 and target journal). Despite growing evidence for the effectiveness of technology-mediated mental and behavioral health services, the adoption in clinical practice of these services remains low. This paper considers drivers and barriers of these services, and provides an analysis of the match between and interplay of humans and technology.
(**KPI:** Publications in line with **publication strategy**; **Citations**)

**Lakens, D.** (2020). Pandemic researchers-recruit your own best critics, *Nature*, *581*(7807), 121. (AIS top 10%). Open science and methodological rigor, as part of individual papers and the general scientific process can be at stake when fast research progress is needed. This world view – by invitation only – highlights the need for a proper balance between timely scientific results and a healthy, internalized system of checks and balances.
(**KPI:** Publications in line with **publication strategy**)

Schulte-Mecklenbeck, M., Johnson, J.G., Böckenholt, U., Goldstein, D.G., Russo, J.E., Sullivan, N.J., & **Willemsen, M.C.** (2017). Process-tracing methods in decision making: on growing up in the 70s, *Current Directions in Psychological Science*, 26(5), 442-450. (AIS top 10%). This paper shows how

process-tracing, largely based on own developed software, can aid the understanding of human decision-making processes by carefully measuring attention, emotion, and the use of strategy.
(**KPI:** Publications in line with **publication strategy**; **Citations**)

**Snijders, C., Conijn, R.,** Fouw, E. de & Berlo, K. van (2022). Humans and Algorithms Detecting Fake News: Effects of Individual and Contextual Confidence on Trust in Algorithmic Advice, *International Journal of Human-Computer Interaction,* 1-12 (E-pub ahead of print). (AIS Q1 and target journal). The paper discusses a very-timely topic on the interaction between humans and algorithms. Although algorithms, in this case for the detection of fake news, can perform quite well, humans are reluctant to follow-up algorithmic advice when they should. The paper shows how the confidence of humans in their own judgment affects their willingness to interact with algorithmic advice and is a good example of how HTI invests in methodological debate and topic-wise in the involvement of humans with AI.
(**KPI:** Publications in line with **publication strategy**)

**Zhang, C., Smolders, K.C.H. J., Lakens, D. & IJsselsteijn, W.A.** (2018). Two experience sampling studies examining the variation of self-control capacity and its relationship with core affect in daily life, *Journal of Research in Personality*, 74 (June), 102-113. (AIS Q1). This study considers the different roles of self-control and emphasizes HTI's interest in matching advanced methodological arguments with the proper data to test it. Using a large-scale experimental design, the authors show that it is necessary to distinguish between intra-individual and inter-individual processes to properly appreciate the effect that self-control has on different mental states.
(**KPI:** Publications in line with **publication strategy**)

**Key societal output**
*The 5 most important societal output in the period 2017-2022*

In 2018 **the HTI group** formally started an Inter-Academic Collaborative Center (in Dutch: Academische werkplaats) on Technological and Social Innovation for Mental Health between GGzE , TU/e and Tilburg University to secure constructive collaboration in numerous joint projects, including additional clinics and clinical partners.
(**KPI: Collaboration** with **stakeholders**; **Research funding** from industry and **third parties**)

In 2020, Alzheimer Nederland and **HTI-TU/e** established a strategic long-term collaboration, resulting in substantial financial support for the TU/e Expertise Center on Dementia and Technology. Together we introduced the concept of "Warm Technology" (see also sections 5.2.1 and 5.2.2), which emphasizes an inclusive perspective on technology, based on user-centered design, and involves treating people with dignity and respect, with an understanding of personal histories, context, and preferences. The notion of Warm Technology has been adopted by Alzheimer Nederland as a key to innovation in the improvement of Quality of Life, and has informed the recent NWO KIC call Living with Dementia.
(**KPI: Outreach** activities; **Research funding** from industry and **third parties**)

**HTI** is committed to communicating research results and reflections about these results to a broad audience. Outreach activities vary from media appearances (Volkskrant, AD, Kennis van Nu, Een Vandaag, Klokhuis, Universiteit van Nederland, NPO Radio, VPRO Tegenlicht) to more general outreach acitivities (at TivoliVredenburg on VR, at Glow, returning H&T Center symposia).

A highlight is the 2022 AI for ALL event at Evoluon, with science fiction writer Bruce Sterling as guest. The event attracted substantial live and online audiences, and is available on YouTube, attracting a substantial number of views. In addition to some 200 persons in the lecture room, over 250 persons were online during the live event.
(**KPI: Outreach** activities)

HTI has made tools of different kinds available to the general public. **Chris Snijders** created an app that can diagnose the likelihood of precursors to skin cancer (odd-spot). The app and the research behind it found its way into the daily routines of the MohsA Skin Center in Eindhoven and lead to an educational webinar for dermatologists ("Big data for dermatology") in 2020.
(**KPI: Dissemination** results to the **general public**; **Outreach** activities)

**HTI-research** contributes to meta-science, creating an impact well beyond our own research disciplines and well beyond academia. Exceptionally strong examples are two MOOCs on statistics, "Improving your statistical inferences" (2017, over 67,650 people already enrolled, rated 4.9/5) and "Improving your statistical questions" (2019, over 7,750 persons already enrolled, rated 4.9/5) by Lakens. Both are freely available via Coursera. They build directly on the work of our group on meta-science and are aimed at helping researchers to design and interpret results of statistical analyses. Daniel Lakens' plea for reserving scientific funds for meta-science through replication research (before a committee of the Dutch house of representatives and the national science foundation NWO) resulted in the actual allocation of funds to this effect.
(**KPI: Outreach** activities; **use of outreach** products by **stakeholders**); **Membership** of civil supervisory and **advisory bodies**)

## APPENDIX A.3: INFORMATION SYSTEMS

**Group leaders**
Remco Dijkman: as of 2020
Jos Trienekens: 2018 – 2020
Uzay Kaymak: 2017 – 2018

**Scientific faculty**

| Faculty member | Part-time factor (**) | Full Professor | Associate Professor | Assistant Professor |
|---|---|---|---|---|
| Dijkman, R.M. | | 2021 – 2022 | 2017 – 2021 | |
| *Grefen, P.W.P.J.* | | *2017 – 2020* | | |
| *Hofstede, A.H.M. ter* | *0.2 fte* | *2017 – 2018* | | |
| *Kaymak, U.* | | *2017 – 2020* | | |
| Eshuis, H. | | | 2021 – 2022 | 2017 – 2021 |
| Türetken, O. | | | 2017 – 2022 | |
| Van Gorp, P.M.E. | | | 2021 – 2022 | 2017 – 2021 |
| Zhang, Y. | | | 2017 – 2022 | |
| *Kusters, R.J.* | *0.2 fte* | | *2017 – 2019* | |
| *Trienekens, J.J.M.* | *0.8 fte* | | *2017 – 2020* | |
| *Vanderfeesten, I.T.P.* | *0.2 fte* | | *2018 – 2022* | *2017 - 2018* |
| Athanasopoulou, A.* | | | | 2020 – 2022 |
| Aysolmaz, B.E.* | | | | 2020 – 2022 |
| Baier, H.J.S.* | | | | 2022 – 2022 |
| Bukhsh, Z.* | | | | 2021 – 2022 |
| Bliek, L.* | 0.8 fte | | | 2021 – 2022 |
| Genga, L.* | | | | 2017 – 2022 |
| Grau Garcia, I.D.C.* | | | | 2021 – 2022 |
| Kinderen, S. de* | | | | 2021 – 2022 |
| Ozkan, B.* | | | | 2017 – 2022 |
| Razavian, M.* | | | | 2017 – 2022 |
| *Firat, M.* | | | | *2017 – 2020* |
| *Wilbik, A.M.* | | | | *2017 – 2020* |
| *Chituc, C.M.* | | | | *2017 – 2017* |
| *Nobile, M.S.* | | | | *2019 – 2021* |
| *Serral Asensio, E.* | *0.5 fte* | | | *2017 – 2018* |

Names of former faculty members are in *italics*.
(*) faculty members currently in a track from Assistant to Associate Professor or from Associate to Full Professor.
(**) indicated part-time factor is per end 2022.

**Keywords:** information systems, business intelligence, process engineering, business engineering

**Research area**

The Information Systems (IS) group creates methods, techniques, and tools for the effective support of operational and innovation processes with information systems thus realizing value for organizations and society. We cover the full lifecycle of information systems development, with a specific focus on intelligent decision support (based on machine learning and artificial intelligence), process aware information systems, and digital platforms and services. We do so in three related research lines. *Business Engineering* focuses on the development of innovative business models and architectures for using information systems, and especially on novel information systems technology. *Process Engineering* engages in the use of information systems within operational processes according to business models and architectures, such that those processes can work more efficiently and effectively. *Business Intelligence* facilitates data-driven decision making in business processes, using the data from the implemented information systems. The group focuses on applications of information systems in the domains of Transportation and Logistics, Services, Mobility, Smart Industry, and Healthcare.

We aim at disciplinary excellence within the three research lines mentioned above through active participation in the research communities around these research lines, by contributing to the conferences and journals that are associated with these research communities, by actively collaborating with other research groups, and by participating in organizations of these communities worldwide. At the same time, we encourage collaborative and multidisciplinary research. While keeping the group's focus on information systems and algorithms from the area of

computer science, there is strong intra-departmental and inter-departmental collaboration in the areas of data-driven decision making and artificial intelligence, responsible information systems design, and operational process improvement, with a specific focus on applications in the domains mentioned above. Information systems in general and novel information systems technology in particular are seen as key enabling technologies in those application domains.

Against this background, our research is strongly embedded in the research themes of the department; we play an active role in setting the research agenda of the themes 'Value of Data-Driven Intelligence' and 'Supply Chain Management', but also contribute to research in the theme 'Sustainability and Circularity'. We are also active in the European Supply Chain Forum (ESCF), which we consider an important vehicle for valorization of our research. In addition, we contribute to the Eindhoven Artificial Intelligence Systems Institute (EAISI) in various roles.

At a national and international level, we are active in the Benelux Association for Artificial Intelligence (BNVKI), which is an important forum to further the AI capability of the university and the Benelux as a whole. All group members are also member of either the national research school for Operations Management and Logistics (Beta), the Netherlands Research School for Information and Knowledge Systems (SIKS), or both, to help further research in these areas.

**Key scientific output**
*The 5 most important scientific output in the period 2017-2022*

**Most Influential Paper Award in 2019** from the Business Process Management Conference Series Steering Committee: **Remco Dijkman**, Marlon Dumas, and Luciano García-Bañuelos. Graph Matching Algorithms for Business Process Model Similarity Search. In: *Proceedings of the International Conference on Business Process Management (BPM)*, Ulm, Germany, pp. 48-63, Springer, 2009. (target output). The paper describes techniques for measuring how similar two business processes are, which can be used for benchmarking and searching business processes. It was selected from papers that were published in the BPM conference proceedings from 2009 and 2010 as the paper that has led to the most follow-up research. It has over 450 citations in Google Scholar.
(**KPI's: Publications** in line with **publication strategy**; **Scientific awards** and prizes)

**Eshuis**, **R.,** Seguel, R. & **Grefen, P.W.P.J.** (2017). Synthesizing Minimal Protocol Adaptors for Asynchronously Interacting Services. *IEEE Transactions on Services Computing, 10*(3), 461-474. (AIS top 10% and target journal). This paper presents an automated method for generating minimal software adaptors that resolve miscommunications between business partners. The method supports business partners in dynamically collaborating with each other in an efficient and agile way. The paper was published in a journal that ranks top 10% in the category "Information Systems" of WoS, with an AIS score of 1.193.
(**KPI:** Publications in line with **publication strategy**)

Ye, Q.C., **Zhang**, **Y.** & Dekker, R. (2017). Fair task allocation in transportation. *Omega, 68*, 1-16. (AIS top 10% and target journal). This paper demonstrates how to design fair algorithms for optimization problems where different players are involved, thus bringing the concepts of fairness and responsibility into algorithmic design for applications in logistics. It was published in a journal that

ranks top 10% in the category "Management" of WoS, with an AIS score of 1.481. The paper won the Best Paper Award 2017 from that journal.
(**KPI:** Publications in line with **publication strategy**)

Nápoles, G., Salgueiro, Y., **Grau, I.**, & Espinosa, M. L. (2022). Recurrence-Aware Long-Term Cognitive Network for Explainable Pattern Classification. IEEE Transactions on Cybernetics. (AIS Top 10% and target journal). This paper presents an explainable artificial intelligence technique for prediction. The paper was published in a journal that ranks top 10% in the category "Artificial Intelligence" of WoS, with an AIS score of 3.433. The paper lay the ground work for follow-up research and has already led to an implementation at the company NXP.
(**KPI:** Publications in line with **publication strategy**)

**Turetken, O., Grefen, P.W.P.J, Gilsing, R.** & **Adali, O.E.** (2019). Service-Dominant Business Model Design for Digital Innovation in Smart Mobility, *Business & Information Systems Engineering, 61*, 9-29. (AIS Q1 and target journal). This paper presents an overview of the research that was done in 6 industry and EU-funded projects. It introduces the SDBMapproach/R method for the design of networked and multi-stakeholder business models. The paper was published in a journal that ranks top 10% in the category "Information Systems" of WoS, with an AIS score of 1.022.
(**KPI:** Publications in line with **publication strategy**)

**Key societal output**
*The 5 most important societal output in the period 2017-2022*

**Oktay Turetken** (2020-now). Expert Member of the Foresight Group of Future Mobility for People and Goods at European Automotive Research Partners Association (EARPA). EARPA is an EU body that brings together 50 independent R&D providers in the mobility domain throughout Europe. The foresight group oversees technological developments and new business models regarding mobility, with the aim to anticipate and advise on the forthcoming research needs that cannot be addressed by industry or academia alone, but that need support from future research and innovation framework programs of the EU.
(**KPI: Membership** of civil supervisory and **advisory bodies**)

**Marco Nobile** (2017). Fuzzy Self-Tuning PSO. This Python library provides an effective tool for solving business intelligence problems. It implements a self-adapting algorithm, which is characterized by an extremely friendly interface so that complex problems can be solved with only a few lines of code. This has led to a high uptake by others, as evidenced by the fact that it has over 65,000 downloads.
(**KPI: Outreach** activities; **Use of outreach** products by **stakeholders**)

**Remco Dijkman** (2016-now). The Business Process Management Game. This serious game presents theory from the area of process engineering in an attractive manner. It has attracted substantial interest from external parties as evidenced by winning the best demo award at the BPM 2019 conference.
(**KPI: Outreach** activities; **Use of outreach** products by **stakeholders**)

**Pieter Van Gorp** (2018). Presentation "Fun & Healthy for All: GameBus 2015-2022" at the Congres Cardiovasculaire Preventie & Hartrevalidatie, March 23rd 2018, Ede. We disseminated to an audience of over 300 medical professionals, including many physiotherapists, how our digital platform GameBus has contributed to lifestyle improvements in large "living lab" studies on primary prevention.
(**KPI: Dissemination** results to **stakeholders**)

**Pieter Van Gorp** (2015-now). GameBus App on IOS, Android, and WWW. The GameBus app was built via innovation funding to demonstrate how our theoretical contributions on citizen-centric health platforms can be turned into practice. The app has attracted over 3,000 registered users.
(**KPI: Outreach** activities; **Use of outreach** products by **stakeholders**)

## APPENDIX A.4: INNOVATION, TECHNOLOGY ENTREPRENEURSHIP & MARKETING

**Group leader:**
Myriam Cloodt & Bob Walrave: as of 2022
Georges (Sjoerd) Romme: 2018 – 2022
Fred Langerak: 2017 – 2018

**Scientific faculty**

| Faculty member | Part-time factor ** | Full Professor | Associate Professor | Assistant Professor |
|---|---|---|---|---|
| Bogers, M.L.A.M. | | 2020 – 2022 | | |
| Langerak, F. | | 2017 – 2022 | | |
| Nijssen, E.J. | | 2017 – 2022 | | |
| Reymen, I.M.M.J. | | 2018 – 2022 | 2017 – 2017 | |
| Romme, A.G.L. | 0.8 fte | 2017 – 2022 | | |
| *Weele, A.J. van* | *0.5 fte* | *2017 – 2018* | | |
| *Weggeman, M.C.D.P.* | *0.2 fte* | *2017 – 2019* | | |
| Cloodt, M.M.A.H. | | | 2017 – 2022 | 2017 – 2017 |
| Raassens, N. | | | 2021 – 2022 | 2017 – 2021 |
| Schepers, J.J.L. | | | 2017 – 2022 | |
| Walrave, B. | | | 2019 – 2022 | 2017 – 2019 |
| *Gelper, S.E.C.* | | | *2020 – 2022* | *2017 – 2020* |
| *Podoynitsyna, K.S.* | | | *2018 – 2020* | *2017 – 2018* |
| Alblas, A.A.* | | | | 2017 – 2022 |
| Bobelyn, A.S.A.* | | | | 2017 – 2022 |
| Bonnin Roca, J.* | | | | 2019 – 2022 |
| Dolmans, S.A.M.* | | | | 2017 – 2022 |
| Huijben, J.C.C.M.* | | | | 2017 – 2022 |
| Keskin, D.* | | | | 2017 – 2022 |
| Korpeoglu, C.G.* | | | | 2020 – 2022 |
| Markus, A.* | | | | 2019 – 2022 |
| Sihag, V.* | | | | 2018 – 2022 |
| Wiegmann, P.M.* | | | | 2019 – 2022 |
| *Boxstael, A. van* | | | | *2017 – 2020* |
| *Eling, K. Holz* | *0.85 fte* | | | *2017 – 2022* |
| *Maira, E.* | | | | *2017 – 2018* |
| *Millemann, J.A.* | | | | *2019 – 2022* |
| *Mullick, S.* | | | | *2017 – 2020* |
| *Peeters, T.J.G.* | | | | *2017 – 2017* |
| *Talmar, M.* | *0.1 fte* | | | *2017 – 2022* |

Names of former faculty members are in *italics*.
(*) faculty members currently in a track from Assistant to Associate Professor or from Associate to Full Professor.
(**) indicated part-time factor is per end 2022.

Fellows on payroll: A.C. Valkenburg (Departmental fellow, 0,4 fte, 2019-2022), P.H. den Ouden (TU/e fellow, 0,4 fte, 2017-2022)

**Keywords:** new product development; new business development; open and collaborative innovation; servitization; technology marketing; innovation ecosystem.

**Research area**
The Innovation, Technology Entrepreneurship & Marketing (ITEM) group focuses on understanding and improving new product development (NPD) and new business development (NBD) processes of high-tech ventures as well as established high-tech firms and organizations. In doing so, we seek to develop theories of, as well as tools for NPD and NBD. As such, we operate in the broader – highly interdisciplinary – field of innovation management, which draws on and connects to disciplines such as engineering, marketing, entrepreneurship, organization, design, and strategy. We use these disciplines in application domains such as sustainable energy, smart mobility, and health. A few research topics studied in the group include open and collaborative innovation, high-tech product innovation, innovation ecosystems, business model innovation, servitization, and digital innovation processes.

We often study NPD and NBD processes and their outcomes in direct collaboration with practitioners to develop evidence-based theories and to test tools and interventions in practice. For this purpose, we established close collaborative ties with external partners, such as ASML, Signify, and Heijmans. Given the interdisciplinary nature of our research, we have also established close interdisciplinary collaborations with researchers from other research groups in the department as well as with faculty of other TU/e departments (e.g., the Built Environment, Electrical Engineering, Applied Physics, and Industrial Design).

By focusing on NPD and NBD, we contribute to the research themes of the department. For example, for the theme of 'Sustainability and Circularity', we researched sustainable business models and the contribution of innovation intermediaries to the energy transition. To the theme on 'Supply Chain Management', we contribute with topics such as servitization, revenue management, and logistics service innovation. Within the theme of 'Value of Data-Driven Intelligence', we worked on data-driven decision support projects for high-tech companies using AI and digital technologies. Finally, our faculty also contributed to the 'Humans and Technology' research theme via empirical studies of the use of service robots. Our researchers are also involved – in a leading role – in three of the five program lines of the European Supply Chain Forum (i.e., Servitization, Circular, and Data2Move).

At the university level, group members actively participate in several research centers and institutes, in particular the Intelligent Lighting Institute (ILI), the Eindhoven Institute for Renewable Energy Systems (EIRES), the Eindhoven AI Systems Institute (EAISI), the Eindhoven Hendrick Casimir Institute (EHCI), the 4TU alliance, and the Eindhoven, Wageningen, Utrecht, and UMC Utrecht Alliance (EWUU). Outside TU/e we actively contribute to Brainport development, the Eindhoven Engine and the activities of the innovation intermediaries EIT InnoEnergy and EIT Digital. We also co-initiated the development of a set of shared PhD courses taught by innovation and entrepreneurship professors of EuroTech universities. One of our members is chair of the European Academy for Standardisation (EURAS). Moreover, ITEM members were leading the organization of the SensUs Entrepreneurship Training and Award (SensUs is annual international student competition on biosensors for health) and leading the Product Development and Management Association (PDMA) research forum.

**Key scientific output:**

*5 most important scientific publications and/or other scientific output 2017-2022:*

Xu, J., Borgh, W. van der, **Nijssen, E. J.** & Lam, S. K. (2021). Why Salespeople Avoid Big-Whale Sales Opportunities. *Journal of Marketing*, 86 (5), 95-116. (AIS top 10% and target journal). This study integrates contingent decision-making and conservation-of-resources theories to develop and test a framework of salespeople's decision making when prospecting. The research includes three sub-studies and is published in a top 10% (AIS-based) target journal, widely recognized as one of the most important marketing journals.
(**KPI:** Publications in line with **publication strategy**)

Bruneel, J., Clarysse, B., **Bobelyn, A.** & Wright, M. (2020). Liquidity events and VC-backed academic spin-offs: The role of search alliances, *Research Policy*, 49(10), 104035. (AIS Q1 and target journal). This paper describes how different types of alliances impact VC-backed academic spin-offs' chances of realizing an IPO or trademark—a so-called liquidity event. It shows that market search alliances increase a spin-off's likelihood of such an event, while technology search alliances reduce this likelihood. Published in a top 10% (AIS-based) target journal that is one of the two core target journals of ITEM group.
(**KPI:** Publications in line with **publication strategy**)

**Eliëns, R., Eling, K., Gelper, S.** & **Langerak, F.** (2018). Rational versus intuitive gatekeeping: Escalation of commitment in the front end of NPD. *Journal of Product Innovation Management,* 35(6): 890-907. (AIS top 10% and target journal). This study investigates if a gatekeeper's thinking style—whether they think rationally or whether they follow their intuition—can prevent escalation of commitment in the front end of new product development. It demonstrates that gatekeepers who think rationally are less likely to escalate their commitment than those who follow their intuition. This study draws on both a correlational study and a randomized experiment. *Journal of Product Innovation Management* is a top 10% (AIS-based) target journal and one of the core target journals of the ITEM group.
(**KPI:** Publications in line with **publication strategy**)

**Verstegen, L., Houkes, W.** & **Reymen, I.** (2019). Configuring collective digital-technology usage in dynamic and complex design practices, *Research Policy*, 48 (8), 103696. (AIS Q1 and target journal). Drawing on data collected in architectural firms, the interdisciplinary author team provide a detailed account of organized usage of digital technology, which serves to significantly advance existing theories of configurational usage. Published in a Q1 (AIS-based) target journal that is one of the two core target journals of ITEM group.
(**KPI:** Publications in line with **publication strategy**)
Holgersson, M., Baldwin, C. Y., Chesbrough, H. & **Bogers, M.** (2022). The Forces of Ecosystem Evolution, *California Management Review,* 64(3), 5-23. (AIS Q1). This article discusses the role of centripetal forces and centrifugal forces in ecosystem dynamics. Specifically, the work described how ecosystems evolve as the result of changes in these forces—which include matters like technological complementarities (centripetal) and knowledge dispersion (centrifugal). *California Management Review* is a widely known journal (Q1 AIS-based), which publishes academic work that is both accessible and relevant to practice.
(**KPI:** Publications in line with **publication strategy**)

**Key societal output:**
*5 most important societal outputs in the period 2017-2022:*

**Talmar, M., Walrave, B., Podoynitsyna, K.S.**, Holmstrom, J. & **Romme, A.G.L.** (2020). Mapping, analyzing and designing innovation ecosystems: The ecosystem pie model, *Long Range Planning*, 53(4): 101850. The Ecosystem Pie Model (EPM) is a tool for mapping, designing, and analyzing innovation ecosystems, which was tested in more than 250 cases and has been adopted by Accenture, Bosch (Germany), Red Eléctrica de España, RWE Generation (Germany), Swedegas (Sweden) and EIT InnoEnergy. A dedicated website facilitates the distribution of EPM. In terms of PlumX metrics (citations & captures), the article ranks in top 10% of all articles published by LRP in the same year.
(**KPI's**: **Outreach** activities; **Use of outreach** products by **stakeholders**; **Altmetrics**)

Organization of the World Open Innovation Conference (WOIC).
To further enhance its global exposure and reputation, the **ITEM group** took over the coordination and organization of the annual (WOIC), as of 2021, from Henry Chesbrough's group at the University of California, Berkeley. Attracting top scholars, businesses, and policy makers alike, the WOIC aims to be bring theory and practice together, by providing the latest in academic research on open innovation and combining this with challenges faced by professionals who manage open innovation in their organizations.
(**KPI's**: **Outreach** activities)

**Van Galen, W.P.L., den Ouden, P.H.** & **Valkenburg, A.C.** (2017). *Smart Mobility General Roadmap: D4.2 Report – Timelines for the topics in Smart Mobility*, Brussels: European Commission.
This general roadmap for smart mobility was developed for cities aiming to become more sustainable, as part of the European project Roadmaps for Energy. In the Netherlands, the roadmap has been used by the municipalities of Amsterdam, Rotterdam, The Hague, Utrecht and Eindhoven as well as the Dutch Ministry of Infrastructure & Environment and EIT Urban Mobility.
(**KPI's**: **Outreach** activities; **Use of outreach** products by **stakeholders**)

**Alblas, A.A.**, Zwaans F. & Schepens, S. (2017), *Insight Driven Design: Balancing Production Speed and Development Learning in Smart Industries*, Eindhoven: Eindhoven University of Technology.
This manual was developed for ASML and provides a set of management principles that enable high-tech companies to successfully develop and introduce new products by means of highly iterative and experimental processes. The manual is widely used within ASML and more than 500 hard copies have been sold to professionals in other high-tech companies.
(**KPI's**: **Outreach** activities; **Use of outreach** products by **stakeholders**)

Since 2017, **Isabelle Reymen** has pioneered TU/e innovation Space, an open community where students and researchers co-create solutions for real-world challenges in collaboration with external partners. TU/e innovation Space currently hosts more than 40 projects on many societal challenges. In 2021, Innovation Space received the Netherlands' first 'higher education award' from the ministry of Education, Culture & Science, in recognition of its societal relevance. To address the COVID-19 challenges, TU/e innovation Space also set up a platform for brokering between problem owners and solution providers: TU/e against COVID-19.
(**KPI's**: **Outreach** activities; **Use of outreach** products by **stakeholders**)

## APPENDIX A.5: OPERATIONS, PLANNING, ACCOUNTING & CONTROL

**Group leader**
Ivo Adan: as of 2020
Ton de Kok: 2017 – 2020
Geert-Jan van Houtum: 2017 – 2017

**Scientific faculty**

| Faculty member | Part-time factor** | Full Professor | Associate Professor | Assistant Professor |
|---|---|---|---|---|
| Adan, I.J.B.F. | | 2017 – 2022 | | |
| Houtum, G.J.J.A.N. van | | 2017 – 2022 | | |
| Kok, A.G. de | 0.2 fte | 2017 – 2022 | | |
| Woensel, T. van | | 2017 – 2022 | | |
| *Fransoo, J.C.* | | *2017 – 2017* | | |
| *Veenstra, A.W.* | *0.2 fte* | *2017 – 2018* | | |
| Akçay, A.E. | | | 2022 – 2022 | 2017 – 2022 |
| Atan, Z. | | | 2019 – 2022 | 2017 – 2019 |
| Basten, R.J.I. | | | 2017 – 2022 | 2017 – 2017 |
| Dellaert, N.P. | | | 2017 – 2022 | |
| Jaarsveld, W.L. van | | | 2020 – 2022 | 2017 – 2020 |
| Martagan, T.G. | | | 2022 – 2022 | 2017 – 2022 |
| Slikker, M. | | | 2017 – 2022 | |
| *Tan, T.* | | | *2017 – 2022* | |
| Broekmeulen, R.A.C.M. | | | | 2017 – 2022 |
| Dang, Q.V.* | | | | 2019 – 2022 |
| Donselaar, K.H. van | | | | 2017 – 2022 |
| Drent, C.* | | | | 2022 – 2022 |
| Drent, M.* | | | | 2021 – 2022 |
| Fecarotti, C.* | | | | 2019 – 2022 |
| Imdahl, C.* | | | | 2021 – 2022 |
| Lieshout, R.N. van* | | | | 2022 – 2022 |
| Marandi, A.* | | | | 2017 – 2022 |
| Martin, L.* | | | | 2021 – 2022 |
| Mutlu, N.R.* | | | | 2017 – 2022 |
| Schlicher, L.P.J.* | | | | 2020 – 2022 |
| Schrotenboer, A.H.* | | | | 2021 – 2022 |
| Tan, L.* | | | | 2020 – 2022 |
| Zhou, Y.* | | | | 2021 – 2022 |
| *Arts, J.J.* | | | | *2017 – 2017* |

| Faculty member | Part-time factor** | Full Professor | Associate Professor | Assistant Professor |
|---|---|---|---|---|
| *Chockalingam, A.* | | | | *2017 – 2019* |
| *Dabadghao, S.S.* | | | | *2017 – 2020* |
| *Flapper, S.D.P.* | | | | *2017 – 2020* |
| *Huang, B.* | | | | *2017 – 2020* |
| *Kinable, J.* | | | | *2017 – 2020* |
| *Lai, S.W.* | | | | *2020 – 2021* |
| *Lurkin, V.J.C.* | | | | *2018 – 2020* |
| *Ooijen, H.P.G. van* | | | | *2017 – 2020* |
| *Rohmer, S.U.K.* | | | | *2020 – 2021* |
| *Udenio, M.* | | | | *2017 – 2017* |
| *Veelenturf, L.P.* | | | | *2017 – 2020* |

Names of former faculty members are in *italics*.
(*) faculty members currently in a track from Assistant to Associate Professor or from Associate to Full Professor.
(**) indicated part-time factor is per end 2022.

Scientific faculty not on payroll: A.W. Veenstra (Full Professor, 0.2 fte, 2018-2022), D. Lamghari-Idrissi (Assistant Professor, 0.2 fte, 2021-2022).

**Keywords:** operations management, supply chains, transportation, maintenance, manufacturing systems

**Research area**
Most of the research within the group of Operations, Planning, Accounting & Control (OPAC) deals with the control of operational processes. In these processes, scarce resources (e.g., machines, people, or transportation means) are used to transform, move, or store materials. The emergence of artificial intelligence, big data analytics and computer power allows us to combine data-driven decision-making with more traditional theory-driven methodologies for operations management. With smart control of the operational processes, activities can be done more efficiently and more effectively. Working on decisions at the strategic, tactical, and operational level, OPAC's research leads to cost savings and a lower (carbon) footprint, helping to deal with the challenges resulting from an aging population and scarcity of resources in general.

We distinguish the following four research lines:
**1. Supply Chain Management**: Within this line of research, we develop efficient and effective methodologies for optimizing supply chains' financial and operational decisions. These methods are applied at high-tech companies, fast-moving consumer goods companies, chemical companies and retailers. We provide methods to support: (i) purchasing (product portfolio decisions, pricing, vendor management), (ii) operations (demand planning, forecasting, inventory management), (iii) distribution (supply chain configuration planning), (iv) sales (order acceptance and revenue management), (v) integration (connecting the flow of work and operations) functions of supply chains, and (vi) re-engineering of supply chains around circularity.

**2. Smart Industry**: There is an ongoing revolution in industry driven by giant leaps in digital, automation, robotic and networking technologies, which can be linked to create the Internet of Things (IoT). The big challenge is to identify which technologies should be combined and how to be more productive with fewer resources and less waste, as such contributing to a more sustainable world. The aim of this research line is to develop new data-driven modeling methods and computational tools to support and improve the design and control of manufacturing networks. This research is firmly grounded on mathematics, with a focus on stochastic models, performance analysis, optimization and control. The resulting decision support tools are validated in various industrial applications including high-tech manufacturing systems, biomanufacturing, and manufacturing logistics.

**3. Transportation**: This research stream focuses on designing efficient, sustainable, and innovative solutions for complex transportation networks that face disruptions and emerging challenges. We develop data-driven methods for freight and passenger (public) transport, explicitly addressing the uncertainties and dynamics that characterize applications in, for example, city logistics, energy, and shared mobility. We benefit from an extensive network of transport and logistics companies that steers our research agenda towards current real-life problems but also serves as a field laboratory for the developed solutions.

**4. Maintenance Operations and Reliability Engineering**: This research focusses on efficient service supply chain management for enabling high uptime of advanced capital goods such as wafer scanners and military equipment which are used in primary processes. In the age of Industry 4.0, new technologies are increasingly being used to increase availability and lower costs: sensors and the IoT are used to gather real-time condition information to enable predictive maintenance and smart logistics, while 3D printing of spare parts and blockchain technology allow fundamental changes to the design and control of service supply chains.

OPAC leads the departmental research theme 'Supply Chain Management' and is also active within the themes 'Value of Data-Driven Intelligence' and 'Sustainability and Circularity'. Its research is well embedded in the Eindhoven Artificial Intelligence Systems Institute (EAISI), where it is also leading the ICAI-Lab "AI-enabled Manufacturing and Maintenance" (AIMM). OPAC leads the national research school for Operations Management and Logistics (Beta), and the European Supply Chain Forum (ESCF). OPAC is also strongly involved in TKI Dinalog.

**Key scientific output**
*The 5 most important scientific output in the period 2017-2022*

**Westerweel, B., Basten, R.**, den Boer, J. & **van Houtum, G.J.** (2021). Printing spare parts at remote locations: Fulfilling the promise of additive manufacturing, *Production and Operations Management*, 30(6), 1615-1632. (AIS top 10% and target journal). This paper shows how to use additive manufacturing as an additional supply source in a supply chain to a remote location. It includes a case study on the Mali mission of the Royal Netherlands Army. This paper is published in a top journal and is known by everyone active on the interface between additive manufacturing and supply chain management (as evidenced by the 25 citations in Scopus mid-January 2023). The paper has received the ISIR best student paper award in 2018.
(**KPI:** Publications in line with **publication strategy**; **Citations**)

Gaast, J. van der, Koster, M.B.M. de, **Adan, I.J.B.F.** & Resing, J.A.C. (2020). Capacity analysis of sequential zone picking systems, *Operations Research*, 68(1), 161-179. (AIS top 10% and target journal). This paper, published in a flagship journal, is the first to analyse one of the most popular internal transport and order picking systems and develops a capacity model, based on multi-class jump-over queueing networks. It received the Best Paper Award of the Special Interest Group Facility Logistics of the INFORMS Transportation Science and Logistics (TSL) Society at the INFORMS Annual Meeting 2020.
(**KPI:** Publications in line with **publication strategy**)

**Dellaert, N.P., Dashty Saridarq F., Van Woensel, T.** & Crainic, T.G. (2019). Branch & Price Based Algorithms for the Two-Echelon Vehicle Routing Problem with Time Windows, *Transportation Science*, 53 (2), 319-622. (AIS Q1 and target journal). This paper studies the two-echelon capacitated vehicle routing problem with time windows. We compare a number of formulations and solution methods on a comprehensive set of instances and are able to solve instances up to five satellites and 100 customers to optimality. This paper is the first paper in the literature that solves such large instance sizes in exact manner.
(**KPI:** Publications in line with **publication strategy**; **Citations**)

**Schlicher, L.P.J., Slikker, M., Van Jaarsveld, W. & van Houtum, G.J.** (2020). Core Nonemptyness of Stratified Pooling Games: A structured Markov decision process approach, *Mathematics of Operations Research*, 45 (4), 1445-1465. (AIS top 10% and target journal). This paper marks the first application of Markov decision processes to cooperative game theory. The paper was published in a journal that ranks top 10% in the category "Applied Mathematics" of WoS, with an AIS score of 1.766.
(**KPI:** Publications in line with **publication strategy**)

**Martagan, T.G.**, Krishnamurthy, A. & Leland, P. (2020). Managing trade-offs in protein manufacturing: how much to waste?, *Manufacturing & Service Operations Management*, 22 (2), 330-345. (AIS top 10% and target journal). This pioneering work considers the challenges and trade-offs involved in the manufacturing of engineered proteins, and has been applied in industry practice at Aldevron. *Manufacturing & Service Operations Management* is a target journal for the OPAC group. (**KPI:** Publications in line with **publication strategy**)

**Key societal output**
*The 5 most important societal output in the period 2017-2022*

**de Kok, A.G.** (2018). Inventory management: Modeling real-life supply chains and empirical validity, in: Foundations and Trends® in Technology, Information and Operations Management, 11(4), 343-437. This monograph provides the first extensive discussion on the empirical validity of inventory models for real-life systems. On top of that a research agenda is provided for extending existing results to capacitated systems, the major hurdle to be taken. A generic simulation-based efficient optimization method for real-life capacitated multi-echelon systems is provided based on a major result on the so-called Newsvendor fractile that unifies and extends all existing results. (**KPI: Dissemination** results to the **stakeholders**)

**Martagan, T.G., Koca, Y., Adan, I.J.B.F.**, Ravenstein, B. van, Baaijens M. & Repping, O. (2021). Operations Research Improves Biomanufacturing Efficiency at Merck Sharp & Dohme, *INFORMS Journal on Applied Analytics,* 51 (2), 150-163. This article presents the details of the three-year collaboration with MSD and the achievements in practice, and was second prize winner in the 2021 INFORMS Innovative Applications in Analytics Award. A number of professional magazines and industry outlets picked up this story. Examples include the interviews of Tugce Martagan in IFORS magazine (https://www.ifors.org/newsletter/ifors-news-march-2020.pdf) and IMPACT magazine (https://www.theorsociety.com/publications/magazines/impact-magazine/; issue 11, Spring, pp. 21-24). The Merck Animal Health collaboration was finalist for the 2022 INFORMS Franz Edelman Award, see https://meetings.informs.org/wordpress/analytics2022/tracks/2022-edelman-competition. Also, dr. Martagan was one of the three finalists of the Marie Skłodowska-Curie 2020 HR AWARDS.
(**KPI: Use of outreach** products by **stakeholders**)

"Sell More, Waste Less, Be Fresh", project by **Karel van Donselaar** and **Rob Broekmeulen.**
In this project, a simple measure was developed to identify which products have a lot of food waste. This measure, called Fresh Case Cover (FCC), has been based on empirical data of three large supermarket chains in Europe. It is widely adopted and has resulted in a lot of food waste reduction and in cost savings of millions of Euros. Further, research results and insights were extensively disseminated via webinars, publications and presentations at business conferences and by incorporating them in a master course. The research is also actively used to educate industry, politics and societal organizations. The project has been awarded with the 2019 IE&IS Valorization Prize. See also: https://www.cursor.tue.nl/en/background/2020/januari/week-2/combating-food-waste-with-smart-purchasing/
(**KPI: Use of outreach** products by **stakeholders**)

**Lamghari-Idrissi, D.**, Van Hugten, R., **Basten, R., & van Houtum, G.J.**, Towards a customer-centric parts and tools concept implemented at ASML, working paper, Eindhoven Universiy of Technology, 2020. For this PhD research, Douniel Lamghari-Idrissi investigated Extreme Long Downtime (XLD) constraints for spare parts inventory planning and showed how much the performance of a factory improves when the yearly number of XLD-s is reduced (while keeping the total yearly downtime at the same level). This formed the basis for a new planning concept for spare parts and service tools at ASML, which has been implemented in 2020. The new concept resulted in a total cost increase of 5% for ASML, and a worldwide decrease of 20% in the number of extreme long downtime events. The decrease in extreme long downtime events represents a value for ASML's customers that is at least one order of magnitude higher than the cost increase. This project has been awarded with the 2021 IE&IS Valorization Prize, see https://research.tue.nl/en/prizes/ieampis-valorization-prize-2021. It was also a finalist for the 2021 INFORMS Wagner prize, see https://research.tue.nl/en/prizes/2021-informs-wagner-prize-finalist
(**KPI: Use of outreach** products by **stakeholders**)

Bouchery, Y., Corbett, C. J., **Fransoo, J. & Tan, T.** (2017), Sustainable Supply Chains: A Research-based Textbook on Operations and Strategy, Springer, ISBN 978-3-319-29791-0. This book is the first textbook on Sustainable Supply Chains that is used at many universities around the globe, with 2.6 million downloads to date.
(**KPI: Outreach** activities; **Dissemination** results to the **general public**)

## APPENDIX A.6: PHILOSOPHY & ETHICS

**Group leader**
Prof.dr. W.N. Houkes: as of 2017

**Scientific faculty**

| Faculty member | Part-time factor ** | Full Professor | Associate Professor | Assistant Professor |
|---|---|---|---|---|
| Houkes, W.N. | | 2019 – 2022 | 2017 – 2019 | |
| Royakkers, L.M.M. | 0.5 fte | 2020 – 2022 | 2017 – 2020 | |
| *Müller, V.C* | | *2019 – 2022* | | |
| *Meijers, A.W.*M. | | *2017 – 2019* | | |
| Nickel, P.J. | | | 2018 – 2022 | 2017 – 2017 |
| Vaesen, K. | | | 2019 – 2022 | 2017 – 2019 |
| Bombaerts, G.J.T.* | | | | 2018 – 2022 |
| Frank, L.E.* | | | | 2017 – 2022 |
| Hummel, P.A.* | | | | 2021 – 2022 |
| O'Neill, E.R.H.* | 0.7 fte | | | 2017 – 2022 |
| Šešelja, D.* | 0.25 fte | | | 2019 – 2022 |
| Spahn, A.* | | | | 2017 – 2022 |
| Sullivan, E.E.* | | | | 2020 – 2022 |
| Zednik, C.A.* | | | | 2020 – 2022 |
| *Gabriels, K.* | | | | *2017 – 2018* |
| *Katzav, J.K.* | | | | *2017 – 2017* |
| *Nyholm, S.R.* | | | | *2017 – 2019* |
| *Vries, M.J. de* | | | | *2017 – 2017* |
| *Zwart, S.D.* | | | | *2017 – 2018* |

Names of former faculty members are in *italics*.
(*) faculty members currently in a track from Assistant to Associate Professor or from Associate to Full Professor.
(**) indicated part-time factor is per end 2022.

**Keywords:** applied ethics, epistemology, meta-ethics, philosophy and ethics of AI, philosophy of science, philosophy of technology, meta-science

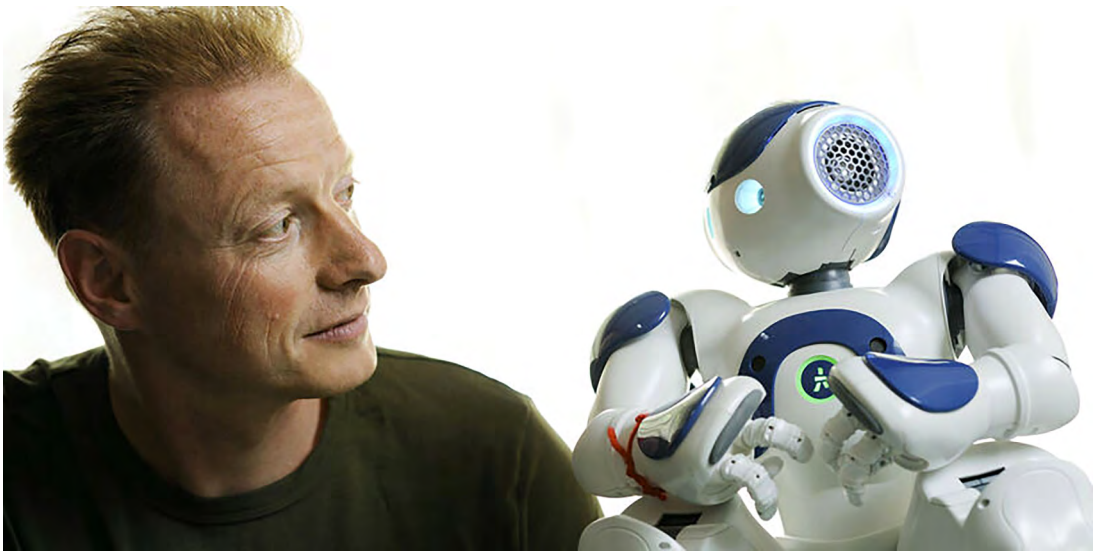
**Research area**
Research at the Philosophy & Ethics (P&E) group connects philosophy and ethics to technology and innovation. We believe the design, use, and regulation of technologies is enriched by ethical and philosophical analysis. In turn, philosophy must be informed by science, innovation, and technological developments. A few of the research topics studied in the group include responsible and explainable AI, artificial moral agency, theories and models of technological and cultural

evolution, research policy, and ethical assessment of persuasive technologies, social robotics, advances in medical and mobility technologies and engineering ethics.

Interdisciplinary cooperation is vital for our research, which often involves direct engagement with the natural, engineering and social sciences. Researchers in the P&E group often study innovative technologies and technology-related problems in detail to enable genuinely empirically informed analyses that are meaningful to philosophers, researchers in other areas, and society. For this purpose, we have established close interdisciplinary collaborations with researchers from other research groups in the department IE&IS, as well as with mechanical engineers, computer scientists, social physicists, and archaeologists, among others.

At the same time, we view fundamental philosophical research as an essential part of what we do. Our research on technology-related problems and technological innovations requires going beyond the application of existing frameworks. Members of the group have proposed substantial changes to existing philosophical theories such as Kantian ethics, responsible innovation frameworks, and the extended-mind hypothesis. Members have also developed entirely new philosophical frameworks, such as the ethical design cycle and theories of technical functions and of engineering knowledge. Moreover, we work on fundamental critical assessments of technology-related research in various sciences, and of research programs in engineering disciplines.

Our research strategy, as described above, is an example of the departmental emphasis on using excellent disciplinary research as a foundation for inter- and transdisciplinary work on complex societal challenges. We aim to contribute directly to ongoing debates within philosophy and are also engaged in a wide variety of interdisciplinary collaborations that focus on particular application areas. Several of these collaborations fall in the scope of the departmental research themes 'Sustainability and Circularity' (e.g., research on energy ethics), 'Value of Data-driven Intelligence' (e.g., research on responsible AI), and 'Humans and Technology' (e.g., research on social robotics).



At TU/e, we participate actively in a number of research institutes, in particular the Eindhoven Artificial Intelligence Systems Institute (EAISI). Outside TU/e, we have strong, institutionalized collaborations, especially within the Netherlands. The P&E group is a member of the Dutch Research School for Philosophy (OZSW). We are one of five institutes participating in the research program "Ethics of Socially Disruptive Technologies", funded by the Dutch Ministry of Education, Culture and Science through its Gravitation scheme. Finally, we recently launched the Eindhoven Center for Philosophy of AI.

**Key scientific output**
*The 5 most important scientific output in the period 2017-2022*

Klenk, M., **O'Neill, E.**, **Arora, C.**, Blunden, C., Eriksen, C., **Frank, L.** & Hopster, J. (2022). Recent Work on Moral Revolutions, *Analysis* 82(2), 354-366. (AIS Q1). This commissioned article analyzes commonalities and points of disagreement in recent philosophical accounts of moral revolutions, which we define minimally as radical, group-level moral change. It is a key early research product of the Ethics of Socially Disruptive Technologies (ESDiT), involving a team of authors from participating institutes. It is published in the most established journal for philosophical discussion pieces regarded as generally relevant for the field, and therefore indicates the large potential for disciplinary impact of work in the ESDiT program.
(KPI: Publications in line with **publication strategy**)

**Müller, V.C.** (2020). Ethics of artificial intelligence and robotics, in: Edward N. Zalta (ed.), *Stanford Encyclopedia of Philosophy* (Summer 2020; Palo Alto: CSLI, Stanford University), 1-70. The Stanford Encyclopedia of Philosophy is the authoritative source of mainstream philosophy on the Internet, and is widely read, by philosophers as well as non-philosophers. This entry provides an in-depth overview of ten debates central to the topic, ranging from privacy and surveillance issues to artificial moral agents. The tweet announcing the publication had >25.000 views in a week. Google for "ethics of AI" has this article as hit #2, after Wikipedia.
(**KPI's**: Publications in line with **publication strategy**; **Altmetrics**)

**Royakkers, L.**, Timmer, J., Kool, L. & van Est, R. (2018). Societal and ethical issues of digitization, *Ethics and Information Technology,* 20(2), 127-142. (AIS top 10% and target journal). This article discusses the social and ethical issues that arise as a result of digitization. It is the first article that gives a taxonomy of public values that should be safeguarded in the digital era. The paper has one of the highest access scores (more than 73,000) of this journal and is in the top 5% of all research outputs scored by Altmetric.
(**KPI**: Publications in line with **publication strategy**; **Citations**)

**Vaesen, K.** & Katzav, J. (2017). How much would each researcher receive if competitive government research funding were distributed equally among researchers?, *PloS one*, 12(9), e0183967. (Target journal). The authors make a strong case for an alternative to currently dominant ways of distributing research money (viz., grant peer review). The paper immediately had a big impact. Since its publication, it has been consulted over 55,000 times, and it was covered by various national and international media outlets.
(**KPI:** Publications in line with **publication strategy**; **Altmetrics**)

**Šešelja, D.** & Frisch, M. (2021) Editor-in-chief of *European Journal for the Philosophy of Science*, the official journal for the European Philosophy of Science Association. It has, since its inception in 2010, quickly established itself as a leading journal in the field. It seeks to further diversity in the philosophy of science by being open to contributions from a large variety of approaches and backgrounds, including working scientists and policymakers, and endorses the 'Barcelona Principles for a Globally Inclusive Philosophy'.
(**KPI: Editorships**)

**Relevance to society: key outputs**
*The 5 most important societal output in the period 2017-2022*

Kool, L., Timmer, J., **Royakkers, L.** & van Est, R. (2017). Opwaarderen: Borgen van publieke waarden in de digitale samenleving, in cooperation with Rathenau Instituut. Report written following a request from the Senate to the Dutch government to determine whether society paid enough attention to the ethical side of digitization. As a result, the Cabinet announced research into the social effects of technological developments. Moreover, as a result of the report the SER (Economic and Social Council) initiated discussions with more than 100 key players in the field during two workshops (2017, 2018).
(**KPI's**: **Use of outreach products** by **stakeholders**)

**Sullivan, E.** (2021). What is machine learning and why does it matter. Interview for "Why? Philosophical discussions about everyday life", a Public radio show in the US, running for over 13 seasons. It is broadcasted through North Dakota Public Radio and has a large internet following. The average listeners include 30,000 for the online podcast and 12,000 live listeners in North Dakota. The broadcast is also syndicated for public radio in Michigan and California, reaching additional listeners. The audience includes a significant number of high school students in North Dakota and spans every state in the US and more than one hundred countries.
(KPI: **Dissemination** results to the **general public**)

**Sullivan, E.**, Sondag, M., Rutter, I., Meulemans, W., Cunningham, S., Speckmann, B. & Alfano, M. (2020). Vulnerability in Social Epistemic Networks. *International Journal of Philosophical Studies* 28(5), 731-753. This article won the PeriTiA prize. This prize, funded by the Horizon 2020 project PeriTiA, was awarded to exceptional work that makes progress in shaping public trust and public policy on socially important issues.
(**KPI**: Public awards and prizes)

**Vaesen, K.**, Scherjon, F., Hemerik, L. & Verpoorte, A. (2019). Inbreeding, Allee effects and stochasticity might be sufficient to account for Neanderthal extinction. *PloS one*, 14(11). The paper offers the currently most parsimonious explanation of Neanderthal extinction. The article was covered by over 100 national and international news outlets (including The Guardian, The Independent, The New Scientist, El Mundo, BBC). This research output ranked first in TU/e's 2019 list of research related media impact.
(**KPI's**: **Dissemination** results to the **general public**; **Altmetrics**)

de Hoop, E., van Oers, L., Becker, S., Macrorie, R., Spath, P., **Astola, M.** & Boon, W. (2019). Smart as a Global Vision? Exploring Smart in Local District Development Projects. *Architecture and Culture*, *7*(3), 437–455. Brainport Smart District (BSD) is a huge district development process that builds a new neighborhood from scratch. At the start of the project, many ethical issues arose on data security, justice aspects of risk distribution etc. P&E researchers were heavily involved in discussions with possible affected citizens. These discussions led to the creation of an ethics team on data management (see https://brainportsmartdistrict.nl/en/portfolio-category/research/.) All this was reported in the publication above.
(**KPI: Use** of outreach products by **stakeholders**)

## APPENDIX A.7: TECHNOLOGY, INNOVATION AND SOCIETY

**Group leader**
Floor Alkemade: as of 2019
Rudi Bekkers: 2017 – 2019

**Scientific faculty**

| Faculty member | Part-time factor** | Full Professor | Associate Professor | Assistant Professor |
|---|---|---|---|---|
| Alkemade, F. | | 2017 – 2022 | | |
| Bekkers, R.N.A. | | 2017 – 2022 | 2017 – 2017 | |
| De Coninck, H.C. | 0.8 fte | 2020 – 2022 | | |
| Oldenziel, R. | | 2017 – 2022 | | |
| Vleuten, E.B.A. van der | | 2017 – 2022 | | |
| *Jeekel, J.F.* | *0.2 fte* | *2017 – 2021* | | |
| *Smits, J.M.* | | *2017 – 2019* | | |
| *Verbong, G.P.J.* | | *2017 – 2020* | | |
| Berendt, F. | | | 2020 – 2022 | |
| Romijn, H.A. | 0.8 fte | | 2017 – 2022 | |
| Sadowski, B.M. | | | 2017 – 2022 | |
| Wieczorek, A.J. | | | 2020 – 2022 | 2017 – 2020 |
| *Castaldi, C.* | | | *2017 – 2019* | *2017 – 2017* |
| Colen Ladeia Torrens, J.N.* | | | | 2021 – 2022 |
| Davids, M.* | | | | 2017 – 2022 |
| Höffken, J.I.* | | | | 2017 – 2022 |
| Kirkels, A.F.* | 0.9 fte | | | 2017 – 2022 |
| Mas Tur, E.M.* | | | | 2017 – 2022 |
| Papachristos, G.* | | | | 2019 – 2022 |
| Raiteri, E.* | | | | 2018 – 2022 |
| Straeten, J.N. van der* | 0.8 fte | | | 2022 – 2022 |
| Veraart, F.C.A.* | 0.9 fte | | | 2017 – 2022 |
| *Kalmbach, K.* | | | | *2017 – 2021* |
| *Schipper, F.* | | | | *2017 – 2017* |

Names of former faculty members are in *italics*.
(*) faculty members currently in a track from Assistant to Associate Professor or from Associate to Full Professor.
(**) indicated part-time factor is per end 2022.

Researchers on payroll: M. Hauck - Drenth (2021-2022), W.P. Pauw (2022-2022)

Scientific faculty not on payroll: Q.C. van Est (Full Professor, 0.2 fte, 2017-2022), J.P.H. Smits (Full Professor, 0.2 fte, 2017-2022).

**Keywords:** sustainability transitions, energy, mobility, climate change mitigation, system innovation, history of technology, patents and standards

**Research area**
The Technology, Innovation and Society (TIS) group performs research on innovation and socio-technical transitions from an economic, transitions studies, and history of technology perspective, to understand and govern socio-technical transitions. More specifically, we aim to be a leading group in the young discipline of socio-technical and sustainability transitions research. As evidence towards this goal, several TIS researchers have contributed to a highly cited agenda-setting paper for the field.

Our systems-oriented research approach is grounded in the insight that technology development, use, and governance are pivotal to, and intimately entwined with, radical transformations in important societal systems such as energy and mobility. Studying such interactive and complex processes requires a deep understanding of both relatively short-term *innovation* processes (including their governance and societal implications) as well as long term, pervasive systemic changes that characterize *socio-technical transitions*. Our research asks how such complex processes can be conceptualized, empirically analyzed, modeled and validated to identify viable pathways and intervention points for desirable and sustainable innovations and transitions. Focus areas include past and ongoing transitions in energy and mobility.

Our research strategy includes collaboration within the university (on energy and mobility technologies and with EIRES), within the department on firm level processes (ITEM) and ethics (P&E) and within national and international networks. This includes the Fair Energy Transition Centre, an interuniversity center that is part of the strategic EWUU alliance. Internationally our key research networks include the sustainability transitions network (STRN), and the Society for the History of Technology (SHOT).

Societal impact is a key value within TIS research, and our projects typically involve close collaboration with societal stakeholders. Our researchers play key roles in local, national and international debates on e.g., climate change, sustainable development, innovation policy, or patents. For example, after the publication of the IPCC WGIII Sixth Assessment Report, Heleen de Coninck was cited hundreds of times in both national and international media on the main results of the report, including on BBC News (**KPI: Dissemination** results to the **general public**).

Researchers in the TIS group excel in research, education and impact. While this is the result of team effort, we are especially proud of Anna Wieczorek (citizen engagement award), Heleen de Coninck (IPCC lead author), and Rudi Bekkers (recently asked to join the European Commission High-Level Forum (HFL) on Standardization) who have greatly contributed to the impact of TIS research in society. Johanna Höffken was awarded the best university teacher of the Netherlands award, illustrating how our research is translated to education for the next generation. The ERC consolidator grant of Floor Alkemade on 'Fostering social tipping dynamics to Accelerate Sustainability Transitions' and the appointment of Ruth Oldenziel as editor in chief of technology and culture demonstrate our research excellence.

**Key scientific output**
*The 5 most important scientific output in the period 2017-2022*

Blanco, G., **de Coninck, H.**, Agbemabiese, L., Mbaye Diagne, E.H., Diaz Anadon, L, Lim, Y.S., Pengue, W.A., Sagar, A.D., Sugiyama, T., Tanaka, K., Verdolini, E. & Witajewski-Baltvilks, J. (2022). Innovation, technology development and transfer. In IPCC, 2022: *Climate Change 2022: Mitigation of Climate Change*. *Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [P.R. Shukla, P.R., Skea, J., Slade, R., Al Khourdajie, A., van Diemen, R., McCollum, D., Pathak, M., Some, S., Vyas, P., Fradera, R., Belkacemi, M., Hasija, A., Lisboa, G., Luz, S., & Malley, J. (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. Heleen de Coninck was a coordinating lead author in the mitigation (working group III) contribution to the IPCC's Sixth Assessment Report (2022). She co-led the chapter on innovation, technology development and transfer with Gabriel Blanco, and contributions were made by TIS group members Rudi Bekkers and Clara Caiafa.
(**KPI: Citations**)

**Bommel, N. van,** & **Höffken**, **J.I.** (2021). Energy justice within, between and beyond European community energy initiatives: A review, *Energy Research and Social Science*, 79, [102157]. (AIS Q1 and target journal). This paper that has already been cited 29 times on Scopus brings together to prominent TIS topics: energy communities and just transitions. The paper explores explore how the notion of energy justice is discussed within scholarly work on community energy initiatives in Europe.
(**KPI:** Publications in line with **publication strategy**)

**Bekkers, R**., Martinelli, A. & Tamagni, F. (2020). The impact of including standards-related documentation in patent prior art: Evidence from an EPO policy change. *Research Policy*, 49(7), 104007. (AIS Q1 and target journal). This paper illustrates the expertise, the creation and adoption of technical standards. Members of TIS had the leading role in a large study commissioned by the European Commission on Standard Essential Patents. This disciplinary expertise is pivotal to understand and govern the enabling technologies for the energy and mobility transition. *Research Policy* is a target journal for the TIS group.
(**KPI:** Publications in line with **publication strategy**)

**van der Vleuten, E.** (Ed.) (2020). Forum: History and Technology in an Age of 'Grand Challenges'. *Technology and Culture*, 61(1), 260-332. (Target journal). Special issue edited by Erik van der Vleuten. *Technology and Culture* is a target journal for the TIS group. The special issue presents research agendas and findings from the Tensions of Europe flagship program "Technology and Societal Challenges ca. 1800-2050.
(**KPI:** Publications in line with **publication strategy**)

Köhler, J., Geels, F. W., Kern, F., Markard, J., **Wieczorek, A., Alkemade**, F., ... Wells, P. (2019). An agenda for sustainability transitions research: state of the art and future directions. *Environmental Innovation and Societal Transitions*, 31, 1-32. (AIS top 10% and target journal). This paper presents the research agenda for the field of sustainability transitions research. The 2019 paper has been cited over 700 times. The active contributions of Anna Wieczorek and Floor Alkemade to the agenda setting process underlines the pivotal role of TIS in the sustainability transitions field. Several substantive responses to the agenda have also been formulated and published.
(**KPI:** Publications in line with **publication strategy**; **Citations**)

**Key societal output**
*The 5 most important societal output in the period 2017-2022*

European Citizens Award for the community-based Virtual Power Plant (cVPP) led by TIS researcher **Anna Wieczorek**. The contest, organized by the European Commission, selected the cVPP research as a top research project in sustainable energy, which contributes to a cleaner and more sustainable future for all EU citizens. The cVPP research develops a radical sustainable innovation with and for citizens. By empowering prosumers and energy communities, it offers advantages for the energy system at large and accelerates energy transition towards sustainability.
(**KPI: Public awards and prizes**)

**Rudi Bekkers** was invited to address the European Parliament during a public hearing on patents and standards (January 2019). He also advices the Dutch government on standardization matters as appointed member of the Forum Standaardisatie. He also serves on the Europe Advisory Council of IEEE SA, one of the largest standard setting bodies in the world, and the European Commission High-Level Forum (HFL) on Standardization.
(**KPI: Membership of civil** supervisory and **advisory bodies**; **Research funding from** industry and **third parties**)

The Bridges project led by **Henny Romijn** supported the Government of Somalia/Somaliland to enhance inclusive economic growth and reduce poverty by assisting in skill development for two key infrastructure sectors: road construction and energy services. In order to meet growing demand for skilled people in these sectors, the project upgrades the quality of education in vocational training institutes and universities and makes them more market-responsive.
(**KPI: Outreach** activities)

In 2022, **Heleen de Coninck** was asked by the Dutch Royal Academy of Science and the Dutch Research Council to chair a task force that aims to set up a major interdisciplinary climate change research initiative, KIN (Klimaatonderzoek Initiatief Nederland (Dutch Climate Research Initiative)).
(**KPI: Membership of civil** supervisory and **advisory bodies***)*

Comparative analysis of standardized protocols for EV roaming: Report D6.1 for the evRoaming4EU project by Van der Kam, M. & **Bekkers, R.N.A**., May 2020, Netherlands Knowledge Platform for Public Charging Infrastructure (NKL). 41 p. This report was already downloaded more than 800 times.
(**KPI's**: **Dissemination** results to **stakeholders**; **Altmetrics**)

# APPENDIX B – DEPARTMENTAL RESEARCH THEMES

This appendix describes each departmental research theme in more detail, including the roadmap for future research. Typical projects per theme are given as an illustration. When the overall project leader is from outside the department, the IE&IS responsible person is indicated. Many of the projects mentioned comprise a successful collaboration of several groups of the department. For organizational purposes, the project lead role rests with only one department or group.

## APPENDIX B.1: HUMANS AND TECHNOLOGY

**Research theme leader(s)**
- Wijnand IJsselsteijn – *2016 - present*

**Core team**
The members of the core team that decides on the strategy, content and implementation of the theme are:
- Wijnand IJsselsteijn
- Annelies Bobelyn
- Raymond Cuijpers
- Rinie van Est
- Yvonne de Kort
- Lambèr Royakkers
- Pieter Van Gorp
- Sonja Rispens

**Keywords:** human-centered design, responsible and ethical AI, human-technology relation

**Website:** Humans and Technology

**Research area**
We focus on human-centered and value-sensitive approaches to technology understanding and design. We investigate how different technologies can impact human mind, behaviour, and values, as well as how technologies should be designed for effective, sustainable, and responsible interaction with humans at individual, interpersonal, organizational and societal levels. The expertise of the 'Humans and Technology' research theme is unique in terms of its potential to translate and apply knowledge and methods from the social sciences and humanities to technological innovation and its societal implementation, as well as study the conditions under which responsible research and innovation may be realized. Based on that, we pursue human-centered and value-sensitive design of technologies in order to improve the human condition and society at large. Our approach fits well to the TU/e strategy focusing on educating excellent engineers who realize that in order to develop valuable and sustainable technologies one must consider, at all times, users, society and our shared ecology as part of the larger technological innovation process.

**Topic roadmap**
**1. Ethical and human-centered AI**
Despite our enthusiasm for the possibilities offered by AI, we will also need to make sure that it will be beneficial to human society and the environment at large. Thus, the main challenges in artificial intelligence are of a socio-technical nature. We need AI that is responsible, fair, free from bias, trustworthy and transparent, where humans can exert meaningful control, and the AI does not pose a threat to human wellbeing, or the future of our planet. Our research focuses on understanding the relevant ethical and human-centred values pertaining to AI, the ways in which AI challenges these values, and methods by which such values may be embodied in real-world systems in various domains, including healthcare, education, public services, media/social media and democracy, environmental monitoring, manufacturing, logistics and mobility.

**2. Human-robot relations and collaborations**
Innovative AI and robotic solutions drive the development of smart technologies. AI-based intelligent robots may hold great benefit to human productivity, health, and wellbeing. Critical to this development is the creation of safe, effective, and pleasurable human-robot interaction. Under that condition, human-centric AI systems can improve their efficiency on collaborative tasks in application domains including healthcare (mental health and elderly healthcare), mobility, entertainment, logistics, retail and manufacturing. Central to productive and meaningful human-robot collaborations is the extent to which worker wellbeing is at the center of the production process, and sustainable, high-quality jobs are created. A broader set of stakeholder values beyond economic growth will be taken into account, using new technologies to ensure prosperity, while respecting the limits of our planet.

**3. Responsible development of extended reality**
Extended reality (XR) opens a new playfield for humans to interact with the world. It is an umbrella term that includes augmented reality, virtual reality, and mixed reality, which all mediate or substitute reality with digital information. Its real power is in the convergence between AI, IoT and XR, when people will be able to interact with intelligent agents and adaptive, interactive environments Responsible XR addresses ethical concerns, including the collection and usage of user data, the nature of online identity, and the psychological effects of alternate, immersive realities. Using human-centric and value-sensitive perspectives to XR, responsible implementations

of XR technologies are explored for applications in (social) media, education, healthcare, urban mobility, and energy efficiency.

**4. Healthful environments, services and applications**
Fostering physical and in particular mental health has become one of the grand challenges of our time. Technological innovations not only offer promise for increasing efficiency, reducing cost and up-scaling but, even more importantly, can also meaningfully contribute to the quality of preventive, diagnostic, curative and palliative care. We aim to promote health and mental wellbeing by creating, utilizing and optimizing novel technological solutions (e.g., ambulatory sensing, self-tracking, AI) that are user-centered, personalized, and grounded in our everyday social and physical context, building on theories and methods from psychology, gerontology, chronobiology, and psychiatry. Important application domains are mHealth, behavior-change applications, warm technology for dementia, and integrative lighting solutions for sleep and mental health and wellbeing**.**

**5. Responsible, open and interdisciplinary science practices**
Responsible Research and Open Science ensure reliability with respect to a high quality of research. These practices include preregistration of research designs, improved statistical inferences, open review practices, open access to research data and publications, and replication of findings across multiple labs. They will aid in establishing a cumulative and more reliable science, thus increasing public trust in scientific evidence. Adherence to the highest ethical standards will help to make research contents more responsive to the needs of society. Our research in this area focuses on how to stimulate responsible and cumulative science practices, and on understanding and overcoming barriers to open and interdisciplinary exchange and collaboration

**Overview of the most important projects**

***ESDiT: Ethics of socially disruptive technologies, roadmap topics 1, 2 and 3***
**Funding: NWO Gravitation**
**IE&IS project leader: Wijnand IJsselsteijn (groups involved HTI & P&E)**
This prestigious 10-year research program has been granted under the NWO Gravitation Scheme – the single largest competitive grant scheme that NWO offers, recognizing the key importance of certain areas of research, and acknowledging the quality of the research teams currently involved. The ESDiT (ethics of socially disruptive technologies) program aims to develop new approaches and methods which help to understand social and ethical aspects of societally disruptive technologies, such as AI, robotics, IoT, bio-engineering or climate engineering. The consortium explores how to innovate ethics of technology itself, so that that ethics may be future-proof in critically evaluating and guiding the development and introduction of societally disruptive technologies.
One of the outcomes of the project is to rethink and reposition the place of SSH (Social Sciences and Humanities) disciplines in relation to engineering sciences through ethical and philosophical analyses with respect to responsible research and innovation.

***QoLEAD: Quality of Life by use of Enabling AI in Dementia, roadmap topics 1 and 4***
**Funding: NWO/ZonMW KIC**
**Project leader: Wijnand IJsselsteijn (groups involved HTI & department Industrial Design)**
The QoLEAD project has been funded under the highly competitive NWO/ZonMW KIC Programme "Living with dementia". Its primary aim is to improve the quality of life of people with dementia by addressing challenges related to dementia in three core areas: 1) health, safety, quality of care; 2) social participation and social contact; 3) autonomy, meaning, self-respect. People with dementia and caregivers are leading these innovations in an open network of field labs, academic institutions and companies. By utilizing the learning and predictive power of AI, QoLEAD aims to tailor interventions and to deliver warm smart care solutions to optimally manage care/support over the entire course of dementia.

***Fluently: The essence of human-robot interaction, roadmap topic 2***
**Funding: EU, Horizon Europe**
**IE&IS responsible: Pascale Le Blanc (group involved: HPM)**
The Fluently Project is granted under the Horizon Europe Programme/Cluster 4 Digital, Industry and Space. It aims to develop a smart interface unit (AI-based system) designed to enable frictionless use of robots, and set up a platform "robo gym" where workers and robots can learn how to collaborate better. Workers can get training to improve their skills to collaborate with robots. The project establishes a first European hub for human-robot interactive training, where humans and robots can learn from each other a common work practice. The main impact of the project is to provide digital services for several companies from different manufacturing sectors to test their robotic solutions on Fluently's digital platform and involve them in trainings based on efficient human-robot collaboration.

***TR5 LIGHTCAP: Light, Cognition, Attention, Perception, roadmap topic 4***
**Funding: EU H2020, MSCI-ITN**
**Project leader: Yvonne de Kort (group involved: HTI and department Built Environment and 6 additional European universities)**
The LIGHTCAP project is granted under the H2020 Marie Skłodowska-Curie Innovative Training Networks (ITN) Programme. It supports the establishment and growth of a European training network to prepare the next generation of lighting experts to deliver on the promise of truly intelligent, integrative and human-centric lighting. It unites international, interdisciplinary and intersectoral expertise from a range of disciplines: neurobiology, cognitive neuroscience, chronobiology, psychology and lighting applications & technology. The project outcomes mainly focus on integrative solutions based on the analysis of biological, visual and/or emotional needs for light to push industry produce better products/solutions for the society. In this respect, the LIGHTCAP consortium implements training modules to support lighting experts and young researchers on human-centered lighting which combines nicely fundamental and applied research.

## APPENDIX B.2: SUPPLY CHAIN MANAGEMENT
## SUBTITLE: *VALUE OF NEW TECHNOLOGY IN END-TO-END SUPPLY CHAINS*

**Research theme leader(s)**
- Zümbül Atan & Rob Basten – *2021 - present*
- Geert-Jan van Houtum – *2016 - 2021*

**Core team**
The members of the core team that decides on the strategy, content and implementation of the theme are:
- Zümbül Atan
- Rob Basten
- Philippe van de Calseyde
- Remco Dijkman
- Néomie Raassens

**Keywords:** Maintenance, Manufacturing, Transport, Servitization, High-tech

**Website:** Supply Chain Management

**Research area**
This theme focuses on using established as well as novel techniques and on combining all required expertise to analyze and optimize supply chain functions, from acquisition of raw materials to the satisfaction of user needs, and the end-of-lifecycle operations. An important aspect is that we combine the technical systems with a behavioral operations management approach, ensuring that new technologies are implemented in industry in a meaningful way. Working directly with companies and having a close relationship with several network organizations such Logistics Community Brabant, World Class Maintenance and Service Logistics Forum enables us to address the most relevant industrial challenges in the high-tech and data-intensive industry.

**Topic Roadmap**
**1. High tech system operations**
New methods and computational tools are developed that exploit digital, automation, and robotic technologies to support and optimize the design and operational control of smart manufacturing networks. The resulting decision support tools are validated in various industrial applications, including high-tech manufacturing, biomanufacturing, manufacturing logistics, warehousing, maintenance, and servitized supply chains. Research questions also address the introduction of the human factor in the optimization of operational processes (together with the research theme Humans & Technology), how to optimize efficient after sales supply chain management, using techniques as sensor networks, 3D printing, and blockchain design technology, and how to manage maintenance, repair, replacement, and discharge for service-centric offerings, in which manufacturers often remain product owners and customers have a pay-per-use or subscription model.

**2. Smart mobility**
This research looks into novel ways to plan, schedule, and organize goods flows. It involves both long-haul distribution (e.g., multi-modal) and short-haul transportation (i.e., urban logistics). The main aim is to increase efficiency by reducing costs and CO2 emissions while maintaining a broad societal perspective focusing on more than just profit maximization. Key challenges are to efficiently handle increased uncertainty and high complexity, making use of advanced planning techniques, as well as (big) data analytics, Internet of Things approaches, and AI. In addition, this research theme focuses on new mobility solutions, from car and bike sharing to mobility-as-a-service (MaaS), and to smart hubs. It investigates these solutions from a business model, transportation optimization, and information systems perspective. In the end, the techniques that are developed from these perspectives, must ensure sustainable value and profit for all stakeholders involved.

**3. Marketing supply chain interface**
In our marketing supply chain interface, we focus on the role of supply chains, including the underlying channel relations, in serving customer needs and building long-term, value-adding customer relationships. We combine knowledge of all supply chain functions, such as procurement, service, supplier management, production/manufacturing, scheduling, warehousing, inventory management, and return management. It includes contributing to the circular economy by developing new business models on resource recovery, product life extension, and sharing platforms. In addition, facilitating collaboration along the supply chain is especially important because in recent years, manufacturers, wholesalers, and retailers have evolved into omni-channels, for which we aim to solve the typical problems, such as lack of inventory visibility, segmentation of supply chain processes, highly demanding order fulfilment processes, and reverse logistics.

**Overview of the most important projects**

***PrimaVera: predictive maintenance for very effective asset management, roadmap topic 1***
**Funding: National Science Agenda (NWA ORC)**
**Project leader: Rob Basten (groups involved: OPAC and HPM)**
No more train delays, power outages, or failure of production machines? This project represents a major step towards this goal. With predictive maintenance, or just-in-time maintenance, the reliability of infrastructure and production resources can be increased, and the costs of maintenance can be reduced. Maintenance is crucial in keeping highly complex and interrelated systems operational and safe. Improved maintenance will yield significant economic benefits as well as increased safety due to fewer disturbances and accidents.

***Data2Move: Data-Driven Disruption Management, NWO, roadmap topic 3***
***Funding: ESCF (European Supply Chain Forum)***
**Project leader: Tom Van Woensel (groups involved: OPAC and ITEM)**
While Data2Move started in 2017 as a NWO funded project, embedding it within the European Supply Chain Forum has allowed the community to grow. This community envisions that data and information technology are key for realizing data-driven decision making in supply chain management. Supply chain and logistics actors are challenged by innovations and disruptions leading to human capital scarcity and unpredictable logistics.
To keep a competitive edge, business should rely on digital supply chains in which algorithms and AI are exploited to create decision support that enables sustainability, efficiency, resilience, robustness, and meaningful work. A digital and transparent data infrastructure both within and across supply chain actors is crucial for achieving it in a resilient way.

***AI Planner of the future Project, industry funded, roadmap topic 2***
***Funding: ESCF (European Supply Chain Forum)***
**Project leader: Tom Van Woensel (groups involved: HPM, HTI, IS, ITEM, OPAC, P&E, TIS)**
The program envisions future planning to be a hybrid form of decision-making in which both human- and artificial intelligence are combined, able to properly handle the complexity within supply chains and logistics. The program is a unique research and valorization network and combines 25 AI-researchers, 12 PhD candidates and over 50 BSc- and MSc-students for five years (2021-2026). This program will help companies in the logistics field to transition to a more data-driven supply chain, whilst meeting sustainability challenges.

## APPENDIX B.3: SUSTAINABILITY AND CIRCULARITY

**Research theme leader(s)**
- Floor Alkemade – *2017 - present*
- Rudi Bekkers – *2016 - 2017*

**Core team**
The members of the core team that decides on the strategy, content and implementation of the theme are:
- Floor Alkemade
- Pascal Le Blanc
- Myriam Cloodt
- Zümbül Atan

**Keywords:** sustainability, circularity, sustainability transitions

**Website:** Sustainability and Circularity

**Research area**
This theme focuses on designing the socio-economic building blocks for a more sustainable and circular society, using a multidisciplinary systems perspective, including the relevant social sciences and humanities within the department IE&IS as well as the TU/e's engineering departments. Such multidisciplinary efforts are needed as the transition to a more sustainable and circular society requires more than technological change alone. Rather, it requires fundamental changes in (1) the behavior of individuals and companies, such as new business models and new collaborations for multiple value creation, and in (2) governance and institutions. Therefore, we analyze, develop and

engineer policies, business models and societal innovations that pave the way towards intrinsically rewarding circular economies, sustainable supply chains, and sustainable behavior of companies and of individuals.

**Topic Roadmap**

**1. Innovation ecosystems for a circular economy**

The transition to a circular sustainable economy requires the evolution of new, circular business models based on strategies for closing, slowing or narrowing resource flows. While companies are used to sell products based on their forward supply chains, they are now more and more aiming to increase their sustainability and embrace circular economy principles. This does however lead to many challenges and many firms struggle to change their existing linear business models to circular business models as the steps required for a successful transition are often poorly understood.

**2. Sustainable behavior of companies and individuals**

The transition to climate neutrality requires significant changes in the behavior of firms and individuals. These two domains connect in the workplace. At the same time, the challenge to ensure attractive jobs for people working in industries affected by the transition is a core element of the EU policies demanding a just transition. A major challenge for organizational sustainability efforts is thus to find ways in which individual actors may facilitate organizational sustainability (behavior). They often face high and conflicting demands that hinder the implementation of sustainability (behavior) and lack the resources to make a difference. Although their organizations may strongly influence them through 'top-down' job design and nudging strategies, there is ample room for individual employees to engage in proactive re-design of the work environment and choice architecture to steer their sustainability behavior.

**3. Sustainability transitions: system integration and societal readiness**

Now that the energy and mobility transitions are gaining momentum, important questions of system level integration occur. Sector coupling and the increasing electrification of industry and transport will lead to large changes in industrial structures. These changes in industrial structures will also affect citizens and communities through their spatial impacts and labor market consequences. Ensuring that the transition will be just requires insights from the social sciences and humanities on ethics, governance and market structures that will provide the rules of the game.

**Overview of the most important projects**

***NEON: Next-Generation Integrated Energy Services fOr Citizen Energy CommuNities; Lighting the way to zero emission energy and mobility, roadmap topic 1 and 3***
***Funding: NWO***
**IE&IS responsible: Floor Alkemade (groups involved: TIS, OPAC; institute EIRES; department Mechanical Engineering; department Built Environment)**
NEON is a multidisciplinary research program addressing three interrelated societal challenges: climate action, renewable energy, and smart & sustainable transport. It focuses on difficult technological problems while simultaneously evaluating and testing all technological and social options in a system setting through social research, living labs and an integral computer model. In total 33 PhD candidates are working in the domains Sustainable energy, Smart & safe mobility, Societal integration and Integral models, covering everything from chemistry and electrical engineering to law and psychology. All working together with the mutual goal of accelerating the energy and mobility transition through integral, multidisciplinary research.

***TR3 ORAKLE: Organizing knowledge and learning for the regional energy transition, roadmap topic 3***
***Funding: NWO - Societal aspects of the regional energy transition, 2019***
**Project leader: Anna Wieczorek (groups involved: HPM and TIS)**
ORAKLE focuses on the organization of learning and the exchange of knowledge about the energy transition in the province of North Brabant. To this end, the team is involved in a co-creative process to develop a knowledge platform. Via this platform, the regional actors will have a new way of sharing a range of lessons (academic-practical, technical-social).

***URBANE project: One health approach to support agroecological transformation of peri-urban farming, roadmap topic 1 and 2***
***Funding: EU HORIZON-CL6-2021-FARM2FORK-01-18***
**IE&IS responsible: Henny Romijn (groups involved: TIS and ITEM)**
URBANE designs real-world case studies that cover different agroecological zones focused on Western Africa. To achieve its aims, the project will be built around the principles of agroecology, meaning it will use nature-based solutions to restore degraded environments. This will deliver significant socioeconomic benefits and ensure resilient & safe food. By adopting a transdisciplinary and collaborative 'One Health' approach, the research aims to achieve optimal health outcomes for people, animals, and plants in their shared environment. The TU/e researchers will be in the lead for the development of new business models that support the transition of peri-urban farming towards agroecological farming concepts and practices. New sustainable and inclusive models will be worked out that support the URBANE approach, do justice to the local contexts, and include assessment of future upscaling potential to ensure long-term sustainable impact.

## APPENDIX B.4: VALUE OF DATA-DRIVEN INTELLIGENCE

**Research theme leader(s)**

- Yingqian Zhang – *2020 - present*
- Uzay Kaymak – *2016 - 2020*

**Core team**

The members of the core team that decides on the strategy, content and implementation of the theme are:

- Yingqiang Zhang
- Maryam Razavian
- Martijn Willemsen
- Alp Akcay
- Lily Frank

**Keywords:** Delivering impact with data

**Website:** Value of Data-Driven Intelligence

**Research area**

The goal of this research theme is to identify, investigate and exploit the rich value that is derivable from big data. The amount of data mined in industrial and governmental processes, health and well-being, and smart cities is growing exponentially. In turn, the reliance placed by humans, businesses and society at large on the information held within data has become critical to our understanding of and control over the rapidly evolving domains of commerce, manufacturing, healthcare, mobility, energy and agri-tech. We investigate, design, and develop artificially intelligent systems, not to replace, but to support and augment human understanding and decision making and to help organizations, and society at large, to innovate with these data. Our multidisciplinary approach extracts real value and true insights from data and ensures that human values and needs are factored in.

**Topic roadmap**

**Domain-aware data analytics and predictive modelling**

Data in different application areas often come in varying forms and degrees of complexity. The theme builds upon techniques acquired from learning analytics, behavioural analytics, process mining, and text mining to develop tailored learning approaches for domains such as health, manufacturing, mobility, energy, education, and business. As human experts we possess extensive domain knowledge in many applications. We develop hybrid data analytics solutions that integrate knowledge-based and data-driven machine learning models for more accurate and trustworthy predictions.

**Data-driven decision support systems**

Decision support systems are widely used to assist individuals and organizations with their judgement and decision-making tasks. We create data-driven decision support systems, based on optimization algorithms that use machine-learning techniques, with objectives that are relevant not only for businesses but also for individuals and society at large.

**Responsible, explainable, and interpretable AI solutions**

Innovating in the fields of big data and AI requires understanding and the incorporation of human needs, interests, and concerns as essential inputs for the design and development of AI. Taking existing notions of human-centred AI, we design and develop AI decision-making systems that understand human values, human behaviour and the dynamics of human-AI interaction, and realize responsibility, explainability and interpretability of AI solutions. This requires dedicated AI and machine-learning algorithms.

**Overview of the most important projects**

***CERTIF-AI: Certification of production process quality through artificial intelligence, roadmap topic 1 and 2***

**Funding: NWO Smart Industry 2019**

**Project leader: Remco Dijkman (groups involved: IS and OPAC)**

CERTIF-AI facilitates the certification that a production process leads to quality products and, when this is not the case, diagnose the problems in the production process.

A key outcome of the project will be the application of AI techniques to real-time sensor data, which for industry will mean fewer errors in production and therefore lower costs or greater reliability of the process and thus a better product or service.

***GOAL: Gamification for overweight prevention and active lifestyle, roadmap topic 1 and 2***
**Funding: Zon-Mw**
**Project leader: Pieter van Gorp (groups involved: IS, HPM; JADS; department Built Environment)**
GOAL aims to develop a multi-dimensional theoretical framework that supports evidence-based overweight prevention via gamified health technologies. This theoretical framework will be directed at eHealth service providers and urban infrastructure designers, supporting them to address gaps that exist in practice between significant elements of obesity-prevention strategies including health behavior change, smart healthy living environments and health game design.

***STABILITY: Sustainable circular extension strategies for inner-city bridges and quay walls, roadmap topic 2 and 3***
**Funding: PrIME – Programme for Infrastructure Management Excellence (NL)**
**Project leader: Zaharah Bukhsh (group involved: IS)**
STABILITY makes the historic quay walls and bridges of the Netherlands future-proof, by designing new AI-based planning methods that transform and tremendously improve the way asset maintenance is planned in practice. The methods will accommodate the wishes of asset managers and account for uncertainties stemming from complex urban environments.

# APPENDIX C – BUDGET AND RESEARCH STAFF

Table C1 gives an overview of the yearly budget available for research.

**Table C1. Budget**

| | 2017 | | 2018 | | 2019 | | 2020 | | 2021 | | 2022 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Funding:* | M€ | % | M€ | % | M€ | % | M€ | % | M€ | % | M€ | % |
| Direct funding [1] | 17,141 | 69% | 17,298 | 67% | 18,739 | 69% | 18,167 | 68% | 18,853 | 66% | 20,122 | 70% |
| Research grants [2] | 1,321 | 5% | 1,521 | 6% | 1,599 | 6% | 2,007 | 8% | 3,065 | 11% | 2,564 | 9% |
| Contract research [3] | 3,627 | 15% | 4,012 | 16% | 4,697 | 17% | 3,921 | 15% | 4,578 | 16% | 4,488 | 16% |
| Other [4] | 2,681 | 11% | 2,920 | 11% | 2,098 | 8% | 2,302 | 9% | 2,275 | 8% | 1,739 | 6% |
| **Total funding** | **24,770** | | **25,751** | | **27,133** | | **26,397** | | **28,771** | | **28.913** | |
| *Expenditure* | | | | | | | | | | | | |
| Personnel costs | 21,132 | 90% | 22,844 | 89% | 24,470 | 90% | 24,924 | 93% | 27,236 | 94% | 27,828 | 91% |
| Other costs | 2,271 | 10% | 2,942 | 11% | 2,774 | 10% | 2,000 | 7% | 1,670 | 6% | 2,618 | 9% |
| **Total expenditures** | **23,403** | | **25,786** | | **27,244** | | **26,924** | | **28,906** | | **30,446** | |
| **Results** | **1,367** | | **-35** | | **-111** | | **-527** | | **-135** | | **-1,533** | |

Table C2 gives an overview of the research staff within IE&IS over the period 2017-2022.

**Table C2. Input of research staff within IE&IS (2017-2022)**

| | 2017 | | 2018 | | 2019 | | 2020 | | 2021 | | 2022 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Research unit** | #[1] | FTE[2] | # | FTE | # | FTE | # | FTE | # | FTE | # | FTE |
| Full Professor[3] | 28 | 9.13 | 28 | 9.46 | 28 | 9.39 | 29 | 9.6 | 26 | 9.63 | 25 | 9.24 |
| Associate Professor[4] | 21 | 7.19 | 23 | 7.93 | 28 | 8.67 | 28 | 9.33 | 31 | 11.60 | 28 | 10.59 |
| Assistant Professor[5] | 76 | 25.83 | 69 | 24.00 | 76 | 26.02 | 77 | 26.50 | 68 | 24.63 | 67 | 25.97 |
| Postdocs | 20 | 9.33 | 25 | 12.02 | 30 | 15.40 | 29 | 13.86 | 24 | 13.36 | 19 | 11.15 |
| Support staff[6] | 4 | 2.03 | 11 | 4.65 | 11 | 7.03 | 12 | 7.87 | 7 | 4.99 | 3 | 1.97 |
| **Total research staff** | **149** | **53.51** | **156** | **58.06** | **173** | **66.51** | **175** | **67.16** | **156** | **64.21** | **141** | **58.92** |
| PhD candidates[7] | 101 | | 106 | | 110 | | 124 | | 121 | | 122 | |

1. Number of scientific staff on payroll; staff members changing positions during calendar year count in both categories.
2. Research FTE in Man-Year Equivalent (mye), where research effort is a percentage of the appointment. Standard research ratio is 40% for Professors, Associate Professors and Assistant Professors, 80% for postdocs and 100% for researchers. For some staff members, the ratio differs from the standard. Staff members changing positions during the calendar year are included in the respective categories based on contract duration, which affects the actual research capacity per category compared to the reported number of researchers.
3. Full Professors; tenured and non-tenured staff.
4. Associate Professors; tenured and non-tenured staff.
5. Assistant Professors; tenured and non-tenured staff.
6. Support staff (Researcher)
7. Standard PhD candidates (employed) and contract PhD candidates (externally or internally funded paid by IE&IS) and PhD candidates on scholarship.

## APPENDIX D – SCIENTIFIC AND SOCIETAL COUNCIL OF DEPARTMENT IE&IS

The members of the department's **Scientific Council** are:

| | | |
|---|---|---|
| Carel-Jan van Driel (chair) | Catch the Tide, Eindhoven, Netherlands | Transformational Coach |
| Armin Grunwald | Karlsruhe Institute of Technology, Institute for Technology Assessment and Systems Analysis (ITAS), Germany | Professor of Philosophy of Technology |
| Catholijn Jonker | Delft University of Technology, Netherlands | Professor of Interactive Intelligence |
| Alan Scheller-Wolf | Carnegie Mellon University, Tepper School of Business, USA | Professor of Operations Management |
| Christopher Tucci | Imperial College, London, UK | Professor of Digital Strategy & Innovation |

The members of the department's **Societal Council** are:

| | |
|---|---|
| Luc Kenter (chair) | Chair Board of Directors Thebe |
| Pallas Achterberg | Challenge Officer Alliander |
| Harold Bol | Senior Director Customer Support Central Services & Quality ASML |
| Anita O'Connor | General Director High School Education Veghel |
| Carel-Jan van Driel | Transformational Coach |
| Bert Garlich | CEO ZiuZ Visual Intelligence |
| André van Lammeren | Deputy director Planbureau voor de Leefomgeving |
| Eric van Schagen | CEO Simac Techniek NV |

# APPENDIX E – PUBLICATION STRATEGY DEPARTMENT IE&IS

The publication strategy of the department IE&IS is geared towards quality and scientific impact of the output of our research. We endorse the Dora Declaration[5] and make an effort to align our policy with its recommendations while also keeping in mind current academic research assessment practices. We have therefore formulated a hybrid strategy, composed of three core components:

- the acknowledgement of variance in publication culture across domains
- the conceptualization of quality as a process rather than mere metric
- the use of the Article Influence Score as general guidance for journal selection at the group and department level

**1. Publication cultures**

The majority of research in the department of IE&IS is inter- or multidisciplinary, and the intradepartmental research landscape is also quite diverse. The department and its groups acknowledge the variance in publication cultures across these domains[6] in terms of, for instance, the most relevant types of research output, rigid vs. more open selection of top and core journals, and weighting the importance of output relative to the subdomain. We regard peer-reviewed journal articles as a central publication type for all disciplines that are represented in the department, as well as for inter- and multidisciplinary research efforts. Other types of publication are important to specific disciplines in the department. For instance, high-impact and high-quality publications in the humanities include monographs, edited volumes and chapters in such volumes, whereas in other domains these may include conference proceedings. We therefore ask every group to characterize the publication culture of their specific domain and provide a list of target outlets.

Groups formulate their target outlets based on internal discussion of the quality and relevance of journals, their editorial boards and review practices. In addition, they explicitly consider the value and impact of all research outputs in addition to research publications. Based on this discussion, groups may opt to prioritize certain outlets[7], for instance, to enhance the group's visibility in the domain, in consideration of the relevance of their specific content, or because of the scientific impact of that specific outlet[8]. Target outlets of every group should be aligned with their stated characterization.

**2. Quality as a process**

Publishing in high-quality journals is a means to demonstrate, as well as improve, the quality of publications. High-quality journals are those journals that are relevant to the target topic, are selective, have thorough review processes and are highly respected by peer scientists. We therefore strive to frequently publish in Q1, and preferably in top 10% journals, but in our selection we always take into consideration that no single metric can provide a 100% valid quantification of quality. To this end, we encourage ongoing discussions of experiences with and opinions on relevant journals in every group and request groups to revisit and internally review their target journals on a regular 3-4 yearly basis.

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5 San Francisco Declaration on Research Assessment

6 NWO (2018). Study into Publication Cultures Social Sciences and Humanities. Den Haag

7 Internal note: this implies even those not rated Q1

8 Internal note: In line with this, we recommend against an opportunistic selection strategy of 'easy wins' in lieu of quality or relevance

**3. Article Influence Score (AIS)**
We acknowledge that no single quality metric is flawless or without risk. Still, in our ambition towards scientific quality and visibility, objective measures serve to provide guidance and clarity in defining what should be considered top. Given the recent criticism on the journal impact factor, we have selected the Article Influence Score as the primary indicator of quality. The AIS uses the structure of the entire network (based on scholarly references) of citations to evaluate the importance of each journal. It also includes the impact during a longer term than the journal impact factor. Moreover, this indicator allows comparisons across disciplines and is relatively stable as it is calculated based on the citations received over five years. The use of this AIS metric should, however, not be restrictive: we encourage groups to consider also qualitative indicators of scientific impact, such as the specific readership of a certain journal, its reputation in the domain, the quality, and status of the editorial board.

**4. Key Performance Indicators**
For formal assessment procedures at the department or group level, we monitor a selection of key performance indicators that together should give a balanced quantitative indication of the department's research. As indicated earlier, this may be informed and enriched with qualitative indicators of scientific impact.

a. Top journals – Striving for scientific excellence, we formulate the ambition to realize an increase in the (absolute) number of publications in top 10% journals and in Q1 journals. As a generic principle and for formal quantification purposes (e.g., research assessments), a journal is considered top 10% if it is in the top 10% of the relevant WoS category based on the AIS; a journal is considered Q1 if it is in the top 25% range of a WoS category based on the AIS.
b. Target journals & outlets – Striving for impact, we formulate the ambition to publish a substantial part of our research in the outlets that groups have recognized as relevant to their domain of work.
c. Editorships and special issues – in addition to publications, the department views editorship and guest editorship of special issues as an important means to create impact and visibility.

**Implication of the strategy for the department and groups**
The publication strategy defined here seeks to align with recent insights into the risks and merits of academic research assessments. It attempts to facilitate fair and meaningful assessments of research output of groups – taking note of differing publication cultures – while allowing some form of quantification for formal research assessment at the departmental level. Quality and scientific impact are hence defined in hybrid terms, employing quantifiable metrics to some extent, yet grounded in peer-based insights into the relevance of academic outlets, and bearing in mind the idiosyncrasies of different research domains.
Groups are furthermore required to establish their list of target outlets, in alignment with the general aims mentioned above – quality, scientific impact and Open Access (see below) – and with their specific publication culture, and are encouraged to publish there on a regular basis. This may include the publication of work in other shape or form than journal articles.

**Implication of the strategy for individual researchers**
For individual researchers, the departmental and group strategy should be interpreted as guiding rather than directive or restrictive. A group's target list may, for instance, help junior researchers in selecting a fitting and ambitious journal, or help researchers in inter-group collaborations in

finding outlets that suit both their as well as their partner's portfolio, but every researcher is free to select the outlet they see most fitting in light of their research and career ambitions. From this, it logically follows that we will not use the current target lists or journal-based metrics, such as AIS, as a surrogate measure of the quality of individual research articles to assess an individual scientist's contributions in hiring or promotion decisions. To this end, we ask researchers to provide their personal rationale for their selection of publication targets in their motivation and explanation with their cv when they appear in front of a 'benoemings advies commissie' (appointment advisory committee).

**5. Open Access**

Open Access publishing enhances the accessibility and visibility of scientific publications and hence facilitates dissemination and valorization of our work. As a department, we therefore warmly advise researchers to consider choosing Open Access for disseminating their work, yet, ultimately and in line with what was raised earlier, researchers should primarily weigh the quality and relevance of the outlet and feel free to select the outlet they consider most fitting for their work.[9]

In addition to Open Access for finalized manuscripts, we also advise that our researchers consider pre-registering their research in platforms such as the Open Science Framework, and sharing their data, software and other forms of output in public, freely accessible repositories in the service of scientific transparency and the creation of value to the scientific community and society at large.

**A learning perspective**

The research world, and in particular its perspective on publication cultures and strategies is changing at great pace. Currently, it seems that consensus is growing on the flaws of specific metrics, but we are yet to develop better alternatives. Our department will therefore take a learning rather than a decisive perspective in monitoring and upholding its publication strategy and will revisit and assess the strategy on a 3-4 yearly basis. In addition, departmental researchers in the meta science domain will be asked to perform more in-depth analyses on the measurable impact of publications and to share their insights for any future revisions of this strategy.


[9] Note that important funding bodies do require Open Access immediately after the original publication date, either via the publisher's platform (gold access), or through a trusted Open Access repository such as the TU/e institutional repository. They typically also require that the publication be user licensed under CC-BT 4.0.
TU/e standard policy is that authors register all academic publications and upload the final author accepted manuscript (AAM) or version of record (VOR) in Pure, TU/e's the central research information system. Via TU/e's public repository, this should ensure green open access to all our publications. The royal route, immediate gold open access publishing, is further facilitated through TU/e's Read &Publish agreements with major publishers, under which we can publish Open Access free of charge. Should the researcher prefer other journals with Open Access service, then this is ideally budgeted in the project proposal, or covered via group funds.

## GROUP PUBLICATION STRATEGY HUMAN PERFORMANCE MANAGEMENT (HPM)

### 1. Characterization of the publication culture of the group's main research domain

Our preferred mode of research output is peer-reviewed journal publications. Our research falls within the ISI domain Social Sciences and is represented best by the ISI categories: Applied Psychology and Management. HPM research is clustered in three domains: health and vitality, teams and collaboration, and sustainable innovation. We have composed a target publication list for each domain, with some overlap. Journals have been selected based on a combination of bibliometric analysis and the relevance of the journal for the research of the HPM group considering topics covered and target audience. In addition to publications, editorships and guest editorships of special issues are also considered an important means to create impact and visibility.

### 2. Target Publication List

| Rank | Scientific Journal | AIS | WoS category | AIS based | |
|---|---|---|---|---|---|
| | | | | Top 10% | Q1 |
| | **Domain: General** | | | | |
| 1 | *Journal of Applied Psychology* | 4.688 | AP/M | * | * |
| 2 | *Journal of Organizational Behavior* | 3.495 | AP/M | * | * |
| 3 | *Journal of Occupational and Organizational Psychology* | 2.058 | AP/M | | * |
| 4 | *Journal of Vocational Behavior* | 1.951 | AP | | * |
| 5 | *European Journal of Work and Organizational Psychology* | 1.524 | AP/M | | |
| | | | | | |
| | **Domain: Health and Vitality** | | | | |
| 1 | *Journal of Occupational Health Psychology* | 3.380 | AP | * | * |
| 2 | *Work and Stress* | 1.896 | AP | | * |
| | | | | | |
| | **Domain: Teams and Collaboration** | | | | |
| 1 | *Applied Psychology: An International Review* | 1.690 | AP | | * |
| 2 | *Group and Organization Management* | 1.441 | AP/M | | |
| | | | | | |
| | **Domain: Sustainable Innovation** | | | | |
| 1 | *Journal of Operations Management* | 3.035 | M | | * |
| 2 | *Journal of Business and Psychology* | 2.087 | AP | | * |

AP = Applied Psychology; M = Management

## GROUP PUBLICATION STRATEGY HUMAN TECHNOLOGY INTERACTION (HTI)

### 1. Characterization of the publication culture of the group's main research domain

The human-Technology Interaction group contributes to the understanding of the role of humans in interaction with technology. It does so by building its research on a disciplinary foundation in the social sciences (mainly cognitive and social psychology, and perception), yet explicitly strives to bridge and contribute to interdisciplinary research fields in multiple areas as varied as human-computer interaction, affective computing, decision-making and human-data interaction, human perception, environmental psychology and meta science.
The publication culture is varied due to the interdisciplinary nature of the sub-disciplines. The highest rating is generally given to articles in international peer-reviewed scientific journals, although in certain interdisciplinary domains, such as human-computer interaction, competitive, strong-reputation conference proceedings also receive a positive rating.
For monodisciplinary research (e.g. social psychology), there are clear top journals, but this is less clearly the case for the interdisciplinary domains. What is considered top is determined by reputation, quality of the editorial board, rejection rates, and, until recently, impact factors – the value of the latter is much debated in several sub disciplines. The publication culture, therefore, is changing. Researchers are increasingly focusing on quality rather than quantity. The demand for transparency and reproducibility is increasing, as is the need for open science practices, including open access publications and open data. Our target list first includes three journals in the 'general' category (all open access), then a few core journals per application domain. These have been selected for their high quality and match with our research ambitions, or because they are a core outlet for the particular domain.
Publications almost always have several authors, often listed in order of their contribution to the article. Lead authorship is rated most highly – especially for researchers at an early stage in their careers. Sometimes the last author is the research leader or the supervisor. A co-author has to have contributed substantially to writing the publication and/or to conducting the research which is the topic of the publication.

### 2. Target publication list

| Rank | Scientific Journal | AIS | WoS category | AIS based | |
|---|---|---|---|---|---|
| | | | | Top 10% | Q1 |
| | **General** | | | | |
| 1 | *Nature Human Behaviour* | 7.767 | MS | * | * |
| 2 | *Plos One* | 1.011 | MS | | |
| 3 | *Scientific Reports* | 1.285 | MS | | |

| Rank | Scientific Journal | AIS | WoS category | AIS based | |
|---|---|---|---|---|---|
| | | | | Top 10% | Q1 |
| | **HCI & Robotics** | | | | |
| 1 | *IEEE transactions on affective computing* | 2.101 | CS&C | | * |
| 2 | *Journal of Medical Internet Research* | 1.865 | HCS&S / MI | | * |
| 3 | *Human-Computer Interaction* | 1.603 | CS&C | | * |
| 4 | *International Journal of Social Robotics* | 0.886 | R | | |
| | | | | | |
| | **Networks & data** | | | | |
| 1 | *User Modeling and User-Adapted Interaction* | 1.209 | CS&C | | * |
| 2 | *Computers in Human Behavior* | 1.868 | PM | * | * |
| 3 | *Journal of Computer Assisted Learning* | 1.105 | E&ER | | |
| 4 | *Journal of Computer-Mediated Communication* | 4.19 | IS&LS | * | * |
| | | | | | |
| | **Perception & Environmental psychology** | | | | |
| 1 | *Environment & behavior* | 1.710 | Est | | * |
| 2 | *Building and Environment* | 1.141 | C&BT | * | * |
| 3 | *LEUKOS* | 0.583 | | | |
| 4 | *Journal of Biological Rhythms* | 1.359 | B/P | | * |
| 5 | *IEEE Transactions on Haptics* | 0.714 | CS&C | | |

B = Biology; C&BT = Construction & Building Technology; CS&C = Computer Science & Cybernetics; E&ER = Education & Educational Research; Est = Environmental studies; HCS&S = Healthcare Sciences and Services; IS&LS = Information Science & Library Science; MI = Medical Informatics; MS = Multidisciplinary Sciences; P = Physiology; PM = Psychology, Multidisciplinary; R = Robotics

**3. Other target publication outlets**

| | |
|---|---|
| ACM Proceedings of the CHI conference on human factors of computer systems | Conference |
| ACM Recommender System Conference (RecSys) | Conference |
| ACM/IEEE International Conference on Human-Robot Interaction | Conference |
| International Conference on Affective Computing & Intelligent Interaction (ACII) | Conference |
| ACM International Conference on Multimodal Interaction | Conference |

## GROUP PUBLICATION STRATEGY INFORMATION SYSTEMS (IS)

### 1. Characterization of the publication culture of the group's main research domain

Our research focuses on the design, optimization and computer-aided support of operational processes within and between organizations through business process engineering, artificial intelligence and decision support. The approach is integrating basic and applied research with contemporary real-world cases, e.g. in smart industries and healthcare. Our research landscape is covered by three coherent clusters of comparable strength regarding quantity and quality, respectively Business Engineering, Process Engineering and Business Intelligence. In the general area of business information systems top conferences and journals are considered as of equal and/or complementary importance regarding scientific quality, impact and the enhancement of the group's visibility.

### 2. Target publication list

| Rank | Scientific Journal | AIS | WoS category | AIS based | |
|---|---|---|---|---|---|
| | | | | Top 10% | Q1 |
| | **Main IS area** | | | | |
| 1 | *IEEE Transactions on Cybernetics* | 3.291 | CS-AI | * | * |
| 2 | *Information Sciences* | 1.331 | CS-IS | | * |
| 3 | *Decision Support Systems* | 1.398 | CS-IS | | * |
| 4 | *IEEE Transactions on Knowledge and Data Engineering* | 1.628 | CS-IS | | * |
| 5 | *IEEE Transactions on Services Computing* | 1.575 | CS-IS | * | * |
| | | | | | |
| | **Subdomain: Business Engineering** | | | | |
| 1 | *Journal of Management Information Systems* | 1.974 | CS-IS; IS&LS | * | * |
| 2 | *Business & Information Systems Engineering* | 1.656 | CS-IS | | * |
| | | | | | |
| | **Subdomain: Process Engineering** | | | | |
| 1 | *Communications of the ACM* | 3.633 | CS-T&M | * | * |
| 2 | *Business & Information Systems Engineering* | 1.656 | CS-IS | | * |
| | | | | | |
| | **Subdomain: Business Intelligence** | | | | |
| 1 | *IEEE Transactions on Fuzzy Systems* | 2.341 | CS-AI | * | * |
| 2 | *Artificial Intelligence* | 2.419 | CS-AI | * | * |

CS-AI = Computer Science, Artificial Intelligence; CS-IS = Computer Science, Information Systems; IS&LS = Information Science & Library Science; CS-T&M = Communication Science – Theory & Methods

**3. Other target publication outlets**

| Rank | Journals | WoS category |
|---|---|---|
| 1 | *Information Systems* | CS/IS |
| 2 | *International Journal of Information Management* | CS/IS&LS |
| 3 | *ACM Transactions on Software Engineering and Methodology* | CS/SE |
| 4 | *Computers in Industry* | CS/IA |
| 5 | *Software and Systems Modelling* | CS/SE |
| 6 | *Journal of Systems and Software* | CS/SE |
| 7 | *Journal of Intelligent Information Systems* | CS/AI |
| 8 | *IEEE Journal of Biomedical and Health Informatics* | MI |

| Rank | Conferences | Peer-reviewed |
|---|---|---|
| 1 | International Conference on Business Process Management | * |
| 2 | European Conference on Information Systems (ECIS) | * |
| 3 | Conference on Advanced Information Systems Engineering (CAISE) | * |
| 4 | International Joint Conference on Artificial Intelligence (IJCAI). | * |
| 5 | IEEE International Conference on Fuzzy Systems | * |
| 6 | IEEE Conference on Computational Intelligence in Bioinformatics and Computational Biology (CIBCB) | * |

## GROUP PUBLICATION STRATEGY INNOVATION, TECHNOLOGY ENTREPRENEURSHIP & MARKETING (ITEM)

### 1. Characterization of the publication culture of the group's main research domain

The research domain of *innovation management (IM)* is an interdisciplinary field that connects the industrial engineering, marketing, planning, organization, entrepreneurship, strategy and other disciplines to application domains such as sustainable energy, smart mobility and big data. A core element of the publication culture in the IM domain is publishing in high-quality journals in the Industrial Engineering, Business, and Management categories in Web of Science. The publication culture of the IM domain also supports publishing in various other journals relevant to (applications of) IM as an interdisciplinary field as well as monographs and (chapters in) edited books.

### 2. Target publication list

| Rank | Scientific Journal | AIS | WoS category | AIS based | |
|---|---|---|---|---|---|
| | | | | Top 10% | Q1 |
| | **Subdomain: Innovation Management (core top journals)** | | | | |
| 1 | *Journal of Product Innovation Management* | 2.233 | IE | * | * |
| 2 | *Research Policy* | 2.753 | M | | * |
| | **Subdomain: Marketing** | | | | |
| 1 | *International Journal of Research in Marketing* | 2.026 | B | | * |
| 2 | *Journal of the Academy of Marketing Science* | 4.802 | B | * | * |
| 3 | *Journal of Marketing* | 4.978 | B | * | * |
| 4 | *Journal of Marketing Research* | 3.558 | B | | * |
| 5 | *Journal of Retailing* | 2.734 | B | | * |
| 6 | *Journal of Service Research* | 2.845 | B | | * |
| | **Subdomain: Entrepreneurship, Organization & Strategy** | | | | |
| 1 | *Journal of Business Venturing* | 5.024 | B | * | * |
| 2 | *Entrepreneurship Theory & Practice* | 4.192 | B | * | * |
| 3 | *Organization Science* | 4.770 | M | * | * |
| 4 | *Organization Studies* | 2.971 | M | | * |
| 5 | *Strategic Management Journal* | 5.321 | M | * | * |
| 6 | *Management Science* | 4.062 | M | * | * |

| Rank | Scientific Journal | AIS | WoS category | AIS based | |
|---|---|---|---|---|---|
| | | | | Top 10% | Q1 |
| | **Subdomain: Other (IM related) target journals** | | | | |
| 1 | *Technovation* | 1.899 | IE | * | * |
| 2 | *Renewable & Sustainable Energy Reviews* | 2.572 | GSST | | * |
| 3 | *Journal of Cleaner Production* | 1.288 | GSST | | |
| 4 | *Industrial Marketing Management* | 1.250 | M | | |
| 5 | *Technological Forecasting & Social Change* | 1.373 | RUP | | * |
| 6 | *R&D Management* | 0.890 | B | | |

B = Business; IE = Industrial Engineering; M = Management; GSST = Green & Sustainable Science & Technology; RUP = Regional & Urban Planning

**3. Other target publication outlets**

| | |
|---|---|
| Monographs and (chapters in) edited books, produced by leading academic publishers | Books |

## GROUP PUBLICATION STRATEGY OPERATIONS PLANNING, ACCOUNTING AND CONTROL (OPAC)

### 1. Characterization of the publication culture of the group's main research domain

The OPAC group is mainly active in the scientific domain Operations Management. In this domain, there is a strong focus on international peer-reviewed top journals and other journals. There is agreement about a few general top journals (denoted as A+ journals in the lists below). The difference between these top journals and other journals is large.
At the level of sub-domains, field-top journals (denoted as A journals) and a second level of focus journals (B journals) are distinguished. Different research groups generally have differences between their lists with A and B journals, because there is no general agreement about these lists and they may also depend on the type of research that is done by a group.

### 2. Target publication list

| Rank | Scientific journal | AIS | WoS category | AIS-based | | Domain based classification |
|---|---|---|---|---|---|---|
| | | | | Top 10% | Q1 | |
| | **General** | | | | | |
| 1 | *Operations Research* | 2.538 | OR&MS | * | * | A+ |
| 2 | *Management Science* | 4.062 | OR&MS | * | * | A+ |
| 3 | *Manufacturing & Service Operations Management* | 3.075 | OR&MS | * | * | A+ |
| 4 | *Transportation Science* | 1.694 | OR&MS | | * | A+ |
| 5 | *Journal of Operations Management* | 3.035 | OR&MS | * | * | A+ |
| 6 | *Production and Operations Management* | 1.587 | ME | * | * | A+ |
| 7 | *European Journal of Operational Research* | 1.359 | OR&MS | | * | A |
| 8 | *IISE Transactions (until 2016: IIE Transactions)* | 0.771 | IE | | * | A |
| 9 | *INFORMS Journal on Applied Analytics* | na | OR&MS | | | A |

| Rank | Scientific journal | AIS | WoS category | AIS-based | | Domain based classification |
|---|---|---|---|---|---|---|
| | | | | Top 10% | Q1 | |
| | **Subdomain: Supply Chain Management** | | | | | |
| 1 | *International Journal of Production Economics* | 1.471 | IE | * | * | B |
| 2 | *Omega* | 1.814 | OR&MS | * | * | B |
| 3 | *OR Spectrum* | 0.787 | OR&MS | | | B |
| | | | | | | |
| | **Subdomain: Design and Control of Manufacturing Networks** | | | | | |
| 1 | *International Journal of Production Economics* | 1.471 | IE | * | * | B |
| 2 | *Journal of Manufacturing Systems* | 1.151 | ME | | * | B |
| 3 | *Computers & Industrial Engineering* | 0.967 | IE | | | B |
| | | | | | | |
| | **Subdomain: Transportation Management** | | | | | |
| 1 | *Transportation Research Part B: Methodological* | 1.924 | TS | * | * | A |
| 2 | *Computers and OR* | 1.121 | IE | | * | B |
| 3 | *Transportation Research Part C: Emerging Technologies* | 2.080 | TS | * | * | B |
| | | | | | | |
| | **Subdomain: Maintenance Optimization and Reliability Engineering** | | | | | |
| 1 | *Reliability Engineering and Systems Safety* | 1.226 | IE | | * | A |
| 2 | *International Journal of Production Economics* | 1.471 | IE | * | * | B |
| | | | | | | |
| | **Subdomain: Sustainable Operations Management** | | | | | |
| 1 | *Journal of Industrial Ecology* | 1.426 | ES | | * | B |
| 2 | *Journal of Cleaner Production* | 1.288 | ES | | * | B |

OR&MS = Operations Research & Management Science; ES = Environmental Sciences; IE = Industrial Engineering; ME = Manufacturing Engineering; TS = Transportation Science & Technology

## GROUP PUBLICATION STRATEGY PHILOSOPHY & ETHICS (P&E)

### 1. Characterization of the publication culture of the group's main research domain

Quality publications in philosophy are not limited to peer-reviewed journal articles, but include monographs, edited volumes and chapters in such volumes. Numerical measures (e.g., AIS) do not provide reliable indicators of journal reputation: WoS categories cover only a selection of sub-disciplines, and even within those categories, distinctions between journals (top 10%, Q1 vs Q2) tend to be marginal. Quality indicators have been described by the Dutch Research School of Philosophy (OZSW) (www.ozsw.nl/quality-indicators-for-philosophy/), as part of a larger project on quality indicators for the humanities (www.qrih.nl/nl/).
Our research concerns fundamental philosophical issues in relation to real-world problems that arise from the design, implementation, use and regulation of innovative technologies.
We focus on fundamental and applied issues in ethics, philosophy of science and technology, and epistemology, in a variety of application areas. We aim to publish work in a wide variety of venues, including recently established ones that foster methodological diversity.
Philosophy is characterized by very small numbers of high-reputation outlets (again, often not included in WoS) that have very low (ca. 5%) acceptance rates and that are not receptive to our technology-related work. The journals listed below are among those that are sufficiently receptive and selective, and that have a sound reputation in philosophy or one of its relevant sub-disciplines.

### 2. Target publication list

| Rank | Scientific Journal | AIS | WoS category | AIS based | |
|---|---|---|---|---|---|
| | | | | Top 10% | Q1 |
| 1 | *Bioethics* | 0.677 | ME | | |
| 2 | *Biology & Philosophy* | 0.874 | HPS | | * |
| 3 | *British Journal for the Philosophy of Science* | 1.772 | HPS | * | * |
| 4 | *Episteme* | 0.925 | P | | * |
| 5 | *Ethical Theory and Moral Practice* | 0.582 | P | | |
| 6 | *Ethics and Information Technology* | 1.180 | P | * | * |
| 7 | *European Journal for Philosophy of Science* | 0.791 | HPS | | |
| 8 | *Journal of Medical Ethics* | 0.811 | ME | | |
| 9 | *Philosophy of Science* | 1.086 | HPS | | * |
| 10 | *Science and Engineering Ethics* | 0.778 | EM | | * |
| 11 | *Synthese* | 1.134 | HPS | * | * |

HPS = History and Philosophy of Science; ME = Medical Ethics; P = Philosophy (AHCI); EM = engineering, multidisciplinary

### 3. Other target publication outlets

Below, we list a small selection of journals in other disciplines, or inter/multidisciplinary journals, in which we aim to publish our work that more directly concerns areas of application (e.g., AI, energy, and models of scientific and technological change). Most of these journals are included in target publication lists of other groups at IE&IS, reflecting our commitment to collaboration with other groups.

| Journal | Groups | Area of application |
|---|---|---|
| *AI and Law* | --- | AI |
| *Energy Research and Social Science* | TIS | Energy |
| *International Journal of Social Robotics* | HTI | Robotics |
| *Journal of Engineering Education* | --- | Engineering Education |
| *PLoS ONE* | HTI, IS | Multidisciplinary |
| *Research Policy* | ITEM, TIS | Scientific and technological change |

## GROUP PUBLICATION STRATEGY TECHNOLOGY, INNOVATION AND SOCIETY (TIS)

### 1. Characterization of the publication culture of the group's main research domain

TIS aims to be a leading scientific research group on innovation and transitions in the context of technological development and socio-technical systems. TIS focuses on two application domains: sustainable energy and sustainable mobility, but explicitly include ongoing as well as past transitions and transitions in the global south.
The selected top journal align with this strategy and the inherent multi-disciplinarity of TIS research. TIS targets a publication portfolio that is a mix between:

- Publications in top journals
- Publication volume in some highly relevant journals
- For researchers in the history of technology field publication of monographs with prestigious publishers or in prestigious series

### 2. Target publication list

| Rank | Scientific Journal | AIS | WoS category | AIS based | |
|---|---|---|---|---|---|
| | | | | Top 10% | Q1 |
| | **General** | | | | |
| 1 | *Research Policy* | 2.753 | M | | * |
| 2 | *Environmental Innovation and Societal Transitions* | 2.572 | ES | * | * |
| 3 | *World development* | 2.089 | DS | * | * |
| 4 | *Technology and Culture* | 0.593 | HPS | | |
| 5 | *Technological forecasting and social change* | 1.373 | B / RUP | | * |
| | | | | | |
| | **Domain specific (Sustainable Energy, Sustainable mobility)** | | | | |
| 1 | *Nature Energy* | 19.734 | E&F | * | * |
| 2 | *Transportation Research Part A: Policy and Practice* | 1.604 | TS | | * |
| 3 | *Energy Research and Social Science* | 1.583 | Est | | * |
| 4 | *Energy Policy* | 1.363 | E&F | | * |
| 5 | *Renewable and Sustainable Energy Reviews* | 2.572 | GSST | * | * |

B = Business; DS = Development Studies; E&F = Energy & Fuels; ES = Environmental Sciences; Est = Environmental studies; GSST = Green & Sustainable Science & Technology; HPS = History and Philosophy of Science; M = Management; RUP = Regional & Urban Planning; TS = Transportation Science & Technology

### 3. Other target publication outlets

| | |
|---|---|
| Publication of monographs with prestigious publishers or in prestigious series | Books |

# APPENDIX F – VALORIZATION PRIZE

To stimulate valorization, the Departmental Board has installed the IE&IS Valorization Prize in 2019. In this appendix, we first provide an overview of the awarded projects since 2019 (for full descriptions of these projects see Appendix N). Next, we present the (internal) call text that we used till 2022.

| Year | Project | Winners |
|---|---|---|
| 2019 | Sell More, Waste Less, Be Fresh | Rob Broekmeulen and Karel van Donselaar |
| 2020 | Community-based Virtual Power Plant – a new model for energy system organization | Anna Wieczorek, Luc van Summeren, Laura van den Berghe, Geert Verbong, George Papachristos, Aleid Groenewoudt, Josja Veul and Sjoerd Pernot |
| 2021 | Improving capital goods performance through service contracts | Douniel Lamghari-Idrissi, Rob Basten and Geert-Jan van Houtum |
| 2022 | Expertise Centre Dementia & Technology | Wijnand IJsselsteijn, Ans Tummers-Heemels and Rens Brankaert |

## CALL FOR IE&IS VALORIZATION PRIZE

To stimulate valorization, the Departmental Board decided to install the IE&IS Valorization Prize from 2019 onwards. The Board of IE&IS invites all scientific staff members to apply for the 'IE&IS Valorization Prize 2022'. Below, we explain the objectives of this prize and the corresponding procedure.

### Objectives

The main objective of the IE&IS Valorization Prize is to reward the efforts of researchers regarding the valorization of their research.

Valorization concerns all activities that create value out of scientific research. These activities are undertaken for stakeholders such as policy makers, the industry, organizations of professionals, the general public, students and learners. They result in reports, instruments, software tools, textbooks, MOOCs, webinars, movies, blogs, publications in professional journals, publications in newspapers, and so on. And they also consist of outreach activities like presentations at specialist conferences and the organization of round tables and workshops for various stakeholders. The success of the valorization of research can be measured by what the impact is at stakeholders, how well the valorization products are used, and how well outreach activities are attended.

All valorization activities are important for our department and can run for many years. However, for the IE&IS Valorization Prize, we focus on the valorization around an IE&IS research project in the past 5 years. The prize may be awarded to an individual researcher or a research team. The award may be given for the original research if these ideas have been widely adopted by stakeholders, and/or for the extra efforts that were undertaken to bring the research and its insights to the relevant stakeholders.

Please note that this is not a research award. The emphasis is on evaluating the breadth of use of the research by stakeholders and the corresponding impact.

**Criteria**
The assessment criteria for the IE&IS Valorization Prize are:
1. Originality/innovativeness of the research for the relevant stakeholders
2. Efforts made to get the research widely disseminated and to make it applicable
3. Relevance of the research for the society, where we distinguish the following stakeholders: policy makers, the industry, organizations of professionals, the general public, students and learners
4. Adoption rate of the research in relation to the nature of the research

**Eligibility**
Any IE&IS research staff member or research team of which at least one member is an employee of IE&IS can apply for the IE&IS Valorization Prize. A significant part of the underlying research of an application and the corresponding valorization activities should have been executed while the applicant(s) worked at IE&IS.

**Selection Committee**
The award committee is made up of five members:
- Two members of the Societal Council of the Department IE&IS;
- Two scientists;
- Chair (can both come from the Societal Council or be a scientist).

The 2022 committee is chaired by Dr. André van Lammeren (Netherlands Environmental Assessment Agency, PBL).

**Award**
The best individual researcher or team of researchers receives the IE&IS Valorization Prize, which consists of a plaque and a cash award of 5000 Euro. In exceptional cases, the committee can decide to select two winning teams. A winning team is expected to spend the cash award to the further development of its research area.

**Application process**
The application process consists of two stages. In the first stage, you are asked to submit a brief initial application (no more than 1.5 A4) using the standard application form. The initial applications are due by *[usually a date in September]*. All initial applications are assessed by the selection committee. The most promising applications will be invited to submit a full application in the second stage. Applicants will be informed of this in the first half of October. For the full application, it is in particular important to show the breadth of use of the research. This can be shown in the form of testimonials of experts, estimates of the number of installations of a software package, sales numbers of textbooks, and so on. Additional information may be requested by the selection committee to better understand the precise nature of the contribution. Details will be given with the invitation to submit a full application.
Full applications are due by *[usually a date half of November]*.

Applications can be submitted at the research support office of IE&IS. Please, send you application by email to: secretariaat.onderzoek.ie&is@tue.nl

The winning team will be announced at the Christmas Reception of the department.

Finally, you may resubmit your last year's initial/full application if the selection committee gave you that option. The rules for resubmissions are given in Appendix A.

## CALL FOR VALORIZATION PRIZE - APPENDIX A: RULES FOR RESUBMITTING APPLICATIONS IN A NEW ROUND

In the initial application stage, the selection committee does not only select the applications for the second stage, but it also denotes whether the same application can be submitted in the next year. Hence, for the first stage, each application gets one of the following options as feedback:

1. An initial application is selected for the full application stage;
2. An initial application is not selected for the full application stage but may be resubmitted (in an updated version) in the next year;
3. An initial application is not selected for the full application stage and cannot be resubmitted in the next year.

In the full application stage, the selection committee selects the winning application. For each other application, it denotes whether the application can be resubmitted for the full application stage in the next year(s). Hence, for the second stage, each application gets one of the following options as feedback:

1. A full application has been selected as winning application;
2. A full application has not been selected as winning application, but may be resubmitted (in an updated version) in the coming 3 years in the full application stage.

## CALL FOR VALORIZATION PRIZE - APPENDIX B: RULES FOR THE CONSTITUTION OF THE SELECTION COMMITTEE

A member can be preferably at most three years in the selection committee. This implies that each year, one or two members of the committee will be replaced by new members. The committee itself will make a scheme for these replacements.

A member of the selection committee steps down when there is a conflict of interest with one of the applications.


**Presentation first IE&IS Valorisation Prize – Ingrid Heynderickx, Karel van Donselaar, Rob Broekmeulen, Carel Jan van Driel**

# APPENDIX G – VALORIZATION COMMUNITIES

Valorization communities play an important role in our valorization strategy. In this appendix, we first explain the two large valorization communities hosted by the department. Next, we give an overview of the valorization communities in which the department participates.

## VALORIZATION COMMUNITIES HOSTED BY DEPT. IE&IS

**European Supply Chain Forum (ESCF)**
Website: https://www.escf.nl
The *European Supply Chain Forum* is an ecosystem hosted by the Dept. IE&IS including over 60 leading (global) players, among which ASML, Bayer, DHL, Dow Chemicals, Eastman, Heineken, Hilti, Huawei, NXP, Office Depot, and Shell. The forum is organized by the department, under the leadership of prof. Tom Van Woensel. The involved companies pay a yearly fee which is used for practice-based research projects, and for costs of organizing events and running the forum.
The forum serves as a platform where all involved partners share problems and insights in the area of operations, logistics, supply chain management, digital transformation, business models, and circularity. Together they also realize many innovations via joint research projects, including projects funded by NWO or TKI Dinalog. The most prominent project is titled "AI Planner of the Future", in which a large group of companies, many faculty members, and 12 PhD candidates collaborate to study the possibilities and impossibilities of AI and data science to improve and transform operations at the involved companies. For all research projects, results are disseminated via ESCF activities. The forum organizes many events (roughly 20 events per year, with on average 30 participants); these include round tables on specific topics, matchmaking events with students, workshops for all partners, and strategic sessions for executives. The forum also publishes a best practices series aimed at a business audience, and reports key research insights in short articles.
The unique value of ESCF is that it combines talent, knowledge, and network into a single ecosystem. It is an important valorization community for the themes 'Supply Chain Management' and 'Value of Data-Driven Intelligence'. Approximately 30 faculty members are involved in the activities of ESCF.

**Center for Humans and Technology (CH&T)**
Website: https://www.tue.nl/en/research/research-areas/humans-and-technology
The *Center for Humans and Technology* is an important valorization community for the theme Humans & Technology. CH&T is focused on human-centered and value-sensitive perspectives on technology understanding, design, and impact. CH&T connects social sciences and humanities with technology research, thus focusing on the relationship between humans and technology and how they influence one another.
CH&T reaches out to both (future) TU/e scientists and external stakeholders, in business, society, and government. In its outreach activities CH&T addresses relevant and urgent socio-technical challenges enabling all parties to share insight and stimulate interdisciplinary exchange and cooperation. Annually, CH&T organizes 3 large events attracting around 200+ participants, including approximately 50% scientists and students, and 50% people from industry, healthcare, education, or government. In 2020, due to corona restrictions, CH&T switched to organizing online-only and hybrid events, e.g. with thought leading scientists in artificial intelligence and behavior change.

CH&T is organized by the department under the leadership of prof. Wijnand IJsselsteijn, and with support of a Scientific Board. Approximately 60 faculty members of the department are involved in the activities of CH&T. Importantly, CH&T operates across the TU/e in a coordinated multi-departmental fashion, connecting human-centered activities and groups from the departments IE&IS, Built Environment, Industrial Design, and Computer Science.

## VALORIZATION COMMUNITIES IN WHICH IE&IS PARTICIPATES

Apart from ESCF and CH&T, there are multiple valorization communities in which the department participates as partner or via its individual faculty members. The table below gives an overview of these communities, to which departmental research theme(s) they relate and what that relation involves

| Valorization community | Departmental Theme(s) | Role IE&IS |
|---|---|---|
| Eindhoven Artificial Intelligence Systems Institute (EAISI) | Humans and Technology<br>Supply Chain Management<br>Value of Data-Driven Intelligence | Involved in steering board, program development, and relations with industry |
| Eindhoven Institute for Renewable Energy Systems (EIRES) | Sustainability and Circularity | Involved in program development |
| European Technology Platform Alice | Supply Chain Management<br>Sustainability and Circularity | Member |
| Sustainability Transitions Research Network | Sustainability and Circularity | Anna Wieczorek and Floor Alkemade are members of the steering group |
| Intergovernmental Panel on Climate Change | Sustainability and Circularity | Heleen de Coninck serves as chapter coordinator |
| TKI Dinalog | Supply Chain Management<br>Value of Data-Driven Intelligence<br>Sustainability and Circularity | Albert Veenstra was director (till 2021), Pascale Le Blanc is member of the program committee |
| Service Logistics Forum | Supply Chain Management | Geert-Jan van Houtum is board member |
| Big Data Value Association | Value of Data-Driven Intelligence | Involved in task force leadership |
| European Factories of the Future Research Association | Value of Data-Driven Intelligence<br>Supply Chain Management | Member |
| European Robotics Association | Value of Data-Driven Intelligence<br>Humans and technology | Involved in activity group focussing on robotics, ethics and innovation |
| European Association for Artificial Intelligence | Value of Data-Driven Intelligence<br>Humans and technology | Involved in activity group focussing on AI, robotics, ethics and innovation |
| Logistics Community Brabant (LCB) | Supply Chain Management | Involved in board and advisory council |
| Brainport Industries Campus (BIC) | Value of Data-Driven Intelligence<br>Supply Chain Management | Involved in board of fieldlab |
| NL AI Coalition | Humans and Technology<br>Value of Data-Driven Intelligence | Wijnand IJsselsteijn is member on behalf of TU/e |
| VSNU Kennistafel AI | Humans and Technology<br>Value of Data-Driven Intelligence | Wijnand IJsselsteijn is member of the writing team, on behalf of the Brainport region |
| euRobotics | Humans and Technology<br>Value of Data-Driven Intelligence | Member |

# APPENDIX H – COLLABORATION OUTSIDE THE DEPARTMENT - OVERVIEW OF RELEVANT INSTITUTES

As department we are involved (at the managerial or coordinating level) in a variety of centers and institutes within and outside the Eindhoven University of Technology. This appendix provides a short description of each center or institute, a reference to their website and the role(s) our staff has in these centers or institutes.

**Eindhoven Artificial Intelligent Systems Institute (EAISI)**
Website: https://www.tue.nl/en/research/institutes/eindhoven-artificial-intelligence-systems-institute
EAISI focuses on the use of data and algorithms in machines, such as robots, autonomous cars and health systems. The institute does not only develop the learning algorithms, but also performs research on collecting and using data, measuring and simulating machine performance, optimizing the interaction between man and machine, and studying and implementing moral and ethical aspects of AI.

**Eindhoven Institute for Renewable Energy Systems (EIRES)**
Website: https://www.tue.nl/en/research/institutes/eindhoven-institute-for-renewable-energy-systems/
EIRES addresses the societal challenge of the energy transition from a broad, multidisciplinary perspective, bringing together research on materials, systems, and processes for energy storage and conversion, including their introduction in the built environment and society. The institute focuses on all fundamental challenges underlying the development of systems with the potential for rapid upscaling and market penetration.

**Eindhoven Hendrik Casimir Institute for photonics and quantum (EHCI)**
Website: https://www.tue.nl/en/research/institutes/eindhoven-hendrik-casimir-institute/
EHCI aims for sustainable solutions by exponentially decreasing the energy consumption of computing and communication, to enable the exponential growth of these technologies. EHCI addresses this challenge by excelling in and through the unique synergy of two eminent research fields: the precision and speed of photonics and the mind-blowing magic of quantum-technology.

**Center for Humans and Technology (CH&T)**
Website: https://www.tue.nl/en/research/research-areas/humans-and-technology/
CH&T focuses on multidisciplinary scientific research on the relation between humans and technology in order to support the responsible development and acceptance of future technologies in application fields, such as energy, mobility, health, work, living, learning and entertainment.

**Intelligent Lighting Institute (ILI)**
Website: https://www.tue.nl/en/storage/electrical-engineering/onderzoek/research-centers-institutes-labs/research-centers-institutes/intelligent-lighting-institute
ILI is a multidisciplinary institute focusing on the development of intelligent lighting solutions that create not only high-quality lighting, but also value beyond illumination, including aspects as perfect autonomous system behavior, perfect system control, security and safety, comfort, cognitive performance, alertness and vitality.

**Jheronimus Academy of Data Science (JADS)**
Website: https://www.jads.nl/
JADS is a collaboration between Eindhoven University of Technology and Tilburg University with a main campus in the city Den Bosch. JADS services a BSc program on Data Science and multiple MSc programs with each have a different focus, varying from data engineering to data entrepreneurship and impact on society. JADS comprises research on value creation from data for business and society.

**TKI Dinalog**
Website: https://www.dinalog.nl/
TKI Dinalog is a consortium, in which companies, knowledge institutes and the government together support innovation in the Dutch logistics sector through enabling public private partnerships in research and development. The consortium focuses on the development of collaborations, on strategic planning of innovation topics and on the preparation of research programs.

**Logistics Community Brabant (LCB)**
Website: https://www.lcb.nu/
Logistics Community Brabant is a collaboration of companies, education and research institutes and governmental organizations of Noord Brabant to foster logistics innovations in Noord-Brabant. This community focusses in particular at realizing innovations in small and medium-sized companies.

**4TU Center for Ethics and Technology (4TU.Ethics)**
Website: https://ethicsandtechnology.eu/
4TU.Ethics is a community of researchers that aims to stimulate and perform research in the field of ethics and technology, both at a fundamental and applied level. It aims to address societal challenges in the context of a globalized and inter-connected world. The goal is to advance understanding of ethical issues in engineering and technology development, to contribute to better practices in these areas, to innovate education in the ethics of technology, and to engage with societal stakeholders and public discussions about technology.

**4TU Center for Resilience Engineering (4TU.RE)**
Website: https://www.4tu.nl/resilience/
4TU.RE supports research on understanding resilience as the ability of coupled social-technical-environmental systems to absorb, react, recover, adapt and reorganize with change. It aims at advancing and consolidating the understanding of resilience thinking, measuring resilience, and resilience coordination and governance.

Eindhoven, Wageningen, Utrecht, and UMC Utrecht Alliance **(EWUU)**
Website: https://ewuu.nl/en/
The alliance of TU/e, Wageningen University & Research, Utrecht University and the University Medical Center Utrecht challenges new generations of researchers and students to cooperate across disciplines, including humanities and social sciences, beta sciences and engineering, plant, animal and environmental sciences, and the medical sciences. The partners thus want to enable shared scientific breakthroughs, such as in molecular life sciences and artificial intelligence, and to find solutions to challenges related to the social themes of health, food, energy and the circular society.

# APPENDIX I – PHD PROGRAM & PHD SUCCESS RATES

The strategic processes described in section 3.7 on PhD supervision within the department IE&IS led in the last six years (i.e., for an influx of 116 PhD candidates in the period 2014-2018) to a length and success rate of PhD trajectories as summarized in Table I1. This table shows that 9% of our PhD candidates obtains their degree within four years, while 46% is successful within five years. At the end of 2022, 20% of the influx from 2014 to 2018 did not yet obtain their doctor's title. Table I1 also shows that the lead time of successful PhD projects has increased in recent years. An important cause of this is the COVID-19 pandemic which has led to delays in PhD trajectories, especially for those involving human studies or industry contacts. In total, 16% discontinued their PhD project after – on average – 22 months. Note that external PhD candidates, those who are employed by industry and usually are working part-time on their PhD research, are not included in this overview.

**Table I1. Success rates PhD candidates IE&IS influx cohorts 2014-2018**

| Start year | Enrollment | | | Grad. in yr 4 or earlier | | Grad. in yr 5 or earlier | | Grad. in yr 6 or earlier | | Grad. in yr 7 or earlier | | Not yet finished | | Dis-continued | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | male | female | total | number | pct | number | pct | number | pct | number | pct | number | pct | number | pct |
| 2014 | 15 | 11 | 26 | 2 | 8% | 17 | 65% | 21 | 81% | 21 | 81% | 0 | 0% | 5 | 19% |
| 2015 | 13 | 7 | 20 | 1 | 5% | 8 | 40% | 13 | 65% | 14 | 70% | 0 | 0% | 6 | 30% |
| 2016 | 12 | 9 | 21 | 1 | 5% | 10 | 48% | 14 | 67% | 16 | 76% | 3 | 14% | 2 | 10% |
| 2017 | 14 | 15 | 29 | 2 | 7% | 11 | 38% | 16 | 55% | | | 10 | 34% | 3 | 10% |
| 2018 | 7 | 13 | 20 | 4 | 20% | 7 | 35% | | | | | 10 | 50% | 3 | 15% |
| Total | 61 | 55 | 116 | 10 | 9% | 53 | 46% | 71 | 61% | 74 | 64% | 23 | 20% | 19 | 16% |

Notes:
- Numbers in the "Grad…." columns are cumulative numbers. In other words, students that graduated in 4 years are also included in the column of number of students that graduated in 5 years or more.
- All PhD candidates conduct research with the primary aim/obligation of graduating, based on a 0.8-1.0 FTE contract. This only includes PhD candidates with employee status and contract, and PhD candidates without employee status, but receiving external funding or a university scholarship.
- One PhD candidate in the 2017 and two in the 2018 cohort continued their PhD research outside the department IE&IS. These PhD candidates are not included in the table.
- Two PhD candidates (one in the 2017 cohort and one in the 2018 cohort) combined their PhD trajectory with an appointment of 25% for education, so they have a five-year instead of a four-year PhD trajectory. The figures have not been corrected for this.
- Some PhD candidates use maternity and care leave. The figures have not been corrected for this.

### Context of the PhD program

The strategic processes on PhD supervision within the department are aligned with the guidelines of the TU/e Graduate School. This Graduate School coordinates MSc, EngD, and PhD education for all university graduate programs. The department of IE&IS has two Graduate Programs: the Graduate Program Industrial Engineering and the Graduate Program Innovation Sciences. The Graduate Program Director (prof. Tom Van Woensel) manages both Graduate Programs. All TU/e Graduate Program Directors meet monthly at the OGS (Overleg Graduate School) with the dean of the Graduate School to discuss relevant topics related to MSc, EngD, and PhD education.

The role of the TU/e Graduate School in relation to PhD education is that:
- it facilitates PhD candidates and (co-)promotors in achieving high-quality PhD trajectories;
- it regulates the program requirements and the quality control of PhD education and supervision across all Graduate Programs in close collaboration with the departments;
- it provides uniformity in requirements, duties, and PhD candidates' assessment, whether on payroll or not.

The mission of the TU/e Graduate School is to educate graduates who are prepared for a successful start of their career in a broad range of sectors (from the high-tech industry and the academic world to the service sector, education, and government) and in an international context. In line with this mission, all graduate education emphasizes high quality of teaching and supervision in a master-apprentice model with personal coaching and guidance. The program includes an international and career orientation with guided development in social and academic skills.

Whether on the TU/e payroll or not, all PhD candidates have the same rights, duties, and responsibilities. They have access to the same facilities, including, but not limited to, courses, conference participation, and research facilities. The PhD program is primarily a job-based education (except for the not-on-payroll PhD candidates) towards becoming independent research professionals. The latter is demonstrated through a dissertation or technological design and its public defense at the end of the PhD trajectory. During the program all PhD candidates are supervised by at least 2 (co-)promotors.

**Educational program**
PhD education is always tailormade to the specific needs of the PhD project and the needs and career ambitions of the PhD candidate. Apart from the scientific integrity course that is compulsory for all TU/e PhD candidates, there is no specific university-wide prescribed set of educational activities. Still, each PhD candidate is advised to select courses from the following offerings in consultation with the supervisors and up to a maximum of 30 credits in total:
1. *Courses from the TU/e's PROOF (PROviding Opportunities For PhD candidates) program*: This program for personal development includes courses on presenting, scientific writing, planning, communication, cultural awareness and career orientation. PROOF courses are given in interdepartmental groups, as such training the PhD candidates in communication across research fields. At the department IE&IS, we added a second compulsory course related to writing scientific English.
2. Most PhD candidates of the department are embedded in a *research school or institute*, such as the 'Beta Research School for Operations Management & Logistics', the 'WTMC Netherlands Graduate Research School of Science, Technology and Modern Culture', and the '4TU.Centre for Ethics and Technology'. These research schools offer additional training options by organizing network events, lectures from well-known international scientists, and regular symposia. These events and symposia offer PhD candidates the opportunity to present their work and receive feedback from colleagues.
3. Many PhD candidates follow an *international course*, that trains them on the science needed for their research project. Or they are encouraged to do an internship at a foreign university to gain international experience.

4. PhD candidates contribute to the department's educational programs as *teaching assistant, instructor, or tutor* for about 10 – 15% of their time (for a 4-years on payroll PhD candidate). As such, they develop their teaching and presentation skills. The department IE&IS has offered six PhD candidates (i.e., four additional ones after 2018, as mentioned in the notes of Table I1) an extended PhD contract with an increased teaching load. To support these PhD candidates in their teaching duty, they are offered a dedicated course program on teaching basics.
5. Near the end of the program PhD candidates can receive one or more career consults by Euflex (a matchmaker between the suppliers of and demand for technical top talent) to help them choosing a career profile among the four most probable ones: academia, education, entrepreneurship, and industry. The sooner the PhD candidate knows what the desired profile is, the better additional courses can be tuned to that profile.

**Quality assurance**

Quality starts from carefully selecting applicants, which is done by a selection committee consisting of three members: the intended promotor and co-promotor and a third member independent of the related research program. To enroll in the PhD program, applicants must have completed a final examination of a Master's program of good quality universities and be fluent in spoken and written English.

To safeguard the quality during the PhD program, the TU/e Graduate School and all TU/e departments use TU/e's Academic Competences and Quality Assurance systematics. At TU/e level, the dean of the department, the Graduate Program Director, and the representative of the departmental PhD council regularly discuss general PhD related issues with the dean of the Graduate School in different settings: the University Consultative Council, the OGS, annual educational review meetings, and the general PhD council, respectively. Within the department, the PhD program's quality is monitored by the Departmental Board, the weekly meetings joined by the Graduate Program Director. Besides general PhD issues discussed by the Board, the progress and performance of the PhD candidates are considered at least annually on a case by case basis between the group chair, the (co-)promotors, and the HR advisor.

To monitor the progress of an individual PhD candidate, a reporting cycle is used, which consists of the following steps:

| Monitoring moment | When | Form |
|---|---|---|
| Training and Supervision Plan (TSP) | 3 months after start | Standard HR form |
| Go/no-go moment | 9 months after start | Standard assessment form |
| Annual review | 18, 30, 42, etc months after start | annual report |
| Doctoral thesis evaluation | When the (co-)promoters assess the work ready to be defended, usually 48 months after the start | Manual forms that are since 2019 implemented in Hora Finita |
| Exit interview and exit survey | as close as possible to drop out or defense date | Interview |

Three months after their start, PhD candidates hand in an individual Training and Supervision Plan (TSP) and discuss this with their promotors. It describes expectations for research and educational activities and serves as a basis for discussions on the candidate's professional development. (Co-) promotors monitor progress described in the TSP informally regularly, and formally once a year to identify possible problems at an early stage. Towards the end of the first year, an evaluation leading to a go/no-go decision is made. The Training and Supervision Plan is taken as a reference, complemented with a more detailed research plan for the next three years, and a written piece of scientific output, giving first evidence of the writing skills of the PhD candidate. At least three scientific staff members make the go/no-go decision: the promotor, co-promotor and an independent third person supplemented with the HR advisor. After 18, 30 and 42 months, all PhD candidates have documented annual performance and progress meetings with their promotor(s). The purpose of these meetings is primarily to provide feedback to the PhD candidate, identify problems and help PhD candidates to recognize their principal achievements of the past year. Promotors have the authority during the whole PhD project to recommend termination of a PhD candidates' program given insufficient progress or scholarly achievement. The PhD candidate is provided with adequate warnings in writing of existing deficiencies and is allowed to correct them. Every effort is made to identify problems early on in order to avoid late termination. An exit interview is the last part of the monitoring process. This interview is done by the dean of the department in combination with the introduction to the public defense. In case the PhD candidate decides to discontinue the research project, the exit interview is performed by the HR advisor. Apart from the exit interview, the TU/e has a safety net for PhD candidates during their trajectory. This safety net includes facilities to prevent problems and issues, and facilities PhD candidates can turn to in case of concrete problems and issues, such as a PhD psychologist and PhD confidential counselors (at TU/e and departmental level).


**PhD defense ceremony Laura Huiberts, 8 February 2018**

The TU/e has strict regulations regarding the conferral of PhD degrees. These regulations stipulate, for instance, that the committee deciding on the approval of the PhD thesis should contain three independent members who are not involved with the research in question. At least one of these members is not affiliated with the TU/e, and at least one of the members is affiliated with the TU/e. These independent members are nominated to the Doctorate Board by the departmental dean, on the recommendation of the promotor.

# APPENDIX J – TABLE SCIENTIFIC RESEARCH OUTPUT

**Table J1. Publications in line with publication strategy – target versus non target scientific output**
**Overview of the data used to create the visualization shown in Figure 5.1**

| Type | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | Total |
|---|---|---|---|---|---|---|---|
| Scientific journal articles in journals with AIS - top 10% | 22 | 37 | 23 | 43 | 46 | 32 | 203 |
| Scientific journal articles in journals with AIS - 11 t/m 25% | 58 | 68 | 50 | 60 | 70 | 89 | 395 |
| Scientific journal articles in target journals with AIS Q2-Q4 | 25 | 10 | 18 | 16 | 23 | 25 | 117 |
| Number of scientific articles in target proceedings (paper) and chapter in books target publishers | 10 | 14 | 14 | 13 | 17 | 14 | 82 |
| *Subtotal target output* | 115 | 129 | 105 | 132 | 156 | 160 | 797 |
| Scientific journal articles with AIS Q2, Q3, Q4 excluding target articles | 60 | 72 | 67 | 82 | 93 | 76 | 450 |
| Scientific journal articles in WoS ESCI | 7 | 13 | 15 | 18 | 15 | 17 | 85 |
| Scientific journal articles in journals not included in WoS | 12 | 20 | 14 | 27 | 31 | 35 | 139 |
| Number of scientific articles (papers) in proceedings and chapters in books (not target proceedings) | 107 | 130 | 137 | 113 | 111 | 82 | 680 |
| *Subtotal non target scientific output* | 186 | 235 | 233 | 240 | 250 | 210 | 1354 |
| **Total** | **301** | **364** | **338** | **372** | **406** | **370** | **2151** |

**Table J2. WoS indexed scientific articles 2017-2022**
**Overview of the data used to create the visualization shown in Figure 5.2.**

| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | Total |
|---|---|---|---|---|---|---|---|
| AIS - top 10% & target journals groups | 14 | 22 | 17 | 28 | 24 | 18 | 123 |
| AIS - top 10% ≠ target journals groups | 8 | 15 | 6 | 15 | 22 | 14 | 80 |
| AIS - top 11 t/m 25% & target journals groups | 41 | 45 | 41 | 42 | 50 | 46 | 265 |
| AIS - top 11 t/m 25% ≠ target journals groups | 17 | 23 | 9 | 18 | 20 | 43 | 130 |
| Target journals groups, though not AIS Q1 | 25 | 10 | 18 | 16 | 23 | 25 | 117 |
| AIS Q2, Q3, Q4 excluding target journals groups | 67 | 85 | 82 | 100 | 108 | 92 | 534 |

# APPENDIX K – OVERVIEW EDITORS TARGET JOURNALS IE&IS

Below all editorial positions at Web of Science journals are listed. Per editorial position it is indicated whether the journal belongs to the AIS top 10%, AIS Q1, and target journals, respectively

**Editorial positions Web of Science journals**

| Journal | Number of I&IS faculty members involved | Kind of editorship | Name IE&IS researcher | AIS top10% | AIS Q1 | Target journals groups |
|---|---|---|---|---|---|---|
| Annals of Mathematics and Artificial Intelligence | 1 | Guest editor | Yingqian Zhang | | | |
| California Management Review | 1 | Guest editor | Marcel Bogers | | * | |
| Career Development International | 1 | Associate editor (2018-2022) | Pascale Le Blanc | | | |
| Entropy | 1 | Editor | Marco Nobile | | | |
| Environmental Innovation and Societal Transitions | 1 | Associate editor | Floor Alkemade | | * | * |
| Environmental Science and Policy | 2 | Guest editor | Anna Wieczorek | | * | |
| | | Guest editor | Henny Romijn | | * | |
| European Journal for Philosophy of Science | 2 | Associate editor & Editor-in-Chief | Dunja Šešelja | | | * |
| | | Associate editor | Emily Sullivan | | | * |
| European Journal of Work and Organizational Psychology | 1 | Guest editor | Maria Peeters | | | * |
| European Journal of Work and Organizational Psychology | 5 | Associate editor (2017-2019) & Guest editor | Evangelia Demerouti | | | * |
| | | Guest editor | Pascale Le Blanc | | | * |
| | | Guest editor | Maria Peeters | | | * |
| | | Guest editor | Sonja Rispens | | | * |
| | | Guest editor | Anna-Sophie Ulfert-Blank | | | * |
| Filosofie-Tijdschrift | 1 | Guest editor | Lambèr Royakkers | | | |
| Flexible Services and Manufacturing Journal | 1 | Associate editor | Tugce Martagan | | | |
| Frontiers in Communication | 1 | Associate editor | Llewellyn van Zyl | | | |
| Frontiers in Psychiatry | 1 | Associate editor | Llewellyn van Zyl | | | |

| Journal | Number of I&IS faculty members involved | Kind of editorship | Name IE&IS researcher | AIS top10% | AIS Q1 | Target journals groups |
|---|---|---|---|---|---|---|
| Frontiers in Psychology | 1 | Associate editor & Editor-in-Chief | Llewellyn van Zyl | | | |
| Industrial Marketing Management | 1 | Guest editor | Marcel Bogers | | | |
| Industry and Innovation | 1 | Guest editor | Carolina Castaldi | | | |
| Information | 1 | Guest editor | Lambèr Royakkers | | | |
| Innovation: Management, Policy & Practice | 1 | Guest editor | Marcel Bogers | | | |
| International Environmental Agreements: Politics, Law and Economics | 1 | Guest editor | Anna Wieczorek | | | |
| International Journal of Environmental Research and Public Health | 1 | Editor | Jan de Jonge | | | |
| International Journal of Production Economics | 1 | Editor | Geert-Jan van Houtum | * | * | * |
| International Journal of Social Robotics | 1 | Editor | Jaap Ham | | | * |
| Journal of Family Business Strategy | 1 | Guest editor | Marcel Bogers | | | |
| Journal for General Philosophy of Science | 1 | Guest editor | Dunja Šešelja | | | |
| Journal of Occupational Health Psychology | 2 | Associate editor | Evangelia Demerouti | * | * | * |
| | | Guest editor | Jan de Jonge | * | * | * |
| Journal of Society for e-Business Studies | 1 | Editor | Irene Vanderfeesten | | | |
| Lighting Research and Technology | 1 | Guest editor | Kynthia Chamilothori | | | |
| Manufacturing & Service Operations Management | 2 | Associate editor | Tarkan Tan | * | * | * |
| | | Associate editor | Geert-Jan van Houtum | * | * | * |
| Mathematical Methods of Operations Research | 1 | Associate editor | Willem van Jaarsveld | | | |
| Naval Research Logistics | 1 | Guest editor | Gizem Korpeoglu | | | |

| Journal | Number of I&IS faculty members involved | Kind of editorship | Name IE&IS researcher | AIS top10% | AIS Q1 | Target journals groups |
|---|---|---|---|---|---|---|
| OR Letters | 1 | Associate editor | Geert-Jan van Houtum | | | |
| OR Spectrum | 1 | Editor | Zümbül Atan | | | * |
| Philosophical Explorations | 1 | Editor-in-Chief | Anthonie Meijers | | * | |
| Queueing Systems: Theory and Applications | 1 | Guest editor | Ivo Adan | | | |
| Regional Studies | 1 | Guest editor | Carolina Castaldi | | * | |
| Research in Transportation Business and Management | 1 | Guest editor | Albert Veenstra | | | |
| Research Policy | 1 | Guest editor | Marcel Bogers | | * | * |
| Robotics & Automation Engineering Journal | 2 | Associate editor | Lambèr Royakkers | | | |
| | | Guest editor | Rinie van Est | | | |
| SA Journal of Industrial Psychology | 1 | Editor | Llewellyn van Zyl | | | |
| SAGE Open | 1 | Editor | Llewellyn van Zyl | | | |
| Service Science | 1 | Editor | Geert-Jan van Houtum | | | |
| Studies in History and Philosophy of Science | 1 | Guest editor | Dunja Šešelja | | * | |
| Sustainability | 1 | Editor | Wolmet Barendregt | | | |
| Technikgeschichte | 2 | Guest editor | Karena Kalmbach | | | |
| | | Guest editor | Andreas Spahn | | | |
| Technological Forecasting and Social Change | 3 | Associate editor | Floor Alkemade | | * | * |
| | | Editor | Marcel Bogers | | * | * |
| | | Guest editor | Bob Walrave | | * | * |
| Technology and Culture | 1 | Editor-in-Chief | Ruth Oldenziel | | | * |
| Technovation | 1 | Associate editor | Sjoerd Romme | * | * | * |
| Transportation Research. Part C: Emerging Technologies | 1 | Guest editor | Luuk Veelenturf | * | * | * |

**Editorships special issues**

| Journal | Year | Name IE&IS researcher | Topic | AIS top10% | AIS Q1 | Target journal groups |
|---|---|---|---|---|---|---|
| *Personal and Ubiquitous Computing* | 2017 | Jaap Ham | Supporting a healthier lifestyle with e-coaching systems | | | |
| *Queueing systems* | 2019 | Ivo Adan | Recent Developments in Queueing Theory | | | |
| *International Journal of Child-Computer Interaction* | 2019 | Wolmet Barendregt | Assumptions about the concept of childhood and the roles of children in design | | | |
| *Telecommunications Policy* | 2019 | Bert Sadowski | Papers from recent European regional conferences of the International Telecommunications Society: 'Competition and Regulation in the Information Age' (2017) and 'Towards a Digital Future: Turning Technology into Markets?' (2018) | | | |
| *Queueing systems* | 2020 | Ivo Adan | Recent Developments in Queueing Theory (part 2) | | | |
| *Technological Forecasting and Social Change* | 2021 | Marcel Bogers | Open Innovation Policy | | * | * |
| *Annals of Mathematics and Artificial Intelligence* | 2021 | Yingqian Zhang | Data science meets optimization | | | |
| *European Journal of Work and Organizational Psycholgy* | 2021 | Evangelia Demerouti | New directions in burnout research | | | * |

**Monographs and books, edited scientific books & edited proceedings**

Bombaerts, G., Jenkins, K., Sanusi, Y. A., & Wang, G. (Eds.) (2020). Energy justice across borders. Springer Open.

Bouchery, Y., Corbett, C. J., Fransoo, J. C., & Tan, T. (Eds.) (2017). Sustainable supply chains: a research-based textbook on operations and strategy. (Springer Series in Supply Chain Management; Vol. 4). Springer.

Brankaert, R. G. A., & IJsselsteijn, W. A. (Eds.) (2019). Dementia lab 2019. Making design work: engaging with dementia in context. (Communications in computer and information science; Vol. 1117). Springer.

Buskens, V., Corten, R., & Snijders, C. C. P. (Eds.) (2020). Advances in the sociology of trust and cooperation: Theory, experiments, and field studies. Walter de Gruyter GmbH.

Emanuel, B. A. M., Schipper, F., & Oldenziel, R. (Eds.) (2020). A U-Turn to the Future: Sustainable Urban Mobility since 1850. (Exploration in Mobility; Vol. 4). Berghahn Books Inc.

Kumar, A., Höffken, J. I., & Pols, A. J. K. (Eds.) (2021). Dilemmas of Energy Transitions in the Global South: Balancing Urgency and Justice. Routledge Taylor & Francis Group.

Matulevičius, R., & Dijkman, R. M. (Eds.) (2018). Advanced Information Systems Engineering Workshops: CAiSE 2018 International Workshops Tallinn, Estonia, June 11–15, 2018: Proceedings. (Lecture notes in business information processing; Vol. 316). Springer.

Vallverdú, J., & Müller, V. C. (Eds.) (2019). Blended cognition: The robotic challenge. Springer.

Olckers, C., van Zyl, L., & van der Vaart, L. (Eds.) (2017). Theoretical orientations and practical applications of psychological ownership. Springer.

Salanova, M., & van Zyl, L. E. (Eds.) (2022). Future Perspectives on Positive Psychology: A Research Agenda. Frontiers Media S.A.

Schrogl, K-U., Giannopapa, C., & Antoni, N. (Eds.) (2021). A Research Agenda for Space Policy: Elgar Research Agendas. Edward Elgar Publishing Ltd.

Sund, K. J., Galavan, R. J., & Bogers, M. L. A. M. (Eds.) (2020). Business Models and Cognition. (New Horizons in Managerial and Organizational Cognition). Emerald Group Publishing Ltd.

Taris, T. W., Peeters, M. C. W., & De Witte, H. (Eds.) (2019). The fun and frustration of modern working life: Contributions from an occupational health psychology perspective. Pelckmans Pro.

Van Zyl, L. E., & Rothmann, Sr., S. (Eds.) (2019). Positive psychological intervention design and protocols for multi-cultural contexts. Springer.

Van Zyl, L. E., & Rothmann Sr., S. (Eds.) (2019). Evidence-based positive psychological intervention practices in multicultural contexts. Springer.

Van Zyl, L. E., & Rothmann, Sr., S. (Eds.) (2019). Theoretical approaches to multi-cultural positive psychological interventions. Springer.

Van Zyl, L. E., Olckers, C., & van der Vaart, L. (Eds.) (2021). Multidisciplinary perspectives on grit: contemporary theories, assessments, applications and critiques. Springer.

Van Zyl, L. E., & Rothmann, Sr., S. (Eds.) (2021). Positive Organizational Interventions: Contemporary Theories, Approaches and Applications. Frontiers Media S.A.

# APPENDIX L – OVERVIEW H-INDICES

**Table L1. H-index full professors IE&IS based on Scopus and Web of Science (reference date early March 2023)**

| Name | H-index Scopus | H-index Web of Science |
|---|---|---|
| Ivo Adan | 29 | 24 |
| Floor Alkemade | 21 | 13 |
| Rudi Bekkers | 14 | 11 |
| Marcel Bogers | 33 | 31 |
| Heleen De Coninck | 22 | 23 |
| Evangelia Demerouti | 77 | 67 |
| Remco Dijkman | 32 | 26 |
| Paul Grefen | 28 | 22 |
| Ingrid Heynderickx | 31 | 27 |
| Wybo Houkes | 12 | 11 |
| Geert-Jan van Houtum | 32 | 27 |
| Wijnand IJsselsteijn | 47 | 39 |
| Jan de Jonge | 38 | 32 |
| Ton de Kok | 30 | 28 |
| Yvonne de Kort | 36 | 31 |
| Fred Langerak | 27 | 23 |
| Pascale Le Blanc | 30 | 22 |
| Ed Nijssen | 27 | 27 |
| Ruth Oldenziel | 10 | 10 |
| Isabelle Reymen | 17 | 15 |
| Lambèr Royakkers | 14 | 11 |
| Sjoerd Romme | 30 | 25 |
| Chris Snijders | 14 | 11 |
| Erik van der Vleuten | 13 | 8 |
| Tom Van Woensel | 39 | 35 |

**Table L2. H-index associate professors IE&IS based on Scopus and Web of Science (reference date early March 2023)**

| | H-index Scopus | H-index Web of Science |
|---|---|---|
| Average | 16 | 14 |
| Maximum | 36 | 34 |
| Minimum | 6 | 5 |
| Median | 15 | 14 |

**Table L3. H-index assistant professors IE&IS based on Scopus and Web of Science (reference date early March 2023)**

| | H-index Scopus | H-index Web of Science |
|---|---|---|
| Average | 7 | 6 |
| Maximum | 21 | 17 |
| Minimum | 1 | 0 |
| Median | 6 | 6 |

## APPENDIX M – EXAMPLES OF IMPORTANT SCIENTIFIC KEYNOTE PRESENTATIONS 2017-2022

Rudi Bekkers: "Discrimination against Foreigners in the Patent System: Evidence from Standard-Essential Patents" at The Future of Open and Collaborative Standard Setting: LCII -TILEC Conference, May 30, 2017, Brussels, Belgium.

Anna Wieczorek: "Unpacking sustainabilities in various transition contexts" at Africa-Europe Dialogue Symposium on Innovation for Sustainable Development, December 1, 2017, Pretoria, South Africa.

Eva Demerouti: "Work engagement, job crafting and employee functioning: translating research into practice" at CIPD 2017 Applied Research Conference, December 2, 2017, Glasgow, UK.

Sjoerd Romme: "University-centered innovation ecosystems" at ISPIM Innovation summit, December 10, 2017, Melbourne, Australia.

Yingqian Zhang: "Machine learning for PHM" at the Fourth European Conference of the Prognostics and Health Management Society (PHME 2018), July 4, 2018, Utrecht, The Netherlands.

Evangelia Demerouti: "Occupational Health Psychology in Action: Moving from Burnout to Proactive Job Redesign" at the Annual Conference British Psychological Society; Division of Occupational Psychology, January 10, 2019, Chester, UK.

Daniël Lakens: "Towards more efficient and reliable science" at Eighth conference of the Association for Researchers in Psychology and Health, January 24, 2019, Egmond aan Zee, The Netherlands.

Sjoerd Romme: "Mixing oil with water: thriving at the interface between engineering, social sciences and humanities" at workshop for faculty & doctoral students, Technology Management & Economics department, Chalmers University of Technology, March 22, 2019, Göteborg, Sweden.

Evangelia Demerouti: "The Work-life Interface from a Contemporary Perspective" at EAWOP 2019 - European Association of Work and Organizational Psychology, May 31, 2019, Turin, Italy.

Daniël Lakens: "The Reproducibility Crisis in Research: Methodological Issues and Proposed Remedies" at Annual Conference International Society of Psychoneuroendocrinology, August 30, 2019, Milan, Italy.

Anna Wieczorek: "Upscaling though value creation. Barriers and opportunities for novel community energy initiatives" at UN Environment Programme, September 13, 2019, DTU, Lyngby, Denmark.

Wijnand IJsselsteijn: "Warm Technology and co-design with People with Dementia", Alzheimer Europe, October 24, 2019, The Hague, The Netherlands.

Yingqian Zhang: "AI for industrial decision-making" at the annual Benelux Conference on Artificial Intelligence and Machine Learning (BNAIC/Benelearn), November 20, 2020 (online).

Daniël Lakens: "Towards a more reliable and efficient psychological science", Dutch Developmental Psychology Conference, May 19, 2021 (online).

Yvonne de Kort: "An integrative perspective on dynamic lighting, and how it should be studied" CIE Conference 2021, September 27, 2021, Kuala Lumpur, Malaysia (online).

Wijnand IJsselsteijn: "Kunstmatige Intelligentie en Menselijke Wijsheid", prof.dr. D.L. Knooklezing at Gerontologiecongres 2021, October 15, 2021, Utrecht, The Netherlands.

Tugce Martagan: "Merck Animal Health Uses Operations Research Methods to Transform Biomanufacturing Productivity for Lifesaving Medicines", 2022 INFORMS Business Analytics Conference, Franz Edelman competition and gala presentation, April 4, 2022, Houston, United States.

Llewellyn van Zyl: "Positive Organizational Psychology 2.0: Grand Challenges and Future Perspectives" at the 5th Sociedad Española de Psicología Positiva, May 12, 2022, Valencia, Spain.

Eva Demerouti: "Professional well-being and work-life balance" at the Dutch congress of Psychiatrists, May 12, 2022, Maastricht, The Netherlands.

Rob Broekmeulen and Karel van Donselaar: "Is your Warehouse Capacity Tight? Order More Inventory! Integrating Warehouse and Inventory Management when Inbound Capacity and Number of Storage Locations are Restricted" at 21st International Symposium on Inventories, International Society for Inventory Research, August 22, 2022, Budapest, Hungary.

Willem van Jaarsveld: "The impact of committing to customer orders in online retail" at 21st International Symposium on Inventories, International Society for Inventory Research, August 25, 2022, Budapest, Hungary.

Willem van Jaarsveld: "Deep Reinforcement Learning in Logistics" at DRL for dynamic decision problems in logistics and healthcare, September 27, 2022, Munich, Germany.

Wijnand IJsselsteijn: "Warm technology: Artificial Intelligence and Design for People with Dementia" at the International Forum on Cognitive Science: AI & Cognitive Science, Aging and Disease, JAIN CHINA & ISOAD Summit 2022, October 27, 2022 (online).

Pascale Le Blanc: "A human-centered approach of technologization in organizations" at at the Conferencia de Competitividad del País Vasco 2022, Foundations of competitiveness in times of uncertainty, organized by Orkestra Instituto Vasco de Competitividad, Universidad de Deusto/ Deusto Business School, November 17, 2022, Bilbao, Spain.

# APPENDIX N – CASES

## BIOMANUFACTURING: IMPROVING PRODUCTIVITY FOR LIFESAVING MEDICINES

The biomanufacturing industry has developed several novel drugs, so-called biopharmaceuticals, to improve the health and well-being of humans and animals. Over 345 million patients worldwide have benefited from biopharmaceuticals in surviving cancer, diabetes, and many other diseases. Unlike conventional chemically synthesized drugs, biomanufacturing methods use living organisms (e.g., viruses and bacteria) to grow the active ingredients. However, these high-tech processes generate unique challenges. For example, biomanufacturing operations include high levels of uncertainty and batch-to-batch variability in production yields and costs. Bio-safety requirements impose constraints, such as a no-wait requirement throughout the production process. Moreover, the growing global demand is stretching production footprints, and markets are becoming increasingly sensitive to costs.
To address these challenges, a multidisciplinary team from TU/e and MSD Animal Health developed a portfolio of optimization models and decision support tools. These tools were aimed at improving biomanufacturing efficiency by using a variety of operations research (OR) and artificial-intelligence (AI) methodologies, such as stochastic optimization, Bayesian learning, and simulation-optimization. As a unique feature, the developed models link the underlying biology and chemistry of biomanufacturing processes with financial trade-offs and business risks.

This unique link between OR, AI, and life sciences has led to substantial and sustainable productivity improvements. The implementation at MSD Animal Health generated around €200 million worth of revenue, with more to come, without requiring additional raw materials, energy resources, new equipment, or facility space. More specifically:
By optimizing fermentation operating decisions, we realized an improvement in batch yield of approximately 50% to 60% and reduced the batch-to-batch variability by 20%.

**Bioreactor MSD**

**MSD lab**

By optimizing the end-to-end planning and scheduling activities, we were able to produce one extra batch per week per production line across multiple production lines.
As a result of these process improvement projects, 40% less energy is now required to produce the same volume of product, saving 240,000 cubic meters of gas and 1,200,000 kilowatt-hours of electricity, and reducing carbon emissions by 468 tons.

The project was executed over five years in close collaboration with MSD Animal Health's Boxmeer facility. The research team of TU/e was led by Tugce Martagan. Besides Tugce, the team consisted of PhD candidates Yesim Koca and Coen Dirckx, and faculty members Ivo Adan and Alp Akcay. The project also involved more than 10 Master's students from the Operations Management and Logistics program, most of whom have continued as full-time employees at MSD.

The project has quickly gained recognition in academia and industry. In 2022, it was awarded with a finalist place in the INFORMS Edelman competition. The research is currently extended to other animal health production sites of MSD, and the plan is to extend it to human health at a later stage. We believe that this work will inspire new research at the intersection of OR, AI, and life sciences in general. As more companies such as MSD embrace OR and AI, we believe that this will significantly help the industry to provide faster and affordable access to life-saving medicines.

## CLIMATE POLICY: PLAYING AND ENABLING A LEADING ROLE IN INTERNATIONAL POLICY MAKING

On April 1, 2020, Heleen de Coninck was appointed as a full professor of socio-technical innovation and climate change. Her appointment provided an opportunity to further bolster the societal impact of the department and the university as a whole. It was a deliberate decision by the department to reduce Heleen's teaching load so that she could strengthen her societal impact activities, and this has paid off.

Heleen has served as the coordinating lead author for the chapter 'Innovation, technology development and transfer' of the part 'Migration of Climate Change' (Working Group III) of the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) of the United Nations (see: AR6 Climate Change 2022: Mitigation of Climate Change – IPCC). Previously, she served as the coordinating lead author of the very impactful 2018 IPCC special report on limiting warming to 1.5 degrees centigrade. She has become a figurehead of climate-policy research, nationally and internationally. The special report was the basis of a broader global movement to limit global warming not to 'well-below 2 degrees', as the Paris Agreement stipulates, but to 1.5 degrees, lowering the climate risks significantly. For example, the report inspired Greta Thunberg to start her 'Fridays for Future' movement and has had a significant impact on global climate negotiations.


**IPCC report press conference**

Upon the publication of the climate-mitigation part of the IPCC Sixth Assessment Report in April 2022, Heleen coordinated a media effort for all Dutch authors involved. This led to collaborative and impactful media coverage of the report in all major national newspapers and on national television. Heleen also featured in international media, for instance in *The Economist* and on *BBC World*.

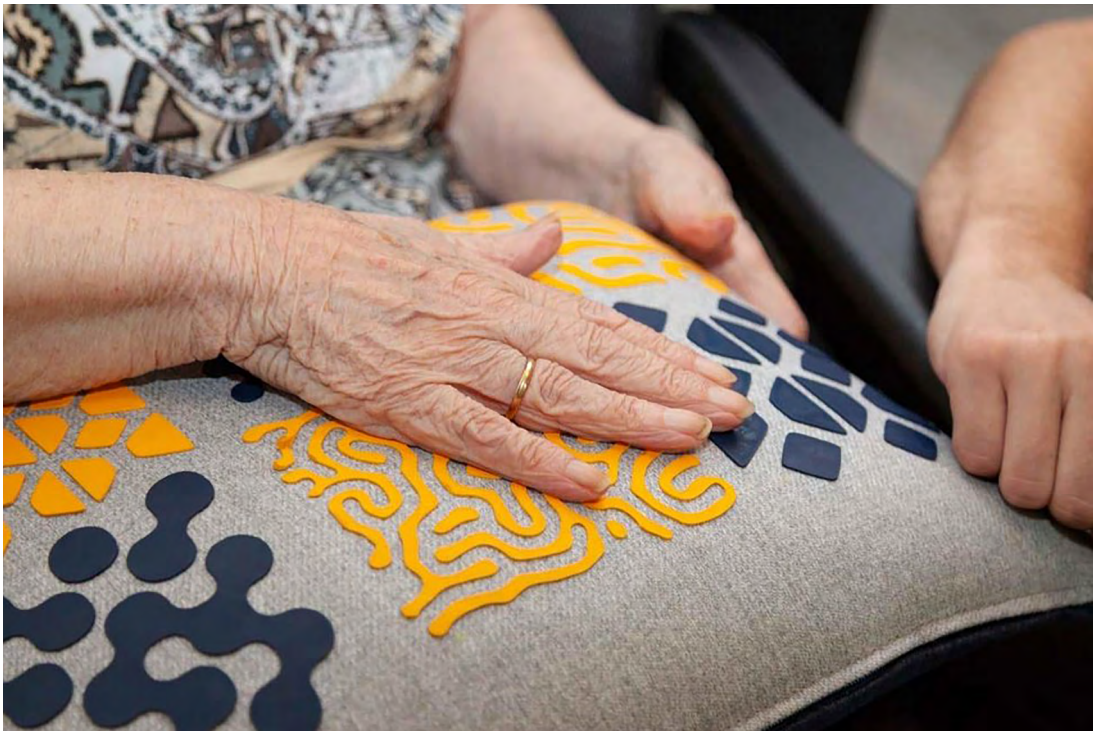
Heleen's impactful work on climate change thus made the department (and the TU/e as a whole) prominent in public media and policymaking regarding climate change. It also led to acquiring funding for closely associated research. For the period 2021 to 2025, €450,000 has been acquired from philanthropic foundations. This allowed hiring two senior researchers that dedicate themselves to impactful research work. One of them, Pieter Pauw, was appointed as a senior researcher on financial system change. He has led the first ever chapter on finance in the annual UN Emission Gap Report, in 2022, which in turn contributed to the decision, in the COP27 in Sharm El-Sheikh, that a transformation of the financial system is needed. He himself played a constructive role in the fossil-fuel-subsidy debate in the Netherlands, featuring in many newspapers and television shows on this topic.

Heleen's appointment also further increased the department's attractiveness for promising energy transition researchers. Many talented candidates responded to the 2020 vacancy for a PhD position to support Heleen on her IPCC work and to work on international climate technology transfer. From this pool of talent, in total 6 new PhD candidates could be appointed: one for the advertised PhD position and five for other PhD vacancies at the TIS group within the energy transition area.

## DEMENTIA: EXPERTISE CENTER DEMENTIA & TECHNOLOGY: WARM TECHNOLOGY FOR PEOPLE WITH DEMENTIA (VALORIZATION PRIZE 2022)

Every three seconds, someone in the world develops dementia – that is, 10 million new cases of dementia worldwide each year. Currently, there are over 55 million people worldwide living with dementia. The annual global cost of dementia is now above US$ 1.3 trillion and is expected to rise to US$ 2.8 trillion by 2030. At the same time, we see a substantial decline in the number of people capable to help take care of our elders, with or without dementia – especially in Europe and the US.

Although much work is focused on finding the root cause of dementia and ways to ameliorate its progression, successful medical interventions are still few and far between. As such, technology is considered as a promising way forward but is often devised without the full consideration of the target user group, or a thorough understanding of the context in which technology is to operate. This leads to technologies that do not successfully take root in care practice, are perceived as impersonal, complicated, and cold, and are not serving the needs of people with dementia themselves.



**VITA experience cushion, designed to connect with people with dementia. The VITA experience cushion produces personal sounds and music based on touch.**

In response, Wijnand IJsselsteijn, Ans Tummers and Rens Brankaert, together with Alzheimer Nederland, developed a novel approach to technology design and evaluation, called *Warm Technology*. The Warm Technology approach to technology design is inclusive, person-centered, and focused on abilities and aspirations of people living with dementia and their informal carers (e.g., partner or family). Early 2021, the Expertise Center Dementia & Technology (ECDT) was launched—receiving a substantial yearly endowment of Alzheimer Nederland—to support innovation around the Warm Technology approach. More specifically, the ECDT focuses on three key areas: (1) Design with and for people living with dementia; (2) pathways from research to market in dementia; (3) development and application of novel technologies. Moreover, the ECDT serves to bring together the larger community working on technology for people with dementia across Europe.

ECDT has an active and successful strategy for community and societal outreach, through a community manager and strategic collaborations with various societal partners (e.g., Alzheimer Cafés, small businesses, municipalities, various NGOs) and care partners. The visibility of the work and vision are enhanced through media appearances, public lectures, and invited talks, and the ECDT regularly organizes conferences, collaborative co-design workshops, dementia hackathons, community events, and technology inspiration sessions. Recent highlights include the 1st International Dementia, Design, and AI conference (DDAI22) organized in Eindhoven, and attended by care professionals, NGOs, SMEs, academic partners, and government representatives. ECDT also co-organized (with JAIN, Vilans, and Alzheimer Nederland, and supported by Health Holland) SME sessions with some 50 representatives from 42 Dutch companies active in the dementia, care & technology space. It also initiated the annual Warm Technology Challenge (WTC), together with Innovation Space, Eindhoven Engine, and Alzheimer Nederland, which invites students to develop innovative and ground-breaking Warm Technology. Finally, Warm Technology has found its way to the educational curriculum through several educational (master) programs at TU/e.

For concrete examples of research and outreach work, see: www.ecdt.nl.

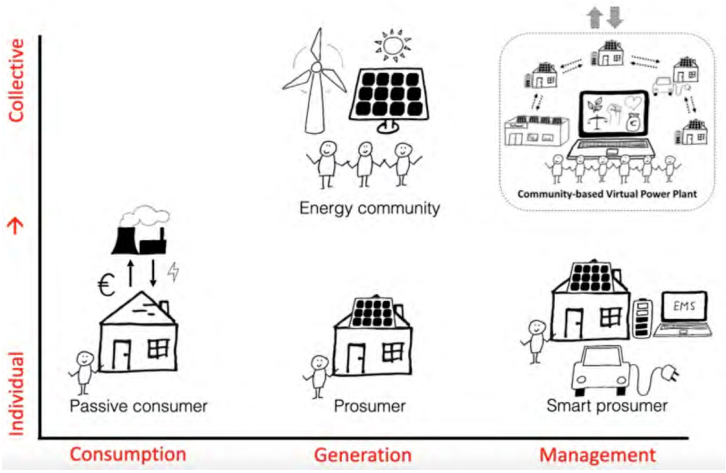
## ENERGY TRANSITION: DEMOCRATIZING ENERGY SYSTEM ORGANIZATION (VALORIZATION PRIZE 2020)

The use of distributed renewable energy sources has increased substantially in recent years. However, their growing deployment, intermittent nature, and lack of storage cause substantial power grid congestion and balancing. This obstructs further deployment of renewables and hinders the green energy transition.

The community-based Virtual Power Plant (cVPP) project has introduced a new AI-based ICT platform that incorporates price changes, energy flows, and weather conditions. This enables prosumers (i.e., energy users that also produce energy themselves) to develop into collective smart prosumers – thus facilitating community-driven energy initiatives to help overcoming some of the obstructions in the current energy transition. cVVP platforms are co-created by a variety of social actors and led by a team of researchers at TU/e – Anna Wieczorek, Luc van Summeren, Laura van den Berghe, Geert Verbong, Sjoerd Pernot, George Papachristos, Aleid Groenewoudt, and Josja Veul. A cVVP is organized and owned by the community and driven by their needs. It allows smart prosumers to not only consume and generate energy but also participate in its management, which helps decentralize and democratize the (traditionally centralized) energy system (see Figure by Luc van Summeren).

Since its inception in 2017, outreach and dissemination have been key to the project. Besides engaging (and enabling) citizens and communities, the project members reached out to and collaborated with European, regional, and national authorities. The cVPP solution has been adopted by several international initiatives and influences future regulation of the energy market in Europe. Moreover, it attracted substantial media attention, including attention at national television and radio channels: it demonstrates what many people considered to be impossible for a long time, namely to make local energy initiatives possible within the context of centralized energy systems. The research is used to educate students, industry, politicians, and civil society organizations. Finally, we are very proud to say that the cVPP project received the prestigious EU citizen's award in 2020!

For a short (11-minutes) video on the value of cVPP-s, see: A community-based Virtual Power Plant.

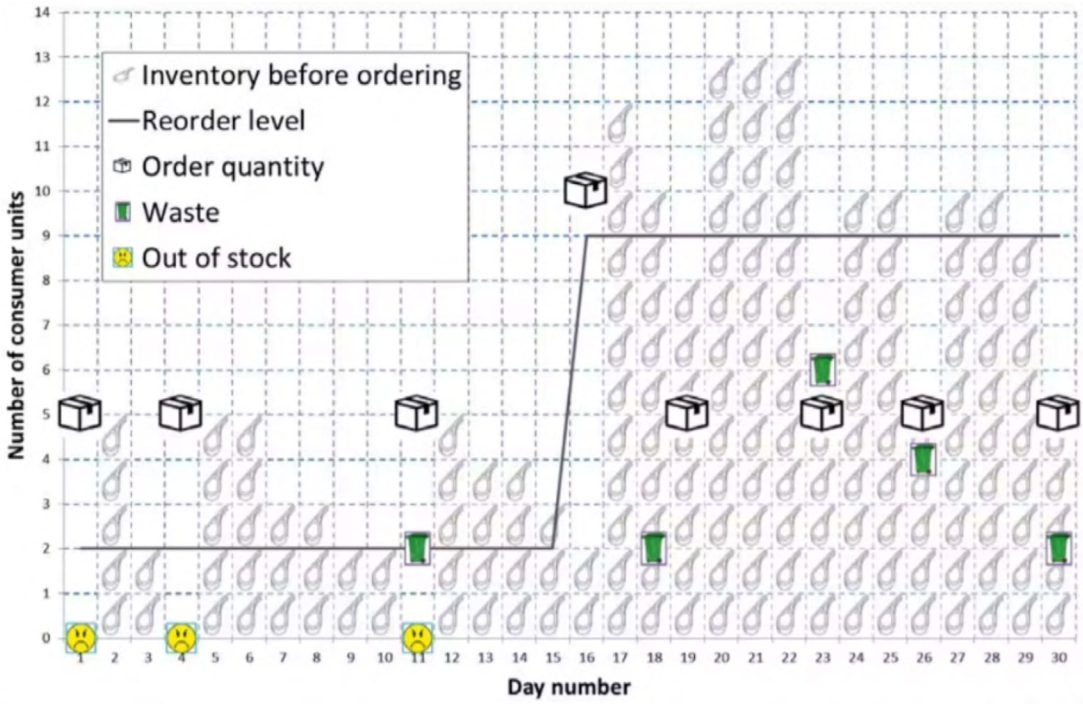


## FOOD WASTE: REDUCING WASTE AND INCREASING FRESHNESS (VALORIZATION PRIZE 2019)

One-third of all food produced for human consumption is lost or wasted. The associated annual costs exceed $990 billion. At the same time, nearly 200 million people are facing acute hunger and 2.3 billion people face dangerous levels of food insecurity according to the UN's Food and Agriculture Organization. Therefore, in 2015, the United Nations adopted a Sustainable Development Goal which seeks to ensure sustainable consumption and calls for cutting in half global food waste by 2030.

The ECR Retail Loss Group (ECR Community | Efficient Consumer Response. (ecr-community.org)) is a large group of retailers (64% of the top 100 retailers worldwide participate in ECR), manufacturers and academics. To contribute to food-waste reduction, they selected Rob Broekmeulen and Karel van Donselaar from TU/e to conduct a 'Sell More, Waste Less' research project based on empirical data from three large retailers. This selection was based on a track record of innovative and practice-based research, which includes a new inventory replenishment logic for perishable products as well as approximations for food waste and service levels. The ECR project aimed to provide retailers with tools and insights on how to reduce food waste and increase the freshness of products in supermarkets.

Rob and Karel started their research in 2015 and developed a set of tools, including user-friendly indicators of food waste (the Fresh Case Cover); an Excel-based tool to make trade-offs between the cost of more waste and the benefits of higher On-Shelf Availability; a list of best practices




**The impact of the reorder level on the inventory levels in the store and the order quantities.**

to reduce waste; and an inventory of the six most effective interventions to reduce waste. The results were disseminated via a report for the industry, a scientific paper, presentations to retailers in workshops and online meetings, via courses in bachelor and master programs in Industrial Engineering, and via multiple graduation projects. Many retailers reaped significant benefits from this project. For example, Albert (Czech Republic, part of Ahold Delhaize) reported more than €1 million per year in savings and called the industry report their 'Holy Bible on food waste reduction'.

After 2018, the research and dissemination via ECR has continued. One known cause of food waste in supermarkets is consumers that squeeze in products to test for freshness. The team developed a method for measuring this behavior and its effects, using empirical data on sales, supply, and waste. They tested their methods in a project with Jumbo Supermarkten (NL) and shared those results with the ECR retailers. In 2021 one of those retailers, Tesco (UK), successfully implemented the methods in their business. In another research project with ECR, Rob and Karel investigated a concept called Service Differentiation with which some retailers already experimented for a small part of their assortment. The research of Rob and Karel showed that this concept can give huge waste reductions under optimized parameters (up to 50%). This concept can be applied for many more items and at more retailers. Currently, again in a project with Jumbo Supermarkten, it is investigated how this concept and the underlying theory can provide support for assortment optimization in order to increase product freshness while still meeting the target service levels.

Since 2020, the dissemination of results via ECR has not only been done via in-person meetings, but also via webinars. As a result, retailers from around the globe, including Australia, South-Africa, Europe and the USA, now participate in these webinars. The physical meetings are also attended by journalists and policy makers, resulting in extra media coverage.

## PATENTS: DESIGNING A EUROPEAN PUBLIC MECHANISM TO ASSESS ESSENTIALITY

Sometimes, relevance to society is best achieved by supporting policymakers in the design of their mechanisms. In this way, Rudi Bekkers, Elena Mas Tur, and Emilio Raiteri were selected by the European Commission (EC) to lead a global team of researchers to design and investigate the feasibility of a so-called Essentiality Assessment system.

This system was conceived to address a significant problem regarding patents that cover technical standards. These technical standards are used in mobile communications, Internet of Things, automobiles, and applications in digital and green technologies. Although they should be available to any implementer, it is not clear to implementers for which patents they should acquire a license when they implement certain technical standards. Patent owners declared over 30,000 patent families as being 'potentially' relevant for all these technical standards. A public system would create transparent and reliable information on which patents are critically important to consider.

This is a sensitive topic for patent owners. The work done for the EC was only possible because of the long-term network and collaborations the researchers at our department have built up with patent offices, but also with many private companies in the field, including these patent owners.

**Meeting High-Level Forum on European Standardisation, chaired by Thierry Breton, Euro-commissioner for the Internal Market**

This existing network provided unprecedented access to data, allowing the use of a natural experiment research design, unique in this field. This experiment showed that setting up a European Essentiality Assessment system is feasible. Furthermore, the researchers developed eight implementation scenarios. The results were described in a widely distributed report and they were presented to more than 1,100 stakeholders (in eight events). Based on the results, the key stakeholders decided to proceed with the next steps to develop an Essentiality Assessment System. The results also attracted broad attention on social networks (with over 10,000 views of LinkedIn announcements). And the researchers were invited to the US patent office and other international bodies to discuss their insights.

An important milestone was reached in November 2020, when the EC Commissioner for Competition and Executive Vice-President Margrethe Vestager announced the EC's intention to follow up on this study's recommendations. The EC is now indeed carrying out an economic impact analysis, which is a required step before legislation is adopted. When implemented, the system of essentiality checks will particularly benefit European SMEs and parties from new industries, who suffer more from information asymmetry than incumbent parties. It will significantly reduce transaction costs by lowering the high degree of expensive and time-consuming litigation of patents required for technical standards. Eventually, the end user will benefit from a wider choice and better-functioning markets.

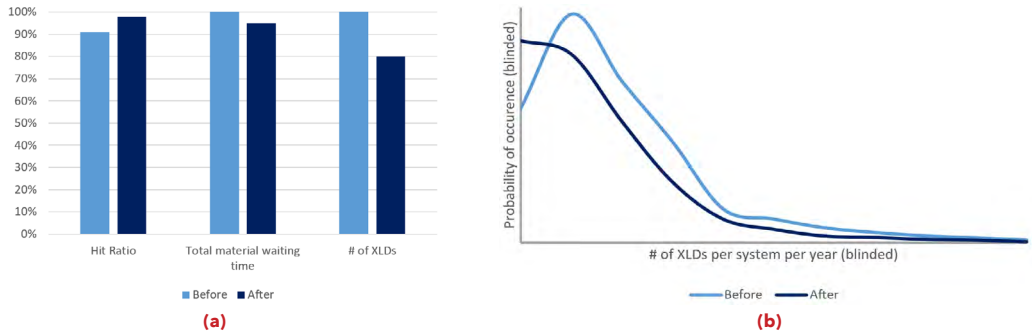
Finally, late 2022, the expertise of TU/e in this area received high recognition when Rudi Bekkers and Robert-Jan Smits (president of the TU/e) were selected, from a set of strong competitors, as the sole university representatives on the EC's High-Level Forum on Standardization (see: High-Level Forum on European Standardisation)! This forum is chaired by Euro commissioner Thierry Breton and will advise European policymakers.

## SEMICONDUCTOR PRODUCTION: IMPLEMENTING A NEW SERVICE SUPPLY CONCEPT AT ASML (VALORIZATION PRIZE 2021)

ASML is technology and market leader in manufacturing lithography machines for the semiconductor industry All major semiconductor manufacturers, including TSMC, Intel and Samsung, are customers of ASML. Almost all of their lithography machines are sold with a full maintenance service contract, which makes ASML responsible for all maintenance that is needed for these machines. In total, they serve over 3,000 machines. The after-sales supply chain is key for solving failures. These are bottleneck machines, so that any downtime leads to a reduced output of the whole factory. A down of one hour already has an estimated cost of €72,000. ASML's customers are also faced with extreme long downtime (XLD) events that are even more disruptive. These XLDs, which can last over 24 hours, lead to enormous reductions of production output, while there is already a worldwide shortage of microchips.

ASML has been one of the most active members of the European Supply Chain Forum after joining in 2001. Since then, our department has collaborated with ASML on various topics, in particular the tactical planning of spare parts. This planning is made for thousands of Stock-Keeping Units (SKUs) that are kept on stock in one global warehouse, a few regional warehouses, and 45 local warehouses. The first jointly developed planning concept was implemented in 2006 and an improved version was implemented in 2015. The core of the concept is a large-scale nonlinear, integer programming problem that minimizes total costs subject to service constraints in terms of *mean system downtimes* for groups of machines that are connected to the same local warehouse. The solution algorithm is a greedy heuristic that builds on techniques from stochastic operations research for a fast evaluation of a given solution.

Because the old service concept was only focused on mean system downtimes, a team consisting of Douniel Lamghari-Idrissi, Rob Basten, and Geert-Jan van Houtum started a new project in 2017 to develop a new service supply concept that also takes XLDs into account. In addition, the service supply concept integrated other wishes of customers, such as the incorporation of service tools, the inclusion of demands for spare parts that are needed as part of the failure diagnosis, and minimal stock levels for high-demand SKUs and SKUs with many Dead-on-Arrival cases.




**(Color online) Customer Impact**

After successful pilots, the new service concept was rolled out in 2020 in ASML's entire service network. The new concept increased the total after sales costs of ASML with 5%, but it reduced the number of XLDs by 20% and hence increased the amount of produced chips. The joint result is an estimated yearly benefit of €1.5 billion for the semiconductor industry as a whole!

This research was awarded with a finalist place in the 2021 INFORMS Wagner Prize competition and it attracted a lot of attention within ASML, with its customers, and in other capital goods industries. The key insight, more production output through a better alignment between a service provider and her customers, is transferable to other after-sales supply chains for capital goods. The success of this project facilitated the start of new joint research projects with ASML on servitization, decision support methods for the operational planning of the after-sales supply chain, and the interaction between the spare-parts planning and the behavior of all involved planners.

# APPENDIX O – PUBLICATIONS ALTMETRIC TOP 5% (2017-2022)

Altmetrics are metrics and qualitative data that can tell you a lot about how often journal articles and other scholarly outputs like datasets are discussed and used around the world. They can include (but are not limited to) peer reviews on Faculty of 1000, citations on Wikipedia and in public policy documents, discussions on research blogs, mainstream media coverage, bookmarks on reference managers like Mendeley, and mentions on social networks such as Twitter and Facebook.

For further information see:

- How are outputs scored? https://help.altmetric.com/support/solutions/articles/6000232839-how-are-outputs-scored-
- How is the Altmetric Attention Score calculated? https://help.altmetric.com/support/solutions/articles/6000233311-how-is-the-altmetric-attention-score-calculated-

Below an overview of the Altmetric top 5% publications of IE&IS 2017-2022 (altmetric scores d.d. 21 January 2022)

### 2017

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| Acerbi, A., Kendal, J., & Tehrani, J. (2017). Cultural complexity and demography: the case of folktales. Evolution and Human Behavior, 38(4), 474–480. https://doi.org/10.1016/j.evolhumbehav.2017.03.005 | **34** |
| Bakker, A. B., & Demerouti, E. (2017). Job demands-resources theory: taking stock and looking forward. Journal of Occupational Health Psychology, 22(3), 273-285. https://doi.org/10.1037/ocp0000056 | **51** |
| Bekkers, R. N. A., & Bombaerts, G. J. T. (2017). Introducing broad skills in higher engineering education: The Patents and Standards course at Eindhoven University of Technology. Technology and Innovation , 19(2), 493-507. https://doi.org/10.21300/19.2.2017.493 | **34** |
| Demerouti, E., & Cropanzano, R. (2017). The buffering role of sportsmanship on the effects of daily negative events. European Journal of Work and Organizational Psychology, 26(2), 263-274 . https://doi.org/10.1080/1359432X.2016.1257610 | **160** |
| Frank, L., & Nyholm, S. (2017). Robot sex and consent: Is consent to sex between a robot and a human conceivable, possible, and desirable? *Artificial Intelligence and Law*, *25*(3), 305-323. https://doi.org/10.1007/s10506-017-9212-y | **105** |
| Hoekstra, A. E., Steinbuch, M., & Verbong, G. P. J. (2017). Creating agent-based energy transition management models that can uncover profitable pathways to climate change mitigation. *Complexity*, *2017*, [1967645]. https://doi.org/10.1155/2017/1967645 | **135** |
| Jansen, R. S., Lakens, D., & Ijsselsteijn, W. A. (2017). An integrative review of the cognitive costs and benefits of note-taking. *Educational Research Review*, *22*(November 2017), 223-233. https://doi.org/10.1016/j.edurev.2017.10.001 | **53** |
| Lakens, D., & Etz, A. J. (2017). Too true to be bad : when sets of studies with significant and nonsignificant findings are probably true. *Social Psychological and Personality Science*, *8*(8), 875-881. https://doi.org/10.1177/1948550617693058 | **168** |
| Lakens, D. (2017). Equivalence tests : a practical primer for t tests, correlations, and meta-analyses. *Social Psychological and Personality Science*, *8*(4), 355-362. https://doi.org/10.1177/1948550617697177 | **337** |
| Morin, O., & Acerbi, A. (2017). Birth of the cool: a two-centuries decline in emotional expression in Anglophone fiction. *Cognition and Emotion*, *31*(8), 1663-1675. https://doi.org/10.1080/02699931.2016.1260528 | **158** |

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|---|---|
| Nijssen, E. J., & van der Borgh, W. (2017). Beyond the water cooler: using socialization to understand use and impact of networking services on collaboration in a business incubator. *R&D Management*, *47*(3), 443-457 . https://doi.org/10.1111/radm.12261 | **284** |
| Vaesen, K., & Katzav, J. (2017). How much would each researcher receive if competitive government research funding were distributed equally among researchers? *PLoS ONE*, *12*(9), 1-11. [e0183967]. https://doi.org/10.1371/journal.pone.0183967 | **629** |
| Wenmaekers, R. H. C., Nicolai, B., Hornikx, M. C. J., & Kohlrausch, A. G. (2017). Why orchestral musicians are bound to wear earplugs: About the ineffectiveness of physical measures to reduce sound exposure. *Journal of the Acoustical Society of America*, *142*(5), 3154-3164. https://doi.org/10.1121/1.5012689 | **58** |


## 2018


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| Albers, C., & Lakens, D. (2018). When power analyses based on pilot data are biased: inaccurate effect size estimators and follow-up bias. *Journal of Experimental Social Psychology*, *74*, 187-195. https://doi.org/10.1016/j.jesp.2017.09.004 | **60** |
| Danaher, J., Nyholm, S. R., & Earp, B. (2018). The quantified relationship. *The American Journal of Bioethics*, *18*(2), 3-19. https://doi.org/10.1080/15265161.2017.1409823 | **108** |
| Demerouti, E., Xanthopoulou, D., & Bakker, A. B. (2018). How do cynical employees serve their customers?: A multi-method study. *European Journal of Work and Organizational Psychology*, *27*(1), 16-27. https://doi.org/10.1080/1359432X.2017.1358165 | **82** |
| Gordon, H. J., Demerouti, E., Le Blanc, P. M., Bakker, A. B., Bipp, T., & Verhagen, M. A. (2018). Individual job redesign: job crafting interventions in healthcare. *Journal of Vocational Behavior*, *104*, 98-114. https://doi.org/10.1016/j.jvb.2017.07.002 | **40** |
| van den Hout, J. J. J., Davis, O. C., Weggeman, M. C. D. P. (2018). The conceptualization of team flow. *The Journal of Psychology, 152*(6), 388-423. https://doi.org/10.1080/00223980.2018.1449729 | **49** |
| de Jonge, J., Shimazu, A., & Dollard, M. (2018). Short-term and long-term effects of off-job activities on recovery and sleep: A two-wave panel study among health care employees. *International Journal of Environmental Research and Public Health*, *15*(9), [2044]. https://doi.org/10.3390/ijerph15092044 | **51** |
| Klein, R. A., Vianello, M., Hasselman, F., Adams, B. G., Adams, R. B., Alper, S., Aveyard, M., Axt, J. R., Babalola, M. T., Bahník, Š., Batra, R., Berkics, M., Bernstein, M. J., Berry, D. R., Bialobrzeska, O., Binan, E. D., Bocian, K., Brandt, M. J., Busching, R., ... Nosek, B. A. (2018). Many Labs 2: Investigating Variation in Replicability Across Samples and Settings. *Advances in Methods and Practices in Psychological Science*, *1*(4), 443-490. https://doi.org/10.1177/2515245918810225 | **194** |
| Lakens, D., Adolfi, F. G., Albers, C. J., Anvari, F., Apps, M. A. J., Argamon, S. E., Baguley, T., Becker, R. B., Benning, S. D., Bradford, D. E., Buchanan, E. M., Caldwell, A. R., Van Calster, B., Carlsson, R., Chen, S. C., Chung, B., Colling, L. J., Collins, G. S., Crook, Z., ... Zwaan, R. A. (2018). Justify your alpha. *Nature Human Behaviour*, *2*(3), 168-171. https://doi.org/10.1038/s41562-018-0311-x | **216** |
| Lamberink, H. J., Otte, W. M., Sinke, M. R. T., Lakens, D., Glasziou, P. P., Tijdink, J. K., & Vinkers, C. H. (2018). Statistical power of clinical trials increased while effect size remained stable: an empirical analysis of 136,212 clinical trials between 1975 and 2014. *Journal of Clinical Epidemiology*, *102*, 123-128. https://doi.org/10.1016/j.jclinepi.2018.06.014 | **131** |
| Moshontz, H., Campbell, L., Ebersole, C. R., IJzerman, H., Urry, H. L., Forscher, P. S., Grahe, J. E., McCarthy, R. J., Musser, E. D., Antfolk, J., Castille, C. M., Evans, T. R., Fiedler, S., Flake, J. K., Forero, D. A., Janssen, S. M. J., Keene, J. R., Protzko, J., Aczel, B., Solas, S. Á., & 77 others. (2018). The psychological science accelerator: advancing psychology through a distributed collaborative network. *Advances in Methods and Practices in Psychological Science, 1*(4), 501-515, https://doi.org/10.1177/2515245918797607 | **44** |
| Petrou, P., Demerouti, E., & Schaufeli, W. B. (2018). Crafting the change: the role of employee job crafting behaviors for successful organizational change. *Journal of Management*, *44*(5), 1766-1792. https://doi.org/10.1177/0149206315624961 | **33** |

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| Royakkers, L., Timmer, J., Kool, L., & van Est, R. (2018). Societal and ethical issues of digitization. *Ethics and Information Technology*, *20*(2), 127-142. https://doi.org/10.1007/s10676-018-9452-x | **48** |
| Simons, K. S., Verweij, E., Lemmens, P. M. C., Jelfs, S., Park, M., Spronk, P. E., Sonneveld, J. P. C., Feijen, H. M., van der Steen, M. S., Kohlrausch, A. G., van den Boogaard, M., & de Jager, C. P. C. (2018). Noise in the intensive care unit and its influence on sleep quality: A multicenter observational study in Dutch intensive care units. *Critical Care*, *22*(1), [250]. https://doi.org/10.1186/s13054-018-2182-y | **83** |
| Xanthopoulou, D., Bakker, A. B., Oerlemans, W. G. M., & Koszucka, M. (2018). Need for recovery after emotional labor: Differential effects of daily deep and surface acting. Journal of Organizational Behavior, 39(4), 481-494. https://doi.org/10.1002/job.2245 | **45** |


## 2019


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|---|---|
| Acerbi, A. (2019). Cognitive attraction and online misinformation. *Palgrave Communications*, *5*(1), [15]. https://doi.org/10.1057/s41599-019-0224-y | **77** |
| Balk, Y. A., de Jonge, J., Geurts, S. A. E., & Oerlemans, W. G. M. (2019). Antecedents and consequences of perceived autonomy support in elite sport: a diary study linking coaches' off-job recovery and athletes' performance satisfaction. *Psychology of Sport and Exercise*, *44*, 26-34. https://doi.org/10.1016/j.psychsport.2019.04.020 | **67** |
| Botvinik-Nezer, R., Holzmeister, F., Camerer, C.F., Dreber, A., Huber, J., Johannesson, M., Kirchler, M., ……., Schonberg, T. (2019). Variability in the analysis of a single neuroimaging dataset by many teams. *bioRxiv*. https://doi.org/10.1101/843193 | **461** |
| Demerouti, E., Veldhuis, W., Coombes, C., & Hunter, R. (2019). Burnout among pilots: psychosocial factors related to happiness and performance at simulator training. *Ergonomics*, *62*(2), 233-245. https://doi.org/10.1080/00140139.2018.1464667 | **62** |
| van Dongen, N. N. N., van Doorn, J. B., Gronau, Q. F., van Ravenzwaaij, D., Hoekstra, R., Haucke, M. N., Lakens, D., Hennig, C., Morey, R. D., Homer, S., Gelman, A., Sprenger, J., & Wagenmakers, E. J. (2019). Multiple perspectives on inference for two simple statistical scenarios. *American Statistician*, *73*(sup1), 328-339. https://doi.org/10.1080/00031305.2019.1565553 | **74** |
| Ershad Sarabi, S., Han, Q., L. Romme, A.G., de Vries, B., Wendling, L. (2019). Key Enablers of and Barriers to the Uptake and Implementation of Nature-Based Solutions in Urban Settings: A Review. *Resources, 8*(3), 1-20. https://doi.org/10.3390/resources8030121 | **44** |
| Köhler, J., Geels, F. W., Kern, F., Markard, J., Wieczorek, A., Alkemade, F., Avelino, F., Bergek, A., Boons, F., Fünfschilling, L., Hess, D., Holtz, G., Hyysalo, S., Jenkins, K., Kivimaa, P., Martiskainen, M., McMeekin, A., Mühlemeier, M. S., Nykvist, B., ... Wells, P. (2019). An agenda for sustainability transitions research: state of the art and future directions. *Environmental Innovation and Societal Transitions*, *31*, 1-32. https://doi.org/10.1016/j.eist.2019.01.004 | **83** |
| te Kulve, M., Schlangen, L.J.M. & van Marken Lichtenbelt, W.D. (2019.) Early evening light mitigates sleep compromising physiological and alerting responses to subsequent late evening light. *Scientific Reports, 9*, [16064]. https://doi.org/10.1038/s41598-019-52352-w | **208** |
| van der Meij, L., Demetriou, A., Tulin, M., Méndez, I., Dekker, P., Pronk, T. (2019). Hormones in speed-dating: The role of testosterone and cortisol in attraction. *Hormones and Behavior, 116*, [104555], 1-12. https://doi.org/10.1016/j.yhbeh.2019.07.003. | **32** |
| Morin, O., Acerbi, A., & Sobchuk, O. (2019). Why people die in novels: testing the ordeal simulation hypothesis. *Palgrave Communications*, *5*(1), [2]. https://doi.org/10.1057/s41599-019-0267-0 | **44** |
| Spelt, H., Dijk, E.K.-v., Ham, J., Westerink, J., IJsselsteijn, W. (2019). Psychophysiological Measures of Reactance to Persuasive Messages Advocating Limited Meat Consumption. *Information, 10*(10), 1-12. https://doi.org/10.3390/info10100320 | **113** |
| Vaesen, K., Scherjon, F., Hemerik, L., & Verpoorte, A. (2019). Inbreeding, Allee effects and stochasticity might be sufficient to account for Neanderthal extinction. *PLoS ONE*, *14*(11), [e0225117]. https://doi.org/10.1371/journal.pone.0225117 | **660** |

## 2020

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| Bhaskar, S., Tan, J., Bogers, M. L. A. M., Minssen, T., Badaruddin, H., Israeli-Korn, S., Chesbrough, H. (2020). At the Epicenter of COVID-19–the Tragic Failure of the Global Supply Chain for Medical Supplies. *Frontiers in Public Health, 8*, [562882], 1-9. https://doi.org/10.3389/fpubh.2020.562882 | **71** |
| Botvinik-Nezer, R., Holzmeister, F., Camerer, C. F., Dreber, A., Huber, J., Johannesson, M., Kirchler, M., Iwanir, R., Mumford, J. A., Adcock, R. A., Avesani, P., Baczkowski, B. M., Bajracharya, A., Bakst, L., Ball, S., Barilari, M., Bault, N., Beaton, D., Beitner, J., ... Schonberg, T. (2020). Variability in the analysis of a single neuroimaging dataset by many teams. *Nature*, *582*(7810), 84-88. https://doi.org/10.1038/s41586-020-2314-9 | **2092** |
| Bruno, M., & Nikolaeva, A. (2020). Towards a maintenance-based approach to mode shift: Comparing two cases of Dutch cycling policy using social practice theory. *Journal of Transport Geography*, *86*, [102772]. https://doi.org/10.1016/j.jtrangeo.2020.102772 | **46** |
| Demerouti, E., Hewett, R., Haun, V., De Gieter, S., Rodríguez-Sánchez, A., & Skakon, J. (2020). From job crafting to home crafting: A daily diary study among six European countries. *Human Relations, 73*(7), 1010–1035. https://doi.org/10.1177/0018726719848809 | **30** |
| Guitart, I. A., Hervet, G. & Gelper, S. (2020). Competitive advertising strategies for programmatic television. *Journal of the Academy of Marketing Science, 48*, 753–775. https://doi.org/10.1007/s11747-019-00691-5 | **32** |
| de Jonge, J. (2020). What makes a good work break? Off-job and on-job recovery as predictors of employee health. *Industrial Health, 58*(2), 142-152. https://doi.org/10.2486/indhealth.2019-0097 | **205** |
| de Jonge, J., Balk, Y. A., & Taris, T. W. (2020). Mental recovery and running-related injuries in recreational runners: the moderating role of passion for running. *International Journal of Environmental Research and Public Health*, *17*(3), [1044]. https://doi.org/10.3390/ijerph17031044 | **257** |
| Lakens, D., McLatchie, N., Isager, P., Scheel, A. M., & Dienes, Z. (2020). Improving inferences about null effects with Bayes factors and equivalence tests. *Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, *75*(1), 45-57. https://doi.org/10.1093/geronb/gby065 | **42** |
| Nyholm, S. & Smids, J., (2020). Automated cars meet human drivers: responsible human-robot coordination and the ethics of mixed traffic. *Ethics and Information Technology, 22,* 335-344. http://dx.doi.org/10.1007/s10676-018-9445-9 | **49** |
| Nyholm, S., & Smids, J. (2020). Can a robot be a good colleague? *Science and Engineering Ethics*, *26*(4), 2169–2188. https://doi.org/10.1007/s11948-019-00172-6 | **44** |
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| Orben, A., Lakens, D. (2020). Crud (Re)Defined. *Advances in Methods and Practices in Psychological Science, 3*(2), 238-247. https://doi.org/10.1177/2515245920917961 | **111** |
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# APPENDIX P – EXTERNAL FUNDING

**Table P1. Projects in funding schemes selecting for scientific excellence**

| Title* | Acronym | Funding organization | Project leader IE&IS | Start year* | Contract value IE&IS* (Euro) | Value total project (EUR) | Non-academic partners involved | Academic partners involved | Research theme |
|---|---|---|---|---|---|---|---|---|---|
| Optimization Models for Faster and Affordable Access to Rare Disease Therapeutics | | NWO-Veni | Martagan | 2018 | € 246.978,00 | € 246.978,00 | | | |
| Increasing the Reliability and Efficiency of Psychological Science | | NWO-Vidi | Lakens | 2018 | € 799.910,00 | € 799.910,00 | | | |
| Cross-border Alliances for Successful, Pan-European Online Sales | DSMFACIL | European Commission (Marie Sklodowska-Curie Individual Fellowship) | Mutlu | 2018 | € 165.599,00 | € 165.599,00 | Bol.com | | |
| Pioneering the Digital Future for Omnichannel Retail Managers | PERFORM | European Commission (Marie Sklodowska-Curie Innovative Training Network) | Mutlu | 2018 | € 456.749,00 | € 3.878.868,96 | Unimarkt, Scheer GmbH, Intouch, Intersport, NTS Retail Solutions, Technology For Mobile, BlueRock Logistics, AWS-Institut für digitale Produkte und Prozesse, BWG foods, Raiffeisenlandesbank Oberösterreich AG, FH OÖ Forschungs & Entwicklungs GmbH | Dublin City University, Linneaus University, Universität Linz | |
| The Artificial Ethicists | | NWO-Veni | O'Neill | 2019 | € 249.514,00 | € 249.514,00 | | | |

| Title* | Acronym | Funding organization | Project leader IE&IS | Start year* | Contract value IE&IS* (Euro) | Value total project (EUR) | Non-academic partners involved | Academic partners involved | Research theme |
|---|---|---|---|---|---|---|---|---|---|
| Virtual Reality Audio for Cyber Environments | VRACE | European Commission (Marie Sklodowska-Curie Innovative Training Network) | IJsselsteijn | 2019 | € 237.180,00 | € 3.961.342,80 | Muller-BBM GMBH, Siemens Industry Software NV, Sennheiser Electronic GMBH & CO KG, IESTA – Institut fur Innovatieve Energie & Stoffaustauschsysteme, ARTIM GMBH, SIMetris GmbH, SYOS, Centre d'Expertise sur les Risques l'Environment la mobilité et l'amenagement, Facebook Technologies LLC | Universität für Musik und darstellende Kunst Wien, Hochshule für Musik Detmold, Centre National de la Recherche Scientifique CNRS, Katholieke Universiteit Leuven, AALTO Korkakoulusaatio SR, Gottfried Wilhelm Universität Hannover, The Queen's University of Belfast | |
| Ethics of Socially Disruptive Technologies | ESDiT | NWO-Gravitation | IJsselsteijn | 2019 | € 3.318.932,00 | € 17.990.612,00 | | University of Twente, Delft University of Technology, Utrecht University, Wageningen University & Research, Leiden University, University Medical Center Utrecht | H&T |
| New Energy and Mobility Outlook for the Netherlands | NEON | NWO-Crossover | Alkemade | 2020 | € 1.400.000,00 | € 12.011.572,00 | Zenmo, NXP, Lightyear, Ampyx power, Damen shipyard, PON, Kitepower, Provincie Noord-Brabant, Verkeersonderneming, Solarge, TNO, Elaad, Heliox, Elestor, Enexis Group, Liander, ProDrive, IHC, NKL, Brainport Development, Dialogic, Rotterdam, Automotive NL, TNO-Solliance, SWOV, PBL, Metalot3C | Eindhoven University of Technology (Mechanical Engineering) | S&C, SCM |

| Title* | Acronym | Funding organization | Project leader IE&IS | Start year* | Contract value IE&IS* (Euro) | Value total project (EUR) | Non-academic partners involved | Academic partners involved | Research theme |
|---|---|---|---|---|---|---|---|---|---|
| LIGHT, Cognition, Attention, Perception | LIGHTCAP (Marie Sklodowska-Curie Innovative Training Network) | European Commission | De Kort | 2020 | € 760.000,00 | € 4 165 704,72 | Regent Beleuchtungskorper, Velus AS, CSEM Centre Suisse d'Electronique, ETAP NV, OVE ARUP & Partners International, Emmlight B.V., Siemens Healthcare, Lucimed, Balder SPRL, Centre Hospilatier Université de Liege, Lighting Europe AISBL, Philips Lighting BV, Zumtobel Lighting GMBH, Stichting Kempenhaeghe | University of Manchester, University of Sheffield, Université de Liège, Universität Basel, École Polytechnique Fédérale de Lausanne, Technische Universität Berlin | H&T |
| Better Protection Against Terrorism: Identification of Optimal Locations for Protective Resources | | NWO-Veni | Schlicher | 2021 | € 247.027,00 | € 247.027,00 | | | |
| Explain Yourself! The Scope of Understanding and Explanation from Machine Learning Models | | NWO-Veni | Sullivan | 2021 | € 249.988,00 | € 249.988,00 | | | |

| Title* | Acronym | Funding organization | Project leader IE&IS | Start year* | Contract value IE&IS* (Euro) | Value total project (EUR) | Non-academic partners involved | Academic partners involved | Research theme |
|---|---|---|---|---|---|---|---|---|---|
| Transit Oriented Development for Inclusive And Sustainable Rural-urban Regions | TOD-IS-RUR (Marie Sklodowska-Curie Innovative Training Network) | European Commission | Oldenziel | 2021 | € 265.619,88 | € 2.691.514,80 | | Universiteit Antwerpen, École Nationale Des Ponts Et Chaussees, École Polytechnique Federale De Lausanne, Université Gustave Eiffel, Kungliga Tekniska Hoegskolan, Sveriges Lantbruksuniversitet, Technische Universität Berlin | S&C |
| Learning the Future of Complex Decisions: A New Mathematical Approach | | NWO-Veni | Schrotenboer | 2022 | €280.000,00 | €280.000,00 | | | |
| Fostering Social Tipping Dynamics to Accelerate the Energy Transition | ERC FAST | ERC-Consolidator | Alkemade | 2022 | 1.999.995,00 | 1.999.995,00 | | | |

Table P2. Tier 2 projects with threshold 50K

| Title* | Acronym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Research theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mobile Support Systems for Behavior Change | | NWO | 2017 | € 223.201,00 | Y | € 625.000,00 | € 125.000,00 | € 500.000,00 | | | SCM |
| Serious Games Supporting Mental Health Professionals in Skill Development and Empathic Interactions in Online Counselling | | NWO | 2017 | € 264.201,00 | Y | € 538.325,00 | € 60.000,00 | € 478.325,00 | GGzE, Philips | Fontys Applied University for ICT, Tilburg University | |
| Real-time Data-driven Maintenance Logistics | | NWO | 2017 | € 176.407,00 | Y | € 957.221,00 | € 140.000,00 | € 817.221,00 | Philips, Fokker Services, NS | Delft University of Technology | SCM |
| Programmatic Advertising Support System | PASS | NWO | 2017 | € 66.528,00 | N | € 82.751,00 | € 0,00 | € 0,00 | | Technical University of Denmark, L'École Polytechnique à Paris, Technische Universität München, École Polytechnique Fédérale de Lausanne, Technion Israel Institute of Technology | |
| Complexity in High-tech Manufacturing | | NWO | 2017 | € 271.401,00 | N | € 866.090,00 | € 366.090,00 | € 500.000,00 | ASML, VDL, Hilti, CQM, Philips | TU Delft ECSF | |

| Title* | Acronym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Research theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Using Process Tracing to Improve Household IoT Users' Privacy Decisions | PRICE | NWO | 2017 | € 250.000,00 | Y | € 250.000,00 | € 0,00 | € 250.000,00 | | Clemton University, University of California Irvine | |
| The Refugee Crisis in Europe: Modelling Humanitarian Logistics | | NWO | 2017 | € 145.625,00 | Y | €166.125,00 | € 20.500,00 | € 0,00 | https://www.nwo.nl/en/projects/313-99-323 | | |
| Data for Compliance in E-Commerce | DAFOE | NWO | 2017 | € 103.268,00 | N | € 103.268,00 | € 60.000,00 | € 0,00 | Gaston Schul Group Moerdijk, ISTIA Software BV | Erasmus Universiteit Rotterdam | |
| Innovations for Future Skills | InFuS@ | NWO | 2017 | € 50.000,00 | N | € 50.000,00 | € 57.380,00 | € 0,00 | NHTV Breda | | |
| Gamification for Overweight Prevention and Active Lifestyle | GOAL | ZonMW | 2018 | € 249.800,00 | Y (W&I) | € 736.033,00 | € 221.500,00 | € 514.533,00 | Saltro, Harten voor Sport | Utrecht University, University Medical Center Utrecht | VoDDI |
| Transparent Explanations for Predictive Analytics Using Interactive Visualization | TEPAIV | NWO | 2018 | € 230.897,00 | N | € 692.689,00 | € 0,00 | € 692.689,00 | | | |
| Working 'With' or 'Against' the Machine? Optimizing Human-Robot Collaboration in Logistic Warehouses. | | NWO | 2018 | € 161.000,00 | Y | € 172.250,00 | € 47.250,00 | € 125.000,00 | Vanderlande, Ingram Micro CFS, Amway/ABG | | H&T |

| Title* | Acronym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Research theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Light to Fight Addiction | | ZonMW | 2018 | € 99.626,00 | N | € 119.626,00 | € 20.000,00 | € 99.626,00 | Novadic Kentron, Arkin, Philips | Utrecht University | H&T |
| Global Resources and Sustainability of European Modernization, 1820 - 2020 | GREACE | NWO | 2018 | € 74.500,00 | N | € 74.500,00 | € 24.500,00 | € 50.000,00 | CBS, Dutch Ministry of Foreign Affairs, Environmental Humanities Lab, Division of History of Science & Technology and Environment of Royal Institute of Technology Sweden | University of Paris Sorbonne, Aarhus University, Luxembourg University, University of Athens, Europa-Universität Viadrina, National Research University Higher School of Economics St. Petersburg, New University of Lisbon, Arctic University of Norway | |
| Smart Energy Systems in the Amsterdam Area: Electric Vehicle as Gateway to Smart and Sustainable Energy Use | SMARTEST | NWO | 2018 | € 88.757,00 | N | € 83.757,00 | € 0,00 | € 0,00 | https://www.nwo.nl/en/projects/408urs16010 | | |

| Title* | Acronym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Research theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Maritime Remote Control Tower for Service Logistics Innovation | MARCONI | NWO | 2019 | € 477.000,00 | Y | € 1.132.220,00 | € 580.220,00 | € 500.000,00 | Nederlandse Defensie Academie, Boskalis, Thales, RH Marine, Damen, Koninklijke Luchtmacht, Gordian | University of Twente, Maastricht University | SCM, VoDDI |
| DAta-dRiven E-Commerce Order FULfillment | DAREFUL | NWO | 2019 | € 337.591,00 | Y | € 337.591,00 | € 0,00 | € 337.591,00 | ESCF, Flipkart, Cogoport | Indian Institute of Management Ahmedabad | SCM, VoDDI |
| Living Lab Sustainable Supply Chain Management in Healthcare | SSCMH | NWO | 2019 | € 237.038,00 | N | € 2.188.756,90 | € 730.000,00 | € 1.458.756,90 | Carinova, H4 Groep, Fietskoerier Deventer, KennisDC Logistiek | HAN University of Applied Sciences, VU Amsterdam, Radboud University Nijmegen, Radboud University Medical Center, Saxion University of Applied Sciences, Windesheim University of Applied Sciences | SCM |
| Serious and Personalized Game for Self-management of Diabetes | DiaGame | NWO | 2019 | € 232.563,00 | Y (W&I) | € 736.033,00 | € 221.500,00 | € 514.533,00 | HRH Diabetes Games, Maxima Medical Centre | | VoDDI |

| Title* | Acronym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Research theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Predictive Maintenance for Very Effective Asset Management | PrimaVera | NWO | 2020 | € 490.076,00 | N | € 4.999.882,00 | € 600.125,00 | € 4.399.757,00 | NLR, RWS, Damen, Technobis, Alfa Laval Royal NL Navy, RWS, NS, ASML, Royal IHC, Rolsch Asset Management, Waterschap De Dommel, ORTEC Consulting Group | University of Twente, Saxion University of Applied Sciences, The Hague University, Radboud University Nijmegen | SCM |
| Coordination and Complexity: Augmenting Adaptive Team Performance in Crisis Situations With Wearable Technology | | NWO | 2020 | € 326.102,00 | Y | € 583.204,00 | € 141.000,00 | € 583.204,00 | Spaarne Gasthuis, Rijnstate Hospital, Grendel Games | Tilburg University | |
| Strengthening Cyber Resilience by Technological Citizenship | | NWO | 2020 | € 264.176,00 | Y | € 264.176,00 | € 15.000,00 | € 264.176,00 | | Rathenau Instituut, Instituut Clingendael | |

| Title* | Acronym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Research theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sharehouse: A Living Lab for Innovating Warehousing, Logistics Education and Work | SHARE-HOUSE | NWO | 2020 | € 237.000,00 | N | € 3.000.000,00 | € 1.000.000,00 | € 2.000.000,00 | STC, Vanderlande, Prologis, Probotics, Troffee, Dexion, Barsan Global Logistics, Dobbe Transport, Sendus Logistics, Proceedix, 21CC, Van Andel Social and Sustainable Innovation, BMWT, CLV, Logistica, KennisDC Logistiek, Topsector Logistiek, Rotterdam, Nippon Express | TNO, VU Amsterdam, Erasmus University Rotterdam, Windesheim of Applied Sciences, Fontys University of Applied Sciences, Rotterdam University of Applied Sciences | S&C, SCM |
| Towards a Smart and Sustainable Infrastructure | TaSaSi | NWO | 2020 | € 156.500,00 | Y | € 313.000,00 | € 156.500,00 | € 156.500,00 | RWS, Witteveen+Bos, Dura Vermeer, Heijmans, TBI, SLF | Groningen University, Delft University of Technology | SCM, S&C |
| Circular Business Model Maturation in Logistics | | NWO | 2020 | € 116.100,00 | N | € 480.800,01 | € 240.400,00 | € 240.400,00 | ASML, Oost NL, Area Reiniging, Drake & Farrell, Milling Company, Aebi Schmidt, Royal Philips, Stichting Transactieland | Utrecht University of Applied Sciences, NHL Stenden University, Wageningen University & Research | SCM |
| Certification of Production Process Quality Through Artificial Intelligence | CERTIF-AI | NWO | 2020 | € 256.102,00 | Y (W&I) | € 1.366.786,00 | € 519.698,00 | € 847.088,00 | Sioux Lime, Brightcape, Additive Industries, Omron, Damen Shipyards, VTEC Lasers & Sensors | JADS, Tilburg University, Utrecht University of Applied Sciences | SCM, VoDDI |

| Title* | Acronym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Research theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Organising Knowledge and Learning for the Regional Energy Transition | ORAKLE | NWO | 2020 | € 400.000,00 | Y | € 440.000,00 | € 40.000,00 | € 400.000,00 | Enpuls B.V., Province of Noord-Brabant | Tilburg University, Tilburg Law School, Telos, PON | S&C |
| Freight Traffic Management as a Service | FTMAAS | NWO | 2020 | € 301.038,00 | N | € 1.833.560,00 | € 610.000,00 | € 1.223.560,00 | Panteia, Noord-Brabant, Limburg, De Verkeersonderneming, SmartPort, ExxonMobil, Technische Unie, FiLogic, Supply Stack, Technolution, PTV, Simacan, TransFollow, CBS, Rainbow Management, eSCF, SmartWayz.nl, Peter Appel Transport, RWS, SUTC/TLN, iSHAREworks.org | Delft University of Technology, VU Amsterdam, Amsterdam University of Applied Sciences, HZ University of Applied Sciences | SCM |
| EXPerimentaL gOvernance for the Regional Energy transition | EXPLORE | NWO | 2020 | € 116.000,00 | N | € 450.450,00 | € 50.450,00 | € 400.000,00 | Provincies Groningen, Noord-Brabant, Overijssel, Zeeland, Zuid-Holland, NP RES | Radboud University, Tilburg University | S&C |
| SYNERGIA | SYNERGIA | NWO | 2020 | € 100.000,00 | N | € 7.406.399,00 | € 2.222.220,00 | € 5.184.179,00 | | Wageningen University & Research, Delft University of Technology, University of Twente, Radboud University | S&C |

| Title* | Acronym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Research theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hoe Kunnen ZZPers en MKBers Gezond en Financieel Weerbaar Blijven Tijdens en Na de COVID-19 crisis? | | ZonMw | 2020 | € 200.000,00 | Y | € 277.626,00 | € 64.625,00 | € 200.000,00 | Kenniscentrum, UWV, ZZP desk | | |
| BioClock | BioClock | NWO | 2021 | € 410.522,00 | N | € 10.129.274,00 | € 251.200,00 | € 10.129.274,00 | ARTIS, Chrono Eyewear BV, Chrono@Work, Edelris, Gemeente Amsterdam, Gemeente Apeldoorn, Gemeente Den Haag, Gemeente Rotterdam, Gemeente Texel, Gemeente Utrecht, GGZ Eindhoven, Good Light Group, Hersenstichting, Janssen Pharmaceutica, Leyden Academy in Vitality and Aging, Methylomics, NEMO, OCellO, Peira, Technolab, Witte Raaf, MediluX, Gemeente Leiden, Center for Human Drug Research, Jeroen Bosch Ziekenhuis, KWF, Hersenstichting | | |
| Lower-Tier Supplier Sustainability Improvement Framework | | NWO | 2021 | € 92.678,00 | N | € 48.600,00 | € 0,00 | € 0,00 | https://www.nwo.nl/en/projects/43920614 | | |

| Title* | Acronym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Research theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Collaborative Human&Robot Coaching Framework for Behavior Change | HUGO | ZonMW | 2021 | € 74.595,00 | N | € 74.595,00 | € 0,00 | € 0,00 | | | |
| Designing Mixed Cropping Systems and Transition Paths Towards Sustainable Ecology Based Agriculture | Cropmix | NWA-ORC | 2022 | € 809.984,00 | N | € 11.349.996,00 | € 1.351.972,00 | € 9.998.024,00 | Triodos Bank and Foundation, Agrifirm, Artemis, Plantum, Vitalis, Bejo Zaden, Farm Frites, BASF | Wageningen University & Research, HAS University of Applied Sciences, VU Amsterdam | S&C, SCM, VoDDI |
| Qolead | Qolead | NWO | 2022 | € 988.977,00 | Y | € 3.088.235,00 | € 472.652,00 | € 2.625.000,00 | Fontys, UT/Tranzo, Rotterdam HS, Vilans, JAIN-TIGNL, Avoord, Zonnehuisgroep Amstelland, Alzheimer Nederland | Maastricht University, Radboud University, Delft University of Technology, Tilburg University, Utrecht University, UMC Groningen, Amsterdam AMC, Rotterdam University | H&T |
| Fieldlabs@ scale | Fieldlabs@ scale | NWO | 2023 | € 338.619,00 | N | € 1.770.753,00 | € 0,00 | € 1.470.753,00 | | VU Amsterdam, University of Twente, Tilburg University | VoDDI |

| Title* | Acronym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Research theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fieldlab Quantum Cryptography Solutions for Safe Society | FIQCS | NWO | 2023 | € 462.000,00 | N | € 1.362.933,00 | € 438.580,00 | € 924.353,00 | TNO, CEN-CENELEC, PhotonDelta, Quantum Delta NL | | S&C, VoDDI |
| Connected Sustainability Histories and Futures of the Global Soyacene | Soy Stories | NWO | 2023 | € 749.985,00 | N | € 749.985,00 | € 0,00 | € 0,00 | | Universidade Federal da Fronteira Sul, VU Amsterdam | S&C |
| Sustainability Trade-offs in the Netherlands' Entangled Modernisation | STONEM | NWO | 2023 | € 749.679,00 | N | € 749.679,00 | € 0,00 | € 0,00 | CBS | Utrecht University, Wageningen University & Research | S&C |

Table P3. Tier 3 projects with threshold 50K

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Erasmus+, Sport - FITWORK | | | 2017 | € 53.235,00 | N | € 53.235,00 | € 0,00 | € 0,00 | | Instituto de Biomecánica de Valencia, Universitat Politècnica de València | |
| Student Ondernemer-schap Euregio VentureLab | SEE-V-Lab | Interreg | 2017 | € 294.288,38 | Y | € 1.597.721,00 | € 0,00 | € 928.994,00 | | Hasselt University, RWTH Aachen, Maastricht University, Université de Liège | |
| Smart Tracking Data Network for Shipment by Inland Waterway | ST4W | Interreg | 2017 | € 164.235,19 | N | € 3.800.000,00 | € 0,00 | € 2.280.000,00 | Waterway Project Foundation, Multitel, CRITT, Logistics in Wallonia, Telematic Bureau for Waterway, Institute for Internationa Transport Law, Autonomous Port of Centre an West, Port of Brussels, Blue Line Logistics, Inlecom Systems | University of Duisburg-Essen | SCM |
| Community-based Virtual Power Plant (cVPP): A Novel Model of Radical Decarbon-isation Based on Empowerment of Low-carbon Community Driven Energy Initiatives | cVPP | Interreg | 2017 | € 548.250,00 | Y | € 6.110.000,00 | € 0,00 | € 3.660.000,00 | Tipperary Energy Agency, Stichting Duurzame Projecten Loenen, EnerGent, National Energy Foundation, Gemeente Apeldoorn, Kamp C, Community Renewable Energy Supply, Tipperary County Council | | |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Data Analytics for Trade Lane Risk Assessments and Control | DARA | TKI Dinalog | 2017 | € 69.502,00 | N | € 279.603,48 | € 139.802,00 | € 139.802,00 | Validaide, Panalpina | | |
| Increasing the Usability, Adoption, and Acceptance of Advanced Planning and Scheduling Systems | | TKI Dinalog | 2017 | € 242.637,00 | Y | € 599.274,00 | € 356.637,00 | € 242.637,00 | IMI, Synple | University of Groningen | |
| Real-Time Data for Products to Move | Data2-Move | European Supply Chain Forum | 2017 | € 510.158,00 | Y | € 744.721,00 | € 220.000,00 | € 510.158,00 | Container Centrale B.V., CTAC, Den Hartogh Logistics, European Supply Chain Forum, H&S Group, Jumbo Supermarkten, MM guide, ORTEC, SCA, Wuunder Nederland | Tilburg University, VU Amsterdam | SCM |
| Managing Knowledge Flows | | ASML | 2017 | € 855.181,00 | N | € 855.181,00 | € 0,00 | € 0,00 | | | |
| BRIDGES | BRIDGES | EU H2020 | 2017 | € 447.141,00 | N | € 3.888.889,00 | € 0,00 | € 3.888.889,00 | Care Nederland | | |
| Accelerating C-ITS Mobility Innovation and depLoyment in Europe | C-MobILE | EU H2020 | 2017 | € 317.909,00 | N | € 12.575.000,05 | € 0,00 | € 0,00 | https://c-mobile-project.eu/partnership-section/ | | |
| Improving the Use of Decision Support Systems | | TKI/PPS | 2017 | € 147.637,00 | Y | € 242.637,00 | € 128.637,00 | € 0,00 | | University of Groningen | |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PhD Supervision Jelle Adan | | Nexperia B.V. | 2017 | € 80.000,00 | N | € 80.000,00 | € 0,00 | € 0,00 | Nexperia B.V. | | |
| MaSelMA Bridge | | TKI Dinalog | 2017 | € 60.000,00 | N | € 60.000,00 | € 0,00 | € 0,00 | Gordian Logistics Experts | | |
| Innovation Bootcamp | | InnoEnergy | 2017 | € 67.200,00 | N | € 40.000,00 | € 0,00 | € 0,00 | InnoEnergy | | |
| Scaling up Co-creation: Avenues and Limits for Integrating Society in Science and Innovation | SCALINGS | European Commission | 2018 | € 775.515,00 | N | € 3.999.871,25 | € 0,00 | € 3.999.871,25 | ARMINES, ESADE, Social Innovation Exchange | Technische Universität München, Denmarks Tekniske Universitet, École Polytechnique Fédérale De Lausanne, Universität Für Bodenkultur Wien, UE We Wroclawiu, University College London | H&T, S&C |
| Multi Utilities Smart Energy GRIDS | MUSE GRIDS | European Commission | 2018 | € 352.040,00 | N | € 7.430.785,00 | € 1.553.207,74 | € 5.877.577,26 | RINA Consulting, CARTIF, Astea, Th!nk E, Siemens Gamesa, Energética S.Coop., EngieLab, Galu Limited, Duferco Energia, European Assocation for Storage of Energy, Glen Dimplex, Eptisa, Municipality of Eilat, ABB, Scame | Aalborg University, Universita Politecnica delle Marche | S&C |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| evRoaming for Electric Mobility in Europe | ev-Roaming-4EU | ERA-NET | 2018 | € 165.000,00 | N | € 1.960.000,00 | € 816.500,00 | € 1.143.500,00 | Netherlands Knowledge Platform for Public Charging Infrastructure, Metropole Region of Amsterdam - Electric, Smartlab, Stromnetz Hamburg, ENIO, E.ON Danmark, Copenhagen Electric | | |
| Operate European Digital Industry with Products and Services | OEDIPUS | EIT Digital | 2018 | € 89.678,00 | N | € 3.707.163,00 | € 1.880.938,00 | € 1.826.225,00 | Siemens, DFKI, Engineering, FIAT, CEA, Océ, Atos, CERFIEL, Digital Catapult, Kone, Innovalia Association | Aalto University | |
| Supplier Sustainability Improvement | | TKI Dinalog | 2018 | € 296.867,00 | Y | € 596.566,00 | € 355.283,00 | € 298.283,00 | Philips Electronics NL BV, Fairphone, ELEVATE, Campinia | | |
| Cash Flow Harmonization: Gearing Supply Chain Finance Towards Cash Flow Stability | | TKI Dinalog | 2018 | € 199.476,00 | Y | € 398.952,00 | € 199.476,00 | € 199.476,00 | Accenture B.V., Rabobank | | |
| Improved Traceability of Parts and Products | IToPP | TKI Dinalog | 2018 | € 167.776,00 | Y | € 484.132,35 | € 267.066,18 | € 217.066,18 | Fokker, IBM, SLF, Louwman Logistics, Ricoh | | SCM |
| Province Adan | | Provincie Noord-Brabant | 2018 | € 144.585,00 | N | € 2.355.812,23 | € 1.405.795,23 | € 950.017,00 | Enpuls, MRE | Radboud University | SCM |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Smart Sustainable Public Spaces Across the NWE Region | SMART-SPACE | Interreg | 2018 | € 205.586,00 | N | € 6.879.620,08 | € 2.751.848,04 | € 4.127.772,04 | Stad Oostende, Ziut B.V., Stad Sint-Niklaas, Stad Middelburg, Comhairle Contae Thiobraid Arann, Intemo Special Products B.V., Lightning Urban Community International | KU Leuven, Université de Picardie Jules Verde | |
| Programmatic Advertising Decision System | PADS | EuroStars | 2018 | € 130.000,00 | N | € 922.815,42 | € 0,00 | € 922.815,42 | Triodor, Orangegames | | VoDDI |
| Semantic world modelling in a semi-open world: A new Frontier in Autonomous Systems Technology | FAST | TKI-HTSM | 2018 | € 307.500,00 | Y | € 1.600.000,00 | € 0,00 | € 1.600.000,00 | | | H&T |
| DYNamisch Licht en Binnenklimaat voor Kantoren | DYNKA | TKI Urban Energy | 2018 | € 274.000,00 | N | € 1.470.352,00 | € 470.594,00 | € 999.758,00 | Huygen Installatie Adviseurs, Philips Lighting, Kropman Services, Almende BV, Stichting Isso | Maastricht University, Zuyd University of Applied Sciences | S&C, H&T |
| Digital Lifecycle Twins for Predictive Maintenance | DayTiMe | ITEA | 2018 | € 248.731,00 | N | € 9.836.406,00 | € 5.861.933,00 | € 3.974.473,00 | Fraunhofer Institute for Production Systems and Design Technology, Phillips, and >25 more | | SCM |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Smart City Shopping - Fully Automated Order Fulfillment, From the Producer to the End Customer | Auto-matMat | Eurostars | 2018 | € 153.362,00 | Y | € 306.724,00 | € 153.362,00 | € 153.362,00 | AutomatMat AS, Boxid | University of Stavanger, Reykjavik University | SCM |
| Advanced Manufacturing Logistics | AML | Provincie Noord-Brabant | 2018 | € 250.448,00 | N | € 250.448,00 | € 0,00 | € 0,00 | KMWE Precision, Romias Robotics, Yaskawa Benelux, DMG Mori, FPC Beyond Packaging | | |
| PhD Supervision Koen Herps | | Nexperia B.V. | 2018 | € 80.000,00 | N | € 80.000,00 | € 0,00 | € 0,00 | Nexperia B.V. | | |
| PhD Supervision Patrick Deenen | | Nexperia B.V. | 2018 | € 80.000,00 | N | € 80.000,00 | € 0,00 | € 0,00 | Nexperia B.V. | | |
| AI Planner of the Future | AIPF | ESCF | 2019 | € 1.100.000,00 | N | € 1.100.000,00 | € 0,00 | € 0,00 | Logistics Community Brabant | EAISI | |
| Slimmer Logistiek E-fulfilment Management | SLEM | OPZuid | 2019 | € 69.975,00 | N | € 2.153.826,00 | € 1.292.295,60 | € 861.530,40 | N.V. Limburgs Instituut voor Ontwikkeling en Financiering (LIOF), BlackBox Robotics, Optec Mechatronics, Concept Robotics, Schneider Electric Logistic Centre, Pharox, Gerlach & co internationale Expediteurs B.V., Verhoex Douane Advies, Gaston Schul, 3D Visual Logistics, Broekman Logistics, Herbalife Nutrition | Fontys Venlo University of Applied Sciences (Logistiek & Techniek), Maastricht University | SCM |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Future Logistics: Een Proeftuin Voor High-tech Service Logistiek | Future Logistics | OPZuid | 2019 | € 120.250,00 | N | € 2.388.060,00 | € 1.203.710,00 | € 1.184.350,00 | DSV Solutions Nederland BV, Smart Robotics, Ephi, Chainstock, F3-Design | AVANS | SCM |
| Pilot for Essentiality Checks of Standard Essential Patents | JRC tender | EC (tender) | 2019 | € 93.032,00 | N | € 217.308,00 | € 0,00 | € 0,00 | Dialogic, AOMB, Taylor Wessing | Technische Universität München | |
| Induced Pluripotent Stem Cell-based Therapy for Spinal Regeneration | iPSpine | European Commission | 2019 | € 494.488,00 | N | € 14.959.781,25 | € 2.094.506,25 | € 436.250,00 | Ntrans Technologies, SpineServ GmbH & Co KG., PharmaLex, Catalyze, Stichting Nationaal Reumafonds | Utrecht University, University of Nantes, University Medical Center Utrecht, University of Ireland Galway, Universität Ulm, Universität Bern, and 10 more | VoDDI |
| FEderated Network of Information eXchange in Logistics | FENIX | European Commission | 2019 | € 255.235,00 | N | € 30.306.733,00 | € 0,00 | € 30.306.733,00 | ERTICO - ITS Europe, TX Logistik, Interporto Bologna, Jan de Rijk Logistics, ESC, PTV AG, Interregional Alliance for the Rhine-Alpine Corridor EGTC, T-Systems | | SCM |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Digitale Fabriek van de Toekomst | Digitale Fabriek van de Toekomst | Provincie Noord-Brabant | 2019 | € 227.024,00 | N | € 3.482.732,00 | € 1.985.439,00 | € 1.497.293,00 | Brainport Industries, Additive Industries B.V., De Cromvoirtse B.V., DMG-Mori Netherlands b.v., Engie, Fujitsu Glovia B.V., IJssel Technologie, Itility B.V., K.M.W.E. Precisie Eindhoven B.V., Neways Electronics International N.V., Omron, PDM Group | Fontys University of Applied Sciences, TNO | SCM |
| DMCoach: App Suite for Personalized Coaching and Lifestyle Awareness Increasing in T2DM Prevention | DMCoach | EIT Digital | 2019 | € 231.902,00 | N | € 6.278.766,00 | € 5.573.944,00 | € 704.822,00 | IMEC, FBK, Engineering | | VoDDI |
| Lane Analysis & Route Advisor | LARA | TKI Dinalog | 2019 | € 101.870,00 | N | € 599.834,00 | € 299.917,00 | € 299.917,00 | Validaide, Panalpina, GEFCO | CWI, VU Amsterdam | SCM |
| Future planning | | TKI Dinalog | 2019 | € 137.130,00 | Y | € 596.260,00 | € 298.130,00 | € 298.130,00 | ChainStock, Groenewout, Hilt, Kramp Groep | | SCM |
| Improving Management Practices, Work Engagement and Workplace Innovation for Productivity and Wellbeing | | UK Research and Innovation | 2019 | € 111.839,00 | N | € 985.523,06 | € 0,00 | € 0,00 | | Erasmus University Rotterdam, University of Strathclyde | |
| Insights on The "Real Impact" of Science | IotRIos | EuroTech Marie Curie COFUND | 2019 | € 67.680,00 | N | 67.680,00 | € 0,00 | € 0,00 | EuroTech | | |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Atlas OPZuid | | OPZuid | 2019 | € 68.996,00 | N | 68.996,00 | € 0,00 | € 0,00 | Uitgekiend BV, Stichting Slimbouwen | | |
| Circular Plastics Network for Training | C-Planet | European Commission | 2020 | € 250.000,00 | N | € 3.937.681,08 | € 0,00 | € 0,00 | Pack4Food npo, AVGI, Kruschitz GmbH, Saubermacher Dienstleistungs AG, The Imagination Factory, NETZSCH-Gerätebau GmbH, Dow Benelux BV, Vanheede Environment Group, INEOS Styrolution, Aage Vestergaard Larsen, Coloplast, Novo Nordisk A/S, City of Ghent, Organic Waste Systems, Plastics Europe, Tomra Sorting GmbH, Ellen McArthur Foundation, Adidas | Ghent University, Montan-universität Leoben, Technical University of Denmark, Friedrich-Alexander-University Erlangen-Nürnberg, KU Leuven, Aristotle University of Thessaloniki, Technische Universität Berlin, Chemical Process and Energy Resources Institute, Fraunhofer Gesellschaft e.V | S&C, SCM |
| COME RES | COME RES | European Commission | 2020 | € 209.901,00 | N | € 2.998.847,50 | € 0,00 | € 0,00 | Becker Büttner Heldt, Ecoazioni | Hasselt University, RWTH Aachen University, Maastricht University, Université de Liège | S&C, H&T |
| METHOUGHT | ME-THOUGHT | Lely | 2020 | € 225.000,00 | Y | € 225.000,00 | € 225.000,00 | € 0,00 | Lely | | SCM |
| Smart Grid Greenparc | SmaGG | RVO | 2020 | € 109.070,00 | N | € 333.422,00 | € 0,00 | € 333.422,00 | Stedin, Jules Energy Projects, BlueTerra Energy Experts, Greenparc Energy | | S&C |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GUARDIAN | GUARDIAN | AAL Association | 2020 | € 73.000,00 | N | € 919.969,00 | € 302.368,00 | € 617.601,00 | Vilans, ConnectedCare, smartrobot. solutions, JEF, INRCA, Zorggroep Noordwest-Veluwe | University of Geneva, Hospital University of Geneva, Università Politecnica delle Marche | H&T |
| Smart Parcel Delivery with On-Demand Time Windows | Smart Parcel | European Commission | 2020 | € 67.680,00 | N | € 150.000,00 | € 0,00 | € 150.000,00 | | Technische Universität München, TU/e | SCM |
| Pork Quality and Safety Assessment Tools | PorQSAT | TKI Agri&Food | 2020 | € 55.000,00 | N | € 3.080.000,00 | € 1.540.000,00 | € 1.540.000,00 | Vion Food Group, ZLTO, Porphyria, Van Esseveldt & Loomans Transport, HJ Meijer en Zonen Harfsen | WUR, HAS | S&C, SCM |
| Disruption Analysis of the Supply Chain due to Corona Virus in the Manufacturing Industry | DAS-COMVIMI | TKI Dinalog | 2020 | € 50.000,00 | N | € 227.025,00 | € 17.160,00 | € 50.000,00 | ASML, DSV Solutions, Ewals Cargo Care B.V., ChainStock B.V., Neways | | |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Smart Human Oriented Platform for Connected Factories | SHOP4CF | European Commission | 2020 | € 581.875,00 | N | € 15.008.469,00 | € 0,00 | € 15.008.469,00 | European Dynamics Luxembourg SA, Fundingbox Research APS, Robert Bosch, Volkswagen, Arcelik A.S., Siemens, Internetsia | Technische Universität München, UM, Teknologian tutkimuskeskus VTT Oy, Fraunhofer Teknologisk Institut, Interuniversitair Micor-electronica Centrum, FZI Forschungs-zentrum Informatik, Uniwersytet Opolski, Technocampus EMC2 ZI Du Chaffault C, Instytut Chemi Bioorganicznej Polskiej Akademii Nauk, Fundacion Tecnalia Researech & Innovation, Universidad Politecnica de Madrid, Tampereen Korkea-koulusaatio SR | SCM, VoDDI |
| Intelligent Lighting | IntelLight | TKI/PPS | 2020 | € 507.666,00 | N | € 1.148.000,00 | € 1.148.000,00 | € 0,00 | Signify | | |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Advanced Augmented Reality Solutions for AI-based Servitization | AdvAR4-AIServ | TKI/PPS | 2020 | € 360.000,00 | N | € 800.000,00 | € 442.500,00 | € 0,00 | ASML | | |
| Wendbaarheid en Weerbaarheid in de Nederlandse Opsporings-ketens | Wend- en Weer-baarheid | Vrij project/ subsidie-gever is Ministerie van Justitie en Veiligheid | 2020 | € 293.329,00 | N | € 586.658,20 | € 0,00 | € 0,00 | Ministerie van Justitie en Veiligheid | Vrije Universiteit Amsterdam | |
| Pervasive Standards and Their Impact on the Standardization Ecosystem and Society | Pervasive standards | Vrij project/ subsidie-gever is NEN | 2020 | € 160.000,00 | | € 160.000,00 | € 0,00 | € 0,00 | NEN | | |
| Collaborative Capital EE HPM | | Eindhoven Engine B.V. | 2020 | € 65.000,00 | N | € 65.000,00 | € 0,00 | € 0,00 | Eindhoven Engine B.V. | | |
| Open Innovation Mindset for Knowledge Sharing and Sourcing Using Digital Platforms | | EuroTech Marie Curie COFUND | 2020 | € 65.760,00 | N | € 81.760,00 | € 0,00 | € 0,00 | | Technical University of Denmark, L'École Polytechnique à Paris, Technical University of Munich, École Polytechnique Fédérale de Lausanne, Technion Israel Institute of Technology | |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EuroTech Postdoc AI in Sustainable Mobility Through MaaS | | EuroTech Marie Curie COFUND | 2020 | € 65.760,00 | N | € 65.760,00,00 | € 0,00 | € 0,00 | | Technical University of Denmark, L'École Polytechnique à Paris, Technical University of Munich, École Polytechnique Fédérale de Lausanne, Technion Israel Institute of Technology | |
| Intelligente Flexibiliteit door Geïntegreerde Hybride Opslag-technologieën | FLEXINet | RVO EZ Kader-regeling | 2021 | € 426.598,00 | N | €5.711.574,00 | € 0,00 | € 0,00 | Power Research Electronics b.v. Emmett Green b.v. Dr Ten b.v., Flemisch Institute for Technological Research NV (VITO), Recoy b.v. LeydenJar Technologies b.v. Summer heat b.v. Heliox, Coöperatieve Hilversumse Energie Transitie (HET) | TU Delft | |
| DynaPlex Minimizing Disruptions in Dutch Logistics | DynaPlex | TKI Dinalog | 2021 | € 415.000,00 | Y | € 2.267.232,00 | € 1.177.000,00 | € 0,00 | ASML, Vanderlande, CQM, Den Hartogh, EWALS, Nexperia, CTT, Bolk, Ahold Delhaize, Pharox, Emons | European Supply Chain Forum, University of Twente | |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AI Powered Digital twin for Lighting Infrastructure in the Context of Front-end Industry 4.0 | AI-TWILIGHT | European Commission | 2021 | € 352.589,00 | N | € 10.205.578,00 | € 0,00 | € 10.205.578,00 | Signify, Budapesti Muszaki , Bme Viking Electrica, Lightinglab Calibratio, Lumileds Netherland , Hungaro Lux Light, Ingelux, PI Lighting SARL, GL Optic Polska SP.Z.P.P.S.K., Ecce'lectro, Tridonic GMBH&Co, MCL, MEDS, Arcom, JCMWave, Infineon Technologies Italia SRL, BMW Group, Hella GMBH&Co, Simscale GMBH, Citeos Lyon, Unipd, Fakt Hungária kft, | Delft University of Technology, Technische Universität Darmstadt | |
| Green Transport Delta - Elektrificatie | GDT | RVO | 2021 | € 319.234,00 | N | € 22.450.032,00 | € 0,00 | € 0,00 | https://brainporteindhoven.com/nl/ondernemen-en-innoveren/markten/mobility/programmabureau-smart-green-mobility/green-transport-delta-elektrificatie | | |
| Alzheimer | | Alzheimer NL | 2021 | € 301.250,00 | N | € 301.250,00 | € 0,00 | € 0,00 | Alzheimer NL | | |
| Gamified mHealth for (Post-)Pandemic Mental Healthcare Support | | GGZ Centraal | 2021 | € 300.000,00 | N | € 300.000,00 | € 0,00 | € 0,00 | GGZ Centraal | | |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BoostEuroTeq: Strengthening Institutional Transformations for Responsible Engineering Education in Europe | Boost-EuroTeQ | European Commission | 2021 | € 278.615,00 | N | € 1.999.999,97 | € 0,00 | € 1.999.999,97 | https://cordis.europa.eu/project/id/101035802 | | |
| Evidence Based Disruption Management | Disruption | TKI Dinalog | 2021 | € 151.752,00 | Y | € 1.123.899,00 | € 562.969,00 | € 0,00 | Chainstock, Hilti, Neways | | |
| Evidence Based Disruption Management | Disruption | TKI Dinalog | 2021 | € 148.248,00 | Y | € 1.123.899,00 | € 0,00 | € 0,00 | Chainstock, Hilti, Neways | | |
| Metrology for Temporal Light Modulation | MetTLM | EMPIR (EU) | 2021 | € 132.543,00 | N | € 1.228.461,20 | € 0,00 | € 1.228.461,20 | https://www.mettlm.eu/project.html | | |
| Just Climate Transitions | | Porticus | 2021 | € 100.000,00 | N | € 100.000,00 | € 0,00 | € 0,00 | | | |
| Measuring Societal Impact of Standards | MSIoS | NEN/XXM | 2021 | € 100.000,00 | N | € 100.000,00 | € 0,00 | € 0,00 | | | |
| A European Positive Sum Approach Towards AI Tools in Support of Law Enforcement and Safeguarding Privacy and Fundamental Rights | popAI | European Commission | 2021 | € 87.700,00 | N | € 87.700,00 | € 0,00 | € 0,00 | https://cordis.europa.eu/project/id/101022001 | | |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Virtual Health and Wellbeing Living Lab Infrastructure | VITALISE | European Commission | 2021 | € 78.750,00 | N | € 78.750,00 | € 0,00 | € 0,00 | https://cordis.europa.eu/project/id/101007990 European Network of Living Labs, LiCalab, INTRAS Foundation | Aristotle University of Thessaloniki, Laurea University of Applied Sciences | |
| Consumer-driven Demands to Reframe Farming Systems | Code Refarm | European Commission | 2021 | € 401.093,00 | N | € 1.242.343,00 | € 0,00 | € 0,00 | NOLDUS, Dutch Poultry Centre, CyRIC | Vienna University of Technology, École Polytechnique Fédérale de Lausanne | VoDDI |
| LLEAD | LLEAD | RVO | 2021 | € 57.684,00 | N | € 608.840,00 | € 308.920,00 | € 299.920,00 | TNO, Sovaassi, De Zakencoach, JLN, Chain Logistics | Windesheim University of Applied Sciences | |
| Generalizable and Under-standable Self-Learning Approaches for Dynamic, Large-Scale Resource Management Optimization Problems | GULAD | GoodYear & Fonds National de la Recherche Luxem-bourg | 2021 | € 263.660,00 | N | € 263.660,00 | € 0,00 | € 0,00 | GoodYear, Fonds National de la Recherche Luxembourg | | |
| Laudes Foundation | Laudes Foundation | EIRES CRT | 2022 | € 99.999,00 | N | € 250.000,00 | € 0,00 | € 0,00 | | | |
| Semi Autonome Energie Systemen van MMIP13 | Holon | RVO Tender | 2022 | € 81.760,00 | N | € 2.479.000,00 | € 0,00 | € 0,00 | ZenMo, TNO , Witteveen + Bos , Quintel, Antea Group , DNV, Drift for Transition | Hanze University of Applied Sciences | |
| Reshaping Supply Chains for Positive Social Impact | Reschape | European Commission | 2022 | € 218.000,00 | N | € 2.616.646,00 | € 0,00 | € 2.616.646,00 | CNR, INESC TEC, Fraunhofer, Zaragoza Logistics Center, RWI - Leibniz-Institut, IRIS | Aston University, Universidad De La Iglesia De Deusto Entidad Religiosa | VoDDI |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fluently: The Essence of Human-robot Interaction | Fluently | European Commission | 2022 | € 533.000,00 | N | € 18.795.214,00 | € 0,00 | € 9.696.409,00 | IRIS, Irida Labs, Gleechi, Odense Robotics, PSC, Prima Industrie, Malta Electromobility Manufacturing, Safran Aircraft, SUPSI, DFKI | Politecnico Di Torino, University of Bath, Syddansk Uni, Waseda University | H&T |
| Enable Everyone's Engagement in the Energy Transition | Every1 | European Commission | 2022 | € 287.998,00 | N | € 4.001.877,00 | € 0,00 | € 4.001.877,00 | Flux50, Eworx Ypiresies Ilektronikou, Th!nk E, Joanneum, MBH, Steinbeis 2i, INESC, RdA Climate Solutions, International Cleantech Network, Institute of Communication and Computer Systems | The Open University UK | S&C |
| One Health Approaches to Support Agroecological Transformation of Peri-urban Farming | Urbane | European Commission | 2022 | € 507.722,00 | N | € 6.689.335,00 | € 0,00 | € 5.999.960,00 | CyRIC, CNR, Senseen, Waziup EV, Ver de Terre Production, Agroecology Europe, Institut Agronomique et Veterinaire Hassan II, Zoological Society of London, Institute of Zoology, Biosense Institute, Carbone Fertile Centre National d'Agroécologie | Universities of Nigeria, Ghana, Senegal, Morocco, Benin, Burkina Faso, Switzerland, University of Cambridge, University of Ibadan, University of Liège, University of Abomey-Calavi, Uni Aube Nouvelle, Université Gaston Berger de Saint Louis | S&C, VoDDI |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Research Training to Design and Implement Tools Supporting Safe Teamwork in Healthcare | Tools4-teams | European Commission | 2022 | € 274.370,00 | N | € 2.569.211,00 | € 0,00 | € 2.569.211,00 | Region Hovedstaden, ORamaVR, Medability, Valide, Nederlands Instituut voor Onderzoek van de Gezondheidszorg, Aerogen, Reinier Haga, FHS NWSchweiz, Caresharing B.V. | VUMC, Uni Bonn, Uni Ireland Galway, Uni Stavanger, Uni Bern, VU, Tilburg University, Uni Kobenhavn, TU Delft, ETH Zurich, LMU München | S&C, H&T |
| Robust and Light AM Components for Military Systems | Roliac | European Commission | 2022 | € 496.899,10 | N | € 3.969.334,91 | € 0,00 | € 496.899,10 | Teknologisk Institut, Fraunhofer, Lortek, Aerotecnic Metallic, AMSIS, LAAM Lisi Aerospace, OHB Hellas, GPM Granges | | SCM |
| Resilient Manufacturing lines based on smart handling systems | SMART-HANDLE | European Commission | 2023 | € 352.528,75 | N | € 5.995.176,25 | € 0,00 | € 5.995.176,25 | AIMEN, TF-CC, KUKA, Roboception, Netcompany-Intrasoft, Demcon, STT Products, ALOUMYL, Menicon, ABEE | University of Patras, Universitat Politècnica de Catalunya | H&T |
| Artificial Intelligence in Manufacturing for Sustainable Applications at SMEs | ARISE | European Commission | 2023 | € 281.250,00 | N | € 7.738.778,00 | € 0,00 | € 7.738.778,00 | LMS, Fraunhofer, EWF, AIMEN, Tecnalia, CEA, Lortek, SINTEF, DFKI, CVI Praze, Viesoji Istaiga Intechcentras, Kliynteh Bulgaria, Pannon Gazdasagi Halozat Egyesulet | | VoDDI |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COOrdinating and Piloting Actions Towards ERA-hubs as InTer- and Intra-regional Ecosystems for Knowledge | COOP-ERATE | European Commission | 2023 | € 348.781,00 | Y | € 1.499.887,00 | € 0,00 | € 1.499.887,00 | STAM, Brainport Development, Ceske Vysoke Uceni Technicke V Praze, Idea Consulting, Science City Lyngby | Danmarks Tekniske Universitet | VoDDI |
| High-tech & Data-driven Agri-Food System of the Future | 4TU HTSF | 4TU Alliance | 2023 | € 1.148.000,00 | N | € 6.035.000,00 | € 0,00 | € 4.955.000,00 | Bakker Barendrecht, Glastuinbouw Nederland, Ridder Growing Solutions, Interpolis Agro, Achmea, Rabobank, Amsterdam - Digitale Stad | Wageningen University & Research, Delft University of Technology, Twente University | S&C, VoDDI |
| LINear to CIrcular Transition | LINCIT | TKI Dinalog | 2023 | € 1.507.493,00 | Y | € 3.003.988,00 | € 1.269.349,00 | € 0,00 | ASML, REWIN, Philips DAP, SBD, Circular Plastics Hub, PostNL, Circular Green, MCE, LINK, Hapert, BOM, SLF, Van der Wal, Van Happen, Suspacc, Dopple, Pottle, LCB, Vanderlande, Lightyear, Green Digital, Ewals, ESCF, DOW, Den Hartogh, DB Schenker | NHL Stenden University of Applied Sciences, Utrecht University of Applied Sciences, Wageningen University & Research | SCM |
| Decentralized Distribution: Disrupting Change in the Logistics Sector | Zero Oper. Logist. | TKI Dinalog | 2023 | € 599.204,00 | Y | € 1.499.204,00 | € 450.000,00 | € 0,00 | Smart Robotics, DSV, Atlas4 | | SCM |

| Title* | Acro-nym | Funding organ-ization | Start year* | Contract value IE&IS* (EUR) | TU/e is coord-inating? Y/N | Value total project (EUR) | Value share industry (EUR) inkind + cash | Value share NWO/EU/ funding body (EUR) | Non-academic partners involved | Academic partners involved | Re-search theme |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Empowering Healthy Lifestyle Behaviour Through Personalised Intervention Portfolios to Prevent and Control Obesity During Vulnerable Stages of Life | Healthyw8 | European Commission | 2023 | € 312.474,00 | N | € 10.000.000,00 | € 0,00 | € 10.000.000,00 | Nium Sarl, Virtech OOD, Spora Sinergies Sccl, Medea Srl, Kneia SL | Luxembourg Institute of Health, LIST, DFKI, Leibniz Institute for Prevention Research and Epidemiology, Center for Agro-food Economics and Development, University of Gastronomic Sciences, CNR, Agrifood Research and Technology Centre of Aragon, University of Évora, Foundation Balearic Islands Health Research Institute, Bologna University Hospital, DTU, University of Twente, UCoimbra, Association Euro Atlantic Diplomacy Society, European Nutrition for Health Alliance, European Federation of the Associations of Dietitians | VoDDI |

## APPENDIX Q – SELECTION OF USED ABBREVIATIONS

| | |
|---|---|
| AI | Artificial Intelligence |
| AIS | Article Influence Score |
| Beta | Beta Research School for Operations Management and Logistics |
| BPM | Business Process Management |
| CH&T | Center for Humans and Technology |
| cVPP | Community-based Virtual Power Plants |
| DORA | San Francisco Declaration on Research Assessement |
| EC | European Commission |
| ECDT | Expertise Center Dementia & Technology |
| ECR | Efficient Consumer Response |
| EAWOP | European Association of Work and Organizational Psychology |
| EAISI | Eindhoven Artificial Intelligence Systems Institute |
| EHCI | Eindhoven Hendrick Casimir Institute |
| EIRES | Eindhoven Institute for Renewable Energy Storage |
| EIT | European Institute of Innovation and Technology |
| EngD | Engineering Doctorate |
| ERC | European Research Council |
| ESCF | European Supply Chain Forum |
| ESCI | Emerging Sources Citation Index |
| ETP | European Technology Platform |
| EuroTech | EuroTech Universities Alliance |
| EWUU | Eindhoven, Wageningen, Utrecht, and UMC Utrecht Alliance |
| FTE | Full-Time Equivalent |
| FWCI | Field-Weighted Citation Index |
| GGzE | Geestelijke Gezondheidszorg Eindhoven (mental health care in Eindhoven) |
| H&T | Humans & Technology |
| HPM | Human Performance Management |
| HTI | Human-Technology Interaction |
| IE&IS | Industrial Engineering & Innovation Sciences |
| IEEE | Institute of Electrical and Electronics Engineers |
| IEEE SA | IEEE Standards Association |
| ILI | Intelligent Lighting Institute |
| INFORMS | Institute for Operations Research and the Management Sciences |
| IoT | Internet of Things |
| IPCC | Intergovernmental Panel on Climate Change |
| IS | Information Systems (group) |
| ISPIM | International Society for Professional Innovation Management |
| ITEM | Innovation, Technology Entrepreneurship & Marketing |
| JADS | Jheronimus Academy of Data Science |
| JAIN | Joint Artificial Intelligent Network |
| KET | Key Enabling Technologies |
| KIC | Knowledge and Innovation Convenant |
| KNAW | Royal Netherlands Academy of Arts and Sciences |
| KPI | Key Performance Indicator |
| LCB | Logistics Community Brabant |

| | |
|---|---|
| MOOC | Massive Open Online Courses |
| MSCA | Marie Skłodowska-Curie Actions |
| MYE | Man-Year Equivalent |
| NGO | Non-Governmental Organization |
| NIAS | Netherlands Institute for Advanced Study |
| NWO | The Netherlands Organization for Scientific Research |
| OGS | Overleg Graduate School (Consultation Graduate School) |
| OPAC | Operations, Planning, Accounting and Control |
| OR | Operations Research |
| P&E | Philosophy & Ethics |
| PDO | Project Development Office |
| PhD | Doctor of Philosophy |
| PROOF | PROviding Opportunities For PhD candidates |
| S&C | Sustainability and Circularity |
| SCM | Supply Chain Management |
| SME | Small and medium-sized enterprises |
| SWOT | Strengths, Weaknesses, Opportunities and Threats |
| TKI | Top consortia for Knowledge and Innovation |
| TKI Dinalog | Dutch Institute for Advanced Logistics |
| TU/e | Eindhoven University of Technology |
| TIS | Technology, Innovation and Society |
| UWV | Uitvoeringsinstituut Werknemersverzekeringen (Employee Insurance Agency) |
| VoDDI | Value of Data-Driven Intelligence |
| VSNU | Association of Cooperating Universities in the Netherlands |
| WOIC | World Open Innovation Conference |
| WoS | Web of science |
| XLD | Extreme Long Downtime |

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tue.nl/en/our-university/departments/industrial-engineering-and-innovation-sciences

April 2023

This report includes photos taken by Odette Beekmans, Bart van Overbeeke and Maud Staassen.

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