WTMC | Netherlands Graduate Research School of Science, Technology and Modern Culture

WTMC Self-evaluation, 2011-2016

13 February 2017

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Factsheet

Evaluation period: 2011-2016

Years in which ECOS accreditations awarded: 1995, 2000, 2005, 2011

Name of research school (Dutch): Landelijke onderzoeksschool Wetenschap, Technologie en Moderne Cultuur

Acronym/abbreviation: WTMC **Website:** http://www.wtmc.eu

University acting as secretary: Maastricht University

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Establishing Institutes

1. Maastricht University (UM):
   - Faculty of Arts & Social Sciences (FASoS)
   - Faculty of Health, Medicine and Life Sciences, Department Health, Ethics & Society (HES)

2. University of Twente (UT):
   - Faculty of Behavioural, Management and Social Sciences, Department of Science, Technology and Policy Studies (STePS)
   - Faculty of Behavioural, Management and Social Sciences, Department of Philosophy

3. Utrecht University (UU):
   - Faculty of Geosciences, Innovation Studies

4. Radboud University Nijmegen (RUN):
   - Faculty of Science, Institute for Science, Innovation and Society (ISIS)

5. Eindhoven University of Technology (TU/e):
   - School of Innovation Sciences, Eindhoven Centre for Innovation Studies (ECIS)

6. VU University Amsterdam (VU):
   -Faculty of Earth and Life Sciences (ALW), Athena Institute

Participating institutes

7. University of Amsterdam (UvA):
    - Amsterdam School of Communications Research (ASCoR, until 2015)

8. University of Groningen (RUG):
    - Faculty of Philosopy (FW)
    - Faculty of Maths and Physics (WNW), Department of Science and Society
    - Faculty of Behavioural and Social Sciences (PPSW), Heymans Institute

9. Wageningen University and Research Center (WUR):
    - Technology & Agrarian Development Group (TAD)

10. Leiden University (UL):
    - Centre for Science and Technology Studies (CWTS)

11. Delft University of Technology (TUD):
    - Faculty Technology, Policy and Management (TBM), Technology Dynamics & Sustainable Development
    - Faculty of Applied Sciences (TNW), Biotechnology and Society

12. Royal Netherlands Academy of Arts & Sciences (KNAW):
    - eHumanities Group (until 2016)

Officers, members of board & committees

Scientific director: Prof. Sally Wyatt, Maastricht University & KNAW

Programme co-ordinators:

- Dr Willem Halffman, Radboud University Nijmegen, 2011-August 2013
- Dr Teun Zuiderent-Jerak, Erasmus University Rotterdam, 2011-August 2014
- Dr Geert Somsen, Maastricht University, July 2013-August 2014
- Dr Govert Valkenburg, Maastricht University, since August 2014
- Dr Bernike Pasveer, Maastricht University, since August 2014

Board members, 2011-2017, name, institution, other dates where relevant:

- Prof. Nelly Oudshoorn, University of Twente, chair 2011-14
- Prof. Paul Wouters, Leiden University, chair, from 2014
- Prof. Klasien Horstman, Maastricht University, 2011-16
- Dr Agnes Meershoek, Maastricht University, from 2016
- Dr Marianne Boenink, University of Twente
- Prof. Jacqueline Broerse, VU Amsterdam
- Prof. Ruud Smits, Utrecht University, 2011
- Prof. Marko Hekkert, Utrecht University, 2012-14
- Prof. Koen Frenken, Eindhoven University of Technology, 2011-13; Utrecht University, 2013-16
- Prof. Ellen Moors, Utrecht University, from 2016 (temporary replacement for Frenken)
- Prof. Geert Verbong, Eindhoven University of Technology, from 2014
- Prof. Hub Zwart, Radboud University Nijmegen

- Prof. Barend van der Meulen, Rathenau Institute, from 2014
- Prof. Huub Dijstelbloem, external member, *Wetenschappelijke Raad voor Het Regeringsbeleid* (WRR; Scientific Council for Government Policy) & University of Amsterdam

PhD representatives in the Board:

- Matthijs Kouw, Maastricht University & Sabrina Sauer, University of Twente, 2010-11
- Yvonne Cuypers, Utrecht University & Dirk Haen, Maastricht University, 2012-13
- Colette Bos, Utrecht University & Marjolein de Boer, Maastricht University, 2014-15
- Jorrit Smit, Leiden University & Esther de Wit, University of Groningen, 2016-17

Training committee:
2011-2015:

- Prof. Harro van Lente, Maastricht University, chair
- Prof. Roland Bal, Erasmus University Rotterdam
- Dr Boelie Elzen, University of Twente
- Prof. Rob Raven, Eindhoven University of Technology / Utrecht University
- Dr Eleftheria Vasileiadou, Eindhoven University of Technology

2015-onwards:

- Dr Willem Halffman, Radboud University Nijmegen, chair
- Dr Boelie Elzen, University of Twente (until end 2016)
- Dr Kornelia Konrad, University of Twente
- Dr Harro Maat, Wageningen University
- Prof. Rob Raven, Utrecht University
- Dr Sarah de Rijcke, Leiden University
- Dr Jenny Slatman, Maastricht University (Tilburg University from January 2017)

PhD representatives:

- Koen Beumer, Maastricht University & Steven Dorrestijn, University of Twente, 2011-13
- Evelien de Hoop, Eindhoven University of Technology & Andreas Mitzschke, Maastricht University, 2014-15
- Mayli Mertens, University of Twente & Casper Roelofs, University of Groningen, 2016-17

Research Committee:

- Prof. Stefan Kuhlmann, University of Twente, chair
- Prof. Wiebe Bijker, Maastricht University
- Prof. Hub Zwart, Radboud University Nijmegen

International Advisory Board:

- Prof. Aant Elzinga, University of Gothenburg, Sweden
- Prof. Thomas Gieryn, Indiana University Bloomington, US
- Prof. Steven Shapin, Harvard University, US
- Prof. Andrew Webster, York University, UK

See Appendix 1 for Organogram of WTMC structure.

Abbreviations & acronyms

Note: English names given, even if Dutch abbreviation in common usage.

4S	Society for Social Studies of Science, http://4sonline.org/
4TU.Ethics	4TU Centre for Ethics and Technology (a collaboration between Wageningen University & the three technical universities of Twente, Delft & Eindhoven, www.4tu.nl/en/
CWTS	Centre for Science & Technology Studies, www.cwts.nl/
EASST	European Association for the Study of Science & Technology, https://easst.nl
ECOS	Research School Accreditation Committee
ECTS	European Credit and Transfer Scheme
FASoS	Faculty of Arts & Social Sciences, Maastricht University
H.NU	Platform for Reform of Dutch Universities, http://platform-hnu.nl
IEEE	Institute of Electrical & Electronics Engineers
LOOWTOK	National Research Training for Science and Technology Studies
KNAW	Royal Netherlands Academy of Arts & Sciences, www.knaw.nl
NGO	Non-Governmental Organisation
NWA	Dutch National Research Agenda, www.wetenschapsagenda.nl
NWO	The Netherlands Organisation for Scientific Research, www.nwo.nl/en
QRiH	Quality and Relevance in the Humanities, www.qrih.nl
SEP	Standard Evaluation Protocol (available on KNAW website)
SiT	Science in Transition, www.scienceintransition.nl
STIS	Science, Technology & Innovation Studies
STS	Science & Technology Studies
TU/e	Eindhoven University of Technology
VSNU	Association of Universities in the Netherlands, www.vsnu.nl/en_GB
WTMC	The Netherlands Graduate Research School for Science, Technology & Modern Culture, www.wtmc.eu
WRR	The Netherlands Scientific Council for Government Policy, https://english.wrr.nl
ZonMW	The Netherlands Organisation for Health Research & Development, www.zonmw.nl/en

Introduction and background

The Netherlands Graduate Research School of Science, Technology and Modern Culture (WTMC) is a collective effort of junior and senior scholars based in the Netherlands who study the development of science, technology and modern culture from an interdisciplinary perspective. Members of WTMC have backgrounds in the anthropology, history, sociology, geography, ethics and philosophy of science and technology, and other interdisciplinary fields including innovation studies, gender studies and cultural studies. Many members started their studies in the natural sciences, engineering or medicine. WTMC is pluralistic not only in terms of discipline, but also in terms of objects of study, and methods and approaches used. To become a member of WTMC, one has to be active in a relevant research area, and to pay a modest annual fee. The participating institutions (see Factsheet) contribute to the infrastructural costs of WTMC through an annual contribution. More detailed information about the governance and finances are provided in Section 5.

Collaborative training for Dutch-based PhD candidates in science, technology and innovation studies (STIS) started in 1986, and was supported by a government grant until the early 1990s.[1] Over the years, the graduate training network gained national and international recognition, and in 1994, it was transformed into what we now know as WTMC. It was officially accredited by the Research School Accreditation Committee (ECOS – *Erkenningscommissie Onderzoekscholen*) of the Royal Netherlands Academy of Arts and Sciences (KNAW) in 1995. Accreditation was reconfirmed in 2000, 2005, and 2011. The reports of the 2010 peer review committee and the 2011 accreditation are included as Appendix 2, and the key points raised by these previous peer review and accreditation committees are addressed below in Section 6. Since 2015, the quality assurance of national graduate schools is taken up in the 2015-2021 Standard Evaluation Protocol (SEP), and included in the evaluation of the host faculty. Since 2005, the host faculty for WTMC has been the Faculty of Arts & Social Sciences (FASoS), Maastricht University. WTMC is independently reviewed by an international peer review committee, meeting on 22-23 March 2017. It is reviewed for the quality of PhD training provided. Research quality and relevance for the participating institutions are evaluated separately, though in this report reference is made to the research activities of senior members, to demonstrate that PhD training is underpinned by active, high-quality researchers. This report and the evaluation of the international peer review committee will be included as part of the FASoS research evaluation, scheduled for September 2017.

1. Objectives of WTMC

WTMC has four objectives, of which the first is the most important:

1. to provide high quality, advanced training for PhD candidates who study science, technology and modern culture, and thus to create new generations of scholars with a solid background in this interdisciplinary field
2. to stimulate and co-ordinate high quality research about science, technology and modern culture
3. to contribute to societal debates about the role of science and technology in society
4. to promote the visibility of the field amongst research funding agencies, universities and others concerned with research and education policy.

[1] At that time it was known as LOOWTOK: *Landelijke OnderzoeksOpleiding Wetenschaps- en TechniekOnderzoeK* (National Research Training for Science and Technology Studies). See also Appendix 7b.

These objectives are realised through the provision of the following activities (which are more fully described later in this document):

- annual five-day summer school, focused on work of internationally renowned scholar, for WTMC PhD candidates and other PhDs (section 2a)
- two three-day thematic workshops each year, open to PhD members of WTMC and to external PhDs if space (section 2a)
- two dissertation days per year (section 2b)
- one post-doc day per year (section 2b)
- annual meeting for all members (section 3c)
- funding for workshops organised by WTMC members, to develop new themes and collaborations (section 3c)
- occasional meetings for supervisors (section 6)
- quarterly newsletter (section 3c)
- mailing list and website (section 3c)

2. Training and supervision programme

The primary objective of WTMC is to provide high-quality training to each new generation of STIS scholars. PhD candidates participating in one of the academic groups affiliated with WTMC obtain their training both locally and nationally. The local component is provided by the home institution. It includes supervision, training in primary skills such as academic writing and theoretical development, and in-depth training in specific methods required for the research. The national component, offered by WTMC, offers training in the substantive area of STIS, including both theory and methodology. The aims of the training offered by WTMC are as follows:

- To obtain an overview of classical and contemporary approaches to the study of the relations between science, technology, innovation and society.
- To learn how to translate insights from these different approaches into one's own research questions and design.
- To obtain insight into the relationship between current STIS studies and disciplines such as philosophy, sociology and history.
- To develop skills to use methodology and theory to study the relation between science, technology, innovation and society.
- To develop skills necessary to communicate with and present one's work to the international research community.
- To develop the skills of understanding how societal and cultural problems can be expressed in relation to questions of science, technology and innovation, and *vice versa*.
- To prepare for a professional career in which knowledge of the relations between science, technology, innovation and society plays a role.

If undertaking a PhD at a Dutch university, it is possible to apply to WTMC by providing a brief description of one's research project and training plan. At least one of the supervisors must also be a member of WTMC. The home university has to guarantee payment of an annual fee for four years, to cover the costs of the workshops and other events. External participants may attend workshops and summer schools on an *ad hoc* basis, and are charged a proportional amount per event. Each event is awarded ECTS (European Credit Transfer Scheme – an EU-wide system of calculating credit points): three for a workshop, and five for a summer school. External participants receive a certificate of attendance, and WTMC members receive a diploma when they have completed four workshops and two summer schools (equivalent to 22 ECTS). A copy

of the Welcome Package sent to all new participants is included in Appendix 4c, and can be found on the WTMC website.

a. Phase 1

The PhD programme has two phases. In the first phase, participants are introduced into the broad field of studies of the relationship between science, technology, innovation and society, and provided with training in particular research skills. During these first two years, PhD candidates attend a total of four workshops (each lasting three days) and two summer schools (each of five days). These are residential to enable concentration and interaction. Workshops are organised around specific themes, while the summer school is organised around both a theme and an anchor teacher, a leading scholar from the field (see Appendix 4b for full list). Examples of recent workshops include: 'Integrity and Fraud in Science', 'Robots', and 'Counting Practices'. Some workshop themes, such as those about 'normativity' and 'users', have been repeated, though each workshop is always different to reflect new literature, and dependent on the availability of senior researchers to contribute. There is always a gap of at least three years between repeated themes, to ensure that any individual participant does not experience similar events. See Appendix 4a for a full list of workshops and summer schools. Electronic copies of readers are sent separately on a USB stick, and sample paper copies will be provided during the site visit.

Prior to the workshops and summer schools, participants receive a course handbook with texts and assignments to prepare in advance. All events are in English and often attract international participants. All WTMC PhD participants are required to present their work at least once during the first two years of the programme, to gain experience of making presentations, and to gain feedback on their work. External participants can make presentations if they so wish, and if there is space in the programme.

Acquiring academic and professional skills is highly important in the WTMC graduate training programme. Workshops and summer schools invite participants to reflect critically on theoretical and methodological approaches and on their own research design and findings. Interaction among the participants is crucial. In addition to a selection of research skills (such as textual analysis, network analysis, interviewing and ethnographic techniques), there is training in skills such as structuring a thesis, writing review articles, composing abstracts for conferences, and writing research proposals for funding. More attention has recently been given to quantitative methods.

b. Phase 2

In the second phase, PhD candidates present their own written work for discussion at 'Dissertation Days'. Two such days are organised every year, to which senior discussants are invited to comment on the work-in-progress, such as a draft article or a dissertation chapter. Texts are distributed in advance, and participants are expected to comment on one other contribution in detail, and to read all contributions. Thus, participants receive feedback on their own work and learn how to provide feedback to others. Writing and editing skills are the focus of the second phase. Close reading of the work of others is not only a way of providing feedback to the authors, but also for readers to develop skills in critical reading, drafting and editing of their own work. Attention is also paid to the final stages of the PhD trajectory (such as dealing with committees and the public defence), and to careers after the PhD is completed. Each Dissertation Day ends with dinner, enabling PhD candidates to maintain and extend their network of contacts with peers and senior scholars in their field.

Attendance at Dissertation Days is not compulsory, and participation is lower than expected given the number of WTMC candidates at this stage. All PhD candidates who do participate find the experience to

be extremely valuable. Nonetheless, this does not translate into high take-up, perhaps because of anxieties about time and/or sharing preliminary work.

In recent years, Post-doc Days have been organised alongside Dissertation Days, for those who completed their PhDs within the preceding three years. On these occasions, funding and book proposals may also be discussed, and the post-PhD career.

c. Relations with local graduate schools, and masters' programmes

Local graduate schools have emerged in recent years, providing a focus for all PhD candidates at department or faculty level in any one university. While these have received considerable local support, they are usually very broad in their coverage. Local graduate schools tend to focus on generic research skills, and the national graduate research schools, such as WTMC, provide substantive content. The standard procedure in Dutch universities is for a formal review towards the end of the first year, at which time a 'go/no go' decision is made about whether a candidate may continue with her/his PhD. These decisions are made locally, with input from supervisors and local graduate schools. Relations between local graduate schools and WTMC vary. In some universities, the division of labour described above works well, but in some universities there remains some tension about the added value of WTMC.

In the previous accreditation period, WTMC offered PhD candidates enrolled in the WTMC programme the opportunity to follow a course in one of the STS and Innovation Studies (research) masters' programmes in the university institutes which participate in WTMC (See Appendix 5). There has not been much take-up, however WTMC members do follow master's level courses on an *ad hoc* basis, to supplement their training in particular substantive or methodological areas. This enables PhD candidates to meet particular deficiencies in their basic knowledge of STIS or other areas relevant for their PhD. 'Following a course' in this case means that the candidate can attend the course, and write papers if required, but will not do an official exam or acquire official ECTS credits. The co-ordinator of the course, however, will inform the promoter of the PhD candidate about attendance of and contribution to the course, and may read and comment upon the written work of the participants. The costs involved for travelling or staying at the other university, as well as the costs involved for buying literature (if necessary) are the responsibility of the university with which the PhD candidate is affiliated. This means that attending a course always involves the approval of the promoter.

In addition, WTMC has discussed collaborating in the organisation of workshops with the 4TU Centre for Ethics and Technology. To date, the collaboration between WTMC and 4TU.Ethics has been rather informal as the timetable and organisation of 4TU.Ethics events (on the theme of responsible innovation, for example) has not fitted easily with the WTMC training scheme. Nonetheless, many WTMC members contribute lectures and reading material.

d. Completion rates

The rate of completion within 5 years has declined slightly from 44 percent in the previous accreditation period (2005-10) to 41 percent now (taking into account candidates who started in 2009), and the rate of completion within 6 years has declined from 62 percent to 59 percent. This is above the average for the humanities (43 percent within 5 years; 48 percent within 6 years), but below the average for the social sciences (53 percent within 5 years; 61 percent within 6 years)[2]. Given the relatively small numbers of PhDs in

[2] See figures produced by VSNU (2016) http://www.vsnu.nl/en_GB/f_c_promovendi.html (accessed 8 January 2016). VSNU is the Association of Universities in the Netherlands.

any one year, it is difficult to draw general conclusions. In 2011, four PhD candidates stopped, one due to illness and three did not succeed in passing the local one-year review. In part this could be explained by the high enrolment in 2011 which perhaps led to not being able to recruit sufficiently well-qualified candidates. It is reassuring that no PhD candidates who have enrolled since 2012 have stopped. Several PhDs have had parental leave and/or choose to work part-time, which extends the time needed to complete a PhD, possibilities that are not visible in average completion rates.

See Appendix 6 for a list of dissertations defended between 2011 and 2016. Copies of dissertations will be available during the site visit.

Table 1. Completion rates, 2009-16

Starting year	Enrol-ment total	Enrol-ment women	Enrol-ment men	Graduated within 4 years	Graduated within 5 years	Graduated within 6 years	Grad-uated within 7 years	Total graduated	Not yet finished	Dis-continued
2009	21	11	10	4	5	4	2	15	5	1
2010	13	8	5	3	3	5	0	11	1	1
2011	20	10	10	0	6	1	-	7	9	4
2012	9	7	2	1	-	-	-	1	8	0
2013	6	3	3	-	-	-	-	-	6	0
2014	8	6	2	-	-	-	-	-	8	0
2015	11	5	6	-	-	-	-	-	11	0
2016	5	4	1	-	-	-	-	-	5	0

e. Career prospects for alumni, and alumni network

The career perspectives of WTMC graduates are excellent. Sixty-four candidates completed their PhDs between 2011-16 (see Appendix 6 for full list of names and titles). Of these, 24 are now working in Dutch universities, 14 in universities elsewhere, and five in universities of applied sciences (known as *hogescholen* in Dutch). In other words, 43 (67%) have academic positions. Of the remainder, ten (16%) are working in government organisations (nine in the Netherlands and one elsewhere) and a further six (9%) are working for civil society organisations (e.g. disease foundations, knowledge transfer organisations). These are all research and policy positions. Two work as journalists, and two work in the private sector (one Dutch consultancy and one private high-tech company in Belgium), and one cannot be found. There appear to be many possible career trajectories for people trained in STIS, inside academia and beyond.

The career prospects for WTMC graduates are very different from the national average. A 2016 report from the KNAW (Royal Netherlands Academy for Arts and Sciences)[3] indicates that 75 percent of all PhD graduates find jobs outside of academia, whereas it is almost the reverse for WTMC graduates.
Alumni who move into Dutch academic positions are eligible to become full members of WTMC. Special arrangements are made for those who finished their PhDs within the preceding three years, who may not yet have a very active research and/or publication record. Post-doc days are arranged for these members, in parallel with Dissertation Days for PhD candidates (see Section 2b). In the past, efforts have been made to establish an alumni network, via LinkedIn, but that is not very active. However, WTMC can also be seen as its own alumni network. When appropriate, we try to invite WTMC alumni to give lectures during workshops and summer schools. More effort is needed to maintain links with our most valuable resource, the PhDs who graduate from WTMC (see Section 7), even if they move outside academia and/or outside the Netherlands.

3. Research context

a. Research programme and output

WTMC is organised around three clusters of research questions. These clusters form the backbone of both the research and the PhD training programme of WTMC. All senior members are assigned to one of the clusters when they join WTMC, and the PhD training activities rotate between the main themes of science (W), technology (T) and modern culture (MC). The clusters are:

(1) Diagnosis of the Modern Research System
This cluster focuses on the history of and contemporary dynamics of national and international research systems, such as the organization of universities, research funding and industrial R&D. Its key question is how the rise of new actors, levels and networks in the world of research has affected the research systems' internal functioning *and* societal position. This is studied from historical, sociological and cultural perspectives, using both quantitative and qualitative methods.

(2) Technological Development and Societal Regulation
This cluster centres on the role of technology in society. Its key questions are how technological systems and artefacts emerge and develop, and how these technologies affect society in the process of their embedding. The aim of such studies is to create new perspectives on the politics of technological culture, and to inform new ways of technology assessment.

(3) Cultural Roles of Science, Technology and Rationality
This cluster focuses on the cultural and normative consequences of the intertwinement of science, technology and modern culture. Its key questions are how the boundaries between science, technology and society are generated, how the definitions of rationality have changed over time, and on how science and technology are represented in politics, philosophy and fiction.

The leaders of the three research clusters are: Prof. Dr Stefan Kuhlman (Research Cluster 1), Prof. Dr Wiebe Bijker (Research Cluster 2), and Prof. Dr Hub Zwart (Research Cluster 3). They constitute the research committee (see Appendix 1, Organogram).

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[3] KNAW (2016) *Promoveren werkt*. Amsterdam: KNAW. English summary available at: http://knaw.nl/shared/resources/actueel/publicaties/pdf/summary-verkenning-promoveren-werkt-20160324

An overview of key publications from WTMC senior staff members for the period 2011-16 is provided in Appendix 7a. Senior staff members were asked to submit their five best publications in the period. These have been clustered into 25 themes, plus 'encyclopedias, handbooks & course books'. However, it is important to bear in mind that this evaluation is of WTMC as a PhD training school. The research groups which participate are evaluated independently. A summary of the most recent evaluations of the research groups participating in WTMC can be found in Appendix 7c. There is a diverse, vibrant and productive research culture supporting the WTMC training activities.

b. Achieving high-quality research

How does WTMC achieve its second objective, of stimulating high-quality research in the field of STIS in the everyday practice of the research graduate school? For decades, the strongest theoretical contributions of STS focused on explaining the rise and decline of scientific knowledge, and the success and failure of technological artefacts and systems. Theoretical approaches such as Large Technological Systems, the Social Construction of Technology (SCOT), Actor Network Theory (ANT), Technological Innovation Systems, and Technological Regimes produced insights into the dynamics of science and technology development, building upon empirical philosophy, history, sociology and evolutionary economics. All of these approaches stress the strong links between societal and cultural shifts and the rise of particular forms of scientific knowledge and technology. Moreover, such work showed the long-term impact of science and technology on society, and the mechanisms by which societies attempt to regulate the risks of technoscience. WTMC explicitly brings together traditional STS with innovation studies, in its membership and its activities. Innovation Studies contributes to and promotes debate around topics such as user-producer relations, innovation system building forms of (energy, transport and health) transitions, and sustainable development.

STIS research produces practical insights. These include demonstrating the usefulness of Responsible Research and Innovation (RRI) for preventing disadvantages of new technologies, the effects of research evaluation systems on actual research practices, contributions to healthcare policy and practice, and the role of expectations in technological innovation. WTMC research has also resulted in a better grasp of the obduracy of technological systems, and of the new cultural meaning and usages of technologies when they travel between different countries and regions. WTMC members have actively contributed to the research that produced these insights (see 'Examples of Relevance, Impact & Quality', & Appendix 7a).

STIS now has its own theoretical canon and has succeeded in producing practical knowledge. In order to renew itself, STIS needs to remain open to both its founding disciplines and to its neighbouring fields for theoretical inspiration and methodological renewal. WTMC stimulates high quality STIS research of this kind in two ways. First, it does so by bringing together scholars who combine knowledge from philosophy, history, sociology, ethnography, scientometrics and economics. WTMC actively aims to promote dialogue between scholars using qualitative and quantitative approaches, as both share a commitment to empirical analysis of science-technology-innovation-society relations. A second way of fostering theoretical innovation is by organising and financing conferences, workshops and panel sessions with academic neighbours. In 2013, for instance, WTMC co-organised an event with the cultural historians of the Huizinga Institute. In addition, workshops have been funded in which WTMC members have collaborated with scholars from the health sciences, sociology and migration studies (see section c. below and Appendix 8).

WTMC explicitly aims to enhance the societal significance and visibility, or valorisation, of its research (objectives 3 & 4). First, it lobbies for positions of WTMC members in academic and societal advisory boards (see Appendix 9 for a selection of societal advisory boards in which WTMC members participate). Second, it helps to make members' activities in various advisory boards and committees more visible, for instance

through the newsletter and website. Third, WTMC contributes to the discussions on how to assess the societal relevance of research. For example, WTMC members have been actively involved in recent discussions about the role of universities, and have also contributed to national reviews of evaluation criteria for the humanities organised by both NWO and the KNAW[4]. Moreover, WTMC stimulates engagement with mass- and social media contributions, and by discussing these contributrions during annual meetings.

In the section, 'Examples of relevance and impact' three important themes of WTMC research are discussed in more detail. The three themes are: transition studies, health, and universities and science systems. In all cases, there is evidence of significant collaboration with societal partners of different sorts, in the Netherlands and internationally.

c. Cohesion

In addition to the research within the three (inter-university) research clusters, WTMC deliberately stimulates interaction between them by providing WTMC members with grants for research workshops for themes that both cross the boundaries between the research clusters and involve members from different universities and institutes. The WTMC Board currently reserves €7000 per year to support such workshops, with a maximum of €2500 per workshop (previously up to €5000 per event could be requested). This funding is also meant to stimulate the exploration of new domains of study, the exchange between STIS with other fields of study, and theory development. Given the many activities, nationally and internationally in STIS, and the availability of workshop funding from other sources, the demand for workshop funding is relatively modest.

In addition to these research workshops, WTMC holds an annual meeting, open to all members and other interested colleagues. For many years, the annual meetings took place over two days, but in 2014 the WTMC Board made the decision to reduce this to one day, for both financial and practical reasons. Overall participation has not declined, as when the meeting took place over two days, many people attended just one day given teaching and other commitments. The programme is made by the academic director, in consultation with the Board. The annual meetings include two or more of the following activities: discussion of recently published books by WTMC members, presentations by invited international scholars, debates on the role of STS in research policy and societal issues. Recent annual meetings have included presentations and discussions about the Dutch National Science Agenda, research integrity, and responsible innovation. We occasionally co-operate with our sister research schools, for example in 2013 we co-hosted a lecture by Steven Shapin with one of the research schools for historians. Annual meetings also provide opportunities for WTMC members to meet with one another informally. See Appendix 8 for an overview of attendance at annual meetings. Full programmes are on the USB stick sent to all committee members.

In addition collaboration between researchers from different universities in the research workshops and annual meetings, many WTMC members collaborate in research projects funded externally by the Netherlands Organisation for Scientific Research (NWO) and in European projects funded by the European Research Council, and under the FP7 and Horizon 2020 programmes. WTMC members are well-positioned to build multidisciplinary consortia, as often required by such funding programmes. Co-authored articles, books and reports are often the result, and edited collections continue to play an important role in fostering collaboration within and between institutions and disciplines, and between junior and senior researchers (see Appendix 7b). Such collaborations are sometimes a result of the mobility of staff across the participating institutes. Of the publications listed in Appendix 7a, 63% are co-

[4] See QRiH, draft manual, 'Evaluation of humanities research according to the SEP', December 2016, www.qrih.nl

authored, sometimes with colleagues in other Dutch universities, sometimes with international colleagues, and sometimes with PhD candidates. Colleagues originally trained in the humanities tend to prepare more single-authored publications, though this is changing, especially amongst the philosophers and ethicists in WTMC.

WTMC has both a website and a mailing list. The website contains relatively stable information, and the mailing list is used almost daily, both by WTMC members and a wider circle of 450 interested individuals for posting information on STIS vacancies, funding opportunities, calls for publications and conferences, new publications and projects, awards, etc. One can join the mailing list without being a member of WTMC. The website was redesigned at the end of November 2012, and by the end of 2016 had been visited 22,280 times by 16,307 unique visitors. Those visiting the website come from 163 different countries, but, as expected, visits from the Netherlands account for 53.4% of the total. The next largest group comes from the United States, accounting for 6.2% of total visitors, followed by Germany, the UK and India, each with about 3.5%. Almost half of the visitors found the website through search engines, using terms such as 'wtmc' or 'wtmc graduate school', and a further 20% found it through referrals from participating universities.

Finally, cohesion in research is at times the *result* of the training programme, since supervisors report that they often learn about new WTMC literature and new colleagues from their PhD candidates when they return from WTMC events.

d. National and international position

National

WTMC is unique in the sense that it brings together research in STS and Innovation Studies from a wide variety of departments from (nearly) all universities in the Netherlands (see Factsheet). The Department of Health Policy and Management at Erasmus University Rotterdam is home to several WTMC members, but has not yet had the opportunity to join WTMC institutionally. Nonetheless it regularly sends PhD candidates to the workshops and summer schools, and was the institutional home of Dr Teun Zuiderent-Jerak, one of the training co-ordinators from 2010-14.

Other national graduate research schools offer research and training programmes that overlap with WTMC to some extent, including:

- PhD programme offered by the 4TU Centre for Ethics and Technology
- Posthumus Institute for Social-Economic History, which has several historians of technology from Eindhoven University among its members
- Huizinga Institute for Cultural History, which is home to several historians of science
- Dutch Research School of Philosophy, established in 2015 (preceded by the Research School for Ethics, OZSE)
- Research School for Media Studies

These do not pose a threat to WTMC, as there are already many collaborations between members of different schools, some people hold dual membership, and some WTMC PhD members participate in activities and workshops offered by other schools.

WTMC and STIS are deeply embedded in the Dutch research landscape, with many members playing key roles in national science policy organisations, and in groups with wider societal aims (see Appendix 9).

International
WTMC's research focus is thoroughly international. Publishing in international peer-reviewed venues is a pre-condition for WTMC membership, and many WTMC members participate in international research projects, including FP7, and now Horizon 2020. The international migration of WTMC staff members and graduates is increasing, both inward and outward.

Another sign of the leading international position of WTMC is the participation of its members in editorial advisory boards of key STIS journals, including: *East Asian Science, Technology and Society; Engaging Science, Technology & Society; Isis; JASIST; Minerva; Research Policy; Science & Technology Studies; Science, Technology & Human Values;* S*cientometrics*; *Social Studies of Science; Techné; Technological Forecasting & Social Change; Technology & Culture;* and *Tecnoscienza.* WTMC members were responsible for the establishment of the *Journal for Responsible Innovation* in 2014; and have long played a role in *Krisis, Journal for Contemporary Philosophy.* WTMC researchers are also members of editorial advisory boards in an impressive array of other journals, including: *Ambix, The Journal of the Society for the Study of Alchemy and Early Chemistry*; *Digital Culture & Society; Environmental Innovation & Societal Transitions; Evolutionary Economics; International Journal of Tuberculosis & Lung Disease (IJTLD); Journal for Artistic Research; Life Sciences, Society & Policy; NanoEthics;* and *Sound Studies*. These lists are by no means exhaustive.

WTMC participates in discussions and meetings organised by EASST and 4S that bring together national STS associations. The WTMC Director was invited by the recently formed Belgian association to provide advice as they established their own programme. WTMC members are active in EASST and 4S, the long-established international organisations (as council, committee and working group members). WTMC members are also actively engaged in other associations, including the following: European Academy for Standardization, European Association for Chemical and Molecular Sciences (History of Chemistry working group), European Sound Studies Association, International Society for Gerontology, Society for Studies of New and Emerging Technologies, Sustainability Transitions Research Network, and *Vereniging van Wijsgerig Ingenieurs* (Society of Philosophical Engineers). The value of WTMC as an international role model was recognised in 2016, when it was awarded the inaugural 4S Infrastructure Prize.

The WTMC Summer Schools have international anchor teachers, who are always leading scholars in STS (Appendix 4b). Given the rising number of non-Dutch people preparing PhDs in Dutch universities, and the possibility for participants from outside the Netherlands to attend WTMC events, all WTMC activities are conducted in English, and have an international character. The perspectives brought into events by non-Dutch participants are always highly appreciated.

e. Research integrity
For the first time, the Standard Evaluation Protocol (SEP) requires reflection on 'the degree of attention given to integrity, ethics, and self-reflection on actions (including in the supervision of PhD candidates)'. Research integrity has been high on the Dutch science policy agenda since the 2011 Stapel affaire and some widely publicised allegations of plagiarism by prominent researchers. Within WTMC, we address research integrity both as an object of critical analysis, and as a practice to be constantly trained. From our colleagues in the history of science, we know that research integrity is not a new matter of concern; and from our colleagues concerned with digital technologies we know that the new means for representing and reproducing information can bring ethical questions into sharp relief, especially those relating to consent and plagiarism. In recent years, we have addressed research integrity explicitly in the following ways:

- Fraud and integrity was the main theme of a PhD workshop in 2014 called, *Drawing the Line: Fraud and the Boundaries of Science.*
- During the 2016 WTMC Annual meeting, a session was devoted to research integrity. In part, this was based on preliminary results from the PRINTEGER project, funded under Horizon 2020, and involving two WTMC participating institutions at Radboud and Leiden universities. The project aims to enhance research integrity by promoting a research culture in which integrity is part and parcel of what it means to do excellent research, and not just an external and restrictive control system. The session also reflected on the emerging debate on the role of indicators and assessment in STIS, taking a forthcoming special issue of *Engaging Science, Technology and Society* as a starting point.
- In December 2016, the current PhD representatives (Mertens & Roelofs) on the Training Committee took the initiative to circulate a questionnaire to all PhD members about their own experiences in relation to research ethics and integrity. This covers how PhD candidates learn about ethics and whether they have experienced unethical research practices. Preliminary results are reassuring on the latter point. More detailed information will be available during the site visit.
- Several members of WTMC are involved in (medical-) ethical review and research integrity committees in their own institutions. Members also participate in national and international ethics committees, such as the Dutch National Committee on Genetically Modified Organisms; Permanent Committee on Ethics and Law of the Dutch Health Council; as advisor on bioethics to the World Federation of the Deaf; Ethics Review panel for the European Commission; and the World Commission on the Ethics of Scientific Knowledge and Technology advising UNESCO.

4. Organisation, governance and management

The governance structure of WTMC is relatively straightforward. The academic director reports to a Board. Each of the main establishing institutes is represented on the Board, at associate or full professor level. In addition, there is one representative of the other participating institutes, one representative of a societal stakeholder group, and two PhD representatives. All members serve for the full accreditation period, except for the PhD members who rotate every two years. The board members select a Chair, in collaboration with the board of the host institution. The training programme is organised by two co-ordinators, supported by a 'training committee', again with a self-chosen chair. In addition, there is a research committee, and an international advisory board. See Factsheet (pp.i-iii) for full list of officers, board and committee members, and Appendix 1 for an organogram of the WTMC structure.

The institutes listed in the Factsheet all contribute to the costs of running WTMC. There are currently 116 senior members (see Table 2 below for breakdown of PhD and senior members, and by gender), and this number is relatively stable. Anyone working in the Netherlands can apply to become a member of WTMC, and they are accepted if they can demonstrate active research engagement in the field, regardless of institutional affiliation. A small annual membership fee is levied. Retired members retain their membership at no charge for as long as they remain active in research. For more details, see Appendix 3 for the Common Arrangement (*Gemeenschappelijke Regeling*), included on the USB stick sent to committee members.

WTMC does not participate in university appointments (as these are fully at the discretion of the universities), yet WTMC can and does decide who is eligible to become a member. The WTMC Board also decides about its own annual budget, the basis of which is guaranteed by the participating institutions. WTMC reports annually

about its actual expenditure and planned budget for the following year to all participating institutes, and to the co-ordinating institute (Maastricht University).

Maastricht University provides for the secretariat (academic director plus secretary), although the costs of the secretariat are not the sole responsibility of the co-ordinating institute. WTMC pays for additional secretarial support from Twente University for the administration of the training workshops and schools. The co-ordinators are appointed via an open, competitive process when a vacancy arises, and the term is usually four to six years. Each co-ordinator (and/or their employer) is compensated for the equivalent of six hours per week. This helps to distribute involvement across the different participating institutes, and secures continuity in expertise in administrating WTMC.

Table 2. Number of WTMC members, and gender balance, 2016

Category	Total	Women	Men
Academic staff	116 (29.55 fte)	53	63
PhDs	53	32	21

The gender balance in WTMC is exemplary, compared to the generally poor situation in Dutch universities. In 2015, only 18.1% of full professors were women, and the Netherlands is always at or near the bottom of any EU league table[5]. Within WTMC, 46% of senior members are women, and 60% of current PhD members are women. Within the training programme, we both formally and informally aim to bolster the confidence of women PhDs. Moreover, we provide important role models. Until 2014, the chair of the WTMC Board was a woman (Oudshoorn). The past and current WTMC academic directors are women (Bijsterveld , Wyatt), and one of the current training co-ordinators is a woman (Pasveer). In all events organised or funded by WTMC, we strive to ensure adequate representation of women. Other aspects of diversity are more difficult. Ethnic and cultural diversity is achieved primarily through participation of non-Dutch participants in workshops and summer schools. Ethnic minorities are severely under-represented in Dutch universities. Sexuality is not always visible or constant, and physical differences and capacities are also not always visible. Co-ordinators always aim to create an environment in which people feel confident to discuss their ideas and to express themselves freely.

5. Financial resources

WTMC's income is based on a contribution system, in which the establishing institutes pay per full-time equivalent (fte) research they guarantee to the school, per PhD candidate, and a fixed amount for the research infrastructure. WTMC's financial situation is sound. At the end of 2016, WTMC had a financial reserve of €153k. This is sufficient to wind down WTMC within one year should that become necessary.

Funding for PhDs is quite unpredictable, with no clearly discernible trends, especially given the relatively small numbers (see Table 3). In 2016, relatively few PhDs started WTMC, however, we have good reason to believe

[5]Rathenau Institute. https://www.rathenau.nl/en/page/share-women-professors-netherlands-and-eu-countries. Accessed 15 November 2016.

this situation will improve in 2017, as we have already informally heard that at least 8 new PhDs will join. Funding PhDs via contract research provides a valuable source for some PhD places, though it can be difficult to manage over a full PhD trajectory.

Table 3. Overview of funding of PhDs, 2011-16

Enrolment		Funding		
Starting year	Total PhDs	Direct funding (1e geldstroom)	Research grants (2e geldstroom)	Contract research (3e geldstroom)
2011	20	7	8	5
2012	9	2	4	1 (+ 2 external PhDs)
2013	6	1	2	3
2014	8	4	4	-
2015	11	4	5	2
2016	5	1	2	2

6. Measures taken in response to previous evaluations

The report of the 2010 peer review panel (Balmer, Suchman, Sørensen) did not identify any weaknesses but it did mention several opportunities for WTMC. The *first* opportunity is to communicate the WTMC research school activities as good practice to the international STS community. WTMC has provided advice and acted as a sounding board for an STS association in the Nordic countries, and in Belgium. The most important and gratifying aspect is that WTMC was awarded the inaugural 4S Infrastructure Prize in 2016, recognising the collective achievement in promoting STS nationally and internationally over almost three decades. The *second* opportunity is to have more foreign PhDs participating in the WTMC training activities, which contributes to developing the international perspective of both Dutch and non-Dutch participants. One advantage of the recent dip in local numbers is that we are now able to accommodate more non-Dutch based PhDs in training activities (see Appendix 4a). A *third* opportunity is to develop occasions for bringing together the supervisors of participating universities, so that we can monitor and support local training and supervision. Two events have been organised, however attendance was quite low. Nonetheless, supervisors do have occasion to meet during the successful and well-attended annual meetings.

The 2011 ECOS accreditation committee expressed two concerns, one of which has not manifested, namely a pressure on the teaching programme due to greater numbers. However, the ECOS committee was primarily concerned with the small size of WTMC, compared to some other national research schools in disciplines such as medicine and economics. However, the small scale and highly crafted workshops are central to WTMC's mission and identity, and the current size enables us to address the other concern about being more open to non-Dutch participation. Both the peer review and ECOS committees, in different ways, raised questions about the international character of WTMC. However, WTMC is 'international' in many respects: English-language training, recognising and promoting international diversity in officers and membership, drawing upon and contributing to the international STIS research community, and increasing focus upon the 'international' and 'global' as topics of research.

During the 2013 Annual Meeting, all members of the International Advisory Board (Elzinga, Gieryn, Shapin & Webster) were invited to participate. Professors Elzinga and Webster acted as discussants during a Dissertation Day immediately preceding the Annual Meeting. A meeting was held between the WTMC Board

and the Advisory Board, in effect, a mid-term review. A number of points were raised for consideration and action. These are listed below, *together with responses and actions*:

- Developing leadership capacity within WTMC as first generation retires. *Of course, the founding generation was remarkable, and contributed enormously to the development of the field within the Netherlands and beyond. However, they took care to train and promote their successors, and the generations behind them (now in their 40s and 50s) should not be under-estimated.*
- Increasing awareness amongst PhD candidates of alternative research methods, beyond the case study (raised by Elzinga and Webster following their experience at the Dissertation Day). *This is constantly under review by co-ordinators, and received explicit attention at the December 2016 workshop focused on quantitative methods.*
- Role of WTMC in broader societal debates, and its extra-academic contributions. *WTMC members do take an active part in a wide range of societal debates, from migration to robots to nanotechnology (see Section 3). However, WTMC does not and cannot speak with a single voice on any societal issue.*
- Role of historians and relationship with other national graduate schools. *There are many members of WTMC who identify history of science and/or technology as a major part of their scholarly identity. However, at present, there are relatively few PhD candidates with history as a major focus. See Section 3d.Where possible, we collaborate with other national graduate schools, and aim to ensure that PhD candidates can participate in events offered by other graduate schools.*
- Role in Horizon 2020 funding. *Horizon 2020 with its emphasis on societal challenges offers many opportunities for STIS researchers, and to date many WTMC members have participated in applications (successful and unsuccessful).*
- Links with sister organisations in other countries. *WTMC has often provided advice and worked with sister organisations (especially in Belgium, the Nordic countries, and the UK) and with umbrella organisations (such as EASST and 4S). WTMC's contributions to the infrastructure of the field were recognised by the 4S Infrastructure Award. See above, opening paragraph of this section.*

Some of these points re-appear in the SWOT analysis in the next section.

7. SWOT analysis

The preparation of the SWOT analysis was an iterative and collaborative process. A first draft was discussed by the Board, and presented during the annual meeting on 25 November 2016. The first draft was circulated to all establishing institutes, with the request for it to be discussed by local WTMC members. In total, 10 pages of feedback were received from nearly all of the participating institutions and the training committee. Many useful ideas were generated for future activities. The key results are presented below.

The preparation of the SWOT analysis was an iterative and collaborative process. A first draft was discussed by the Board, and presented during the annual meeting on 25 November 2016. The first draft was circulated to all establishing institutes, with the request for it to be discussed by local WTMC members. In total, 10 pages of feedback were received from nearly all of the participating institutions and the training committee. Many useful ideas were generated for future activities. The key results are presented below.

Strengths

- High quality, interdisciplinary & international training programme in STIS theory and methods, resulting in good career opportunities for graduates
- Strong track record in funding acquisition, academic publication and societal engagement
- Development and maintenance of community amongst new and old graduates, especially those within academia

Weaknesses

- Low level of participation in second phase of training (Dissertation Days)
- Limited methodological repertoire (weakness of field as whole)
- Weaker networks with WTMC graduates who leave academia, and with senior STIS scholars who have not undertaken the WTMC training programme

Opportunities

- Renewed focus on 'grand societal challenges' provides opportunities for funding and engagement
- Retirement of founding generation provides new generations with career prospects
- Stronger collaboration with sister organisations in Europe and elsewhere, and with WTMC alumni who leave the Netherlands

Threats

- Mainstreaming STIS across the academy challenges 'unique selling point' of WTMC
- Increased competition between Dutch universities (national policy) threatens inter-university collaboration in national research schools and in acquiring funding for research
- 'Post-truth' political climate undermines research and expertise, and challenges key STIS insights

8. Outlook

The future of WTMC is promising. We have the luxury of building upon a strong base that has been developed over almost 30 years. The founding generation took care to ensure its own succession. The structure and activities of WTMC provide excellent training for each generation, and support the completion of high quality PhD dissertations. In turn, this means that WTMC graduates are in a strong position in both academic and wider labour markets, and the networks developed during one's time with WTMC are valuable for people's careers. Even though the financial resources of WTMC are adequate for meeting the costs, the success of WTMC depends upon the collegiality and collaboration of many people across the establishing and participating institutes and in the wider STIS community in the Netherlands. WTMC could do more to maintain and extend its network with graduates who do not stay in academia, with graduates who leave the Netherlands either temporarily or for longer periods, and with STIS researchers who move to the Netherlands after having completed a PhD elsewhere.

As a field, STIS faces a number of challenges that are not unique to the Netherlands. For many years, STS has been committed to the case study as the primary method. This has generated numerous interesting cases and theoretical insights. Given the long-standing engagement of innovation studies and scientometrics with STS in the Netherlands, Dutch-based scholars are better placed to expand their methodological repertoire. By doing so, WTMC members will remain in a strong position to contribute to debates and policy discussions and interventions about the science system, including about evaluation and quality mechanisms.

The recent rise of populist political parties that explicitly reject expert knowledge threatens not only funding for universities and for research but also the very notion of 'socially robust knowledge'. WTMC researchers need to strengthen alliances with their sister organisations around the world and across the disciplines to defend universities as spaces for debate and for the production of knowledge that are open to all.

Examples of relevance, impact and quality

For the first time, the Standard Evaluation Protocol, invites those being evaluated to 'explain the relevance of the [research school's] work to society'. For WTMC, our relevance lies chiefly in training successive generations of PhDs in the field of STIS, preparing them to conduct independent high-quality research in a variety of settings (see Section 2e). However, we have included here three short accounts of WTMC work, conducted by senior and PhD members, that represent important strands of WTMC research (see Appendix 7a for publications).

NOTE: there are many acronyms – please consult the list of abbreviations and acronyms on p.iv

A. Transition studies – an interdisciplinary approach to sustainable development

B. Health-related research – conducted in collaboration with societal actors

C. Universities and science systems – policy and action

A. Transition studies – an interdisciplinary approach to sustainable development

Transitions research is a new interdisciplinary approach to sustainable development and other grand societal challenges. It draws on several theoretical sources, including STS, complexity theory, innovation studies, neo-institutional theory, history, and governance studies. The main argument for engaging in transition studies is that the emergence of persistent sustainability problems in sectors as energy, transport, water and food, requires transformative change or a transition, as incremental changes will not suffice to deal with these sustainability problems. The Sustainability Transition Research Network is an international platform for meeting researchers and exchanging ideas, results and experiences. Scholars from the Netherlands have greatly contributed to the establishment of the field and the network.

Since 2011, transition research within WTMC has not only aimed to analyse and understand sustainability issues from an academic point of view, but the research has also resulted in reports specifically targeting stakeholders and policy makers, ranging from intergovernmental and international organizations, national governments, regulators and NGOs to private firms. An example is a 2014 report for the Rathenau Institute on the societal debate on shale gas.

Researchers have also been actively involved in professional training programs (Pioneers into Practice, and Transition Management training at DRIFT) and in looking for practical solutions on global (biofuels, energy), national (sharing economy, energy transitions, healthcare) and local levels (sustainable mobility, urban nature-based solutions).

Biofuels: Sustainable innovation or gold rush? (2011-2016)

This project investigated organisational models of innovation, production and use of biofuels, to assess whether any can be regarded as sustainable in social, economic and environmental terms. The project, funded by NWO, included PhD candidates, other WTMC members from Eindhoven and the Rathenau Institute, and a Tanzanian partner. Societal stakeholders included the Dutch Ministry of Economic Affairs, Agriculture and Innovation, the Dutch Ministry of Foreign Affairs, and several NGOs.

The focus was on the cultivation of the second-generation biofuel crops Jatropha in Tanzania and Pongamia in India. The main result is that there are no large-scale, long-lasting biofuel projects that could be called sustainable regardless of their organizational model. Smaller-scale projects that operated more sustainably in environmental and social terms lacked the potential to make a meaningful contribution to emission reduction targets and struggled to become financially viable.

Project results were presented not only in scientific publications, but also in fora for policy makers and NGOs in the Netherlands, India and Burkina Faso. The researchers assisted Diligent Energy Systems in Tanzania with their smallholder biofuel certification project and with feasibility studies for a small-scale socially and environmentally responsible biodiesel facility. A representative from Friends of the Earth Netherlands was invited to lecture on their activist work on biofuels in comparison with the scientific work in the project and to partake in a debate with students. The researchers have helped set up the Bioenergy Forum FACT, which facilitates exchange of information between bioenergy project stakeholders in the global South such as businesses and NGOs. The final conference report has been disseminated widely and led to numerous positive responses, e.g., from the authors of the KNAW Position paper 'Biofuel and wood as energy sources', and to critical questions, e.g., from the chief executive of JatroSolutions GmbH and Siemens-Bosch Hausgeräte, who challenged problems with their

Jatropha oil cook stove exposed by the researchers. The project contributed significantly to puncturing the hype that surrounded Jatropha biofuels after 2008.

Energy transitions

In the project 'Experimenting for sustainability transitions', Dutch researchers work together with colleagues from India and Thailand to explore the role of 'sustainability experiments'. The first stakeholder workshop was held during the preparation stage of the research proposal in Kolkata, January 2010. The second stakeholder workshop, co-sponsored by the Asian-Pacific Network and the Research Council of Norway, attracted over 60 participants from both academic and non-academic backgrounds, and included a policy round table on biofuels. The intermediate and final stakeholder workshops were held in Kolkata (2013) and Chiang Mai (2014). In these workshops, a novel sustainability assessment method of various sustainable innovations in the context of electricity and mobility regimes in India and Thailand was discussed and further developed. The workshops included stakeholders from industry, policy, civil society and academia, plus 10-15 project members. The workshops and the results of the project more generally fed into the development of a booklet for practitioners, distributed to all participants, and published online.

Future directions: Sustainable mobility

Sustainable Mobility has become a key research domain for WTMC researchers. Several large research projects have been started that are transdisciplinary, co-financed by societal actors, and actively engage policy makers, urban planners, and municipal authorities to address practical problems.

The programme 'From Automobility to Smart Mobility' (2015-2019) is a collaboration between TU/e, Rijkswaterstaat (the Dutch Agency for Infrastructure and Waterways) and the Ministry of Infrastructure and Environment. It involves 5 PhDs, academic staff and several staff members of the Agency and the Ministry. It focuses on deconstructing the concept of 'Smart Mobility', a fuzzy technological concept that is being mobilized in research, demonstration projects and pilots with the promise of dealing with all kinds of mobility related problems. However, the sustainability of smart mobility solutions is more assumed than made being explicit. Specifically the programme focuses on ongoing experiments in the field of smart mobility (e.g. car sharing, automated and connected driving), the (envisioned) role of users (on services, expected behaviour) and governance issues in relation to smart mobility (e.g. the role of *Rijkswaterstaat* in the future mobility system).

Other research focuses on urban and regional transitions, mobility and the role of bicycles. The Smart Cycling Futures (SCF) program (2016-2020), funded by NWO and coordinated by Utrecht University has established Living labs to ensure that the research projects are well connected with practical problems and solutions. In the same domain the Sustainable Urban Mobility (SUM) programme on bicycle challenges started in 2016. SUM is a global *Research-Book-Web-Teaching* program for the long-term development of urban sustainable mobility, initiated by History Division of the Technology, Innovation and Society Group at Eindhoven University of Technology and the Foundation for the History of Technology in the Netherlands. SUM contributes to the current debate on how urban mobility may become more sustainable.

Other projects drawing on concepts and frameworks from transition studies are underway about the sharing economy, age-friendly housing, animal testing, life sciences, and nature-based solutions for sustainable urban transitions.

B. Health-related research – conducted in collaboration with societal actors

The health domain encompasses a high variety of practices and this variety is reflected in health-related research in WTMC. What the various projects and programmes have in common is that they are conducted in close collaboration with different actors in the health domain, such as national policy and advisory bodies (e.g. Ministry of Health; National Institute for Public Health and the Environment (RIVM); Healthcare Inspectorate; Netherlands Health Care Institute), health services organisations (such as hospitals, organisations for home care, nursing homes), professional organisations (nursing and medical specialist associations, vocational therapists, social work), educational institutions (undergraduate, graduate & post graduate), local public health facilities, neighbourhood teams, patient and/or community organizations and communities and citizens.

Programmes investigate how scientific knowledge, evidence and/or health technologies play a constitutive role in the form and functioning of these practices, the extent to which this role in specific practices and contexts can be considered as productive or perverse and by whom, what the consequences are, not only for quality, effectiveness of care and treatment but also in terms of power relations between actors, voices that can be heard and processes of in- and exclusion.

Based on insights generated by these programmes, tools and instruments are adapted and/or alternatives are developed, in collaboration with stakeholders in the field. The collaboration with and involvement of different stakeholders guarantee a real impact on the practices being studied.

Besides the specific actors and practices that are involved in specific projects, WTMC researchers translate insights in educational material for different health-focused curricula (e.g. health policy and management, medical curricula, health sciences, nursing).

Depending on the particular practice, the specific ways science and technology are 'present' differ. In policy practices for instance, the focus is on rules and regulations, financing structures, accountability systems and tools. In health services organisations these policy instruments interact with professional standards, protocols, and evidence-based treatment. WTMC researchers generally move between regulatory, organisational and 'front line' practices to analyse the ways in which knowledge and technologies travel between them and with what consequences.

In academic terms, WTMC research on health and healthcare contributes to discussions in several disciplines, including but not restricted to STS, innovation studies, medical sociology, health services, public health, public administration, and organisation studies.

Participatory approaches addressing health in disadvantaged neighbourhoods

- Interactive development (with citizens and professionals) of the soap "Bianca in the neighbourhood" on mental health problems, lifestyle and community conditions to improve mental resilience.
- Citizen summits in Maastricht, an initiative where citizens were invited to define priorities for the local health policy agenda and formulate ideas for health interventions. The city council of Maastricht integrated ideas and priorities in local health policy.
- Manifesto on citizen initiatives and accountability (from controlling to learning) signed by the province of Limburg and several city councils in South Limburg, in which they declare to change accountability instruments in such a way that citizen participation is better acknowledged and will receive more room to develop.

- Netherlands Organisation for Health Research and Development (ZonMw) request to develop more qualitative measurements for evidence for approaches to address health issues in populations with low socio-economic status.
- Research on inter-organisational and inter-professional collaboration in the borough of Feyenoord (Rotterdam), including a study of the new building to accommodate neighbourhood care.

Collaborations with professionals/professional association

- Research on 'task distribution' and the development of new professional roles with/for association of nursing and physician assistants, and Ministry of Health.
- Research on development of self-management policies and practices (e.g. in hospitals, nursing homes, home care, mental health).
- Evaluation of developments in education for medical specialists, i.e. the introduction of the CANMEDS model for medical specialist competencies.
- Video-reflexive ethnography. This method involves practitioners and researchers collectively analysing video footage of their own practices. It is applied in the field of safety in hospitals. It explicates mundane and implicit routines which over time have become invisible but which remain crucial aspects for promoting safety. The method contributes to strong reflexive structures in existing practice that function independently from the researchers and that remain functional after the project is over.
    - Improved practice in several concrete hospital settings in the Netherlands
    - Surgery department Mayo Clinic, US
    - Translated in recommendations for good practice of the Association of Supervisory Boards in the Netherlands
    - Implemented by ProRail on the maintenance and safety of the Dutch railway and the practice in control rooms in particular

Collaborations with national policy actors

- Research for and with the Dutch healthcare inspectorate on the development of new supervision arrangements (i.e. 'experimentalist governance' in coping with uncertainties in supervision) and the evaluation of current supervisory methods (i.e. supervision of medical error; use of performance indicators).
- Research for and with Netherlands Healthcare Institute (*Zorginstituut Nederland*, ZiN) on decision-making for the reimbursement package; e.g. the ways in which 'evidence' is constructed in reimbursement decisions; controversies over decisions; new types of reimbursement policymaking, such as 'conditional reimbursement'.

Research into *Verwijsindex Jeugdzorg* (Reference Index Youth Care)

- Critical analysis of this newly implemented instrument was picked up by all national news media and professional organisations involved in youth care, and led to questions in the Dutch parliament (and one of the academic articles based on this research was awarded a prize, see Appendix 7d).

C. Universities and science systems – policy and action

Debates on the state of science systems and the position of universities have intensified in the period 2011-2016, and the Netherlands is no exception. Questions relating to quality assessment, societal impact and knowledge mobilization, relevance, funding, the relationship between research and education, complaints about the neoliberal management of universities, political and public pressures on universities, and questions about research integrity were posed nationally and internationally. WTMC scholars have played a prominent role in The Netherlands and elsewhere.

Though the nature of contributions vary and reflect differences in organisational missions and personal positions, all place scientific research and scientific organisations in a broader, societal context. In addition to individual actions, WTMC members are involved in four institutions and initiatives that have played a key role in these debates: Rathenau Institute, CWTS, Science in Transition, and H.NU. Together these cover the whole spectrum of policy influences, policy phases and stakeholder interactions in science policy. Some of the most prominent contributions are listed below.

Research assessments and bibliometrics. Science in Transition and CWTS are part of an international chorus that points out flaws in the science system and aims for change. Although parts of the analysis go back quite some time (and draw on long-standing critiques made by Dutch and other scientometricians), this debate has gained momentum in recent years.[6] CWTS is involved in this debate, and has been influential in the discussion on the use of (biblio)metrics in evaluation. This resulted in the *Leiden Manifesto*, published in *Nature*, April 2015 (and awarded the EASST John Ziman prize in 2016). In addition there are numerous international debates, publications and workshops to which WTMC members have contributed

At the national level, members of WTMC were involved in organising congresses (Science in Transition), public lectures and debates. This has led to wide support for better research assessments. At policy level this resulted in:

- VSNU signed the *San Francisco Declaration on Research Assessment* at the second Science in Transition conference held in December 2014.
- The Government White Paper 2025 *Vision for Science: Choices for the Future* (2014) promotes rethinking scientific quality, advocates stakeholder interaction and proposes a National Research Agenda (see below).

WTMC members are involved in the translation to real changes. The new 'Standard Evaluation Protocol (SEP)' for universities dropped 'quantity' as a separate category, and now emphasises societal impact of science. The protocol is endorsed by the KNAW, VSNU and NWO. The Rathenau Institute led a co-

[6] Some examples are: The *San Francisco Declaration on Research Assessment* wants to put an end to the use of bibliometric parameters when deciding which researchers should receive grants or jobs (December 2012). *The Economist* made the problems in science a cover story ('How Science Goes Wrong'), focusing on unreliable research, and stating that many errors in science go uncorrected (October 2013). Nobel Prize winner Randy Schekman calls for a boycott of journals with high impact factors like *Science, Nature* and *Cell* (December 2013). The Reproducibility Initiative wants to reproduce landmark studies since reproducing important papers in the current system is not rewarded, while it is of vital importance. *The Lancet* wants to "increase value and reduce waste" in biomedical research, and discusses how to do so in a series of articles (January 2014). In response the REWARD Network was started (http://researchwaste.net/). The US National Institutes of Health are exploring initiatives to restore the self-correcting nature of pre-clinical research (January 2014).

creation-research project with these organisations and disciplinary bodies on the possibilities to evaluate societal impacts of research (ERiC: Evaluation of Research in Context). WTMC members are also active in various initiatives to define quality indicators for the humanities, and one output has been the website 'Quality and Relevance in the Humanities'(QRiH).

Management of universities in society. Worldwide, universities are under pressure to combine and improve several knowledge functions. Traditionally combining higher education with scientific research, they are now pushed to be at the frontier of research, to provide higher education at an international level, to create impact for the national economy, public sectors and societal stakeholders, to be a driving force of urban and regional economies, to stimulate international excellent scientific research talent, to build human research capital for the national economy and society, and to support professional practices and policy making through providing evidence.

Dutch universities are not immune from these pressures, and as in many other countries, face stagnating public budgets and increased competition for resources. The debate in the Netherlands has become increasingly conflictual. In recent years, there have been heated debates about the funding of universities and research career policies, sometimes leading to internal conflicts within universities about the perverse effects of new public management. The research council has been restructured with formal effect in late 2016, and there has been a new government science policy.

WTMC members have contributed to these debates in various ways, including:

- Participation in the Science in Transition (SiT) actions and initiatives has raised awareness of the issues nationwide, through a manifesto, congresses, workshops, media attention, op-eds, public lectures and debates. Members of SiT have been invited to participate in a public hearing with members of the Dutch parliament, and to join the international US-based METRICS Network, focused on transforming research practices to improve the quality of scientific studies in biomedicine and beyond.
- Involvement in protest movements at universities, including the H.NU platform which mobilises against current management practices at universities. Multiple members were invited to present their views in meetings at the University of Amsterdam during and after the occupation of the University by staff and students in 2015.
- A joint scenario project of the Rathenau Institute and the VSNU on the future of Dutch universities, including multiple national and local stakeholder workshops.
- Engagement with national policy making and direct advice to Parliament and a 'second opinion' report to the parliament on the new government science policy.
- Multiple contributions regarding the scientific careers for young researchers and women, including policy-oriented reports, workshops within universities, network building (CWTS, Rathenau Institute).
- Multiple contributions on research funding, including a report on internal allocation of funding within universities used within universities and by the government and the Parliament.

National Research Agenda (NWA). In 2015, the KNAW, NWO and VSNU undertook an experiment in engaging the broad public in defining a national research agenda. The public were invited to submit research questions, which have subsequently been clustered, and have informed investment priorities. WTMC members were involved in many of the working groups and meetings to engage the public and other stakeholders. The NWA was also the topic of a heated discussion during the 2015 Annual Meeting. It was a fascinating experiment, and would itself be a good topic for WTMC research.

APPENDICES

1. Organogram of WTMC structure

2. 2010 Evaluation report & 2011 ECOS letter – included on USB stick

3. Formal basis - *Gemeenschappelijke Regeling* (in Dutch) – included on USB stick

4. Information on Training and Supervision
   4a. WTMC Training Activities, 2011-16
   4b. WTMC Anchor Teachers, 1987-2017
   4c. WTMC Welcome Package – included on USB stick, and can be found on WTMC website

5. (Research) MA/MSc Programs in STS and Innovation Studies

6. Completed Dissertations, 2011-16

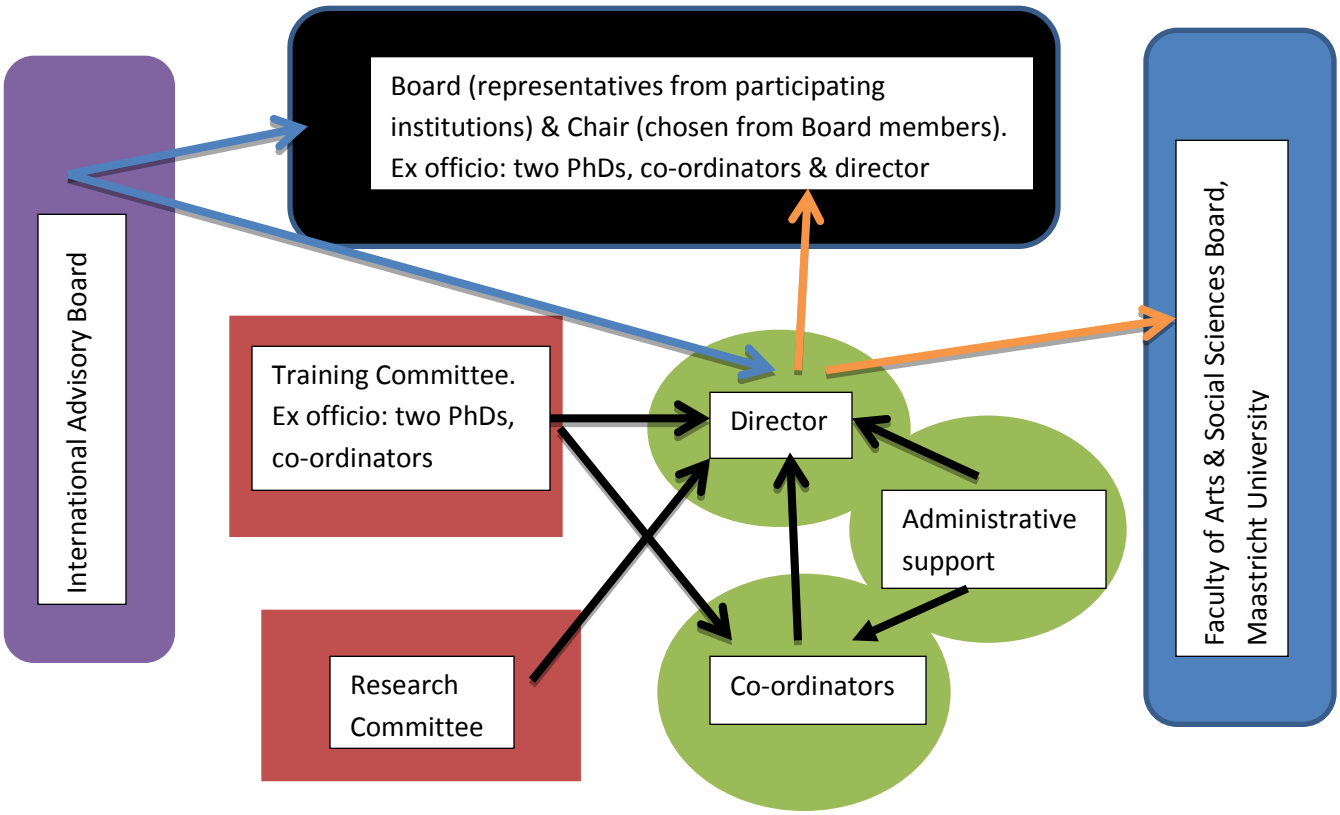
7. Publications, research evaluations, and prizes
   7a. Key publications by WTMC senior members, 2011-16 (separate document)
   7b. Edited volumes as history and exemplar of WTMC and of the field
   7c. Summary of the SEP evaluations of the institutes participating in WTMC
   7d. Awards & prizes bestowed upon WTMC, WTMC members & PhD candidates 2011-16

8. Annual Meetings & WTMC-funded Research Workshops

9. WTMC Members in Science Policy & Societal Organisations

During the meeting on 22-23 March 2017, paper copies of readers & completed dissertations will be available.

Appendix 1. Organogram of WTMC structure



Appendix 4a. WTMC training activities, 2011-16

2011

- Workshop 'STS goes Mental', 16-18 February - *29 participants: 27 WTMC and 2 external*
- Workshop 'Models and Simulation', 27-29 April - *30 participants: 26 WTMC and 4 external*
- Summer School 'Values and Infrastructure at Play', anchor teacher Professor Geoffrey Bowker, 22-26 August - *30 participants: 28 WTMC and 2 external*

2012

- Workshop 'Normativity as Object and as Practice, 25-27 April - *32 participants: 29 WTMC and 3 external*
- Workshop 'Science and Citizenship', 13-16 June - *26 participants: 23 WTMC and 3 external*
- Summer School 'Seeing through Numbers', anchor teacher Professor Helen Verran, 20-24 August - *31 participants: 26 WTMC and 5 external*
- Workshop 'Assessing Technology Assessment', 31 October-2 November - *28 participants: 22 WTMC and 6 external*

2013

- Workshop 'The Nature of Nature', 10-12 April - *29 participants: 28 WTMC and 1 external*
- Summer School 'Participation and the Politics of Difference', anchor teacher Professor Steven Epstein 26-30 August - *32 participants: 23 WTMC and 9 external*
- Workshop 'Publics, Problems, and Technologies', 6-8 November - *23 participants: 18 WTMC and 5 external*

2014

- Workshop 'Drawing the Line: Fraud and the Boundaries of Science', 15-17 April - *20 participants: 19 WTMC and 1 external*
- Summer School 'What is STS for? What are STS scholars for?', anchor teacher Professor Gary Downey, 7-11 July - *20 participants: 17 WTMC and 3 external*
- Workshop 'Language's Others', 22-24 October - *14 participants: 12 WTMC and 2 external*

2015

- Workshop 'Robots', 22-24 April - *19 participants: 15 WTMC and 2 external*
- Summer School 'Politics of Science, Technology, and STS', anchor teacher Professor Mark Brown, 24-28 August 2015 - *31 participants: 16 WTMC and 15 external*

- Autumn Workshop 'Future-Making', 21-23 October - *22 participants: 14 WTMC and 8 external*

2016

- Workshop 'Foucault's Legacy', 13-15 April - *27 participants: 18 WTMC and 9 external*
- Summer School 'Time and STS', anchor teacher Professor Ulrike Felt, 22-26 August - *21 participants: 16 WTMC and 5 external*
- Workshop '… AND COUNTING, Quantitative Research in and about STS', 7-9 December - *16 participants: 13 WTMC and 3 external*

Appendix 4b. WTMC Anchor Teachers, 1987-2017

Donald MacKenzie (1987)
Harry Collins (1988)
Roy Porter (1989)
Helga Nowotny (1990)
Steve Shapin (1991)
Bruno Latour (1992)
Brian Wynne (1993)
John Law (1994)
Trevor Pinch (1995)
Karin Knorr Cetina & Ted Porter (1996)
Donna Haraway (1997)
Sheila Jasanoff (1998)
Tom Gieryn (2000)
Aant Elzinga (2001)
Steve Woolgar (2002)
Lucy Suchman (2003)
Andrew Webster (2004)
Tom Misa (2005)
Susan Leigh Star (2006)
Steven Yearley (2007)
Andrew Feenberg (2008)
David Nye (2009)
Michael Lynch (2010)
Geoffrey Bowker (2011)
Helen Verran (2012)
Steve Epstein (2013)
Gary Downey (2014)
Mark Brown (2015)
Ulrike Felt (2016)
Christine Hine (2017)

Note: It is WTMC policy not to invite Dutch-based scholars to take on the role of anchor teacher. Dutch-based scholars regularly contribute via individual lectures at summer schools, workshops and dissertation days, as each event includes 4-6 guest lectures.

Appendix 5. (Research) MA/MSc Programs in STS and Innovation Studies, at Establishing Universities

Eindhoven University of Technology

Innovation Sciences, 2 years, international mobility

Maastricht University, Faculty of Health, Medicine & Life Sciences

Global Health, 1 year

Maastricht University, Faculty of Arts & Social Sciences

European Studies on Society, Science & Technology (ESST), 1 year, international mobility

Cultures of Arts, Science & Technology (CAST), 2 years

Radboud University Nijmegen

Science in Society, 2 years

Utrecht University, Faculty of Geosciences

Innovation Sciences (IS), 2 years

Sustainable Business & Innovation (SBI), 2 years

University of Twente, Faculty of Behavioural, Management and Social Sciences

Philosophy of Science, Technology and Society (PSTS), 2 years

VU University Amsterdam, Athena Institute

Management Policy Analysis and Entrepreneurship in the Health and Life Sciences, 2 years

Appendix 6. Completed dissertations, 2011-16

2011

Sjoerd Bakker, 15 April, Utrecht University, supervisor Harro van Lente, *Competing expectations. The case of the hydrogen car*

Haico te Kulve, 21 April, University of Twente, supervisor Arie Rip, *Anticipatory interventions and the co-evolution of nanotechnology and society*

Julia Quartz, 21 April, Maastricht University, supervisor Wiebe Bijker, *Constructing agrarian alternatives; how a creative dissent project engages with the vulnerable livelihood of marginal farmers in South India*

Martin Ruivenkamp, 21 April, University of Twente, supervisor Arie Rip, *Circulating images of nanotechnology*

Clare Shelley-Egan, 13 May, University of Twente, supervisor Arie Rip, *Ethics in practice*

Anneloes Roelofsen, 23 June, VU Amsterdam, supervisor Joske Bunders, *Exploring the future of ecogenomics responding to an evolving problematic situation of nanotechnology in society*

Louis Neven, 1 September, University of Twente, supervisor Nelly Oudshoorn, *Representations of the old and ageing in the design of the new and emerging*

Anne-Charlotte Hoes, 14 December, VU Amsterdam, supervisor Joske Bunders, *Inside the black box of agricultural innovation projects*

Roy Kloet, 22 December, VU Amsterdam, supervisor Joske Bunders, *Realizing societal ambitions in innovative research programs. The case of the Dutch Ecogenomics Consortium*

2012

Yvonne Jansen, 2 March, Erasmus Universiteit Rotterdam, supervisor Roland Bal, *Pragmatic trials; the mutual shaping of research and primary health care practices*

Erwin van Rijswoud, 8 March, Radboud University Nijmegen, supervisor Hub Zwart, *How does science-based public expertise evolve in a society in which this expertise, for a variety of reasons, has become both indispensable and contested?*

Alireza Parandian, 12 March, Delft University of Technology, supervisor Theo Toonen, *Constructive TA of newly emerging technologies. Stimulating learning by anticipation through bridging events*

Alexandra Supper, 6 June, Maastricht University, supervisor Karin Bijsterveld, *Sonification of science: A trading zone between science and art*

Federica Lucivero, 19 July, University of Twente, supervisor Philip Brey, *Molecular diagnostics: Towards a realistic form of ethical technology assessment*

Steven Dorrestijn, 10 October, University of Twente, supervisor Hans Achterhuis, *The design of our lives. Technical mediation and subjectivation after Foucault*

Iris Wallenburg, 31 October, Erasmus University Rotterdam, supervisor Pauline Meurs, *The modern doctor. Unraveling the practices of residency training reform*

Johanna Höffken, 12 December, Maastricht University, supervisor Wiebe Bijker, *Power to the people? Civic engagement with small-scale hydroelectric plants in India*

Marieke Hendriksen, 18 December, Leiden University, supervisor Rob Zwijnenberg, *Aesthesis in anatomy: Materiality and elegance in the eighteenth-century Leiden Anatomical Collections*

Jenny Boulboullé, 20 December, Maastricht University, supervisor Rob Zwijnenberg, *In touch with life; investigating epistemic practices in the life sciences from a hand-on perspective*

Matthijs Kouw, 20 December, Maastricht University, supervisor Sally Wyatt, *Pragmatic constructions. Simulation and the vulnerability of technological cultures*

2013

Jonna Brenninkmeijer, University of Groningen, supervisor Trudy Dehue, *Brain technologies of the self. How working on the self by working on the brain constitutes a new way of being oneself*

Joeri Bruynincks, 19 April, Maastricht University, supervisor Karin Bijsterveld, *Sound science recording and listening in the biology of bird songs 1880-1980*

Lise Bitsch, 24 May, University of Twente, supervisor Stefan Kuhlmann, *Spaces of genomics: Exploring the innovation journey of genomics and common disease research*

Anne-Lorène Vernay, 28 May, Delft University of Technology, supervisor Hans de Bruijn/Karel Mulder, *Circular urban systems - Moving towards systems integration*

Inge Ulnicane-Ozolina, 21 June, University of Twente, supervisor Stefan Kuhlmann, *Influence of institute governance on international research collaboration: Towards a typological theory*

Hieke Huistra, 11 September, Leiden University, supervisor Rob Zwijnenberg, *Preparations on the move. The Leiden Anatomical Collections in the nineteenth century.*

Sabrina Sauer, 18 September, University of Twente, supervisor Nelly Oudshoorn, *User innovativeness in Living Laboratories - Everyday user improvisations with ICTs as a source of innovation*

Joyce Zwartkruis, 11 October, Utrecht University, supervisor Ellen Moors/Harro van Lente, *Framing in innovation. Towards sustainable agro-food systems*

Tjerk Timan, 6 November, University of Twente, supervisor Nelly Oudshoorn, *Changing landscapes of surveillance*

Sonja Jerak-Zuiderent, 15 November, Erasmus University of Rotterdam, supervisor Roland Bal, *Generative accountability. Comparing with care*

Lotte Krabbenborg, 29 November, University of Groningen, supervisor Arie Rip/Menno Gerkema, *Involvement of civil society actors in nanotechnology: Creating productive spaces for interaction*

Jasper Aalbers, 10 December, Maastricht University, supervisor Karin Bijsterveld, *Echoes of the city. Staging the urban soundscape in fiction film*

2014

Annelies Jacobs, 15 January, Maastricht University, supervisor Karin Bijsterveld, *Het geluid van gisteren. Waarom Amsterdam vroeger ook niet stil was*

Jess Bier, 3 April, Maastricht University, supervisor Sally Wyatt, *Mapping Israel, mapping Palestine: How segregated landscapes shape scientific knowled*ge

Lucie Dalibert, 10 April, University of Twente, supervisor Peter-Paul Verbeek, *Posthumanism and somatechnologies: Exploring the intimate relations between humans and technologies*

Inge Mutsaers, 17 June, Radboud University Nijmegen, supervisor Hub Zwart, *Immunisation and its discontents. An analysis of the use and usefulness of immunological models in political philosophy*

Fabian de Kloe, 18 June, Maastricht University, supervisor Wiebe Bijker, *Constructing worlds with words; science and international language in the early twentieth century*

Marlous Arentshorst, 1 October, VU Amsterdam, supervisor Joske Bunders, *Future visions of medical neuroimaging. The challenge of realising responsible research and innovation*

Sanne van der Hout, 6 October, Radboud University Nijmegen, supervisor Hub Zwart, *It's alive! Ecological genomics and the promise of a new relationship with nature*

Felix Schirmann, 9 October, University of Groningen, supervisor Trudy Dehue, *The good, the bad, and the brain: Theory and history of the neuroscience of morality*

Rosanne Edelenbosch, 16 December, VU Amsterdam, supervisor Jacqueline Broerse, *Deliberating neurotechnologies for education. Facilitating frame reflection*

2015

Ivo Maathuis, 22 January, University of Twente, supervisor Nelly Oudshoorn, *Technologies of Compliance? Telecare technologies and self-management of chronic patients*

Marijke Hermans, 6 February, Maastricht University, supervisor Marjolein van Asselt, *Engaging with risks. Citizens, science and policy in mobile phone mast siting controversies*

Dirk Haen, 13 March, Maastricht University, supervisor Tsjalling Swierstra, *The politics of good food. Why food engineers and citizen-consumers are talking at cross-purposes*

Esther van Loon, 20 May, Erasmus University Rotterdam, supervisor Roland Bal, *Reflexive standardization and standardized reflexivity*

Wolfgang Kaltenbrunner, 25 May, Leiden University, supervisor Paul Wouters, *Reflexive inertia: Reinventing scholarship through digital practices*

Inge Lecluijze, 4 November, Maastricht University, supervisor Klasien Horstman, *The wrong tool for the job: The introduction of the Child Index in Dutch child welfare*

Boukje Huijben, 1 December, Eindhoven University of Technology, supervisor Geert Verbong, *Mainstreaming solar: PV business model design under shifting regulation regimes*

Bethany JoAnn Hipple Walters, 4 December, Erasmus University Rotterdam, supervisor Roland Bal, *Managing the chronic: Investigating chronic disease management in the Netherlands*

2016

Meggie Pijnappel, 4 February, Radboud University Nijmegen, supervisor Hub Zwart, *Lost in technification. Uncovering the latent clash of society values in Dutch public policy discourse on animal-testing alternatives*

Colette Bos, 5 February, Utrecht University, supervisor Harro van Lente, *Articulation. How societal goals matter in nanotechnology*

Suyash Jolly, 18 February, Eindhoven University of Technology, supervisor Rob Raven, *Collective institutional entrepreneurship for fostering sustainable energy transitions in India*

Frans Sengers, 18 February, Eindhoven University of Technology, supervisor Rob Raven, *Transforming transport in Thailand: experimenting for transitions to sustainable urban mobility*

Carla Alvial Palavicino, 25 February, University of Twente, supervisor Stefan Kuhlmann, *Mindful anticipation. A practice approach to the study of emergent technologies*

Koen Dortmans, 26 February, Radboud University Nijmegen, supervisor Tsjalling Swierstra, *Behind the scenes of life sciences on stage*

Trust Saidi, 10 March, Maastricht University, supervisor Wiebe Bijker, *Travelling nanotechnologies*

Pankaj Sekhsaria, 10 March, Maastricht University, supervisor Wiebe Bijker, *Enculturing innovation. Indian engagements with nanotechnology*

Koen Beumer, 10 March, Maastricht University, supervisor Wiebe Bijker, *Nanotechnology and development. Styles of governance in India, South Africa, and Kenya*

Annapurna Mamidipudi, 14 April, Maastricht University, supervisor Wiebe Bijker, *Towards a theory of innovation in handloom weaving in India*

Joost van Driessche, 9 June, University of Groningen, supervisor René Boomkens, *Muishond*

Evelien de Hoop, 27 October, Eindhoven University of Technology, supervisor Koen Frenken, *Material voices. Articulating democracy through biodiesel's socio-material entanglements in India*

Alejandro Balanzo Guzman, 24 November, Twente University, supervisor Stefan Kuhlmann, *Unfolding Capacity. Strategies of farmers, organizations as change agents*

Marjolein de Boer, 14 December, Maastricht University, supervisor Klasien Horstman, *Extended bodies. An empirical-philosophical study to women's bodily experiences in breast cancer*

Bart van Oost, 20 December, Maastricht University, supervisor Wiebe Bijker, *Our climate, our underground. Understanding the slow implementation of carbon capture and storage*

Appendix 7b. Edited volumes as history and exemplar of WTMC and of the field

Edited volumes have been and continue to be extremely important to the development of science, technology and innovation studies (STIS). Edited volumes are often undervalued and under-rated in formal evaluations, but in the spirit of defining our own criteria for excellence (Irwin reference), we want to draw attention to some of the many edited volumes in which WTMC members have been involved, as editors, contributors and series editors. We start at the beginning, with a volume that quickly established itself as part of the canon, namely *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, edited by Wiebe Bijker, Thomas Hughes and Trevor Pinch, first published by The MIT Press in 1987 and re-issued 25 years later in 2012.

In 1984 an international workshop on the social construction of technology was held at Twente University. It brought together most of the Dutch technology-studying STS researchers together with their counterparts from the UK, US, France and Germany. The workshop led to the publication of an edited volume in 1987, which came to be known as "the school-bus book", because of its yellow and black striped cover. Parallel to the making of that volume and largely by the same people, the ancestor network of WTMC was being created (see Introduction).

The school-bus book has achieved a somewhat iconic status since its publication. In a preface to the anniversary edition of 2012, Deborah G. Douglas writes: 'The ideas of this book are everywhere. Collectively, the authors of these essays have captured the most ancient and most modern notions of history and the telling of the story of technology. It is, quite simply, a treasure (p.vii).' She recalls the impact the volume had on graduate students: '"Combustible", "constructive", "catalytic", and "creative" were the alliterative quartet of adjectives that I wrote down in my seminar notes in the fall of 1987. The book was hot off the press when Professor Arnold Thackray assigned it to all incoming graduate students in the introductory seminar of the History and Sociology of Science Department at the University of Pennsylvania' (p.vii). Douglas goes on to acknowledge that the volume was as irritating to some readers as it was exhilarating to others, but then concludes about the institutional impact of the volume: 'Whether or not one agrees with the ideas of social construction, the certainty and power with which anyone today can claim to being a scholar of technology owes much to this book' (p.viii). The volume was included in the list of thirty most influential titles ever published by The MIT Press, and displayed at the MIT Museum as part of the MIT's 150th anniversary celebration.

The edited volume also led to The MIT Press establishing the 'Inside Technology' book series. Larry Cohen, editor at The MIT Press, argued: 'What I knew of the sociology and philosophy of science and technology at the time did not excite me. What we needed, I thought, was a new sort of rubric for publishing about science and engineering. What I saw in [the volume] *SCOTS* was the map to that new program' (p.xiii). For Cohen, a key characteristic of the book that convinced him to establish the new STS book series—and a characteristic that also describes WTMC—was 'the integration of empirics and theory: the authors in the volume, if they did nothing else, all had compelling stories to tell. What appealed to me in SCOT was that it provided a set of tools for structuring the telling of complex stories. But the stories were what ultimately mattered, and that is why I always tried to put pressure on our authors to let their theory emerge from the story rather than having the story appear as a pendant to the theory' (p.xiii).

The ‘Inside Technology’ series has been an important source of inspiration for many cohorts of WTMC researchers, both for the fine books published and as a possible outlet for their own work. At the end of 2016, the series had published 75 titles, 13 of which (17%) are by WTMC members.
Edited volumes continue to play an important role in the development of the field. One recent example is given below.

Emerging Technologies for Diagnosing Alzheimer's Disease. Innovating with Care. Marianne Boenink, Harro van Lente & Ellen Moors (eds) Palgrave Macmillan, 2016

This book explores international biomedical research and development on the early diagnosis of Alzheimer's disease. It offers timely, multidisciplinary reflections on the social and ethical issues raised by promises of early diagnostics and asks under which conditions emerging diagnostic technologies can be considered a responsible innovation. The contributors provide an overview and a critical discussion of recent developments in biomedical research on Alzheimer's disease, and explore the values at stake in current practices of dealing with Alzheimer's disease and dementia. Novel diagnostic technologies for Alzheimer's disease emerge in a complex and shifting field, full of controversies. Innovating with care requires a precise mapping of how concepts, values and responsibilities are filled in through the confrontation of practices. The volume offers a practice-based approach to responsible innovation that is also applicable to other fields of innovation. The book grew out of a workshop, itself part of a project funded by the Responsible Innovation programme of NWO. This was a multidisciplinary collaboration, a requirement of the funding that was facilitated by WTMC. The funding supported two PhD projects. Contributors to the workshop and the book include not only those directly working on the project but also other WTMC members and non-Dutch based researchers.

This book was discussed at the 2016 WTMC Annual Meeting. These meetings often feature discussions of recent books, both monographs and edited volumes. Since 2011, in addition to the above volume, the following edited volumes have been on the programme:

- Dijstelbloem, H. & Meijer, A. (eds) (2011) *Migration and the New Technological Borders of Europe.* Palgrave Macmillan
- Egyedi, T. & Mehos, D. (eds) (2012) *Inverse Infrastructures: Disrupting Networks from Below*. Edward Elgar
- Hazareesingh, S. & Maat, H. (eds) (2016) *Local Subversions of Colonial Cultures; Commodities and Anti-commodities in Global History.* Palgrave MacMillan
- Hilgartner, S., Miller, C. & Hagendijk, R. (eds) (2015) *Science and Democracy. Making Knowledge and Making Power in the Biosciences and Beyond*. Routledge
- Wouters, P., Scharnhorst, A., Beaulieu, A. & Wyatt, S. (eds) (2013) *Virtual Knowledge. Experimenting in the Humanities and Social Sciences*. The MIT Press

Appendix 7c. Summary of the SEP evaluations of the institutes participating in WTMC

Each criteria is scored on a 5-point scale, where 5 is best (except Leiden – see Notes).

Name	Year	Quality	Productivity	Relevance	Viability
TUE – modern societies in transition	2010	4.75	5	5	4.75
TUE – systems innovation & sustainability	2010	4	4.5	4.5	3.5
Leiden – CWTS – see Notes	2016	2	not applicable	1	2
Utrecht – innovation studies	2014	4.5	5	5	5
Maastricht – health, ethics, society	2010	5	5	5	4
Maastricht – STS	2010	5	5	5	5
Twente – philosophy	2013	4	4	5	5
Twente – STePS	2014	5	5	5	3/4
EUR – iBMG	2013	5	5	5	5
VU University – Athena Institute	2009	4	4	5	3.5
Radboud University Nijmegen – ISIS	2013	3.5	4	5	3.5

Notes:

- The Rathenau Institute is not evaluated according to the SEP (Standard Evaluation Protocol), given its governmental advisory role. It was last evaluated in 2013, for the period 2006-2011, and received a positive evaluation.
- Wageningen is not included as there are very few WTMC members based in Wageningen.
- Leiden (CWTS) was evaluated according to the new SEP, in which productivity is no longer included as a separate criterion. The new SEP uses a 4-point scale, and 1 is the highest.

Appendix 7d. Awards & prizes bestowed upon WTMC, WTMC members & PhD candidates 2011-16

Award for WTMC as a whole

- Inaugural 4S Infrastructure Award, 4S, 2016

Awards for PhD candidates

- **Joeri Bruyninckx**: Nicholas Mullins Prize for best student paper, 4S, 2012 - 'Sound Sterile: Making Scientific Field Recordings in Ornithology', in the *Oxford Handbook of Sound Studies*
- **Jess Bier**: Student Paper Prize of the Middle East Section (MES) of the American Anthropological Association (AAA), 2013 - 'The Colonizer in the Computer: The British and Israeli Influence on Palestinian Authority Cartography in the West Bank'
- **Felix Schirmann**: Studieprijs Stichting Praemium Erasmianum, 2015 – for his PhD dissertation *The Good, the Bad, and the Brain: Theory and History of the Neuroscience of Morality*
- **Inge Lecluijze, Bart Penders**, Frans Feron & **Klasien Horstman**: Diana Forsythe Award 2015 from the American Medical Informatics Association (AMIA) - for the article (2014) 'Infrastructural Work in Child Welfare: Incommensurable politics in the Dutch Child Index', *Scandinavian Journal of Information Systems* 26(2): 31–52
- **Mayli Mertens**: Award for Best Formal Paper by a Graduate Student, Association for Practical and Professional Ethics (APPE), 2016 – 'Objectivity Beyond the Red Line: A case for binocularity in war reporting'
- **Jess Bier**: Award for Best Dissertation, Maastricht University, 2016 (for dissertations defended in 2014 & 2015), *Mapping Israel, mapping Palestine: How segregated landscapes shape scientific knowled*ge

Awards, prizes & honours for senior members

- **Annemarie Mol**: Spinoza Prize 2012, highest scientific honour in the Netherlands awarded by the Netherlands Organisation for Scientific Research (NWO)
- **Rob Raven**, Jochen Markard & Bernhard Truffer: Christopher Freeman Prize, EASST, 2012 – for the section on 'Sustainability Transitions', *Research Policy*
- **Niki Vermeulen**, Sakari Tamminen & Andrew Webster: Olga Amsterdamska Prize, EASST, 2012 - for the book *Bio-Objects, Life in the 21st Century*, Routledge
- **Wiebe Bijker**: Leonardo da Vinci Medal 2012, awarded by the Society for the History of Technology for his 'outstanding contribution to the history of technology'
- **Nelly Oudshoorn:** Foundation for the Sociology of Health and Illness (FSHI) book prize, 2012 - for *Telecare Technologies and the Transformation of Healthcare*, Palgrave Macmillan
- **Peter-Paul Verbeek**: Professor Roger Borghgraef Prize in Biomedical Ethics, awarded by KU Leuven, 2012
- **Simone van der Burg:** Oréal-UNESCO for Women in Science Programme, l'Oréal Nederland and UNESCO Nederland, 2014
- **Ernst Homburg:** American Chemical Society's Historical Division Award for Outstanding Achievement in the History of Chemistry, 2014

- **Cyrus Mody** & Andrew Nelson: Distinguished Contribution to Electrotechnical History, IEEE/Society for the History of Technology, 2014

- Diana Hicks, **Paul Wouters,** Ludo Waltman, **Sarah de Rijcke** & Ismael Rafols: John Ziman Prize, EASST, 2016 – for "The Leiden Manifesto for Research Metrics", *Nature,* 520 (7548): 429-431 (2015)
- Sampsa Hyysalo, Torben Elgaard Jenssen & **Nelly Oudshoorn:** Christopher Freeman Award, EASST, 2016 - for *The New Production of Users,* Routledge (editors, 2016)
- **Arie Rip:** 4S Mentoring Award, 4S, 2016
- **Peter-Paul Verbeek**: World Technology Award in Ethics, 2016

- **Karin Bijsterveld** & **Annemarie Mol:** members of the Royal Netherlands Academy of Arts and Sciences (KNAW)
- **Raf de Bont & Peter-Paul Verbeek:** members of Young Academy of the KNAW
- **Karin Bijsterveld & Peter-Paul Verbeek**: members of *Koninklijke Hollandsche Maatschappij der Wetenschappen*/Royal Holland Society of Sciences and Humanities
- **Anna Harris:** member of Global Young Academy
- **Sarah de Rijcke:** member of Young Academy of Europe

Appendix 8. Annual Meetings and WTMC-funded Research Workshops

Annual meetings, 2011-16 (all held in Amsterdam)

Note: Full Annual Meeting Programmes are included on USB stick.

Date	Number of participants
8-9 December 2011	53
13-14 December 2012 – 25th anniversary conference	67
28-29 November 2013 – including meeting with International Advisory Board	59
20-21 November 2014	59
11 December 2015	55
25 November 2016	58

Workshops funded by WTMC, 2011-16

Title of event, date	Organiser, university	WTMC contribution
Hotspots of Development: places and spaces, movement and connections, 12-14 December 2011	Dr Rob Hagendijk, University of Amsterdam Dr Harro Maat, Wageningen University	€4,000
Neurodevices, 15-16 September 2011	Prof. Trudy Dehue, University of Groningen	€2,057
Understanding research coordination, 14-15 March 2012	Prof. Barend van der Meulen, Rathenau Institute	€2,217
Global Health and STS, 12-13 November 2012	Dr Nora Engel, Maastricht University	€4,950
The Politics of Visualisation, 28-29 May 2015	Prof. Huub Dijstelbloem, *Wetenschappelijke Raad voor het Regeringsbeleid*/University of Amsterdam	€3,000

Appendix 9. WTMC Members in Science Policy & Societal Organisations

NWO (Netherlands Organisation for Scientific Research) & ZonMw (Netherlands Organisation for Health Research and Development)

- Roland Bal, Chair Methodology program prevention research, ZonMw, 2010-2013
- Wiebe Bijker, Chair of the Board of NWO-WOTRO Science for Global Development (2013-2017)
- Huub Dijstelbloem, member of Steering Group 'Omstreden democratie' (2010-2014)
- Koen Frenken, member of Complexity committee (2009-continuing)
- Johanna Höffken, member of newly established 'Jong NWO-MVI platform' (2016-2018)
- Klasien Horstman & Paul Wouters, members of Programme Committee, Fostering Responsible Research Practices, ZonMW (2016-)
- Harro van Lente, Henny Romijn, Tsjalling Swierstra & Peter-Paul Verbeek, members of the Advisory Board for NWO Responsible Innovation programme (MVI), (various years)
- Sally Wyatt, member of Permanent Committee for Large-scale Scientific Infrastructure (2015-continuing)

In addition, many WTMC members have participated in committees that decide on funding applications, including the Veni, Vidi, Vici scheme, the Talent scheme for new PhDs, and the Humanities Investment Committee.

Other science policy

- Stefan Kuhlmann, Scientific Advisory Board of German Federal Report on Next Generation Scientists 2017 (*Bundesbericht Wissenschaftlicher Nachwuchs 2017*), 2014-2017
- Paul Wouters, member of the EU Expert Group on Altmetrics (2016-2017)
- Paul Wouters, member KNAW steering group Quality Indicators for the Humanities (2012-2014)
- Sally Wyatt, Member of KNAW Committee for Big Data (2015-2017)

Other government policy

- Roland Bal, Chair supervisory committee 'Public disclosure of supervisory reports', Healthcare Inspectorate (2012-2013)
- Wiebe Bijker, member Health Council of the Netherlands (2008-2016)
- Jacqueline Broerse, member, Advisory Board Dutch Medicines Evaluation Board (CBG – *College Beoordeling Geneesmiddelen*) (2013-continuing)
- Jacqueline Broerse, member, Working Group Patient Participation, Dutch Clinical Trials Foundation (2010-present)
- Klasien Horstman, member, Scientific Advisory Board RIVM *Verkenningen Toekomst Volksgezondheid* (2010-2014)

- Barend van der Meulen, Member of *Raad voor Cultuur, commissie kennisinfrastructuur* (Council for Culture, panel knowledge infrastructure)

Societal organisations

- Roland Bal, Member of Board, Care Portal Rotterdam, 2009-2012
- Koen Beumer, Editor and author of Sciencepalooza.nl (popular science blog) (since 2008)
- Jess Bier, Cartographer for Nepal Earthquake Task, Humanitarian Open Street Map Team (2015)
- Antoinette de Bont Member of the supervisory board of the Dutch Knowledge Centre for Youth Health Care
- Koen Frenken, Socio-Economic Council (SER), Member of Robotization committee, 2015-2016
- Anna Harris, Steering Committee, Masters in Dramatic Arts, ToneelAcademie, Maastricht, Netherlands (2016-continuing)
- Ernst Homburg, member Supervisory Board Museumplein Limburg (formerly Continium) (Kerkrade) (2011-2016)
- Ernst Homburg, member, Erfgoed Platform Limburg (Roermond) Member (2015-continuing)
- Jessica Mesman Member of the 'de 7 Dwergen', independent think tank on patient safety (2009-continuing)
- Annalisa Pelizza, International Advisory Board for Digital Communities, Prix Ars Electronica Linz (2006-2013)
- Vivian van Saaze, member Wetenschappelijk Advies Raad, Limburgs Museum, Venlo
- Jo Wachelder, Chair of the Scholarly Advisory Board of Limburgs Museum, Venlo, (2006-2014)
- Paul Wouters, Judge of the MacArthur Foundation's 100&Challenge competition for $100 million grant to solve a critical social problem

This list does not include the many committees in which WTMC members participate in their own institutions, nor does it include evaluation and review activities.