27 May 2011

Review Architecture and the Built Environment TU/e and TU Delft

Review of research groups and programmes
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1. Preface

This report summarizes the results of the peer review assessment of the research programmes and institutes of Architecture and the Built Environment at the Eindhoven University of Technology (TU/e) and the Delft University of Technology (TUD) during the period 2003 – 2009. It also includes the review of the Berlage Institute in as far as it carries out research in conjunction with the TU Delft. The purpose of this report is to present the results of the assessment of the research management and quality of the research groups and the faculties as a whole.

A committee of 8 members plus the chairman and secretary carried out the evaluation. The areas of expertise covered the broad range of disciplines within Architecture and the Built Environment. For the review, the committee used the Standard Evaluation Protocol 2009-2015 for Public Research Organisations (SEP) that was developed by VSNU, KNAW and NWO. The starting point for the evaluation was a self-evaluation report from each university. Also, additional information was provided on a (secluded) website. On behalf of the committee, I want to express our gratitude for the efforts made by all involved parties to prepare the documentation required for this evaluation. This documentation contained valuable information and formed a very useful basis for an objective evaluation procedure.

During the site visit both the universities and all the research groups / institutes gave a short presentation followed by a discussion with the committee. These discussions were open and provided the committee with essential additional information. The committee members are very thankful to all representatives for their willingness to share their opinions and concerns with us in a very open and candid manner.

As a chair of the committee, I want to thank my fellow committee members for their commitment and dedication to this evaluation process. We had fruitful deliberations, where we could build on each other’s expertise and the willingness to adopt thoughtful considerations. I am very pleased that this report reflects the consensus opinions of the committee.

Last but not least I want to underline that the review was a very inspiring exercise for the committee. It (almost) goes without saying, that the quality of architectural education AND architectural research in the Netherlands is respected and revered worldwide. To some extents, the review process including reading the reports, viewing the presentations and interviewing our colleagues was a real treat. The outcomes seemed almost clear from the start. As such, given the highly-regarded stature of the subjects of our inquiry, the review was a challenging task. Simply put, the high quality and the spirit of the research at both the universities impressed us all. To be sure, we found things worth criticising and things worth praising - they are described on the pages that follow. Lastly, I want to say that it has been an honour for all of us involved to be able to play a role in the advancement of our collective research area: Architecture and the Built Environment.

Prof. Peter Russell
Chairman
2. The review committee and the review procedure

2.1 Scope and objective of the assessment

The review committee was asked to perform an assessment of the research groups and programmes in Architecture and the Built Environment at the Delft University of Technology (Architecture & OTB), the Eindhoven University of Technology (Architecture, Building and Planning) and the Berlage Institute. The Delft University of Technology (TU Delft) and the Eindhoven University of Technology (TU/e) are part of the 3TU Federation. The Berlage Institute is an independent institute, based in Rotterdam, but it has links with the TU Delft covering research and doctoral work. The review covers the research in the period 2003 – 2009.

The framework of the research assessment is the Standard Evaluation Protocol 2009 – 2015 (SEP). This protocol was devised and approved by the three organisations that are primarily responsible for public funded research in the Netherlands: the Association of Universities in the Netherlands (VSNU), the Royal Netherlands Academy of Arts and Sciences (KNAW) and the Netherlands Organisation for Scientific Research (NWO). In accordance with the Standard Evaluation Protocol 2009 - 2015 for Public Research Organisations (SEP), the committee’s tasks were to assess the quality of the institutes and the research programmes on the basis of the information provided by the institutes and through interviews with the management and research leaders and to advise how this quality might be improved. The SEP is part of a quality assurance system that targets the following three objectives with regard to research and research management:

- Improvement of the quality of research through an assessment carried out according to international standards of quality and relevance;
- Improvement of research management and leadership;
- Accountability to higher levels of the research organisations and funding agencies, government, and society at large.

The entire Faculty of Architecture and the Built Environment of the TU Delft and three of the research groups at the TU Eindhoven (IBT, LC and PEBE) chose to participate in a pilot called "Evaluating Research in Context" (ERIC). The ERiC project consists of three phases.

1. A conceptual phase where the specific characteristics of architectural research have been reviewed and discussed in workshops.
2. The development and testing of a set of criteria and indicators for research evaluation, in which the specific characteristics of architectural research are taken into account.
3. An analysis of the architectural research within ISI databases, to assess the possibilities of using bibliometric indicators for evaluations.

In addition, the participating research groups also conducted a stakeholder consultation (the TU Delft did this through a survey and the TU Eindhoven chose to conduct interviews). The stakeholder consultations were used as input for the self-evaluation (as criteria for establishing societal relevance).

2.2 Composition of the review committee

The composition of the committee was as follows:

- Professor Peter Russell, chairman (RWTH Aachen University)
- Professor Rachelle Alterman (Israel Institute of Technology)
- Professor Nicholas Bullock (University of Cambridge)
A short curriculum vitae of each of the committee members is included in Appendix A.

Dr. Frank Zuijdam of the Technopolis Group was appointed secretary to the committee.

2.3 Independence
All members of the committee signed a ‘Declaration of Unbiasedness’ to safeguard that they would assess the quality of the institutes and research programmes objective and without prejudice. Any existing personal or professional relationships between committee members and the institutes under review were reported and discussed. The committee concluded that there were no unacceptable relations or dependencies and that there was no specific risk in terms of bias or undue influence.

2.4 Data provided to the committee
The committee received detailed documentation consisting of the following:

- Self-evaluation report of the institutes under review (the Berlage Institute included)
- Reports of stakeholders consults of LC, IBT and PEBE (TU/e)
- Terms of Reference for the Review

Also additional information was provided:

- Mid term Review of the institutes under review
- Appendices with additional information, such as key publications, profiles of the staff, ratio staff – publications, CV’s, et cetera.

The research assessment did not include a citation analysis given the negative advice the Rathenau Institute formulated within the framework of the Evaluating Research in Context-project: "the publication and citation pattern of the departments of architecture show a rather scattered pattern covering many topics and disciplines showing little structure, [this] makes it undesirable to use standard bibliometric indicators in the current situation”.¹

Additionally, both universities provided the committee with revised statistics at the request of the committee on very short notice. These figures were used to determine performance indicators based on tenured staff.

¹ ERIC, Pilot Study at Faculty of Architecture TU Delft. Final report (February 2010).
2.5 Procedure followed by the committee

The Committee proceeded according to the SEP. Prior to the assembly of the committee, each member of the committee formulated a number of questions after reading the self-evaluations and the additional information. All the questions were collected and sent to the research groups. Preceding the interviews, the committee was briefed by the secretary about the research assessment according to SEP.

The site visits took place from the 22nd to the 25th of November 2010 (see the schedule in Appendix B). After the interviews, the committee discussed the scores and comments. The final assessments were based on the documentation provided by the institutes, the additional information and the interviews with the management and with the leaders of the programmes.

The text for the report was finalised through e-mail exchange. The final version was presented to the institutes for factual corrections and comments. The comments were discussed by the committee and led to changes in the report on a number of points. The final report was presented to the boards of the participating universities and was printed after their formal acceptance. The committee used the rating system of the SEP, the meaning of the scores is described in Appendix C.

2.6 Remarks about the Standard Evaluation Protocol

Although it appears irrelevant to a research assessment, the exclusion of information about the education tasks and duties among the researchers made it difficult to fully weigh the performances of the people being assessed. The percentage of time spent on research is usually somewhat idealistic and to be able to see what other duties the researchers were burdened with (or not) would help in future to give a better evaluation.

The committee received key publications (but not from every group), but this was not part of the SEP-procedure. Nonetheless, the committee used this as additional information to underpin the conclusions about the quality of the research. The members of the committee are adamant that unless you can read one or two papers from a researcher, the evaluation is based purely on meta-information and statistics. Our recommendation is that in future, copies from one or two papers per researcher would help to consolidate the evaluation.
3. Developments since the previous review

3.1 From Evaluation to Evaluation

Since the last evaluation of the faculties of Architecture and the Built Environment took place in 2004 a number of significant changes have occurred in both the context of practice and the working environments of the two institutions. The climate change debate has sharpened the focus on lean thinking and maximizing the effective use of existing resources, whilst the banking crisis has raised issues of ethics, values and value. Both Universities have changed their physical accommodation which has inevitably allowed them, each for different reasons, consider the way they operate, the way they link to other groups both within and outside the universities and the working culture they wish to foster.

At the last evaluation two themes dominated the assessment. Firstly the recognition and appreciation of design related to research and secondly, perhaps due to the lack of a traditional research culture the poor representation of the two faculties in NWO funded programmes.

Since the last evaluation in both institutions one could identify some significant changes in approach. Firstly the strong emphasis on design, and the importance of recognising design as a way of conducting research, has become integrated into the culture of architectural research as research for practice. This was reflected in the concern for evaluating the societal impact of research and the valorisation of knowledge. A major focus of both institutions research strategies was to strengthen the scientific research culture, by increasing the number of D. Phil studentships and citations in internationally peer reviewed publications. Secondly the shift in emphasis away from new building to the more effective use and management of existing building stocks was reflected in the research agendas and the TU Eindhoven’s development plan for 2014 “Beyond Building; Creating a Better Environment”.

In 2004 the Delft School of Design (DSD), a newly formed graduate research centre, spanning between the TU Delft Faculty of Architecture and the Berlage Institute, with the aim of developing and giving shape to design research, impressed the committee. At the Mid-term research assessment the committee’s opinion was that “DSD is one of the promising innovations in the research field of TU Delft. The Committee is impressed by the catalytic effect that the DSD has already had and is convinced of its even greater potential to raise the (intellectual) level of research across the full breadth of the faculty.

It was disappointing to find that as a result of the fire the DSD had not only lost its physical identity, but also its support, and was no longer providing the strong position for practice led research. The previous evaluation made clear that “the Dutch schools of architecture with their technological, scientific foundations are uniquely placed to bring a rigour to the design process and at the same time bring the freedom and breadth of thinking, that comes from intuition, to the world of engineering”. The two faculties are well embedded in practice with strong links to industry and government agencies. Most of the research programmes had raised their scientific credentials and found a productive balance between fundamental, applied and multi-disciplinary research. Bridging the gap between design in practice and research is still a challenge that the Dutch schools are uniquely qualified to fill, supported by alternative initiatives such as the Why Factory, the Berlage Institute, professional European postgraduate Master programme and the embryo “doctorate through practice” programme.

The 2004 Committee “was particularly impressed by the fact that most of the programmes that were submitted for evaluation are well embedded in Dutch society”. This trend has continued, especially in the TU Eindhoven where the two emerging Urbanism streams were both attracting second-stream funds and being closely aligned with practice. At the TU Delft the merging of sections from OTB with sections within
Urbanism and Innovations in the Management of the built environment, has the opportunity to deepen the rigour of the research, foster integrated multi-disciplinary thinking and be highly applicable to practice.

A further note is perhaps necessary in that during the visits to the two universities and the Berlage Institute, it became apparent, that in the background both faculties were to receive new Deans (the dean of the TU Delft has already been appointed, the dean for the TU/e will be appointed in 2012) and that further discussions about the reorganisation of the departments (at least in Delft) were well underway. All of which made the context for offering constructive criticism rather difficult. (i.e. it is hard to evaluate a design if that which is on paper is no longer the current design!) Nonetheless, the committee took the documentation at face value and, where possible, has made adjustments for new information when available.

3.2 General Comments on Research in Architecture and the Built Environment in the 3TU Universities

Architectural Research is a term that is often called into question not only in the Netherlands, but also worldwide. The fight for funds from national research organisations is a fight being fought in almost every European nation. This is partly due to the position taken by architects in the past, which has often been counter-productive. It also has to do with the lack of support from other fields in showing that architectural research, given certain parameters, is a viable and necessary form of research worthy of national support.

Here the committee addresses an open letter to not only the Deans, but also the Presidents of the universities to openly campaign for the acceptance of architectural research from national research funding agencies. It goes without saying, (but we will state it anyway) that this behoves a certain rigour on the part of the researchers themselves. Nonetheless, this appears to be a general condition that all the institutes are operating under and should the leadership of the universities be serious about their commitment to these faculties, then their support in achieving second and third stream funding is important, if not essential.

3.2.1 The case for Architectural Research and Innovation: There is a thing called Architectural Research

Architectural Research is that which investigates the thing called architecture, be it an object, a process, a profession or a field of studies. What architecture apparently not is, is a field of research unto its own. That, at least to this point in time, is the accepted situation in fields of "hard science" like chemistry or physics. This is not altogether bad, as it is not necessary to name architecture itself as a research method in order to perform research about it.

Indeed, by using methods from other fields, architectural researchers can borrow methods from other fields in order to fulfil the goals of their research. This is a good thing. This calls, however, for a stringency of thought and method that is not taught in schools of architecture. Therein lies the problem: researchers want to be taken seriously by the serious research community, but given no training in "serious" research, how can they be convincing?

There needs to be an open debate about this, but not just in the architectural research community, but in the research community as a whole. The establishment of architectural research needs to have the support of natural scientists, engineers, medicine and the humanities alike. Only by employing the scientific community as a whole, can the argument for architectural research be convincingly carried by the presidents of the TU/e and the TU Delft.
3.2.2 Motivating Architectural Researchers: Create the Environment - then get out of the way

In both universities, the committee members were witness to a kind of research management found in very few places in Europe or North America. Indeed, to some extent, the members were at a loss as to how to deal with constructs such as the MTOZ in Eindhoven or the Huxley-esque diagram of reorganisation from Delft over the past years. Additionally, through questioning in Delft, it became apparent, that "acquired funds" as part of a research project when not fully usurped, went to the faculty as opposed to the researcher or research group.

In all this made us wary of the kinds of management practices that are sound in theory, but have nothing to do with the motivations of the individual researchers. Whether this means rewarding frugality (or business sense) or giving researchers a stable playing field, it must be said that in general, the committee missed a sense of how to motivate researchers among those responsible for the management of research.

If we could make one simple recommendation, it would be to create the environment that stimulates that which motivates the researchers and once that is done, please get out of the way. Should anyone in management not be clear about what motivates a researcher, simply ask them.

3.2.3 Architectural Researchers: Be creative, be diligent, be precise, be professional

The committee was rather overwhelmed not just by the enthusiasm that was met with in the interviews with researchers, but also by the commitment to peer-reviewed articles and assessments. As such, this is not a criticism per se, but rather a reiteration of that which will make architectural design acceptable in the wider research community: transparency and peer-review.

In some of the research groups, it is clear that the dissemination must also take place in trade magazines and through other media. The members of the committee do not want to diminish the relevance or importance of this, but simply to state, that the scientific reputation of the research departments is the key to the well-founded placement of architecture within the university and with that, to reinforce the need for solid peer-reviewed publications.

3.2.4 Let rogue thinkers do just that

Just as it is deemed necessary to identify practitioners as vital members of a university-based faculty of architecture, it might also be necessary to identify a certain type of researcher as a necessary part of the research activities within a Faculty of Architecture.

Firstly, to the theme: practitioners; the committee members were unanimous in the admonition that an architecture faculty without practitioners is not viable. This implies, that some kind of compensation (ideal or otherwise) is made for those who can do and can teach, but are not researchers. This is vitally important to the schools, but also to the individuals who may be teaching in universities, but are without the wherewithal (or the mandate) to undertake research.

Secondly, within the research community, there is a large body of research carried out by architects adhering to the methodologies that they have imported from other fields to study certain aspects of the phenomenon: Architecture. There is, however, an intellectual suspicion that something has been missed and that methods from other fields will never discover this per se.

As long as this suspicion exists, it is deemed necessary to fund and provoke institutions like the Berlage Institute or the newly formed Why Factory. To be sure, the results will have to pass the muster of international research recognition. However, in order to perform this evaluation, the experiments must be carried out, despite divergent methods. The chance exists, that perhaps a kind of research that is specific to architecture will become emergent. This in itself, in the opinion of the committee, is
worthy of further experimentation and thus, despite the difficulties in assessing institutions like the Berlage Institute or the Why Factory, the committee implores the directors and deans to explore ways to secure this kind of research experiment for the years to come.
4. TU Eindhoven: Faculty of Architecture, Building and Planning

4.1 Assessment on the institute level

4.1.1 The Faculty of Architecture, Building and Planning

Mission, vision, objectives and research activities

The Mission and Objectives are well thought out and in general, the futures of the Faculty’s research aims are finely tuned to those of the University. The description in the Assessment and the presentation in Eindhoven showed a very solid faculty enjoying new accommodations and working quite hard to meet the expectations of all stakeholders, especially the TU/e management.

In some ways, the reorganisation of some of the research programmes after the results of the previous research assessment is both encouraging and at the same time disturbing. It is encouraging in that the results of these assessments do not fall on deaf ears and when the faculty management feels it necessary to act, it does so. On the other hand, research groups need years to consolidate themselves - the cycle of PhDs runs at between three and five years. With this in mind, it would particularly unsettling to see realignments of research groups being renewed in light of yet another evaluation. Reorganisation is best done from within according to internal timetables.

The committee would recommend letting the research groups have the time to sort themselves out and to let those that are not "sort-able" to have other options for pursuing research questions. This would mean that when new groups are formed, that they enjoy a period of "statistical protection" before the first real assessment and that non-conformity will not be necessarily frowned upon.

4.1.2 Assessment of the quality of the faculty

The overall quality of the faculty is quite high. Statistics about the ranking of schools of architecture are seldom found. However, among the committee members it was clear from the start that although the institution is not in the rarefied air of the top ten architectural research faculties worldwide, the Faculty of Architecture, Building and Planning at the TU/e can hold its own against other universities. This is important as, as it is in Germany, there are polytechnic studies in architecture where research plays little or no role. As such, the Faculty within the TU/e has done a commendable job in clearly showing the difference through high quality relevant research.

As stated in the general comments about the Standard Evaluation Protocol, the complete dearth of information about teaching duties among the researchers makes it well nigh impossible to assess "the faculty", as teaching is the primary activity of institutions of higher learning.

4.1.3 Assessment of the productivity of the faculty

The productivity of the faculty is rather heterogeneous. This is not surprising, given the universal difference in architects who have practises alongside their teaching duties or architects who conduct research alongside their teaching duties. Furthermore, some of the research groups have only been in existence for a few years and as such, have disparate performance numbers among the members of the group.

Additionally, in the aspirant groups, the cohesiveness of the groups could be called into question. In two of the groups (IBT and PEBE), the need to find a place in one of the groups means that the essential motivations of the group members are not
necessarily aligned. It appears that it is not possible to have the option of being a "lone scholar", as one of the committee members describes himself.

On the other hand, the established groups such as DDSS, SD and BPS have burgeoning research activities and performance characteristics that might otherwise call into question the aspect of quality rather than quantity. But, the committee is assured that the quality of this prodigious body of work is also of the highest quality. At most, the statistics begged the question, "How long can they keep it up?"

At the other end of the scale, the committee was faced with assessing researchers who applied sometimes 6% (and in one case 0%) of their time to research. This means, in a forty-hour week, the person dedicated 2 hours and forty minutes to research. In the context of writing research proposals or even research papers, statistics such as these calls into question the numbers. It is possible, that there is a confusion of administrative numbers with real time spent doing research and it might be necessary to declare a certain percentage as the threshold value (say 10%). Everything under this is not serious and therefore not worth mentioning. This also protects against the countervailing case, where someone with a nominal small amount of time spends much more time conducting research thereby generating glorious numbers.

4.1.4 Assessment of the relevance of the faculty
The relevance of the Faculty is without question. Indeed, as the aspects of structural engineering are an integrated part of the Faculty of Architecture, Building and Planning, the situation at the TU/e provides an essential alternate model to that found in the TU Delft or in other universities in Europe.

4.1.5 Assessment of the vitality and feasibility of the faculty
The Faculty is full of vitality. Indeed, it seems that the future of the Faculty for Architecture, Building and Planning is entirely intertwined with the long-term goals and objectives of the TU/e. Seeing that the faculty has only just recently occupied its new building, the members of the faculty can count on the support of the university over the next few years.

To be sure, in any School of Architecture it remains a daunting challenge to conduct research when all the while the cause of architectural research is called into question partly from outside the faculty and partly from within. The notion of research by design is perhaps not without merit, but without rigour becomes a goalless debate about what it is architects do as opposed to what it is that architects can contribute to research. Although bits of this stance could be discerned in the discussions with some researchers, the overall conditions for research in Eindhoven are strong and robust.

4.1.6 Assessment of the SWOT-analysis and vision for the future
The SWOT analysis is, in itself correct and plausible. Generally, however, it belies one of the fundamental aspects of the TU/e Faculty of Architecture, Building and Planning that, in many ways, is the largest target of criticism from the committee members. The process of "embedding" research proposals means that no researcher is without a research area and that what is more, someone in the faculty will evaluate the "quality" of the research before it is carried out. This means that for PhDs as part of second-source and third-source funding, that researchers must not only convince the Professors funding the research, but also the members of the research board as well. While this is noble in the sense of rigour, possibly hinders "edgy" research though the democratic process of committees.

In discussions with the committee, the general feeling was that the management of research combined with the need to place research within one of the research programmes might let the faculty meet management goals, but perhaps miss out on the "loose cannons" and "wild ideas" that are not usually part of a managed research assignment. To put it bluntly, management tends to tame difficulties, but not to solve problems. It is generally felt that the review and "gatekeeper" processes at the TU/e
Faculty of Architecture, Building and Planning work well in well-run departments, but have not helped researchers seeking to orient themselves within the faculty. The lack of coherence in some of the aspirant programmes is evidence of this. The national directives apparently require the grouping of researchers in "containers" of research activities. That said then it is the opinion of the committee that there needs to be an "everything else" research group to allow lone wolves and obsessed researchers time and place to investigate their ideas.

4.2 Building Physics & Systems (BPS)

4.2.1 Programme description

The Building Physics and Systems research program is based on the idea that the design of buildings and the built environment requires truly innovative sustainable solutions, which increasingly require a multi-disciplinary approach. In an academic research environment, the design process of sustainable buildings is examined alongside the building physics of experimental, theoretical and numerical modelling of physical aspects in the indoor and outdoor environment and the building envelope, such as heat, air and moisture transfer, wind, light and acoustics, simulation of behaviour of buildings, systems and components. Such a combination of expertise in energy, comfort and indoor health aspects of the built environment is unique.

Research within the program yields scientific results that contribute to the understanding and knowledge of physical behaviour and integral building design processes. Through laboratory tests and other externally financed projects, the research program also provides information to the building industry and engineering consultancy firms. The main research areas are Acoustics, Building Services, Building Simulation, Heat and Moisture Transfer, Indoor Environment Design, Lighting and Material Science. Synergy between the chairs is essential to encompass the complexity of the built environment.

The research is carried out by a network of collaborators within a common research program with the same strategic mission, the sustainable control of a high-quality built environment. The multi-perspective approach offers the best way to tackle the complexity of sustainability within the built environment.

4.2.2 Quality

The Building Physics and Systems research program has a unique combination of competences within the built environment, providing very good opportunities for multidisciplinary research in the field, which is essential for research and development of truly innovative sustainable solutions. The program has reached a high scientific quality through a strong interaction between fundamental research and more applied research that addresses more specific problems from the built environment in cooperation with industry.

The quality of the published results is very good and the work related to wind effects, integrated design and building simulation is excellent. The program has found a good balance between dissemination amongst the research community, through academic publications, and dissemination amongst the building industry, by means of professional literature.

4.2.3 Productivity

The Building Physics and Systems research program is one of the largest groups in the faculty with a consistent and steadily productive performance.

Both the quality and quantity of the publication output has been increasing during the period under evaluation. There has been a strong focus (and increase) in the number of articles in peer-reviewed international journals, especially during the last three
years. The number of conference papers has increased as well. Although the number of professional articles has decreased, there is still a good balance between academic and professional publications. The research group has received several “best paper awards” for both journal papers and papers published in key scientific conference proceedings.

The external funding level is consistent at around 25% of the research income and consists of both smaller projects, carried out in cooperation with the industry, and larger projects funded by EU or other research agencies. However, in view of the research profile of the programme, it seems that there is still an unexploited potential for attracting funding from scientific research councils.

### 4.2.4 Relevance

There is an increasing tension between the requirements for considerable improvements in energy efficiency in the building sector and the occupant expectations to a healthy and comfortable living environment. The research programme is highly relevant in this context, as it focuses on many of the most important research topics needed to balance these often conflicting requirements.

However, it is the impression of the committee, based on the diversity of the research activities, projects and publications that improving the cooperation between the different research areas could considerably strengthen the research strategy. Although the programme has a unique position to conduct research in fields covering many relevant disciplines, it lacks a more holistic research approach and, thereby, may be in risk of losing focus.

### 4.2.5 Viability

The research programme has a strong focus on research in specific fields, which is performed with high quality and productivity. However, the programme does not fully exploit the potential of such fields and, moreover, does not project an image as dynamic as it could and should be. The collaboration between the various subgroups is not very clear and, apparently, a clear common, long term vision is also missing – it should provide a clearer focus on a holistic research approach involving multi-disciplinary work and attributing well defined roles to the individual subgroups. The committee considers it important to define such a long-term vision. The well-equipped laboratory is a great asset of the programme and its future maintenance and development should constitute a high priority.

Simply put, the research is of highest quality and hence, shows potential of becoming less relevant through the confidence of success. The scoring is as much a reflection of the outputs as of the responses from the interviews.

![Figure 1 Scores Building Physics & Systems (BPS)](image)

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4.3 Design and Decision Support Systems (DDSS)

4.3.1 Programme description
The research program “Design Decision Support Systems” is one of the seven research programs in the faculty of architecture at the TU/e. DDSS works in the field of computer aided design and planning, bringing together advanced expertise on data collection, modelling, and applied computer science. Its researchers are drawn from a variety of backgrounds in architecture, urban planning, computer science, civil engineering, social psychology and research methodology. The ongoing projects show a significant and comprehensive effort to support design, construction and management issues at every scale from the architecture of buildings through urban fields to strategic planning tasks: notable applications include building information systems, urban green space management, transport logistics, emergency evacuation models, and national-scale activity-travel prediction.

4.3.2 Quality
DDSS clearly represents the international leadership in academic reputation in its field. The programme can claim pre-eminence both in the range of problems addressed and in its commitment to harness modelling in support of decision-making. DDSS conducts research that is both academically rigorous and of practical relevance. We commend the programme’s growing success with second and third stream funding. Innovative, fundamental results are submitted for publication to journals with a critical reviewing standard, and are elaborated in externally funded projects. A high rate of peer-reviewed papers proves the strength and efforts of academic output and results. The intellectual reputation of the research program is strong, its international network is extensive, and citation and esteem indicators are healthy.

4.3.3 Productivity
The research program has a singularly prolific productivity rate, whether measured in output to high-level publication, or conference presentations, or in successful turnover of PhD based research, or in third party products. Without going into a detailed review of DDSS output the committee recommends that some thought be given to greater selectivity in pursuit of work of the highest quality.

4.3.4 Relevance
User relevance is the DDSS mantra and applies to all aspects of the program. Most projects are stakeholder-initiated. The group’s self-assessment highlights the attention paid to bringing innovative thinking to practice through dissemination and valorisation - a process that may take years. There was clear evidence of improvement over the research assessment period (previous score 4). We note the effective use of partnership with commercial consultancy. The same application-oriented ethos extends to the identification of PhD topics in relation to open questions, national or international. Several theses have resulted in business start-ups.

The assessment panel was disappointed that the projects presented on the occasion of the TU/e visit seemed either somewhat outdated (e.g. 3D box) or undeveloped (e.g. digital domes). There may be scope for a greater focus on relevance to architectural design and a stronger supportive role for DDSS vis-à-vis fellow TU/e research programs, as previously noted in the 2007 research review. Furthermore we encourage the group to integrate more open-source products for long-term dissemination.

4.3.5 Viability
The program has two chairs, six staff and 26 PhDs and post-docs. The assessment panel discussed the remarkable increase of PhD candidates in relation to fixed supervision capacity.
It was not clear to us how the DDSS supports its own faculty. Many computer-oriented research teams in architectural faculties are confronted by ignorance of computer models and decision-support tools amongst colleagues. With its enormous external standing, the DDSS can surely set an example by opening a bridge to research issues and projects ongoing within the Faculty of Architecture Building and Planning. This is highly recommended.

Honouring the huge proficiency of the program leaders, Harry Timmermans and Bauke de Vries, the panel found the DDSS program structure to be somewhat centralized. We would hope to see more flexibility and experimental work by the very talented staff. More enthusiastic involvement of younger members of the group is essential to continuing viability of this prestigious program in years ahead.

In essence, the group is undoubtedly successful, yet in the choice of technologies to demonstrate to the committee, showed a certain degree of complacency that is dangerous to the viability of the group. As such, the scores reflect not only the outputs, but also the answers and demeanour of the group in the interviews.

Figure 2 Scores Design and Decision Support Systems TU/e

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4.4 Innovation in Building Technology (IBT)

4.4.1 Programme Description

Building technology has to evolve and be developed to meet the needs of material and energy shortages so as to develop a more sustainable future. IBT was initiated in 2009, founded on the Slimbouwen and Lifespan principles (Lichtenberg) which anticipate the vision for the development of the construction industry (CI) to renew building construction as formulated by international organisations such as European Construction Technology Platform (ECTP 2007) The United Nations Environmental Programme (UNEP 2007), the National Green Building Councils and the International Initiative for Sustainable Built Environment (IISBE). These initiatives set the objective for the Construction industry by 2030:

- To provide value to present and future stake holders satisfying the needs of its clients and society;
- To deliver exceptional, sustainable and durable buildings of high quality and demonstrating a long-term responsibility to the environment (zero impact);
- To establish an increased knowledge base, sustained innovation (invention, diffusion, application) and excellent operations.

Changing the construction industry specifically needs an academic contribution at a holistic level, and to develop approaches which add value to building users according to their primary processes. IBT aims to develop new building technology and processes based on new visions like Slimbouwen and Lifespan, focused on an integrated approach. The programme aims to “establish efficient, flexible and sustainable building construction by integrated product and process innovation”.

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4.4.2 Quality

The research group which was formed in 2009 has taken a well trodden path of addressing the construction industry's response to meet the needs of material and energy shortages so as to develop a more sustainable future. The programme is constructed around the Slimbouwen and Lifespan principles which advocate a holistic approach integrating both product and process innovation.

The Faculty has a long tradition of innovation in integrated building construction through the work of Professor John Habraken (Supports). This tradition was holistic in its approach of integrating design, construction and use through time. IBT's ambitions could continue this tradition. At this stage, the experience of the group is stronger in practice and consultancy. Refereed publications are low, and the ratio of academic publications per member of tenured staff is in the bottom quartile for the Faculty.

The group is in the process of building international affiliations with some of the leading centres (Loughborough University, National University of Hong Kong, EHT Zurich and TU Munich) and is collaborating with other Dutch Institutions. However it is difficult within the short time frame to assess the quality of the relationships and outcomes.

4.4.3 Productivity

The earning capacity from second stream funding streams (STW/NWO) is low. The funding from government bodies and industry is high and individual members of staff have had success in acquiring grants from foundations and contract research. However, the academic output has scope for improvement with only two refereed articles in five years. The group has shown its ability to work and communicate with practice, and the results are appreciated by the review committee. For the long-term viability of the group, the focus should equally be on achieving a high academic reputation.

Given that the programme has only been in operation since 2009, the PhD programme is difficult to assess. The ambition is to attract international PhDs including funding and set up consortia for collective research.

4.4.4 Relevance

The theme of this programme, which places construction innovation for both product and process in the wider context of how the product continues to be used and managed and through evaluation links this back to the briefing and product improvement cycle, is timely. The programme has ambitions to make links with other programmes and departments within 3 TU and also international connections.

The current links and initiatives by individual members of the programme have funded a pilot platform (Action House and House of Tomorrow Today) to test ideas and valorise process and design innovation. “Over 30 building projects have been carried out in practice in accordance with the Slimbouwen and Lifespan hypotheses. The market network is strong and practice provides a field laboratory for the testing and development of new technologies and pilot projects gaining knowledge about the adoption and experience of users”

The diversity of research topics reflects individual interests with little central focus or coordination. This range of interests is represented by only one PhD candidate. Greater focus and integration is required. The overarching ambition of the group to find a “balance” between establishing a new building technology and understanding the process of delivery needs to be clearly articulated.

From the presentation to the committee and list of outputs it is not clear how effectively the feedback and learning is being disseminated to both the construction and end user communities. Technopolis in their stakeholder interviews found that stakeholders “have a high opinion of IBT”s work and their interaction with IBT is...
highly appreciated”. There is an opportunity in the future for greater outreach. The report recommends; establishing an advisory board; the publication of an accessible widely distributed newsletter and alliances with other partners. All these proposals should be considered in the next stage of development.

4.4.5 Viability

The programme has ambitious plans for an area of applied research which could have considerable relevance for the construction industry and continues a field of research where TU Eindhoven has a strong legacy. The programme needs greater focus. Currently it aims to cover a wide range of interests and there is no publication or keynote address of international standing which would position the group as leaders in this area of applied research.

This programme could benefit by working closely, or merging with PEBE to strengthen its ability to bid for second stream funding, and strengthen its PhD programme.

With two of the three current chairs retiring soon, this would be an excellent opportunity to search internationally for a candidate that covers both construction (supply) and user needs (demand) interests and has a strong research profile.

Figure 3 Scores Innovation in Building Technology TU/e

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<td>Viability</td>
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4.5 Architecture of the Living City (LC)

4.5.1 Programme description

The research programme ‘Architecture of the Living City’ was founded in 2007-08 by those newly appointed to the chairs of ‘Architecture and Urban Culture’ and of ‘Architectural History and Theory’. The programme concentrates on the character of the Dutch urban and regional development and its immediate European context. During the period of post-war reconstruction, urbanization in the Netherlands was characterized by a large number of urban extensions, culminating in the Vinex program that has just reached the end of its final phase. It will be followed by a new approach that, rather than starting afresh with a tabula rasa, will focus on the conversion of existing urban landscapes, city fragments and buildings.

Before moving to action or intervention, this new approach will require an understanding of the identity and values of what already exists. This understanding will in turn need special techniques of morphological and typological analysis, as well as a better grasp of the key principles that shape our urban behaviour, ranging from the societal use and perception of space, to questions of cultural heritage and sustainable development. In anticipation of the application of this approach, the Architecture of the Living City programme will seek to focus on understanding and exploring the redevelopment of the existing city and its architecture, and the way they must respond to the changing socio-economical context and the cultural constraints and demands imposed upon them.

The Architecture of the Living City programme envisages close collaboration with the Urbanisms programme with which it shares a common interest in the genesis of the
existing city and its architecture and the way that they may be reused, adapted or reshaped by new interventions. Like the latter, the Architecture of the Living City programme has a strong interest in design-related research issues such as: mapping; typo-morphological studies; the development of alternative scenarios for particular locations; and the theory of design. The programme is currently developing four broad research projects: contributing to the general academic background of theory and history; extending the methodological ‘toolbox’ of spatial research; studying the architectural object in its specific context; and investigating the design of individual projects in terms of typology, morphology, style, and technology.

4.5.2 Quality

The research of the principal members of the programme is known internationally, though the emphasis on the Dutch city and its context and the fact that many of the publications are in Dutch gives them a higher profile nationally than abroad. However, the growing number of international collaborations, through UNESCO and the World Heritage Comparative Studies, will ensure greater international visibility for the programme in the future. The international reputation of individual members of the group is evident both from publications and from ventures such as the launching a series of publications with the University of Minnesota.

4.5.3 Productivity

The productivity of the programme measured in terms of the number of narrowly academic publications is lower than that of the other programmes in the Faculty. However, this fails to take account of the very size of the constituency, concerned with architectural and urban issues that they seek to address. For these purposes, publication in professional journals and magazines such as Oase, Dash and Positions should be recognised as a useful (if different) measure of productivity and relevance. On this basis, the number of publications by the programme’s tenured staff over the last two years improves significantly to compare more favourably with other programmes in the faculty. Recently established, the programme has only one (0.8 FTE) internal PhD student though there are currently four others with external funding. However, plans for a two-year Master programme are in preparation and with it the prospect of more doctoral students.

4.5.4 Relevance

A measure of the social relevance of the programme is provided by the engagement of members of the programme in various forms of practice and research by design, in membership of professional committees, as well as in the exhibitions and the volume of professional publications produced by the members of the programme. Though the programme may encounter difficulties in competing for NWO funding, it is a further measure of its larger societal relevance that it has started to attract contract research such as the Belvedere Project and funding from the Ministry of Housing, Spatial Planning and the Environment.

4.5.5 Viability

Newly formed, the programme needs time to consolidate, develop its central themes and establish links and areas of collaboration with other programmes in the Faculty, notably with Urbanisms, and then to grow. The programme’s future strategy envisages an expansion of the number of research students, initially by drawing students into the programme from the Graduate Studios that are seen to provide a useful testing ground for research topics and methods and, as resources become available, into a programme for PhD students.

The principal problem faced by the programme is the difficulty of securing recognition by key research funding organisations like NWO for the research by design that
characterises much of the programme’s activity. The programme’s record of engagement with practice is strong but its research success appears to be contingent on winning the willingness of NWO to recognise that architectural research needs to be judged in its own terms. Perhaps the preparedness of the Higher Education Funding Council for England and Wales to review the way that architectural research was assessed for the Research Assessment Exercise in 2008 may provide some encouragement to those who believe that the present system in the Netherlands should be changed.

Figure 4 Scores Architecture of the Living City TU/e

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4.6 Performance Engineering in the Built Environment (PEBE)

4.6.1 Programme description

The research programme “Performance Engineering for the Built Environments” (PEBE) is one of the four “aspirant-programmes” of the Faculty of Architecture at the TU/e. Since the PEBE research programme views its mission as “integrating performance value of built environments in an aging society to prepare the construction sector for the developments in the 21st century”, its activity is centred on various performance projects on housing and infrastructure. Moreover, the PEBE program embraced Vision 2030 of the European Construction Technology Platform (ECTP), a collaborative effort aimed at achieving a sustainable and competitive construction sector by 2030. It takes into account the growing number of new ICT options to support choices in total-quality systems, and societal aging, meaning that all functions in society are performed by increasingly older people from earlier technology generations.

The objectives of this research programme concern construction management and gerontotechnology, focusing on the integration of different types of values (health and wellness, competitiveness, sustainability, etc.). The focus is on the end-user during the occupancy phase of built environments, and on the development of criteria for quality guidelines. The research activity integrates various components and phases, namely (i) data mining and empirical analysis of the phenomena, (ii) adoption and extension of technological and social sciences theories, and (iii) development of methodologies to provide construction flexibility in a rapidly changing world. The program aims at bringing together expertises on (i) the needs and characteristics of the construction industry, (ii) the technological consequences of societal aging, (iii) community health and (iv) construction procedures.

4.6.2 Quality

The research carried out in this programme has high international level, even though refereed articles are published in a small number of journals (which may indicate a relatively narrow focus). The international recognition of the research programme is very high, and particularly outstanding in the case of Professor J.E.M.H. van Bronswijk. This is attested by (i) the numerous awards, distinctions, participations in international Journal Editorial Boards and Advisory Committees, Academy Memberships and Honorary Positions, and by (ii) the organisation of International
Conferences in their fields of expertise. However, it does not seem very correct to count the awards and international reputation of a PhD. student enrolled in 2009 since they devoted no work to the programme – only the work done in the context of the programme should be credited. Finally, the success in obtaining funds, both at the European and National levels, also reflects the high scientific quality of the work developed.

4.6.3 Productivity

In view of the very small number of tenured research staff members (3), the numbers of academic publications (45 refereed articles, 2 books and 62 conference papers) and professional publications (37 articles, 1 book, 1 book chapter and 62 conference papers) are amazingly high, particularly if one notices that (i) only 1 PhD. thesis was concluded in the period under consideration (in 2009) and (ii) it is said that "our service to the public goes mainly through the channels of radio, television and interviews for newspapers and magazines in a more or less monthly frequency" (a very high and frequent service to the public). However, most of the academic productivity of this research programme stems from the activity of a single person - Professor J.E.M.H. van Bronswijk. Indeed, Professor G. Maas and Assistant Professor F. van Gassel, the other two tenured staff members, have not published any refereed articles since 2005 – this is not too surprising if one realises that Professor G. Maas only devotes 15% of his time to research. The research of Professor J.E.M.H. Bronswijk is almost exclusively focused on gerontechnology, as attested by the fact that many of her refereed papers are published in the “Gerontechnology” Journal. Moreover, it is surprising to see that one PhD. student (F. van Boven) who devoted either 10% (2006) or 0% (2007-2009) of his time to research has managed to publish 2 referred articles (as sole author) in 2009!

4.6.4 Relevance

The high scientific relevance of the research activity carried in this programme can be quantified by (i) the significant amount of funding earned from European and national research agencies, (ii) the impact of the multidisciplinary published work and (iii) the invitations to disseminate it. This relevance also stems from the widely perceived importance that the output of this research activity will have in the solving the new problems posed by the increasing number of aging societies, such as those existing nowadays in several European countries.

4.6.5 Viability

In spite of the obvious “attractive power” of this research programme, as attested by the amount of funding recently earned and the enrolment of 8 new PhD. students since 2006, it is very difficult to envisage its viability in the present form. The most outstanding and productive researcher of this (very small) team is approaching retirement age. As it was decided to stop this programme after retirement of the most productive researcher, the committee didn’t assess the Viability criterion.

Figure 5 Scores Performance Engineering in the Built Environment TU/e

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4.7 Structural Design (SD)

4.7.1 Programme description

The research programme “Structural Design” (SD) is one of the three “fully established programmes” of the Faculty of Architecture at the TU/e. The activity of the SD research programme is geared towards the design of prestigious (“talked-about”) buildings that incorporate the highest structural safety standards. The programme carries out scientific research that (i) adopts an integral and innovative approach and (ii) aims at providing to the society higher quality design and constructions tools and procedures, as well as contribute to advance the current knowledge concerning structural elements and building systems made of various materials, such as concrete, steel, masonry, aluminium or timber. When compared with the research on structural analysis and design carried out in Civil Engineering Departments, the distinctive feature of the SD programme lies in the fact that the areas and topics covered deal almost exclusively with buildings (mostly) and bridges, since these domains (i) are those more closely related with architectural and environmental issues, and (ii) share very similar problems, challenges, analytical tools and design methodologies.

The SD research programme is mainly focused on two areas, namely (i) Innovative Structural Design (ISD) and (ii) Fundamental Structural Behaviour (FSB), which are covered by three main chairs: Innovative Structural Design, Applied Mechanics and Design and Material-Related Structural Design. ISD is primarily aimed at creating and incorporating innovative structural systems into multi-disciplinary design approaches (for instance, the inclusion of pre-cast bubble-deck floor slabs in a computer-aided structural system design). On the other hand, FSB focuses on stress engineering, which encompasses theoretical, numerical and experimental analyses of the behaviour of structural elements and building systems made of concrete, steel, masonry, aluminium or timber. The research results reported concern (i) steel frames with resistant walls made of concrete, bricks or glass, (ii) thin-walled structures, (iii) aluminium structures, (iv) wood mechanics and timber structures, (v) design of tall buildings and (vi) computational spatial and structural design.

4.7.2 Quality

The research carried out in this programme has the highest international level. The quality of the publications, both academic and professional (the distinction is very clearly made), is very impressive. Both fundamental and applied research results are being published regularly in top international scientific journals, as well as reported in the most prestigious conferences. The international recognition/visibility of some of the programme researchers is also attested by (i) their participations in international Journal Editorial Boards and Technical Committees, and by (ii) the organisation of International Conferences in their fields of expertise. Moreover, the success of this research programme in obtaining competitive NWO/STW funding also reflects the high scientific quality of the work developed.

4.7.3 Productivity

Although the numbers of academic publications (66 refereed articles, 8 books and 180 conference papers) and professional publications (85 articles, 3 books and 11 book chapters) are quite reasonable for the size of the tenured research staff membership, the number of PhD. theses concluded in the period under consideration (a total of 12 – 5 in 2009, 1 in 2008, 0 in 2007, 2 in 2006, 3 in 2005, 0 in 2004 and 1 in 2003) is rather low. Moreover, it is visible that most of the academic productivity of this research programme stems from a relatively small fraction of the tenured research staff since several of its members devote most of their time to education. It is also noted that several tenured research staff members do not have a PhD. degree and/or only devote 10% of their time to research, a fact that obviously severely limits their expectable scientific productivity.
4.7.4 Relevance
The research activity carried out in this programme had a significant impact on advancing the scientific knowledge in the domains related to their expertise and some of its outputs had a very direct influence on the production of design codes and recommendations at the European level, namely on the Structural Euro codes. Moreover, the large number of professional publications also shows that there is a fairly high transfer of technology from the research programme to the building industry, even if this positive impact is not matched by a significant amount of contract funds.

4.7.5 Viability
In view of the quality and quantity of the research staff involved, as well as the quality of the available experimental and computational infrastructures, the viability of this research programme depends heavily on the ability (i) to obtain funding from research agencies (both European and National) and from the building industry, and (ii) to enrol bright PhD students. Concerning this last aspect, which seems to be the major threat to the viability of this research programme, measures should be taken (i) to motivate the non-PhD, tenured research staff members to obtain this degree and (ii) to devise strategies to attract high-quality national and foreign candidates, taking into account that his research programme, unlike all the others in the Faculty of Architecture of the TU/e, must compete fiercely with all the Civil Engineering Departments from other universities. This may be achieved by focusing on specialised areas more closely linked with innovative/daring/challenging structures and/or design approaches.

Figure 6 Scores Structural Design TU/e

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4.8 Urbanisms (U)

4.8.1 Programme description
Urbanisms emerged as one of TU/e’s four ‘aspirant’ research programs in response to the critical 2007 mid-term Research Assessment. Led by Prof Bruno de Meulder with just two associate professors and one assistant professor (1.99 FTE), the group presents itself as 'small but beautiful, young but solid'. The group has five PhD students. The name Urbanisms expresses an orientation both to urbanism as theoretical reflection, and urbanism as planning and design practice. The program’s research agenda is wide-ranging in scale and substance: an eclectic variety of topics from different cultural, economical and social contexts is justified - indeed ‘cherished’ - on the basis that 'topics are always approached from the same angle, being urbanism in its double meaning'.

4.8.2 Quality
The TU/e self-assessment speaks of Urbanisms as a program that has achieved spectacular progress in academic recognition. This is most evident in the winning of two competitive second-stream funding projects from NWO, each involving two PhD
students and a post-doc: one is a study of the role of mapping in strategic regional development projects, the other of ‘inclusive urbanism’ as applied to children and migrant entrepreneurs. Reflecting the dual ambition of the program, the Chair and his colleagues participate both in academic networks and in professional spheres of architecture and urban planning across the Netherlands and Belgium. The program also has a post-colonial interest and various live overseas linkages in South and South East Asia.

The mid-term assessment was concerned about a lack of coherence in TU/e’s urban research area and an unrealistic spread of themes in relation to the available research capacity. Some of this concern may still apply to the current aspiration to develop a mixed genre of research which simultaneously interrogates the city - at every scale - and the practice of urbanism. Clearly the group has to balance intellectual coherence with a adaptive response to funding opportunities, but elasticity can be taken too far, for example in its needlessly vague stance towards climate change research (Self Assessment §5.10).

4.8.3 Productivity
The program produced no PhD theses in the review period, but its zero profile is about to be changed by the five doctoral projects in progress under the NWO funding that ends this year. Aiming always to bridge the gap between fundamental research and its application in practice, the group’s publication policy targets both at the professional sector and the international research community. It has a healthy productivity of professionally oriented work on planning, landscape and housing, and some solid book contributions, notably the newly-released Designing for a Region edited by Nancy Meijsnans. The published output of academically-oriented articles still languishes despite a stated policy that whenever possible absolute priority will be given to publication in international peer-reviewed scholarly journals. In quantity the group averaged just three papers a year over the review period, and as to quality there should be concern that fewer than half of its articles were in Scopus-listed periodicals (A+U, Architectural Design, Landscape Research, JHBE, JPER, TPR, Theory Culture & Society).

4.8.4 Relevance
Urbanisms has a strong profile of societal relevance, as evidenced in everyday engagement of program members with public agencies, municipalities (including Eindhoven), real estate groups, housing associations and professional networks. This engagement yields a modest amount of third stream funding, which the program aims to increase through forming privileged coalitions with a subset of contract research partners. Both relevance and earning capacity will be enhanced by the ongoing process of program consolidation within TU/e, in particular there is a clear complementary course-load in what is offered by the Urbanisms and the Living City programs.

4.8.5 Viability
Urbanisms is a small but important group of researchers. The Chair spoke frankly to the Assessment Panel about the difficulty of maintaining research momentum in a context of diminishing support. Looking forward, the viability of the group will depend upon increased collaboration with cognate researchers within the Faculty of Architecture Building and Planning. Our score recognises the constraints on the program as presently constituted but we are confident that a reconfigured group has the potential to establish Eindhoven more firmly as recognised centre of excellence within the global community of planning research.
Figure 7 Scores Urbanisms TU/e

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5. TU Delft: Faculty of Architecture and the OTB Research Institute for the Built Environment

5.1 Assessment on the institute level

5.1.1 The Faculty of Architecture and the OTB Research Institute for the Built Environment

Mission, vision, objectives, research activities and resources

As with the TU Eindhoven, the Mission and Objectives of the Faculty are fully in line with the current dialectics of the profession as well as the university's leadership. In general, the Faculty is amazingly productive, despite the sheer size (and until the Numerus Clausus is put in place, the unpredictability of teaching loads). Altogether the Faculty for Architecture and the Built Environment made a very good impression on the committee, despite the fact (or in lieu of it) that merely 30 Months ago, the Faculty's accommodations were consumed in a freak fire one fine sunny day in May 2008.

The faculty’s predominance within the metier of Architecture in the Netherlands is both a privilege and a curse. In the former, it allows faculty members access to industry that are long fought over by other universities. In the latter, the Faculty is expected to continually deliver research and graduates that set the standard for Architectural Faculties not only in the Netherlands, but also in Europe and the rest of the world.

5.1.2 Assessment of the quality of the faculty

The TU Delft enjoys a "Level One" acceptance worldwide as one of the leading institutions for architectural education and research. As such, the members of the faculty enjoy an automatic recognition of quality, but are also burdened with the expectations of the architectural community worldwide to continue the previous output in quality and in quantity.

The members of the committee were impressed with the plethora of publications that were produced by the members of the faculty. Nonetheless, this prodigious output begs a question of quality or quantity. In particular, the publication output was plentiful, but perhaps at the cost of peer-reviewed publication in order to maintain the volume of output.

5.1.3 Assessment of the productivity of the faculty

Simply put, the output of the Faculty of Architecture and the Built Environment is phenomenal. When that is qualified to be the scientific output, that is, the peer-reviewed articles and journals, then the productivity of the members of the faculty range from good to okay. It must be stated that the members of the committee found really no horrifying numbers, although the earlier comments about 6% researchers apply here as well. What is apparent is that the Faculty has a well-oiled system of publishing books, but that given limited time, the chance to publish in peer-reviewed and hence "scientifically relevant" journals is limited.

The committee was impressed with the overall commitment to peer-reviewed articles and even in questioning with "underperforming groups", was assured that this is indeed relevant to the stature of the group and of the faculty as a whole.
5.1.4 Assessment of the relevance of the faculty

Given the position the Faculty of Architecture and the Built Environment has within the TU Delft, it enjoys an almost automatic recognition of relevance. This is not just hot air, as the success of departments like the OTB groups have shown not only the societal relevance in the Netherlands, but also their implications for European planning.

Furthermore, the sheer size of the teaching and research activities at the TU Delft means that it is attractive for foreign students and researchers alike - thus cementing the relevance worldwide.

5.1.5 Assessment of the vitality and feasibility of the faculty

If one were to blindly walk into the faculty of Architecture and the Built Environment today and then be told that in May 2008, the school was destroyed in a fire, then it would not be surprising to hear one or more observers say "What we need is a fire!". The ability to reorganise, rethink, reinterpret and re-map the activities of the faculty onto temporary and then new accommodations speaks largely for the vitality of the faculty. In some ways, the bad fortune was indeed a good fortune as the members of the faculty from the Dean down to the students pulled together to keep the idea of the faculty alive. As such, these acts speak much louder than any words can.

5.1.6 Assessment of the SWOT-analysis and vision for the future

There is a classic saying: "If It's not broken, then don't fix it!". During the assessment and in particular to a slide shown by the Director of Research, it became clear for the members of the committee, that the Faculty of Architecture and the Built Environment at the TU Delft has undergone a series of realignments of the research activities which have decentralised, re-centralised and reformed the various research interests at least 3 times over the past 8 years. This, to put it blunt, is unacceptable.

The management of research is a very "Hit and Miss" affair. Truly, research cannot be planned. It can, however, be coddled, be supported, be enhanced, be enabled and be pushed. Once, however, these acts are done, then the coddlers, enhancers, pushers and supporters must get out of the way and let researchers fumble and stumble into the dark night of the unknown that is investigated during the activities we call research.

Rearranging the research groups is perhaps necessary every five to ten years. However, it seems that the researchers at the TU Delft have been doing nothing else over the past six years. Given that and the fire, it is astounding to which levels of output the members of the faculty have shown to be capable of. If the rearrangement were to stop, imagine the potential output of researchers in a stable environment. It is the recommendation of the committee to do just that.

5.2 Architecture

5.2.1 Programme description

The research program 'The Architectural Project and Its Foundations' of the Department of Architecture focuses on architecture as 'metier', or a 'craft' in the broadest sense of the word; a field where making and thinking are inextricably linked. It regards the 'architectural project' as the cornerstone of architectural practice and reflection, and the junction of a complex combination of cultural, social, functional, economical and ecological factors.

The aim of the research program is to firmly reposition architecture as a field of expertise with its own specific logic, rationale and instruments. This focus on architecture as 'craft' and 'project' entails a return to the history, tools and paradigms of the discipline. This encompasses two areas of enquiry: first, the investigation of how
architectural projects can perform at the scale of the building, the city and the territory, called the sub-program ‘The Architectural Project’; and second, the study of existing approaches and perspectives, instruments and disciplinary boundaries, called the sub-program ‘Foundations’. The ‘Architectural Project’ sub-program brings together four research themes: Building Types and Models; Architecture and the City; Borders and Territories; and Mapping Randstad Holland. The ‘Foundations’ sub-programme has two themes: ‘Revisions’, changing ideals and shifting realities; and ‘Positions’, the architectural discipline and its instruments.

5.2.2 Quality
The research work of both sub-programmes is recognised internationally. The work of the former is known through publications such as Raumplan vs. Plan Libre (M. Risselada, 1987) and the publications such as The Dutch urban block and the public realm (S. Komossa, 2010) and Atlas of the Dutch Urban Block (S. Komoss et al. 2005) which describe the typology of Dutch cities. The work of the ‘Foundations’ programme is particularly well known for the groups’ publications on Team 10, notably Team 10, 1953-1981, In Search of a Utopia of the Present (M. Risselada and D. van der Heuvel eds. 2005), Another Modern, The Post-war Architecture and Urbanism of Candilis-Josic-Woods (T. Avermate, 2005), and, more recently, for a rethinking of the traditional Modernist paradigm from a colonial or non-European or North American perspective in, for example, Colonial Modern: Aesthetics of the Past, Rebellions for the Future (T. Avermate, S. Karakayali, M. von Ostend eds. 2010). The work of both sub-programmes has also achieved international recognition by exhibitions that have travelled widely both in Europe and North America.

5.2.3 Productivity
Given the nature of the research it is understandable that the level of external research funding is low, though the level ‘academic’ funding has risen relative to the other programmes in the last three years. A more appropriate measure of productivity for this kind of research is the number of publications: despite the loss of senior academics, the programme scores well on both book chapters and books. A number of the programme’s publications are in non-refereed or professional publications, a reminder of the importance of this form of publication for the visibility and reputation, both nationally and internationally, of specifically architectural research which sits uncomfortably alongside a model of research fashioned on the natural or medical sciences.

5.2.4 Relevance
It is difficult to identify ‘stakeholders’ for architectural research in the way that is possible in other, more obviously applied fields of research. However the programme’s publications in professional and non-refereed architectural publications, ranging from magazines like Blueprint or Wallpaper to widely read journals like the Architectural Review, and the success of their exhibitions demonstrate the interest of the architectural profession and of the wider circle of those with an interest in architecture in the programme’s research.

5.2.5 Viability
Both sub-programmes are fortunate in the energy, enthusiasm and ambition of their researchers, though young, they are keen to publish, to boost the number of PhD students and to take on the joint challenge of increasing external funding and persuading the NWO of the legitimacy of research into architecture as a field in its own right. However, the fact that a number of posts, particularly two professorships, remain vacant is a threat to both programmes. The absence of the two chairs not only limits the recruitment of new PhD students, but makes more difficult the task of unifying the groups working in each sub-programme and integrating the DSD, with its potential for working on specifically architectural issues, into the work of the...
programme as a whole. However, the Faculty will need to ensure in appointing new professors that the interests of the new chairs are compatible with those working in the programme and that the new chairs can consolidate rather than reorganise a programme that is full of potential.

Figure 8 Scores Architecture TUD

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5.3 Computation & Performance

5.3.1 Programme description
The aim of the Computation & Performance research program is to improve the performance of buildings and the built environment through innovative scientifically-grounded IT. This includes computational methods for measurement, prediction and simulation of building performances, structural engineering design, information modelling, decision tools including interactive participatory techniques, and design communication. The program underpins the TU Delft's contributions to non-standard architecture and parametric design. Its overall aim is to enhance performance, defined in terms of qualitative as well as technical aspects, psychological as well as physical factors.

The group’s innovative applications address every stage of the design, manufacturing and construction process, as well as buildings-in-use. The team also includes a subgroup specialising in technical aspects of glass as a building material.

5.3.2 Quality
The group is well staffed with an advantageous age balance and a highly motivated leadership. Its emphasis in the dual definition of performance (technical and socio-cultural) positions it distinctively in a competitive field. Over the review period the group has built its standing within the international scientific community. Its self-assessment defines ETH Zurich, MIT and Carnegie Mellon as peers, though quality metrics still lag.

5.3.3 Productivity
Numerically the group doubled in size in the review period, with a 50% growth in FTE terms. Its level of external research funding has fluctuated with a slight upward trend in recent years. PhD inflow is improving and completion times are improving. Publications have been broadly stable over the review period. The program’s favoured research output has been the conference paper rather than the peer-reviewed journal article. The group accepts that its current average of four reviewed papers per year is ‘too low’ and aims to boost the annual output to twelve.

5.3.4 Relevance
The program’s relevance is evident on all fronts. Internally it performs a significant role supporting chairs of the Faculty of Architecture across almost the full scope of ongoing research - Computation and Performance is described as ‘grounded within chairs’. Externally it maintains an impressive range of collaborations within TUD and
externally, including participations in the TUD Energy Club and a consortium entering both the US and European Solar Decathlons, as well as significant commissions from the Dutch Government.

5.3.5 Viability
The organization of the group is decentralized, providing autonomy to subgroups and individuals. Its expertise is almost well settled. The group has to focus on the existing competence by the experts and aimed research fields. It needs to safeguard its critical mass. Given the excellence of ongoing work, the visible strategy to manage and publicize the program's intellectual property is of paramount importance. The research directions and intentions reflect the changing composition of the group and match its group members' expertise. The interests and research fields follow the important and current societal challenges.

Figure 9 Scores Computation & Performance TUD

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5.4 Design & History

5.4.1 Programme description
Design & History is a joint research group run by the Department ©MIT and the Institute of History of Art, Architecture and Urbanism (IHAAU). ©MIT neatly distinguishes between three different scale levels: modification (material), intervention (buildings) and transformation. The IHAAU focuses on history, historiography and theories that are related to the fields of art, architecture and urbanism. The unifying theme is the explicitly historical focus of the research. ©MIT concentrates on ‘operative’ history, whereas the IHAAU sees the analysis of decision making processes as a prerequisite for understanding the past and the future production of architectural, urban and landscape phenomena. These approaches are distinct but perfectly complementary.

The ©MIT’s research area combines three research lines ‘Knowledge of the Past’, ‘Intervention’ and ‘Societal Framework’, concentrating on a central theme, the Legacy of the Twentieth century. The IHAAU research area is centrally concerned with large-scale developments (Metropolis) and the history of modern architecture (Modernity and Tradition). Around the theme Knowledge of the Past, IHAAU and ©MIT already collaborate on the projects History of the Faculty (building), Rietveld’s Universe and Zonnestraal.

The objectives of the Design & History research group are threefold: to provide decision makers, planners and designers with the intellectual and practical tools to approach future programmes of reconstruction and repair in the most responsible way that scientific research and practical expertise can provide; to produce in-depth historical analysis of architectural movements; and to unravel the often quite explicit philosophical, social, cultural and theoretical implications involved in specific design approaches.

One of the goals and ambitions of ‘Design & History’ is also to organise a separate Master programme for architectural historians and theoreticians, as well as to create a post-graduate school.
5.4.2 Quality

Each of the two constitutive groups — RMIT and IHAUU — of this joint research group possesses its own coherent research programme with its own academic significance, based on prominent researchers. Moreover, for both groups there are close links between research and education.

These evident qualities are a necessary but not a sufficient condition to guarantee the coherence and the success of the overall programme. At this moment, it is not clear to what degree the two groups share the same ambitions. Although both groups confirm that they feel comfortable working together and see their work as complementary and coherent, they have yet to give proof of true symbiotic cooperation. The members of the Design & History research group, encountered and interviewed by the committee, have shown to be very conscious of the need to rewrite as soon as possible the existing sub-programs and the research lines of both IHAUU and RMIT in an overall policy document. The committee is convinced of the great interest of proposing a comprehensive conservation programme for the legacy of the 20th century as the main research theme of the group. The committee nevertheless wants to emphasize the necessity for the research group to produce the argument of the historical, cultural and theoretical foundations of its innovative approach and of the urgent attention which interventions in monuments, especially in a technological sense, need.

Contacts with other (historical) disciplines are well established. The professional networks of IHAUU, and especially of RMIT, are extensive. Nevertheless, most of the researchers are trained as historians and not as designers. The intended link to practical tools and to design should not be taken for granted, though technical infrastructure and professional staff with the appropriate design skills could probably bridge this gap.

5.4.3 Productivity

At present, the programme’s publication capacity is limited and should be expanded. More profit should be made from initiatives like EAHN and Docomomo.

Generally, in order to establish a clear publication strategy and to win wider academic recognition in international scientific and institutional circles, more effort must be made to orient the programme’s investigations towards a well-defined field of research questions and production of knowledge. This should be both autonomous and coherent as established as having a practice-based methodology. Superfluous research activities and projects have to be avoided. Some of the PhD topics are not sufficiently directly linked to the central research focus of the programme. The PhD-programme has to be co-ordinated and streamlined and, ideally, opened up to promoters and copromoters of the two component groups within the programme. External funding for PhD’s has to be actively promoted by addressing societal and governmental organisations.

Most of the PhD students are externally funded. The success rate of PhD’s is high but the average duration between 5 to 7 years, is rather long.

A lot of effort has been invested in creating appropriate forms of publication, founding a new journal, collaborating with publishers, finding new funding, etc. More structural commitments to publishers and academic journals should nevertheless increase these possibilities further, although the committee is aware of the great efforts already done in this matter.

5.4.4 Relevance

There is little doubt about the professional, societal and disciplinary relevance of the research field of the programme. Transformation and re-use are fundamental cultural issues for our present and future living environment. However, the initial intention of the ‘founding father’ of the research group still has to be made explicit, established scientifically and developed professionally. The design dimension and programmatic
aspect of the research must not be overlooked but placed at the very heart of the programme’s strategy.

The constitution of this new field of historical and scientific research and professional practice demands professionals trained in different fields with a range of cultural, architectural and technological interests. In the field of preservation, knowledge transfer is a key issue, requiring a movement away from a fixation with objects to fundamental reflection on the nature of change and how this affects buildings and their environment. These questions need to be explored with a network of different actors to encourage debate that involves society as a whole. The programme must engage with broad social issues and should consider how best to offer its expertise to those beyond the academic community.

5.4.5 Viability

Although, at present, the two groups @MIT and IHAAU, do not seem to fit completely together, and although the proposed focus of the programme is still too general and not supported actively by either party, they offer a range of complementary qualities which can be very well developed. As it stands, ‘Design & History’ is a group of excellent individuals who have yet to establish a coherent, shared programme. Without this common vision the research group has yet to achieve or demonstrate viability.

The commission asks the question if the research goal might be better achieved by adding more qualified professionals in their quality of design and policy oriented researchers in this common research programme.

At present, the external funding for the research group is, despite the actual economical situation, too low. Relying on its academic reputation, the group must fight for, and explore new funding, particularly from European and international sources.

5.4.6 Conclusion

Design & History covers a very interesting and relevant field of research, with an important societal impact. But the strategy for the research programme and the organisation of the two groups has not been sufficiently thought through to establish a clear and unique research goal in this interdisciplinary and design related field. More effort has to be put in finding external funding. The PhD students must cover the field of research more effectively. The existing publication strategy must further develop partnerships in the publishing world.

Figure 10 Scores Design & History TUD

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5.5 Governance of Geo-information and land development (OTB)

5.5.1 Programme description

The Governance of Geo-information and Land Development Group became part of the prestigious OTB research centre in 2003, when it was moved there from Geodesic technopolis group.
Engineering. Currently, the group’s chairs and teaching obligations are anchored at the Faculty of Technology Policy and Management. The group’s strong research profile may have benefited from these institutional moves. It bridges different academic cultures – engineering, law, urban planning, and policy analysis. In 2011 the OTB will become part of the Faculty of Architecture. Once it becomes more closely affiliated with the Faculty of Architecture, the group is likely to generate distinctive bilateral benefits.

The research group spans three interlinked focus areas, all related to land regulation: governance of land development, land tenure (property rights), and Geo-information\(^2\) (information systems for land measurement and registration). While this specific linkage of technical and public policy fields is uncommon in the North American university tradition, it has many counterparts in leading European and the Far East universities. At the Delft Faculty of Architecture, the group’s areas of expertise will likely be most relevant to two programs: Urbanism will benefit from the additional expertise in property rights and planning law; and real estate management – currently focused mostly on private sector considerations – will find that the group’s knowledge of public-sector land policies within which the private sector must operate to be quite valuable.

### 5.5.2 Quality

The smallest of the research groups – only 7 tenured faculty members - presents a research profile of excellence. The group has shown how the three focus areas can create a synergetic research program to address the key issues in land regulation. Despite its size, this group encompasses the most relevant areas of expertise - urban planning, law, and geodesic engineering. Colleagues at OTB (who will also move to the Faculty of Architecture) amply provide the obviously missing expertise of economics.

This group has adopted an effective model whereby not only the chairs but also each of the tenured staff achieves an individually high standing. This unusual accomplishment possibly reflects the group’s structure of complementing rather than paralleling expertise. Although the program has not had large numbers of PhD students, several of its graduates quickly gained high academic positions at other universities.

The group’s research program is wisely framed to contribute to the international or comparative state of knowledge. The faculty members take an active part in key international organizations engaged in land policy – those that practice (World Bank and UNHabitat) and those that encourage scholarship (the EU’s COST program and the major academic associations in the field).

When studying the local Dutch context, this group has been able to draw out general findings that contribute to theory or method. The group has therefore been successful in winning two competitive National Research Council (NWO) grants and a very high score in a European FP7 submission (though no grant).

### 5.5.3 Productivity

The academic outputs of the land-governance group are indicators of the group’s high academic accomplishments. The metrics place the group as leading in average number of total publications per FTE – 11.8 in 2009, 10.3 in 2008 and 9.7 in 2007. Especially noteworthy is the relatively high number of refereed journal articles - 1 per tenured staff member during 2009. The large list of prestigious journals in which the group has published encompasses many ISI-listed journals as well as major law journals (which ISI does not list).

Over the years, the group has also been successful in generating large amounts of external funding – including two competitive grants from NWO. Although this group’s

\(^2\) in the British tradition the latter area is seen as part of “surveying”
earning capacity per tenured faculty member is lower than Housing Quality and Green Building, this probably stems from this group’s focus on the public sector where funding may be less ample than in private industry.

5.5.4 Relevance
The research program has struck a wise balance between relevance to ongoing Dutch land-policy issues and relevance to the international state of knowledge. In the Netherlands, the past decade has seen major transformations in the country’s traditional government-oriented “active land policy” towards a more market-driven policy. Recent changes in the planning and land development laws have also contributed to a sense of turbulence. The Delft research group’s research has responded to the thirst for knowledge-based guidance, providing a forward-looking and comparative perspective for Dutch policymakers. Because many still view the Netherlands as the world’s “planning paradise”, the lessons from the Dutch experience are of relevance to other Western countries.

In the developing world, economic or social development cannot proceed without addressing the land-policy issues and without installing adequate land management systems. The currently global relevance of the group’s research topics is an opportunity for the group to increase its international scope.

In sum, the Land Tenure group is one of the gems at Delft – small in size but addressing issues of very high national and international relevance.

5.5.5 Viability
The program is small, but its interdisciplinary composition gives it tenacity beyond its numbers and perhaps some of the benefits of compactness. As part of OTB the group is embedded in a rich research environment with a broad range of various social-science experts easily accessible. Once the formal links with the Faculty of Architecture are forged, the group will be able to create partnerships with a set of complementing experts with whom the group has not had strong ties.

The new locus will likely also expose the group to a wider range of international students and visitors, and may broaden its research agenda beyond Europe. The new linkages will likely also help the group to meet its declared goal of bringing in a somewhat larger number of PhD students.

The Delft group is likely to be in growing demand nationally and internationally. If the group decides to increase the number of tenured and junior staff and will be savvy in harnessing the opportunities of the Architecture Faculty, it is positioned to become one of the world’s leading interdisciplinary research centres on land policy.

Figure 11 Scores Governance of Geo-information and land development TUD/OTB

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5.6 Green Building Innovation

5.6.1 Programme description
Green Building Innovation (GBI) covers the indoor environment, the outdoor
environment and the dividing skin in-between, as well as the essential flows that enable living, working and travelling: energy, water and materials. Strongly founded on the existing knowledge and experience (the basic competences), the research group focuses on themes that are currently significant in terms of societal and scientific value. These are: closing and connecting cycles (control of the essential flows), renovation (energy renovation of existing buildings), carbon neutrality (of buildings, neighbourhoods, cities and regions) and climate adaptation (responsiveness to heat and water excesses).

Technology for a sustainable built environment requires more scientific development. The main objective of GBI is contributing to the development of science in building technology, producing knowledge and innovative concepts for the building industry and supporting a sustainable transformation of the built environment.

For the long-term GBI focuses on continuous enhancement of its basic competences. For the mid-term perspective the focus lies on societal urgent issues, through inter- and cross-disciplinary research. For the short-term, research is accepted in fertile areas of building technology, showing proactive leadership where interests meet opportunities.

5.6.2 Quality
In research for new technologies and design strategies for a sustainable built environment, an interdisciplinary research approach is a key to successful results. The competence is well distributed and balanced. It ranges from building physics up to the architectural design issues of construction to address urgent societal and scientific themes. The department has, by their dynamic and challenging approach to achieve an integrated research programme, impressed the committee.

The research programme includes many very interesting projects and the strong demand from the building industry has lead to a lot of development projects in cooperation with the industry. However, a good mix of applied and fundamental research is needed for a proper balance between technological development and scientific research, where the latter is important to maintain and further develop the basic competences and scientific excellence.

The collaboration with the research unit “computation and performance” is very useful and should be enhanced (see e.g. BT research Portfolio, Oct. 2010). There is a great potential in it and can push forward the practicability of the computer based simulation and evaluation of complex building arrangements.

Based on the evidence put forth, the committee finds that the pressure to increase research funding and the push from the building industry for innovation have been pushing the balance towards a short term research strategy. The department is encouraged to also strive for semi-governmental funding (second source), in order to improve quality and basic competences. True, certain groups are well endowed from 2nd and 3rd Party funding, but in the opinion of the committee, the necessity to pursue these kinds of funding has not permeated all of the research groups.

5.6.3 Productivity
The analysis of the output from the department shows a proportionate contribution of books, book chapters, conference papers, professional publications and editorships of journals/books although the publication rate has been decreasing in the last years. There is a strong focus on dissemination to the building sector, which is good for the knowledge transfer to the industry, while the dissemination and contribution to the research community internationally through articles in international refereed journals are relatively low and should be improved.

The department has been very active and successful in attracting external funding, so it today are funding about 2/3 of the research. This has helped to increase the research activities and the number of PhD students considerably.
5.6.4 Relevance

The field of technological innovation for a future sustainable built environment is highly relevant worldwide, which is demonstrated by the continuing demand from the building industry for research, development and consultancy. The department has a clear vision of its role in respect.

The driven concept of the possibly to disassemble and recycle building elements fits to the needs of the future as well as the integration of installation components in the prefabricated units reflects the demands of sustainable design. Also the topic “case studies to gather qualitative data on the team work interaction” by reflecting social and economic sciences shows the relevance and seriousness of the on-going research.

The research achievements are highly visible in the building sector and have been adopted by stakeholders in the building industry. There is a strong demand from the industry for GBI staff member’s expertise and dissemination of research results.

5.6.5 Viability

There are many opportunities and possibilities for funding and research collaboration as well as a strong interest from the building industry in the area of sustainability, climate change and energy use in the built environment. This is, among other things, reflected in the increase in external funding which have more than doubled in the review period.

It is the impression of the committee that the activities in the department is mainly carried out by a handful of hyperactive persons with the tenured staff FTE covering less than 20% of the total research staff FTE. The increase in external funding including project management, PhD supervision and development of new application has lead to structural overtime and focus on solving day-to-day problems. The committee recommends in the future a stronger focus on tenured staff for management and selection of research activities to ensure a balance between technological and scientific research. In this respect it is also important that it be possible to use project overheads to invest in and maintain research infrastructure, i.e. laboratories, and in development of basic research competences in order to ensure the future scientific quality and competitiveness of the department.

Figure 12 Scores Green Building Innovation TUD

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5.7 Housing Quality (Architecture & OTB)

5.7.1 Programme description

Fifteen years ago, Housing Quality grew out of OTB which itself was established 25 years ago. The aim of Housing Quality is to develop knowledge to support practices in the building, regeneration and maintenance of housing in the decades to come. The programme uses multidisciplinary approaches to provide new scientific insights through a combination of four perspectives: technical knowledge of the health and sustainability of dwellings (product); organizational knowledge for the management of housing providers (organization); knowledge of effective policy instruments and
enforcement procedures (governance); and innovation of building and maintenance procedures (process).

Research questions address the task of improving housing quality. Firstly, in relation to the product: what constitutes sustainable housing stock and how can the sustainability of the existing housing stock be improved? Secondly, in relation to the processes, organization and governance: how can the actors involved in the housing market contribute to the realization of sustainable housing, for example, by ensuring adequate organization, cooperation and policy instruments?

The objectives include fundamental contributions to the scientific fields that relate to the improvement of housing quality; contributions to the innovation of the educational curricula; and insights that can be used for improving the actual quality of the housing stock.

The programme aims to be a frontrunner at the national level and to be a key player in specific niches of the international research arena, particularly in the areas of assessment methods for energy efficient housing, building regulations, and strategic management of social landlords.

5.7.2 Quality

The research program of Housing Quality is very coherent and has developed an important multidisciplinary expertise over the years. Its success is based on the work of a number of prominent researchers. They have developed an extensive network embedded in the professional, economic, academic and administrative world, and have close collaboration with stakeholders.

The programme’s academic reputation is quite high but is limited mainly to the local and national levels. The programme lacks international visibility and this should be improved. The research group has been very successful in obtaining external funding. Until 2008, Housing Quality won by far the highest external funding per tenured faculty, and since then it is just behind GBI. The proportion of direct and external funding is consistently around 50%. However, the funding sources are almost exclusively Dutch. By seeking more international and European funding, the group would open possibilities for broader research topics.

The number of tenured staff is relatively small. In comparison to other groups, Housing Quality has a high proportion of non-tenured in relation to tenured staff. The programme draws a continuous flow of PhD students, also from abroad. The number of publications is very high. However, there is as yet no real strategy as to the choice of journals. Also, a wider differentiation of media is deemed to be necessary.

5.7.3 Productivity

The publication output has been doubled in recent years and is still growing. Housing Quality has the highest rate of professional publications per tenured staff within the Faculty of Architecture as well as by far the highest number of refereed articles — between 0.6 and 1 per staff on a yearly basis.

The success rate of PhD-students with employee status is not very high – after 7 years it is 45%. The success rates of PhD-students with scholarship or external funding are better but still not impressive. Most of the staff is Dutch, but a few come from the UK and from Belgium.

Many of the staff members are editors in international academic journals, almost all based in the UK. Many of the staff’s publications are in professional journals but these are almost exclusively Dutch. Housing Quality plays a role in policy making but only on the national level.
5.7.4 Relevance
The Housing Quality research group relates good housing policy strongly to management and governance in building processes, energy and the environment. It is certainly a front-runner at the national level and has significant influence on the Dutch housing market and policy. Recently, the program has been more involved in international research projects as well on the European level as in developing and transitional countries where housing is of vital importance.

However, beyond its current focus on quality of life, ecological footprint and economic assets, the program should focus also on architectural and urban design, and urban planning as an essential dimension of good housing policy. The assessment committee sees more relevance in developing fundamental research programs in combining these matters, rather than in consultancy and quality control which constitute Housing Quality’s main research program today.

5.7.5 Viability
Housing Quality made the conscious decision to be part of the academic world by being very selective in their research strategy. As in previous years, the HQ research group is sure to get the necessary funding from its stakeholders as it delivers the expected results, but this should not become a goal in itself. Its productivity is very high. In the short term, the viability and vitality of its research group are assured. The high number of PhD students indicates that the field will be able to draw new-generation scholars.

5.7.6 Conclusion
The very productive Housing Quality research group can easily maintain its output, but should improve its international reputation and its range of fundamental research. Research has to be oriented more to innovation and theorization. The academic staff should be reinforced with scholars in architectural design and urban planning.

Figure 13 Scores Housing Quality TUD/Architecture & OTB

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5.8 Innovations in Management of the Built Environment

5.8.1 Programme description
The program - “Innovations in Management of the Built Environment”- undertakes research in real estate management, urban area redevelopment and design and construction management. The research group’s uniqueness is its interdisciplinary integration of architectural design, urbanism and engineering with expertise in strategic management, economics, mathematics, sociology, psychology and construction law. This scale of interdisciplinary collaboration is almost unknown among North American faculties of architecture, and while TUD is not alone in Europe in this type of research endeavour, it is one of the largest.

The overall goal of this research program is to improve the knowledge-base of the various players – mostly private sector – engaged in the initiation, design,
construction and development of the built environment. It complements the largely public policy and regulatory focus of the Governance of Geoinformation and Land Development program.

5.8.2 Quality

Under the leadership of two high-profile practice-Chair professors, the program's two stated objectives are: 1) to contribute to the best possible alignment between the supply of real estate and dynamic market demand for buildings, infrastructure and public space; and 2) to facilitate cooperation, innovation and integration in planning, design and construction processes of building and urban areas. To achieve these goals, staff combine conventional research modes with innovative initiatives such as three “Knowledge Centres” which are successful in injecting research-grounded knowledge into the real-life decisions of a wide range of practitioners.

The program and its outreach activities are evidently well known and respected in the Netherlands. Looking ahead, its major challenge is to find a new balance between topics oriented to the particular – and partly unique – Dutch real estate context, and topics that can be generalised to international contexts. There is also scope to strengthen its coverage of residential real estate – the largest built-up land use - alongside established strengths in relation to development of offices, education institutions, retail and leisure facilities, healthcare, and urban infrastructure.

5.8.3 Productivity

IMBE's 30 members (9.6 FTE) place it among the three larger research programs in terms of tenured staff, but when non-tenured staff and PhD students are counted it falls to sixth place among the 8 assessed programs. Publication productivity per FTE is impressive, particularly in relation to books and book chapters, among them major contributions to the international state of knowledge through esteemed academic publishers. The low percentage of academic publications among total publications reflects the difficulty of finding a balance between locally and professionally focused research and internationally relevant, generalised research. Once the program is successful in its goal of increasing the number of its PhD students, the number of peer-reviewed academic publications will likely increase.

The amount of funds generated by the IMBE is not as high as one might expect from a real-estate group with such strong local links with the building industry. This may reflect the need to reframe the relationship between the “knowledge centres” and the funding of research within the university. The group should also seek to diversify its research clients and funding sources by reframing some of the research questions to be more in tune with competitive national and especially international funds. Such a strategy may also stimulate more international peer reviewed publications. The integration of several key elements of the OTB within the Department of Urbanism will provide opportunities for members of the Innovations in Management group to cooperate on relevant topics and gain more experience in writing research proposals for competitive funding.

5.8.4 Relevance

The global architecture profession is undergoing transformations stemming from the need to reflect economic realities in the marketplace and growing cross-border competition among professionals. The Innovations in Management of the Built Environment program is well positioned in one of the largest research-active built-environment faculties in the western world. The program is currently playing an impressive role in creating a new knowledge base for real estate development needs within The Netherlands. Its potential global impact remains to be tapped. Although incremental change in the range of topics is likely to occur as more foreign students are attracted to Delft for both the MSc and the PhD degrees, there is need for a concerted strategy to find a new balance between local relevance and international
5.8.5 Viability
The demand by architects for knowledge about real estate development and project management is likely to grow in the Netherlands and globally. The IMBE research program is well linked to the degree program, where architecture students may choose to specialize in real estate management as part of their MSc specialization. This is a unique education opportunity and the demand is likely to grow internationally. Furthermore, the MSc course requirements include a solid training in research methods. One would therefore expect that, if there were a few more faculty members and targeted funding, a higher number of PhD candidates would be attracted to the real-estate program.

Figure 14 Scores Innovations in Management for the Built Environment TUD

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5.9 Urbanism

5.9.1 Programme description
Urbanism is the largest department in the Faculty. In 2009 there where 153 research staff of whom 40 were guest researchers, 26.1 FTE researchers of whom 10.1 were tenured and an international PhD programme that has grown from 12 students in 2003 to 52 today. The mid-term review expressed concern at the fragmentation of research interests within the department. The period of recovery since the fire has been marked by consolidation into four teams: the internationally-oriented Randstad Centre for Strategic Spatial Planning and Design; the U-Lab, specialising in analysis of complex urban ecologies, especially urbanised delta areas; the polder expertise of the Urban Landscape Architecture programme; and - most recent addition - the Faculty’s avant-garde think-tank, the Why Factory. Urbanism will also soon accommodate related elements of the OTB Research Institute for the Built Environment, bringing expertise in Dutch regional planning and design, European spatial planning and mobility and transport studies.

5.9.2 Quality
The department defines its core task as to mobilise interdisciplinary knowledge, skills and reputation towards the creation of more sustainable living environments. In particular it aims at research leadership in the fields of delta urbanism, polycentric urban landscapes, design support tools, and comparative study of spatial planning systems. Each of these research strands originated in Dutch planning concerns but has been internationalised in response to encouragement from the mid-term assessment panel - for example the Randstad becomes a prototype of spatial planning for complex urban regions worldwide. TUD has significant international standing in these fields, as evidenced by speaking invitations, journal editorships, stakeholder collaborations and other esteem indicators. The recognition of quality extends to younger colleagues as well and is, in some cases, considered higher than that of the twelve Chairs.
5.9.3 Productivity
Urbanism has between a fifth and a quarter of the Faculty of Architecture's research capacity. The output analysis shows a broadly proportionate contribution of books (including landmark publications such as the Polder Atlas and Komossa’s Dutch Urban Block) book chapters, editorships of books and journals, and conference papers. By contrast its productivity of refereed articles is poor, with a weak conversion rate of conference papers into articles, and only twelve peer-reviewed papers published in the seven-year period. The department recognises this as a key issue and has set in place an appraisal and funding strategy involving individual targets and support towards attaining them. Arrival of OTB colleagues should help to raise academic expectations given their exceptionally high productivity in the score table of Scopus-listed publications. A similar shift of research culture is occurring in relation to PhD supervision. Urbanism had few doctoral monographs in the review period. It now has 52 researchers, many of them externally funded. PhD output is set to increase rapidly, provided the department can handle the management challenge of supervising timely completion.

5.9.4 Relevance
The department has a clear vision of its real-world relevance in an era of climate change, global competition, and neoliberal governance. Urbanism is strongly embedded into practice at local, national and international levels and scores highly for its activities in public outreach, policy review, practitioner workshops, technical publishing, and dissemination in popular booklets, exhibitions, websites, and film media, with the Why Factory pushing the experimental boundaries of communicative urban design. The department values its connectedness to society, while recognising the danger that its success with short-term client-led projects may yield little in the way of third-stream funding and distract from publication and large-scale proactive bidding.

5.9.5 Viability
In comparison with competitor planning schools, Urbanism has the advantage of being able to draw on the technical infrastructure (computing, workshops, publishing and media) and the charismatic reputation of the Faculty of Architecture. In a context of retrenchment it benefits from having a broad basis of expertise, which will be further reinforced by the OTB Research Institute for the Built Environment. OTB will also make it possible to attempt the coordination of large-scale international research programmes, (Seventh Framework, ESPON, Interreg etc).

Figure 15 Scores Urbanism TUD

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6. Berlage Institute

6.1.1 Programme description
As an independent foundation, the Berlage Institute takes part in Dutch government policy on culture, focusing specifically on architecture. Partially funded by the Dutch Ministry of Education, Culture and Science the Institute aims to nurture the professional community in the Netherlands by providing a place for cultural debate and international encounter and exchange.

As a cultural platform it aims to provide “a context in which its researchers can establish, test and propagate new forms of synthesising skills that can strengthen the visionary quality of their work”

The activities of the Institute are structured around six distinct research themes:
- New living/working conditions.
- Tourism and territory
- Emerging technology and techniques
- Structuring metropolitan formations
- Cohabitation and conflict
- Energy and the built environment

The Institute was established in 1990 as an independent postgraduate “laboratory of architecture”. The intake is roughly 50% from outside Europe, the majority of who are enrolled for the two-year masters programme. In 2000 an agreement was signed with TU Delft to validate doctorates, and a Berlage professorship was created to ensure an academic link. The current doctoral programme, under the theme “the city as a project” has 9 students who attend the Institute on a monthly basis for seminars and presentations, with an annual colloquium with outside critics. The majority of the students are undertaking the doctoral programme in parallel to practice, and a number are tutors in schools of architecture.

The Institute has strong international links with other practice focused schools of architecture such as the Architectural Association, London and Cooper Union, New York.

6.1.2 Quality
The work of the research programme is difficult to assess on the same criteria as the other two universities. The strength of the Berlage is its focus on linking research to architectural practice and providing “a place for cultural debate and international encounter”. The number of refereed articles is nil, and the PhD programme was begun only a year ago. The three past doctorates were undertaken within the TU Delft programme.

The strength of the programme is its own publications, conferences and exhibitions. Brussels- A Manifesto: Towards the Capital of Europe 2007 is the outcome of a project undertaken by the international postgraduate masters course to explore the impact of the proposed re-planning of the European Commission Quarter of Brussels on the future representation of Brussels and Europe. The conclusions published by NAi Publishers and A+ Editions provided a valuable context to the subsequent planning debate and competition. Hunch, the Institute’s magazine, has international coverage, and aims to provide a “bridge between the culture of Dutch architecture and the international discourse on architecture, urbanism and landscape”. Recent issues have covered themes such as Bureaucracy and Consensus. The research themes of the
Institute’s programmes are established by a Research Board composed of eminent Dutch and international Practitioners. The quality of the PhD programme is overseen by a scientific committee including representatives from TU Delft, the AA, Columbia University, and the University of Applied Arts in Vienna.

6.1.3 Productivity
The number of books and book chapters published since 2005 as a proportion of tenured members of staff is comparable to the architecture and urbanism programmes at the TU Delft. However, the number of refereed works or publications in journals unattached to the Berlage or its immediate set of peers is low.

6.1.4 Relevance
Architectural and urban design practice needs the underpinning of theory based on research. The Berlage with its focus on international design based master’s courses for practitioners, and programme of public meetings, seminars, exhibitions and conferences is a unique institution for bringing together academia with practice. Its weakness, perhaps due to its size, is its breadth of outreach and depth of interests. It has become self-referential and this is re-enforced by it generating its own publications, and drawing a high proportion of its doctoral students from its own masters programme or associated institutions.

6.1.5 Viability
The research output of the Berlage should be assessed as far wider than the PhD programme. Its two-year masters programme for postgraduate professionals, has a strong content of case study project work which is undertaken in the spirit of design as research and published. Cities are attracted as partners – Rotterdam, Tirana, Mexico City, or building types are chosen for in depth analysis both as changing organisational structures and new urban form, for example The Architecture of Hospitals (2004).

Enrolled in its two-year postgraduate programme the Institute has approximately 50 fee-paying students, in 5 studios with Groups varying in size from 8 to 12 students. Tutors, drawn from the permanent staff and local practices, are supported by guest critics and experts. The Berlage's international reputation as a place for exploring design ideas, supported by the image of the Netherlands as a focus for innovative design thinking and Rotterdam as the home of internationally recognised practices (OMA, MVRDV, KCAP, West8) has supported the high regard that Dutch Architecture and Urbanism has internationally. However, looking ahead the Institute recognises the competition from larger better-equipped, well-funded academic institutions. The current financial situation is in dire straits due to the recession and the instability of government support for the arts. They have seen a reduction in commissions and sponsorship and a drop in applications. Keeping quality staff to maintain the reputation is a concern.

In the 2005 assessment, and subsequent interim review the Delft School of Design (DSD) was recognised as a potential focus for research through design crossing between architecture and urbanism and working at masters and doctorate level between the Dutch universities. DSD has not achieved this goal and has vacant professorial posts. In addition, the Why Factory, begun by Winy Maas in 2008 as part of the Urbanism programme in order to expand “the argumentative power of the architectural and urbanistic professions”, has established a high profile and attracts external resources. The opportunity to bring DSD, The Why Factory and the Berlage closer together as a post-professional graduate research centre representing the Dutch higher education sector, government and the professions, deserves active consideration.
6.1.6 Scores

Given the parameters of the Standard Evaluation Protocol, the committee voted unanimously to refrain from issuing any scores for the Berlage Institute in this evaluation procedure. The small number of PhDs in the evaluation period, the unique programmatic nature of the PhDs currently being undertaken, the lack of any classically funded research and the altogether different funding (and its associated directives) make scoring the Berlage Institutes research activities meaningless.

On the other hand, the committee is given the mandate to make an evaluation and as such, would venture the following points:

1. The small number of researchers at the Berlage Institute means that the programme is fragile and as such, needs careful guidance. This could be the research council of the TU Delft, fully recognising the unique situation that surrounds the Berlage Institute. Similarly, it would be good to embed the researchers at the Berlage in the PhD support structures that the TU Delft offers its own researchers, but again in recognition of the unique position of the Berlage in the research landscape.

2. A coordinated dialogue with the DSD and the Why Factory could help to identify the specific otherness that the Berlage offers to architectural researchers. To some extent, the Why Factory and in some ways, the DSD are both competitors to the Berlage in that all three are offering non-traditional methods and environments for conducting architectural research. The main body of research that the committee saw during the evaluation was based on known methods and long-established protocols. There is the possibility, however, that there does exist a specific "architectural research method" and the committee recommends pursuing these "other ways" of conducting architectural research in the chance that something like this might emerge from this "otherness".

3. As a cultural institution, the Berlage Institute lies under other directives and criteria for its funding and long-term sustainability. In light of incubating the research work being carried out, the committee would encourage the Deans of the Architecture Faculties at both universities to start a discussion about ensuring the long-term sustainability of the research work at the Berlage.
Appendix A  Curriculum Vitae Committee members

Professor Peter Russell

Peter Russell was born in 1963 in Ottawa, Canada. He received his High School Diploma in 1980 from a high school located west of Calgary, Canada. Afterwards lived for 15 months aboard a 17 meter sailboat on the west coast of the USA and Mexico.

He studied Engineering and Graphic Design before he came to Architecture. He has used computers since 1976 and is involved with the application of computers in design since 1985. At the Technical University of Nova Scotia (now Dalhousie University) he completed the first digital architectural thesis while working for Apple Canada, Inc. in their Research Partnership Program.

In 1990, he moved to Switzerland and worked in a small atelier for Digital Design before moving to Berlin in 1992. There he worked as an architect and as a consultant for Digital Design Integration. While in Berlin, he was also employed as a Lecturer for CAD at the Hochschule der Künste (now the University of the Arts). His work as a freelance Architect included the role as coordinating architect for the Reichstagsprüsidentenpalais in Berlin for Thomas van den Valentin, Architect.

Between 1997 and 2001, Peter Russell worked on the development of the Netzentwurf with Professor Dr. Niklaus Kohler in the Institute for Industrial Building Production (ifib) at the University of Karlsruhe. The Netzentwurf is a web-based Design platform that allows synchronous and asynchronous criticism and discussion to take place across institutional, industrial and international borders. He also carried out research in developing a European Virtual University of Architecture and Construction within the EU fifth Framework program. His doctoral work is investigating the visual depiction of non-geometric building information.

In March 2002 he was called to the RWTH Aachen University as Professor for Computer Supported Planning in Architecture (CAAD) in the Faculty of Architecture. The Institute has continued the Netzentwurf tradition and has undertaken further development of the platform. In research, the CAAD Chair is involved in projects dealing with student mobility, virtual environments, building intelligence as well as building information interfaces. The institute currently employs around 30 people.

In 2006 he founded IP Arch GmbH with five other architects. IP Arch is an architectural office dedicated to implementing integrated planning principles in the creation of responsible architecture. The office has currently 10 employees.

Since May 2005, Peter Russell is the Dean of the Faculty of Architecture at the RWTH Aachen University and since June 2007, Chairman of the Dean’s Council of the University.
**Professor Rachelle Alterman**

Dr. Rachelle Alterman is a chaired professor in the Faculty of Architecture and Town Planning at the Technion – Israel Institute of Technology. She heads the Research Center for Urban and Regional Studies and the Graduate Program in Real Estate. With degrees in urban planning and in law from Canadian and Israeli universities, Dr. Alterman is known internationally as one of the leading scholars in cross-national comparative land-use law, property rights and planning theory. Many of her 200 academic publications pioneer in cross-national comparative research on these topics, including 6 international books. Alterman is the Founding President of the International Academic Association on Planning, Law and Property Rights, established in The Netherlands in February 2007.

Professor Alterman serves or has served on the Editorial Advisory Boards of leading academic journals in the urban planning field based in the USA and Europe. She has been a visiting professor at several universities: University of North Carolina at Chapel Hill, New York University, University of Wisconsin Madison, University of Michigan Ann Arbor, and Radboud University and Wageningen University in the Netherlands. She was also an International Scientific Fellow in Japan and at the Lincoln Institute on Land Policy in Cambridge, Mass.

Web site: [http://alterman.technion.ac.il](http://alterman.technion.ac.il) email: alterman@technion.ac.il

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Nicholas Bullock

Positions Held

1972-  Lecturer and then Reader in Architectural and Planning History, Department of Architecture, Cambridge University
1974-  Fellow and Director of Studies, King’s College, Cambridge
1984-  Lecturer, Housing and Urbanism Programme, Graduate School, Architectural Association

Administration Experience

1974-91  Graduate Tutor, King’s College
1991-97  Vice-Provost, King’s College
2000-04  Member of the University’s General Board
          (the University’s central committee on all educational and financial matters)
2000-06  Chair, Management Committee, Cambridge University Language Centre
2002-04  Chair, Council of the School of Arts and Humanities
          (the Cambridge equivalent of the Dean for all the faculties of arts and humanities)
2000-02/8-09  Head of Department, Department of Architecture

Current Research Interests

Working as a lone scholar, my broad interests lie in the way that architecture and planning have shaped the late 19th and 20th century city in Europe and North America. I have a special interest in the history of housing, from the housing reform movement before 1914, to housing policy and construction during the inter-war and post-war periods. Currently, my principal focus is writing a book, ‘From Liberation to Revolt, the Architecture of Modernisation in France 1945-68’.
**Dinar Camotim**

He was born in 1953 in Coimbra (Portugal) and currently resides in Lisbon (Portugal) with his wife Isabel. The couple has no children. He received his Undergraduate degree in Civil Engineering (1976) from the Technical University of Lisbon (Portugal). He received his M.A.Sc. (1981) and PhD. (1985) degrees in Civil Engineering from the University of Waterloo (Canada), where he worked under the supervision of the late John Roorda.

He is currently Professor in the Department of Civil Engineering and Architecture of the Technical University of Lisbon, Portugal, where he (i) teaches both undergraduate and graduate courses on “Structural Mechanics” and “Structural Engineering” (with emphasis on Structural Stability and “Steel Structures”) and (ii) leads a research team working in the area of “Stability, Non-Linear Behaviour and Design of Thin-Walled Structures”. His major fields of interest are: “Structural Stability and Vibration”, “Numerical Methods in Structural Engineering” and “Non-Linear Analysis and Design of Thin-Walled Metal and FRP Composite Members and Structures”.

He supervised or co-supervised 2 Post-Doctoral fellows, 15 PhD. students and 18 M.A.Sc. students, both at the Technical University of Lisbon (Portugal) and at a few Brazilian Universities.

He has co-authored one book on Structural Stability (in Portuguese), 5 book chapters, about 80 papers published in peer-reviewed journals and about 300 papers published in conference proceedings.


He chaired the Organizing Committees of two international conferences (CIMS'2000 and SDSS'06), was a Member of the International Scientific Committee of about 45 international conferences and organized or co-organized Mini-Symposia in 14 international conferences.

He is a past Vice-Chair and Chair of the ASCE (American Society of Civil Engineers) EMI (Engineering Mechanics Institute) Stability Committee.

He is a Member of the Executive Committee of the Structural Stability Research Council (SSRC).

He is a Member of the Technical Committees 7 (Cold-Formed Thin-Walled Sheet Steel) and 8 (Stability) of the European Convention for Constructional Steelwork (ECCS).

He is Associate Editor of the ASCE Journal of Engineering Mechanics (for Stability).

He is a Member of the Editorial Board of the following international journals: Thin-Walled Structures, International Journal of Structural Stability and Dynamics, Steel and Composite Structures, International Journal of Advanced Steel Construction, IES Journal A: Civil and Structural Engineering (Institution of Engineers – Singapore) and South American Journal of Structural Engineering (in Portuguese).

He received Teaching Excellence Awards from the University of Waterloo (Canada) and the Technical University of Lisbon (Portugal).

He received the “IJSSD Award 2007” (best paper published in the International Journal of Structural Stability and Dynamics in 2007).

He received the ASCE “Shortridge Hardesty Award 2010” (“in recognition of sustained and substantial contribution to the field of structural stability during his career of active teaching and research”).
Dirk Donath

1985 – 1988  Doctorate research
1988 – 1990  Technical assistant in ’Design and Planning’ at the faculty of architecture, HAB Weimar
1990 - 1992  Head of ’Computer Planning Unit’ at the faculty of architecture, HAB Weimar


Since 18 years he is a Full Professor at the Bauhaus University Weimar and a Chair holder in “design and planning methods” at the faculty of architecture.

At the same time he worked as a practicing and full licensed Architect and partner at the architectural office at nitschke-donath architect ltd, realising a variety of projects in the areas of social housing, educational, public and cultural buildings. His office served many projects in heritage conservation, protected buildings and monuments and won various architectural competitions with the first prize too.

He is a Visiting Professor in Architecture at the Addis Ababa University to be a Chair holder in “Building Construction” at the EiABC - Ethiopian Institute of Architecture, Building Construction and City Development since 2008.

In his academic career he is doing various research projects sponsored by both public and industry sources, getting many grants and scholarships from the industry and government. His main focus is directed to theory and practice in architecture and planning methods and building construction issues.

Over years he worked as a Consultant and mentor for a lot of PhD Students and post doctorate studies worldwide. He published numerous international blind reviewed publications and two books.
Michael Hebbert
1994 – present Professor of Manchester University (1994-present).

Michael Hebbert is Professor of Town Planning at the University of Manchester and is a member of the Manchester Architecture Research Centre. He has wide ranging research interests in the fields of town planning history, urban design, and city governance. Among other topics, his writings have explored the planning histories of London and Manchester, the concept of regionalism in the UK and Europe, the nature and meaning of urban green-space, railway station design, and many aspects of street layout and the public realm. In 2010-11 he has a major project funded by the UK Economic and Social Research Council on the application of urban climate knowledge in urban design since 1950.

Michael graduated in Modern History from Merton College Oxford in 1969 and obtained his doctorate under (Sir) Peter Hall in Geography at the University of Reading in 1977. From 1979-1994 he convened the urban planning masters at the London School of Economics. He has been active in community initiatives and building trusts in London and Manchester and chaired the design review panel for the London Crossrail project. In 2002-10 he edited the Elsevier journal Progress in Planning and currently serves on the boards of Planning Perspectives, Journal of Planning History, DISP, Polity and Space and Progress in Planning. He is a chartered town planner (Member of the Royal Town Planning Institute) and an elected member of both the Academy of Urbanism and the Academy of Social Sciences.
Per Heiselberg

Professor, PhD, M.Sc

Department of Civil Engineering, Aalborg University, Sohngaardsholmsvej 57, 9000 Aalborg, Denmark. Phone: +45 9940 8541, Fax: +45 9814 8243, E-mail: ph@civil.aau.dk

M.Sc. in Indoor Environmental Engineering from Aalborg University in 1986. PhD. from Aalborg University in 1990. In 1994 associate professor at Aalborg University, in 2001 appointed Professor MSO and head of the Hybrid Ventilation Centre at Aalborg University, 2003 - 2006 appointed as adjunct professor at Hunan University, Changsha, China. 2007 appointed as visiting professor at Chongqing University, Chongqing, China. 2008-2012 appointed as guest professor at Tokyo Polytechnic University, Japan and in 2010 appointed full professor at Department of Civil Engineering, Aalborg University.

The research activities focus on the following subjects:

- Energy-efficient building design (Design of low energy buildings – integration of architectural and technical issues, modelling of double skin facades, night cooling of buildings, multifunctional facades, daylight in buildings, passive energy technologies for buildings)
- Ventilation and air flow in buildings (Modelling and measurements of air and contaminants flows (both gas- and particles) in buildings, ventilation effectiveness, efficient ventilation of large enclosures, numerical simulation of air flows as well as modelling of natural and hybrid ventilation.)

Participated in international research projects related to energy conservation in buildings since 1988 through IEA (ECB&CS Annex20, Annex 26, Annex35, Annex 43, Annex 44, Annex 52 and Annex 53). Acted as Operating Agent (Project leader) for IEA-ECBCS Annex35 and 44. Has the last 5 years participated in EU-projects within the ASIA Link programme (2 projects) and the Intelligent Energy Europe programme (3 projects) and the EU SME programme (1 project).

In charge of the Danish Research Council project (postdoctoral grant 1998-2001): Development of probabilistic calculation method for natural ventilation and from 2004-2007 the Danish Research Council project: ”Development of integrated models for multifunctional facades”. From 2001-2006 leader of Center for Hybrid Ventilation at Aalborg University (partly funded by VKR foundation). From 2009 - 2014 Leader of a DSF Strategic Research Centre on “Zero Energy Buildings”. Participated in and been in charge of more than 20 national research projects for the Danish Energy Agency (EFP, EUDP, PSO) and more than 10 projects for the building industry.

Partner and member of the steering group of the innovation network for energy efficient buildings “InnoBYG (2010-2014)”.


Member of ASHRAE, ISIAQ and IISBE
Pieter Uyttenhove

Pieter Uyttenhove is full professor of urban planning at the department of Architecture and Urban Planning of Ghent University, Belgium, and is currently head of department.

He was educated as an engineer-architect at the University of Leuven, as an urbanist at the Institut d’Urbanisme de Paris and made his PhD at the École des Hautes Études en Sciences Sociales (EHESS) in Paris.

Doctoral research is being done under his direction on historical and theoretical urban planning matters as urban network development; national road development; the development of landscape imagery; the interaction between urban planning, landscape and heritage; the architecture of information.

He is the director of Labo S, a research laboratory for urban design and urban planning. In the last 5 years, Labo S did research for public authorities on different levels on ‘new landscapes’ in (sub)urbanized areas; regional identity in a changing world; landscape transformation through chronophotographic studies; a contemporary and urbanistic approach of architectural, landscape and urban heritage and made a landscape-atlas on municipal and regional level of the Scheldt-valley between Antwerp and Ghent dealing with natural, hydraulic, cultural, economic, etc. matters.

He was founder and chairman of Studio Open City, a cross-institutional cultural platform for urban design. Formerly he was joint-curator of the drawing collection of the Académie d’Architecture in Paris and co-ordinator of the architectural program of Antwerp European Cultural Capital. Since 2002 he is co-director of GUST (Ghent Urban Studies Team).

He is the author of several books and many articles in international reviews. He is the editor of the recently published, Recollecting landscapes : herfotografie, geheugen en transformatie: 1904-1980-2004. He recently was one of the organizers of the international colloquium on ‘Analogous Spaces’. In 2009, he published a book on Marcel Lods. Action, architecture, histoire, at Verdier (Paris).
John Worthington
Co-Founder DEGW

Graduated from the Architectural Association, London AA Dip (Hons) in 1964 and was on a Harkness Fellowship (1965-67) at the University of Pennsylvania (M.Arch Penn) and the University of California Berkeley. He returned to the UK and was co-founder of DEGW (1973) a strategic design and consulting firm operating worldwide. From 1992-97 he was Professor of Architecture and Director of the Institute of Advanced Architectural Studies (IoAAS) at the University of York. Whilst at York he was a member of the HEFCE UK Research Assessment Panel for the Built Environment (1996) and undertook for the VROM a review of architecture and planning education in the Netherlands compared with five other European countries (1995). He held the Graham Willis Professorship at the University of Sheffield (1998-2008) has been a Visiting Professor at Chalmers University of Technology, Gothenburg (2000-03) and a Professorial Fellow at the University of Melbourne (2006-10). He was on the QANU Research Review for Architecture, Urbanism and Building Science (2005) and the Built Environment panel for the UK Research Assessment Exercise 2008.

His major interests are the design and briefing process (Blyth and Worthington; Managing the Brief for Better Design, Second Edition 2010) workplace design and change (Worthington, Reinventing the Workplace, Second Edition 1998) and urban design and estates strategies. He is past President and a current patron of the Urban Design Group, Director of the Academy of Urbanism and a past chair of CABE/RIBA Building Futures (2003-09).
# Appendix B  Programme Site Visit

<table>
<thead>
<tr>
<th>Date</th>
<th>Action</th>
<th>Remarks</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>21</strong> November</td>
<td></td>
<td></td>
<td><strong>EINDHOVEN</strong></td>
</tr>
<tr>
<td>18:00</td>
<td>Ultimate arrival time at Hotel</td>
<td></td>
<td>Hotel</td>
</tr>
<tr>
<td>19:00</td>
<td>Informal dinner with the committee</td>
<td>Separate: discussion about the assignment, planning, how to operate, etc.</td>
<td>Hotel restaurant</td>
</tr>
<tr>
<td><strong>22</strong> November</td>
<td></td>
<td></td>
<td><strong>EINDHOVEN</strong></td>
</tr>
<tr>
<td>Before 8:30</td>
<td>Breakfast &amp; checking out storage luggage</td>
<td>Storage of luggage</td>
<td></td>
</tr>
<tr>
<td>8:30 – 9:00</td>
<td>Pick up at hotel</td>
<td>Taxi to university</td>
<td></td>
</tr>
<tr>
<td>9:00–10:00</td>
<td>Welcome by the Dean &amp; Introduction of Research Programmes by Director of Research</td>
<td></td>
<td>Vrt 2</td>
</tr>
<tr>
<td>10:00-10:30</td>
<td>COFFEE &amp; faculty tour</td>
<td></td>
<td>Vertigo</td>
</tr>
<tr>
<td>10:30-11:00</td>
<td>RG Urbanisms (U)</td>
<td>Presentation + discussion</td>
<td>Vrt 9</td>
</tr>
<tr>
<td>11:00-11:30</td>
<td>RG Architecture of the Living City (LC)</td>
<td>Presentation + discussion</td>
<td>Vrt 9</td>
</tr>
<tr>
<td>11:30-11:40</td>
<td>COFFEE BREAK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:40-12:10</td>
<td>RG Innovation in Building Technology (IBT)</td>
<td>Presentation + discussion</td>
<td>Vrt 9</td>
</tr>
<tr>
<td>12:10-12:40</td>
<td>RG Performance Engineering for Built Environments (PEBE)</td>
<td>Presentation + discussion</td>
<td>Vrt 9</td>
</tr>
<tr>
<td>12:40-13:30</td>
<td>LUNCH</td>
<td>Poster presentation of PhD research; interaction with PhD’s.</td>
<td>Vrt 5, atrium</td>
</tr>
<tr>
<td>13:30-14:10</td>
<td>RG Building Physics and Systems (BPS)</td>
<td>Presentation + discussion</td>
<td>Vrt 9</td>
</tr>
<tr>
<td>14:10-14:50</td>
<td>RG Structural Design (SD)</td>
<td>Presentation + discussion</td>
<td>Vrt 9</td>
</tr>
<tr>
<td>14:50-15:30</td>
<td>TEA BREAK &amp; lab tour</td>
<td></td>
<td>Vertigo</td>
</tr>
<tr>
<td>15:30-16:10</td>
<td>RG Design and Decision Support Systems (DDSS)</td>
<td>Presentation + discussion</td>
<td>Vrt 9</td>
</tr>
<tr>
<td>16:10-16:30</td>
<td>Meeting with Standing Committee for Research (VCW)</td>
<td></td>
<td>Vrt 9</td>
</tr>
<tr>
<td>16:30-19:00</td>
<td>Short review of the site visit by the End of the afternoon to discuss the first impressions and some</td>
<td></td>
<td>Vrt 9</td>
</tr>
<tr>
<td>Time</td>
<td>Event</td>
<td>Location</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------------------------------------------------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>19:00-21:00</td>
<td>Working diner: committee and academic staff</td>
<td>Room for informal interaction, poster presentation of PhD research</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plaza</td>
<td></td>
</tr>
<tr>
<td>21:00-22:00</td>
<td>Transfer Eindhoven – Delft</td>
<td>Luggage will be picked up by assistant before transfer to Delft</td>
<td></td>
</tr>
<tr>
<td>23 November</td>
<td></td>
<td>DELFT</td>
<td></td>
</tr>
<tr>
<td>07:30-08:30</td>
<td>Breakfast</td>
<td>Hotel</td>
<td></td>
</tr>
<tr>
<td>08:30-09:00</td>
<td>Pick up at hotel</td>
<td>Walk to university + short tour faculty (serre East + South, Street)</td>
<td></td>
</tr>
<tr>
<td>09:00-09:15</td>
<td>Welcome by the Dean of Architecture TU Delft</td>
<td>Berlagezaal 1</td>
<td></td>
</tr>
<tr>
<td>09:15-10:00</td>
<td>Architecture &amp; The Built Environment</td>
<td>Presentation + Discussion Berlagezaal 1</td>
<td></td>
</tr>
<tr>
<td>10:00-10:30</td>
<td>COFFEE BREAK</td>
<td>Berlagezaal 2</td>
<td></td>
</tr>
<tr>
<td>10:30-11:15</td>
<td>RG Architecture Presentation + discussion</td>
<td>Berlagezaal 1</td>
<td></td>
</tr>
<tr>
<td>11:15-12:00</td>
<td>RG Design &amp; History Presentation + discussion</td>
<td>Berlagezaal 1</td>
<td></td>
</tr>
<tr>
<td>12:00-12:45</td>
<td>LUNCH</td>
<td>Berlagezaal 2</td>
<td></td>
</tr>
<tr>
<td>12:45-13:30</td>
<td>RG Green Building Innovation Presentation &amp; Discussion</td>
<td>Berlagezaal 1</td>
<td></td>
</tr>
<tr>
<td>13:30-14:15</td>
<td>RG Computation &amp; Performance Presentation &amp; Discussion</td>
<td>Berlagezaal 1</td>
<td></td>
</tr>
<tr>
<td>14:15-15:00</td>
<td>RG Urbanism Presentation &amp; Discussion</td>
<td>Berlagezaal 1</td>
<td></td>
</tr>
<tr>
<td>15:00-15:30</td>
<td>TEA BREAK</td>
<td>Berlagezaal 2</td>
<td></td>
</tr>
<tr>
<td>15:30-16:15</td>
<td>RG Innovations in the Management of the Built Environment Presentation &amp; Discussion</td>
<td>Berlagezaal 1</td>
<td></td>
</tr>
<tr>
<td>16:15-17:00</td>
<td>RG Housing Quality Presentation &amp; Discussion</td>
<td>Berlagezaal 1</td>
<td></td>
</tr>
<tr>
<td>17:00-17:30</td>
<td>Tour faculty (Research groups)</td>
<td>Faculty</td>
<td></td>
</tr>
<tr>
<td>17:30-19:00</td>
<td>Short review of the site visit by the committee</td>
<td>Separate: end of the afternoon to discuss the first impressions and some preliminary conclusions BG WEST 670</td>
<td></td>
</tr>
<tr>
<td>19:00-21:00</td>
<td>Working dinner: committee and academic staff Room for informal interaction with the members of the academic staff.</td>
<td>Berlagezaal 2</td>
<td></td>
</tr>
<tr>
<td>24 November</td>
<td></td>
<td>DELFT</td>
<td></td>
</tr>
<tr>
<td>07:30-08:30</td>
<td>Breakfast</td>
<td>Hotel</td>
<td></td>
</tr>
<tr>
<td>08:30-09:00</td>
<td>Walk to faculty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>09:00-09:45</td>
<td>RG Governance of Geoinformation and land development</td>
<td>Presentation &amp; Discussion Berlagezaal 1</td>
<td></td>
</tr>
<tr>
<td>10:00-11:00</td>
<td>Transfer to Berlage Institute + coffee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:00-11:45</td>
<td>6.1.7 The Berlage Institute: The City as a Project</td>
<td>Presentation &amp; Discussion Rotterdam</td>
<td></td>
</tr>
<tr>
<td>11:45-12:15</td>
<td>Tour Berlage Institute</td>
<td>Rotterdam</td>
<td></td>
</tr>
<tr>
<td>12:15-13:00</td>
<td>LUNCH</td>
<td>Rotterdam</td>
<td></td>
</tr>
<tr>
<td>13:00-14:00</td>
<td>Transfer to Delft</td>
<td>DELFT</td>
<td></td>
</tr>
<tr>
<td>14:00-14:30</td>
<td>Review of the site visit OTB + Berlage by the committee</td>
<td>Separate, first impressions and preliminary conclusions BK: BG-WEST-670</td>
<td></td>
</tr>
<tr>
<td>14:30-19:00</td>
<td>Committee deliberation Rest of the afternoon, discussions about the outline of</td>
<td>BK: BG-WEST-670</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Event</td>
<td>Details</td>
<td>Location</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------</td>
<td>------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>19:00-21:00</td>
<td>Committee Dinner</td>
<td>Continue discussion about outline and conclusions</td>
<td>Delft</td>
</tr>
<tr>
<td>25 November</td>
<td>7:30-10:00 Breakfast + checking out</td>
<td>Storing luggage if necessary</td>
<td>Hotel</td>
</tr>
<tr>
<td>10:00-10:30</td>
<td>Transfer to faculty</td>
<td>By taxi (with luggage)</td>
<td></td>
</tr>
<tr>
<td>10:30-12:00</td>
<td>Review of the Site Visit: conclusions</td>
<td>Public: with Deans en Rectors</td>
<td>Berlagezaal 1</td>
</tr>
<tr>
<td>12:00-13:00</td>
<td>LUNCH</td>
<td>With Deans and Rectors</td>
<td>Berlagezaal 2</td>
</tr>
<tr>
<td>13:00-on</td>
<td>Transport to hotel, airport, train station</td>
<td></td>
<td>Delft</td>
</tr>
</tbody>
</table>
Appendix C Criteria and scores Standard Evaluation protocol

Criteria

Criterion 1: Quality

Quality refers to the level of the research conducted by the researchers of an institute and its groups or programmes compared to accepted (international) standards in that field. As a rule, quality is measured by judging the international academic reputation, the position and the output of the unit to be evaluated. However, in case of a national orientation of a research field, the point of reference consists of other groups in the country. When judging research quality, sub-criteria are:

- Quality and scientific relevance of the research
- Leadership of the institute and the individual leadership of the principal investigators, including research policy and research management
- The academic reputation of the researchers
- Organizational aspects of the institute and of the research programmes, such as the human and financial resources
- PhD training in the institute or within research programmes.

Assessment of PhD training

The evaluation committee is requested to focus on the success rates, supervision and organisational embedment of the programme in the research organisation and research activities involved in the PhD-training. Furthermore, the committee is requested to reflect on the availability of educational resources, such as courses and resources for conference attendance. Information on these aspects is to be provided in the self-evaluation report of the institute.

The PhD-programmes are to be assessed on the level of the institute. When the institute assessed by the committee is part of one faculty, but the PhD programme is part of broader interfaculty or interuniversity research school or graduate school, the committee is requested to reflect on these links.

In the Netherlands, PhD training is often organized in research schools. These schools can be collaborations of various universities in a particular field or units within a single university (the latter are usually referred to as ‘graduate schools’). A research school may seek accreditation once every six years through the ECOS-accreditation (Erkenningscommissie Onderzoekscholen), which operates under the auspices of the Royal Netherlands Academy of Arts and Sciences (KNAW). This accreditation focuses primarily on PhD training, but also on the research mission of the research school. Normally, ECOS accreditation is sought after a SEP evaluation. The report(s) of the SEP evaluation(s) may be used as input for the ECOS-accreditation, if not older than three years. When an ECOS-accreditation is sought after a SEP evaluation, it is recommended to include the information requested by the ECOS in the SEP-self-evaluation.

Criterion 2: Productivity

Productivity regards the relationship between input and output. Output should always be judged in relation to the mission and resources of the institute. When looking at productivity in terms of publications of scientific articles and the like, a verdict is usually cast in comparison with international standards of a quantitative nature.
However, this is often not possible when looking at other forms of output (for example health protocols, designs, policy reports). Since many institutes will have variegated output and scientific activities, evaluators are asked to also include other forms of (qualitative) information in their assessment.

- At the level of the institute, the judgment regards the policy measures to raise the output to the best and most relevant level possible.
- At the level of the research group or programme, both the output directed toward the scientific community and the output for wider audiences are to be judged. Quantitative and qualitative measurements may be used.

**Criterion 3: Societal relevance**

This criterion covers the social, economic and cultural relevance of the research. Thus, it concerns a great variety of subjects that are both scientifically and socially relevant (global warming, sustainable energy, inequality, governance, migration and integration, quality of life, water, religion, cultural identity, language problems, etc.). In principle, all research activities can be (or become) relevant for these subjects, though this might be more obvious in some cases than in others. When assessing research activities in terms of societal relevance, evaluators are asked to consider one or more of the following three aspects. The three are not mutually exclusive and meant as indicative guidelines. The institute specifies in its self-evaluation report on which aspect(s) it would like to be evaluated.

At the level of the institute, this criterion is assessed by reviewing the policy measures aimed at enhancing societal relevance, and the societal orientation of researchers and their activities. This includes the institute’s policy for making the results of research available to other than academic users (knowledge transfer).

At the level of the research group or programme this criterion can be assessed by reviewing the various kinds of output and activities through impact indicators or more qualitative measurements.

For the assessment of societal relevance, evidence may be gathered through stakeholder surveys, stakeholder conferences, various forms of impact analysis (studies of behavioural changes of groups or institutions, concrete benefits for specific stakeholders), case studies, etc. Several methods have been developed for specific areas (the payback method for health research, for example) and new methods are being developed. More information about these developments is available through links at the SEP-website www.knaw.nl/sep and at www.eric-project.nl

- **Societal quality of the work.** This aspect refers primarily to the policy and efforts of the institute and/or research groups to interact in a productive way with stakeholders in society who are interested in input from scientific research. It may also refer to the contribution of research to important issues and debates in society.

- **Societal impact of the work.** This aspect refers to how research affects specific stakeholders or specific procedures in society (for example protocols, laws and regulations, curricula). This can be measured, for example, via charting behavioural changes of actors or institutions.

- **Valorisation of the work.** This aspect refers to the activities aimed at making research results available and suitable for application in products, processes and services. This includes activities regarding the availability of results and the interaction with public and private organisations, as well as direct contributions such as commercial or non-profit use of research results and expertise.

At the level of the institute, this criterion is assessed by reviewing the policy measures aimed at enhancing societal relevance, and the societal orientation of researchers and their activities. This includes the institute’s policy for making the results of research available to other than academic users (knowledge transfer).
At the level of the research group or programme this criterion can be assessed by reviewing the various kinds of output and activities through impact indicators or more qualitative measurements.

For the assessment of societal relevance, evidence may be gathered through stakeholder surveys, stakeholder conferences, various forms of impact analysis (studies of behavioural changes of groups or institutions, concrete benefits for specific stakeholders), case studies, etc. Several methods have been developed for specific areas (the payback method for health research, for example) and new methods are being developed. More information about these developments is available through links at the SEP-website www.knaw.nl/sep and at www.eric-project.nl.

Criterion 4: Viability

This dual criterion regards the institute’s ability to react adequately to important changes in the environment. It refers to both internal (personnel, research practice) and external (developments in the field, in society) dynamics of the group. In the self-evaluation, this can best be assessed through a SWOT-analysis.

- At the institute level, the ability of the institute to react adequately to important changes may be shown by the process of establishing research themes, personnel policy, subject choices, concentration of research lines, etc.
- At the level of the group or programme, for example, it may be shown by the way in which projects are professionally managed. This regards an assessment of policy decisions as well as an assessment of project management, including cost-benefit analysis.

Five point scale

For the assessment of the groups or programmes, the verdict should be cast in both qualitative and quantitative terms. In the text, the most important considerations of the committee should be clarified, while the conclusion should be summarized in a single term according to a five point scale, ‘excellent’ meaning world class research, and ‘un-satisfactory’ meaning below acceptable standards. The committee is requested to consider the full range of the five point scale and apply the criteria according to the descriptions given.

For disciplines that operate primarily in a national context, such as Dutch language, or Dutch law, the relevance of international competitiveness is transferred to relevance on a national level. For these disciplines, research should receive the qualification ‘excellent’ when it is regarded the top group in the country.

5. **Excellent:** Research is world leading. Researchers are working at the forefront of their field internationally and their research has an important and substantial impact in the field.

4. **Very good:** Research is internationally competitive and makes a significant contribution to the field. Research is considered nationally leading.

3. **Good:** Work is competitive at the national level and makes a valuable contribution in the international field. Research is considered internationally visible.

2. **Satisfactory:** Work adds to our understanding and is solid, but not exciting. Research is nationally visible.

1. **Unsatisfactory:** Work is neither solid nor exciting, flawed in the scientific and or technical approach, repetitions of other work, etc.