



TUT Research Assessment Exercise 2011 Assessment Report

PANEL II: Faculty of Built Environment

Panel members

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Units of Assessment

Department of Civil Engineering

School of Architecture

The Panel was asked to assess research conducted at the Units of Assessment in comparison to research conducted in internationally recognized units all over the world in the field in question. The assessment period was 2005–2010. The Assessment Criteria were: Scientific Quality, Scientific Impact, Societal Impact, Research Environment, and Future Potential. The Assessment Scale was: Outstanding International Level (5), Very Good International Level (4), Good International Level (3), Fair International Level (2), and Poor International Level (1). In addition to assigning a numerical rating and preparing a written statement on each of the Assessment Criteria, the Panel was asked to provide an overview of the Unit as well as recommendations for the future.

The Panel was also invited to give more general comments on issues that it considered important. These can be found in the beginning of this Report.

The detailed guidelines for carrying out the Assessment were defined in the Terms of Reference Document, which is available on TUT's website. The Site Visit Week took place in June 2011.



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GENERAL COMMENTS

While recognising the important differences between and within the two units of assessment, we would like to present a set of brief general impressions concerning both units.

- Both units showed enthusiasm and optimism for their future. Negative attitudes have not been observed. Based on the interviews and presentations, the departments' performance appears much better than what could be read from the self-evaluation. The departments also seem to have a clear idea of their research strategy, even though no strategic plan was presented. This could be addressed by developing a strategic plan that matches the TUT plan better.
- The greater level of autonomy at TUT was seen as an opportunity to develop the units further. The panel has very positive experience with university autonomy. The autonomy of the university should be propagated down to the subsequent structural levels, e.g. to the faculties, departments, chairs and researchers.
- The Department of Civil Engineering is a high quality traditional and stable unit that has a history of highly relevant technical research for the benefit of society. The School of Architecture appears in the process of transition toward more research. The Department of Civil Engineering has both an upcoming challenge and opportunity to develop new approaches through the natural retirements coming up within the next few years. Support in this process would be helpful to turn the renewal process into opportunities for new directions and initiatives. Many civil engineering departments in the world are going through a similar process at this moment. Re-orientation will bring shifts away from more traditional mono-disciplinary fields to broader fields.
- No unit presented a clear and coherent strategy that linked own research to larger, complex societal issues such as "sustainable development, energy, the built environment in an information age, etc." This moment of transition toward a more autonomous university would be an excellent point in time to reflect upon the role each unit can play in larger societal issues.
- External funding for Civil Engineering was high, 4,5 million out of 7,0 million Euro total. It was communicated by the unit that a significant portion of the external funding is "short term" funding, which creates a lot of pressure on the unit for maintaining the excellent laboratory facilities present as well as focusing on longer term doctoral research projects. There are a large number of "researchers" within Civil Engineering that are not a part of the faculty and in numerous cases do not hold a doctoral degree. At the same time, these researchers play an important role in providing the base necessary for maintaining the excellent world class laboratory facilities present. As a part of a longer term strategy, the unit should strive for reducing the number of researchers and increase the number of doctoral students. The university has an important role in supporting the change in emphasis toward more doctoral students, which should result in a significant increase in the number of doctoral degrees, published papers, and increased visibility.



- Even though not much discussed, tenure track was seen as a positive development by the panel and those concerned. International tenure track searches may provide the single most important factor in successful internationalization.
- Internationalization was an issue in both units. All scientists had remarkably good international networks and were active in international societies. The level of the number of international publications is also increasing at an impressive rate, but can be improved further. However, especially striking was the low number of international PhD students and scientific staff. Finland is seen by the outside world as a very advanced and technological society, which should facilitate international recruitment.
- The Faculty of Built Environment appears to be only an administrative body, since the funding from the University goes directly to the departments. The Dean has limited (if any) mandate to work out a Strategic Research Agenda of the whole faculty.
- Collaboration does exist between Architecture and Civil Engineering, but seems to exist almost only on accidental basis today. Significant opportunities and synergies can be realized through joint strategic planning.
- The Department of Civil Engineering is one of two remaining departments in Finland. The experimental facilities at the Department of Civil Engineering are excellent and unique in Scandinavia, and would place among the top 10-15 for Civil Engineering departments in the USA. TUT needs to evaluate how this unique experimental environment can be sustained into the future, since this is clearly a national resource.



DEPARTMENT OF CIVIL ENGINEERING

1. Overview

The Department of Civil Engineering defines its key research areas as structural engineering and the behaviour of structures, building physics and the life cycle engineering of structures, earth and foundation structures, railway technology, and building processes and real estate services. Of those areas building physics and railway technology are clear areas of international excellence. The focus on renovation is also strong and may be strengthened further through collaboration with architecture. Foundation engineering and soil structure interaction is another area of high international competence. Other areas identified as having a strong international potential include the behaviour of structures, energy issues for the future and building information systems.

The importance of the key subject areas within the Department to society is clearly stated in the self-assessment package. The importance to the Finnish building and construction industries are further highlighted by the fact that the department is one of only two in Finland and hosts some unique professorships and competencies within Finland that cannot be found at any other university. The staff exhibited energy for the future and a sense of purpose for Finnish society. Research is generally applied in nature and based on an experimental approach. The Department does society a great service through providing comprehensive and useful translational research projects. This is an excellent base for building deeper and more basic research themes in civil engineering in the future. However, the intensity of the very applied nature of many of the activities may hinder basic research development, which may require a supporting mechanism and a more focused research agenda to stand out in the field.

The Department of Civil Engineering lies close to the overall strategy of TUT in the sense that it has a strong emphasis on high-standard technology research that is connected to the needs of industry and Finnish society. At the research level, several of the staff had extensive networks outside Finland and participated actively in European standardization work. However, the department could benefit from an increased number of foreign doctoral students and staff.

The Department of Civil Engineering needs to develop a long-term strategy for the research that is tied to the great challenges of tomorrow's society. This is particularly important for being competitive in the upcoming EU Framework 8 program, as well as developing themes for increasing basic research and therefore also the competitiveness for the Academy of Finland funding.

Importantly, the department needs to do a better job at marketing itself for recognition through the organization of international conferences and workshops on specialized topics. A dynamic group could be evolved as a future internationally recognized authority and flagship institution through the development and execution of a joint research agenda.



2. Scientific Quality of the Unit's Research

Rating: Very Good International Level (4)

Based on the interviews and the self-assessment package several areas were identified by the panel as being of high scientific quality research. Of these, the areas of building physics and railway technology stood out as clear areas of international excellence, followed by foundation engineering and soil-structure interaction and renovation. Areas of rising scientific quality included behaviour of structures, energy issues for the future, and BIM. All of the groups presented appear to have a strong research culture, which can be strengthened further through an increased emphasis on doctoral studies. The focus is primarily laboratory-based and field studies, with a mix of analytical studies, which is well suited for studying today's complex problems related to a sustainable built environment.

However, with the extent of research programs and excellent research facilities, the number of refereed journal papers is on the low side, although it has steadily increased in number and quality throughout the years.

In summary, the scientific quality of unit was found to be at a very good international level, with railway technology being at the outstanding international level.

3. Scientific Impact of the Unit's Research

Rating: Good International Level (3)

The self-assessment report of the unit of assessment states several examples of the scientific impact of the unit. The researchers are active in numerous international scientific organizations, and serve as editorial staff members on five international journals, including the prestigious Journal of Structural Mechanics, Engineering Structures, Journal of Building Physics and the International Journal for Numerical and Analytical Methods in Geomechanics. The staff has also served on the organization committees for several international conferences and participates actively in EU COST projects and other international expert and working groups. Many of the senior professors have also served as opponents of doctoral dissertations outside Finland and have had joint projects with other universities and research institutes in Europe and the USA. The unit also lists 4 professors at other universities as their alumni.

The metrics presented in the self-evaluation package indicate external research grants per year at round € 4.5 million in 2010, which compares favourably with many other units of similar size. The number of doctoral students is low. Similarly, the number of peer reviewed papers is on the low side in comparison with typical production at civil engineering departments in research universities in Europe and the USA. However, the number of publications is increasing continuously from year to year and has the potential to increase further.



Building physics and railroad technology research agendas are rare in combination even at the world level. Both laboratory facilities and research results are comprehensive and rigorous. These environments could benefit from center-like organizations to both build synergies with other groups and help capturing better the significant research contributions and highlight the impact to the international community.

Hence, in summary the scientific impact of the unit of Civil Engineering is at the good international level.

4. Societal Impact of the Unit's Research

Rating: Outstanding International Level (5)

The Dept. of Civil Engineering understands its important role in society. The department is involved in applied research and development, and has strong ties with industry and key governmental agencies. The self-evaluation describes several standardization activities at both the Finnish and the EU level, as well as active participation in committees guiding sector development. These activities have resulted in an impressive number of guidelines for the built environment having been developed by the Department. The senior staff is also active as experts to sector authorities and sector enterprises.

Overall, the unit performs at an outstanding international level when it comes to societal impact.

5. Research Environment at the Unit

Rating: Very Good International Level (4)

The research environment at the Department is defined by excellence in experimental facilities, which are truly unique in Scandinavia. This is complemented by a strong affinity to field studies and verification of new concepts in the field. These facilities and the associated personnel provide the basis for more in-depth theoretical and analytical studies. The Department has significant potential for further linking the strong experimental tradition to more basic research. The facilities are supported by a rather large number of researchers, many of which do not have a doctoral degree. The department is encouraged to evaluate carefully the need for the large staff in order to focus resources further on doctoral level studies.

There is a trend internationally in civil engineering toward the use of Nondestructive Testing and Evaluation methods and IT technology to cover a much broader area of measurement for condition assessment of structures across broad geographical spaces. TUT could benefit in investing in these new technologies, thus building on the excellence found in civil engineering as well as the strong ICT related programs found in Finland. An example could



be a broad research theme including real time monitoring of railroad and track condition assessment with nondestructive measurement technologies.

At the same time, the department needs to develop a clear message for professors, research staff, and students on the importance of doctoral level studies in this unique environment. Some possible mechanisms to encourage the transition to more doctoral student production include clearly linking salary increases to doctoral student and journal paper production, as well as the level of external funding brought in by each of the professors and senior researchers.

Overall, the research environment is at the very good international level.

6. Future Potential of the Unit

Rating: Outstanding International Level (5)

The subject areas covered by the department are of critical importance for society. The Department understands this and has developed a clear strategy for research that is based on excellence in experimental laboratory and field research. This provides an excellent basis for extending into more fundamental research. The links with architecture and planning around common themes for the built environment also looks very promising. The uniqueness of some of the research themes on building physics and cold regions engineering is also a competitive advantage that very few universities can claim today. Based on the material presented in the self-evaluation and the presentations and discussions during the site visits, the department was judged to have an outstanding potential for securing a position in the international community as a preferred partner in international research networks within the next 5-10 years. A more detailed discussion of the criteria behind this rating is provided below.

(a) *Potential of its research groups amidst dynamic international competition.* The professors in railway technology, building physics, and foundation engineering are examples of leaders at the international level, followed by senior staff dealing with renovation, behavior of structures, energy issues, and BIM. A major focus during the next 5 years should be on extending the excellent international networks that have been built into further internationalizing the department. This includes hiring researchers from outside Finland, encouraging post-doctoral researchers to spend time outside Finland, recruiting international students, establishing funds for guest professorships etc. A major aspect of the internationalization is to establish a group of departments at peer universities for purposes of comparisons and being role models. These peer departments should be selected based on criteria that are consistent with those of the aspirations of TUT to become internationally leading in key areas of excellence.

(b) *The potential of the research environment to provide support for the chosen research strategy.* The Department has a long-standing approach to research, which is based on excellence in the laboratory and the field. However, the Dept. is in need for a strategic plan



that enables and supports the development and maintenance of a strong, deep and sustainable doctoral studies centered research culture. The Department leadership needs to develop a consistent and strong message that a sustained focus on doctoral education is necessary for future resources, pay raises, etc. However, in summary the Dept. has a truly excellent basis to build on for the future.

(c) *Future leadership potential.* Given the uniqueness of the facilities, the closeness to industry, the deep understanding of the role of civil engineering in society, and the fact that this is one of only two civil engineering programs in Finland, the department is uniquely placed for positioning itself for sustained international leadership.

(d) *The potential of the chosen research objectives and research topics to make an impact at the international level on the scientific community and society at large.* Many groups within the Dept. are already making an impact at both the international level and on the scientific community. This can be strengthened by increasing the weight on basic research and through links to other disciplines, such as transportation, water resources, environmental engineering and information and communications technology. The Dept. should be well placed to lead in the digitalization of the built environment through collaboration with the information technology programs at TUT.

(e) *The potential of emerging research areas.* The future focus on developing synergies between civil engineering and the School of Architecture is noteworthy in identifying new, emerging research areas. This would be further strengthened by creating stronger links with transportation and logistics and environmental engineering. In addition, there are significant opportunities within the Dept. of Civil Engineering to identify clear cross-disciplinary research themes that link the different groups within the Department as well as key groups outside the Dept. of Civil Engineering. Examples of such themes could include sustainable technologies for the built environment, climate change, transport and construction in an urban environment, or smart infrastructure and transport systems.

7. Recommendations for the Future

- The department needs to find ways to focus its limited resources on supporting doctoral education.
- Transportation and Logistics should be brought back into the Faculty of Built Environment. This will allow a comprehensive research focus on transport ranging from planning to the constructed infrastructure within a systems perspective.
- Water Resources and Environmental Engineering should also be brought back into the Faculty of Built Environment. This will encourage new thinking for a sustainable built environment.
- Two or three key research themes of significant societal importance should be selected for the whole department to collaborate around. Examples could include sustainability, climate change, etc.
- Internationalization of the department could be strengthened through identifying funding for sabbaticals for the professors and for visits by internationally respected



researchers to TUT for shorter and longer visits (as visiting professors, etc). These types of international exchanges could also support the change toward a doctoral studies centered research culture.

- TUT needs a commitment toward increasing diversity at the academic level through the recruitment of new professors and students with diversity as one criterion. This will enhance TUT significantly internationally. Currently, most of the professors and staff are the products of TUT. This is not a drawback considering the demands from the region. However, it hinders the diversity development and the internationalization of the university.
- A center-like institute should be formed in order to build upon the unique national research infrastructure found in the department and position TUT for succeeding in developing leadership in addressing the grand challenges driven research initiatives on the horizon.



SCHOOL OF ARCHITECTURE

1. Overview

The School of Architecture defines its major research area (until 2010) as modeling of urban structures as well as morphological and typological research. The EDGE laboratory has been central in this development, and from 2010 the research activities have expanded considerably. New focal areas for research brought in recently are user-centered space research, change in living and parametric planning.

In these research areas, there is a considerable ongoing research activity, and a great enthusiasm and positive drive in a group of young researcher and research assistants. We met a group of ten young female architects and researchers, quite a contrast to the totally opposite situation when we met the professors and teaching staff. It is to be hoped that this pronounced gender imbalance will be rectified in future recruitment plans for academic staff.

The research is mostly applied research carried out in cooperation with public and private partners, who are also to some extent acting as clients for the research projects. The research work related to urban structures as well as morphological and typological research is partly on the level of basic research, with theoretical studies and development of generic models as well as applied models for studies on urban development.

In terms of geographical context, the research focus for the case studies and examples is mainly regional and national, ranging from studies of the Helsinki area to small villages and rural communities within Finland. International cases and examples are used in addition in a number of research projects, but the international approach was not the major focus in any project.

The School of Architecture states that a core objective is to support the good integration of teaching and research. The documented research indicates that this stated objective is satisfactorily met within the field of urban planning, but that there were not yet sufficiently strong links in the area of architectural design, nor in the area of architectural history and theory.

In a school of architecture, artistic work through architectural practice is fundamental for the education of students, in parallel with – and as part of – research work; the Unit has a clear strategy and priority to keep up this tradition, maintaining strong links with architectural practice. Most of the professors and teaching staff are involved in practice, and the assessment of the “artistic quality” of the Unit’s work is based partly on the achievement of their professional practice, both in terms of competition entries and built projects. The Unit’s documents, within this category of artistic work, include architectural projects recognized at top international level, while the educational programmes and listed research projects have a predominantly national focus. There is a potential for developing links between architectural practice and the development and research issues that arise from these projects. They also



form a possibility for Research by Design (RbD) work, which is a future research area for the School of Architecture, with considerable potential, as several international schools of architecture have demonstrated positively.

It should be noted that, seen from the perspective of TUT's overall strategy for the development of international activities, the School of Architecture has at the present time a relatively weak international record.

The Unit states that sustainable building is a theme pervading all the fields of research outlined in their strategy, and we see convincing examples of this approach in the research on renewal, modernization and retrofitting of the large existing building stock, particularly housing. The Unit is very positive with respect to possible opportunities for research cooperation with civil engineering in this area of research.

But there exists further opportunities at TUT for the development of sustainable architecture and sustainable urban development, by cooperating not only with civil engineering but also other research groups (transportation, environmental planning etc). It is almost a paradox that there are so few common research activities at TUT between architecture and engineering / technology, when there is a potential for developing sustainable buildings, new construction typologies and innovative materials for the building sector. This could also be an area for more experimental studies at Master and post graduate level within the School of Architecture, and it could be a major arena for Research-by-Design (RbD) projects.

The School of Architecture has since 1982 published in their international Datutop series, and this series represents an important documentation of the ongoing work over years as well as being an important communication channel and promotional tool for the school, both nationally and internationally. But there is a lack of external information through annual reports related to the programme of studies and to the research projects. It should be noted also that there is limited information available on the web.

There are plans for turning the publications towards international refereed articles, and we strongly recommend this to be an area of absolute priority for the Unit. Until now, the international publication rate is below the critical level, as there are no recorded international publications in refereed journals. It should be noted, in all fairness, that this situation is usually the case in schools of architecture, due to the creative and artistic nature of the discipline.

The School is relatively small related to other departments at TUT, but also in relation to other architectural schools internationally. The school has a low number of incoming students and, accordingly, a limited staff. The current size is almost at the critical level, which understandably makes it difficult to make a substantial contribution in terms of scientific architectural research.

The School of Architecture's current reliance, in terms of its international visibility, on research related to architectural practice, although very positive, should be matched by an equally strong emphasis on scientific architectural research, as well as in History and Theory.



A change in attitude towards international research topics is needed, opening up greater opportunities to participate in international research programmes and research collaborations, which is possible without losing the beneficial relationship with local issues and with architectural practice. The School of Architecture would also benefit, in this respect, from an increased number of foreign doctoral students and members of staff.

The School of Architecture has presented an impressive list of qualitative research mainly in the field of urban design. Recently, attention has shifted towards more quantitative research using computational modeling techniques.

In summary, it is imperative that comparable levels of research initiative should also be invested at the architectural scale, in housing design, building information systems, environmental control systems and new building materials, with greater collaboration with Civil Engineering on all these topics. Research on real estate as well as design process management are also not adequately represented.

From a broader perspective, the School of Architecture has a clear understanding of its role in society and a good overview of the broad landscape of architectural research. It needs to exploit its potential and strengthen as well as diversify its long-term strategy for research tied to the great challenges of tomorrow's society.

2. Scientific and Artistic Quality of the Unit's Research

Rating: Good International Level (3)

In the field of architecture, scientific works are closely linked to artistic works and practice. It is therefore, that the panel has chosen to assess both scientific and artistic work of the unit. The self-assessment package highlights several examples of high quality scientific research as well as artistic achievements in the form of built architectural projects.

Of these, the areas of urban studies in general and urban modelling in particular stood out as leading areas of international excellence.

A major part of the scientific output consists of monographs, part of them in Finnish. These monographs serve well in distributing knowledge in the professional domain and attracting new projects. However, almost no publications were found in scientific journals. Only after a rigorous review process by international reviewers can scientific value be measured at the international standard. It seems that at least part of the research output can potentially be published in scientific journals, especially the ongoing research in urban modeling and simulation. The School of Architecture plans a new doctoral programme with well known scholars in this field and this is an important step forward in entering the field of scientific publications.



The area of Artistic achievements was also high, due, in particular, to the high level of international reputation obtained by two projects built by a member of the academic staff: specifically the Merikeskus Vellamo project and the Museum of the History of Polish Jews.

Areas of rising scientific quality included research on building materials, although it should be noted that such research is at present limited to one research project. In general, architectural research is very much under-represented compared to research at the urban scale. There is also insufficient evidence of research work carried out within the field of environmental sustainability.

All of the groups presented appear to have a good research culture, which can be strengthened further through a greater emphasis on doctoral studies. The focus is primarily analytical and based on field-work case studies, which is suitable for research at the urban scale, although it would be desirable for basic research and laboratory-based work to be included as well, which would be possible if the areas of research were to include more work focused at the architectural scale, and particularly on issues of environmental sustainability and energy, while social and economic sustainability is already well addressed within the urban scale projects.

However, within the relatively limited extent of research programmes undertaken, there is at the present time no evidence of publications in refereed journals.

In summary, the quality of the research level material originating from the Unit was found to be at a good international level, with urban modelling in particular and artistic achievements being at the very good international level.

3. Scientific and Artistic Impact of the Unit's Research

Rating: Good International Level (3)

The self-assessment report submitted by the Unit states lucidly that, given the relatively limited volume of research work currently undertaken by the School of Architecture, scientific impact is currently limited, although artistic impact is relatively strong, due primarily to the international significance of two major built projects.

The number of doctoral students is low, although gradually on the increase. The number of research project applications is increasing from year to year and so has the share of projects submitted for funding by the Academy of Finland and the EU.

Because the research results are mainly disseminated locally and at the national level, the international scientific impact is limited. Appropriate journals should be approached for publication on urban modeling and simulation research such as *Environment and Planning*, *Urban Studies*, and geographic oriented journals. Although a long-standing field of scientific publications on Architecture is related to *History and Theory*, and although this area is



covered in the School by professorships, no scientific publications in English were reported and there is a lack of international orientation with respect to publications.

Evidence of scientific impact other than peer-reviewed work is given: the researchers are active in several international scientific and educational organisations (e.g.: AESOP) and serve as editorial staff members on national and international journals.

The members of staff have also served on the organisation committees for several international conferences and participate actively in collaborative projects and other international expert and working groups. Many of the senior professors have also had joint projects with other universities and research institutes in Europe and the USA, and are active in international research networks, some of them funded by EU programmes.

Hence, in summary, the scientific and artistic impact of the Unit is at a good international level.

4. Societal Impact of the Unit's Research

Rating: Very Good International Level (4)

The societal impact of the research conducted in the Unit is strong and it is clear that the School of Architecture understands the importance of its role in society. However this impact is mainly limited to Finland and there are limited activities on an international level, with the exception of the impact of two significant architectural projects.

Many projects are applied research and development projects undertaken in collaboration with municipalities, local, regional and national authorities, housing corporations, etc. demonstrating a close and multifaceted relationship with public and private bodies as well as with society at large.

The projects are engaged with topical issues but it is important to observe that while doing so, they are all keen to respond not only to immediate short-term requirements but also to a broader, long-term, social and political agenda which is of higher theoretical significance.

An impressive list of memberships of all professors in various committees stresses involvement with real-life architectural and urbanistic issues, not only in terms of design but also in terms of social objectives.

Overall, the unit performs very well in terms of societal impact at the local level and needs to further extend its influence beyond the local level.



5. Research Environment at the Unit

Rating: Fair International Level (2)

The research environment is characterized by a very creative and positive academic atmosphere. The teaching staff engaged in research made a clear verbal and visual presentation of the overall “landscape” of research within the Unit, identifying the different fields of investigation and the logical interconnections between them. It is apparent that the teaching staff is highly motivated and the students are articulate as well as very diverse in terms of their interests and areas of expertise.

However, the research environment has two shortcomings, both of which have also been identified by the Unit: the first one is material and concerns the lack of workshop facilities, the second one is cultural.

a) Lack of workshop facilities.

Most surprisingly, considering the fact that this School of Architecture is part of a Technical University and is part of the same faculty as the Department of Civil Engineering, both sharing a “practical” pedagogical approach and philosophy, no suitable workshop facilities are provided for the students of Architecture. Neither is there any clear evidence that these students have access to the impressive laboratories and testing facilities managed and run by the Civil Engineers.

It is essential that the School of Architecture is at least provided with the range of model-making and fabrication tools that most schools now have at their disposal as a basic part of their equipment, including, in particular, the latest laser cutting and rapid prototyping equipment, but also the more conventional tools used for working wood, metal and plastic materials.

Radical schools of architecture always have well equipped and well staffed workshop facilities and even those that are strongly theoretically oriented are currently stressing the importance of “fabrication”, particularly since rapid prototyping technology allows for an immediate testing of advanced design propositions, in a very quick feedback loop which brings theoretical research and actual “making” in a close and unprecedented proximity to one another.

Indeed, ICT is now commonly seen not just as a tool but as one of the main drivers for significant conceptual changes in architectural design and design processes. Therefore it is remarkable that this School of architecture, at the heart of a technical university, lacks such digital fabrication facilities.

In this respect, further intensified collaboration with the Department of Civil Engineering, possibly within joint research projects, could open up new research challenges. If the school were to encourage more research proposals related to the scale of Architecture, such as experimental building designs and innovative materials, it could benefit considerably, if it had



a workshop, by building up its own reputation as a research centre known for its experimental facilities, complemented by field studies and verification of new concepts in the field. These facilities and the associated personnel, whether fully dedicated to Architecture or shared with Civil Engineering, would in turn provide the basis for more in-depth theoretical and analytical studies, linking the experimental work to basic research.

b) Lack of a systematic research programme.

A rigorous research culture does not yet appear to be fully established at the School. Apart from the special case of “artistically” recognized initiatives that originate from design projects in architectural practice, there does not seem to be a clearly established set of procedures for directing strategically the research work of the school and particularly for preparing the ground for PhD candidates. Whether or not a research project will lead to a PhD is often not known upfront, which causes uncertainty for the students as well as for the school.

A positive fact is that Research by Design (RbD) is embraced as a promising option. Although the concept is still under discussion internationally and has not been universally adopted by all universities, very good ideas were presented on the uptake of this research approach.

The new doctoral program ‘Advanced Urban Modeling’ is a solid basis for increasing the research output.

Especially over the year 2010, significant changes are visible: increase of research funding, increase of refereed publications and increase of PhD researchers. Continuation of this trend is expected to give better results in the near future.

A structured academic programme is needed to manage the research process in a more sustainable manner and to set a long-term focus. Continuous monitoring and mentoring of the research is needed to sustain the research output at a more international level.

It could be that EDGE, AML and iRoom are capable of addressing these demands, but we were not given, in the time available during our visit, enough information to be able to ascertain whether this is the case.

In summary, the department needs to pass on a clear message to professors, research staff and students stressing the importance of doctoral level studies in this unique environment.

6. Future Potential of the Unit

Rating: Very Good International Level (4)

The School of Architecture at TUT is still small. It has the potential to grow bigger and therefore to acquire the critical mass it needs, in terms of both student numbers and staff,



and in particular PhD candidates, in order to generate and sustain a rich and diversified culture of research at a high international level.

In the current worldwide economic circumstances, schools of architecture are becoming more and more competitive in order to attract high calibre staff and students in what has become a truly international academic research market, and so the challenges that have to be met are getting increasingly critical. We feel that the School of Architecture at TUT is in a good position to meet these challenges if it takes a number of key steps in order to position itself better.

The School already has a strong foundation in terms of the research work that has been initiated up to now and is currently under way, and it can exploit this potential further.

Moreover, the imminent renovation of the School accommodation, if it is accompanied, as we have already pointed out above, by a suitable level of investment in workshop facilities, will give it a robust base to operate from.

One of the great assets of the school lies in the fact that it seamlessly integrates Architecture with Urban Design and Planning, which is not usually the case. The potential links between architecture, urban design, planning and civil engineering around common themes for the built environment therefore look very promising indeed. Based on the material presented in the self-evaluation and the presentations and discussions during the site visits, the School of Architecture was judged to have a very good potential for securing a position in the international community as a preferred partner in international research networks within the next 5-10 years.

The next section identifies in more detail the recommendations we feel would be appropriate in order for the School to better fulfil its research potential.

7. Recommendations for the Future

This section is, in a sense, a recapitulation, as bullet points, of all the observations we have made in the preceding pages, in the form of a set of positive recommendations rather than critical analyses.

These are key points only, reflecting our general overview of the School during our short visit. They would require further elaboration and qualification, but we hope that, even in this succinct form, they might provide some useful indications as to what we feel would be particularly beneficial to the School.

Since the terms of reference of this Research Assessment Exercise are to make an evaluation of the School of Architecture only in terms of its current research performance and its potential future research performance, rather than to make an overall academic evaluation of the School, the recommendations we are suggesting with respect to the broader context of



the School are made only on those points which we feel would, directly or indirectly, benefit its research “ecology”, in so far as the two are intimately interconnected.

- a) More work at an architectural scale.
- b) Develop workshop facilities.
- c) More work on sustainability.
- d) More work on History and Theory.
- e) More effective and intensive collaboration with the Department of Civil Engineering.
- f) More multidisciplinary work involving other departments of TUT.
- g) More research at an international rather than local level.
- h) More experimental work in architectural design (biomorphic, parametric, etc...).
- i) More open and less conventional definition of what might legitimately be considered to constitute “architectural design” (links with film, fashion, product design, virtual reality architecture, nanotechnology, etc...), pushing the boundaries of the art.
- j) More work related to “fabrication”. Acquiring the reputation of a design “factory” or experimental laboratory developing and testing prototypes, possibly even at 1 to 1 scale.
- k) More research to be published in peer-reviewed publications in refereed journals.
- l) More funding from the building industry, as is the case in the Department of Civil Engineering.
- m) Encourage research related to architectural project management and design information management.
- n) Increase the number of students.
- o) Strengthen the research strategy and “ecology” of the School.
- p) Develop the Web site.
- q) Publish a comprehensive yearly catalogue of all students work at the School, at all levels leading up to the PhD work, as well as an exhibition.
- r) More work on different aspects of architectural design (lighting, acoustics, etc...).
- s) Develop research by design (RbD).
- t) Redress the gender imbalance in the teaching staff.