

Evaluation report for the research review of

ITC, Space for Global Development

at

University of Twente

for the period 2014-2020

January 2022



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Preface

Due to the Covid-19 pandemic the research review of ITC was postponed and finally took place in hybrid form in September 2021. With four committee members physically present and three committee members online, the evaluation was a challenge for both the ITC organisation and the committee members. I would like to thank both the ITC organisation and the committee members for their dedication, flexibility, and creativity in executing this evaluation under difficult circumstances. Special thanks for Meg van Bogaert for the compilation and writing of the final report.

The committee was impressed by many aspects of ITC and the quality of its research and organisation. I sincerely hope that the observations, suggestions, and recommendation in this report will stimulate ITC to further work on its mission, its portfolio and on continuation of a viable, societal relevant and scientifically strong institute.

Professor Arnold Bregt

Committee chair

14 January 2022

1. Introduction

1.1. Scope of the assessment

In January 2021 the Executive Board of the University of Twente commissioned a review of the research conducted in the Space for Global Development research programme at the Faculty of Geo-Information Science and Earth Observation (ITC). The review is part of the regular six-year quality assurance cycle of the university; it is intended to monitor and suggest improvements to the quality of research and fulfil the duty of accountability towards government and society. The quality assessment contained in this report follows the assessment system in the Strategy Evaluation Protocol for Public Research Organizations 2021-2027 (SEP) by the Association of Universities in the Netherlands (VSNU), the Netherlands Organization for Scientific Research (NWO) and the Royal Netherlands Academy of Arts and Sciences (KNAW). The review covers research undertaken between 2014 and 2020.

In accordance with the SEP for research reviews, the committee was requested to assess within specified guidelines. The committee was asked to evaluate the performance of the research programme using assessment criteria specified in the SEP and to offer its written conclusions as well as recommendations based on considerations and arguments. The main assessment categories are 1) Research Quality; 2) Societal Relevance; and 3) Viability.

The committee was asked to include four specific topics::

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

Finally, the research programme asked the committee to pay attention to five additional and specific questions:

- What is the advice of the committee on focusing our open science activities concerning the domain and mission?
- What is the advice of the committee on investments in research infrastructure like laboratory facilities in the years to come?
- What is the advice of the committee on enhancing PhD efficiency?
- What are urgent changes in the current research themes to maximize our impact and viability?
- How should the programme align talent management in relation to ITC's values and mission?
- Please advise on how to evaluate/monitor the Netherlands Code of Conduct for Research Integrity in research practice

1.2. The review committee

The Executive Board of the University of Twente appointed a review committee (hereafter: committee) of seven external peers, including a mid-career researcher and a PhD student. The committee consisted of:

- Prof. dr. ir. Arnold Bregt (chair), Professor at the Department of Environmental Sciences and Dean of Education, Wageningen University & Research, the Netherlands;

- Prof. Sir dr. Paul Curran, Professor Emeritus and ex-President, City, University of London, UK;
- Prof. dr. Ann van Griensven, Professor in Hydrology and Hydraulic Engineering, Vrije Universiteit Brussel (VUB), Belgium;
- Prof. dr. João Porto de Albuquerque, Professor and Director of the Institute of Global Sustainable Development, University of Warwick, UK;
- Prof. dr. Serena Coetzee, Professor and Head of the Department of Geography, Geoinformatics and Meteorology, University of Pretoria, South Africa;
- Dr. ir. Sandra Verhagen, Assistant Professor at the Department of Geoscience and Remote Sensing, Delft University, the Netherlands;
- Anne Hoek van Dijke, MSc, PhD candidate in Hydrology and Remote Sensing, Wageningen University & Research, the Netherlands.

The University of Twente Executive Board appointed dr. Meg Van Bogaert as the secretary to the committee.

Members of the committee signed a declaration and disclosure form to the effect that they would judge without bias, personal preference, or personal interest, and their judgment is made without undue influence from the institute, the programmes, or other stakeholders. Any existing professional relationships between committee members and programmes under review were disclosed. The committee concluded that there was no risk in terms of bias or undue influence.

1.3. Information provided to the committee

The committee received detailed documentation consisting of the following parts:

- Self-evaluation report 2014-2020, including appendices;
- Standard Evaluation Protocol 2021-2027.

1.4. Procedures followed by the committee

The site visit took place on 22 and 23 September 2021. Originally, the members of the committee intended to meet in Enschede in April 2021. However, due to the Covid-19 pandemic, the site visit to Enschede was first postponed and later replaced by a hybrid site visit, in which some of the committee members and external stakeholder representatives participated via a digital platform. Before the site visit, the committee members were asked to read the two documents above and formulate questions for the interviews. In a kick-off meeting at the start of the site visit, the committee agreed upon procedural matters and discussed its preliminary findings.

During its final meeting on 23 September 2021, the committee discussed its findings. To conclude the visit, the committee chair presented the main preliminary conclusions to the research programme, institute, and university. The schedule for the site visit is included in appendix 2.

This report describes the findings, conclusions, and recommendations of the committee. The research programme is evaluated with regards to its own aim and mission and related to research programmes and institutes worldwide in similar disciplines and on similar topics. The text for the assessment report was finalised through email exchanges. The final version of the report was presented to the research programme management and University Executive Board for factual corrections and comments. The report was completed on 14 January 2022.

2. Strategy, targets, and organisation

2.1. Organisational structure

Organisation, Management and Governance

The Faculty of Geo-Information Science and Earth Observation of the University of Twente (UT), also known as ITC, focuses on understanding and helping to solve real-world problems, using geospatial data, methods, and tools. The International Training Centre for Aerial Survey (ITC) was started in 1950 by the national government to assist in developing skills and knowledge for rebuilding third world countries after the second world war. In the following decades, the institute went through several developments and was integrated as a Faculty within UT in 2010. The next development is the relocation of the Faculty to the UT campus in 2022.

ITCs response to the Mid-Term Review is that “ITC strives for a stronger integration” of ITC with UT. UT is young university, has an excellent campus, is academically solid and entrepreneurial. According to the committee, ITC’s world-class reputation for research quality and societal impact makes it the ‘Jewel in UT’s Crown’. It is clearly in UTs interest for ITC to thrive, there are potentially synergistic academic strengths (e.g., Technology, Social Sciences) and supportive organisational strengths (e.g., Twente Graduate School). The committee is confident about the upcoming further integration of ITC into UT. The committee emphasized the importance of retaining the unique character of the faculty ITC and the multicultural, friendly, supportive and ‘elite but not elitist’ academic culture, which is so characteristic of ITC.

Within ITC, research, education, and institutional strengthening activities are led by six departments, each focussing on a particular research theme. Two departments are technology-oriented, while four are application domain-oriented:

- Earth Observation Sciences (EOS);
- Geo-Information Processing (GIP);
- Earth Systems Analysis (ESA);
- Urban and Regional Planning and Geo-Information Management (PGM);
- Natural Resources (NRS);
- Water Resources (WRS).

Each department has its own research themes. In addition, areas of complementary expertise have been developed over time, leading to the identification of new, multidisciplinary topics. During the site visit, the committee met with an open, well-organised and well-supported research organisation.

2.2. Mission and strategy

From 2014 to 2020, ITC aimed to enhance its standing as an internationally recognized knowledge organisation in the spatial domain, renowned for its collaborative educational and research activities, particularly in the majority world. The research programme, called Space for Global Development, aimed to serve society by providing and developing relevant geospatial data, methods, and tools to facilitate sustainable development. The needs and demands of (potential) users in majority world countries were incorporated in the research and institutional strengthening projects. Furthermore, ITC embodied a set of core values – focused on society, driven by synergy, entrepreneurship, and its international nature. The four main research aims were:

1. Become a pro-active player in international agenda setting;
2. Start research-based start-up companies;
3. Further diversity funding sources and act internationally;
4. Fill knowledge gaps and align with other valid policy guidelines.

A SWOT analysis in October 2020 by ITCs Academic Board formed the basis of the future strategic goals and resulted in three strategic pathways to fulfil ITC's mission. These pathways anticipated scientific, societal, and institutional developments and outline ITC's future role in shaping those developments. Furthermore, to measure the impact and quality of its research, ITC has defined a large set of indicators according to the six categories described in SEP. The committee appreciated that ITC used the SEP review to present the indicators they intended to use. However, one would expect far fewer indicators (not more than 10-15) and even fewer key performance indicators (approximately 5). Anything more and it becomes difficult to prioritize activity and change at pace would not be possible, as effort and resources would be diffused.

Both in the previous evaluation and the Mid-term Review, the need for ITC to move beyond an unlinked collection of initiatives and indicators to the development of its trilogy of vision, strategic plan and targets were recommended. This would start with a clear and collective view of where colleagues would like ITC to be in say, ten years' time.

The committee congratulates ITC on starting the strategic process. The present strategy is clear in some respects, and ITC has created a well-organised infrastructure and support organisation. Nevertheless, ITCs vision and strategy are not consistently formulated in documents seen by the committee. This is well-illustrated by the recent, expertly crafted, ITC document 'Global Challenges, Local Actions: Vision, Values and Practices of ITC for 2020 – 2030' that did not fully align with the initial documentation provided to the committee (above). For example, the Global Challenges, Local Actions document provided a clear and compelling statement of institutional ambition that could be the basis of a vision ('to be consistently among the top five geo-information science centres in the world') but this credible ambition was not in the initial documentation provided to the committee or discussed during the visit. This inconsistency across documentation was reflected in the interviews. When asked about priorities for research, individual responses were given that did not provide clear, common aspirations or targets regarding future research, funding opportunities and societal relevance.

ITC is an organisation that – by nature - is continuously in transition. The committee noted that ITC will need to develop and agree, as matter of urgency, a clear statement of where it wants to be in say, ten years (vision), how it intends to get there (strategy) and how it will track its progress (targets). To do this successfully, the starting point will be clarity on ITC's values (four different sets of values were provided to the committee: past, current, future and UT), priorities (what to do and – more importantly – what not to do) and desired level of autonomy and/or integration with UT. Concerning this latter point, the identity and culture of ITC and differences in focus in relation to entrepreneurship and inclusion between ITC and UT are points in need of attention.

Themes

Looking forward, ITC identified four long-term research themes that would facilitate research into global problems:

- Hazards, Risk & Resilience;
- Food Security & Biodiversity;

- Geo-Health;
- Big Data/Governance.

From the interviews during the site visit, the committee learned that the development of these themes is based on a collective, bottom-up approach. The committee appreciates the development of the research themes and considers that the themes were well chosen and relevant for the future. To make them a success, it is important that ITC fully commits to them. This includes a clear definition of the objectives and the support needed (staff & resources) for each theme. Most research that is done at ITC fits into the themes, although it was mentioned that some researchers did not feel fully included in the decision of the themes and for whom it might be difficult to fit into a theme. Although it is not a requirement to join a theme, there is some worry about the position of (often fundamental) research at ITC. According to the committee, researchers should have the freedom to choose research topics that are not related to these themes.

2.3. PhD policy and training

Traditionally, many PhD candidates join the research programme with a scholarship, e.g., from the Chinese Scholarship Council (CSC), Nuffic, or external/own funding. Overall, the committee was positive about the PhD training and supervision, many good things were observed. The PhD candidates value the research environment ITC provides and are happy and proud to work at ITC. There are clear PhD guidelines, and these guidelines are known to all PhD candidates. PhD candidates mentioned that it is clear to them what is expected and specifically appreciate that ITC has a 'qualifying' evaluation after 6 to 9 months. This allows some time to change direction and improve before the go/no-go decision moment after one year.

The PhD candidates are a very international group and there is variety in their funding. The PhD candidates the committee talked to, suggested that there is some 'inequality' between the contract PhDs and scholarship PhDs. It was suggested that this is more prominent in some of the departments and varies between supervisors. The committee emphasized that all PhD's should be treated equally and receive the same opportunities, regardless of their source of funding. Also, ITC could consider ways of involving interested PhD candidates in strategic and group matters, e.g., by having PhD representatives in the management meetings regardless of their funding. This should be included in an ITC wide (top-down) policy on PhDs. The committee requests specific attention for the training/coaching research staff involved in the supervision of PhD candidates.

ITC is to be congratulated on the work that is done to increase the sense of a PhD community and the sharing of learning among PhD candidates (e.g., science days). The PhD IT Community (pITCom) started in 2017 and aims to organize research activities and social events in line with interests among PhD candidates. The committee recommends that ITC increases its support and appreciation of pITCom, and jointly work on supporting the PhD community. One of the suggestions of the committee is that ITC and pITCom could jointly organise the recent onboarding days for newly arrived PhD candidates. It was mentioned by the PhD candidates that some felt lonely during the pandemic lockdown. Again, there seem to be differences in the way departments dealt with the challenges faced by the research staff (and PhD candidates) during the lockdown. The introduction of a formal mentoring or coaching programme might help PhD candidates in their integration and wellbeing. According to the committee, feeling part of a cohort of newly arrived PhD candidates helps with the integration of, in particular, international candidates. The committee also recommends including in the onboarding, a tour of facilities and laboratories, a talk about research support and open science and an introduction to all group members.

The completion rate is low, with only around half of the PhD candidates graduating after 5-6 years and this is a known area of concern. Specifically, PhD candidates who do fieldwork risk the longest delays and the pandemic will only have made the problem worse. This challenge was recognised by ITC and during the site visit, it was mentioned that actions are being taken. The committee noted that taking more than 6 years leads to an increased risk of discontinuation but was pleased to see that ITC has been identifying causes for the delay and is taking action to shorten the duration of the average PhD trajectory. Three actions taken are 1) encourage candidates to take relevant courses, e.g., on professional effectiveness and speed reading; 2) include progression explicitly in the annual review and deal early on with potential delays; and 3) more clearly define the requirements for graduation to two published papers (most PhD candidates currently aim for three publications). The most important recommendation the committee has in this respect is to ensure that PhD completion rate data are discussed explicitly in the annual review of all supervisors. In addition, it will be important to organize mentoring, train supervisors on how to guide PhD candidates and to notice a potential delay and act upon it. By paying structural attention to progress in the talks between PhD student and supervisor, reasons for possible delays are detected earlier and action can be taken to prevent (large) delays. Furthermore, the committee noted that the pandemic not only has a contemporary impact but will continue to have an impact for the foreseeable future.

In conclusion, based on their background (majority world) and funding (scholarships), the group of PhD candidates at ITC is not representative of PhD communities seen at other Dutch faculties or institutes. ITC has potentially a more vulnerable group of PhD candidates. Thus, it is important to have a good monitoring system of the well-being of the PhDs, for example through a close (ITC level) PhD counsellor, or more frequent surveys.

The committee also discussed the future careers of PhD students as many will seek academic posts elsewhere, or in start-ups or commercial/government organisations. The committee was not provided with comprehensive long-term employability data. Based on survey data by ITC (sample size 28), PhD graduates find relevant positions, both at universities and outside. Based on the interviews with ITC representatives, no clear plan was provided to the committee to help PhD candidates to gain employment in, for example, start-ups or prestigious academic or commercial/government institutions around the world. A plan for PhD student employability will be needed.

Diversity

The committee noted that the SEP requires it to consider 'to what extent diversity (including gender, age, ethnic and cultural background and disciplines) is a concern'. The committee saw a diverse ITC PhD candidate community and a set of shared, albeit undocumented, values around the importance of diversity. However, there is a big gender gap, which increases in more senior levels and leadership positions.

Concerning the gender diversity of the staff, improvements were observed over the period of evaluation. The number of women in the organisation has increased and the committee learned that hiring committees had become more diverse. But while the student and PhD populations are very diverse (both in ethnicity, age, and gender), diversity among permanent staff (in particular, the management) could and should be improved. From the interviews, the committee was not convinced that the urgency of this problem is acknowledged throughout the senior levels of ITC. Furthermore, mechanisms for implementation of measures were not visible and the UT diversity officer seems far away. According to the committee, improvement of the gender diversity imbalance requires more than 'doing one's best to hire women'. The intention to improve is visible, it might help to offer online training to increase awareness of (often unconscious) behaviour that might counteract good intentions.

Rudimentary data were provided on age and gender and these data underpin the emerging diversity policy. Granular data were not provided to the committee on other aspects like disability, sexual orientation, or crucially (given the student mix) ethnicity. Likewise derivative diversity data on, for example, the gender pay gap, committee membership by gender, age, ethnicity etc. were not available. The committee understood that it is not permitted by Dutch law to record some of the base data (e.g., ethnicity). Nevertheless, analysis of the situation (using surrogate data where necessary) is an essential prerequisite to understand the issues and taking targeted action. Especially, at the more senior levels of leadership, more could be done to implement mechanisms to promote and increase all facets of diversity.

The committee recommends increased attention to mechanisms to promote diversity and inclusion, including but not restricted to gender balance. Although the committee acknowledged the efforts that have been made towards this direction, it would be advisable to set clear targets and make more visible the measures taken to achieve progress. In particular, regarding ethnicity, it would be important to start monitoring ways of defining progress as well as making sure there is coordination with UT's diversity and inclusion office with visibility for measures taken to widen inclusion and diversity (e.g., awareness campaigns on diversity and inclusion, monitoring of diversity indicators in the composition of strategic committees, leadership courses for those with minority backgrounds, assessment of perceptions and barriers to underrepresented groups).

Early and mid-career research staff

ITC has invested in future capacity through a Tenure Track (TT) programme to provide young, talented researchers with the opportunity to become full professors. This TT-programme started in 2008 and there is a flanking policy, consisting of a research assistant, increased research time and a small (lump sum) budget. Research time for ITC researchers is on average 30%, TT have an additional 25% to spend on research, education or capacity development. To date, a total of five have reached full professor level. Others decided to leave the TT programme, or their TT-positions were discontinued. In case of leaving/discontinuation, most researchers left the TT programme but remained at ITC. The tenure trackers (TTs) the committee talked to during the site visit felt that they receive excellent support. Furthermore, they feel involved in strategic decision making. The committee noted that the TT system is both generous and supportive.

The committee appreciated the fact that the TTs are involved in the redefinition of the assessment criteria for tenure and the broadening of career track opportunities. It is important to make clear agreements on flexible career paths in which both research and education are rewarded, including reward and recognition and ITC seems to have designed a good procedure. It remains important that diverse career paths and flexibility do not lead to increased discontinuations and clear agreements and a reward & recognition system are essential. Regarding training opportunities, the committee emphasizes the importance that - in addition to a tailor-made training and coaching programme - all TTs should follow mandatory PhD supervision and leadership training. At present, this training is optional but most of the TTs the committee talked to did not follow them.

HRM policy

ITC formulated a 10% increase in research staff (20 FTE) over the next five years. The lack of a clear staffing plan to support this future growth made it difficult for the committee to determine the feasibility of this increase. For example, it was not clear if these research staff members will be early career or full professors, in which academic area they should work and why 10% is a realistic number.

With respect to more general human resource issues, the committee concluded that the Heads of

Department are interested in the welfare of their researchers. In general, the committee recognised the conclusion that staff members are satisfied and feel involved. However, the committee wondered whether the management has sufficient focus on satisfaction across the organisation. The committee recommends regular monitoring of well-being, using general engagement or topic-specific pulse-surveys and discussion of the results.

3. Assessment of SEP criteria for ITC

3.1. Research quality

ITC is a distinctive world-leading research institute, the bibliometric data show that the contribution to the scientific body of knowledge is both significant and sustained and the high research quality is reflected in international rankings. The quality of the research was impressive, with a focus on research that responds to societal challenges. This is logical given the capacity development goal of ITC.

The international academic reputation of ITC is outstanding. A visible shift within the institute – observed in junior and mid-career research staff – was visible from an explicit focus on capacity building and education in the past towards research, education, and capacity building today and research, education, capacity development and entrepreneurial activities in the future. The committee appreciates ITC's policy on “growing own internal talents”, but also suggests recruiting well established external senior staff in order to create a more diverse research culture. The increased focus on research requires that ITC considers the following:

- focus on high quality journal papers;
- development of research partnerships;
- recruiting external established senior researchers in addition to ‘growing own talent’;
- keep an eye on the fluctuating PhD numbers by using enterprise, alumni etc. to secure funding.

There was much evidence in the self-evaluation report and the interviews that there is freedom to focus on one's personal priorities or research agenda. Some of the researchers did express concerns, however, that the four themes that have been identified may inhibit this in the future. Those researchers who work on topics that do not easily fit into one of the themes might have this concern.

According to the committee, many research-strong individuals focus on achieving academic excellence. This might potentially lead to a conflict between individuals excelling on the one hand and team efforts and jointly defined themes on the other hand. This relates to values that are perceived as important for the institutional culture, which should be clarified and made explicit.

ITC has a strong and unique culture. The committee noted that this has advantages as well as drawbacks. Positive is that everybody feels part of this culture, including the PhD candidates, and is proud of belonging to ITC. A potential drawback is that the organization is less open to external feedback and might not hear the critical voice from within the organization. The committee emphasized the importance of being open to external and internal feedback on all aspects and making sure to value critical constructive voices.

Funding

Before the merger with UT, the base funding was largely provided by the Netherlands Development Programme. One of the threats for ITC is this politically motivated merger has sensitive base funding. ITC aimed and still aims at diversification of funding sources. To a certain extent, ITC has been successful in this, with a modest but clear increase in successful grant applications. To be more successful, ITC will further strengthen its (personal) grant support programme. According to the committee, to really become successful in grant applications, ITC should shift towards long-term programmes rather than short-term projects. This might require going from working on local and ad hoc problems that lead to scientific research, to looking at scientific innovation.

Partnerships

ITC has a very strong focus on the ‘majority world’, the level of international collaboration is outstanding, sector-leading and increasing, with 94% of publications being co-authored with international colleagues. The recent increase in collaboration with colleagues in Africa and Latin America is significant. On the other hand, there are relatively few regional projects. It was acknowledged in the self-evaluation report that ITC is not strongly involved in the setting of the national research agenda. Related to this is ITCs ambition to focus more strongly on local and regional collaborations on topics like drought, liveability and cadastral planning. In the educational programmes, students with an international background can also work on Dutch multidisciplinary, wicked problems that require solutions. ITC has several part-time chairs who are also connected to other institutes, like the Red Cross and KNMI, with the aim to strengthen strategic partnerships. Building and sustaining further partnerships with Dutch organisations and companies is stimulated by the committee.

Facilities and support staff

The committee compliments ITC with its research support and laboratory facilities. There is strong research support, the support staff balances proactive and reactive support well. The committee does point out the importance of getting all research staff (senior and junior) familiarized with what facilities are available. Furthermore, there seem to be opportunities for increased collaboration between the different labs.

Open science, research integrity and data infrastructure

The committee welcomes the strategic aims of ITC towards open science. ITC highly values open science which is included in ITCs strategy. The committee noticed strong initiatives towards Open Access Data (protocols, repositories etc) and upcoming ambitions towards Open-Source software (centralized repository and management) and with these, the ambition to improve the reproducibility of the results.

The number of open access publications increased rapidly (from 15% to 71% in the evaluation period). The increased focus on high-quality scientific research led to an increase in publishing in high impact journals and embracing the challenge of open access publishing. ITC mentioned that somewhat hindering the further increase of these percentages is the ambition of ITC to be in the Top 5 of the Shanghai Index which requires publishing in top journals that are not necessarily open access. However, the committee is of the opinion that there are many open access high impact journals in the field (e.g., HESS and Geoscience). Most high ranked journals also offer the option for open publication if the authors pay a fee. By providing more support and advice at all levels, ITC can stimulate both high impact and open access publications. ITC has to make sure that the required – and often high – fees are not a hurdle to publish open access. The requirements of funding agencies concerning open access publication are helpful for ITC to improve in this respect.

ITC hired an open science officer, and the storage and publishing of research data sets are exemplary. Within the scientific staff, there is interest in and focus on the topic of open science and several initiatives are observed, e.g., concerning publications and more recent open access data. The committee met a few individuals that are very passionate about open science and have a clear vision. CRIB has been opened to alumni, and there are ideas to have a data/model sharing platform on the website. There might be potential conflicts with spin-off ideas, private users of data and the combination of open access publishing and preferred journals. According to the committee, researchers should be allowed by ITC not to choose for open access but must be able to motivate why not.

The ambitions and commitments at different levels are appreciated with the involvement of supporting staff, research staff and PhD students. Currently, it seems that the initiatives often start at the individual level and

hence it is a challenge to get procedures being adopted by all staff. For example, the committee mentions the upcoming ambition on open-source software, which should be centralized more strongly in a repository. This might require a culture change and the committee stimulates ITC to come up with ways to implement individual initiatives at the institute level. A potential point of tension may be related to the use of data for private initiatives. Exceptions should always be allowed when well-motivated.

ITC has the potential to be a role model in open access, in particular, its expertise in dealing with large data sets, by continuing its efforts and initiatives and enlarging the enthusiasm and awareness of open science in all departments and under all employees. In the process of improving the ITC wide strategy, the committee emphasizes the importance of defining performance indicators (such as number of papers in open access journals, number of downloads etc.), evaluating them and showing best practices. A specific suggestion is to create one or two key 'flagship' datasets to enlarge visibility and impact. Open science will help to increase the exposure impact of ITC.

The policy on research integrity is robust and there is good support in place for staff and students related to ethical issues and plans for more support. According to the committee, the ambition in terms of societal relevance and increased use of social media by research staff includes a possible side effect of which ITC is not sufficiently aware. The implications of using geospatial information and technologies in social media might not always lead to positive comments. The committee recommends to, going forward, make sure that the researchers are increasingly aware of potential risks of being present on social media.

3.2. Relevance to society

ITC has had significant impacts in several relevant policy areas related both to research, education, and capacity development. More established research fields (e.g., disaster management) have been recently complemented with topical and important focus areas, such as geo-health. The committee saw evidence of positive and impactful relationships with external stakeholders (universities, NGOs, and companies in particular) at the project level and related to individual researchers. The committee also commends the participation of ITC researchers and activities related to impactful international bodies.

ITC produced a considerable amount of innovative applied research, and the outcomes were used by others, though connections were often at the project level and related to individual researchers. The collaborations with stakeholders are strong, many have existed for a long time and the use is significant. The committee does see opportunities for even more significant use, value, and sustainability of the collaborations. Although ITC clearly has an impact, a faculty wide policy and strategy seemed to be lacking. The committee stimulates ITC to define a strategy, including criteria for measuring the success of impact, mechanisms for strategic partnerships and working on institutional relevance. This strategy should also include clarification on potential conflicts or competition with the ambition to perform excellent research and be at the top of academic rankings. According to the committee, part of the strategy should also include expansion in internationally relevant collaborations, e.g., with international organisations such as FAO and agenda setting bodies.

Increasingly, ITC is including citizen science in its research activities in addition to other activities (like training and sensor instalment). To enlarge the impact of citizen science, ITC is recommended to consider how to use the results of citizen science (research objectives, products, and papers) and how to share results with not only the participants but also with society at large.

ITC is a world-leading but appealingly modest organisation. It has the ambition to increase its visibility via

social media, and several nice examples were provided during the site visit. According to the committee, ITC has a good international reputation and can use social media for further branding of its own name. To the committee, ITC must not be expecting or relying on individual staff members to share their work via social media. Science communication should be supported at the faculty level for all departments and include open science and an opportunity for societal impact. The committee recommends that ITC puts mechanisms in place to support research staff, e.g., providing a standard and making sure that it does not become a burden.

One of ITC's strengths is its wide network of stakeholders, specifically its large network of alumni and (research) partners. It would be useful to know and understand where PhDs find their work after graduation and how the PhD qualification contributes to the alumni in their day-to-day work. This will help to describe and/or quantify the impact ITC has in this respect. Although the network was considered a strength by the committee, ITC should more explicitly include the collaborations with alumni and stakeholders at a strategic level, to move from interactions centred on individuals and projects to relationships with strategic focus areas. Especially the relationship with alumni seems to hold a potential that could be even better utilised, given that ITC alumni occupy positions of relevance in several high-profile international organisations. This could be leveraged in two directions: (a) receive input on strategic directions for ITC research and education to remain relevant and impactful (e.g., through advisory boards and other types of engagement of external stakeholders); (b) expand the participation of ITC researchers and partnerships with relevant international policy agenda setting bodies.

3.3. Viability

When looking at the present status of ITC, the committee has every confidence in a bright future. ITC is a world leader in its field. To maintain this position, or even improve, the committee sees several challenges and opportunities for improvement. This requires flexibility and ITC can adapt. The institute has been in transition for 20 years and dealt well with it. It made very important contributions to capacity building in the majority world and scientific leadership.

The combination of capacity development, research and education at ITC was consistently reflected in the interviews during the site visit. The committee also noticed that the demands, wishes and needs of the majority world are changing. ITC showed that it has an adaptive culture, it already shifted from a predominant focus on education and capacity development towards starting research lines. The focus on high-quality research is further increasing, especially (though not only) for the early to mid career researchers. This requires ITC to rethink its future strategy in terms of the balance between capacity development, research, and education, as well as the way to have them interact to further strengthen ITC's profile. There is a strong bottom-up attitude in the organisation; individual researchers see challenges, start projects, do research, and communicate about the results. This gives dynamics and satisfaction. To make these initiatives sustainable and long-lasting, they could be stimulated and supported more strongly, e.g., by programmes to sustain them in the longer run. If programmes are in place and people leave the institute, the programmes will remain and continue to be of value to the institute. By creating strategic collaborations, focusing more strongly on long-term programmes, and thinking about where to expand (or not to expand), ITC could make even more use of its asset of stakeholders. The committee stimulates ITC to shift more towards a focus on global challenges and less on solutions to local problems that cannot be used more widely. Also, ITC is stimulated to develop mechanisms for ensuring that impact is not dependent on individuals. The committee also stimulates ITC to shift towards setting the agenda and working from a scientific point of view rather than solving practical issues and following trends. The four themes ITC defined might play an important role in this, though should be clear and supported by all staff members.

An important aspect to pay attention to in the upcoming period is to progress a new generation of academic leaders through a successful tenure track. To the committee, foresight leadership could be addressed more clearly. A revision of the evaluation of the tenure track is ongoing, this is seen as important both for the success and for setting targets that are more qualitative and less metric. The revised targets could be adjusted to better fit the mission of ITC and new generations could be involved in the networks. The tenure-track staff feel involved in the agenda-setting, though the committee encourages ITC to make sure that the new generation is well-prepared to becoming the future leaders. Furthermore, ITC is encouraged to make sure to 'transfer' to the younger generation and support them in building up new and/or extended networks. In this, alumni can be of major value. In this respect, the committee emphasizes the importance of the aforementioned, long-lasting research programmes and finding a balance between bottom-up and institutional initiatives.

For its research, ITC has income from different funding sources. A major part of the (direct) funding comes from the Ministry of Foreign Affairs. ITC understands that depending on this resource, is a risk for its viability. The committee thus is in favour of ITC's approach to manage the funding risk and aim at a variety of funding sources. ITC also needs to consider how best to tailor a strategy to maximise the probability of securing sustainable funding (i.e., maintain capacity development).

In conclusion, ITC has a world-leading role in the field of remote sensing and spatial analysis, and it has to maintain and strengthen that position and explore more the potential of the alumni and partner network. Visibility is important, as ITC has a very positive image which should be maintained, also after further integration to UT.

4. Recommendations

In the light of the above findings, the committee has the following recommendations for ITC:

1. Strategy: develop a unified statement on ITC's vision and associated strategy. This should include clarity on values, targets, priorities, and organisational structure. To measure the impact and quality of its research, ITC is recommended to define a smaller set of indicators (approximately 10-15) and even fewer key performance indicators (approximately 5).
2. PhD training: increased attention is required for the well-being of PhD candidates, specifically regarding the Covid-19 situation and international PhD candidates. It is important to ensure 'equality' between all PhD candidates, independent of funding source. The committee is of the opinion that a more prominent role for pITCom (e.g., representation in the management) is required. Furthermore, more explicit mentoring could be developed, and supervisors should be trained in supervision of PhD candidates.
3. Open science: ITC has the potential to be an international role model. The number of open access publications has strongly increased and the developments in open-access data are encouraging. The committee recommends providing support and advice to the research staff and clearly define performance indicators.
4. HRM: ITC needs to develop a policy and mechanisms to promote diversity and inclusion. At the more senior levels, in particular at management level, diversity is lacking and no mechanisms are in place to deal with it.
5. Societal relevance: To be able to underpin the outstanding work ITC is doing, the committee suggests defining a strategy and policy on societal relevance and impact, including criteria to measure the success of the impact.
6. There is attention for the welfare of the researchers. Still, increased focus on satisfaction across the entire organisation is recommended, e.g., by regular monitoring of well-being and discussion of the results.

In the Terms of Reference, ITC requested the committee to offer its assessment and recommendations on several topics. The questions on open science, research themes, PhD duration and talent management were part of the interviews and discussions during the site visit and are dealt with explicitly in this report. Regarding the two remaining topics, the committee has the following observations and suggestions

7. Research Infrastructure: ITC's research infrastructure is overall very well equipped and organized. The support staff are experienced and dedicated. The committee recommends frequent, periodic evaluation of the research infrastructure and especially research equipment as technologies develop fast in the domain of ITC.
8. Monitoring and evaluating research integrity in research practice: the interview with support staff led to the conclusion that ITC and UT activities in relation to integrity and ethics are going into the right direction. The committee has no explicit recommendations in this respect, except for continuing on the path set.

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 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

Date & Time	Activity	Participants
22 September		
10.00 – 12.30	Kick-off meeting committee (including lunch)	Committee
12.30 - 12.45	Welcome by the Dean	Committee & all participants
12.45 – 13.45	Interview on research program ITC	Committee & Faculty Board
13.45 – 14.00	Closed committee meeting	
14.00 – 15.00	Poser session Departments	Each department 2-3 posters + PFR
15.00 – 15.30	Closed committee meeting and break	
15.30 – 16.30	Interviews with Heads of Department	Committee and HoD
16.30 – 16.45	Closed committee meeting	
16.45 – 17.45	Interview focus areas	Geo-Health, Food-security and Biodiversity, Hazards-Risk-Resilience, (Big) Geospatial data analytics
23 September		
8.30 – 9.00	Closed committee meeting	
9.00 – 9.45	Interview stakeholders (online)	Committee and six stakeholders
9.45 – 10.00	Closed committee meeting	
10.00 – 11.00	Interview Tenure Track Staff	Committee and assistant and associate professors
11.00 – 11.25	Closed committee meeting and break	
11.24 – 12.25	Research support	Representatives Geo Science Lab, Research Support data policy, ethics committee, Open Science, Capacity development and the Coordinator Research
12.25 – 12.45	Closed committee meeting	
12.45 – 14.15	Lunch with PhDs and poster sessions	
14.15 – 14.30	Closed committee meeting	
14.30 – 15.30	Labs	Tour of GI Science Lab, RS-GIS lab, Library, GDR
15.30 – 17.30	Closed committee meeting	
17.30 – 18.00	Plenary meeting of first findings	ITC staff and committee
18.00	Closing	

Appendix 3: Quantitative data

Table 1: Research staff in FTE

	2014		2015		2016		2017		2018		2019		2020	
	FTE	#	FTE	#	FTE	#	FTE	#	FTE	#	FTE	#	FTE	#
Scientific staff	19.4	71	19.6	77	21.7	82	22.7	85	23.9	90	25.0	100	25.6	105
Assistant professor	11.4	42	11.6	47	13.2	50	14.0	51	15.2	58	15.5	63	14.3	58
Associate professor	4.0	14	3.9	14	4.2	17	4.7	17	4.7	16	5.4	21	6.1	25
Full professor	3.9	15	4.0	16	4.3	15	4.1	17	4.1	16	4.1	16	5.3	21
Postdocs	8.3	17	11.5	18	13.7	20	16.3	22	14.2	23	11.6	19	16.7	34
PhD candidates														
Employed	10.1	20	24.9	30	38.0	51	47.4	54	45.2	54	38.2	50	36.3	50
Scholar	111	141	104	122	95	108	85	100	75	98	63	84	60	70
External	17.0	36	8.9	11	9.4	12	10.7	13	16.8	20	17.5	22	21.3	25
Total research staff	165	285	169	258	178	273	182	274	175	285	156	275	160	283
Visiting fellows	14.8	52	18.2	53	15.1	28	9.5	29	5.8	24	0	0	0	0
Support staff	6.3	15	6.3	15	6.4	15	6.9	15	7.2	16	7.3	16	7.2	16

Table 2 main categories in research output for the years 2013-2018

categories	2014	2015	2016	2017	2018	2019	2020
Book	12	9	12	1	5	1	2
Refereed article	222	225	223	246	275	283	280
Non-refereed article	31	24	24	9	5	12	4
Book chapter	37	44	47	47	76	21	29
PhD thesis	26	17	18	16	26	32	16
Conference paper	46	114	95	75	58	87	46
Professional publication	12	7	12	17	28	25	18
Publications aimed at the general public	1	1	2			1	2
Other research output	107	107	123	125	134	72	44

Table 3: funding in FTE

	2014	2015	2016	2017	2018	2019	2020
	%	%	%	%	%	%	%sci
FTE	165.4	169.0	177.8	182.1	175.2	156.3	160.0
Direct funding	40.2	36.8	39.9	39.1	46.0	40.1	42.3
Research grants	3.7	9.2	6.2	7.9	18.5	7.7	6.2
Contract research	56.1	54.0	53.9	53.0	35.6	52.2	51.5
Other	0	0	0	0	0	0	0
Total funding	100	100	100	100	100	100	100