



RESEARCH ASSESSMENT

WAGENINGEN INSTITUTE FOR
ENVIRONMENT AND CLIMATE
RESEARCH, 2014-2020

**WAGENINGEN UNIVERSITY &
RESEARCH**

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This report was finalised on 27 September 2021

PREFACE

The committee enjoyed the interesting discussions and exchanges with members of the WIMEK clusters. Complex environmental challenges can only be mastered by inter-and transdisciplinary approaches. The mission of WIMEK is therefore timely and of high scientific and societal relevance. The clusters are well-positioned to achieve high impact results, especially if opportunities for collaboration within and across clusters are realized. The committee has been impressed by the high scientific quality of the work and the results that have already been achieved. We also acknowledge that WIMEK offers an inspiring environment for early career researchers.

We would like to thank WIMEK and Qanu for the excellent preparation and support throughout the review process. All committee members regretted that it was not possible to be there in person and engage in many informal conversations. But the overall setting of the digital interactions made the most of this situation. And fewer trips are also beneficial in reducing CO₂ emissions.

We wish WIMEK every success in the future and hope that our review will contribute to further improve the excellent work.

Prof. Claudia Pahl-Wostl
Chair



EXECUTIVE SUMMARY AND MAIN RECOMMENDATIONS

The committee found that on the whole WIMEK has managed to create a brilliant mind-hub for junior researchers, with on the whole impressive research quality and societal impact. Overall, the committee encountered a good, safe, and interacting atmosphere within the clusters. It considers it quintessential to preserve this atmosphere in the coming years. An issue that all clusters seem to grapple with to some extent is the ambition and necessity to stimulate collaboration across disciplines. Also, for all clusters a long duration of PhD trajectories is on the agenda, although it was not always identified as a major problem by PhD candidates themselves. Societal impact becomes more and more important for funding agencies, for the assessment of research organizations and for individual careers. However, the committee found that societal impact seems not yet to be sufficiently recognized in tenure track criteria. For all clusters, this seems to get in the way of truly boosting societal impact.

The committee found that the **Climate, Water & Society** (CWS) is a diverse cluster with a broad scientific focus, very topical expertise and excellent research. However, the committee found that the cluster's vision on where it wants to go is not yet fully articulated. It struck the committee that many of the CWS cluster's most influential publications are about transdisciplinary topics. It is therefore appropriate that the cluster strives to increase collaboration between groups, and the committee fully endorses this ambition. The biggest challenge for the CWS cluster is to set priorities. The committee observed that the CWS cluster makes excellent contributions to society at different levels, from the municipal to the international scale. If the cluster succeeds in its ambition to create more inter- and transdisciplinarity, this will allow it to have more direct relevance for a variety of stakeholders, and thus increase its impact even further. It would also help to incorporate more social sciences expertise. Currently, the societal dimension is prominent in the CWS cluster's mission, but weaker in the actual research activities and not entirely integrated. PhDs candidates within the CWS cluster experience a lot of room for creative input into their own trajectory. However, the flipside of the freedom they have is that they find it sometimes difficult to plan and finish their theses in time. The CWS cluster correctly identifies a lack of diversity in the tenured staff as one of its weaknesses. Overall, the committee was impressed by the high quality of research and impact within the cluster.

The **Soil Sciences cluster** is one of the top research and student education centres of excellence globally in soil science. The committee finds that the cluster has a clear and fitting mission. As with the CWS cluster, the intended future destination is less clear. By leading a number of large international projects over the past six years, the Soil cluster has demonstrated its ability to act as initiator of multidisciplinary and transdisciplinary projects with scientists, governmental institutions, land user associations, farmers, NGO's and other relevant stakeholders. These and other projects have resulted in many highly-quality publications that are often used by researchers within the field. The globally leading position of the Soil cluster and its strong relationships with the Dutch government, the EU and UN bodies places it in a uniquely strong position. It could and should, in the committee's view, deploy leadership activities that could build on this position. The committee got a very favorable impression of PhD supervision in the Soil cluster. It sensed a true feeling of excitement about the future. This will be a powerful motor.

In the cluster **Environmental Technology and Microbiology** (ETM), the themes of the three chair groups are very well aligned with global trends in circular economy and sustainability. The committee appreciates that the cluster is trying to open up new fields, and even to change established paradigms. The committee fully agrees with the 'science for impact' and 'from principles to technology' strategy and thinks that such a strategy can be very fruitful. ETM's field of research is a strategic priority in The Netherlands and across Europe, North America and East Asia. ETM's infrastructure will therefore likely be in substantial demand. According to the committee, expanding the use of its excellent infrastructures can have multiple benefits. However, the cluster will need to shape its proposition to the requirements of industry, and market its capabilities. The committee found that the ETM cluster has done well in the past six years in terms of research quality, but noted that both productivity and the use of research products by peers seems to have declined in the past years. This phenomenon need not be directly related to research quality, but there is cause for vigilance. Thanks to the excellent relations of ETM at different levels of private and public



society, stakeholders are strongly involved in the design and execution of ETM research. This is worth a compliment. Over the years, the ETM cluster has achieved world-class results in transferring technology, but the committee thinks ETM has the potential to realise even more impact. On some points, the PhD supervision at ETM could be improved, in the committee's view. It found that the frequency of supervision per PhD student varies widely, depending on the supervisor.

The committee finds that the cluster **Landscape Architecture and Spatial Planning** (LSP) has a well-articulated and unique mission. The cluster's transdisciplinary approach is well-timed and essential in order to deal with the urgent challenges to land use and landscape architecture. Development of innovative concepts and methods concerning landscapes is currently in high demand, both from the scientific and the policy communities. It is often advocated but hardly ever accomplished. The research quality of the LSP cluster has improved significantly in the past couple of years, and it has grown significantly both in number of staff and in number of publications. The LSP cluster puts a strong emphasis on transdisciplinary projects, with broad participation of citizens, local authorities, politicians, NGOs, farmers and other local commercial parties; it embraces the cooperation of academia, government, companies and civil society. The committee finds these practices exemplary. The remarkable success in recent years suggests an open and collaborative environment. The LSP cluster is a diverse community in terms of gender as well as age, nationality and scientific background. This diversity is essential for fulfilling its complex tasks. The cluster is therefore in an excellent position to do innovative and internationally highly visible research. The committee fully agrees with the cluster that after this recent renaissance it is now time to consolidate, identify its unique selling points and develop new strategies to reach its goals.

Main Recommendations

To WIMEK as a whole, and Wageningen University and Research:

- Give the WIMEK clusters a helping hand in stimulating exploratory interdisciplinary and transdisciplinary, high-risk research with high impact, to ensure that this kind of research becomes more structurally embedded.
- Be aware that interdisciplinary and practice-oriented research cannot be directly compared with single-disciplinary research. The criteria for the assessment of academic outputs should therefore be adapted.
- Share experiences on co-creation, in order to better understand the conditions under which participatory methods will have added value and lead to larger societal impact.
- Give junior researchers more accountability and acknowledgement for scientific advancement and highlight achievements at the junior level. This may ultimately encourage more junior researchers, and in particular female and non-Dutch academics, to look for long-term research opportunities at WIMEK.
- Prioritize the types of societal impact and then strive for explicit and objective recognition of societal impact and activities, to align human resource processes with organizational objectives.
- Avoid fierce competition between individual researchers, since this does not contribute to a happy working environment, fruitful collaboration, and productivity in general.
- Integrate supporting activities for PhD's (such as peer groups, buddy system, postdoc being coaches to PhDs) are well appreciated. It would be good to integrate such activities in a WIMEK-wide policy.
- Assess the needs of postdoctoral students and help them, for instance with career guidance tools.
- For all PhD projects, make ambition meet duration. This pertains both to the scope of the project and the number of papers needed to be able to graduate.
- Add intermediate milestones explicitly in PhD guidance and policy, particularly in the second and third year, where they are now lacking.
- Make sure that staff has sufficient time for mentoring and supervision.
- Set clear goals for the training of junior as well as senior scientists in research integrity.



To the cluster Climate, Water & Society (CWS)

- Embark on a focused effort to build a vision on where you want to be in six years. In doing so, look broader than just the water topic. Take into account your great expertise on for instance climate, energy storage systems, biodiversity, and pollution.
- Subsequently, determine what combinations of expertise are necessary to perform cutting-edge research with regard to the challenges you identified.
- Be bolder, and do not shy away from international ambitions
- Define stakeholder groups and processes more distinctly, and develop a strategy for interactions at the science-policy interface. This will lead to trans- or interdisciplinarity in a natural way.
- Give high priority to organizing the cross-disciplinary PhD activities you planned. Hire a staff member dedicated to improving funding for interdisciplinary research projects.
- Integrate social science and even humanities into the natural and life sciences.
- Put clear interventions and targets in place to hire and keep female and international full and associate professors.
- Train supervisors to intervene when PhD students are overambitious.

To the Soil Sciences Cluster:

- Embark on a dedicated collective effort to set priorities and operationalize indicators and processes to assess how things are developing. This will help you to get a stronger grip on the future and reinforce international leadership. Be ambitious on societal impact.
- Affirm your international stature by publishing a strategic paper on the role of soils in the UN's sustainable development goals.
- For inclusion, safety and equality, do not solely depend on an open culture but have some mechanisms in place that safeguard these aspects.
- Install targeted measures are required to encourage the promotion of females and internationals to the higher-ranking functions of associate and full professors.
- Guard the balance in the ratio between PhD candidates and experienced staff, in order to keep up PhD supervision at the present high level.

To the cluster Environmental Technology and Microbiology (ETM):

- Clearly articulate outcome expectations at the end of six years from a problem-solving perspective, to enhance your attractiveness both to potential staff members and to external partners and stakeholders.
- Seek more European leadership positions. This will help to build new projects and alliances, and also allow you to better showcase your excellent research infrastructures.
- Conduct strategic pre-market assessment research, to determine which of your strengths is in greatest demand. Consult your many private sector and government partners.
- Investigate whether it is possible to widen the range of your clients and possible markets.
- Be more inclusive towards young scientists from the Global South, who are normally severely resource-constrained.
- Investigate the underlying cause of declining productivity and use of research products by peers.
- Include more societal issues in your research programme, in collaboration with social scientists.
- Actively stimulate collaboration between cluster members.
- Make sure that every PhD candidate gets sufficient supervision. Consider working with external mentors.



To the cluster Landscape Architecture and Spatial Planning (LSP):

- Take a step back; analyze ongoing processes and networks carefully, as a base for identifying your unique selling points, setting priorities and selecting a few key opportunities to maximize societal impact.
- Put special funding mechanisms in place to stimulate collaboration across clusters, share best practices on how to do interdisciplinary research, organise seminars and institute advisory roles to stimulate interdisciplinarity in research projects.
- Consider collaborating with other research clusters within WIMEK, such as CWS and Soil, that both adopt a landscape approach in some research lines.
- Take up leadership in defining new collaborative research lines, as knowledge integrators and process designers, promoting the landscape approach as key to sustainability and resilience.
- Strengthen the methodological side of your research.
- Document your work in at least two key publications: one on conceptual foundations and another on the methodological mixed methods approach.
- Put further emphasis on the use of the agent-based models.
- Train supervisors to see it as their task to guard that PhD students do not do too much work, so that they stay on track.



1. PROCEDURE

1.1. Aims of the assessment

Wageningen University & Research (WUR) asked an assessment committee of external peers to perform an assessment of the research conducted at the Wageningen Institute for Environment and Climate Research (WIMEK) over the period 2014-2020. For this review, the university asked the committee to assess the quality of research as well as to offer recommendations for the following four clusters:

- Climate, Water and Society (CWS)
- Soil Science
- Environmental Technology and Microbiology (ETM)
- Landscape Architecture and Spatial Planning (LSP)

In accordance with the Strategy Evaluation Protocol 2021-2027 (SEP) for research reviews in the Netherlands, the committee was requested to carry out the assessment according to a number of guidelines. The evaluation was to include a backward-looking and a forward-looking component. The committee was asked to judge the performance of the unit on the main assessment criteria specified in the SEP and to offer its written conclusions as well as recommendations based on considerations and arguments. The main assessment criteria are:

- 1) Research Quality;
- 2) Societal Relevance;
- 3) Viability of the Unit.

During the evaluation of these criteria, the assessment committee was asked to incorporate four specific aspects relating to how the unit organises and actually performs its research, how it is composed in terms of leadership and personnel, and how the unit is run on a daily basis. These aspects are:

- 1) Open Science;
- 2) PhD Policy and Training;
- 3) Academic Culture;
- 4) Human Resources Policy.

In addition to these criteria specified in the Standard Evaluation Protocol, the board requested the committee to pay attention to the following additional questions and offer their assessment and recommendations:

Cluster CWS:

- *How can CWS further improve the inter- and transdisciplinarity in its research?*

Cluster ETM:

- *Does the committee see additional avenues to further promote our large and open access research facilities (ETE and MIB Lab facilities in general, and MODUTECH-UNLOCK more specific) in an international context?*

Cluster LSP:

- *How can LSP and its members capitalize on their strength and identity as 'projecting and transforming' disciplines in competition with other disciplines and achieve more academic recognition?*

The Soil Science cluster asked no additional question.



1.2. Composition of the committee

The composition of the committee was as follows:

- Prof. Claudia Pahl-Wostl, full professor for resources management at the Institute for Environmental Systems Research (USF) in Osnabrück (chair of the committee).
- Prof. Ingrid Sarlöv Herlin, head of the Department of Landscape Architecture, Planning and Management at the Swedish University of Agricultural Sciences (SLU) in Uppsala.
- Prof. Steven Banwart, holds the Leadership Chair in Integrated Soil / Agriculture / Water research and is director of the Global Food and Environment Institute at the University of Leeds.
- Prof. Juan Lema, professor of Chemical Engineering at Department of Chemical Engineering, University of Santiago de Compostela.
- Dr. Leena Srivastava, deputy director general for Science at the International Institute for Applied Systems Analysis (IIASA) in Vienna.
- Dr. Amy Lusher, research scientist at the Norwegian Institute for Water Research in Oslo.
- Dr. Guoyong Leng, senior researcher at the Environmental Change Institute (ECI) at the University of Oxford.
- Dr. Frank Dentener senior expert and group leader at the Joint Research Centre Ispra (JRC).
- Dr. Alexander Popp, senior scientist at the Potsdam Institute for Climate Impact Research (PIK).
- Sem Vijverberg MSc., PhD candidate at the Institute for Environmental Studies (IVM) at VU Amsterdam.

The committee was supported by Peter Hildering MSc., who acted as project manager on behalf of Qanu, and Mariette Huisjes MA who acted as secretary.

All members of the committee signed a statement of independence to guarantee an unbiased and independent assessment of the quality of the research performed by WIMEK. Personal or professional relationships between committee members and the research unit under review were reported and discussed at the start of the site visit amongst committee members. The committee concluded that no specific risk in terms of bias or undue influence existed and that all members were sufficiently independent.

1.3 Realization of the assessment outcome

The committee proceeded according to the SEP 2021-2027. Prior to the first meeting, all committee members independently formulated a preliminary assessment of the units under review based on the written information provided.

The final review is based on both the documentation provided by the Department and the information gathered during the interviews with management and representatives of the research unit during the online site visit. The online site visit took place on 31 May - 3 June 2021 (see the schedule in Appendix 2).

Prior to the interviews, the committee was briefed by Qanu about research reviews according to the SEP 2021-2027 and briefly discussed the preliminary findings. The committee also agreed upon procedural matters and aspects of the review. After the interviews it discussed its findings and comments in order to allow the chair to present the preliminary findings. The committee members then each contributed to the writing of the assessment report. The first draft of the report was finalized by the secretary and all committee members offered feedback, which was processed before a new draft was sent to WIMEK.

The draft report by the committee and secretary was presented to WIMEK for factual corrections and comments. In close consultation with the chair, the comments were reviewed to create the final report. The final report was presented to the Board of Wageningen University & Research and to the management of the research unit.



The committee used the criteria and categories of the Strategy Evaluation Protocol 2021-2027. For more information see Appendix 1.

1.4. Quality of the information

The committee received the following documents:

- The Self-Evaluation Report
- Overviews and data on selected performance indicators, including Case Studies
- The Terms of Reference;
- The SEP 2021-2027
- Information on staff, organization and policies of WIMEK and WUR

The committee was satisfied with the quality of the information received. The self-evaluation report, appendices and case studies painted a clear picture of the mission, strategy and accomplishments of WIMEK.



2. STRUCTURE, ORGANIZATION AND MISSION OF WIMEK

2.1. Introduction

The Wageningen Institute for Environment and Climate Research (WIMEK) is one of six Graduate Schools at Wageningen University & Research (WUR) and was founded in 1993. WIMEK aims to develop an integrated understanding of environmental change, its impact on the quality of life, and sustainability, and it offers solutions for environmental improvement. WIMEK combines fundamental, strategic and participatory research in environmental, climate and sustainability sciences, from both social and natural sciences perspectives. WIMEK is focussed on pressing environmental problems and sustainable solutions from a local to a global scale. The scientific expertise of researchers associated with WIMEK covers the environmental domains of soil, water, atmosphere, landscape, and spatial planning, as well as environmental governance, economics, policy, technology, microbiology and toxicology.

2.2 Strategy and mission

The main aims of the WIMEK graduate school are:

- To conduct high quality scientific research for impact at the global scientific forefront of environmental and climate research,
- To provide an inspiring tailor-made in-depth and skill-oriented training programme for PhD candidates and postdocs,
- To form an internal WUR interdisciplinary network and social community of staff, postdocs and PhD candidates on environmental, climate and related sustainability sciences,
- To work transdisciplinary, by exchanging emerging insights, recent research results and novel technological & policy approaches in an interactive way to companies, public institutions, regulating authorities and other parties in society.

In order to focus its research programme, WIMEK has identified three Grand Environmental Challenges, for which it aims to contribute to solutions. These are:

1. *Climate action*: towards fair and effective solutions for climate change mitigation and adaptation,
2. *Managing our future biosphere*: developing strategies for the sustainable use of soil, water, atmosphere, biodiversity, ecosystems and landscapes,
3. *Advancing circular systems*: inclusive innovation towards closed water, nutrient, and material flows.

These Grand Challenges are the basis of WIMEK's strategy. It promotes interdisciplinary and transdisciplinary research between chair groups on these challenges. Strategic activities to achieve this include providing seed money for grant applications, quality assurance of research performed on these topics, an honours programme in which talented master students take part in a grant competition for a PhD programme and the education and training of PhD students working on these challenges.

2.3. Management and organization

WIMEK is a graduate school, cross cutting the scientific departments at WUR, and is positioned as the horizontal bar in its matrix structure. As a graduate school for environment and climate research, WIMEK is responsible for PhD education and training in these fields, coordinating the development of a coherent research programme for environment and climate research, and to safeguard, monitor and stimulate the quality and progress of research by staff, postdocs and PhDs.



A Graduate School is research supportive and has no tasks and responsibilities in the formal management of human resources, finances, education at the bachelor and master level and research facilities. This is the responsibility of the chair groups, which are the foundational units for research and education at Wageningen University.

Nineteen chair groups participate in WIMEK, of which eleven with their full research capacity and eight with a limited number of senior researchers, postdocs and PhD candidates. Most of the chair groups participate in one of the following clusters:

- Climate, Water and Society (CWS)
- Environmental Technology and Microbiology (ETE-MIB)
- Landscape Architecture and Spatial Planning (LSP)
- Soil Science (Soil)
- Wageningen Centre of Sustainability Governance
- Section Economics

The function of the clusters is to bundle research expertise in a certain domain, to acquire a stronger strategic position, to share support staff and equipment when this is advantageous and to increase visibility. The clusters in turn are grouped in large science groups covering all of WUR. The WIMEK clusters under review in this report are part of the following science groups: Agrotechnology & Food Science, Environmental Sciences and Social Sciences.

The WIMEK management organization consists of a General Board, a Scientific Director and executive staff, an Education Committee, a PhD Council and an International Advisory Board. The Board is in charge of the development of the general policy and strategy of the Graduate School and decides on the budget. The Scientific Director is responsible for the daily management of the School. He or she prepares its long-term vision, its scientific direction and an action plan, and discusses this with the executive board of WUR and the science groups. The International Advisory Board advises WIMEK on strategy and research quality.

WIMEK receives a budget for the execution of its main tasks, and can use it to appoint staff, organize PhD education and training, and to promote its research programme through financial incentives. This budget is a percentage of the research revenues generated by the academic staff within the Graduate School.

2.4 Recommendations at the level of WIMEK and WUR

Inter- and transdisciplinarity

Stimulating the collaboration across disciplines is an ambition and necessity for all clusters within WIMEK. By combining expertise, they will be better equipped to respond to complex scientific and societal issues. At the same time, the committee concludes from the interviews that all clusters to some extent struggle to achieve this trans- and interdisciplinarity. The committee thinks that Wageningen University could give the WIMEK clusters (and in all probability other units within the university as well) a helping hand. This could for instance have the form of giving more incentives for collaboration between chair groups at cluster level, such as additional dedicated funds for seed projects. In this or another way Wageningen University could promote exploratory interdisciplinary and transdisciplinary, high-risk research with high impact, and ensure that this kind of research becomes more structurally embedded, and not only happens ad hoc when individual researchers see a shared opportunity. In addition, the committee recommends awareness that interdisciplinary and practice-oriented research cannot be directly compared with the performance of single-disciplinary research. The ongoing development of changing criteria for the assessment of academic outputs – a move from quantitative to qualitative performance indicators – is in line with this.

The university could also support the clusters in identifying target audiences and performing stakeholder analyses. Clusters are not specialized in this kind of work and being professionally facilitated will contribute to a more strategic vision at cluster level on potential chances that could both increase impact and stimulate scientific innovation.



With regard to inter- and transdisciplinarity, the committee is enthusiastic about the 'landscape approach' developed by the LSP cluster. The cluster collects and integrates knowledge from various academic disciplines and stakeholder perspectives and translates this knowledge into solutions for current and future problems. This approach could be a source of inspiration for other clusters.

2.5 Recommendations for all clusters

Talent management

The committee found that WIMEK has managed to create a brilliant mind-hub with their junior researchers. The challenge is then to hold on to some of this talent for the long term. The committee thinks that the junior researchers would benefit from receiving more accountability and acknowledgement for scientific advancement and highlighting achievements at the junior level. When junior academics see that their work does not go unnoticed and is not overshadowed by supervisors' larger reputations, this may provide a level of ownership and drive for their research. In addition, PhD candidates and postdoctoral researchers could also be given the spotlight more frequently. The combination of more ownership, more acknowledgement and more visibility may ultimately encourage more junior researchers, and in particular female and non-Dutch academics, to look for long-term research opportunities at WIMEK. In addition, if junior or even mid-career researchers can show that their work is showcased or rewarded by the cluster, this will support them during external funding calls as well as outreach activities.

Societal impact becomes more and more important for funding agencies, for the assessment of research organizations and for individual careers. However, the committee found that societal impact seems not yet to be sufficiently and, in any case, not explicitly recognized in tenure track criteria. According to the experience of several interview participants, the degree of recognition remains implicit, and largely depends on the particular views of the various tenure track committees. In the committee's view, this is an unsatisfactory situation. The committee recommends that WIMEK prioritizes the societal impact it finds most important. It should then strive for explicit and objective recognition of societal impact and activities, supporting activities to reach this impact in clear tenure track criteria. Such a shift in perspective seems needed to align human resource processes with organizational objectives.

In the same vein, while it is undoubtedly worthwhile to honour individual achievements, team collaboration is equally important, particularly now that solutions for complex societal problems require the integration of knowledge and expertise from different scientific disciplines. The committee therefore recommends putting incentives in place to stimulate multidisciplinary collaborations, within but certainly also across teams. Moreover, fierce competition between individual researchers should be avoided, since this does not contribute to a happy working environment, fruitful collaboration, and productivity in general.

PhD supervision and training

Most of the PhD candidates who are enrolled in the WIMEK research school follow the educational programme of the Wageningen graduate school. In their first six months, they write a project proposal and develop an individual training and supervision programme. Since recently, the candidates also design a data management plan. These plans and proposals are approved by the WIMEK graduate school. After 8 to 14 months, the candidate's progress is evaluated in a go/no go interview. PhD candidates are guided by at least two, and preferably not more than three supervisors. In addition to the go/no go interview the PhD candidate and the supervisors have annual evaluations. In these talks, both the candidate's progress and the supervisors' coaching role are evaluated.

Overall, the committee encountered a good, safe, and interacting atmosphere within clusters. It is quintessential to preserve this in the coming years. Supporting activities for PhD's (such as peer groups, buddy system, postdoc being coaches to PhDs) are well appreciated. It would be good to integrate such activities in a WIMEK-wide policy.



It struck the committee that over all clusters, the group of postdocs feel somewhat forgotten. It would be good to assess their needs and for instance develop a coaching programme and/or career guidance tools that may help them find a new position after finishing their contract.

A long duration of PhD trajectories is an issue that most clusters seem to grapple with, although it was not always identified as a major problem by PhD candidates themselves. The committee has three recommendations that could help to repair this. In the first place, for all PhD projects, ambition should meet duration. This pertains both to the scope of the project and the number of papers needed to be able to graduate. Secondly, the committee recommends adding intermediate milestones explicitly in PhD guidance and policy, particularly in the second and third year, where they are now lacking. These milestones should include clear requirements, not only concerning output (i.e. number of research papers).

Finally, mentoring and supervision in general should be something that is given sufficient time for. If supervisors are overloaded with other work, there may be a tendency for reduced guidance. Across clusters it was mentioned that some researchers supervise many PhD students at the same time. The committee suggests having an internal discussion whether there should be a limit on how many PhD students (and by extension maybe also graduate students and postdocs) one person should supervise at the same time. Perhaps this is something to think about moving forward, especially as postdocs and new hires are recruited in the coming years.



3. ASSESSMENT OF THE CLUSTER CLIMATE, WATER & SOCIETY

3.1. Organisation

The following chair groups are involved in the cluster Climate, Water & Society (CWS):

- Aquatic Ecology and Water Quality
- Environmental Systems Analysis
- Hydrology and Quantitative Water Management
- Meteorology and Air Quality
- Water Resources Management
- Water Systems and Global Change

In total, the cluster contains 107 academic staff members (in fte's), of whom 69 are PhD candidates and 18 are postdoctoral researchers.

3.2. Aims and strategy

The CWS cluster studies environmental systems, with a focus on addressing challenges related to water and climate. Its mission is to improve our understanding and ability to represent natural and human dimensions of climate and water resources in a changing global environment. The cluster intends to reach this understanding by excellent monodisciplinary research in the atmospheric, hydrological and ecological sciences combined with innovative multidisciplinary, interdisciplinary and transdisciplinary approaches to climate, water and society. The cluster's strength is a team of excellent scientists with complementary expertise. For the future, it aims to improve the inter- and transdisciplinary collaborations within the cluster, to create more synergy. Also, by integrating the work of different groups, the cluster will be even better suited to respond to society's demand for knowledge-based adaptation to meteorological and hydrological extremes.

The committee found that the CWS cluster is a diverse cluster with a broad scientific focus and a mission that is well-aligned with the overall WIMEK mission to address Grand Environmental Challenges. The cluster has a lot to offer, and its expertise is very topical. However, the committee found that the cluster's vision on where it wants to be in – say – six years is not fully articulated yet, beyond consolidation and improvement on weaknesses. The committee recommends CWS to embark on a focused effort to make such a vision more concrete. The cluster could reflect on how the diversity of expertise within the cluster can be used to tap into the many promising opportunities, in particular the scientific and societal need for well-funded information, solutions and services to adapt to a changing climate and water situation. Subsequently, the cluster could determine what combinations of expertise are necessary to perform cutting-edge research with regard to these challenges. When crafting such a vision for the future, the committee encourages the cluster to look broader than just the water topic. It should definitely take into account the great expertise it has on for instance climate, energy storage systems, biodiversity, and pollution.

3.3. Research Quality

The committee has established that the research quality of the CWS cluster is of an excellent level. CWS has published over 1900 publications in peer reviewed scientific journals in the past six years, including well-known journals such as *Science*, *Nature* and *PNAS*. Peers within the field often use the results generated by CWS, indicated by a high number of citations of CWS work in peer reviewed journals, exceeding averages in the field. The committee was impressed by the quality of the examples of publications CWS provided in the self-evaluation report. Prestigious personal grants, for instance from the European Research Council, and in particular a high number of early-career grants also bear witness to the appreciation of the research. In addition, the cluster has an outstanding track record in acquiring research grants from a variety of funding sources, such as NWO and KNAW, but also the European Research Council, ministries and charity organisations. All of this underscores the very high quality of research, an excellence that can be found in all chair groups of the CWS cluster. The committee found the case studies presented



in the self-evaluation and during the online site visit convincing. They describe interesting and important topics, to which different chair groups can contribute. As an example, the fine-scale simulation of evaporation which used a large eddy simulation to link the atmospheric hydrological cycle to water and landscape management, as presented during the online site visit, was very inspiring. It could open up new insights in how climate adaptation may work on landscape scales. The committee wholeheartedly considers this kind of projects as top science. In the face of this broad acknowledgement of its qualities, the committee thinks the CWS cluster may act even more boldly, and not shy away from international ambitions. The cluster could for instance make more contributions to international assessments and research projects, and strive to become a knowledge hub for climate solutions.

It struck the committee that many of the most influential publications are about transdisciplinary topics, such as climate and food system emissions, the meteorological mechanisms leading to droughts, and relationships between CO₂ emissions and plant drought resilience. It is therefore not surprising that the cluster strives to increase collaboration between groups, and the committee fully endorses this ambition. The cluster is already very multidisciplinary and there is excellent evidence of working across disciplines within specific topics. This strength should be utilised even more. Also, while there are of course many disciplinary research topics that need further improvement, the high societal and scientific impact is increasingly moving towards inter- and transdisciplinary research. Given the complexity of global change across temporal and spatial scales as well as the interplay between the biophysical and social dimension, integrated research fields are of high importance and increasingly requested by society. For that reason, the committee sees great chances for the multidisciplinary research of CWS. This is particularly the case for climate and ecosystem services and landscape management, using models and observations to assess impact of global challenges on human well-being in the future.

Since CWS is a broad and large cluster, with many chair groups that are already very successful, and all have their own national and international networks, it has a long-standing history of successful but rather parallel activities. Encouraging collaboration in such a structure is a challenge. The CWS cluster has already put some mechanisms in place (or planned) to foster collaborations, such as the CWS strategy day (which was held only once so far but should definitely be repeated in some form or other, according to the committee), and planned PhD days and symposia around cross-cutting themes. Also, several promising themes have been identified for collaboration across the cluster, but also with other clusters. These themes could possibly be implemented as research lines, as is done in the Soil Sciences cluster. At the same time, the excellent monodisciplinary work in for instance atmospheric, hydrological and ecological science should definitely be continued. Also, the cluster understandably does not aim at growing boundlessly, since it is already large. This means that the biggest challenge for the CWS cluster is to set priorities. In order to do this systematically and effectively, the ambitions and strategy at the cluster level should be more clearly specified, as stated above. This means determining what the cluster wants to achieve, and what the criteria are for measuring success and achievements. It may also help, according to the committee, to define stakeholder groups and processes more distinctly, and to develop a strategy for interactions at the science-policy interface. This will lead to trans- or interdisciplinarity in a natural way. In the same spirit, the committee thinks that more exchange and collaboration with the cluster Landscape Architecture and Spatial Planning, for instance on some pioneering demo projects could be useful.

In its discussion with PhD candidates, the committee heard that they still signal a lack of mechanisms to stimulate interdisciplinarity. The committee therefore recommends giving high priority to organizing the planned cross-disciplinary PhD activities. It also applauds the initiative to hire a staff member dedicated to improving funding for interdisciplinary research projects. It encourages joint proposal writing and joint PhD training across chair groups, as suggested in the self-evaluation report.

The committee is under the impression that the body of research and the narrative in the self-evaluation report do not quite live up to the cluster's name in a balanced way. There seems to be a strong focus on water. The societal dimension is prominent in the mission, but weaker in the actual research activities and not entirely integrated. The committee recommends addressing this component more, by integrating social science and even humanities into



the natural and life sciences. This will address the increasing demand for an integrated analysis of physical and socio-economic or societal issues and also improve the holistic perspective on sustainable development.

3.4. Societal Relevance

The committee observed that the CWS cluster makes excellent contributions to society at different levels, from the municipal to the international scale. It provides policy makers with syntheses of the latest science and its implications and uncertainties and gives scientific advice in different forms to governments, grassroots and water user federations, the private sector and NGO's. As a result, the cluster has significant impact and is of great societal relevance. It played a part in the Dutch government's policy to solve the 'nitrogen crisis', for instance, and in a policy advice on the effects of microplastics in nature and society, written on request of the Chief Scientific Advisors of the European Commission. CWS research has also been used by prestigious international actors, including the International Panel on Climate Change (IPCC) and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES).

The committee is convinced that if the cluster succeeds in its ambition to create more inter- and transdisciplinarity, this will allow it to have more direct relevance for a variety of stakeholders, and thus increase its impact even further. However, working for and with stakeholders also presents the risks of absorbing much of the capacity, and the risk of not sufficiently innovating. The committee recommends CWS – as part of the strategy exercise mentioned in paragraph 4.1 – to carefully consider which stakeholders it wants to work with and to what extent. It also recommends CWS to ensure that the knowledge that results from working for stakeholders flows back into new research.

The committee notes that virtual and augmented realities offer new ways for knowledge transfer, especially for future scenarios. The work of the CWS cluster could be very well suited to make use of these methods. They could improve the visualization of simulation driven data and enable a wide range of applications for intuitive human-machine interaction. Modern sensor technology would enable the recording of objects and scenarios as well as interaction with them. The committee recommends investigating these possibilities.

Open science

The CWS cluster is not only strong in knowledge transfer to society, but also in working with participatory methods, or co-creation. Several examples of this were presented to the committee, in particular by the water groups. There is for instance the work on climate-information services, developed with and for farmers in Ethiopia, Bolivia, Ghana and Bangladesh; there is the Wageningen Lowland Runoff Simulator, an open-source hydrological model used by weather boards; and RAINLINK, an open-source app for rainfall mapping through cellular communication networks in regions with scarce data. Clearly, not all research activities are equally suited for co-creation of science, and co-creation also comes with the cost of potentially limiting innovative power. The committee recommends treading carefully along this path and widely sharing experiences on co-creation within CWS and WIMEK. The aim of this benchmarking would be to better understand the conditions under which participatory methods will have added value and lead to larger societal impacts.

The CWS cluster states that it embraces the key elements of open science. Involving stakeholders in research design as described above is one of these. The cluster also mentions the increasing share of open access publications, its efforts to ensure that results of contract research can be disclosed, using open-source model codes and asking all groups and all PhD candidates to craft data management plans. To the committee this seems a good way of stimulating open science.

Media appearances are a way for the CWS cluster to reach out to a wider public. The cluster also engages in citizen science, for example with the project Nature's Calendar. This aims to monitor, analyse, forecast and communicate yearly recurring life cycle events. Through the Calendar, citizen scientists can experience for themselves that due to



the increase in temperature, the length of the growing season has significantly increased. This is a very good and effective way of communicating academic results with the public.

On the whole, the committee is satisfied with the way the CWS cluster performs open science and encourages it to progress further on this road. The ultimate aim should be making *all* publications open access and dealing with *all* research data in a FAIR way.

3.5 Viability

Future outlook

It is obvious to the committee that the work of the CWS cluster is extremely relevant and will be so for a long time to come, due to the fast-growing impact of global challenges on human well-being. The fact that a large number of the cluster's early career scientists received personal grants underscores the future potential of the cluster. CWS staff has good skills to obtain grants and the chair groups are connected to world-leading organisations. In short: there is plenty of work to do, and the cluster is well-situated to make a meaningful contribution. As stated above, the main challenge for the cluster's future will be to set its own priorities in a well thought out way. The committee strongly recommends CWS to invest in this process. Whilst setting priorities, the cluster should ensure that there will be sufficient to carry the research forward. The challenge then is to find a balance between on the one hand giving excellent PhD's and postdocs the opportunity to continue their research within WIMEK, and on the other hand attracting sufficient 'fresh blood' to support the development of new ideas.

Academic culture

The cluster aims to further open up its academic culture and strives for a safe and inclusive work environment. It points out that the new tenure track system at Wageningen University has created much better career perspectives for talented individual scientists, but also introduced a large emphasis on personal grants and individual performance, which may occasionally result in opportunistic, individualistic behaviour and stimulate competition and disincentive internal and long-term collaboration.

The committee finds this a good point and compliments the cluster for noting it. It fully endorses the ambition to balance individual and team performance. From the documentation it has not become entirely clear to the committee what institutional mechanisms and practices are in place to support a positive culture for inclusion, safety and equality. The same goes for research integrity. Setting clear goals on this area might help ensure that research integrity is achieved in all domains of research. For inclusion, safety and equality the committee recommends not solely depending on an open culture but having some mechanisms in place that safeguard these aspects.

Talent management

Human resource management at the CWS cluster is aimed at attracting and keeping the talented staff that is needed to keep up the cluster's high level of research quality. This by no means a foregone conclusion, given the ample career opportunities for environmental specialists.

Parallel to the job market opportunities, the number of students interested in CWS themes has been growing, resulting in a high teaching load for the cluster's staff. The committee found that this is perceived as a threat for research. The cluster will need to address this, and the committee appreciates that it already has some ideas on how to deal with it: lobbying for increased funding, and training tenured staff in grant-writing so that they may rapidly build a small research group. Elsewhere, appointing teaching assistants with specific tasks such as correcting exams has also provided some relief. The cluster may consider this as a complementary option.

Diversity

The CWS cluster correctly identifies a lack of diversity in the tenured staff as one of its weaknesses. There is a clear lack of diversity both in terms of gender and in terms of cultural background. Further efforts are required to hire and keep female and international full and associate professors. These efforts have to go beyond informal



discussions and encompass clear interventions and targets. The high number of talented female researchers that have managed to acquire personal grants is a promising start, but it will not be self-evident that they rise through the ranks. The cluster will have to create the right conditions for this to happen.

The committee thinks that a little push for the more senior staff to take training on diversity might help. Currently, mostly young researchers take such training, the committee was told during one of the interviews, but the senior staff does not.

3.6. PhD supervision and training

The committee spoke with some of the PhD candidates associated with the WIMEK cluster and got the impression that – together with the postdoctoral researchers – they form a group of engaged and constructive junior scientists working in an open atmosphere. This is a true asset for the CWS cluster.

PhDs candidates within the CWS cluster experience a lot of room for creative input into their own trajectory. However, the flipside of the freedom they have is that they find it sometimes difficult to plan and finish their theses in time. Due to inexperience, an ambitious PhD student cannot always oversee the time investments that are needed for extra activities. It was mentioned by the PhD students that supervisors should intervene when they are overambitious. The committee recommends that this should be part of the supervision training, if it is not already incorporated. Fixed intermediate milestones within a PhD trajectory could also help to keep PhD's on track. For the first year, such strict milestones are already in place (for instance an improved training and supervision plan and Sense A1 course). After the first year, milestones re-appear again only in the last year. It could help to add some milestones in the second and third year, and to safeguard the progress in the annual evaluation meetings.

It was voiced that both postdocs and PhD candidates would benefit from having a personal coach assigned to them, indicating there is still room for improvement in terms of supervision. For PhD students, a postdoc might fulfill this role, for postdocs a coach might be a peer, tenure tracker or someone else provided by the cluster. The committee recommends the cluster to consider this option as an addition to the current supervision arrangements.

Finally, the committee wants to raise awareness concerning the disadvantages of sandwich PhD candidates when they are working from their home country. Being at Wageningen allows PhD's to use advanced facilities such as high-speed internet, computational resources and research labs, and a supporting network of other Ph.D. candidates in an academic environment. These resources are often absent or of lower quality when they are working from the associate research institution abroad. There might for instance be extra frequent monitoring of sandwich PhD's, and early remediation or even stopping if there are serious doubts about the support or supervision the candidate receives at home.



4. ASSESSMENT OF THE CLUSTER SOIL SCIENCES

4.1. Organisation

The following chair groups are involved in the Soil Sciences cluster:

- Soil Physics and Land Management
- Soil Chemistry and Chemical Soil Quality
- Soil Biology and Biological Soil Quality
- Soil Geography and Landscape

In total, the cluster contains about 60 academic staff members (in fte's), of whom 44 are PhD candidates and 5 are postdocs.

4.2. Aims and strategy

The mission of the Soil Sciences cluster is to enable sustainable use and management of soil resources for reliable food production, improved quality of life and an environment that is resilient to climate change. The cluster strives for this by advancing understanding of the dynamic interactions between physical, biological and chemical soil properties and processes and of the impact of land use and management on soil health and ecosystem functioning.

The Soil cluster's strategy includes four main aims:

1. to be a world-leading academic group for high-impact research in the domain of its mission;
2. to generate and openly communicate science-based knowledge on sustainable soil/land management, serving multiple stakeholders from local to global;
3. to provide a world-renowned platform for research through a range of global knowledge networks and state-of-the art research facilities;
4. to develop the skills of new and current soil scientists (particularly in the early career phases), who will further enhance the cluster's mission and its contribution world-wide.

In the past six years, the cluster identified five research lines that it wants to focus on. Each prioritises a range of research topics, which are regularly reviewed. The research lines provide opportunities for joint action within the cluster, working together across chair groups through shared research projects and the co-supervising of PhD candidates. Each research line is led by two early-career researchers from different chair groups within the cluster to spur integration. The research lines are:

- soil-water interactions
- soil carbon management and climate change
- biodiverse agroecosystems
- multifunctional land evaluation
- nutrient cycling and contamination mitigation

The research lines relate directly to WIMEK's Grand Environmental Challenges, the United Nations Sustainable Development Goals, the UN Convention to Combat Desertification, the UN Environmental Program about Land Degradation Neutrality, the European Commission's Green Deal, and other policy and societal initiatives in the soil domain.

The committee finds that the Soil cluster has a clear mission that fits the cluster's recognised position as a global academic leader in soil research, teaching and impact. The research lines that have been identified align strongly with the WIMEK Grand Challenges and international policy, which is good. The committee also endorses the cluster's holistic approach that combines biological, chemical, physical and human interaction.



Less clear is the intended future destination and what success will look like in six years. The committee's impression from the self-evaluation is that the strategic aim is primarily to keep doing similar things but better, bigger and more integrated. The Soil cluster's strategy to date has primarily focused on improving the organisational structure, especially establishing the identified research lines as focal points of cluster strengths. The soil laboratories have also been re-structured and built into broader university facilities' organisation, and the cluster has found funding to keep them up to scratch. These are all necessary steps to strengthen the cluster and to keep its prominent position.

However, to get a stronger grip on the future and reinforce international leadership, the committee recommends a dedicated collective effort to set priorities and operationalize indicators and processes to assess how things are developing. This could for instance be done over a condensed period, involving key stakeholders and partners for reflection and advice. To optimize and facilitate the aforementioned strategy-building process, the cluster could consider asking support from the central university level.

By developing a sharper vision on the future, the cluster could become more agenda-setting in science and policy communities, in the committee's view. The committee recommends the cluster to be more outward looking. This should include identifying the major external drivers for soils research, looking beyond 2030. Soil will certainly play a central role in the continued development of solutions at the nexus of global challenges intersecting the climate crisis, food security, land degradation and water resources.

As an example, identifying big global challenges and ambitious solutions that will be required from interdisciplinary soils research post-2030 would provide the basis for a Theory of Change approach. Such an approach would help map the cluster's strengths (and gaps) against these future outcomes and identify pathways to develop the cluster and its partnerships, to fill gaps and to do what is necessary to deliver the solutions.

4.3. Research Quality

By leading a number of large international projects over the past six years, the Soil cluster has demonstrated its ability to act as initiator of multidisciplinary and transdisciplinary projects with scientists, governmental institutions, land user associations, farmers, NGO's and other relevant stakeholders. In these projects, the partners have jointly advanced the state of knowledge and solved problems on the ground, thus generating scientific and societal impact. These and other projects have resulted in many highly-quality publications that are often used by researchers within the field. In addition, various methods and approaches developed by the Soil Science cluster are being used by peers. Examples include an inclusive bottom-up approach that engages people in environmental stewardship and sustainable change, the freely available NINJA tool developed in collaboration with two other universities and used for calculating soil quality indicators, the SWAP model to simulate soil-water-plant processes and interactions and various soil chemical models.

The committee underscores that the Soil cluster of Wageningen University is one of the top research and student education centres of excellence globally in soil science. This is evidenced by the quality and scale of research outputs, the scale of research income, the critical mass of academic talent, and the scale and excellence of engagement with citizens, industry and government.

The quality of research output is evidenced by its use by peers, as shown in the citation metrics that the cluster provided. This shows that the average use of the cluster's research papers is more than twice the global average within the field. At least four of the cluster's papers are among the most influential papers in the field within the past six years. This quality is maintained at scale with peer-review publications at or approaching 200 per year during the past six years, which the committee deems impressive with less than 40 tenured staff members.

The cluster secured externally funded research grants and contracts with a value over €70 million over six years, which is exceptional considering the size of the cluster. The committee notes the predominance of academic staff



at early- and mid- career stages within the acquired grants, with 20 staff at assistant professorial and 'docent' level and a further 10 at associate professorial level. This staff profile across career stages has been largely consistent over the past six years, growing slightly for number of assistant professorial and professorial staff through appointments and promotions. This stable staff profile aligned with the publication and income track record indicates both a critical mass of excellence and a strong pool of talent for the succession of senior staff.

Particular strengths of the Soil cluster are the collective body of published work on soil chemical pollution and soil carbon management, particularly related to climate change and to soil health and land degradation. The cluster contributes substantially to major synthesis and agenda-setting studies, evidenced e.g., by the influential journal articles 'Soil quality – a critical review', 'Sensitivity of labile carbon fractions to tillage and organic matter management and their potential as comprehensive soil quality indicators across pedoclimatic conditions in Europe' and 'Modelling soil processes: Review, key challenges, and new perspectives'. This array of evidence supports the Soil cluster as one of the top soil science centres of excellence globally.

Since it is already very strong, the cluster does not need many recommendations on reinforcing its research quality. Nevertheless, the committee has one recommendation. It suggests that the Soil cluster could use and affirm its international stature by publishing a strategic paper on the role of soils in the UN's sustainable development goals. This would further strengthen the cluster's agenda setting role and confirm its international reputation.

4.4. Societal Relevance

The scale of the Soil cluster's societal impact is evidenced most clearly by the use of its research outputs in government and industry publications and other communications. This includes a total 186 publications for governmental and non-governmental organisations tackling major global and national societal challenges. The principal organisations citing the cluster's research output are those of the United Nations (primarily the UN Food and Agriculture Organisation FAO), but also the UN Environment Programme (UNEP) and the UN Educational, Scientific and Cultural Organisation (UNESCO). This indicates substantial standing and recognition of the cluster's research relevance and quality at global scale. Furthermore, over 80 publications and activities from the Soil cluster were covered by media in the past six years. Further evidence is provided in the SER appendices, noting many additional activities and outcomes with schools, citizens groups and companies including global and national corporate brands.

In considering further strategy development as suggested in paragraph 5.2., the cluster should challenge itself to be more ambitious on societal impact, in the committee's view. It should seek to provide global leadership to set agendas and influence research funding priorities, in order to ensure it is as relevant as possible to solving major challenges. The globally leading position of the Soil cluster and its strong relationships with the Dutch government, the EU and UN bodies places it in a uniquely strong position. It could and should, in the committee's view, deploy leadership activities that could build on this position. Examples are to build large coalitions and convene international strategy groups with global partners. Such coalitions could establish new vital directions of research, draft future destinations for soil science and solutions to global challenges, create roadmaps with government and industry for delivery of high impact outcomes, and synthesise evidence to support the funding for the proposed programmes. The cluster could strategically develop these ideas with key partners such as Syngenta, Joint Research Centre of the European Union, World Bank, FAO and UNEP. One approach could be to engage with selected closely collaborating individuals within those organisations and establish an external group to advise on how best to utilise the Soil cluster's strengths and range of national and global research and impact partnerships to create this type of global leadership.

Open science

From the documentation provided and the online site visit, the committee concludes that the Soil cluster is committed to and experienced in working openly and collaborating widely with stakeholders from local to global levels. This is a clear strength of the cluster. It is also good at reaching out to a wider public, as is evidenced by many



news appearances, some very well-attended MOOC's and original educational activities where researchers use earthworms in demonstrations.

Concerning open access publications and FAIR data management, the cluster fully supports and conforms to national and international requirements to increase accessibility of research output. Since 2015, it has realised a significant 128 per cent increase in open access publications. Presently, a total of 64 per cent of academic publications is open access. The committee sees evidence of a strong ethos and commitment to FAIR principles for data management, and an acknowledgement that there is more to do on this front. The FAIR principle is not fully adhered to yet in publishing research data. The committee recommends the cluster to act accordingly and strive for further progress towards full open access publishing and FAIR data management.

4.5. Viability

Future outlook

Given the outstanding position of the Soil cluster as described in paragraphs 5.4. and 5.5. and the prominent position of soil sciences in some of the world's largest challenges, the cluster's future looks bright. As stated above, the committee is convinced that the cluster can maximise its impact if it develops a sharper vision on the future and dares to be bolder in taking up international leadership roles. Importantly, while talking to staff members of the cluster at different levels, the committee sensed a true feeling of excitement about the future. This will be a powerful motor.

Academic culture

The Soil cluster values and strives to create an inclusive atmosphere for both the staff and the community of PhD candidates. From the documentation it has not become entirely clear to the committee what institutional mechanisms and practices are in place to support a positive culture for inclusion, safety and equality. The same goes for research integrity. The self-evaluation report mentions that the cluster finds research integrity important and that it fosters an open culture where staff members are able to discuss and address potential conflicts jeopardizing scientific integrity. However, details are not provided. Setting clear goals on this area might help ensure that research integrity is achieved in all domains of research. For inclusion, safety and equality the committee recommends not solely depending on an open culture but having some mechanisms that safeguard these aspects.

Talent management

The high scientific impact of the cluster builds on its successes in attracting highly qualified, motivated researchers from a diversity of backgrounds and nationalities. Hiring foreign staff has become easier since 2018, when the curricula of the most relevant undergraduate programmes became fully in English.

The committee found clear evidence that staff training, development, coaching, mentoring and career planning and support are well organised at the Soil Cluster. Staff retention looks very strong and provides stable leadership and group compositions.

As in many academic groups, the high-reaching environment and high workload may cause stress with PhD candidates and tenure-track staff. The cluster chair holders are aware of this, the committee found. They increased support to staff members, for instance with the coordination of large international research projects and programmes. This has lowered the workload somewhat.

Diversity

The Soil cluster values a diverse staff. In gender terms, the ratio at the level of PhD candidates and associate professors is balanced. At the level of full professors however female professors are strongly underrepresented (20%). Similarly, at the level of PhD candidates, the Soil cluster is very international, with more than half of the PhD students coming from abroad, but not so at the higher levels of the hierarchy. In the committee's view, targeted



measures are required to encourage the promotion of females and internationals to the higher-ranking functions of associate and full professors. This will balance the perspectives that are needed to connect with the outside world and make sure that all junior staff members and stakeholders feel that they are represented in the cluster's leadership.

4.6. PhD training and education

The committee got a very favorable impression of PhD supervision in the Soil cluster. Each PhD has two supervisors, and there is a buddy system. PhD candidates told the committee that they experience the cluster as an open, diverse research group with good social cohesion. The supervisors seemed to be aware of the importance of good supervision and coaching and they enjoy the supervision process. Some of the PhD teams of the cluster belonging to the individual chair groups meet every two weeks and there are additional PhD meetings and discussion groups, which likely benefits the good atmosphere. Various prizes and awards have been attributed to PhD candidates supervised by staff members of the cluster, which is more evidence of excellence in supervision.

The committee recommends guarding the balance in the ratio between PhD candidates and experienced staff, in order to keep up PhD supervision at the present high level.



5. ASSESSMENT OF THE CLUSTER ENVIRONMENTAL TECHNOLOGY AND MICROBIOLOGY

5.1. Organisation

The following chair groups are involved in the cluster Environmental Technology and Microbiology (ETM):

- Microbiology
- Biorecovery
- Environment and Water

In total, the cluster contains 53 academic staff members (in fte's), of whom 46 are non-permanent staff (PhD students and postdoctoral researchers) and 7 are permanent staff.

5.2 Aims and strategy

The mission of the ETM cluster is to combine fundamental and applied research in order help reduce the human footprint and safeguard a sustainable supply of water, energy, food and other resources for the world's growing population. Six years ago, the transition towards a circular economy became a global priority, driven by the depletion of petroleum-based resources and the increasing need to reduce emissions of greenhouse gases and pollution. This transition to circularity and renewable resources requires novel solutions, and ETM has taken on the challenge to develop the concepts and technologies that are needed to provide these.

ETM has defined five focus areas:

- Renewable products: develop renewable fertilisers from waste and redirect residual carbon flows to renewable products and healthy soil;
- Circular water: eliminate contaminants like micropollutants, pathogens, salts, and redesign water provision;
- Fundamentals for circularity: apply deep insights into ecology and physiology of microbial communities to development of biotechnologies and nature-based solutions; dedicate physical-chemical treatment to reuse of residual stream-based resources;
- Balance in food-waste cycles: design rural-urban smart grids, and ii) include the energy factor in technological solutions in rural-urban systems;
- Circular examples: collaborate with societal stakeholders on practical showcases for technologies and system integration enabling active knowledge uptake with inclusion of start-ups, pilots, and demo projects.

ETM's prime focus is on WIMEK's Grand Environmental Challenge III: Advancing circular systems, inclusive innovation towards closed water, nutrient and material flows. ETM also contributes to challenges I (Finding fair and effective solutions for climate change mitigation and adaptation) and II. (Managing our future biosphere, developing strategies for the sustainable use of soil, water, atmosphere, biodiversity, ecosystems and landscapes). To contribute to solving these challenges ETM develops technologies based on the principles of biological cycles. These bio-based technologies, rooted in the action of microorganisms, are supported by physical-chemical techniques when needed.

ETM participates in mission driven research programs of the Dutch Top Sectors (Water, Food, Energy and Chemistry), the Dutch Research Council and the EU. Its goal is to ensure the transfer of knowledge and newly developed technologies to the relevant private companies, authorities, and applied knowledge institutes in the environmental and biobased sectors. The close contact and collaboration with stakeholders make many of the projects thoroughly transdisciplinary.

The committee remarks that the themes of the three chair groups are very well aligned with global trends in circular economy and sustainability. It appreciates that the cluster is trying to open up new fields, and even to change established paradigms, such as decentralized wastewater treatment or water cycle management. The committee



fully agrees with the 'science for impact' and 'from principles to technology' strategy the cluster has chosen and thinks that such a strategy can be very fruitful. The committee does recommend more focused strategy-forming. A clear articulation of outcome expectations at the end of six years, from a problem-solving perspective, may greatly enhance the attractiveness of the cluster both to potential staff members and to external partners and stakeholders.

The ETM cluster has a wide range of open access laboratory facilities. They include climate controlled walk-in incubators, high-tech machines such as a Triple Quadrupole Mass Spectrometer, outdoor pilot scale wetland facilities, equipment for anaerobic cultivation, instruments for gas, chemicals and bio-products detection and quantification and equipment for molecular ecological studies. Recently, the cluster added the UNLOCK infrastructure for microbiome research. It would like to further expand its open access research facilities and share them with users from Wageningen University but also from outside the university and outside the Netherlands. The cluster asked the committee to recommend on a course of action to stimulate this shared use of facilities.

The committee remarks that the ETM field of research is a strategic priority in The Netherlands and across Europe, North America and East Asia. The infrastructure therefore will likely be in substantial demand, but the cluster will need to shape its proposition to the requirements of industry, and market its capabilities. To achieve this, the committee suggests the cluster to conduct strategic pre-market assessment research, which is designed to determine the client needs and which of its strengths is in greatest demand. The ETM self-evaluation demonstrates many influential private sector and government partners. They can be consulted, and the cluster can possibly investigate whether it is possible to widen the range of clients and possible markets. Then the cluster can shape its infrastructure proposition to meet what it learns are the greatest demands are. The cluster could also consider investing in marketing for its infrastructures, using traditional and social media in Western countries and in for instance China. The latter may offer potential collaborations on various areas if the labs are advertised through suitable mechanisms.

According to the committee, expanding the use of its excellent infrastructures can have multiple benefits for the cluster. More extensive use of ETM's excellent infrastructures by the international community will presumably lead to both research collaborations as well as opportunities to generate additional revenue for research enhancement. However, the committee also advocates a more inclusive approach towards young scientists from the Global South, who are normally severely resource-constrained. This could be done by facilitating the remote access of this infrastructure for their research purposes and the provision of services. Research design would obviously remain in the hands of the remote researcher.

The committee thinks that taking up leadership positions in international/European research as recommended below is another avenue to showcase the infrastructures. They could lead international programs such as COST actions and organize activities such as international summer schools. This is a way to find new opportunities and partners.

5.3. Research Quality

The committee found that the ETM cluster has done well in the past six years in terms of research quality. The examples given in the self-evaluation report of breakthrough research (such as the discovery of novel pathways for CO₂ fixation, proof-of-principle for bioremediation of micropollutants in groundwater, and a geospatial design tool that allows for optimally balancing nutrient supply and demand) are quite convincing.

The committee did note that both productivity and the use of research products by peers seems to have declined in the past years. It is aware of the fact that this cannot be directly translated to conclusions concerning research quality but does recommend the groups to investigate this and try to determine the underlying cause. A number of suggestions were already discussed during the site visit. A possible explanation is that the groups have launched a relatively large number of new projects in the past years, which need some time to be recognized within the field.



The committee also notes that the recent grant successes seem to have led to a major workload with some groups, which might have impacted the time researchers can spend on producing high-quality papers. Finally, it might be that the early years in the census period were exceptionally successful and not realistically sustainable at such a high level. However, in discussions with the cluster, there was mention of concern that effort and quality could be diluted by the large scale of new projects that are being funded. ETM should not be defensive or overly concerned, but it would be good to investigate this and keep an eye on it the next couple of years. Because of the enormous range of activity and the large success in grant income – and acknowledging the limitation of staff numbers, given the rate of growth of activity – it is good to be on guard.

5.4. Societal Relevance

Over the years, the ETM cluster has demonstrated its ability to transfer technology and transform its findings into products or services. It has achieved world-class results, such as procedures for municipal and industrial water treatment and for desulfurizing waste streams or recovering sulfur. The cluster has built mutual relations with prestigious companies and administrations and developed a very good alliance policy at various levels. On a scientific level, the SIAM network for anaerobic microbiology linking several Dutch research institutes and the CHINED-4D co-operation with Chinese universities in the field of environmental science are examples. On a technological level the cluster has built a close and exemplary relationship with WETSUS, the European center of excellence for sustainable water technology and the Amsterdam Institute of Advanced Metropolitan Solutions AMS. These relations allow the cluster to take prominent positions in its field. ETM's technologies and concepts have also been successfully put into practice through an impressive number of spin-off companies, such as DeSaH BV, ChainCraft, AquaBattery, LeAF and Plant-e.

In spite of these achievements, the committee thinks ETM has the potential to realise even more impact. In its view, it would be useful for the cluster to have some understanding of the gap between potential for societal impact and its realisation, which in turn would help to maximize the cluster's societal impact through cooperation with industry and/or spin-off activities. Wageningen University might be able to provide support for such activities at the central level.

Finally, the committee is of the opinion that possibly ETM could enhance its impact by including more societal issues in its research programme, in collaboration with social scientists. For example, social acceptance and perception of technologies by its users – including those in the Global South – seem to be very promising and topical themes.

Open science

Thanks to the excellent relations of ETM at different levels of private and public society, stakeholders are strongly involved in the design and execution of ETM research. This is worthy of a compliment.

To further improve its international positioning, ETM could, in the committee's view, seek more European leadership positions. It could organize international events such as summer schools, symposia and conferences, or lead international research initiatives that could for instance seek funding from the European Cooperation in Science and Technology COST. On top of building new projects and alliances, such leadership would also allow ETM to better showcase its excellent research infrastructures.

ETM has adopted the general university rules to stimulate open access publishing and accessible storage of research data. The percentage of open access publications has steadily risen over the past years from 25% in 2015 to 73% in 2020. This satisfies the committee. It encourages ETM to keep investing in open science, with the aim of making all publications open access. The implementation of the UNLOCK infrastructure should be able to ensure that the FAIR principles are applied. The committee recommends ETM to make these ambitions more explicit and measure progress in FAIR data sharing.



5.5. Viability

Future outlook

According to the committee, ETM correctly assesses that its expertise will remain in great demand, due to the current urgent environmental crises, the societal calls for a circular economy and the interest of new generations in environmental issues. The ETM cluster has everything in place to respond to these demands.

Academic culture

The cluster invests in a collaborative atmosphere in multiple ways, and has implemented the key values originality, integrity, togetherness and personal involvement. However, from the documentation it has not become entirely clear to the committee what institutional mechanisms and practices are in place to support these values, and more in general a positive culture for inclusion, safety and equality. The same goes for research integrity. Setting clear goals in these areas might help ensure that research integrity is achieved in all domains of research. For inclusion, safety and equality the committee recommends not solely depending on an open culture but having some mechanisms that safeguard these aspects.

Perhaps an unexamined weakness as perceived by the committee (for it does not occur in the SWOT analysis) is the limited collaboration among cluster members. While collaborations do exist, the committee thinks they could most likely be scaled up to a higher level, allowing ETM to tackle more ambitious projects. The committee therefore recommends putting measures in place to actively stimulate collaboration between cluster members.

Talent management

Human resource policy at ETM is oriented towards developing talents and guarding the sustainability of the groups. The cluster notes that diversity of research areas and associated research methods makes it challenging to have all required expertise in the house. ETM plans to continue its policy to create resilience as a cluster by adequately replacing colleagues that leave and temporarily hiring people to cope with periods of high workload. The committee endorses these ambitions.

Diversity

The committee found that ETM is well-balanced in disciplines, age, gender, and cultural background.

5.6. PhD training and education

The committee was favorably impressed by ETM's initiative to create peer groups for PhDs candidates. These group meetings are much appreciated and there is momentum to scale the idea to other clusters. The PhD candidates at ETM are also happy about the hiring of extra postdocs to increase the capacity available for supervision.

However, on some points, the PhD supervision at ETM could be improved, in the committee's view. It found that the frequency of supervision per PhD student varies widely, depending on the supervisor. In some cases, having more supervision would be beneficial, PhD candidates told the committee. The committee recommends making sure that every PhD candidate gets sufficient supervision. Also, an external mentor could be beneficial, in the committee's view: someone who is not directly related with the research activities of the PhD candidate. Such an external mentor can focus on the social aspect of coaching without there being a potential conflict of interest between mentor and mentee. The PhD student might then feel able to speak more freely.

In its discussion with the committee, ETM staff stated that PhD trajectories are not always comparable and flexibility in their duration is sometimes good. However, the PhD candidates at ETM acknowledged the WIMEK-wide issue of long PhD trajectories to be an issue. ETM has tried to reduce the duration of PhD trajectories by asking the supervisors to help shorten it, but this did not resolve the issue. The committee agrees with the PhD candidates that perhaps the ambitions for PhD projects should be set less high in order to be more realistic to complete within four years. Furthermore, it may be useful for WIMEK to put in place a central PhD counsellor who will track the



development of PhD students and provide annual consolidated feedback to the leadership of WIMEK on the health and success of the PhD programme.

6. ASSESSMENT OF THE CLUSTER LANDSCAPE ARCHITECTURE AND SPATIAL PLANNING

6.1. Organisation

The following chair groups are involved in the cluster Landscape Architecture and Spatial Planning (LSP):

- Landscape architecture
- Land use planning

In total, the cluster contained 14 academic staff members (in fte's), of whom 6 are PhD candidates and 4 are postdoctoral researchers on December 31, 2020. The number of fte's translates into 39 individuals that work at the LSP cluster.

The cluster originated in 2018 from two separate chair groups that were both considered to be too small to be viable. The cluster reported that at that time, satisfaction and motivation among the staff were low, due to high teaching loads, structural financial deficits and unstable leadership. With the appointment of two new chairholders in 2019 and 2020 however, it gained new vigour and entered into a much more prosperous and optimistic phase. Due to successful acquisitions of research funding, it almost doubled in size.

6.2. Aims and strategy

The LSP cluster studies how modifications of landscapes contribute to the quality of life of those inhabiting the landscapes. It focuses on the interactions between different types of land use and landforms, the interplay with the abiotic context, the spatial behaviour of species and the plurality of stakeholders. The cluster aims to devise sound and creative solutions for optimal land use, based on empirical analyses, model-based simulations and ethical and esthetical considerations. In doing so, it addresses some of the most urgent societal problems of our time, such as climate change, biodiversity decline and loss of environmental quality.

The LSP research covers all three Grand Environmental Challenges identified by WIMEK: Climate action, Managing our future biosphere and Advancing circular systems.

LSP focusses on three main research themes:

- Climate action in terms of mitigation and adaptation measures that influence landscapes;
- Transitions in the countryside related to agricultural and nature policies, market developments and demography;
- Urban developments and mobility related to economic activities, housing, public space and infrastructure.

Since its start in 2018, the cluster has developed its own 'landscape approach'. The core quality of this is that it collects and integrates knowledge from various disciplines (such as hydrology, meteorology, soil science, economy and environmental psychology) and translates this knowledge into solutions for current and future landscape problems. To make such solutions practical and feasible, the cluster integrates scientific knowledge with more specific, sometimes tacit, knowledge of local situations. Methods used by the LSP cluster include landscape analysis, discussion of value systems, and generation of transformative knowledge about instruments that can bring about landscape change. The cluster employs researchers with varying scientific backgrounds: landscape architects, spatial planners, ecologists, geographers, sociologists, public administration scientists, urban designers, engineers and environmental economists.

The committee finds the LSP cluster's mission well-articulated, unique and addressing topics of high scientific and societal relevance. In the period under review, the LSP cluster has acquired substantial research funding. This has been an unprecedented success in the history of the two groups, that has brought about substantial growth in and



rejuvenation of staff. The committee fully agrees with the cluster that after this renaissance and period of fast growth it would now be a good idea to consolidate. In the committee's view, the cluster should identify its unique selling points and develop new strategies to reach its goals. Taking a step back like this will safeguard group coherence, keep the cluster resilient and help it retain control. Growing at too high a pace may subject it to external dynamics and prevent it from charting its own course.

As with other landscape architecture and spatial planning schools, the LSP cluster has originated from a tradition of educators of landscape architects and spatial planners. It is therefore rooted in a holistic, practice-oriented approach, strongly connected to landscape professionals. Such an approach can be very innovative and may generate solutions to societal challenges, and inspire trained professionals. At the same time, academics with a wide, interdisciplinary and practice-oriented portfolio have difficulties attracting research funding. In addition, interdisciplinary research is time-consuming and risky, since more effort is required for researchers to find a shared language and epistemology of their field. The committee recommends to redirect funding from the separate chair groups towards a more centralised mechanism within the cluster, to stimulate collaboration across clusters, sharing best practices on how to actually do interdisciplinary research, organising seminars and instituting advisory roles to stimulate interdisciplinarity in research projects.

6.3. Research Quality

The committee observed that research quality of the cluster has improved significantly in the past couple of years, and that the size and strength has been increasing with the hiring of many PhD students, postdocs and tenure track researchers, leading to a doubling of research output in recent years. The Landscape Architecture chair group is currently considered to be a top school in its field, with a high-quality output. Topics addressed are highly relevant and published in international journals that are respected by researchers in the field. They are often used by peers, as demonstrated in citation metrics provided by the cluster.

The Land Use Planning chair group successfully repositioned itself towards the many environmental challenges and the fierce competition for space in the Dutch countryside. It is now reaping the fruits of that move, being the only large Dutch planning group that is equipped to address these challenges. The committee is impressed by these recent achievements, that bear witness to ample talent and high energy within the cluster. Besides successful project acquisitions the cluster has recently also brought up methodological innovation and novel solutions to present landscape and land.

In its self-evaluation report, the LSP cluster mentions that due to its special profile as an applied science, it does not solely focus on research publications as output. According to the committee, the publications that the cluster does produce are however often of pivotal character: directed towards theory building, outlining applied approaches and new positions on transdisciplinary research. Examples are the papers 'Design makes you understand - Mapping the contributions of designing to regional planning and development' and 'Assessing the influences of ecological restoration on perceptions of cultural ecosystem services by residents of agricultural landscapes of western China'. The cluster is also internationally leading in the application of the methods 'research through design' and 'agent-based modelling'.

The cluster's transdisciplinary approach – which integrates knowledge from multiple disciplines into research that contributes to transformations in real-world situations – is well-timed and essential in order to deal with the urgent challenges to land use and landscape architecture. Research on experimental virtual environments and agent-based modelling are particularly promising routes for the future, in the committee's view. The integration of landscape analyses, value systems and knowledge of instruments that can bring about actual landscape change (such as landscape designs, spatial plans and spatial policy instruments) is an equally important route. In this context, ethical issues and issues related to cultural values such as heritage are of particular significance.



In conclusion, the committee finds that recent developments at the cluster are very promising. It sees many opportunities for further scholarly work that is conceptually as well as methodologically trendsetting in an international context. LSP is already highly recognised in the field and successful in acquiring EU funding. The committee is optimistic about the cluster's ambition of gaining more academic recognition. To this end, the cluster might consider collaborating with other research clusters within WIMEK, such as CWS and Soil, that both adopt a landscape approach in some research lines. In particular, the collaboration with CWS could be very interesting. Integrated management of water requires a nexus approach and, in the end, an integrated management of landscapes. The LSP cluster could take the leadership in defining new collaborative research lines, as knowledge integrators and process designers, promoting the landscape approach as key to sustainability and resilience.

LSP mentions in its self-evaluation report that it could strengthen the methodological side of the research. The committee agrees with this observation. Such strengthening could involve more use of predictive modelling, parametric design and agent-based modelling, artist research and the use of the WUR visualization lab.

In order to capitalize on its strength and identity as a 'projecting and transforming' research cluster in competition with other disciplines, the committee further recommends that LSP should document its work in at least two key publications: one on conceptual foundations and another on the methodological mixed methods approach. The paper on conceptual foundations should review the concepts on which quantitative and on which qualitative assessment of landscapes are built and develop a framework how such concepts can be integrated in a mixed methods approach to combine the strengths of both aspects. Both papers should include a review of the state of the art and highlight why and how the LSP approach is at the forefront of an emerging research domain and practice of landscape research and management. Such papers could provide foundations for further scholarly work in which applications are documented and analyzed and the effectiveness of different methods is compared. Thus far, a more systematic comparative case study analysis has often been lacking in the field on learning and transformative change in social-ecological systems. It remains unclear why certain tools or process designs have proven to be successful, and others remained unsuccessful. The LSP cluster could make a difference here. Furthermore, it could increase its visibility in the Netherlands and outside by organizing international conferences on selected topics that are at the heart of its expertise.

6.4. Societal Relevance

The strongest evidence of the LSP cluster's societal relevance – as put forward in its self-evaluation – is the fact that it brings about actual landscape transformations. Examples are the codesign of a community garden in Arnhem in 2015, the Green Quays in Breda, that are currently built as a pilot, and the implementation of three energy gardens in Assen, Montfoort and Wijhe. Another example is that the current government-formation process in the Netherlands is informed by a formal policy advice about reinforced spatial planning in the Netherlands, of which one of the cluster's staff members was a prominent author. Evidence of the strong collaboration with various societal partners can also be seen in the cluster's project portfolio. The committee finds this evidence of high relevance quite convincing. It adds that the cluster's participation in the international, European and national organisations also makes it impactful, as does the output for professional and societal target groups, policy support and advice to practitioners.

Given the strong applicational focus of its work, it seems legitimate to the committee that the LSP cluster may strive to become agenda setting in policy communities, both national and international. It recommends analyzing ongoing processes and networks carefully, as a base for identifying the cluster's unique selling points, setting priorities and selecting a few key opportunities to maximize societal impact.

The committee recommends putting further emphasis on the use of the agent-based models, since this seems a promising approach to acquire relevant information on societal interactions when real-life experiments are not



possible or suitable. The cluster could consider collaboration with computer scientists and statisticians to develop the method further, or any alternative innovative research approach with potentially high policy impacts.

Open science

It is clear to the committee that the LSP cluster puts a strong emphasis on transdisciplinary projects, with broad participation of citizens, local authorities, politicians, NGOs, farmers and other local commercial parties; and that it embraces the cooperation of academia, government, companies and civil society. Most of its projects are conducted in co-creation and embedded in real-life environments or living labs. In addition, the cluster set up learning communities that extend beyond the projects' core teams. It also embraces the training of PhD's in cooperation with practice partners in the context of industrial doctorates, as a way to disseminate its scientific approach. The committee finds these practices exemplary, to the extent that they could inspire other research units.

The committee found that there is a good level of engagement with the public within the LSP cluster. Its research output gets a lot of attention in social media, news outlets, policy documents, etc. Putting in effort to intensify this media outreach even further seems worth the energy. The problems and solutions the LSP work on are not very tangible. Being able to explain in crystal clear terms what a landscape approach is and why it is needed, is therefore key.

The share of open access publications by the LSP cluster has increased from 23 % in 2015 to 77 % in 2020. This is a remarkable achievement. The committee encourages LSP to keep investing in open science, with the aim of making all publications open access. It also recommends to keep investing in FAIR data sharing whenever possible.

6.5. Viability

Future outlook

Development of innovative concepts and methods concerning landscapes is currently in high demand, both from the scientific and the policy communities. It is often advocated but hardly ever accomplished. In this context, the committee is of the opinion that integrating functional aspects of landscapes with aesthetic and ethical dimensions in transdisciplinary processes – LSP's core business – is a promising approach to developing transformative knowledge. The cluster is therefore in an excellent position to do innovative and internationally highly visible research. As WUR now in general is moving away from a purely quantitative research evaluation system this will be in favour for the LSP and increase its recognition within the university.

Academic culture

The remarkable success in recent years suggests an open and collaborative environment. Indeed, during its discussions with the staff – and in particular with the PhD's and postdocs – the committee perceived a strong cluster identity, that transcends chair group identity. Bearing in mind that many of the LSP researchers are relatively new to the cluster and in spite of the COVID situation that has limited physical meetings in the recent past, this is truly worthy of a compliment.

The committee did not find any information on research integrity. Setting clear goals in this area for the training of junior as well as senior scientists might help ensure that research integrity is achieved in all domains of research.

Talent management

The open and collaborative atmosphere that the committee encountered at LSP indicates good talent management. The cluster describes that overall growth in the number of PhD students and postdocs has given rise to new dynamics. Now that there is a group of about 25 PhD students and postdocs, they started organizing meetings and forums to actively exchange ideas and challenge and motivate each other in their daily work. The cluster is perfectly right in cherishing this coherence and prioritizing the building of social capital over further expansion of the cluster, in the committee's view.



Developing a system of mentoring and setting out clear career policies could well be a future priority. Postdocs noted towards the committee that they do a lot of educational work, which is not properly considered while their progress is being evaluated. Improving the evaluation criteria was one of their recommendations. The new system of performance assessment that is currently in the making at the WUR will suit the cluster quite well and should feed into the tenure track targets as soon as possible.

Diversity

The LSP cluster is a diverse community in terms of gender as well as age, nationality and scientific background. This diversity is essential for fulfilling its complex tasks.

6.6. PhD training and education

All PhD students at LSP are members of a graduate school (WIMEK, Wageningen School of Social Sciences or the graduate school for Production Ecology & Resource Conservation) and follow the corresponding training and supervision plans. All supervisors are requested to follow a course on PhD supervision. All PhD students are invited to present on a regular basis in the monthly cluster meetings. Otherwise, the committee found no evidence of quality assurance, so that may be a point for future development.

In their discussions with the committee, the PhD candidates gave the impression of being satisfied with the supervision and support they received and sharing a positive 'group feeling'. It is commendable, in the committee's view, that supervisors at LSP see it as their task to guard that PhD students do not do too much work, so that they stay on track. In line with these comments, the WIMEK-wide issue of long PhD trajectories seems not to be an issue at LSP and was not recognized as such by the interviewed PhDs and postdocs.



APPENDICES



APPENDIX 1: THE SEP 2021-2027 CRITERIA AND CATEGORIES

The committee was requested to assess the quality of research conducted by the UHS as well as to offer recommendations in order to improve the quality of research and the strategy of the UHS. The committee was requested to carry out the assessment according to the guidelines specified in the Strategy Evaluation Protocol. The evaluation included a backward-looking and a forward-looking component. Specifically, the committee was asked to judge the performance of the unit on the main assessment criteria and offer its written conclusions as well as recommendations based on considerations and arguments. The main assessment criteria are:

- 1) **Research Quality:** the quality of the unit's research over the past six-year period is assessed in its international, national or – where appropriate – regional context. The assessment committee does so by assessing a research unit in light of its own aims and strategy. Central in this assessment are the contributions to the body of scientific knowledge. The assessment committee reflects on the quality and scientific relevance of the research. Moreover, the academic reputation and leadership within the field is assessed. The committee's assessment is grounded in a narrative argument and supported by evidence of the scientific achievements of the unit in the context of the national or international research field, as appropriate to the specific claims made in the narrative.
- 2) **Societal Relevance:** the societal relevance of the unit's research in terms of impact, public engagement and uptake of the unit's research is assessed in economic, social, cultural, educational or any other terms that may be relevant. Societal impact may often take longer to become apparent. Societal impact that became evident in the past six years may therefore well be due to research done by the unit long before. The assessment committee reflects on societal relevance by assessing a research unit's accomplishments in light of its own aims and strategy. The assessment committee also reflects, where applicable, on the teaching-research nexus. The assessment is grounded in a narrative argument that describes the key research findings and their implications, while it also includes evidence for the societal relevance in terms of impact and engagement of the research unit.
- 3) **Viability of the Unit:** the extent to which the research unit's goals for the coming six-year period remain scientifically and societally relevant is assessed. It is also assessed whether its aims and strategy as well as the foresight of its leadership and its overall management are optimal to attain these goals. Finally, it is assessed whether the plans and resources are adequate to implement this strategy. The assessment committee also reflects on the viability of the research unit in relation to the expected developments in the field and societal developments as well as on the wider institutional context of the research unit

During the evaluation of these criteria, the assessment committee was asked to incorporate four specific aspects. These aspects were included, as they are becoming increasingly important in the current scientific context and help to shape the past as well as future quality of the research unit. These four aspects relate to how the unit organises and actually performs its research, how it is composed in terms of leadership and personnel, and how the unit is being run on a daily basis. These aspects are as follows:

- 4) **Open Science:** availability of research output, reuse of data, involvement of societal stakeholders;
- 5) **PhD Policy and Training:** supervision and instruction of PhD candidates;
- 6) **Academic Culture:** openness, (social) safety and inclusivity; and research integrity;
- 7) **Human Resources Policy:** diversity and talent management.



APPENDIX 2: PROGRAMME OF THE SITE VISIT

DAY 1: Monday 31 May 2021

TIME	ACTIVITY	WHO
13:00 – 15:00	Preparation of the reviews	Review committee (RC)
15:00 – 15:30	Introduction to the assessment of research units following the new SEP protocol Discussion	RC
15:30 – 16:30	Presentation of WIMEK and the WIMEK clusters; connections to PE&RC and WASS	WIMEK Director or Chair WIMEK Board; WIMEK cluster representatives; RC
16:30 – 17:30	Preparation of the reviews	RC

DAY 2: Tuesday 01-06-2021

Cluster 1: Soil Science

TIME	ACTIVITY	WHO
09:00 – 09:30	Final preparations Tuesday	
09:30 – 10:15	Presentation research strategy, talent policy, future perspectives cluster 1 (max 10 minutes); discussion	RC, representatives cluster Soil, WIMEK Director and secretary
10:30 – 11:15	Presentation research lines / themes and case studies; research quality and societal relevance	RC, representatives cluster Soil, WIMEK Director and secretary
11:30 – 12:30	PhD and postdoc policy / pitches / Discussion with PhD candidates and postdocs	RC and PhD candidates and postdocs

Cluster 2: ETM

TIME	ACTIVITY	WHO
13:30 – 14:15	Presentation research strategy, talent policy, future perspectives cluster 1 (max 10 minutes); discussion	RC, representatives cluster ETM, WIMEK Director and secretary
14:30 – 15:15	Presentation research lines / themes and case studies; research quality and societal relevance	RC, representatives cluster ETM, WIMEK Director and secretary
15:30 – 16:30	PhD and postdoc policy / pitches / Discussion with PhD candidates and postdocs	RC and PhD candidates and postdocs
16:30 – 17:00	Internal evaluation Tuesday	RC



DAY 3: Wednesday 2 June 2021**Cluster 3: LSP**

TIME	ACTIVITY	WHO
09:00 – 09:30	Final preparations Wednesday	RC
09:30 – 10:15	Presentation research strategy, talent policy, future perspectives cluster 1 (max 10 minutes); discussion	RC, representatives cluster LSP, WIMEK Director and secretary
10:30 – 11:15	Presentation research lines / themes and case studies; research quality and societal relevance	RC, representatives cluster LSP, WIMEK Director and secretary
11:30 – 12:30	PhD and postdoc policy Discussion with PhD candidates and postdocs	RC and PhD candidates and postdocs
12.30 – 13:00	Internal evaluation LSP	

Cluster 4: CWS

TIME	ACTIVITY	WHO
14:00 – 14:45	Presentation research strategy, talent policy, future perspectives cluster 1 (max 10 minutes); discussion	RC, representatives cluster CWS, WIMEK Director and secretary
15:00 – 15:45	Presentation research lines / themes and case studies; research quality and societal relevance	RC, representatives cluster CWS, WIMEK Director and secretary
16:00 – 17:00	PhD and postdoc policy Discussion with PhD candidates and postdocs	RC and PhD candidates and postdocs
17:00 – 17:30	Internal evaluation CWS	RC

DAY 4: Thursday 3 June 2021**WIMEK & presentation main conclusions and findings by AC**

TIME	ACTIVITY	WHO
09:30 – 10:15	Presentation WIMEK (max 15 minutes) and discussion	RC, WIMEK Board, WIMEK Director, WIMEK team
10:30 – 12:00	Internal discussion RC: summary, conclusions and recommendations	RC
12:00 – 12:30	Presentation main conclusions and recommendations by RC	RC, WIMEK Board, WIMEK Director, WIMEK team, cluster representatives
12:30 – 13:00	Closure, goodbye	RC, WIMEK Board, WIMEK Director, WIMEK team, cluster representatives



APPENDIX 3: QUANTITATIVE DATA

Quantitative data on the research unit's composition and funding:

- Input of research staff;
- Funding;
- PhD candidates.

Number of staff members and research input in WIMEK

	2014		2015		2016		2017		2018		2019		2020	
Scientific staff	#	FTE	#	FTE	#	FTE	#	FTE	#	FTE	#	FTE	#	FTE
Professor ¹	39	8.2	38	8.2	37	9.0	37	9.5	37	9.7	40	9.6	37	9.7
Associate professor ¹	23	6.9	28	7.5	36	9.9	37	11.1	38	11.4	47	13.4	47	12.5
Assistant professor ¹	51	14.9	51	14.2	47	12.3	43	14.4	40	13.6	43	12.9	53	14.1
Subtotal	113	30.0	117	29.8	120	31.3	117	35.0	115	34.7	130	35.8	137	36.2
Post-docs ²	22	10.7	23	14.0	31	16.2	37	18.3	41	23.8	38	23.0	38	24.3
PhD candidates ³	234	115.9	243	120.8	253	129.4	262	130.1	263	129.2	272	137.0	300	150.2
Total	369	157	384	165	404	177	416	183	419	188	440	196	475	211

#: Total number of staff members

FTE: Research Capacity in Full Time Equivalents

	2014	2015	2016	2017	2018	2019	2020	Average
Academic publications (total)	433	514	515	493	590	543	673	537
a. Refereed articles	341	374	420	382	475	450	573	431
b. Non-refereed articles	10	11	12	12	32	22	28	18
c. Refereed books	1	2	0	1	1	2	0	1
d. Refereed book chapters	22	37	25	31	20	16	7	23
e. PhD Theses	37	61	36	46	45	44	57	47
f. Conference papers	20	27	22	17	13	9	5	16
% open access publications	19%	35%	40%	50%	61%	65%	72%	51%

The % open access refers to refereed scientific articles and do not include the PhD theses; these are in principle all open access.

Note: the categories (a) refereed articles and (e) are complete; the categories (c) refereed books and (d) refereed book chapters are in most cases registered in the WUR publication database, but the categories (b) non-refereed articles and (f) conference papers are often not registered and these two categories are very incomplete.

Research funding at WIMEK level

	2014		2015		2016		2017		2018		2019		2020		Average	
Funding	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%
Direct funding ¹	44.4	28.3	45.8	27.8	47.0	26.6	43.2	23.6	44.9	23.9	50.4	25.7	55.3	26.3	47.3	25.9
Research grants ²	21.4	13.7	25.5	15.5	35.6	20.1	45.1	24.6	46.8	24.9	48.6	24.8	53.2	25.3	39.5	21.6
Contract research ³	91.1	58.1	93.3	56.7	94.3	53.3	95.0	51.8	96.2	51.2	97.0	49.5	102.0	48.4	95.5	52.4
Total funding	157	100	165	100	177	100	183	100	188	100	196	100	211	100	182	100

Note 1: Direct funding by the University

Note 2: Research grants obtained in national scientific competition (e.g. grants from NWO, KNAW)

Note 3: Research contracts for specific research projects obtained from external organisations, such as industry, governmental ministries, European Commission, charity organisations

PhD candidate: Research capacity amounts to 75% of the appointment/fellowship (all categories except external)



Duration and the success rate of Employed PhD Candidates/Research Assistants

Starting year	Enrolment		Success rates																
	Enrolment (male / female)		Total (M+F)	Graduated in year 4 or earlier		Graduated in year 5 or earlier		Graduated in year 6 or earlier		Graduated before 31-12-2020		Not yet finished		Discontinued <18 months		Discontinued 18 - 48 months		All but dissertation	
	# M	# F	#	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
2011	8	10	18	2	11	8	44	12	67	16	89	-	-	1	6	1	6	-	-
2012	13	13	26	2	8	8	31	15	58	16	62	6	23	3	12	1	4	-	-
2013	16	12	28	1	4	9	32	20	71	21	75	6	21	-	-	1	4	-	-
2014	12	13	25	-	-	10	40	16	64	17	68	5	20	2	8	1	4	-	-
2015	14	9	23	1	4	11	48	-	-	15	65	6	26	1	4	-	-	1	4
2016	14	17	31	1	3	-	-	-	-	13	42	17	55	-	-	1	3	-	-
Total	77	74	151	7	5	59	39	91	60	98	65	40	26	7	5	5	3	1	1

Notes: Table shows numbers (#) of male (M) and female (F) PhD candidates

All employed PhD candidates conducting research with the primary aim/obligation of graduating, based on a 0.8-1.0 FTE contract.

Reasons to discontinue PhD < 18 months: Not enough progress (3); acceptance of another job (3) and conflict with supervisors (1); Reasons to discontinue PhD > 18 months: illness (3); acceptance of another job (2); all but dissertation (1). This last category means that a PhD candidate has finished all research tasks and published the results, but has not succeeded in finalising the final text of the PhD thesis.

Duration and the success rate of fellowship PhDs (sandwich and guest PhD candidates)

Starting year	Enrolment		Success rates																
	Enrolment (male / female)		Total (M+F)	Graduated in year 4 or earlier		Graduated in year 5 or earlier		Graduated in year 6 or earlier		Graduated before 31-12-2020		Not yet finished		Discontinued <18 months		Discontinued 18 - 48 months		All but dissertation	
	# M	# F	#	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
2011	10	8	18	-	-	4	22	6	33	8	44	3	17	4	22	3	17	-	-
2012	13	14	27	1	4	10	37	15	56	23	85	2	7	1	4	1	4	-	-
2013	9	6	15	1	7	6	40	10	67	13	87	1	7	-	-	-	-	1	7
2014	7	9	16	-	-	4	25	4	25	7	44	5	31	-	-	3	19	1	6
2015	9	6	15	1	7	3	20	-	-	8	53	7	47	-	-	-	-	-	-
2016	19	7	26	-	-	-	-	-	-	10	38	15	58	1	4	-	-	-	-
Total	67	50	117	3	3	37	32	53	45	69	59	33	28	6	5	7	6	2	2

Notes: Table shows numbers (#) of male (M) and female (F) PhD candidates

All scholarship PhD candidates conducting research with the primary aim/obligation of graduating, based on a 0.8-1.0 FTE contract.

Reasons to discontinue PhD < 18 months: Not enough progress (2); illness (2); lack of academic attitude (2); Reasons to discontinue PhD > 18 months: Not enough progress (4); illness (1); lack of academic attitude (2); all but dissertation (2). The discontinued fellowship PhDs include 4 PhD candidates from Uzbekistan and 2 PhD candidates from Trinidad & Tobago, who participated in failed and discontinued collaborative programmes.