

Estonian Higher Education Accreditation Center

Evaluation of Research in Geodesy (2.1) and Civil Engineering (2.8) in Estonia

Institutes evaluated

Estonian Agricultural University

Faculty of Rural Engineering

- Institute of Land Surveying
- Institute of Rural Building

Tallinn Technical University

Faculty of Civil Engineering

- Department of Structural Design
- Department of Building Production
- Department of Transportation

Evaluation dates:

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Part I

General Overview

Introduction

At the request of the Estonian Higher Education Accreditation Centre, Tallinn (EHEAC), an evaluation team (hereafter named the “Evaluators”) visited institutes in Estonia carrying out research activities in civil engineering and geodesy. The evaluating team consisted of Prof. Jean Berlamont (Katholieke Universiteit Leuven), Prof. Markku Poutanen (Finnish Geodetic Institute), Prof. Martin Vermeer (Helsinki University of Technology) and Prof. Pekka Kanerva (Helsinki University of Technology).

The institutions to be evaluated were:

1) Estonian Agricultural University, Faculty of Rural Engineering (Head: Ass. Prof. Siim Maasikamäe, Ph.D.):

- Institute of Land Surveying (Head: Prof. Jüri Randjärv, Ph.D.)
- Institute of Rural Building (Head: Prof. Jaan Miljan, Ph.D.)

3) Tallinn Technical University, Faculty of Civil Engineering (Head: Prof. Karl Õiger, Dr.Tech.Sc.):

- Department of Structural Design (Head: Prof. Kalju Loorits, Ph.D.)
- Department of Building Production (Ass. Prof. Toomas Laur, Ph.D.)
- Department of Transportation (Prof. Maano Koppel, Ph.D.)

The evaluators were provided in advance with self-assessment reports from each of these institutions, prepared by the members of these groups.

After a brief orientation meeting at EHEAC, the evaluators visited the different departments and institutes in Tartu and Tallinn during two days (one day in Tartu and Tallinn). At these meetings staff members of the various laboratories presented their work. During these presentations as well as during the subsequent discussions additional information about the research activities was provided. This included additional documents such as copies of published papers.

Approach to the evaluation

The evaluators were asked to:

- 1) Judge the activities of research and development in the units evaluated and the research topics implemented by them to ensure the governmental funding for internationally recognised research and development. The Team was asked to concentrate on research units (university departments, laboratories) with specific comments to sub-units, groups if necessary.
- 2) Identify deficiencies in the activities of research and development units.
- 3) Give recommendations on the development concerning research and development and research areas to the state of Estonia.

The Team received the following materials: A working schedule, principles and criteria for evaluation of the research units, evaluation guidelines for the ranking of research units, and self-evaluation reports created by the research units themselves.

On a first evaluation point, the *quality of the research activities* since 1997 was considered. This assessment is largely based on the records of scientific publications.

<i>Excellent</i>	<i>The majority of the submitted works are at a high international level and virtually all others at a good international level.</i>
<i>Excellent to good</i>	<i>At least one third of the submitted works are at a high international level and many others at a good international level, these together comprise a clear majority.</i>
<i>Good</i>	<i>The majority of the submitted works are at least at a good international level and virtually all others at a fair international level</i>
<i>Good to satisfactory</i>	<i>At least one third of the submitted works are at a good international level and many others at a fair international level, these together comprise a clear majority</i>
<i>Satisfactory</i>	<i>The majority of the submitted works are at least at a fair international level</i>
<i>Satisfactory to unsatisfactory</i>	<i>A minority of the submitted works are at a fair international level</i>
<i>Unsatisfactory</i>	<i>None, or virtually none, of the submitted works are at a fair international level</i>

Regarding the grading of the research activities, the evaluation team was instructed by the EHEAC to reserve the term **excellent** for groups, which were found to be among the best 10% of the European groups in the corresponding field. Similarly, the term **excellent to good** should be used if the evaluated group was found to be among the best 25 % of corresponding European groups. The full scale comprised 7 levels, in addition to the highest ones the grades are **good**, **good to satisfactory**, **satisfactory**, **satisfactory to unsatisfactory**, and **unsatisfactory**.

The *over-all capability* of a research unit was evaluated based on a the combined assessment of the following criteria (each graded in three levels):

- The originality/novelty of past and ongoing research activities
- The strategy and perspective of the research
- Multidisciplinarity and relevance for other research areas
- The competence of the research groups and their capacity for development
- National and international co-operation
- Success in applying for grants

As the result of this assessment one of the four grades **excellent**, **good**, **satisfactory** or **unsatisfactory** was given for the group.

Finally, on a third evaluation point **the implementation opportunities** for the research results and their importance for the Estonian society was assessed. Here we adopted a three level grading: **no comment**, **good** or **very good**.

The other target of the team was to evaluate the level of the graduate study programs, which are shown in separate reports.

Part II

General Comments

Generally speaking, what struck the evaluators most was the enormous drive to “catch up”: to make up for the lost time, in the short amount of time that has passed since the fall of the Soviet Union and Estonian independence. This is shown a/o. by the long working hours, which we are no longer used to in Western Europe. There is hope and perspective for the future.

The evaluation team was presented with an overview of the present organization of Estonian science, research and development and of the channels and mechanisms for state and other research funding.

As a general statement the evaluators are happy to see that the available budgets increased relatively rapidly during the last few years. If this effort can be continued for the coming years, one can be sure that Estonia will be catching up soon with the rest of Europe. In particular it should be emphasised that there is a need for a long-term continuation of financial support for both geodesy and land surveying and civil/ building engineering. Both respond to great societal needs in Estonia, which are unlikely to diminish by much in the next decade.

The evaluation team also welcomes the idea that financing of research is more and more allocated in a competitive way through the Science Foundation and the Technology Agency and target funding. Thus, research money is not distributed over different disciplines and research groups more or less equally or according to pre-set schemes, but by taking the quality of the research groups as the main criterion, together with the societal relevance of the proposed research for Estonia. Obviously the quality of the research teams should be measured according to international standards. Still, a good balance should be maintained between competitive research funding of researchers and research teams and the basic financing of research and teaching institutions.

The evaluation team has noted that, at least in the civil engineering departments in Tartu and Tallinn, most of the graduate students have to combine study and research with a job outside the university. Only a minority of them has a scholarship or a job within the university (assistants or lecturers). The evaluators recommend that more semi-permanent positions be created for doctoral and post-doctoral students, which will allow them to devote themselves more fully to research. In particular the absence of post-doctoral researchers was noted, whilst they usually form the most productive core of a research group.

The evaluators have found out that most young researchers feel the need to spend some time abroad in another university but that not all of them are given this opportunity. Those who can leave their home institution do so with foreign funding and scholarships. Temporarily working abroad is a most enriching experience for young researchers: They can overlook their own group in a critical way from some distance, they learn to be self reliant and how to organise themselves and their work. The (scientific) cultural cross fertilisation is most rewarding. The team therefore advises to actively encourage mobility of young researchers by somehow providing scholarships

for studying abroad, either on a national level or by trying to organise as much international funding for it as possible.

The evaluation team has noted that most young researchers are fluent in (a) foreign language(s), in particular in English. Since this is instrumental in the interaction with foreign research groups and necessary for publications in international journals, this trend should be encouraged and young researchers should be given the opportunity to improve their speaking and writing skills in (scientific) English.

It is a general observation that most of the research work is only published in Estonian. The review team estimates that the most important part of this work could be published also internationally in English, which would increase the international visibility of the research groups and their chances for international collaboration and research funding. The work that actually is published in English is mostly published at conferences but only exceptionally in (international reviewed) journals. The evaluation team estimates that some of the work is certainly publishable in these journals and encourages the research groups to do so in order to increase the visibility of the research groups and the international appreciation (and citation) of the work done.

Most of the research teams are small and their persistence in the future is uncertain because of the age of the professors and the fact that they very often depend on only one or two young researchers, which may leave the University at any given opportunity. The smallness of the groups is indeed a major risk factor: the loss of one single position – or even the non-filling of a vacated position - may jeopardize the whole group's success. Therefore, it would be desirable:

1. To add positions;
2. To better motivate young people to stay to guarantee continuity.

An obvious recommendation is also networking between different research groups in Estonia, to develop complementary expertise and to concentrate research in a particular field in one place to reach the critical mass. Of course also international co-operation and networking may be very instrumental in solving the “critical mass” problems of a small country.

The evaluation team has visited very ambitious research groups, which see many more research needs in their field than they ever can realistically meet, given the available human resources and financial means. It should be realised that choices have to be made and that high quality research work can only be achieved if efforts are focused. This is true everywhere but especially in small countries like Estonia.

Finally, to close these general remarks, the evaluation team has met with ambitious young researchers and hopes that they will be given the opportunity to realise their research plans for the benefit of the Estonian society.

Part III

Evaluation of institutes and research groups

1) Institute of Land Surveying, Faculty of Rural Engineering, EAU

Head: Prof. Jüri Randjärv, PhD

The activities of the Institute of Land Surveying include geodesy as one of its specialties. Geodesy is by its nature a very international activity, perhaps more than the other disciplines under review. About 1/3 of the Estonian land surveyors and geodesists have received their education in the EAU, which is the only institute at academic level in the field. The Institute thus has an important impact on the education in the field. The Estonian Land Board (Maa-Amet) is currently the main co-ordinator of the geodetic and cadastral work, which is commissioned to private companies. Therefore, connections to both Land Board and private enterprises are vital to the further success and national importance of the EAU Institute of Land Surveying.

There are all together 6 (associate) professors, 5 M.Sc. (3 of them are currently doctoral students in geodesy) and 2 B.Sc. assistants, giving lectures ranging from land management and cadastral works to higher geodesy. During the last 3 years there have been 31 B.Sc. degrees awarded but no M.Sc. or Ph.D. degrees.

The geodesy group at EAU is thus small, which calls for a strict focus, specialization and consolidation, in order to be successful, also internationally.

On the whole, we find the group's quality of research in an international comparison **satisfactory**. This reflects the current situation. The group is on the right track.

Judged by its overall capability, the group is rated **good to satisfactory**. Especially young people making their doctoral thesis have already now international contacts, and they have earned merits in presenting and publishing their work in international forums.

Internationally speaking, most of the research of the unit is not very remarkable; however, its practical applicability in the Estonian context is significant and important. As an example, the determination of a precise geoid and of a map projection system for the Estonian territory, while not differing from what other countries have already done, is essential for accurately mapping the country and using modern global satellite positioning technology. This is an example of a work every nation has to do on a national basis, solving for the problems specific for their own territory. Therefore, the implementation opportunities for the research results and their importance for the Estonian society are judged to be **good**.

1. Strengths and weaknesses: Size and financing are the main weaknesses seen. As mentioned above, even missing one single key person may cause serious problems. Inviting external lecturers could help to diminish the burden in teaching all necessary fields. This, however, requires some additional funding. Additional funding also would be very welcome to allow the doctoral students to work some time abroad. Both will help in increasing contacts with other institutes and research groups.

Another potential weakness is a too instrumental view of things, an over-appreciation of specific tools. This is evident, e.g., in the self-evaluation report's description of the objectives of the doctoral study (p. 10). Whilst the importance of training the next generation of faculty and lecturers is clear, the objective of the study should be to train scientists, generalists capable of independent thinking and problem solving. In discussions we found staff well aware of this.

As a strong point, the presence of a strong geodetic research component closely connected to education can be mentioned. People seem to be highly motivated and interested in their research and teaching tasks. Also, a lot of good teaching material have been prepared in the Estonian language. This hopefully will help to attract more students to the field.

2. ***Adequacy of resources:*** Material resources, though modest, are not really in short supply. However, the possibility to update the instrumentation is essential in such rapidly evolving field as geodesy and surveying. Human resources are a scant commodity, which may complicate the succession as old staff retires. The ***library***, as small as it is, appears to be well equipped and especially well organized with a focus on using modern technology and promoting international contacts.
3. ***Special reasons why the unit has not been more productive during the assessment period:*** N/A.
4. ***Success of the unit in publishing its work:*** Good and improving. History has been very short.
5. ***The adoption of a national perspective*** would not really change our evaluation, as geodesy is an international science. Recent international publication activity of the unit, still small in volume but growing, has been - appropriately - mostly in English.

The “working groups” listed below are not actually separate, formally organized groups; they are more like projects. For this reason, we will not review them separately.

1.1. Working Group: Improvement of the method of using the basic map digital database by proof of the agricultural land maps and on the area calculation. Head: Jüri Randjärv, Ph D (Eng). Research associates: Jaks Lankots, Ph D (Geogr), Natalja Liba, MSc (Econ)

Finances: Target-funding from Estonian Science Foundation for the research work subject No 0170109s98 sub-subject No 83/2 (1998–2002)

1.2. Working Group: The marking of control points before orthophoto photographing and the measuring of marked-centers in the relation of state base network points. Head: Natalja Liba, MSc. Research associates: Taavi Veermets, MA student, Ave Kargaja, student, Ina Melnikova, student.

Finances: Customer: Estonian Land Board; contractual research work, subject No L013MIM02, (2001-2002)

1.3. Working Group: Determination of the normal height by high-precision leveling of the first order state geodetic network's points determined with the GPS measurements. Head: Feliks

Virma, Ph D (Econ). Research associates: Tarmo Kall, MSc (Eng) – consultant, Raivo Uustare, Dipl. Eng., Taivo Paabo, student, Taavi Veermets, student.

Finances: Customer: Estonian Land Board; contract No 121 (1998)

1.4 Working Group: Gravimetric measurements of the state geodetic network's points (cooperation with Kampsax Geoplan from Denmark). Head: Heldur Sildvee, PhD (Eng), Harli Jürgenson, MSc (Eng), Avo Järv, Dipl. Eng.

Finances: Estonian Land Board (1998)

Recommendations:

1. The Institute is currently the leading institution within Estonia in the field of surveying science and geodesy. This should be its focus also in the future, and it should work to strengthen this position. National and international networking would play an essential role in this.
2. Having the foreseen capabilities in mind, possible areas of focus should be chosen according to their national importance. They could include:
 - Precise gravimetry and geoid determination
 - Precise positioning using evolving modern satellite techniques
 - Photogrammetric techniques in land surveying

2) Institute of Rural Building, Faculty of Rural Engineering, EAU

Head: Prof. Jaan Miljan, PhD

The research activities presented to the evaluation team contain two different research areas having only a weak connection with each other. Therefore the evaluation team decided to evaluate them separately.

1st TOPIC: SUSTAINABLE BUILDING

The research area contains four sub-areas:

2.1 Sub-direction: Assessment of technical situation of existing buildings. Head: Tõnu Keskküla, DSc. Research associates: Jaan Miljan, PhD, Erki Laiakask, MSc student, Alo Karu, MSc student.

2.2 Sub-direction: Using environment and animal friendly and sustainable building methods in construction and reconstruction of farm buildings. Head: Jaan Miljan, PhD. Research associates: Aime Pajumägi, DSc student, Meelis Tartto, MSc student, Arvo Leola, DSc student, Riina Miljan, MSc Jaan Praks - Dr. Med. Vet, Imbi Veermäe - Dr. Agr. Väino Poikalainen, Dr. of Food Science, Vello Luts.

2.3. Sub-direction: Research of timber structures and other local building materials. Head: Tõnu Keskküla, DSc. Research associates: Jaan Miljan, PhD, Valeri Aleksandrov, MSc student, Mauro Ilves, MSc Student, Maidu Saar, MSc Student, Lilita Ozola.

2.4 Sub-direction: Research of durability of reinforced concrete structures of agricultural buildings. Head: Jaan Miljan, PhD, Erki Laiakask, MSc student, Mihkel Kiviste, MSc student, Heiki Tomann, MSc student, Meelis Tartto, MSc Student, Riina Miljan, MSc.

The sub-areas are very close to each other and practically the whole research team is participating in all of them. Besides the head of the institute, there are two scientists with Ph.D. degrees and one with a M.Sc. degree. All of them are participating in the projects.

There is some collaboration with national scientists and scientists from abroad.

The funding mainly comes from the Estonian Science Foundation and Target Funding of the Estonian Ministry of Education.

The research is oriented towards the solving of practical problems. The research is based on both theoretical calculations and field observations. The theoretical calculations are mostly common engineering calculations without any deeper building physics analysis or development of proper theoretical models.

The *particular strength* of the group is its possibility to understand the requirements of users of agricultural buildings and the knowledge of the particular circumstances and microclimate inside

these buildings. That makes it possible to target the research to the most relevant practical problems.

The *particular weakness* of the group is its small size and missing traditions in basic research. There seems to be a shortage of modern laboratory equipment and too small funding. These are the most severe obstacles that hamper the future development of research.

The international publications of the group are mostly in international conference proceedings. The research activities are judged as **satisfactory**.

Two of the doctoral students are over 50 years old. The M.Sc. students are studying during weekends and evenings, after normal full-time work outside the university. The overall capability of the “sustainable building” group is rated as **satisfactory**.

Because the building costs are an essential part of the investments costs in modern agriculture, the development of economical building types, suitable for modern agriculture is important and requires a close co-operation with other branches of agricultural research, specially with livestock keeping. The research and development results in agricultural building are readily implemented through the teaching in EAU. Therefore the implementation of the research results is **good**.

Recommendations

1. The quality of research could be improved by increasing the co-operation with domestic and foreign research institutes. Proper approaches would be engagement in common research projects and the joint organization of postgraduate courses and programs.
2. The publishing activity has a good level, but still more should be published in English and in peer reviewed journals.

2nd TOPIC: EXPERIMENTAL RESIDUAL STRESS ANALYSIS

Leader: Prof. Jakub Křo, DSc.

The members of the research group are in charge of applied mechanics and structural analysis courses in the institute of rural engineering. Three of them have a Ph.D. degree, two of them a M.Sc. One of them is expected to defend his Ph.D. thesis within one year.

The connection between this very specialized research topic and rural building could not be clearly understood by the evaluation team.

The research is financed by target funding of the Ministry of Education.

The results are properly reported in international well-known journals and participated in international specialty conferences. (Conferences on residual stresses)

The research group seems to have good research traditions and seems to have the capability to carry out research successfully, in spite of the limited funding. The research activity is judged as **good**.

The *particular strength* of the group is a good research tradition, where a good combination of theoretical modeling and experimental research is reached. The *weakness* is its small size.

The junior members of the group carry out the research. They seem to be well motivated and talented. The overall capability is judged as **good**.

Although there seems to be a potential for industrial implementation, the practical application of the results so far has limited (**no comments**).

Recommendations

1. Numerical analysis, e.g. based on FEM could be used.
2. The shortage of modern experimental equipment reduces the possibilities for innovative experiments. Intensive co-operation with institutes having modern equipment is recommended.
3. Although the group has connections with some companies outside the university, and with the TTU, more contacts with industry are recommended to enhance the chances for implementation of the research results.

General remarks on Tallinn Technical University (TTU): Faculty of Civil Engineering

The infrastructure of the Faculty of Engineering of the TTU seems to be quite adequate. The library is well provided and efficiently organized: it provides a suitable place for students and researchers to study.

It seems that the faculty is well established. There is no need for the “pioneering spirit” which is so clearly present in EAU. In comparison to EAU external funding seems to be quite substantial, which may explain the relatively favorable research comfort in the faculty.

The laboratory for structural design is well equipped with the typical structural laboratory hardware, but modern testing machinery is missing. Also modern data collection and processing equipment is lacking.

It seems that the current strength of the departments that we visited in the faculty strongly depends on only a few persons: that may make the faculty quite vulnerable in the future and requires proper attention.

The faculty has been heavily involved in working out the Estonian versions of the Euro-codes and building material specifications. This exercise is most useful for the Estonian civil engineering community, especially in view of the expected entrance of Estonia into the E.U., but it has led a heavy burden on the shoulders of the staff, who otherwise could have spent their time in more fundamental research work. They however accepted to carry out the task out of devotion to the Estonian civil engineering society. Apart from teaching and scientific research, service to society is indeed an essential task of a university (especially of a technical university), but it should not become so important that it outbalances the two other tasks.

3) Department of Structural Design, Faculty of Civil Engineering, TTU (Head: Prof. Kalju Loorits, Ph.D.)

The joint main topics:

Building investigations and design (code TTU9698EE, Prof. Emeritus Valdek Kulbach, afterwards Prof. Karl Õiger, period 1996 – 1997)

Actual problems of sustainable development in structural engineering (code 0140228s98, Prof. Karl Õiger, period 1998 – 2001)

The department contains a large number of chairs: Architecture, Geotechnics, Timber and plastic structures, Reinforced concrete structures and Steel structures.

The members of different chairs co-operate in different ad hoc research groups. Among the main researchers are 10 with a Ph.D. degree and 2 M.Sc. During the evaluation period 8 M.Sc. degrees have been awarded, but no Ph.D. The number of M.Sc. students is now 22 and of doctoral students 6. The department appears to be successful in attracting new graduate students.

The research activity is very unevenly distributed over the different chairs. In particular, no research project was presented is the subject of geotechnics.

Many different topics were presented but the research emphasis is on

- light, flexible suspended structures
- renovation of buildings,

The rating of the quality of the research in an international comparison by the evaluation team is **good**. This rating reflects mainly the work done during the last few years. The evaluation team wants to emphasize that they notice a promising evolution and expect the team to reach excellence probably in the next five years.

The overall capability of the research group has been rated **good**, on the way to excellence.

The implementation opportunities for the research are **very good**. They are extremely relevant for the Estonian society but may also be interesting in a wider international perspective. Therefore the group is encouraged to continue and intensify its international publication policy.

On the national scene it seems that there is a great need in presenting the research work (codes and building material specifications) to the wider engineering society. This will require a continued and intensified involvement of the staff in continuing education activities.

Recommendations

1. Since so much emphasis is on flexible, suspended structures it is recommended to pay more attention to dynamics of structures, e.g. by numerical analysis.

2. The value of the laboratory work could be greatly enhanced by introducing up to date data collection and – processing equipment.
3. The research group should continue and intensify its international publication policy, especially in peer reviewed journals
4. The authorities should realize that many of the leading researchers are soon to be retired and should anticipate the need for competent successors.
5. The department should consider organizing special programs for doctoral students to take advantage of the presence of closely related chairs in TTU. There are several young doctoral students who will benefit from this, which will enable them to finish their doctoral degree in a relatively short period of time.

4) Department of Building Production, Faculty of Civil Engineering, TTU (Ass. Prof. Toomas Laur, Ph.D.)

The Department of Building Production comprises the chairs of Building Materials, Building Technology, and Construction Economy and Management. The evaluation team sees a contrast between the technically oriented two first chairs on the one hand, and the more organizationally oriented last chair. The latter also includes facility management and economics.

The Department appears well equipped materially. There seems to be no problem attracting funding for practical investigations on the use of the fly ash from oil shale burning. The evaluators, unfortunately did not visit the Testing Laboratory of Building Materials.

The Chair of Building Materials has a staff of five, two of them Ph.D and one M.Sc. The Chair of Building Technology has a staff of three, of which one Ph.D. and one M.Ec. Construction Economics and Management has seven staff members, of which four Ph.D., one Dr.Ec.Sc. and one M.Sc.

During the years covered by the review, four students obtained their M.Sc degree. There are currently 10 M.Sc. and 4 doctoral students.

Research topics of the Department include:

- Using oil shale fly ash to produce expansive or shrinkage compensated cement;
- Producing more durable cement using industrial residue;
- Facilities management;
- Housing stock management.

The first two topics are related to the special oil shale situation in Estonia; the last two ones to the problems of the poor quality of building during the Soviet era.

The chair of construction economics and management has a good publication record. It appears that there has been little activity or publications in the field of Building Technology during recent years.

Quality of research in international comparison: **satisfactory**.

This rating is based on the results of the building materials group. The evaluation team does not feel qualified to rate the construction economics and management group properly.

Although practical applicability is very important, the evaluators found it somewhat disappointing that the research was *only* practical, applied and empirical. Rating of the overall capability of the group: **good**.

Implementation of results and their importance: this can be judged very positively, especially the use of shale oil fly ashes in cement production. **Very good**.

1. **Strengths and weaknesses:** strength is the significant practical usefulness of much of the work of the department. A weakness is the lack of theoretical significance.

2. *Adequacy of resources:* Good, due to external funding.
3. *Special reasons why the unit has not been more productive during the assessment period:*
N/A
4. *Success of the unit in publishing its work:* Decent. The Construction Economics and Management group has published, partly internationally in English.
5. *The adoption of a national perspective* would stress the importance of this field due to the specific Estonian oil shale situation.

Recommendation

In an academic environment practical work alone is not sufficient, it should be supported by more fundamental work. The building materials group should therefore undertake also innovative research work, even if initially perhaps on a small scale, while attracting gifted doctoral students for this.

5) Department of Transportation, Faculty of Civil Engineering, TTU (Prof. Maano Koppel, Ph.D.)

Quality assurance problems in road construction and land surveying in new economic conditions (code TTU 9642ET, prof. Peep Sürje 1997)

The Department of Transportation comprises the Chair of Geodesy, the Chair of Road Engineering, and the Chair of Transportation Logistics. Most active of these is clearly the Chair of Road Engineering, which has four staff members, with one of them holding a Ph.D. The chair of Transportation Logistics was not included in the evaluation exercise.

During the review period, six students obtained their M.Sc degree. There are currently 4 M.Sc. and 3 doctoral students.

This department was seen as the least dynamic of the three departments evaluated in TTU. Most of the external funding attracted cannot properly be called research funding. Standardization and guidelines drafting activities, while important and valuable in their own right to society, cannot be classified as research either.

The Department is well equipped. Its current focus is too applied. More attention to fundamentals is called for.

The Geodesy chair in the Department of Transportation was not included in the scope of our evaluation. However, to have a better understanding of the relations between geodesy at EAU and at TTU, two team members (MV and MP) shortly visited the geodesy section in the TTU. The geodesy section apparently lacks a research component, which is not good because in an academic environment education and research should go hand in hand. There is an obvious need for basic, practical surveying education. This need must be fulfilled also in the future when current staff will retire. One possible way could be a more close collaboration with EAU's Institute of Land Surveying.

Quality of research in international comparison: **satisfactory to unsatisfactory**.

Overall capability of the research group: **satisfactory**.

Implementation opportunities: these are **good**, as the Estonian road network is in a bad state of maintenance.

1. **Strengths and weaknesses:** strength is the ability to attract funding due to the practical significance of the work. A weakness is the lack of true research activity, as most of the work is applied and practical. Another weakness is the lack of sufficient English language skills within the group.
2. **Adequacy of resources:** Due to the ability to attract external funding, seems to be OK.
3. **Special reasons why the unit has not been more productive during the assessment period:**
N/A

4. *Success of the unit in publishing its work:* Most of the publications are in conference proceedings, often of conferences where other road-engineering people attend too. So publishing success has been limited.
5. *The adoption of a national perspective* would not really change our judgement. Many of the problems within the discipline are common with surrounding countries.

Recommendation:

A better focus is called for. As it seems possible to get funding via contracts with industry this offers opportunities to deepen the research also in the fundamentals. A closer co-operation with other disciplines is highly recommended.

Part IV

Summary of evaluation

1. As an overall rating the evaluation team found that in most cases an appropriate rating would be **good to satisfactory**.
2. The number of Ph.D. degrees awarded during the evaluation period is insufficient.
3. It was noted that funding of doctoral and post-doctoral students is unsatisfactory so that most of them are able to continue their studies only during the evening and the weekends. In the long run this is not a sustainable situation, which seriously limits the possibilities to promote research.
4. The evaluation team noted the high motivation of several young doctoral candidates, which is a good sign if they will be given the opportunity to stay in research.
5. Most of the work done has been published in the Estonian language. In many cases this is reasonable because the work is nationally relevant and important. However, the best of this work is also of wider importance and deserves publication in English.

Part V

Recommendations

1. Universities should strive for scientific excellence without any compromise. An academic education should form scientific minds, not just operators of tools. This is also true for engineering.
2. Research should be focused. This is especially true in small countries like Estonia. As an example, research in the field of geodesy should be concentrated in one place.
3. It is recommended to review at regular time intervals research priorities in view of their continued relevance for Estonian society and economy.
4. Research would greatly benefit from updating laboratory equipment to state of the art standards, even if this would imply considerable costs.
5. The smallness of many groups is their weakness. Therefore it is recommended to focus on nationally important topics and to target the funding so that productive groups are able to increase the number of semi-permanent positions. This would also help young promising researchers to stay because currently they need to seek daytime jobs and can study only part time.
6. Doctoral and post-doctoral students are the driving force for research. Therefore it is recommended that the number of such positions be increased.
7. Many research results are published in Estonian language only. It is recommended to increase the number of papers submitted to peer reviewed international journals.
8. Networking between and with different institutes, universities, disciplines, private enterprises, foreign countries,... is the appropriate way to solve the problems of scale and sharing expertise and reaching critical mass. It may e.g. be useful to invite foreign professors not only to give advanced lectures but in particular to actively participate in the research and advise doctoral students
9. It is recommended to actively encourage mobility of young researchers by providing scholarships for studying abroad during an extended period of time.
10. Since this is instrumental in the interaction with foreign research groups and necessary for publications in international journals, this trend should be encouraged and young researchers should be given the opportunity to improve their speaking and writing skills in (scientific) English.

Tallinn, 09.11.2002

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