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Latvia: Research Assessment Exercise

Panel Report: Engineering and Computer Science

technopolis |group|, November 2013

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1. Introduction

The Panel examined the submissions from 37 research units (RU) from across Latvian University and Research Institutions and visited 18 of those units. The submissions varied greatly in the level of detail and the content which made assessment difficult in some cases.

Each submission was read in detail by at least two Panel members and then discussed by the whole Panel on at least two occasions, namely, before and after the Panel visits to the selected research units.

The research activities covered a broad range of engineering topics and included, computer science, structural engineering, bio engineering, digital signal processing, embedded systems, heat, gas and light technologies etc. The nature of the research was both theoretical and applied with many projects making a major contribution to Latvian society and industry while others were having an impact outside Latvia. However the size and make up of many of the research units lacked a critical mass which limits their ability to become international players in their research area. Another limiting factor is that much of the research work is reported in regional journals and conferences which lack impact and are not widely read or regarded internationally.

As a result of in depth examination of the submissions, the visits and detailed discussions of each submission the Panel have concluded the following:

- The RUs with score 4 [Strong International Player] should continue and are performing well.
- The RUs with score 3 [Strong National Player with some International Recognition] should be analysed from a size point of view and reinforced.
- The RUs with score 2 [Satisfactory National Player] should be analysed to consider the opportunity to combine with other RUs.
- The RUs with score 1 [Poor National Player] should be terminated.

The Panel would like to express their thanks to all the members of the research units – both staff and students - that they met and appreciate their input and comments which they found very valuable.

2. E_01 Institute of Electronics and Computer Science

Name of the institution	Institute of Electronics and Computer Science (IECS)
Name of university	N/A
Type of institution	State Research Institute

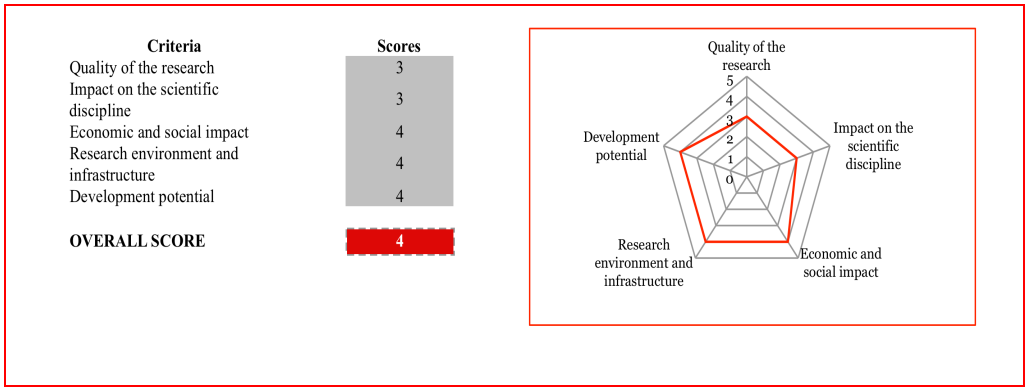
The Institute of Electronics and Computer Science (IECS) is a public independent structure (state research institute), founded by the Academy of Science of Latvia in 1960 and now under the supervision of the Minister of Education and Science of Latvia.

The IECS is organised into 6 different activities (so called labs):

- Digital Signal Processing, Embedded Systems and Cyber-Physical Systems - grouped into the R&D Center for Smart Sensors and Networked Embedded Systems
- Time Measurements
- Sampling Conversion
- Computer Network Management

The IECS lists 33 FTE researchers (more than 100 total staff of which 80 are researchers) and as a result is a major actor in Latvia in the fields of networks, engineering science and signal processing.

Figure 1 Scores: E_01



Overall Score

The Institute of Electronics and Computer Science is a strong leader in Latvia and is becoming an internationally recognised player in the field networks engineering science and signal processing (e.g. NASA's International Laser Ranging Service use of their event timer). Their realisations and inventions contribute mainly to their growing recognition and attractiveness. The IECS is increasing efforts to publish in international high impact journal, encourages networking and promotes its attractiveness towards new and young talent. Its position and cooperation within the Latvian eco system and major international partners will enhance their capability to become a well-recognised international player in the future.

Quality of Research

Most of the Institute's research is applied and includes a combination of theory, algorithms, as well as implementation in hardware; some custom products are also sold to customers. This broad scope has likely resulted in less focus on traditional

publications-based activities. Until 2011, the Institute generated a quite low number of publications, which were mostly in local and low-impact venues. The international presence of the research has been rapidly increasing, as seen through the number of publications in peer-reviewed journals edited outside Latvia (edited by IEEE, Springer, etc.) in 2012.

The Institute's theoretical work in signal processing and data acquisitions combined with applications validation in the fields of environment, communication and network engineering (domotics for example) is recognised through national leadership. Efforts are being made to expand recognition at the international level, even though more effort is clearly needed here. The best paper collection contains well-written and solid research.

Impact on the scientific discipline

The main activities and publications at the local and national levels limit the impact on the scientific discipline. The highest number of citations is 134 for a well-experienced researcher, obtained as the result of international collaborative work. Work with international impact is carried out for instance in digital signal processing, multispectral data processing, ultra-wideband systems, and sensor network. For example, the event timer developed (and also manufactured) by the Institute appears to be used by NASA's International Laser Ranging Service and results in the best state of the art performances worldwide. Despite the fact that no data has been published in a peer reviewed journal or conference, a public announcement was made at the Electronics 2012 show in Munich. Little effort has been done to disseminate the research results to the international scientific community before 2011.

Economic and social impact

Educational activities through the training of Master degree students are quite sustained. Large efforts are being made to recruit high-quality PhD students. The number of PhD students and applicants is increasing substantially since 2012. The efforts to increase international collaborations, hiring more PhD students might increase the attractiveness of the Institute. The IECS publishes mainly in conference proceedings, with the aim of developing international network contacts, as well as enabling young scientists to attend conferences.

Based on the self-assessment report, the number of filed patents is reasonable in the 2006-2011 period: an average 6 patents/year, and the trend is increasing. Numerous computer programs are produced each year. IECS does extensive contract research, makes products and delivers to companies with some success such as the event timer or the very sensitive ultra wide band comparator. It is difficult to draw a roadmap of activities without industry development in the research fields of IECS. Cooperation within European Framework Programmes is quite sustained which contributes to the IECS gaining visibility. The Institute has recently begun to spread out its developments. There might be opportunities for spin off companies which could help in the development of Latvian SMEs industrial network. This is clearly an outstanding unit in terms of impact in Latvia.

Research environment and infrastructure

State of the art equipment is available for fast data acquisitions, analysis and computing at the Institute. The equipment is shared with other Institutes and Universities for training purposes and research. Some of the technical equipment is reported to be insufficient and partly outdated; there might be a lack of workstations and software licenses acquisition issues. The Institute has an unusually large number of support staff (about 20% of the personnel). Due to the applied, hardware-oriented direction of some of the research, the large number of technical personnel may be justified. The funding level, computed as funding per researcher, is quite high in comparison to other institutes and departments. This welcome situation is due in major part to the high dynamism of the director Modris Greitan, who consciously promotes efforts to boost the IECS recognition and attractiveness worldwide and attracting new talents. Priority has been

given to the research environment by upgrading the labs before the administration facilities, both being hosted in old buildings. Salaries to attract young and new talents (including PhD students) are higher than in other units.

Development potential

The Institute of Electronics and Computer Science has demonstrated its capacity to be a leader in the country and increase the number of academic collaborations at the national, regional, European and international levels. The number of postgraduate members has been increasing consistently since 2007. Their number of publications with high impact is evolving positively. However, the Institute would benefit from more visibility in the highest regarded scientific journals. This trend is important for collaborations with other institutes in Latvia and at the international level. The gain in critical mass to reach higher visibility has to be envisaged by stronger links or synergies with other Institutes, in the fields of data acquisition, signal processing or communications and networks. Incentives should be given to collaborate with industry or spin off companies.

Conclusions and recommendations

The Institute of Electronics and Computer Science is a well-managed unit of 80 researchers (33 FTEs) which is recognised in its excellence. The gain in recognition as a strong international player will certainly increase its attractiveness towards young and new talent. The management of the Institute is sensitive to these aspects and certainly operates in that direction.

The Institute of Electronics and Computer Science is part of networks at the national, as well as European level and fosters strong collaborations with major players at the international level. The IECS is a reference model for national collaborations and can increase its potential by leading a consolidation effort with other Latvian research units' experts in similar fields.

3. E_02 RTU Centre for Building Science

Name of the institution	RTU Centre for Building Science
Name of university	Riga Technical University (RTU)
Type of institution	University

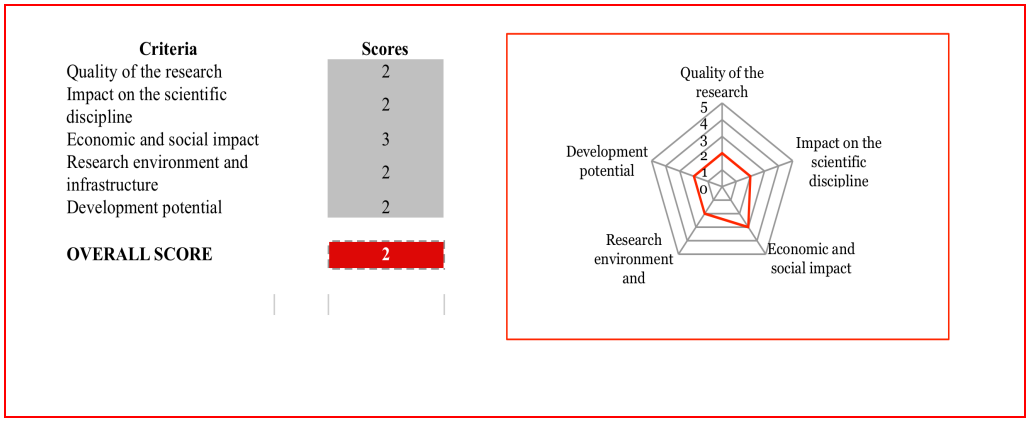
The Centre for Building Science at RTU belongs to the Faculty of Civil Engineering at RTU. It was established in 2005 with the aim to promote interdisciplinarity among the construction industry science and other industries.

The Centre is an umbrella organisation for a number of Institutes, scientists and laboratories in the Faculty of Civil Engineering at RTU. The Institutes involved in the Centre's research are the following:

- Institute of Transport Infrastructure Engineering (E_25);
- Institute of Structural Engineering and Reconstruction (E_24);
- Institute of Heat, Gas and Water Technologies (E_03);
- Institute of Materials and Structures (E_23);
- Institute of Building Production (not part of the RAE).

The Centre has four research themes, namely: water research, roads and bridges, geomatics and materials science. Research is carried out mainly in three laboratories: Water Research Laboratory, Concrete Laboratory and Laboratory of Road Building Materials. The number of total staff FTEs at the Centre was 38 in 2011 but increased substantially in 2012.

Figure 2 Scores: E_02



Overall Score

The Centre's quality of research and impact on the scientific discipline is average as per international standards. Its economic and social impact is good, research infrastructures are modern but organisation of the management is not clear. The Centre needs to clarify its role and structure in parallel to the embedded Institutes.

Quality of Research

Researchers at the Centre have published the results of their research mainly in regional journals and in conference proceedings. Publications in prestigious international journals are quite limited. The number of research outputs is average, in absolute terms,

but rather low if numbers are normalised per researcher. Numbers of research outputs and citations in Scopus are average. The international profile of researchers, as evidenced e.g. by invited lectures, editorial boards, awards etc. is average. Overall, the Centre of Building Science is a satisfactory national player, with relatively limited international recognition.

Impact on the scientific discipline

The coherence of research topics addressed within the Centre for Building Science is somewhat limited; hence the specific scientific discipline covered by the Centre is not clearly defined. The number of publications in prestigious international journals with high impact is quite limited. Efforts with foreign collaborators have been moderate in 2006-2011 but increased in 2012. The international profile of researchers, as evidenced e.g. by invited lectures, editorial boards, awards etc. is average. Overall, the Centre of Building Science has a stable position in the national scientific community, whereas its position within the international scientific community is still evolving.

Economic and social impact

The Centre for Building Science has obtained a reasonable number of patents, all valid only at the national level. Publications with users are limited. Training provided to doctoral students has been rather low in the period 2006-2011, but numbers are higher in 2012. No doctoral graduates have been employed in business or in public services yet. Collaborations and visits with the business/public sector are rather limited. Non-academic collaborations are limited to Latvian Associations, but rather few concrete results of these collaborations are evident. Membership in committees and in scientific advisory boards of non-academic entities is rather limited. The societal impact of the research is positive, especially with regards to the quality of drinking water and road asphalt paving materials. Overall, the research of the Centre for Building Science is important for society and the Centre's interaction with non-academics (business, policy makers, and the public) is moderate, but evolving.

Research environment and infrastructure

The Centre for Building Science comprises a unit within the Faculty of Civil Engineering with a fairly high number of academics, researchers and support personnel. Organisation of the management of research at the Centre is not given a clear description. The same holds for the long-term strategic and financial resource planning, including the human resource development strategy. The research is carried out mainly in three well-equipped laboratories with modern measuring instruments. The ratio of students involved in research to the overall number of staff members is reasonable. Overall, the Centre provides a research environment that is comparable with globally recognised academic institutions in its discipline, although the aspects of management and resource planning need some clarification.

Development potential

The Centre has a clear vision for the future and reasonably defined plans, however it still needs to clarify its role and structure in parallel to the embedded Institutes. Strengths, weaknesses, opportunities and threats are realistically assessed. The size of the Centre is rather large, but its ability to attract high-level doctoral students and scientists from abroad is limited. The ratio of non-state to state funding is relatively high. The fact that international funding comes mainly from framework projects is quite positive. Research conducted at the Centre has a strong component relevant to national needs. Involvement in promising international collaboration projects and networks is rather limited but evolving. Overall, the Centre for Building Science is capable of remaining a visible local player in its area of research, with a strong potential to become a trustworthy partner within the international scientific community.

Conclusions and recommendations

The Centre is an umbrella organisation for a number of Institutes, scientists and laboratories in the Faculty of Civil Engineering at RTU. The overall impression is that

the Centre was established in order to facilitate participation in large projects, so it may be seen more as an administrative unit and not so much as an integrated research unit.

The Centre needs to clarify its role and management structure in parallel to the embedded Institutes.

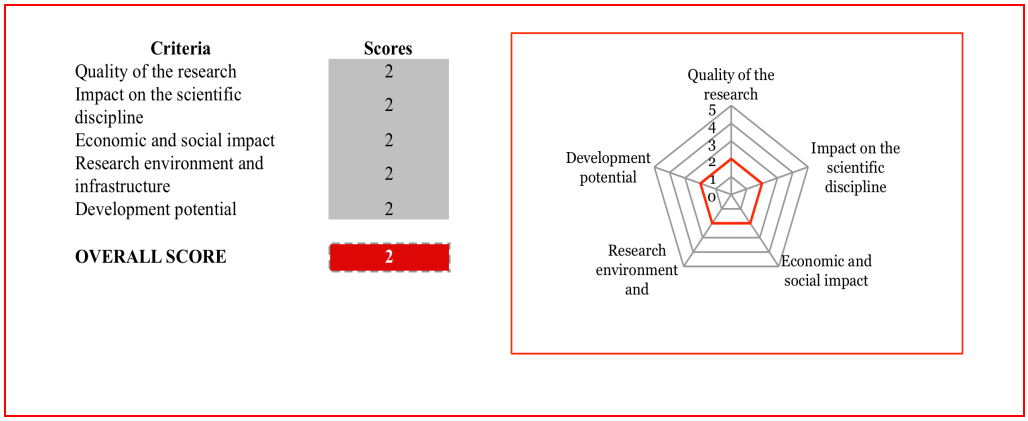
4. E_03 RTU Institute of Heat, Gas and Water Technologies

Name of the institution	**RTU Institute of Heat, Gas and Water Technologies**
Name of university	Riga Technical University (RTU)
Type of institution	University

The Institute of Heat, Gas and Water Technology belongs to the Faculty of Civil Engineering at RTU. It is part of the Centre for Building Science at RTU (E_02), which was established in 2005 with the aim to promote interdisciplinarity among the construction industry science and other industries.

The Institute carries out research in the fields of heat supply, ventilation and air conditioning, water supply, sewage drainage and gas supply.

Figure 3 Scores: E_03



Overall Score

The quality of research and impact on the scientific discipline is average as per international standards. Its economic and social impact is average, research infrastructures are reasonable but the management needs further elaboration. Funding is limited.

Quality of Research

The research is relevant to the environment and societal concerns. It forms a consistent set with complementary basis.

The publications outcome is low given the number of researchers involved in the organisation but it is slightly compensated by the ratio of citations to publications. The number of people publishing is average compared to the total staff.

The national and international collaborations are based on exchanges and EU joint projects otherwise efforts with foreign collaborators have been moderate. The non-academic collaborations section is not completed in an understandable manner. There is some national recognition with awards and participation in editorials boards, scientific committees.

However, the international profile of researchers, as evidenced e.g. by invited lectures, editorial boards, awards etc. is not high, as per international standards. Overall, the Institute of Heat, Gas and Water Technology is a satisfactory national player.

Impact on the scientific discipline

The report does not show significant impact on the international community but there is presence at the national level (memberships, editorial boards…).

The number of publications in prestigious international journals with high impact is quite limited. The number of research outputs is average, in absolute terms, but rather low if numbers are normalised per researcher. Numbers of research outputs and citations in Scopus are low. Collaboration at the national level is reasonable. Efforts with foreign collaborators have been moderate. The international profile of researchers, as evidenced e.g. by invited lectures, editorial boards, awards etc. is not high, as per international standards. Overall, the Institute of Heat, Gas and Water Technology has a stable position in the national scientific community, whereas its position within the international scientific community is still evolving; its impact at international level is somehow undetermined.

Economic and social impact

There are no registered/maintained patents from 2006 up to 2012. The bibliometric indicators must be improved especially the number of publications with users. The number of defended dissertations is reasonable but it does not correspond with the number of started post-graduates studies; it could indicate large dropouts during the post-graduation period. The report shows that doctorate students join the university staff after finishing their thesis, only one of the doctoral graduates has been employed outside academia. The social impact of the Institute is seen only from the education point of view.

The participation as members of non-academic organisations is significant.

The area of research developed by the Institute offers good prospects due to environmental policies and energy concerns: buildings with positive energy balance; energy networks…the economic and societal aspects are clearly impacted.

Research environment and infrastructure

The Institute of Heat, Gas and Water Technology comprises a unit within the Faculty of Civil Engineering with a fairly high number of academics and researchers but limited support personnel. Organisation of the management of research at the Institute is not given a clear description. The same holds true for the long-term strategic and financial resource planning, including the human resource development strategy. Laboratories and research infrastructure are average. The ratio of students involved in research to the overall number of staff members is average. Overall, the Institute provides a research environment that is still evolving to achieve a level that is expected in the internationally scientific community of a respected Institute.

Development potential

The Institute's vision and plans for the future are not clearly defined. Strengths, weaknesses, opportunities and threats are not assessed in the 2006-2011 report, but they are reasonably assessed in the 2012 report.

The size of the Institute is reasonable, but its ability to attract high-level doctoral students and scientists from abroad is limited. Funding is low, at all levels (national, international).

The research work is aligning with the national policy of saving energy, sewage treatment and energy management. The financial and human resources will be attracted by these environmental concerns, however the funds will first come from the national and European institutions due to the decisions on regulation and required heavy investment.

Conclusions and recommendations

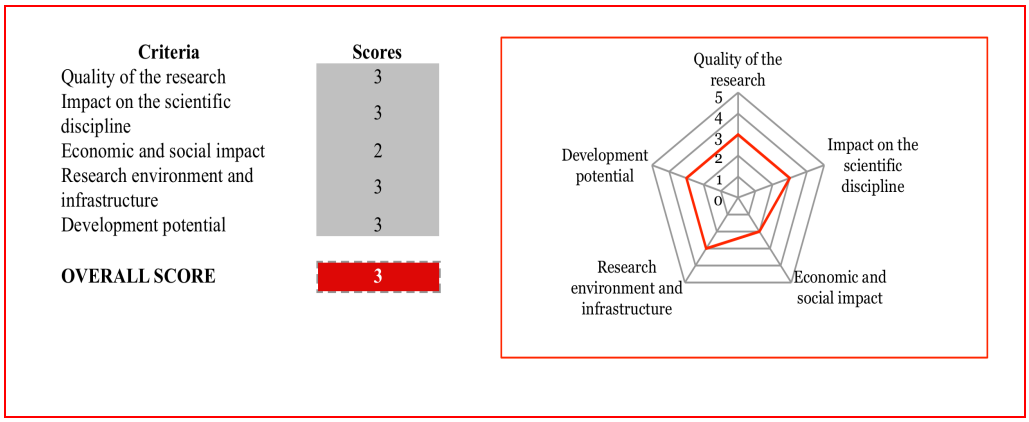
The Institute of Heat, Gas and Water Technology is a relatively small unit in the Faculty of Civil Engineering at RTU. The unit deals with interesting research problems, however it lacks visibility at the international level. The Institute should develop a more ambitious strategy plan to ensure its long-term future and viability with a clear focus on external funding and attraction of young scientists.

5. E_04 RTU Institute of Information Technology

Name of the institution	RTU Institute of Information Technology
Name of university	Riga Technical University (RTU)
Type of institution	University department

The Institute is part of the Faculty of Computer Science and Information technology of Riga Technical University. The staff comprises 27 FTEs of which 5 are professors and the rest at various other career levels. The research of the Institute covers four fields: Mathematical Foundation of Computer Science; Computer and Systems Software; IT Systems Analysis, Modeling and Design; and IT Computer Management.

Figure 4 Scores: E_04



Overall Score

The level of research is good and the research themes are timely. The Institute seems well managed and has potential to further develop its research and improve its international visibility.

Quality of Research

Most of the research is directed towards systems analysis, modeling, and design, and the research typically concerns enterprise applications and operations-research-type of problems. Although the size of the research personnel corresponds to 27 FTE, it is surprising that only 7 people contributed to the publication lists. It is likely that the main focus of the staff is on education and not research. The best papers collection contains sound research published in good-quality, internationally recognised journals, but no publications are in the top journals of the field or in the highest-ranked conferences.

Impact on the scientific discipline

Most publications listed in the self-evaluation report are not in internationally recognised journals, and there is very few, if any, publication in the very top-quality journals or in high-tier conferences. The Institute has a presence in EU regional and FP6 and FP7 programmes which gives an international dimension to the research. The Institute also maintains a significant international collaborative network.

Economic and social impact

The impact of the Institute is mostly through Masters and PhD students completing their degrees. The Institute's research orientation should make it possible for a much

larger participation in non-academic collaborations and innovation activities. In fact, there are no concrete examples given of the impact of the research activities on local companies and industry. It is surprising that a clearer strategy is not given for this issue: the self-evaluation text for societal impact is the same as for relation to scientific competitors!

Research environment and infrastructure

There are no reported issues with technical equipment. The Institute hosts a number of labs, mostly for educational activities it seems. An HPC and cloud computing facility is under development. The Institute is a viable size for a well-connected and communicating research unit. The funding is on a medium-low level compared to the other Latvian units. A particular strength of the Institute is its unusually even gender balance, also among the Faculty. The management of the Institute seems strong, and the head of the department presented a good and well thought-out plan for the future at the site visit. However, the self-assessment report does not contain a clearly presented research strategy.

Development potential

There are well-identified research themes such as simulation and modeling, in which the Institute's staff interests and momentum seem to be concentrated. They have been publishing and contributing at the European level. In addition, the Institute has contacts in this field abroad and it would seem to be the main theme in which to concentrate. The Institute's research topics should be relevant and of interest to local industry and enterprise; such cooperation constitutes an untapped resource for the Institute. Due to what appears to be a strong and insightful management, the Institute is well placed to develop the existing themes, expand their activities, and to become an international player in its field.

Conclusions and recommendations

Overall, there are many positive characteristics of this Institute. The Panel believe that the management and staff are well equipped to address the challenges of the Institute, which are, for instance,

- A broader involvement of researchers in international publications (based on the observation that only 7 people provided publication lists in the self-evaluation report);
- An improvement of the international impact of their research through high-quality publications;
- The development of non-academic collaborations, which should be possible due to the Institute's research direction.

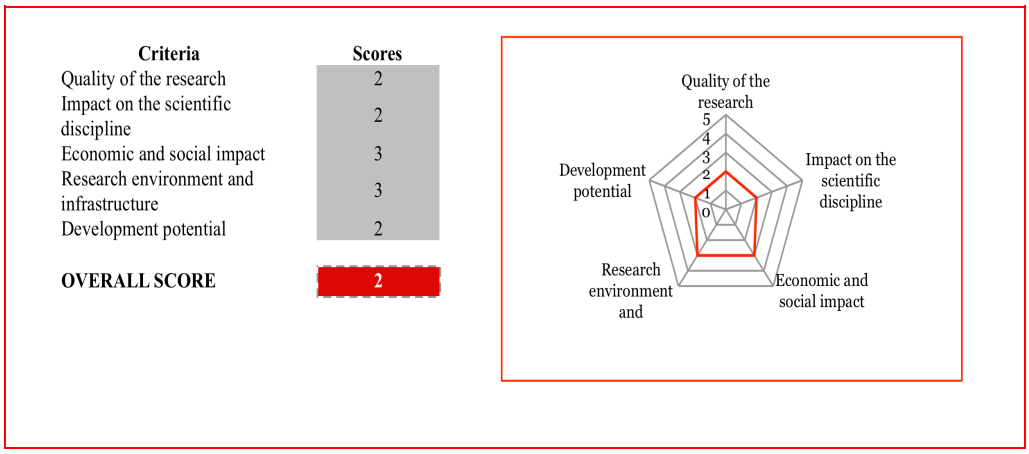
6. E_05 RTU Institute of Applied Computer Systems

Name of the institution	RTU Institute of Applied Computer Systems
Name of university	Riga Technical University (RTU)
Type of institution	University

The Institute of Applied Computer Systems is a publicly funded Institute within the Riga Technical University working in the areas of eLearning, system analysis, modelling and design. It is part of the Faculty of Computer Science and Information Technology.

The staff is made up of a number of professors [6] and roughly the same number of Assistant and Associate Professors with a large number of technical and support staff. The total staff complement is given as 37.9 FTEs in the 2006-2011 self-assessment report.

Figure 5 Scores: E_05



Overall Score

The Institute is operating satisfactorily at the national level but is lacking in its contributions to research internationally through its projects and publications.

Quality of Research

The Institute has identified a number of areas in which staff are carrying out research. There is a wide range of research topics listed against the staff ranging from eLearning systems through software engineering applications to formal methods; the research appears scattered in many subfields.

The Institute has projects funded from the various streams of the EU: ERDF, one FP6 and one FP7. They also have local funding from the Latvian government. They were asked to join a project with Fraunhofer Institute and participate in a collaborative project Europe-Asia.

There are a number of external links with both universities and companies, which have resulted in projects and internships. There is no direct evidence that the Institute is a leading exponent in any of the areas. There are a number of topics such as the multi agent activity, which are identified as having potential. Also the robotic activity is being well developed and has been contributing successfully to international robotic games.

In summary the research activity appears scattered in a number of areas as individual projects and appears as technology transfer rather than international research.

Impact on the scientific discipline

The five listed publications are based on eLearning systems and business processes. The papers' content is mainly on proposed approaches and do not present a detailed and comprehensive research examination of the topic. A total of 19 researchers contributed to the publication list. There are only a few publications a year in internationally recognised journals.

Overall the research papers presented are limited in their international contribution; they focus mainly on learning and business processes and report on experiments using their approach in a local environment.

Economic and social impact

The impact is mainly through Masters and PhD students and some international cooperation. The societal impact seems to be mainly through the eLearning activity and its application to Latvian secondary schools.

The Institute develops web portals for customers. There is some cooperation with IT industry partners, and also visibility in national media. For example, the Institute had a project to bring robots to the agriculture industry but they never got it through to concrete applications.

The Institute has engaged in a number of projects funded through the EU and currently is active in a project with European and Asian partners. There is a number of projects listed with other universities and businesses but they are described as mainly cooperation rather than leading the projects. It is not well described what role the Institute played or how critical it was or will be to the success of a project. There is no detailed substantiation of the claim that the Institute holds 'a very strong position in the European and Chinese markets in the area of Applied Software …'

Research environment and infrastructure

The staff do not appear to be organised into clusters of personnel to promote interaction etc.

There are no reported issues with technical equipment. For teaching and research, they received funding from IBM for facilities. They also have a robotics laboratory and they have the equipment to interact with industry. There is quite a large number of technical personnel. There is some LSC & EU funding, but the Institute suffers from a generally low funding level.

In summary, the Institute has good facilities; they need space, computers and technicians for the type of work they do and they have all that.

Development potential

There is no mission statement and list of objectives for the Institute which would help focus research activity.

The Institute's future plans are listed as mainly continuing the existing research topics. It would benefit from a mission statement and a list of objectives plus an examination of the current topics in the light of the development of major research initiatives in, for example, the European Union. The current funding level is low per staff member.

The research strategy statement is not very convincing and just basically says the research should continue as before. The Institute could likely benefit from a strengthening of the scientific leadership.

The younger staff and PhD students displayed a high level of commitment and enthusiasm.

Conclusions and recommendations

The Institute has a number of projects that are more in the area of technology transfer than research and has demonstrated some success in that area. However from a research point of view it is lacking a strong international presence in publications and projects.

The Institute needs a mission statement and a list of objectives that would reflect its activities. A future plan should be drafted. The area of research overlaps with other units under assessment and combining or rationalising these activities should be considered.

7. E_06 RTU Institute of Telecommunications

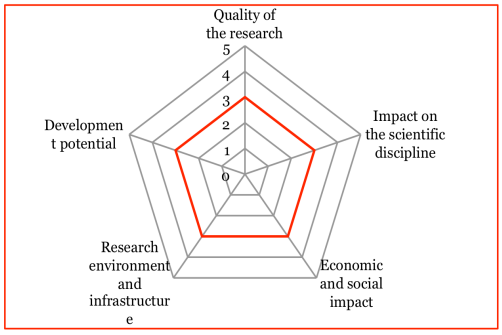
Name of the institution	RTU Institute of Telecommunications
Name of university	Riga Technical University (RTU)
Type of institution	University

The RTU Institute of Telecommunications (RTU-IT) has a staff of 44 FTE researchers and is affiliated to the Faculty of Electronics and Telecommunications of Riga Technical University.

The Institute is focused on optical networks and electrical communication and is mainly focussed on high density wavelength division multiplexing (HDWDM) and PON (Passive Optical Networks) modelling, characterisation and optimisation.

Figure 6 Scores: E_06

Criteria	Scores
Quality of the research	3
Impact on the scientific discipline	3
Economic and social impact	3
Research environment and infrastructure	3
Development potential	3
OVERALL SCORE	**3**



Overall Score

The RTU–IT is a well-managed research unit, which is well focused on electrical and optical networks communications. Their publication record has had an impact at the national and regional level only. They obtain state of the art results that bring them some recognition at the international level. They have a good challenging strategy to improve the speed of fibre optic communication systems. Their research environment has been improving and they will certainly benefit from moving into the new facilities. Researchers and PhD students are well connected via European and international collaborations and visits. Relations with industry are still weak. Hopefully, opportunities are possible to improve them in the environment of the new facilities and with the involvement of the management. Their future development would certainly benefit from interdisciplinary research, by sharing competences with a research unit studying computer science.

Quality of Research

The Institute of Telecommunications (RTU IT) is active in the fields of optical networks and electrical communication. Their research is mainly focussed on high density wavelength division multiplexing (HDWDM) and PON (Passive Optical Networks) modelling, characterisation and optimisation based on high-speed rate of > 10GB/s/channel and now moving to the 40GB/s/channel version.

Another part of their activity is devoted to system network management and modelling, encryption and encoding and results have been obtained for the theoretical and practical

implementation of fibre optic transmission systems. A model has been developed based on wavelength division multiplexing which has been used to experiment with different transmission speeds as well as modulated signals in a wide optical band. The team has been publishing mainly in local and regional conferences and low impact journals. The publications reflect the mix of theoretical analysis and practical application of the approach and are well presented; the work represents a different approach to other activity in the area. The team is quite young and shows good vitality: they attend international conferences recognised by learned societies (i.e. IEEE). Some of team were formerly Master students and were awarded several recognitions. Their international visibility is still low. The team appears as a strong national player gaining some recognition at the international level.

Impact on the scientific discipline

The main activities and publications at the local and national level limit the impact of research. The highest number of citations is 37 for a well-experienced researcher, based mainly on local and national collaborative work. A high level of self-citation is apparent (> 50%) which shows the local impact of research. The WCDMA activity is their best research activity. They have demonstrated HDWDM at 10Gbs and wish to compete by applying intensity, phase and polarisation modulation techniques with simultaneous transmission against international state of the art teams. The publications mainly represent a detailed approach to the wavelength division multiplexing model and its application. The analysis and results are comprehensive and contribute to the activity in the international arena. The table list no PhDs completed for the assessment period. There is some collaboration outside Latvia through EU funding.

Economic and social impact

The RTU-IT is making a substantial effort to train Master students. The number of PhD students increased to 7 (by 60%) in 2012. However, numbers are still low as compared to total academic staff (44). The senior staff of RTU-IT participate in the boards of local, national and regional learned societies or associations only; they are contributing to the editorial Boards of national and low impact factor journals. Relations with industry and collaborations are established through Latvian Competence Centres: however only information exchanges through seminars and poster sessions are provided. There are no collaborations with companies at the international level. There were no invited presentations as of 2012. No patents have been filed between 2006 and 2011 whereas efforts have been made in 2012(3 patents filed) to gain IP. The RTU-IT is working with the telecommunications industry and claims to have improved their performance. They also provide specialist training courses for industry. There is no detailed evidence of work outside Latvia.

Research environment and infrastructure

The RTU-IT enjoys state of the art equipment and computing tools for modelling and characterisation of fast optical actuation and measurements, optical benches and passive devices platforms. This equipment is devoted to research. The infrastructure is described as being mainly based on an 80 km wavelength division multiplexing communications system. A list of the existing equipment is given which appears sufficient for the existing research activities. The RTU-IT is moving to the Kipsala Campus where an incubation area is situated. Being part of a mixed research and entrepreneurial facility is a unique opportunity to share resources with other institutes whilst enhancing collaborations, relations with industry and generate new values; they will profit from an improved research environment by moving into the new facilities. PhD students are enthusiastic despite difficulties in terms of salaries. Management is very active in improving the infrastructure and environment.

Development potential

The RTU-IT has gained some national and regional recognition in the field of optical communications. The RTU-IT has been operational in the area of wavelength division multiplexing communications since the 1990s and has been publishing in both

theoretical and practical aspects in this area. It has managed to establish itself as a contributor in the field and consolidated this activity with external research grants and interaction with local companies.

The RTU-IT has given thought to a number of medium and long-term aims which are reasonable. There is potential given the interest and potential of fibre optic communications to build on this activity further both within Latvia and further afield. They plan to extend their research to high security level and modulation methods for high-speed (to 40 Gbit/s) HDWDM systems. This will increase their capacity to face the new challenges which will appear in the future network embedding in very high-speed devices and systems.

However, they do not mention how they will increase their capability: a recommendation would be to share competences with another team involved in information and computer science, that is, to initiate interactions with another institute focused on computer science. At the present time, inter-disciplinary research is missing. Overall they have a good focus and it would be a pity if they miss key milestones in their evolution. They are very active in exploiting societal needs and developing their international collaboration.

Conclusions and recommendations

The RTU Institute of Telecommunications is a strong national player with some international recognition. They have a well-focused, challenging strategy to improve their performance and impact in the field of electrical and optical communication networks. Their relevance would certainly increase by sharing competences with research units studying in the fields of computer science and telecommunication.

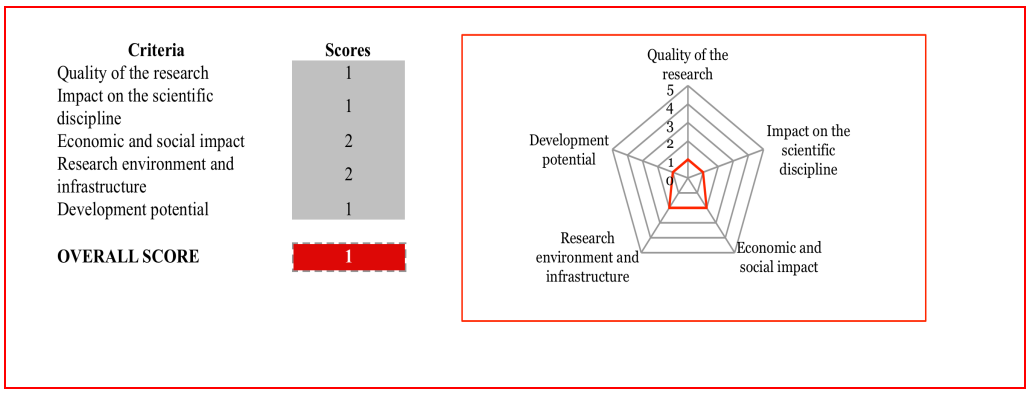
8. E_07 RTU Institute of Radioelectronics

Name of the institution	RTU Institute of Radioelectronics
Name of university	Faculty of Electronics and Telecommunications
Type of institution	University

The RTU Institute of Radioelectronics is a Higher Education Institute of 19, 64 FTE researchers affiliated to the RTU Faculty of Electronics and Telecommunications.

It conducts various research activities that might be of interest to radioelectronics ranging from materials science to antennas and communication theory. No clear organisation into groups is evidenced.

Figure 7 Scores: E_07



Overall Score

The RTU-IRE is studying various topics ranging from materials science to signal processing as well as software and education science.

The large spread of topics, for such a small team, which results in an unfocused strategy, is certainly responsible for the low impact of the research. Moreover, the age distribution among the researchers appears to be a concern for the future of the RTU-IRE.

Quality of Research

The Institute of Radioelectronics (RTU-IRE) of 19 FTE staff works on various subjects which could be of interest to radioelectronics (magnetic and photonics materials, antenna theory signal processing and mobile communications, chaos application to radioelectronics (algorithms generation and simulations), implementation of new algorithms of signal processing in FPGA and ASIC, application of telematics in distance education). Unfortunately, the absence of critical mass on a given subject is detrimental to the visibility of the RTU-IRE at the national and international levels. The publications mostly appear in local, national and regional journals; a few publications on materials science appear in international journals with low impact factor. The average number of citations per paper as well as the number of patents are too low for an institution of the size of IRE.

Impact on the scientific discipline

The research seems to be conducted in a very opportunistic way without a real and clear strategy. Theoretical studies on ferroelectrics properties (susceptibility, permeability, etc.), degradation of chalcogenides by electron beam have low impact to the scientific

community. The developed research and the self-assessment report do not show significant impact on the international scientific community. The bibliometric outputs are relatively poor. The SWOT analysis pointed out this problem of research thematic fragmentation. Moreover, groups without significant coupling limits the perimeter of the research. Most publications are produced in national and regional journals and conferences proceedings. The impact of the RTU-IRE is very modest and uncertain. Heterogeneity of the subjects is certainly responsible for the resulting low level of citations to individuals and papers.

There is an insignificant number of PhD defences. The situation is not favourable to make IRE a strong player in the different fields cited above. Many tables are not well completed or not at all, it makes the assessment difficult, especially to identify the IRE national position.

Economic and social impact

The Institute trains Master students mainly. Due to the low number of research staff, the number of PhD students remains low (2 in 2012), partially due to interrupted studies. The senior staff of RTU-IRE participate in the boards of local, national and regional learned societies or associations only. They are part of the editorial Boards of national and low impact factor journals. There are no significant registered/maintained patents from 2006 up to 2012. Relations with industry and collaborations are established through the Latvian Competence Centres, with some bilateral contracts that provide some budget to the RTU-IRE. The foreign collaborations are limited to reviewing scientific paper.

There are no collaborations with companies at the international level. Members participate in boards of local and regional learned societies and editorials boards. No invited presentations as of 2012. The human resources are a concern because of the age distribution of the staff and the lack of new PhD students. Moreover, the management does not seem to take up corrective measures to change the laboratory orientations.

The bibliometric indicators must be improved especially the number of ISI journals and the impact factors. The report shows a non-significant number of defended dissertations but shows the loss due to the PhD studies interruptions. The participation as members to non-academic board is non-significant.

As it was said above, the report does not detail the outcomes of the research and its societal impacts. The area of research (electronics) developed by the institution offers good perspectives of demand by industry or academics.

Research environment and infrastructure

State of the art test equipment is available to the Institute through competence centres. They can access testing of different electronic products taking into account electromagnetic compatibility. Today they can access an anechoid chamber which is mostly used for services purposes to the industry. Tests can be run up to 30 GHz. The centre provides a powerful server, workstations and specialised software (including FPGA, ASIC). Due to the size of the Institute, no heavy equipment can be owned and maintained. The RTU-IRE relies on external resources and infrastructures to run its research. The RTU-IRE plans to move into renovated buildings. Due to this situation, no visit to the laboratories was possible.

Development potential

The research subjects of the RTU-IRE are too heterogeneous in nature as well as their number too high with respect to the number of academic staff. They range in many fields from materials science and technology to circuit design and communication theory. The number of people per subject is way too small to gain critical mass and visibility in the future. The Faculty of Electronics and Telecommunications should reconsider the activities of the RTU-IRE and the relevance of a team without critical mass, which is unfocused on its research topics. The age distribution among the staff is an issue, which has as well to be taken into account for its future.

Conclusions and recommendations

The RTU Institute of Radioelectronics (RTU-IRE) research topics are too heterogeneous and unfocused for a team of such a small size. The materials studies are not related to the other topics relevant to communication theory. This fact is responsible for the low impact of the research. The RTU Faculty of Electronics and Telecommunications should reconsider the relevance and activity of such a team.

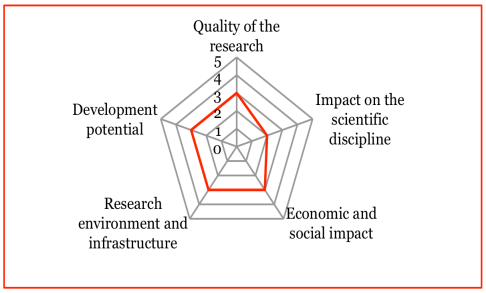
9. E_08 Institute of Industrial Electronics and Electrical Technologies

Name of the institution	RTU Institute of Industrial Electronics and Electrical Technologies
Name of university	Riga Technical University (RTU)
Type of institution	University

The Institute of Industrial Electronics and Electrical Technologies is part of the Faculty of Power and Electrical Engineering at RTU. The Institute conducts research on power electronics converters and technology, renewable energy systems and fuel cells, industrial control, drives and lightning systems. It covers most of the topics of the Industrial Electronics area. 43 staff worked at the Institute in 2011.

Figure 8 Scores: E_08

Criteria	Scores
Quality of the research	3
Impact on the scientific discipline	2
Economic and social impact	3
Research environment and infrastructure	3
Development potential	3
OVERALL SCORE	3



Overall Score

The Institute is a strong national player with some international recognition for the quality of its research and its impact on the development of the scientific discipline.

The Institute can be considered as the main unit working on power systems in Latvia. There is a satisfactory level of interactions with non-academics and the conducted research has a significant potential impact on the economic and society. The Institute has the potential to reach international standards.

Quality of Research

The research subjects regarding for instance renewables, new lighting systems, power electronics are current preoccupations but they are conducted separately i.e. more component oriented than system.

The topics can be grouped into three of four main topics, for instance: power electronics conversion for energy (interfacing renewables, for grid applications, for drives…), modelling /control methods, lighting …regarding the current research concerns: smart energy, renewables integration, intelligent grids.

There is a number of non-publishing researchers and a lack of ISI published journals, the bibliometric outputs have to be improved. However there is a significant activity of international collaboration with national and external entities; these collaborations must be sustained even developed; the outcomes are not well quantified but show recognition of the Institute.

The Panel found a good balance in networking with academia and industry. They lack critical mass on some of the subjects they included in their research topics (i.e. advanced lighting systems and computer automation and robotics). Their efforts to run a strong and sustained PhD programme can bring high added value and will help them to gain visibility in the future.

Impact on the scientific discipline

The developed research does not show significant impact on the international scientific community. The bibliometric outputs are very poor in terms of number of publications in high ranked journals and ratio of citations per paper. The scope of the research is too restricted to some objects without emphasising the new challenges and potentialities: vehicle to grid and electric vehicles technologies, renewables integration, and new control methods. The infrastructure (equipment, facilities,) must be adapted to the ambition of being an Institute with significant visibility. The report shows recognition on the memberships of journals or editorial boards with some national awards and one academician position (honorary).

Economic and social impact

The number of registered/maintained patents is impressive (more than 280). The description of this huge set is not exploited in the report, only five or six patents have been mentioned in the report corpus: a stabilisator for PEM Fuel Cell Output Voltage, a power supply for transport application, technology for artificial muscles and storage for recovering power. On the other hand, the collaboration with industrialists is impressive from this point of view. The number of defended dissertations is reasonable but does not correspond with the number of started post-graduates studies. As an example, for the period of 2006-2010, 50 started post-graduate studies with only 14 PhD defences. The report shows that doctorate students join the university staff after finishing their thesis even if the character of applied research is the subject matter of their dissertations, etc. The collaboration with non-academic entities is significant and the involvement on non-academic boards as well but mainly on a national level.

The objective to create opportunities for new start-up company's spin-off (completely or partially) from the Institute should be considered as a priority. Some incentive should be given by decision makers to help develop this strategy. As a support for these measures, a Post Doc programme with opportunities for entrepreneurship, facilitated in an incubation area, would be very helpful in this respect.

Research environment and infrastructure

Developing cross disciplinary research actions towards European institutions and industrialists is a positive policy especially the actions towards the 2020 European strategic vision. However, it appears a very low and irregular ratio of the funding coming from research contracts but a non-negligible contribution from European structural funds. The level of funding is not sufficient to allow fundamental and long-term research. Too many contracts have an amount lower than 3000 LVL and focused on too restricted objectives. The funding resources (mainly from European Commission) are well used especially for purchasing heavy equipment.

In order to sustain the Institute's efforts in their evolution, state of the art facilities seem to be a needed as well as an update of research equipment in all fields (network, actuation, sensing, characterisation, software, etc.). This was confirmed during the visit. It is important to be attractive to potential industrial and academic partners at the national and international levels, and produce effective cooperation. That would also be attractive to high-level good students. The Institute is used to share equipment with other teams for the sake of running costs efficiency. The Institute is in a critical phase of its development in which upgraded facilities and equipment would promote their progress.

Development potential

The SWOT analysis is common to the majority of RTU Institutes; it is honestly done pointing out the structural weaknesses with an objective vision on the opportunities offered by the European funds for equipment modernisation and the possibility of exchanges and mobility. The problem of the non-attractive of researcher position is endemic for many countries and is not manageable by the institution. The weaknesses are clearly inherent by the low level of publications and the low structuring research projects (too many small projects). The strategy of investment in the Institute's equipment to support the research programmes is clearly promising, it gives an opportunity for new research directions.

The strategy followed by the Institute is to increase cross-disciplinary cooperation and IIEET will benefit from the educational programmes as well as its relation with the industry. An incubation centre for new spin off enterprises would increase the attractiveness and the speed of development. The Institute could reconsider the range of its research topics, in order to dedicate a critical mass to each area. In this respect, synergies with other institutes could be examined and defined for material and human resource effectiveness.

Conclusions and recommendations

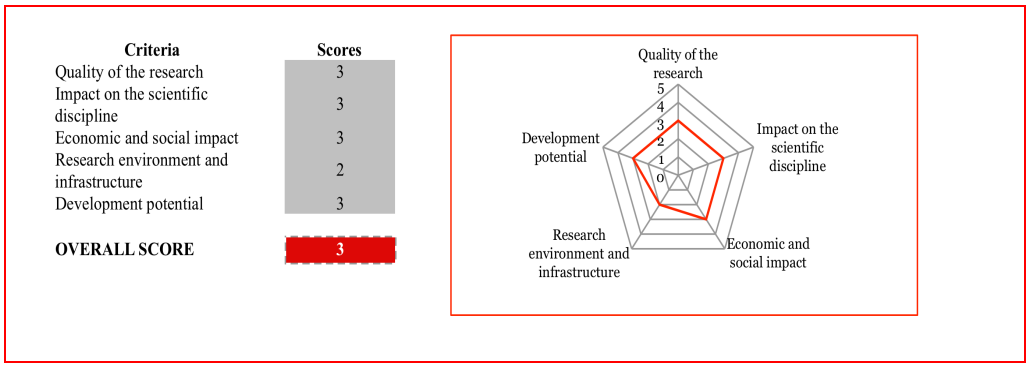
The Institute of Industrial Electronics and Electrical Technologies needs new infrastructures to proceed in its development. Their position in the Latvian eco system in the field of energy has established them as a major national player with potential for international recognition. They could also play a role in starting new activities, potentially through spin off companies. In order to do so, they must clarify their policy on I.P. and aim at supporting patents that can be extended outside Latvia. Their future development could certainly benefit from collaborative work in Latvia with other research units in the complementary fields (energy and automotive, lighting or transportation).

10. E_09 Institute of Power Engineering

Name of the institution	RTU Institute of Power Engineering
Name of university	Riga Technical University (RTU)
Type of institution	University

The Institute of Power Engineering is conducting both fundamental and applied research in power engineering (power systems, electric machines), for instance, developing simulation and control tools for power system stability, analysis, planning, etc. It is part of the Faculty of Power and Electrical Engineering.

Figure 9 Scores: E_09



Overall Score

The Institute is a strong national player with some international recognition for the quality of its research and its impact on the development of the scientific discipline.

The Institute can be considered as the main unit working on power systems in Latvia. There is a satisfactory level of interaction with non-academics and the conducted research has a significant potential impact on the economy and society. The Institute has the potential to reach international standards.

Quality of Research

The Institute conducts theoretical and applied research, develops tools and conducts applied studies for non-academic partners. The Institute can be considered as a leader in Latvia. Even if the chosen subjects are very interesting, current and rich on open problems, there is a risk of dispersion due to the range of scientific fields (climate change modelling, energy economics, power system, electrical engineering).

Concerning the scientific publications, the bibliometric data shows some weaknesses on the ratio of the cited papers regarding the total (0, 16). This can be due to the low number of publications in refereed international journals (IEEE, Elsevier, etc.). The number of conference abstracts is very irregular. This must be improved drastically. The international collaborations are significant especially with Russia and the EU. The participation in editorial boards are at the national level. Many topics have not been described in the report.

Impact on the scientific discipline

The Institute can be considered as the main unit working on power systems in Latvia. However the relative poor impact on the international academic field decreases the visibility of the Institute.

There is adequate and sufficient collaboration with foreign universities and research institutes (19). In joint-projects 2 exchanges of scientists with foreign universities are mentioned and the organisation of the annual RTU conference on Power and Electrical Engineering and 2 project PEGASSE meetings by the Institute indicates that it is the leading scientific Institute in the field of power engineering in Latvia.

Economic and social impact

There is a reasonable number of registered/maintained patents but only at the national level. There is an important academic partnership with European enterprises and academics due to EU funded projects but the collaboration with the industry is weak. The Institute's staff is well represented at the national level (committees, awards…). The scientific basis of the Institute gives opportunities to impact the national energy policy by sustaining national programmes involving operator and equipment providers.

In conclusion, the conducted research has a significant potential impact on the economy and society but it has to be developed by grouping the staff on some strong topics. The number of defended PhD dissertations is at a good level, but there is concern about the difference between the number of starting PhD studies and the number of defended thesis.

Research environment and infrastructure

The research infrastructure (equipment and building facilities) seems old and insufficient. Therefore the research has been directed more towards theoretical research with low experimental validation. The majority of research is performed by using simulation software, for instance, EUROSTAG for dynamic simulation. To be competitive the infrastructure must be developed by including for instance Real Time Power Hardware in the Loop facility (PHIL) The European Union funding programmes are very worthwhile to develop heavy investments like experimental benchmarking.

State and non-state funding per researcher is average (low) and total funding has changed drastically during the reported years without a clear trend (table 7.1, 153 – 222 – 379 – 196 – 155 – 287 x 1000 LVL). Despite these absolute numbers, 6 EU framework programme projects (Pegasse, Icoeur, ERAF) and a large number of 23 contract research projects have been carried out, indicating the suitable research environment of the Institute.

Development potential

The Institute of Power Engineering has a dominant position in Latvian research; the topics have to be redistributed in order to create more collaborative research actions both inside and outside the Institute.

Career progression and perspective for staff and researchers is not sufficient due to underpayment. There is no detailed plan on how to manage the weaknesses and threats.

The development strategy of the Institute is based on RTU Development Program for 2009 – 2015 and corresponds to state priority scientific directions, as well as with the EU strategic aims. The international level can be reached by working on these promising fields on actual problems of generation, transmission and distribution of the energy.

The orientation to EU programmes is good and must be sustained even developed. It will provide a wider prospect of international collaboration. Taking this into account and knowing the current human resources, the Institute can increase its national position and will be able to reach international standards.

Conclusions and recommendations

The Institute is a strong national player with a large potential to be an international one. Power systems are currently a very fertile field for researchers: smart grids related problems, intelligent buildings, V2G, renewable integration, new transmission system, dispersed generation. It would be prudent to focus, including the Institute's skills, on one or to two main applications which can provide a significant basis for both pure and applied research production.

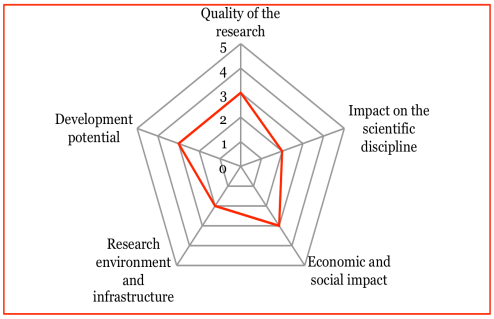
11. E_10 Institute of Energy Systems and Environment

Name of the institution	RTU Institute of Energy Systems and Environment
Name of university	Riga Technical University (RTU)
Type of institution	University

The Institute of Energy Systems and Environment is part of the Faculty of Power and Electrical Engineering at RTU. It deals with energy management, supply monitoring and assessment with the main issues being energy efficiency, renewable sources utilisation and environmental impact studies.

Figure 10 Scores: E_10

Criteria	Scores
Quality of the research	3
Impact on the scientific discipline	2
Economic and social impact	3
Research environment and infrastructure	2
Development potential	3
OVERALL SCORE	3



Overall Score

The research is centred on the environmental and societal concerns. This research is highly attractive. The scientific staff is relatively young giving opportunities for a long term strategy.

The IESE position of leadership in Latvia is not disputable. It can be considered as a strong national Institute with good potential to gain international recognition.

Quality of Research

The IESE is working on subjects dealing with energy and pollution problems. The Institute is very active in Latvia. The presented report, which is well written, gives a good impression about the quality of the research being carried out. The selected papers can be considered at the international level and show some international collaboration. However the bibliometric data does not reflect international activity as the, researchers of the Institute have published the results of their research mainly in regional journals and in conference proceedings. Publications in well-established international journals are quite limited. It must be improved in quantity and in quality (number of citations per paper).

The international cooperation is significant in both academic and non-academic collaboration.

The IESE can be considered as a strong national Institute with good potential for international recognition.

Impact on the scientific discipline

The Institute's research has real potential for impacting scientific aspects such as renewables integration, energy management in buildings, hydrogen biotechnologies, eco-design… These research fields are of strong and increasing interest and rich in open problems and technology demands. In the opposite direction, the bibliometric indexes are not strong and do not reflect the activity of the Institute.

The number of research outputs is average, both in absolute terms and if normalised per researcher and citations in Scopus are low. Collaboration at the national level is good. Efforts with foreign collaborators have been significant. The international profile of researchers, as evidenced e.g. by invited lectures, editorial boards, awards etc. is average. Overall, the Institute of Energy Systems and Environment is a strong national player, whereas its position within the international scientific community is still evolving.

Economic and social impact

The number of registered/maintained patents is very low. There is an interesting partnership with EU Institutions Services.

The collaboration activity is reasonable both inside the country and abroad with both business and academics. There is an impressive engagement of the IESE staff in academic and non-academic boards.

The societal impact of IESE research is not disputable at the national level with real potential for development. The ratio of the number of PhDs defending dissertations is reasonable given the number of researchers and academics involved. There is a significant increase in the number of defended dissertation showing good progression for the last two years. The PhD students finishing from IESE are working in research and public organisations. Overall, the research of the Institute of Energy Systems and Environment is important for society and the Institute's interaction with non-academics (business, policy makers and the public) is satisfactory.

Research environment and infrastructure

The Institute of Energy Systems and Environment comprises a unit within the Faculty of Power and Electrical Engineering with a reasonable number of academics, researchers and support personnel. Organisation of the management of research at the Institute is accomplished through an established management system. The long-term strategy and financial resource planning, including the human resource development needs further elaboration. The research is centred on the themes of energy and the environment. The work is carried out in laboratories of average quality. The ratio of students involved in research to the overall number of staff members is reasonable. Overall, the Institute provides a research environment that is nearly comparable with globally recognised academic institutions in its discipline, but is still evolving.

The strategic positioning and the resources planning are ambitious but realistic. The orientation work must be strengthened around two or three main related areas. The research infrastructure has to be improved, mainly the buildings, in order to support future plans.

Development potential

The SWOT analysis is well documented and realistic. Concerning the research fields, the position of IESE as a leader in Latvia seems to be clear. The image of the Institute and its established relationship with EC and industries will help with further developments. The orientation to ecological issues is potentially worthwhile and useful for the Institute. The collaboration with EU programmes has to be increased. Involvement in promising international collaboration projects and networks is rather limited but evolving. The ability to raise funds is proven. The progression of the PhD dissertations is good. The economic hurdles to the Institute's development can be overcome with the help of external funds (EC, Industry). There is potential to be an international player.

Conclusions and recommendations

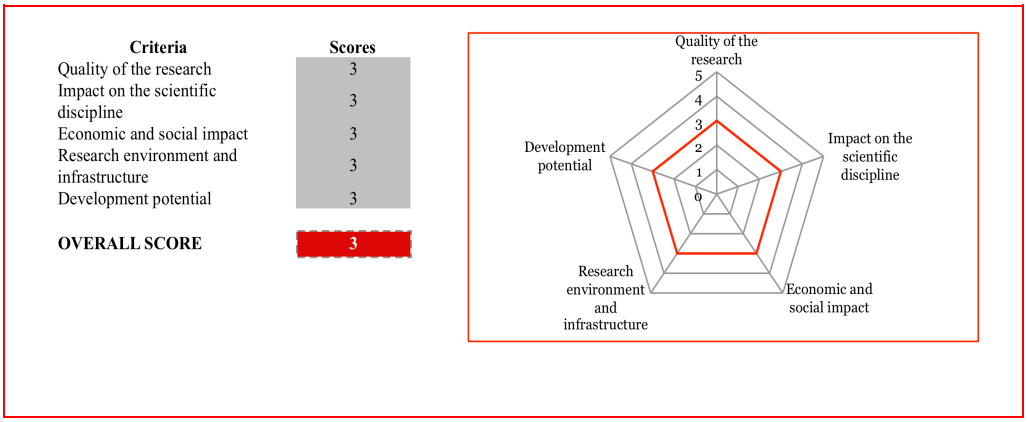
The Institute is a visible national player with high potential to be an international one. The new buildings and equipment will be helpful. The Institute has a clear vision for the future and reasonably defined plans but it must work on more grouped subjects in order to have more visibility. The bibliometric indicators must be improved by publishing in highly ranked international journals.

12. E_11 RTU Institute of Mechanical Engineering

Name of the institution	RTU Institute of Mechanical Engineering (IME)
Name of university	Riga Technical University (RTU)
Type of institution	University

The Institute is part of the Faculty of Transport and Mechanical Engineering (FTME) at RTU. Research fields cover measurements methods and instruments, machine parts tribology, metal cutting theory and tools, manufacturing engineering (including nanotechnology). The main research is on 3D surface roughness and theory of surface contact mechanism where 8 subtopics are listed. The number of personnel increased from around 35 in the years 2006 – 2008 to a stable number of around 60 in the years 2009 – 2012.

Figure 11 Scores: E_11



Overall Score

A clear research strategy and objectives are missing.

The average age of the scientific staff is a concern for the viability and continuity of the Institute. Participation in ambitious international programmes could make the Institute attractive for early stage researchers.

Quality of Research

The Institute is a strong national player with some international recognition. IME main activities are in the area of 3D surface analysis and issues of contacts mechanics & tribology. This work mostly is not published in ISI journals. IME also does not participate in major European programmes like FP7, COST or EUREKA. This inhibits the visibility of the Institute.

The number of publications in reviewed scientific journals for the total number of researchers is quite low (4.4). From the 5 submitted papers, 3 are journal papers and 2 proceedings papers. However, the citation factor is high 1.53 for a minority of the 30 given Scopus publications, while 66.7 % have no citations. A large number of publications of the researchers are published in RTU proceedings in the Latvian language and that restricts the international recognition of the research. The number of co-authors from other countries is high (24). An average start of 5 PhDs per year (table 3.1) is quite good, but from these starts only 5 PhDs have been finished in period 2006 – 2011 and 8 in 2012. The 8 research topics of the Institute are given without a detailed

description that could have given more information on the actual quality of the research. In 2011, the number of academic and research staff is given as 53, but only 15 persons are listed in table 1.2, meaning that a lot of staff is probably still working towards their doctoral degree or have no degree. This is not a good sign for the research quality and can be improved.

Impact on the scientific discipline

The Institute is a strong national player with some international recognition. The exchanges of scientific staff with other universities (6 national, 5 international) and the visits of foreign scientists (5 persons each for 1 month stay) at research institutes and enterprises are mainly for training of doctoral students and have low impact on the international scientific community. However, at national level, the 3 mentioned collaborations with universities and research institutes (exchange of scientists and joint projects), the 4 joint projects with enterprises and the 3 workshops indicate that the Institute is a strong national player. Some international recognition is acquired through the cooperation with 9 universities and research institutes and with 8 enterprises and through the organisation of 5 international conferences or workshops. The membership in editorial international boards of scientific journals is poor.

The Institute could increase its international impact and exposure by participating in European programmes like FP7, COST, and EUREKA.

Economic and social impact

There is important research and a satisfactory level of interaction with non-academics. The Institute of Mechanical Engineering is very active and important for the local society with several interactions with national industry. The research is oriented to the national machine building and metal processing companies and starting joint projects with companies seems to have a high priority. The specialised research infrastructure is accessible for external users and the funding is mainly coming from projects with industry (see 7.1.2). A long list of 58 non-academic consultations and testing (all in Latvia, mainly SIA) proves the good interaction of the Institute with the national industry. From the staff, only one person is very active in memberships in national committees (Rudzitis) and this can be improved. The number of patents is more than average (8), and the ratio of PhD students making further career in industry is low (20%). Despite this, quite a lot of popularising actions (27) have been done.

Research environment and infrastructure

The Institute is a strong national player. No description of the organisation of the management research and no long-term strategic or financial resource planning (certainly not on the human recourse development strategy) are provided. IME is the leading Institute in Latvia for surface investigations and this reflects in the availability of a good infrastructure/equipment for research on surface roughness, welding, surface parameters and deviations and metal investigations. The number of academic staff and senior researchers increased a lot, from 20 in 2006 to 53 in 2011 and there are good contacts with local industry. The size of administration personnel is high (6) while the technical personnel is quite low (2) to carry on the existing and future projects on the given equipment, so attention should be paid to this issue.

The Institute has a good financial basis and should use that to renew the scientific staff (see SWOT) and also to invest in state-of-the-art equipment. The cooperation with external partners is well organised.

Development potential

The Institute has the potential to become an international player. The SWOT evaluation is kept short, thus the analysis and management measures to overcome weaknesses and threats are missing. The weaknesses as retirement and pre-retirement of academic staff and difficulty to attract young scientist are identified. However, it is assumed that the size of the Institute is large enough in terms of staff and infrastructure/equipment to maintain its position in the scientific community. Moreover, the research direction is in

the same line with the main area of expertise (surface roughness, tribology). Most non-state funding is at this moment coming from 2 international projects making it dependent on non-state funding (2nd position of all national institutes/faculties). A long-term plan for the non-state funding is missing. The state funding is average and in 2012 the funding mainly through ESF and ERDF projects.

Conclusions and recommendations

The Institute of Mechanical Engineering is a strong national player with some international recognition for the quality of its research and the impact of the research on the development of the scientific discipline. There are many interactions with industry and the organisation with external partners is well organised. The Institute has a good financial basis but a clear research strategy and objectives are missing.

The Institute has the potential to hold its national position and even to become an international player.

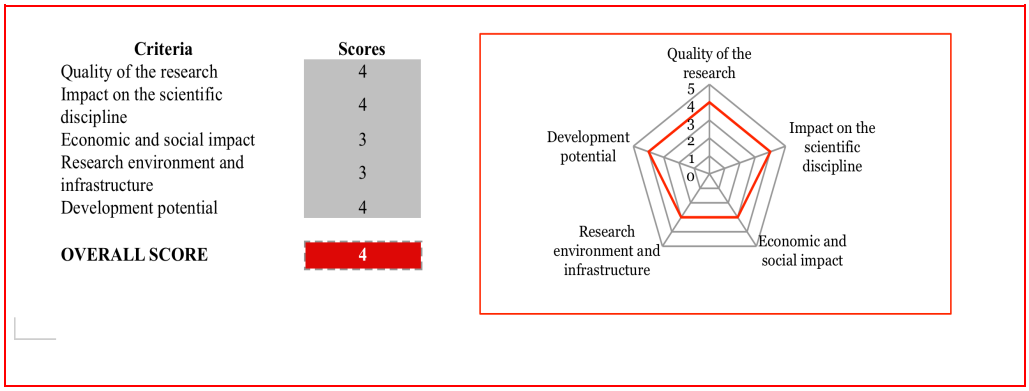
13. E_12 UL Faculty of Computing

Name of the institution	UL Faculty of Computing
Name of university	University of Latvia (UL)
Type of institution	University

This is a Faculty within the University of Latvia with a wide range of activity. Staff size in 2011 was 30.9 FTEs.

It has a number of computer science activities which you would normally expect to find in a University Department. They range from theoretical to practical with the work on quantum computing being of an international standard, the other activities are not of that standard.

Figure 12 Scores: E_03



Overall Score

This is essentially a unit, which equates to a computer science department in other universities and as a result there is a wide range of activities across the staff. There is however variation in the standard of research taking place.

There is one group whose research is of an international standard and which is led by a well-respected researcher in the field of quantum computing. This group has a solid approach and plans for the future. Other groups are performing applied research which is being taken up by industry and lacks a research focus.

Quality of Research

This is a Faculty of Computing which has a range of computer science research topics including both theoretical and practical. Research is conducted in three main areas: Quantum Computing, Computer Engineering, and Tools and Methods for Software Development. The term Faculty is used to describe what we feel is a Department in other universities in Europe.

Of particular note is the work in quantum computing in particular algorithms specifically designed for quantum computers. The quantum computing group is particularly well established and carries out research with an impressively broad interdisciplinary scope: from algorithms to electronic structure calculations. The quantum computing work is well regarded and has resulted in a new method to determine the quantum lower bound known as quantum adversary which is used by other researchers in the field. The principal investigator has received an ERC award – possibly the first in Latvia.

The Faculty is also active in other areas of computer science such as embedded systems, software engineering and publishing at the international level also. Some of the work in the software activities did not appear to have strong research content and appeared to be based on IT support for the university and local government.

Impact on the scientific discipline

The quantum computing group publishes in the top journals and cooperates with top researchers in the field. Some people in the other groups also possess international visibility. The provided best papers are of good quality.

The quantum computing research has enabled collaboration with other major institutions throughout Europe working on quantum computers. It seems that as a result of this activity the Faculty is leading the EU FP7 project in the area.

Other research activity has been deliberately aligned with topics in the EU Framework challenges which are commendable. There is a fair amount of publications in the best journals in the field.

Economic and social impact

The level of interaction with society is good: there are a number of cooperation agreements with several IT companies in Latvia. These projects directly impact on local society, for example, fruit growing monitoring, intelligent vehicles, software engineering etc. The institution also organises a software testing conference together with IT companies.

The placement policy for students to industry, about 150 students per year, is also another good contribution to local economy and society.

Research environment and infrastructure

Technical equipment is reported to be in line with international standards. There is a surprisingly low average funding for an institution that carries this out high-quality research.

The infrastructure is listed in terms of buildings and equipment and appears to be adequate. Some of the accommodation has recently been refurbished

Development potential

There is a clear vision statement with a list of objectives and plans to achieve the objectives. The Faculty has obviously given thought to its future position and activities. Given its previous activities and contributions the objectives are realistic although they present considerable challenges in particular with respect to funding in the current economic conditions.

The self-evaluation is well structured and its research strategy is well formulated and seems realistic. Some research directions are not yet internationally well established.

Conclusions and recommendations

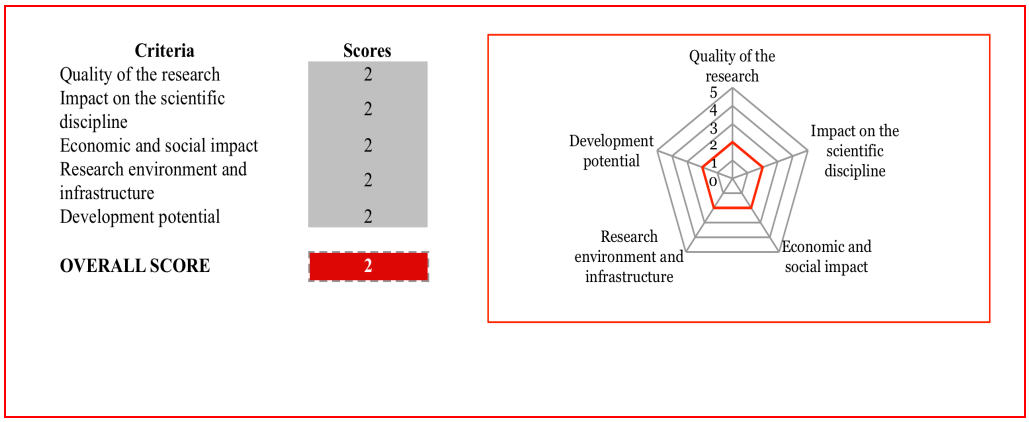
There is certainly work in this unit which is of a high international standard and has made good research contributions and is therefore worth investing in - they have shown leadership in Europe and have plans for future research activity. Other activities in the Faculty need a clearer research focus and visibility in international publications. The Faculty should be the centre for computer science research activity in the University.

14. E_13 LUA Faculty of Engineering

Name of the institution	LUA Faculty of Engineering
Name of university	Latvia University of Agriculture (LUA)
Type of institution	University

The LUA Faculty of Engineering consists of 4 institutes: the institute of agricultural energetics, the institute of mechanics, and the institute of agricultural machinery the motor vehicle institute. Research directions within each institute are very wide. The Faculty has a high number of full professors (8) and associate professors (9).

Figure 13 Scores: E_13



Overall Score

The Faculty of Engineering of the Latvia University of Agriculture has no coordinated policy regarding the various institutes involved in this assessment process. Each institute has its own strategic objectives. For this reason the global vision and plans is a very difficult practicing for FE/LUA. The SWOT analysis is flat and very brief. The ability to obtain funding from EU and industrialists is not proven. The selection of research items is not developed.

Quality of Research

The Faculty is a satisfactory national player. Four institutes whose strategy is defined by themselves compose the Faculty. The interests of some of the institutes have a common background. In general the research topics of the Faculty are very widespread ranging from wind and solar energy, modelling, control, heating, vehicles and biomass. It makes the competitiveness weak regarding other specialised institutions since the risk of dispersion is very high.

From the 5 included scientific papers, 4 are published in the journal Agronomy Research. Two papers (papers 3 on heat accumulation and paper 5 on a solar collector) give calculation methods, so it is difficult to consider them as a high level scientific paper. In these publications and also in the other provided papers, the references are to papers in the Latvian language and not in high-standard publications. The output per researcher is average (9.3), but the citation index is low (0.33) and 90 % of the 80 Scopus papers are not cited at all. There is a low number of co-authors from other countries, only 4. Many of the papers of the researchers are published in Engineering for Rural Development, Jelgava. There is a total of 80 Scopus publications, but only 14 are peer-reviewed (following table 2.2).

Impact on the scientific discipline

The Faculty is a satisfactory national player and as mentioned before encompassing four different institutes: each with a large range of research topics.

The large spectrum of the research fields decreases the global impact of the institution. Furthermore it is difficult to make a distinction in the quality and the impact of the research discipline for the different institutes. For such a large institution, the number of international visits and staff exchanges is very low: 1 visit to Germany and 1 PhD student for a stay of (4 months in Brno). Several prizes have been awarded to G. Moskvins. The research with the PhD students seems to be mainly applied research without attention to fundamental research and 9 PhD-theses have been completed in the reported period.

The section 6.2 is not well completed; it does not provide information about the position of the unit regarding the national and international competitors. The bibliometric indexes and the level of external collaborations need to be improved.

Economic and social impact

The Faculty has a satisfactory level of interaction with non-academics. At national level 7 collaborations with national enterprises (consulting, preparation of technical documentation (SIA)) are reported, while at international level only one cooperation with a foreign university and two with research institutes are mentioned. A positive point is the organisation of the annual international conference Engineering for rural development that can contribute to the improvement of interaction with non-academics and recognition in the international scientific community. The number of patents is extremely high (65), but there is no indication on their subject and the impact in industry. There have been a few popularising actions; only 7, have taken place. There is little attention to the transfer of knowledge in the reported period, since only 2 of the 9 PhD students went to industry and also there is nothing written in table 7.1.2 relating to the contribution to economic development and commercialisation of the research and its results. However, 17 doctoral dissertations are expected to be finalised in 2013 – 2016 and 7 of the PhD students are already employed in a company, so the interaction with non-academics must be important.

The Faculty is present in national editorial boards and some faculty members have received awards.

Research environment and infrastructure

The Faculty is a satisfactory national player. There is a good infrastructure and equipment for most of the institutes, allowing them to have a quite good research environment; the exception is the Institute of Agricultural Machinery with an urgent need of high-speed hardware. The Motor Vehicle Institute has new and modern AVL equipment, but the status of the other equipment is not described. The AVL equipment seems to have been purchased with funds from the European Region Development Fund (ERDF) in autumn 2008. But from other information there were no European grants before 2011, so the information is not accurate enough.

It seems that the infrastructure can sustain the Faculty research programmes. The research strategy is focused on the means and not on research programme for the five next years. The number of PhD students is at the average level.

The number of total staff shows a considerable decrease from 65 in 2006 to 43 in 2011 and to 40 in 2012. This together with the specific decrease in academic/research staff and administration and technical staff should concern the Faculty if it intends to preserve and improve its research.

Development potential

The Faculty has the potential to become a strong national player. However the very short SWOT analysis is far from complete. For example only 2 threats, unstable economic situation, capacity of human resources, are described while there are clearly many more. The long-term strategy for funding is to attract EU financial recourses, but until 2010

there was no EU funding (although mentioned in the text), so there is very little expertise in this direction.

The table dedicated to the funding (Tab 7.1) shows no research contracts, EC or other international funding. Beside it is expressed in LVL (no thousand LVL) causing confusion when compared with panel E data.

In the next period, the key activities for the Faculty are the continued use of solar power research for agricultural products drying and storage. The Institute of Agricultural Energetics has a long-term research plan coordinated with FE and LUA strategic plans for the next 10 years showing good development potential. Funding, as reported until 2011, shows only state budget funding and no non-state or international funding. However the report table of 2012 shows an improvement of the ESF, ERDF and contract funds, but more detailed information of the new ESF, ERDF funding is missing. Most projects are in the framework of the Latvian Council of Science (LCS) and from the Ministry of Agriculture (MA), thus the Faculty is not looking for partners in the EU and worldwide.

Conclusions and recommendations

The Faculty is a satisfactory national player for the quality of research and the impact of the research on the development of the scientific discipline. The Faculty has a satisfactory level of interaction with non-academics.

It seems that the infrastructure can sustain the Faculty research programmes. The decrease in academic/research staff and administration and technical staff should concern the Faculty if it intends to preserve and improve its research.

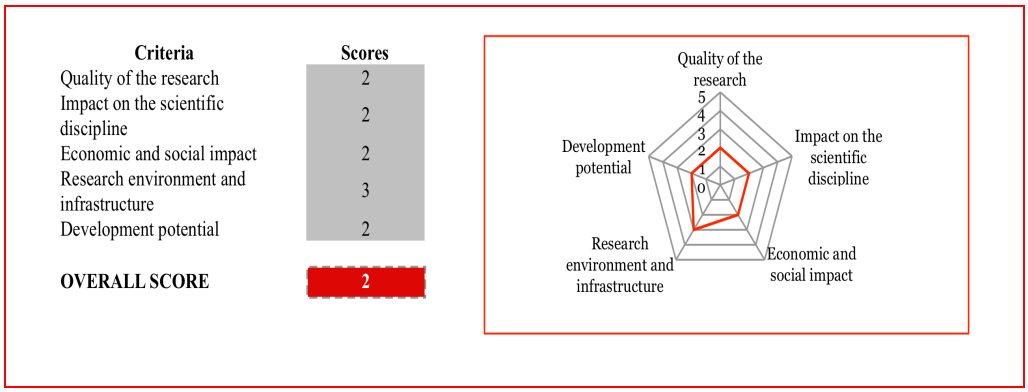
The Faculty has no coordinated policy regarding the various institutes. Each institute has its own strategic objectives. Nevertheless the Faculty has the potential to maintain its position as a strong national player.

15. E_14 LUA Faculty of Computing

Name of the institution	LUA Faculty of Computing
Name of university	Latvia University of Agriculture
Type of institution	University

The Faculty is part of the Latvia University of Agriculture. The research staff correspond to 20 FTE. There are only 1–2 professors with the bulk of the researchers as Lecturers and Assistant Professors. There are also quite a large number of technical personnel (14). The Faculty lists its research fields as being Computer Control, Systems Analysis, Modeling and Design, and Technologies and Management of E-Studies/Administration.

Figure 14 Scores: E_14



Overall Score

The Faculty operates at a national level, but is lacking in its contributions to research internationally through its projects and publications.

Quality of Research

The Faculty's description of its research touches on a number of projects such as bioinformatics, robotics, eLearning and applications of IT technology in physics and agriculture. There seems to be a strong emphasis on interdisciplinary work. The description of the Faculty's research has partly an unfortunate apologetic tone. The originality and innovation of the work is not detailed and links to international projects in similar areas are not detailed. The best papers collection is not very convincing and possesses generally low research content.

Impact on the scientific discipline

There is a lack of international cooperation and collaboration, which limits the impact of the Faculty's research. Most of the work seems to be focussed within Latvia but with some cooperation with other Baltic States. The publications suffer from a low number of citations.

Economic and social impact

One spin-off company is reported. There are contacts and projects with other Baltic states in the bio area. Otherwise, there does not seem to be much interaction with non-academics. Successful collaboration with social partners such as IT companies is listed as a strength, but the discussion under the heading Societal Impact only mentions the

spin-off company and scientific seminars. In 2006 the Faculty started a doctoral programme and the first students are currently finishing.

Research environment and infrastructure

The Faculty sustains quite a large number of technical personnel. The funding situation per researcher is at a medium level compared to other units in Latvia. There is EU funding as well as some funding from LCS. The infrastructure facilities are based on measuring equipment, computers and bioreactors. No comments are made on the adequacy or otherwise of the equipment, but it would appear to be satisfactory for the type of research activities that are conducted at the unit. There appears to a space problem for the Faculty and a need for new/renovated buildings.

Development potential

The Faculty plans, according to the research strategy outlined, is to concentrate on more practical research questions in order to seize opportunities from its position within LUA. The future potential of the Faculty was not addressed directly in the sense of a mission statement plus objectives. It is essentially planning to continue existing themes of research but states the present level of funding is not sufficient to maintain its research activities.

Conclusions and recommendations

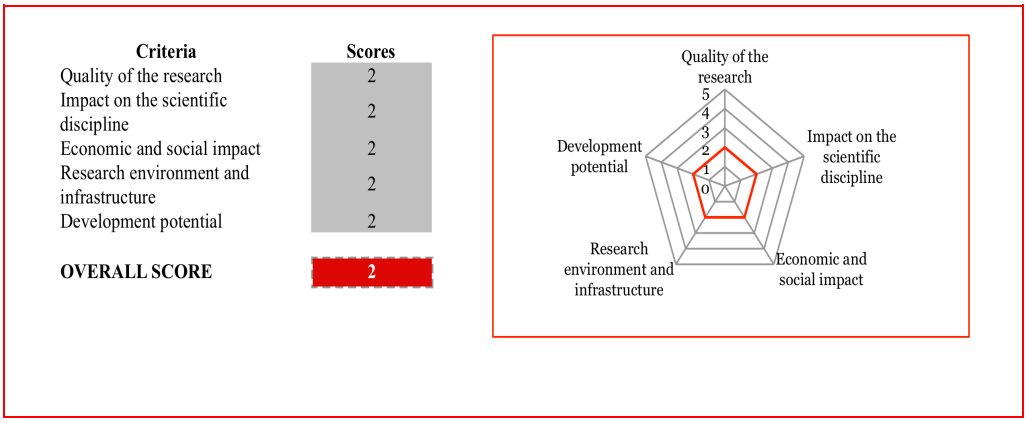
The Panel believes that use should be made of the Faculty's position as a part of LUA and to concentrate the development in interdisciplinary projects of relevance for LUA. However, it is equally important, in order to develop the institution LUA, to attempt a strengthening of the general depth, quality, and international impact of the conducted research though merging with other relevant units.

16. E_15 LUA Faculty of Rural Engineering

Name of the institution	LUA Faculty of Rural Engineering
Name of university	Latvia University of Agriculture (LUA)
Type of institution	University

The Latvia University of Agriculture Faculty of Rural Engineering comprises four Departments, namely: the Department of Environmental Engineering and Water Management, the Department of Structural Engineering, the Department of Architecture and Building and the Department of Land Management and Geodesy. The main research themes are in water management, environmental engineering, civil engineering and landscape architecture. The number of FTEs in the Faculty was 15.5 in 2011 but was nearly double in 2012.

Figure 15 Scores: E_15



Overall Score

The quality of research and impact on the scientific discipline is average as per international standards. Its economic and social impact is average, research infrastructures are in need of renewal and organisation of the management needs further elaboration. Funding of the Faculty is low.

Quality of Research

Researchers of the Faculty of Rural Engineering have published the results of their research mainly in conference proceedings and in regional journals. Publications in prestigious international journals are quite limited. The number of research outputs is average, in absolute terms, but rather low if numbers are normalised per researcher. The number of research outputs and citations in Scopus are low. Collaboration at the national level is evolving but efforts with foreign collaborators have been limited. The international profile of researchers, as evidenced e.g. by invited lectures, editorial boards, awards etc. is not high, as per international standards. Overall, the Faculty of Rural Engineering at LUA is a satisfactory national player, with limited international recognition.

Impact on the scientific discipline

The scientific discipline covered by the Faculty of Rural Engineering is quite diverse; part of it is not directly relevant to rural engineering. The number of publications in prestigious international journals with high impact is quite limited. Overall, the Faculty

of Rural Engineering has a stable position in the national scientific community, whereas its position within the international scientific community is still evolving; its impact at international level is somehow undetermined.

Economic and social impact

One patent has been registered. Publications with users are limited. Training provided to doctoral students has been limited. Only one of the doctoral graduates has been employed outside academia. Collaborations and visits with the business/public sector are limited. Non-academic collaborations are rather limited. Membership in committees and in scientific advisory boards of non-academic entities is limited. The societal impact of the research is mainly related to interaction with public and private partners in the fields of agriculture, food, forestry and veterinary. Overall, the research of the Faculty of Rural Engineering at LUA is important for society and the Faculty's interaction with non-academics (business, policy makers, and the public) is moderate.

Research environment and infrastructure

The Faculty of Rural Engineering comprises a unit within the Latvian University of Agriculture with a moderate number of academics and researchers but no support (administrative, technical) personnel. Organisation of the management of research at the Faculty is not given a clear description. The same holds for the long-term strategic and financial resource planning, including the human resource development strategy. Laboratories and research infrastructures seem to have equipment that is in need of maintenance or renewal. The ratio of students involved in research to the overall number of staff members is low. Overall, the Faculty provides a research environment that is still evolving to achieve a level that is expected in the internationally scientific community of a respected institution.

Development potential

The Faculty's vision and plans for the future are not clearly defined. Strengths, weaknesses, opportunities and threats are reasonably assessed. The size of the Faculty is average but has grown in 2012; however, its ability to attract high-level doctoral students and scientists from abroad is limited. Funding is low, at all levels (national, international). Research conducted at the Faculty is relevant to national needs. Involvement in promising international collaboration projects and networks is quite limited. Overall, the Faculty of Rural Engineering at LUA is capable of remaining a visible local player in its area of research, which from time to time can be expected to contribute to the activities of the international scientific community.

Conclusions and recommendations

Research in the Faculty of Rural Engineering at LUA is average. The scientific discipline covered by the Faculty is diverse, with some small parts of it not being directly relevant to rural engineering. Overall, the Faculty is capable of remaining a visible local player in its area of research, which from time to time can be expected to contribute to the activities of the international scientific community.

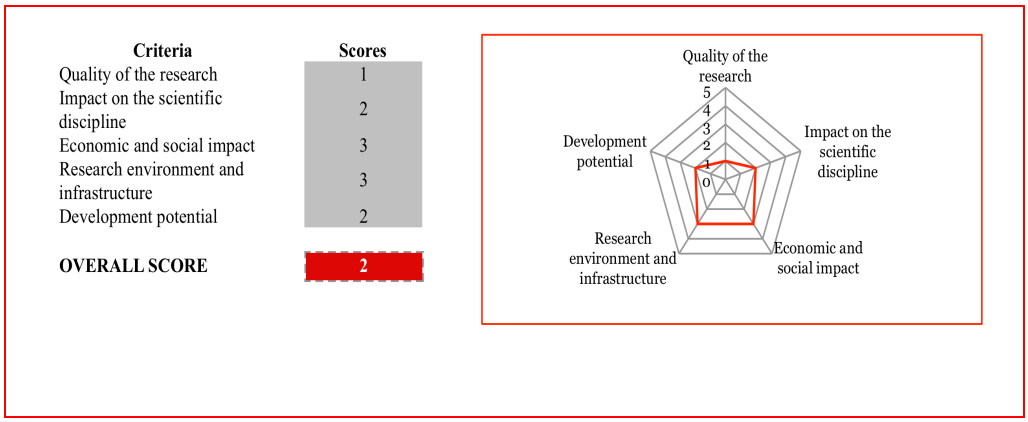
The Faculty could benefit through stronger ties and collaboration with the Faculty of Civil Engineering at RTU.

17. E_16 Rezekne HEI Engineering Direction

Name of the institution	Rezekne HEI Engineering Direction
Name of university	Rezekne Higher Education Institution
Type of institution	University (?)

The Institute is part of the Rezekne Higher Education Institution. The volume of research activity corresponds to only 5 FTE, where most staff are labelled leading researchers. There are almost no technical and administrative personnel. The Institute reports the research fields as being mostly within Engineering and Agricultural Sciences, but also with a small component of Social Sciences.

Figure 16 Scores: E_16



Overall Score

The level of research is quite low. However, the focus of the Institute is on investigations more than research, and many of these investigations are of high significance for Latvia.

Quality of Research

The research direction presented comprises a quite unusual broad mix of different disciplines. Some key words are complex solving of regional development problems, methodology of systems analysis, interdisciplinary studies and projects, balancing the economic and spiritual, etc. It is notable that there are 13 people providing publications list for only 5 FTE. There is a quite high total output of publications for such a limited number of staff. However, much of the outputs resemble more investigations and description of inventions than research. Almost no publications appear in internationally recognised journals and the citation index is low (0.63), while the not-cited papers are 62.5% and only one co-author is reported from a foreign country. The best papers collection is quite weak.

Impact on the scientific discipline

The Institute has stable and rather strong contacts in the national scientific community, but the impact on the international scientific community is small. Collaboration with foreign universities is not so small (14 universities), but the cooperation is not at a high research level since 5 are in an ALFA project and with others only exchange of information and educational resources. Three international projects are mentioned; Baltic Sea, Alfa III, Brownfield in Baltic states. Memberships are mainly local (Latgale) and from the 11 started doctoral studies (5 in 2008) none is finalised. There are very

little international exchanges: only 1 visit is abroad and there have been no foreign visitors to the Institute.

Economic and social impact

The Institute carries out a satisfactory level of interaction with non-academics. The Research Institute for Regional studies was established in 2010 for society and economy development in the Latgale region. This goal is emphasised in the text of the delivered document (key word for scientists: regional competitiveness). The Institute themes are in industrial, environmental, social and humanities sectors. Although the general research direction is obscurely described the practical projects that the Institute is involved in concerns many issues that are of high importance for society: impact of pollution on the Baltic sea water from Latvia's water bodies, identification of brownfield sites, protective coatings, new functional materials, etc. Worth mentioning are also the many training seminars and the activities of the Contact Point for Transfer of Environmental Technologies (list in 4.6 and 7.1.2). For such a short existence of only a few years, a good number of 14 patents are described, all for local applications. There is strong collaboration with 12 national enterprises (11 with SIA).

Research environment and infrastructure

Extensive equipment seems to be available (gas chromatographs, calorimeters, spectrometers, etc.) but the equipment of the scientific infrastructure is seen as a weakness. The total value of the equipment is estimated to more than 1 million LVL. The number of technical personnel is low (0.5) for this sophisticated equipment. Although the funding per researcher is unusually high (5th of all institutions), the lack of experience of the staff in organisation and management of research projects is seen as a weakness. The number in administration personnel is also low (0.28).

Development potential

The intentions and opportunities of the Institute are clear, namely to hold its position as a strong national player, and the Institute carries out much work that is of significance and importance for society. However, the activities are quite scattered, and the scientific research content in much of the work is unclear. The research description in the self-evaluation is not convincing in the generic part (the part that does not describe the actual projects). The Institute is quite small for a unit that wants to encompass such a wide range of issues. Another problem could be the international funding. The aim of the Institute is to play an essential role in the sustainability of the region. The development is directed within the social, economic and cultural environment of the region. The potential growth of the Institute is linked with implementation of activities launched in 2012 and planned in subsequent years.

Conclusions and recommendations

The activities carried out in practice are more closely related to a non-academic research institute than an academic research institution. The size of the unit is subcritical for carrying out such a broad range of activities. A reorganisation of the activities within a larger unit and perhaps with another mission than as a research-oriented academic institution should be considered.

18. E_17 UL Institute of Mathematics and Computer Science, Computer Science Direction

Name of the institution	UL Institute of Mathematics and Computer Science, Computer Science Direction
Name of university	University of Latvia (UL)
Type of institution	University

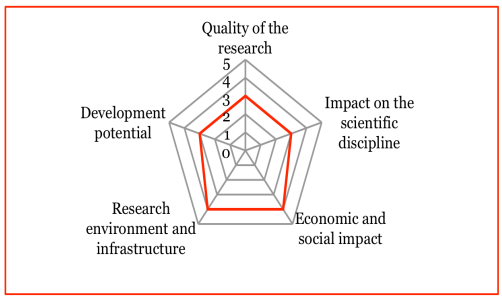
The Institute is part of the University of Latvia. Panel E has been asked to evaluate only the Computer Science division of the Institute, while the Mathematics division has been assessed in Panel M 5M_22.

The research personnel corresponds to 54 FTE, of which there are about 20 each of staff titled Leading Researchers and Researchers.

Research is conducted in a broad range of core computer science subjects but also in practical engineering fields, most notably in Real Time Systems Development. The Institute also serves a crucial role in the national Internet architecture in Latvia.

Figure 17 Scores: E_17

Criteria	Scores
Quality of the research	3
Impact on the scientific discipline	3
Economic and social impact	4
Research environment and infrastructure	4
Development potential	3
OVERALL SCORE	3



Overall Score

There is no question that the Institute due to its size and the breadth of its activities has a leading role in informatics (as they define it) in Latvia. There is also a notable international presence in research. However, further development is needed to become a really strong international player in the research themes.

Quality of Research

The mission of the Institute is to be the scientific centre of informatics (Computer Science ICT, and Engineering) in Latvia. A total of 7 CS & IT research fields are listed, and 27 people contributed to the publication lists in the self-evaluation report. A leading position in Europe/world in many research sections is noted as strength in the SWOT analysis. Much good quality research is carried out, but the best paper collection and the publication lists does not substantiate the somewhat excessive claim of a leading position in Europe/world in many research sections.

Impact on the scientific discipline

The Institute has good links with international institutions and individuals and as a result is engaged in a number of international projects, for instance EU Framework programmes. The freeware graph-modelling tool GRADE is widely used and reportedly

downloaded a large number of times. However, the international scientific impact of the research is limited as the publication pattern is concentrated in local journals or non-well-established conferences. However, it should be noted that there is a positive trend in recent years of increased presence in internationally recognised journals.

Economic and social impact

The Institute has tasks delegated to it by the government, which means that it is well involved in operations that have direct relevance to Latvia, for example management of the Latvian domain name and links to EU Geant project. This is in addition to the training of students and projects locally. The Real-Time Systems Development has had a large impact due to a long-term $ 300k-a-year contract with the US enterprise TELOS to develop the technology behind their successful FM broadcasting equipment.

Research environment and infrastructure

The infrastructure includes an operational cloud based environment plus services. This is being used in a range of practical applications. The Institute is linked into Geant — maintaining the national REN — and has plans to develop a unified research infrastructure. The Institute recognises the importance of such an infrastructure for research and collaboration and how it is affecting research progress throughout the world. The funding situation seems unusually good in comparison with most other Latvian institutions. There are many external funders: LCS, state research programmes, national co-financing for Framework Programmes, Structural Funds, EU Framework Programmes, etc.

Development potential

The Institute plays an important network role in linking Latvia within Europe and maintaining the Latvian domain name. It has also developed plans to enhance the infrastructure to provide facilities that would enable Latvian researchers to compete internationally. A further development is needed in the core research areas, with respect to depth and international impact, in order to fulfil the highly stated mission of the Institute.

Conclusions and recommendations

The Institute is strong in terms of infrastructure, and it attracts a substantial amount of funding. The international socio-economic impact of the Real Time Systems group is substantial. However, the Panel believes that an increased presence of the Institute's research in internationally high-impact journals and high-tier conferences is crucial for the further development of the Institute. On the basis of the discussions at the site visit, it seems that the attempts to get local journals internationally recognised and indexed is of higher priority than efforts to increase visibility in already established international venues.

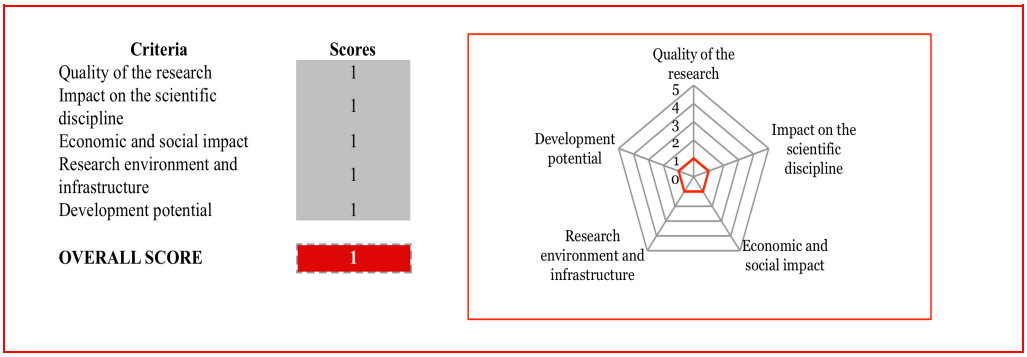
19. E_18 ISMA Computer Technologies Research Institute

Name of the institution	ISMA Computer Technologies Research Institute
Name of university	ISMA University of Applied Sciences
Type of institution	University

The ISMA-Computer Technologies Research Institute (CTRI) is a unit of 12 FTE research staff which was established in 2010 under the umbrella of the ISMA University of Applied Sciences.

CTRI is currently involved in two research topics: Modelling of an electronic devices and their interactions and with Nanoeducation and nanothinking. Recently they have extended their research topics into Applied Linguistics and Multilingual Problems in Communications and Systemic Approach to Innovative Education Management.

Figure 18 Scores: E_18



Overall Score

The publication and citations record of ISMA -CTRI is very limited. The main research focus is on nanotechnology and the modelling of nano electronic devices. This is coupled with a link to education based on these topics.

There are two main professional study programmes, information systems and computer systems, which are educating and training students. The Master's level programme effectiveness is not quantified. No PhDs have been completed.

However, there is not much explanation of the strategy or the way the two main research directions are linked.

Quality of Research

The Computer Technologies Research Institute (CTRI) is currently involved in two research directions on Modelling of nanoelectronic devices and Nanoeducation and nanothinking. Since 2010, this work has been coupled to Applied Linguistics and Multilingual Problems in Communications and Systemic Approach to Innovative Education Management. The CTRI has implemented a Professional Master's study programme, Computer Systems to prepare professionally skilled 5th level specialists of computer systems.

They have trained Master students but no experience has been reported at the doctoral level. With such a disparity in the topics, mostly researched by the same small team (12), their strategy seems questionable. No access to technology in the modelling effort limits the impact on the scientific community: this activity is rather a catch up activity than

really an original contribution of the Institute. Many groups worldwide (UC Santa Barbara, Univ Tsukuba, U Barcelona, CEA INAC, etc.) have already published these types of models based on NEGF or ab initio calculations. Unfortunately, none of these groups' work is cited in the provided papers. This seems to be a relatively new Institute and its publications and impact as a result is limited.

Impact on the scientific discipline

The few publications of the CTRI appear in regional conference proceedings and low impact factor journals. The number of citations is very modest. The topics are relevant but lack significance whenever one considers the results. While the modelling work on nanotubes appears in several journals or conferences, the research on nanoeducation and nanothinking is modestly disseminated, even though it is claimed as a priority for the Institute. There is not much evidence of the Institute's impact in the European and international arenas. There are links to a number of universities and institutions abroad which have resulted in visits. Their citation counts are given as zero.

Economic and social impact

Because of the recent establishment of the team, no evaluation of the economic impact can be made. On the societal side, the Institute has relationships at the European level mostly through European FP projects. There are two main professional study programmes, information systems and computer systems, which are educating and training students. The Master's level programme effectiveness is not quantified. No PhDs have been completed. The strategy is not clear on these points.

Research environment and infrastructure

The description in the self-assessment report is very succinct. There is not much detail on the infrastructure. There is less than 1 computer per researcher available.

Development potential

The subjects are too disparate with the given staff to define a real clear strategy for the Institute. There is no clear plan about the future development potential of the Institute.

Conclusions and recommendations

The ISMA Computer Technologies Research Institute (CTRI) established in 2010 is hardly visible in terms of publication record and performance. There is no evidence of an original link between the two main research directions that the research unit is following in the fields of nanoelectronics devices modelling and nanoeducation and nanothinking. No evidence of a clear strategy to link them is given for the future. Moreover, no critical mass appears in either direction which would strongly suggest reconsidering the existence of such a research unit.

A strong recommendation is to simplify: incorporate the modelling activity to a different research unit working on nanotechnology or device modelling and the educational part within another faculty (sociology, education sciences, etc.) or in cooperation with another major Latvian University.

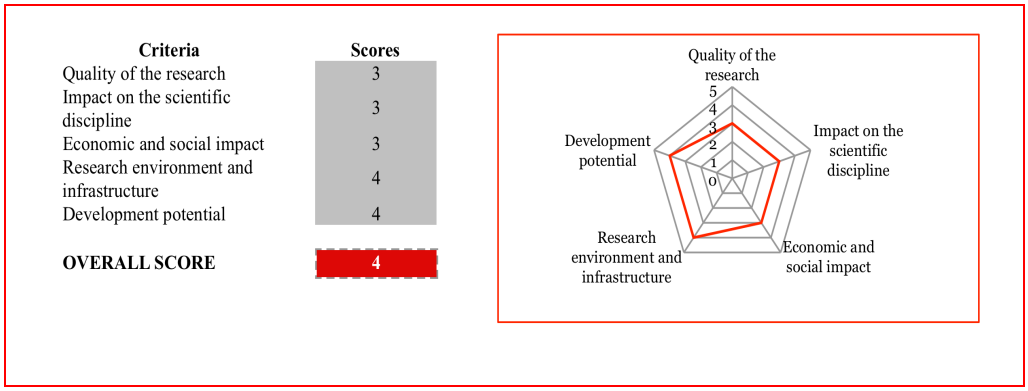
20. E_19 Transport and Telecommunication Institute (TTI)

Name of the institution	**Transport and Telecommunication Institute (TTI)**
Name of university	N/A
Type of institution	State Research Institute

The Transport and Telecommunication Institute (TTI) is a non-state higher education structure, established as a result of the Riga Aviation University in 1999. Nowadays, TTI is under the joint supervision of the university and a joint stock company Riga Aviation University.

The Transport and Telecommunication Institute aims at providing a framework for transportation research and policies. It is a national leader in research and education in the fields of transportation modelling, intelligent transportation systems, systems analysis of complex transportation systems and transportation analytics. The Institute has established research and education programmes up to the Masters and PhD levels. Research staff counts 41 - FTE: 10.75 (as of 2011).

Figure 19 Scores: E_19



Overall Score

The Transport and Telecommunications Institute is a unique national player and is strengthening its position in order to become an international visible key player in the field of education as well as research in logistics and transport modelling and simulation. Their publication record and their impact is still improving, whereas their strong awareness at the national and regional levels is proven. Their efforts in upgrading their infrastructure (buildings and equipment) will make them attractive to national, regional and international collaboration with academia or industry: good initial signs are observed with increasing number of participations to European projects and agreements with international players in the aviation industry. TTI has strong assets and good potential to remain a national, regional leader in the field of transport logistics, modelling and simulation and become a major international player in the field.

Quality of Research

Researchers of the Transport and Telecommunication Institute (TTI) have published the results of their research mainly in regional journals and in conference proceedings. Publications in prestigious international journals are relatively limited. The number of research outputs is high, both in absolute terms and if numbers are normalised per researcher.

In the self-assessment, numerous research objectives are not well valued by the specific outputs obtained in the evaluation period. There might be dispersion in terms of goals, which can affect the global efficiency of the research, given the low number of researchers. TTI is very active in the organisation of specialised international conferences in their field of activity such as space and security, reliability and statistics in transport and telecommunication, development of air cargo transportation, Transbaltica.

TTI is also very active in specialised journal editions (Computer modelling and new technologies, Transport and telecommunication, Research and Technologies-Step into the Future). Overall, the Transport and Telecommunications Institute is a rather strong national player, with some international recognition.

Impact on the scientific discipline

The specific scientific discipline covered by the Institute is well defined and rather coherent, with a possible exception of the work on assessing higher education. Most of the publications appear in local or regional journals or conferences. That is why their impact is rather low, despite the fact that the Institute has an established awareness at the national or regional levels. The number of publications in prestigious international journals with high impact is limited. The number of research outputs and citations in Scopus are relatively low. The number of research outputs is high, both in absolute terms and if numbers are normalised per researcher.

Collaboration at the national level is good. Efforts with foreign collaborators have been moderate. Recognition has been obtained recently through invitations and book editing at the international level especially in the field of statistical analysis and automatic control. Furthermore, the Institute has included the role of renewable energies and new transportation tools in its research topics. This approach to innovation is only slightly mentioned in the report. However, the President Igor Kabashkin has presented the Transport and Energy Competence Centre, as a collaborative research coordination structure, during the visit. Overall, the Transport and Telecommunications Institute is a strong national player with some international recognition.

Economic and social impact

The Transport and Telecommunications Institute has obtained one patent. No trademark has been registered during the whole period under evaluation: this might reduce the attractiveness of the Institute to the industry in a sector which is very much tuned to applications. Publications with users are rather limited. Employment of nearly half of the doctoral graduates in business or in public services is positive in terms of impact. Collaborations and visits with the business/public sector are average, however visits abroad or to the unit practically do not exist.

Their significant involvement in national, interregional and European projects (COST and FP7) recognises them as a future major international player. They plan to apply to H2020 in the future. The moderate relations with industry until 2011, might have generated hesitations in terms of strategy in this very applied research field. Recently, TTI has been pro-active by signing agreements of cooperation with Lufthansa, Boeing and Airbus on maintenance training education programmes. The Institute members are very well involved in learned society's boards, consulting, invited to national, regional conferences programme committees.

The societal impact of research is mostly visible with regards to the definition of transportation policies. However, the impact on job creations is low despite the fact that there are many opportunities in the field of transport management and control. Training provided to doctoral students has been reasonable, given the size of the Institute. The education programme is sustained at a good level and seems to be satisfying about 4000 students. Overall, the research of the Transport and Telecommunications Institute is important for society.

Research environment and infrastructure

The Transport and Telecommunications Institute has a rather small number of academics and researchers, but quite a high number of support personnel. Organisation of the management of research at the Institute is given an average description. The same holds for the long-term strategic and financial resource planning, including the human resource development strategy. The research is centred mainly on the themes of transportation and telecommunications, and the work is carried out mainly in a number of laboratories which seem to be well equipped. The ratio of students involved in research to the overall number of staff members is reasonable. Overall, the Institute provides a research environment that is comparable with globally recognised academic institutions in its discipline, although the management and resource planning activities need some elaboration.

Most of the available equipment, software and databases are accessible to students and researchers unless specified (network research). These tools are accessible through international cooperation at the European and international level (US mainly); most of them are state of the art. The Institute has new equipment and their facilities compare with the best places in Europe for aircraft research. The 2D (2D Maintenance Training Device and Virtual Aircraft) and 3D (3D Virtual Procedure Trainer) maintenance training platforms of their Academic and Professional Aviation Centre, shown during the visit, are good examples. During the visit, very good exchanges were established with management (President Igor Kabashkin and Rector Irina Yatskiv), professors, researchers and PhD students. The latter claimed satisfaction in working in good conditions and with higher salaries than the average.

Development potential

The Master and PhD levels programmes should be sustained and might be added to by a Post Doc programme with an encouragement to entrepreneurship in parallel. This orientation should be encouraged at the University level for the Institutes that practice their research in very applied fields. Encouragements to spin off activities will boost as well the advanced research policy in applied fields.

The Transport and Telecommunication Institute is among those Institutes which deliver high standards of education and are able to achieve such a goal.

The Institute has a clear vision for the future priorities and reasonably defined plans: in the area of logistics, modelling and simulation of transportation. Strengths, weaknesses, opportunities and threats are realistically assessed.

The size of the Institute is rather large, but its ability to attract high-level doctoral students and scientists from abroad is limited. The ratio of non-state to state funding is high. Efforts to attract international funding are evolving. Involvement in promising international collaboration projects and networks is rather limited but evolving. The Institute includes in its future strategy sustained activities in virtual reality (signed cooperation agreement with Fraunhofer), safety management and education and training in collaboration with local and international partners (such as Boeing and Airbus) in the frame of a platform supported by the Ministry of Education and the EU – Aviation Research Centre. Overall, the Transport and Telecommunications Institute is capable of remaining a visible local player in its area of research, and is becoming a trustworthy partner within the international scientific community.

Conclusions and recommendations

The Transport and Telecommunications Institute is a well-managed unit of 220 research staff (41 TFE) which is recognised in its field of expertise at the national and regional level and has some international recognition. They provide a very good framework and infrastructure in the field of transport logistics modelling and simulation research, education and professional training. These assets will certainly strengthen their position to become a major international player with major academic as well as industrial partners. The dynamic management of the Institute is keen on pushing in that direction.

The Transport and Telecommunications Institute is actively and strongly involved in national, regional and European networks. At the national level they could benefit from strong collaboration with other local institutes in the field of education, software and telecommunication to strengthen their position. Some incentive might be given to collaborate with expert units in energy management.

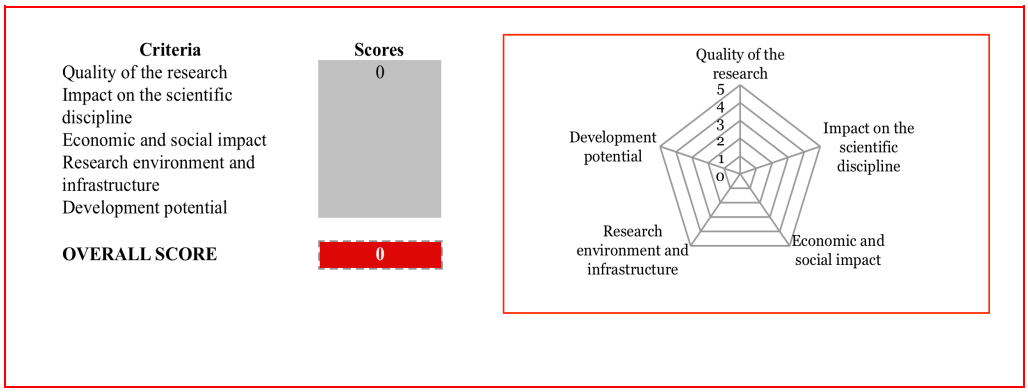
21. E_20 JSC Riga Electric Machine Building Works

Name of the institution	JSC Riga Electric Machine Building Works
Name of university	N/A
Type of institution	State Scientific Institute

JSC Riga Electric Machine Building Works is a State Scientific Institute, with 3 FTE in 2011. The Scientific Research and Testing Centre of the institute was established in September 2011, although R&D had been started there long before that.

The main activities of the Institute are testing of electric machines, electric equipment, control systems and their prototypes.

Figure 20 Scores: E_20



Main activities of the institute are testing of electric machines, electric equipment, control systems and their prototypes.

Overall Score

The institution is not conducting any significant research activities.

Quality of Research

The Institute is not conducting any significant research activities, but is largely active as a testing and development centre for electric equipment. This is also illustrated by the very limited scientific output in papers etc.

Conclusions and recommendations

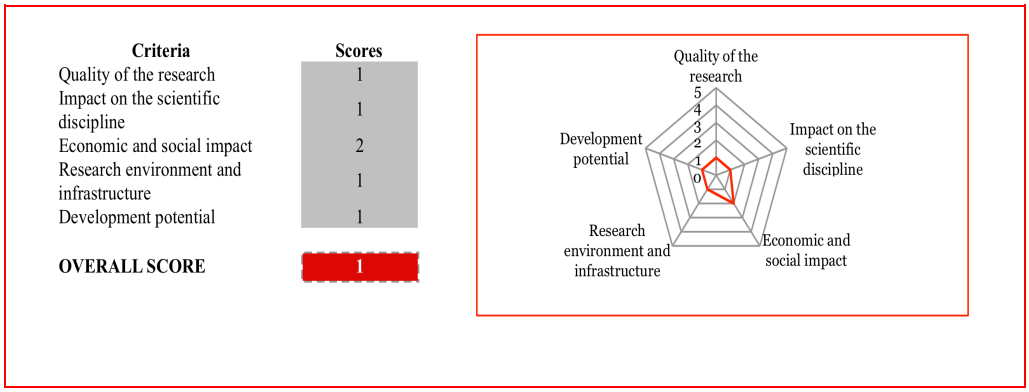
The Institute is not assessed as a research institute. If the ambition exists to become a research unit, it is recommended that active collaboration is set-up with relevant university research groups or to merge the Institute with a relevant university research unit.

22. E_21 VU Institute of Sociotechnical Systems Engineering

Name of the institution	VU Institute of Sociotechnical Systems Engineering
Name of university	Vidzeme University of Applied Sciences (VU)
Type of institution	University

This is a small unit in the Vidzeme University of Applied Sciences (VU), a relatively small university situated in Valmiera. It deals with Sociotechnical Systems Engineering which is an unusual research topic area combining five research areas: Logistics Information Systems and RFID Technologies; Heterogeneous and Distributed Simulation Technologies and Tools, Politics Simulation Systems; Virtual and Augmented Reality Technologies in E-Learning; and Technologies Acceptance and Sustainability Simulation. The Institute has participated in two FP7 projects (one is still ongoing), however in terms of publications its research output is not good.

Figure 21 Scores: E_21



Overall Score

There is little evidence or record of achievements in the international research arena.

Quality of Research

This unit is described as a Sociotechnical Systems Engineering Institute. The sociotechnical research mix, such as computer science and psychometrics is unusual.

There is no explicit or detailed explanation of the Institute's research and achievements – a list of topics and publications is given only.

Although there are only 9 FTE researchers, five research areas are listed: Logistics Information Systems and RFID Technologies; Heterogeneous and Distributed Simulation Technologies and Tools, Politics Simulation Systems; Virtual and Augmented Reality Technologies in E-Learning; and Technologies Acceptance and Sustainability Simulation. This is a large number for such a small group.

Impact on the scientific discipline

The total number of research outputs is small. Moreover, the 7 publications listed contain no journal publications, only contributions to non-highly-ranked conferences. The best papers collection is quite weak.

The publications suffer from a low number of citations. There are some international collaborators listed, which likely are involved in the Framework projects.

Economic and social impact

The description of the Institute's societal impact is however not well explained. The main impact would seem to be through FP 7 projects but the Latvian contribution is not clear or detailed.

There is little detail of contributions to society. The Institute has participated in two EU 7 framework projects, and performs a limited amount of contract research. There is some work with industry.

Only 1 PhD has been awarded in the reporting period.

Research environment and infrastructure

The technical infrastructure is reported as satisfactory, but there is only a limited access to the scientific literature, and a lack of funds for e.g. travel. The infrastructure is based on an RFID lab and virtual reality lab; they have developed projects with a local industry and a museum.

Development potential

The Institute has a mission statement and objectives. They have given very specific objectives and deliverables of what is to be achieved over the coming years – given the current record it is not clear if they can be achieved. For example it says to obtain 5 patents by 2016 yet the Institute currently has no patents.

The Institute carries out an unusual sociotechnical research mix. The general low quality and quantitative output is a concern. The funding level is low. The research strategy is generally formulated and does not give a convincing impression.

Conclusions and recommendations

The research output of this small Institute in the international arena is very limited and it is difficult to see why such an Institute should be funded.

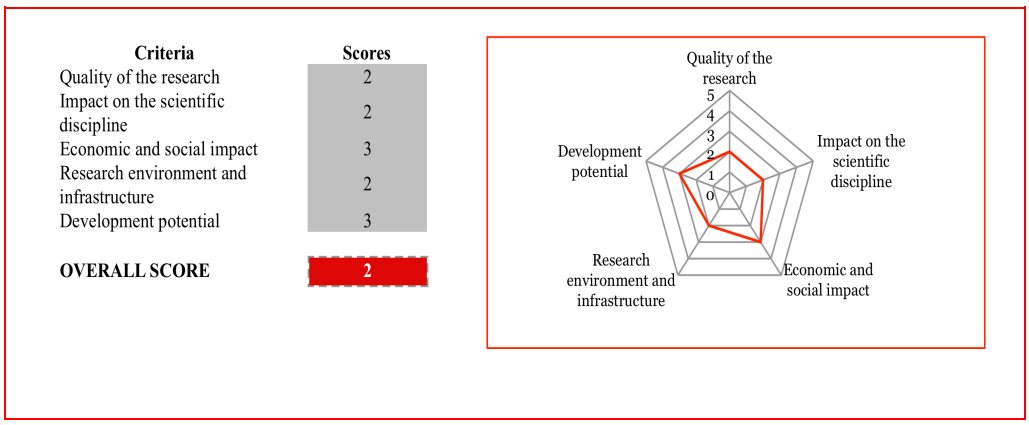
23. E_22 RTU Faculty of Architecture and Urban Planning

Name of the institution	RTU Faculty of Architecture and Urban Planning
Name of university	Riga Technical University (RTU)
Type of institution	University

The Faculty of Architecture and Urban Planning of Riga Technical University is the only higher education institution in Latvia offering education in the areas of architecture, territorial planning and restoration of cultural monuments. The Faculty also offers specialisation in interior and landscape architecture.

Research at the Faculty focuses mainly on the history of architecture, the protection of cultural monuments, urban planning and spatial planning. The number of academic and research personnel (FTEs) in the Faculty is rather small and the student body is the smallest in RTU.

Figure 22 Scores: E_22



Overall Score

The quality of research and impact on the scientific discipline is average as per international standards. Its economic and social impact is satisfactory. Research infrastructures are not given detailed descriptions. Research conducted at the Faculty is relevant to national needs.

Quality of Research

Research in the Faculty of Architecture and Urban Planning is published mainly in conference proceedings and in regional journals. Publications in prestigious international journals are practically non-existent. The number of research outputs is sufficient, both in absolute terms and if numbers are normalized per researcher. However, the number of research outputs and citations in Scopus are extremely low. Collaboration at the national level is evolving but efforts with foreign collaborators have been limited. The international profile of researchers, as evidenced e.g. by invited lectures, editorial boards, awards etc. is not high, as per international standards. Overall, the Faculty of Architecture and Urban Planning is a satisfactory national player, with limited international recognition.

Impact on the scientific discipline

The scientific discipline covered by the Faculty of Architecture and Urban Planning is spread over architecture and urban planning. The number of publications in high quality

international journals with high impact is practically zero. Overall, the Faculty of Architecture and Urban Planning has a stable position in the national scientific community, whereas its position within the international scientific community is still evolving and its impact at international level is somehow undetermined.

Economic and social impact

No patents have been registered. Publications with users are limited. Training provided to doctoral students has been satisfactory. The fact that some (two) of the doctoral graduates have been employed outside academia is positive. Collaborations and visits with the business/public sector are quite limited. Non-academic collaborations are also limited. Membership in committees and on scientific advisory boards of non-academic entities is good. The societal impact of the research is mainly related to interaction with municipalities and institutes from the state administration. Overall, the research of the Faculty of Architecture and Urban Planning is important for society and the Institute's interaction with non-academics (business, policy makers, and the public) is moderate.

Research environment and infrastructure

The Faculty of Architecture and Urban Planning comprises a unit within the Riga Technical University with a small number of academics and researchers, limited administrative personnel and sufficient technical personnel. Organisation of the management of research at the Faculty is not given in a clear description. The same holds for the long-term strategic and financial resource planning, including the human resource development strategy. The available research infrastructure is not described in sufficient detail to assess. The ratio of students involved in research to the overall number of staff members is satisfactory. Overall, the Faculty provides a research environment that is still evolving to achieve a level that is expected in the internationally scientific community of a respected institution.

Development potential

The Faculty's vision and plans for the future are reasonably well defined. Strengths, weaknesses, opportunities and threats are well assessed. The size of the Faculty is rather small and its ability to attract high-level doctoral students and scientists from abroad is limited. Non-state funding is quite low. Research conducted at the Faculty is relevant to national needs. Involvement in promising international collaboration projects and networks does not seem to be in place. Overall, the Faculty of Architecture and Urban Planning is capable of remaining a visible local player in its area of research (and probably the only one), which can be expected to contribute to the activities of the international scientific community.

Conclusions and recommendations

The Faculty of Architecture and Urban Planning of Riga Technical University is the only higher education institution in Latvia offering education in the areas of architecture, territorial planning and restoration of cultural monuments. Overall, the Faculty is capable of remaining a visible local player in its area of research, which from time to time can be expected to contribute to the activities of the international scientific community.

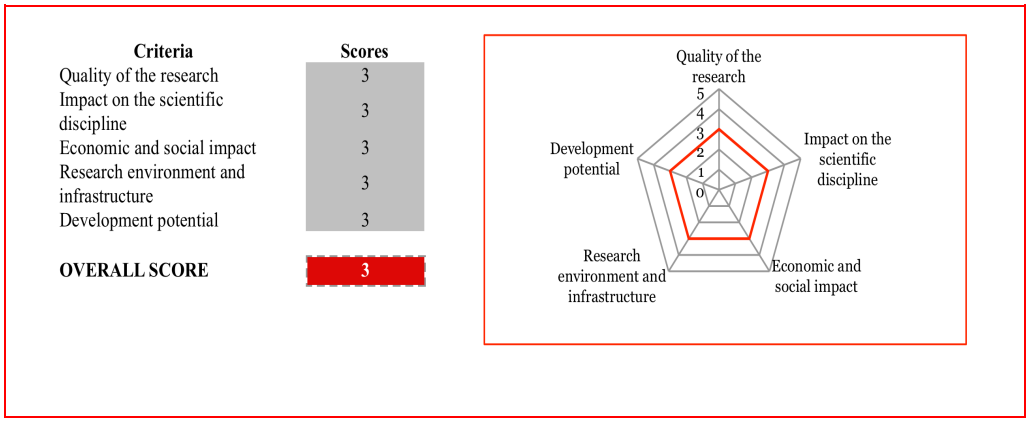
24. E_23 RTU Institute of Materials and Structures

Name of the institution	RTU Institute of Materials and Structures
Name of university	Riga Technical University (RTU)
Type of institution	University

The Institute of Materials and Structures is part of the Faculty of Civil Engineering at RTU and included within the Centre for Building Science at RTU (E_02), which was established in 2005 with the aim to promote interdisciplinarity among the construction industry science and other industries.

Research in the Institute is focussed on the development of new construction materials for civil engineering applications.

Figure 23 Scores: E_23



Overall Score

The Institute is a strong national player with some international recognition and is capable of remaining a strong national player with the potential to become a trustworthy international partner.

Quality of Research

Research at the Institute of Materials and Structures focuses on the development of new products with high added value. Researchers of the Institute have published the results of their research in regional journals, in some international journals as well as in conference proceedings. A number of publications appear in good quality international journals. The number of research outputs is average, in absolute terms, but high if numbers are normalised per researcher. The number of research outputs and citations in Scopus are average. Training provided to doctoral students has been satisfactory given the size of the unit. The international profile of researchers, as evidenced e.g. by invited lectures, editorial boards, awards etc. is low. Unfortunately no ISI papers were published after 2009, although the participation in conferences is increasing. The Institute is a strong national player with some international recognition.

Impact on the scientific discipline

The specific scientific discipline covered by the Institute of Materials and Structures is well defined. The number of publications in prestigious international journals with high impact is average. Collaboration at the national level is good, especially with enterprises. Efforts with foreign collaborators have been moderate. The international profile of

researchers, as evidenced e.g. by invited lectures, editorial boards, awards etc. is low. Together with the limited number of ISI publications the Institute lacks the international visibility to be a strong international player. This has been recognised (see SWOT) and international cooperation have been set up.

Economic and social impact

Publications with users are limited. No doctoral graduates have been employed in business or in public services yet. Collaborations and visits with the national business/public sector are good. Membership in committees and in scientific advisory boards of non-academic entities is low. The societal impact of research is positive, especially with regards to new materials research. Overall, the research of the Institute of Materials and Structures is important for society; the Institute's interaction with non-academics (business, policy makers, etc.) is moderate. There are many small projects with local industries that will be good experience for master students and young researchers. Unfortunately this work only occasionally will lead to scientific output and generation of new knowledge.

Research environment and infrastructure

The Institute of Materials and Structures comprises a unit within the Faculty of Civil Engineering with a small number of academics and researchers, no administrative personnel but sufficient technical personnel. Organisation of the management of research at the Centre is not given a clear description. The same holds for the long-term strategic and financial resource planning, including the human resource development strategy. The work is carried out mainly in laboratories with average equipment in materials research. The ratio of students involved in research to the overall number of staff members is rather high. Overall, the Institute provides a research environment that is still evolving to achieve a level that is expected in the international scientific community of a respected unit in the discipline of materials and structures. The Institute has a good balance of state and external funding. The Institute should aim to get involved in the forthcoming European programmes in Horizon 2020. Cooperation in COST is acknowledged. However finances are apparently insufficient for maintenance and investment of laboratory equipment (see SWOT), although the Institute has a substantial amount of application projects with local industries.

Development potential

The Institute has a reasonably clear vision for the future and reasonably defined plans. Strengths, weaknesses, opportunities and threats are realistically assessed. The size of the Institute is small and its ability to attract high-level doctoral students and scientists from abroad is quite limited. The ratio of non-state to state funding is relatively high. The fact that international funding comes mainly from framework projects is quite positive. Research conducted at the Centre has a strong component relevant to national needs. Involvement in promising international collaboration projects and networks is evolving. Overall, the Institute of Materials and Structures is capable of remaining a visible local player in its area of research, with good potential to become a trustworthy partner within the international scientific community. The Institute could have a clearer long-term strategy with measurable objectives and milestones. This will improve the international visibility and the potential to attract good quality scientist. In particular the work on sustainable materials and recycling has international scope.

Conclusions and recommendations

The Institute has the potential to become a strong international player. To achieve this, the Institute should develop a long-term strategy with clear objectives and milestones and should develop further partnerships with European research and industrial organisations. The Institute is already involved in European projects and should continue to do so, in order to improve its international visibility and recognition.

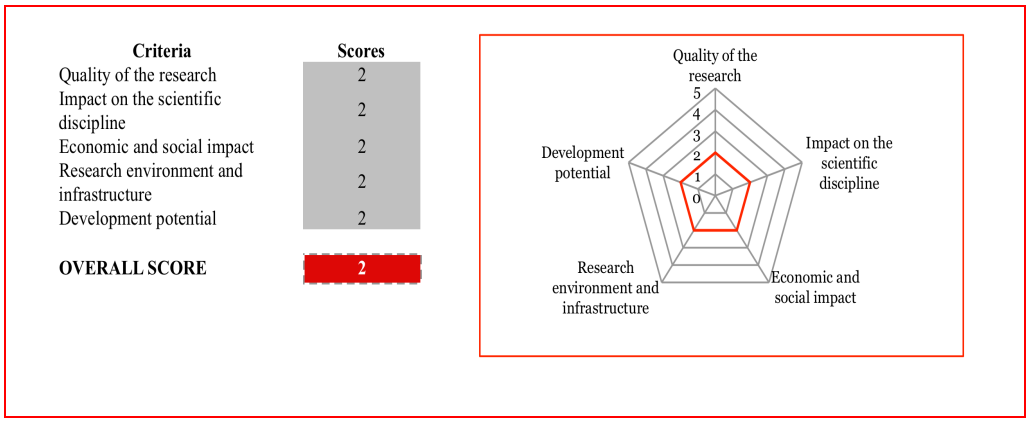
25. E_24 RTU Institute of Structural Engineering and Reconstruction

Name of the institution	RTU Institute of Structural Engineering and Reconstruction
Name of university	Riga Technical University (RTU)
Type of institution	University

The Institute of Structural Engineering and Reconstruction is part of the Faculty of Civil Engineering at RTU and included in the Centre for Building Science at RTU (E_02), which was established in 2005 with the aim to promote interdisciplinarity among the construction industry science and other industries.

Research in the Institute is focused around a number of topics in structural engineering, including mechanics, composite materials, computer-aided design etc. The number of FTEs in the Institute was 11 in 2011.

Figure 24 Scores: E_24



Overall Score

Research carried out at the Institute is interesting. The quality of research and impact on the scientific discipline is average as per international standards. Its economic and social impact is moderate. The research infrastructure is moderate.

Quality of Research

Research at the Institute of Structural Engineering and Reconstruction is well focused in structural engineering; a small part of it is related to materials technology. Researchers of the Institute have published the results of their research mainly in regional journals and in conference proceedings. Publications in high quality international journals are quite limited. Overall, the Institute of Structural Engineering and Reconstruction is a satisfactory national player, with relatively limited international recognition.

Impact on the scientific discipline

The specific scientific discipline covered by the Institute is interesting and well defined. The number of publications in prestigious international journals with high impact is quite limited. The number of research outputs is average, in absolute terms, but rather low if numbers are normalised per researcher. The number of research outputs and citations in Scopus are low. Collaboration at the national level is limited and efforts with foreign collaborators have also been limited. The international profile of researchers, as

evidenced e.g. by invited lectures, editorial boards, awards etc. is low. Overall, the Institute of Structural Engineering and Reconstruction has a stable position in the national scientific community, whereas its position within the international scientific community is still evolving.

Economic and social impact

The Institute of Structural Engineering and Reconstruction has obtained a reasonable number of patents, all valid at the national level. Publications with users are limited. Training provided to doctoral students has been rather low, given the size of the unit. No doctoral graduates have been employed in business or in public services yet. Collaborations and visits with the business/public sector are limited. Non-academic collaborations are limited. Membership in committees and in scientific advisory boards of non-academic entities is quite limited. The societal impact of the research should be more positive, however this has not fully demonstrated. Overall, the research of the Institute of Structural Engineering and Reconstruction is important for society and the Institute's interaction with non-academics (business, policy makers, and the public) is moderate.

Research environment and infrastructure

The Institute of Structural Engineering and Reconstruction comprises a unit within the Faculty of Civil Engineering with an average number of academics, limited administrative personnel and no technical personnel. Organisation of the management of research at the Institute is not given as a clear description. The same holds for the long-term strategic and financial resource planning, including the human resource development strategy. The experimental work is carried out in rather poorly equipped laboratories. The ratio of students involved in research to the overall number of staff members is rather low. Overall, the Institute provides a research environment that is still evolving to achieve a level that is expected in the international scientific community of a respected unit in the discipline of structural engineering.

Development potential

Strengths, weaknesses, opportunities and threats are realistically assessed. The size of the Institute is average, but its ability to attract high-level doctoral students and scientists from abroad is limited. Overall funding is low and the ratio of non-state to state funding is low. Involvement in promising international collaboration projects and networks is quite limited. Overall, the Institute of Structural Engineering and Reconstruction is capable of remaining a visible local player in its area of research, which from time to time can be expected to contribute to the activities of the international scientific community.

Conclusions and recommendations

The Institute of Structural Engineering and Reconstruction is a relatively small unit in the Faculty of Civil Engineering at RTU. The Institute deals with interesting research problems, however it lacks visibility at the international level.

The Institute should develop a more ambitious strategy plan to ensure its long-term future and viability with a clear focus on external funding and attraction to young scientists. Moreover, some synergy and collaboration with the Institute of Materials and Structures and the Institute of Transport Infrastructure Engineering in the same Faculty could be beneficial for all units.

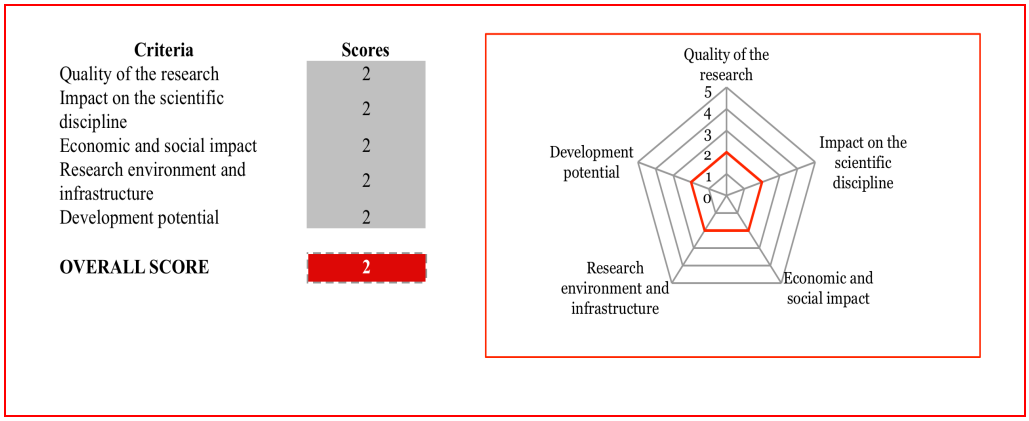
26. E_25 RTU Institute of Transport Infrastructure Engineering

Name of the institution	RTU Institute of Transport Infrastructure Engineering
Name of university	Riga Technical University (RTU)
Type of institution	University

The Institute of Transport Infrastructure Engineering is a unit within the Faculty of Civil Engineering at RTU, with a size of 9.5 FTEs (in 2011). It is part of the Centre for Building Science at RTU (E_02), which was established in 2005 with the aim to promote interdisciplinarity among the construction industry science and other industries.

Research activities are in the fields of road transport infrastructure (mainly asphalt pavements) as well as in geomatics.

Figure 25 Scores: E_25



Overall Score

The quality of research and impact on the scientific discipline is average as per international standards. Its economic and social impact is moderate. Research infrastructures are adequately developed.

Quality of Research

Research at the Institute of Transportation Engineering is focused mainly in pavement materials and transportation systems. Researchers of the Institute have published the results of their research mainly in regional journals and in conference proceedings. Publications in high quality international journals are quite limited. The number of research outputs is low, both in absolute terms and if the numbers are normalised per researcher. The number of research outputs and citations in Scopus are low. The international profile of researchers, as evidenced e.g. by invited lectures, editorial boards, awards etc. is low. Overall, the Institute of Transportation Engineering is a satisfactory national player, with relatively limited international recognition.

Impact on the scientific discipline

The specific scientific discipline covered by the Institute is well defined; research is strongly application-oriented for domestic governmental bodies. The number of publications in high quality international journals with high impact is quite limited. Efforts with foreign collaborators have been average. The international profile of researchers, as evidenced e.g. by invited lectures, editorial boards, awards etc. is low. Overall, the Institute of Transportation Engineering has a stable position in the national

scientific community, whereas its position within the international scientific community is still evolving.

Economic and social impact

No patents have been registered. Publications with users are limited. Training provided to doctoral students has been average, given the size of the unit. No doctoral graduates have been employed in business or in public services yet. Collaborations and visits with the business/public sector are limited. Non-academic collaborations are limited. Membership in committees and in scientific advisory boards of non-academic entities is quite limited. The societal impact of research is positive, as far as aspects of road pavement quality is concerned. Overall, the research of the Institute of Transportation Engineering is important for society and the Institute's interaction with non-academics (business, policy makers, and the public) is still evolving.

Research environment and infrastructure

The Institute of Transportation Engineering comprises a unit within the Faculty of Civil Engineering with an average number of academics, some technical personnel but no administrative personnel. Organisation of the management of research at the Institute is not given a clear description. The same holds for the long-term strategic and financial resource planning, including the human resource development strategy. The experimental work is carried out in reasonably well-equipped laboratories. The ratio of students involved in research to the overall number of staff members is average. Overall, the Institute provides a research environment that is still evolving to achieve a level that is expected in the international scientific community of a respected unit in the discipline of transportation engineering.

Development potential

The Institute has a clear vision for the future and reasonably defined plans. Strengths, weaknesses, opportunities and threats are realistically assessed. The size of the Institute is rather average, but its ability to attract high-level doctoral students and scientists from abroad is limited. Overall funding is low but the ratio of non-state to state funding is average. Involvement in promising international collaboration projects and networks is quite limited. Overall, the Institute of Structural Engineering and Reconstruction is capable of remaining a visible local player in its area of research, which from time to time can be expected to contribute to the activities of the international scientific community.

Conclusions and recommendations

The Institute of Transport Infrastructure Engineering is a unit in the Faculty of Civil Engineering at RTU. The unit conducts research in transportation materials (e.g. asphalt pavements) and geomatics and provides services, however it lacks visibility at the international level.

The Institute should develop a more ambitious strategy plan to ensure its long-term future and viability with a clear focus on external funding and attraction to young scientists. Moreover, some synergy and collaboration with the Institute of Materials and Structures and the Institute of Structural Engineering and Reconstruction in the same Faculty could be beneficial for all units.

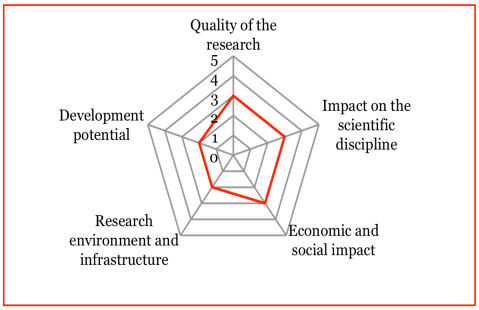
27. E_26 RTU Department of Engineering Mathematics

Name of the institution	RTU Department of Engineering Mathematics
Name of university	Riga Technical University (RTU)
Type of institution	University

The Department is part of the Faculty of Computer Science and Information technologies of Riga Technical University. The research personnel correspond to 16 FTEs. There are 3 Professors and Assistant Professors; the majority (9) of the rest of the staff are listed as Lecturers. Research is conducted mainly in Fluid Flow Stability, Water Quality Analysis, Eddy Current Non-destructive Testing, and Statistical Modelling.

Figure 26 Scores: E_26

Criteria	Scores
Quality of the research	3
Impact on the scientific discipline	3
Economic and social impact	3
Research environment and infrastructure	2
Development potential	2
OVERALL SCORE	**2**



Overall Score

The work conducted in fluid flow stability is carried out at a high international level, but it seems to centre on a single PI. The rest of the research is not at the same level. Although the total number of people involved in research is 17, there seems to be only a small number of people that actively contribute to the research output.

Quality of Research

Although a total volume of 16 FTE researchers is reported, only 4 staff publications are reported in the self-evaluation report. Determining an average score for the Department is challenging since there seems to be one researcher and one field that stands out, namely, fluid flow stability. This work is of internationally high quality, published in the leading journals in the field. The research in non-destructive testing and statistical modelling displays some international presence, but in venues with less impact.

Impact on the scientific discipline

The citation statistics are good. The Department's fluid flow stability group enjoys good international connections with e.g. Ottawa and Hong Kong. The Department also participates in EU framework programmes. Thus the Department has contributed in the international arena.

Economic and social impact

The Department educates a very low number of PhD students. The research directions of the Department, analysis of drinking water, hydrodynamics, and non-destructive testing, are clearly relevant for the Latvian economy. The one cooperation with non-

academics seems to be some work related to coin validators. However, taking into account the low number of people that seem to be active in research, the level of interaction can be assessed only as satisfactory.

Research environment and infrastructure

The size of the Department has shrunk from a staff of 41 in 2007 down to the present level of 24. This development is likely to have had a serious effect on the research environment and the morale. The Department reports a fairly large number of technical personnel in comparison to the total staff. The Department has only limited access to library databases and reports insufficient funding for purchase of technical equipment and scientific software. It is not clear whether fluid mechanics software has been developed in house.

Development potential

The Department is already a quite strong international player in some areas. However, the situation is very sensitive, since the research of highest quality seems to be centred mostly on one PI. There is a troubling extreme dependence of external funding: there is no reported state budget funding at all! The funding per researcher is quite low. There is no clear forward development plan given for the Department.

Conclusions and recommendations

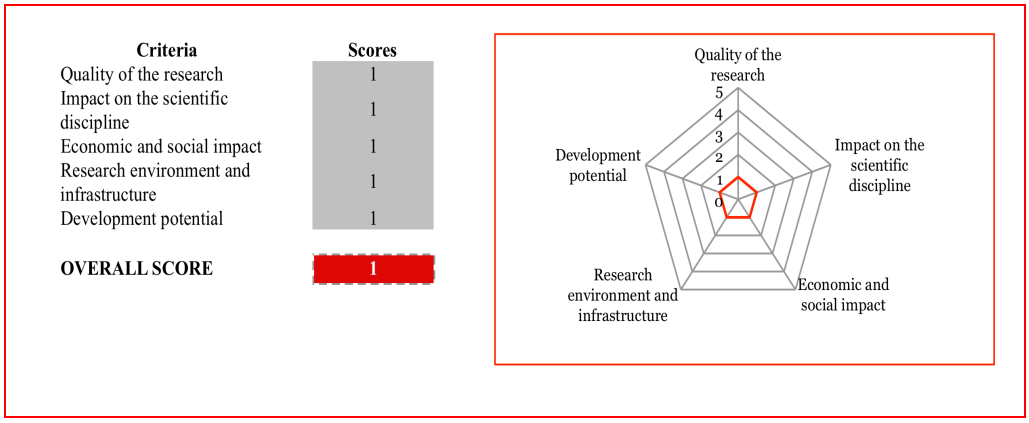
The apparently small number of people that actively contribute to the research output is problematic. Also the low level of funding is troubling. There is a lack of a forward development plan in the self-evaluation. The Department thus faces serious management challenges in the future, and a reorganisation of the unit within RTU—without losing their competence, particularly in fluid mechanics and non-destructive testing—should be considered.

28. E_27 RTU Department of Probability Theory and Mathematical Statistics

Name of the institution	RTU Department of Probability Theory and Mathematical Statistics
Name of university	Riga Technical University
Type of institution	University

The Department is part of the Faculty of Computer Science and Information Technologies of Riga Technical University. It reports a research activity corresponding to 4 FTEs. The personnel are Professors and Associate or Assistant Professors. Research is conducted within the topics of Probability Theory and Mathematical Statistics.

Figure 27 Scores: E_27



Overall Score

The overall performance of the Department is poor.

Quality of Research

The Department is very small and has produced a very low number of publications, sometimes zero, but with a sudden spike in 2011. The paragraph 2.1. The unit's research is left blank in the self-assessment! Also other sections of the self-evaluation are mostly empty. During the period 2006–2012 there are no publications in the category 1. Original articles... and only a handful in conference proceedings and an obscure Slovakian journal. The unit's best publications contains an unpublished manuscript.

Impact on the scientific discipline

There are *zero* citations in the reported period. The impact is nil.

Economic and social impact

This section in the self-assessment report is left blank, as is most other sections as well. There is no doctoral training, no Master's degrees, no collaboration with industry or society, and no outreach activities.

Research environment and infrastructure

This seems to be a very small Department with reducing personnel. There is no funding (core, state budget, research programs, ESF/ERAF, FP etc.) except for a few very small grants from the Latvian Council of Science.

Development potential

The situation seems desperate. No strategy is provided to address the Department's apparently dire situation.

Conclusions and recommendations

It is difficult to imagine how this unit could have any future. The personnel would likely benefit by becoming a part of a larger unit in which opportunities, funding, and expectation of performance can be raised to an acceptable level.

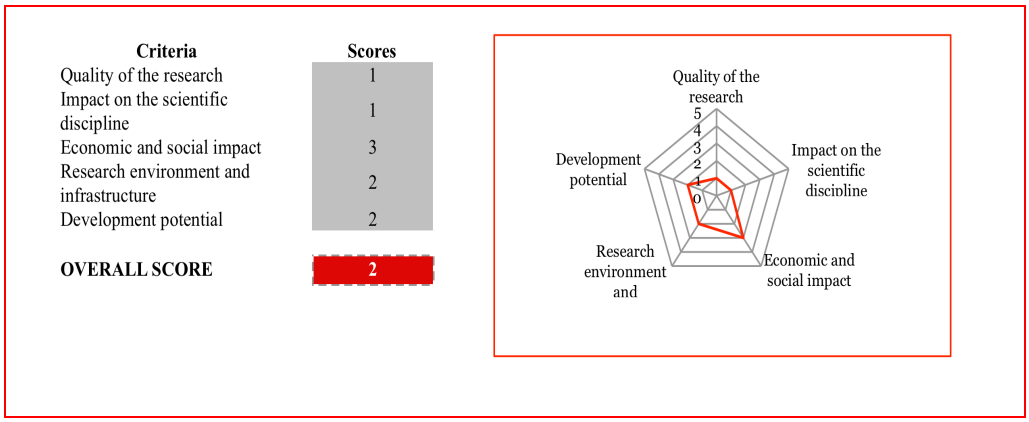
29. E_28 RTU Environment Modelling Centre

Name of the institution	RTU Environment Modelling Centre
Name of university	Riga Technical University (RTU)
Type of institution	University

This is a small Centre within Riga Technical University's Faculty of Computer Science and Information Technologies focusing on modelling and simulation of water based phenomena.

The Centre was founded in 1993, as the successor to the scientific laboratory of Electrical Simulation (founded in 1960). At present, the team includes 5, 25 FTEs, including specialists in information technology, hydrogeologists, mathematicians having knowledge in the fields of mathematical physics, of probability theory and mathematical statistics. It was involved in developing the regional hydrological management of Latvia for 2010-2012.

Figure 28 Scores: E_28



Overall Score

This is a small Centre with basically a single focus on one topic. It is not producing research at the international level but is an area of important societal impact.

Quality of Research

The Centre hosts only a small research staff and is focused on modelling and simulation of water based phenomena pursued by an interdisciplinary research team. There is no detailed explanation of the achievements or success of the research.

Impact on the scientific discipline

Some of the selected publications are locally focussed so the international impact is low.

There does not appear to be any permanent academic personnel attached to the Centre. There were no visits abroad or visitors from abroad so little international impact.

Although the work appears to be crucial from a societal point of view, the impact on the scientific discipline is low. The work concerns mostly implementation of known procedures for local use. No international academic cooperation is reported.

Economic and social impact

There are no MSc or PhD students completing. The Centre has carried out a number of projects in conjunction with local companies and government, which directly impact the environment hence the contribution to society, is direct.

The Centre carries out contract work to create hydrogeological models for groundwater management, an activity of obviously high societal importance.

Research environment and infrastructure

The Centre reports adequate infrastructure for scientific activities. The funding level is at a medium level compared to other institutes.

Development potential

The self-evaluation presents a well-focused interdisciplinary approach to the modelling of groundwater processes. However, the published works are mostly investigations of contract type as opposed to scientific research. Almost no publications appear in international journals.

The future focus will be on water planning policy and its implementation. There is not a strong case made for the future potential of the Centre.

To stand a chance to develop into a stronger national player the Centre would need to develop a stronger research component. An alternative could be to reorganise into a non-academic research institute devoted to the subject matter.

Conclusions and recommendations

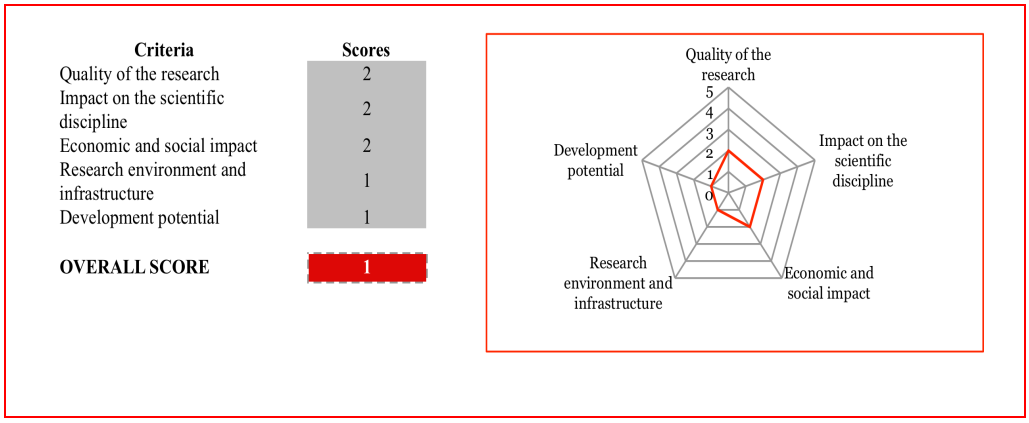
This Centre is not publishing or operating at the international level in publications or research. The topic is of interest to the local community and if maintained it should be merged with a unit with similar or complementary interests.

30. E_29 RTU Institute of Computer Control, Automation and Computer Engineering

Name of the institution	RTU Institute of Computer Control, Automation and Computer Engineering
Name of university	Riga Technical University
Type of institution	University

The RTU Institute of Computer Control, Automation and Computer Engineering is part of the Faculty of Computer Science and Information technology of RTU. Its staff was 13, 5 FTE in 2011. They work on fundamental and application aspects of multimedia and macromedia in the sensor networks environment.

Figure 29 Scores: E_29



Overall Score

The RTU-ICCACE lists a wide range of research topics with emphasis on networks and computer control systems in a number of application areas. In particular a medical wireless system for monitoring heart patients in their local environment; commercial hardware was employed with locally developed software. An interesting and important contribution to society but the contribution to research in the area is not detailed. Other research is mentioned briefly.

Quality of Research

The Institute of Computer Control, Automation and Computer Engineering (RTU-ICCACE) focuses on the research of special multimedia and macromedia technologies in sensor networks environment and on the architecture of control systems, their multimedia support and the development of network infrastructures (system maintainability, availability and safety). Their motivation is the application to modern manufacturing technologies, flexible production, agriculture, medical care and treatment, information technologies, etc. The main research focus is the development of intelligent computer control for system combined management, maintenance and recovery. They have been concentrating on the problems of management, maintenance, diagnostics and recovery tasks for the complex systems, creating decision making algorithms; application of methods of artificial intelligence and information technologies following a variable multifactor approach. Their main implementation is the demonstration on a mobile ECG system requiring a network able to manage sensor information and telecommunication. An interesting and important society project but the contribution to research in the area is not detailed. They are active as well in medical

3D imaging (MRI). Their programme is hardly visible at the national or regional level with a low number of publications/researcher. The dissemination of their research is quite confidential.

Impact on the scientific discipline

The selected publications provide a little more detail of the background to the medical image processing and other topics. In general the publications are short and as a result do not provide an in-depth or detailed treatment of the topics. The impact has not been substantial. There is no significant recognition of the scientific work whether by invitations to conference, scientific boards or journals, participation to national, regional or European consortia. The Institute doesn't claim any cross-disciplinary or multidisciplinary collaboration, which would benefit the quality of the research as well as its impact. The field of sensor network and telecommunication is potentially able to bring many new developments certainly appealing to many publications and good patent opportunities.

Economic and social impact

There is no clear information or strategy delivered on economic and social impact of the research. The RTU-ICCACE trains many master students every year (average of 1 per researcher). The medical work has had a good societal impact. Three PhDs have completed with mainly academic employment. However, PhD, Post doc's programmes are missing in the strategy and are few in reality. No patents have been filed in the considered period of evaluation.

Research environment and infrastructure

The RTU-ICCACE has not responded to questions concerning forward planning, impact on society, doctoral training, research infrastructure etc.

Development potential

The RTU-ICCACE has not responded to questions concerning forward planning, impact on society, doctoral training, research infrastructure etc.

Conclusions and recommendations

The RTU-ICCACE's critical mass is too low and research results are too timid to envisage a clear ambitious strategy for this unit in the future. Ideas and potential applications fields exist in the field of communications and sensor system networks. The necessary resources for their development would be much higher than what an Institute of this size can handle. There would be good opportunities to share these activities under the umbrella of other research units in the Faculty of Computer Science and Information Technology and the Faculty of Electronics and Telecommunications in order to gain in critical mass and visibility.

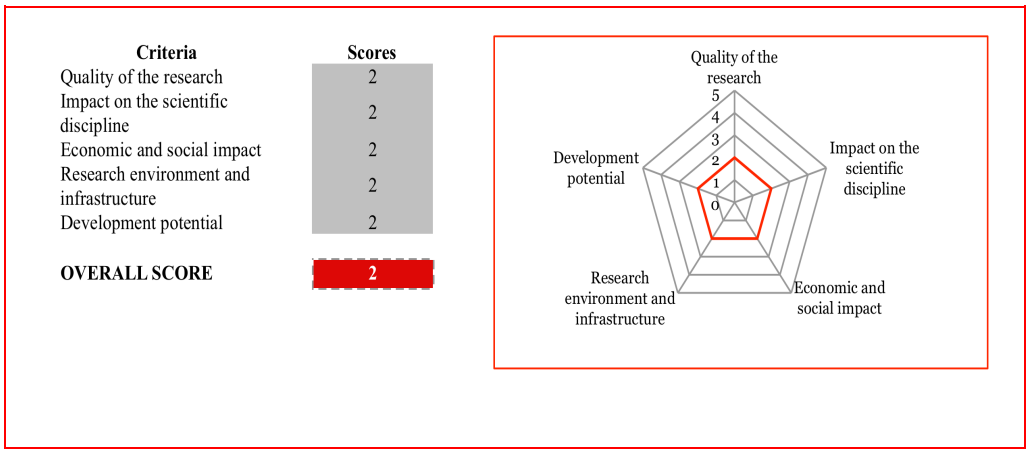
31. E_30 RTU Department of Transport Electronics and Telematics

Name of the institution	RTU Department of Transport Electronics and Telematics
Name of university	Riga Technical University
Type of institution	University

The RTU Department of Transport Electronics and Telematics (RTU-DTET) is an 8 FTE research unit affiliated to the Faculty of Electronics and Telecommunications of Riga Technical University. The RTU-DTET focuses on the study of complex signal processing in transport navigation systems and their modelling.

They have established a Radio Navigation Laboratory (GPS lab) equipped with a satellite signal simulator, an FPGA design platform, and a Computer Network performance-testing laboratory. The RTU-DTET is a local, national player in its discipline.

Figure 30 Scores: E_30



Overall Score

The Department of Transport Electronics and Telematics (RTU-DTET) studies signal processing in the field of transport navigation systems. The research topics are relevant and timely from the scientific and societal points of view. Unfortunately, the impact of the RTU-DTET is only visible at the local and national levels. The RTU-DTET established several research tools which would give them unique possibilities to expand their competences.

The research strategy is described in a very opportunistic way and doesn't point out clear development plans. The age structure is an issue in this team.

Overall, the RTU-DTET appears to be a reasonable national player.

Quality of Research

The Department of Transport Electronics and Telematics (RTU-DTET) focuses on the study of complex signal processing in transport navigation systems and their modelling. They include as well as navigation system testing, wireless communication between mobile objects and infrastructure protocols management and validation, queuing problems in networks and quality of service related issues. Vehicle to vehicle communication optimisation and interaction with network, distance estimation using Intelligent Fusion of Navigation Data (inertia measurement unit and GPS) are among the important research topics. The research activities are very relevant and could have a

large societal impact, as the subjects are sources of innovation. Nevertheless, the research is described in terms of grant titles and seems to be mainly based on system modelling and positioning systems. There is little detail of the approach or the research and what the impact and contribution of the research has been. The RTU-DTET has not pointed out its originality with respect to the international state of the art in this area. Most of the communications appear in local, regional and a few international conferences. They publish peer-reviewed papers in low impact factor journals. A large number of citations are self-citations. Overall, the RTU-DTET has its main audience at the local and national levels.

Impact on the scientific discipline

The Department has a good background in information theory. However, the output of the research needs to be disseminated in journals with higher impact factors (i.e. IEEE ComSoc or the ACM). This affects the total number of citations or citations per researcher which is not higher than 1/researcher over the 5 years period 2006-2011. The number of Master students is significant (up to 19 in 2011) with sustained (between 2 and 4 generally) PhD students. There is a small participation (due to the size of the team) in European FP and Eureka programmes. The listed publications give more details mainly of the positioning system for traffic from both a practical and theoretical/formulaic aspect. The publications are short and do not reflect an in depth treatment of the topic. There is not much cooperation with external organisations and hence the impact on the scientific areas is limited. There is not a lot of foreign collaboration mainly a link with ETH Zurich – with student exchanges.

Economic and social impact

Typically the topics addressed by the RTU-DTET are very often industry driven. Only one collaboration with SAF Tehnika is mentioned for the design of a production tool (not explicit). There is a cooperation programme with employers for student placements and lectures. Most of the contacts with industry are established for training internships purposes (19 in 2011). Only a few research contracts with the industry have been established, which is surprising due to the relevant character of the research topics. In the reference period, 4 PhD dissertations have been defended on queue management, network control modelling, filtering and instabilities in networks. The RTU-DTET has limited participation into European projects mainly on critical paths problems. There are also a number of projects with local authorities on traffic and IT. The age structure is an issue with a majority (5 people) of permanent staff older than 60.

Research environment and infrastructure

The RTU-DTET has access to equipment provided by RTU such as a Radio Navigation Laboratory (GPS lab) equipped with a unique satellite signal simulator, an FPGA design platform, and a Computer Network performance-testing laboratory. A sensor network lab is under development. The infrastructure is based mainly on GCS receivers and network equipment and in comparison to other Latvian units reasonably well equipped. The way the Institute shares its equipment with other units and between research and education activities requires some clarification. The buildings are unfortunately far from being state of the art.

Development potential

The topics studied by the Department of Transport Electronics and Telematics are potentially strong topics in the future of communication and networks management. Short distance wireless communication and their associated networks will request sustained attention in tomorrow's daily life: these methods will be necessary in the field of transport (car to car, train to train, car to object, etc.) as well as domotics (smart homes, etc.). New components will be needed which work in frequency ranges that keep increasing. The Department does not include this topic in its strategy. Many issues for research remain to be addressed (open cyclic networks, signal to noise ratio, data fusions, etc.): these topics will need a strong characterisation and modelling activities. The topics addressed in the area of telematics have tremendous social challenges. There

is room for industrial cooperation and spin off companies. These ambitious challenges should be addressed in a context with higher critical mass. The Department's main focus seems to be on traffic and transport and it is making an impact locally but does not seem to be strong on the international stage. The future seems to be based on continuing the same research themes. The SWOT analysis states 'search for new research areas' which does not indicate a unit with a clear development plan.

Conclusions and recommendations

The Department of Transport Electronics and Telematics (RTU-DTET) is a local national player in the field of signal processing applied to transport navigation systems. Their research is only visible at the local level. Their participation in European projects is low. The staff age structure and the low number of FTE researchers in the unit could become an issue for its future evolution. The research topics are relevant from the scientific and societal viewpoints but the research strategy is very opportunistic without clear development plans. The themes studied by RTU-DTET would certainly gain in visibility if they were part of a larger research unit providing a critical mass on Telecommunications research.

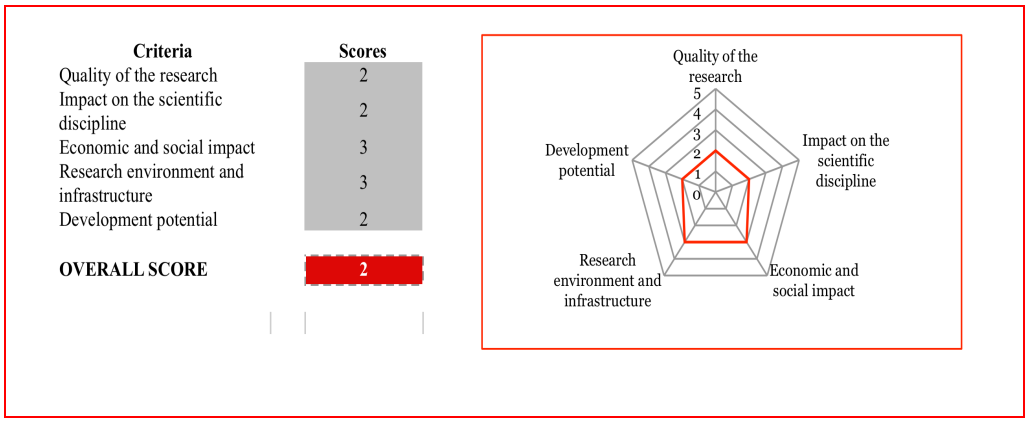
32. E_31 RTU Distance Education Study Centre

Name of the institution	RTU Distance Education Study Centre
Name of university	Riga Technical University (RTU)
Type of institution	University

This is a small Centre of 7 FTEs focussing on distance learning within Riga Technical University's Faculty of Electronics and Telecommunications.

The task of DESC is to organise distance learning and/or e-learning course development and delivery. DESC is also active in R&D activities in interactive television based T-learning, mobile learning, and integration of different media for future life-long learning. Research activities also cover e-inclusion, cognitive aspects of e-learning and e-portfolio design. The Centre is equipped with videoconferencing equipment and multi-media (video, audio, interactivity design) production technology.

Figure 31 Scores: E_31



Overall Score

The Centre is performing satisfactorily at the national level but is not publishing at the international level. There is no clear development for the future of the Centre.

Quality of Research

The main theme of the Centre is distance learning and the thrust seems to be on the integration of different technologies in the production and delivery of eLearning. The group is part of a European initiative in Education Grand Challenges which is taking a long-term view of the problem. The contributions to the subject area are not detailed - it is not clear what their role or contribution has been.

Impact on the scientific discipline

This is a small group and the publication output is also limited. There are 7 (!) different research fields specified for a total of 7 researchers. There are 3 researchers that provide publication lists and almost none of the publications appear in internationally well-regarded journals. Most publications are in conferences of unknown quality. The provided best papers are not convincing, except the first one, in which the DESC researcher is one of 17 authors. The rest of the papers are generally not well written and contain little research content.

There are interaction with foreign collaborators and a fair amount of PhD students, but the impact on the international research discipline is quite limited.

Economic and social impact

The contribution to society has been through courses to universities, industry and public authorities. The impact is not described. There is a good level of interaction with industrial partners, partner universities, and government entities.

Research environment and infrastructure

The infrastructure is reported to be adequate for this quickly developing field. The Centre has a quite good level of funding per researcher in comparison to other units.

Development potential

There does not appear to be any permanent academic staff in the unit; only researchers. There is no management plan given. Many of the self-assessment sections are only briefly addressed. The strategy is to continue existing themes with more international research projects but it is not detailed as to how the latter will be achieved. They state that they foresee a reduced request for distance learning in the future - their main business.

Commercial products that replace the Centre's capabilities could become a real threat to the Centre's more practical deliverables. The scientific research leg of the activities is not very strong.

Conclusions and recommendations

This Centre has a clear focus on distance learning but is not having an impact internationally. It has a small number of staff and limited outputs and should be regarded as a research group and included in bigger computing entity.

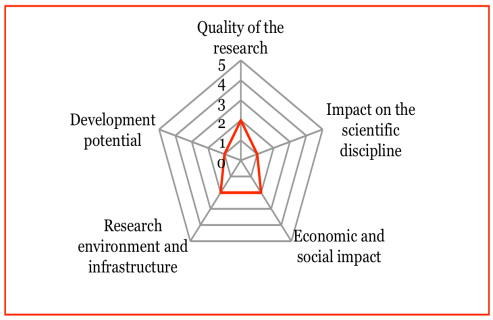
33. E_32 RTU Department of Heat and Power Engineering System

Name of the institution	RTU Department of Heat and Power Engineering Systems
Name of university	Riga Technical University (RTU)
Type of institution	University

The name of the institution is given as Department of Heat and Power Engineering Systems but in the self-evaluation report it is always referred to as the Chair of Heat and Power Engineering Systems. This is logical since there is only one professor (and no associate professors) in the group. The Chair is part of the Faculty of Transport and Mechanical Engineering (FTME). Six research fields are given, mostly technical topics but also on energy economics.

Figure 32 Scores: E_32

Criteria	Scores
Quality of the research	2
Impact on the scientific discipline	1
Economic and social impact	2
Research environment and infrastructure	2
Development potential	1
OVERALL SCORE	**1**



Overall Score

Considering the problem of the critical size, the Chair should evolve to an Institute. The strategy of the development is feeding this objective.

The ability to raise funding exists but the amounts are very low. However, the in table 7.1 it is unclear concerning the core and state budgets which may be because the Chair does not exist as an Institute.

Quality of Research

The Chair is a satisfactory national player. All the submitted papers are conference papers, where two are in the Scientific Proceedings of RTU. Papers 2 and 3 seem of low quality (mentioned references?). The 13 papers in Scopus have no citations at all (100 % not cited papers). The list of original articles gives 5 publications, all from proceedings. The output/researcher is high (16.8). There are no defended PhD dissertations during the period 2006-2011.

The developed research is divided into six subtasks related to technical and economic aspects. The topics are too disparate regarding the number of researchers involved in the Chair.

Impact on the scientific discipline

The Chair is a poor national player. 4 national conferences/workshops have been organised, but all are courses. One international conference has been organised and the

outcome of collaboration (4.5) contains text partly in the Latvian language. Some of the Scopus publications have foreign co-authors, but few foreign collaborations are listed. In 6.5 is written that on average at least one Dr.sc.ing. defends a thesis in heat and power engineering annually. But nothing is given in 3.2 of finished doctoral dissertations. Also there is no international exchange of staff.

The Chair's members are participating on editorial boards of national journals and many of them have been awarded at national level.

There is no international recognition (awards, invited papers, scientific committees, journals boards…). The bibliometric indicators have to be improved drastically.

Economic and social impact

The Chair has a low level of interaction with non-academics. Only one non-academic collaboration is mentioned (exchange of experience?). The 6 collaborations with national enterprises are mainly student internships, while only 6 international cooperations are given. The number of popularising documents/activities is low, only 3 and there are no patents. Other scientific and social activities are poor (invited presentations 0, scientific membership only local, 4 local prizes, 7 non-academic membership for Turlajs). They claim that the highly qualified specialists who studied at the Department are working in enterprises in Latvia and abroad and that they are successful managers. All graduation papers are in cooperation with small, medium and large industry enterprises. The doctoral research in progress plays a major role in the development of partner enterprises is claimed, but no doctoral thesis finished. The absence of PhD defended dissertation is a point to improve. Even if the international collaborations exist, the mutual invitations should be taken into account in the perspectives. The social impact of the Chair research is well documented.

Research environment and infrastructure

The Chair is a satisfactory player. The number of academic staff is very low, only is 4 and there is no research staff, no administrative personnel and no technicians (although 6.25 in 2008?). For the infrastructure, an adequate list of equipment is given, but the status of the equipment is not presented. It seems that the equipment is at the disposal of external users under contract conditions, but this is not mentioned in the funding section. The funding is extremely low and there is no international funding. No funds in 2009 – 2010 and only 100LVL (?) in 2008, thus no core funding, just grants of the Latvia Council of Science (2006 – 2008). In 2011 is the first contract funding of 31.300 LVL, thus high in comparison with other funds (only in 2011). EU framework programme projects are mentioned but there are no figures about funding. 10 market-oriented research projects are listed but the funding information is also missing. The list of projects (7.1.1) does not agree with the received funding.

The Chair has not the critical size to be able to manage all the subtasks. Except the section 6.6 which is a catalogue. The participation in EC projects should be a good way to sustain the research objectives.

Development potential

The Department has very limited scope for developing its research quality and reputation. With the obtained funding in the recent years, it is nearly impossible to do quality research; there is no real expectations that this will be better in the future. The high percentage of academic personnel with a doctoral degree is seen as strength. But with only 4 staff members to cover 6 research fields (G1) is not so. The number of doctors of science and masters in progress is seen as strength to establish a scientific research institute in the future! However, the Department is the only unit in Latvia to educate highly required specialists in heat power engineering and heat physics. They propose to expand and improve technical material and resources by attracting the necessary funding (opportunity), but this is also a threat due to limited budget and insufficient funding. Bachelor students seem to be important in developing engineering projects and applied research projects, but their level is not sufficient to do high-level research. Power engineering is mentioned as one of the main state priorities both in the

field of technology and scientific research, but this trend cannot be seen while analysing the obtained funding.

Conclusions and recommendations

As mentioned before, considering the problem of the critical size, the Chair should evolve to an Institute. The balance between theory/practice is planned. The SWOT analysis is honest. The research infrastructure seems to be able to support the carried out research. No evaluation report for 2012 is given.

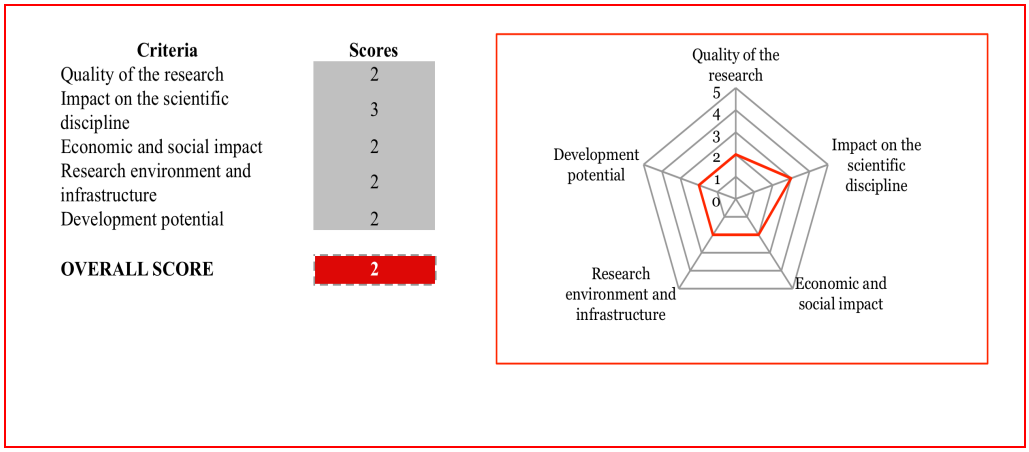
34. E_33 RTU Institute of Aeronautics

Name of the institution	RTU Institute of Aeronautics
Name of university	Riga Technical University (RTU)
Type of institution	University

The Institute of Aeronautics is part of RTU Faculty of Transport and Mechanical Engineering. It is active in the following areas:

- Aeronautics and Air Transport
- Functional Materials and Nanotechnologies
- Technical diagnostics and non-destructive methods of control

Figure 33 Scores: E_33



Overall Score

The Institute is a strong national player with some international recognition.

The Institute should develop a long-term strategy to ensure continuity and viability.

No clear objectives and milestones have been formulated.

Quality of Research

The Institute is a satisfactory national player. All submitted publications are in Scopus, but their research quality is not so impressive. In Scopus there are 36 publications with very low citations (0.03) and 97.2 % not cited papers. The list of the researchers' output gives mainly local papers with a high percentage of papers written in Latvian or Russian, and the output/researcher is rather low.

Impact on the scientific discipline

The Institute is a satisfactory national player with some international recognition. Annually, the Institute organises 4 national conferences/workshops. It is surprising that the list of national collaborations/conferences in 4.1 is the same as the international ones in 4.4. Only one visit abroad is reported (Columbia, 15 months) and no foreign visitors. The number of completed Ph.D. is 10 (6 in accordance to 6.5), while 27 doctoral dissertations are started. 7 Scopus papers have co-authors from another country. A long list of universities and higher educational establishments for multilateral cooperation in joint research and cooperation projects is given. The research in the Institute is on

transport and traffic and mechanical engineering and engineering technology. The number of international project could be improved.

Economic and social impact

The Institute has a sufficient number of master students and PhD studies. Good cooperation with local authorities and local enterprises. Important research but low level of interaction with non-academics. Only 3 collaboration projects with enterprises are given, all from the Division of Transport and Traffic (collaboration contact with Chalmers University, Sweden) patents (8) without further information on applications and no popularising activities. Little non-academic collaboration, only 3 guest lectures, one invited presentation and no prizes. Memberships in editorial boards (7), are all for Journal Transport and Engineering. Intelligent Transport Systems. The number of PhD-students who pursue industry careers is low (only 1) and present employment is not given. As indicated in the SWOT analysis there are few projects in the field of transport. No information about the social impact of the research.

Research environment and infrastructure

The Institute is a satisfactory national player. The Institute is part of the Faculty of Transport and Mechanical Engineering (FTME). The difference between the Institute of Transport Vehicle Technologies and RTU TMF AERTI is not clear. The Institute consists of the Laboratory of Transport Machine Elements and Transport Machines Repair and Laboratory of Transport Machine-building Vacuum Technologies. This last one seems to have good and up-to-date equipment. Academic staff is 5.3 and research staff 10.8, but their number is decreasing drastically, from 32 (56) to 16, so a decrease to a third in just a few years. The administrative personnel is also fluctuating from 0 – 3 – 0.25, as well as for the technical personnel 23 – 45 – 13. The decrease of the total personnel is from 111 in 2008 to 40 in 2011. The fact that infrastructure is not appropriate for people with physical disabilities is given as a weakness. With EU funding the research infrastructure has been renewed and modernised.

Development potential

The Institute has the potential to become a strong national player. However, nothing is written to describe the relation with scientific competitors, the management or the research strategy. Two thirds of the funding is from EU Framework Programme Projects and the total funding varies without a clear trend from 35 – 141 – 56; no evaluation of funding sources is presented. An extended list of Strengths is provided in the SWOT analysis. Strong fluctuations in academic staff, total personnel and funding over the years makes it is difficult to do prognoses for the coming years. The Institute should develop a long-term strategy to ensure continuity and viability. No clear objectives and milestones have been formulated.

Conclusions and recommendations

The Institute has the potential to become a strong national player. To achieve this, the Institute should develop a long-term strategy with clear objectives and milestones. Furthermore the Institute should become actively involved in European and international projects to improve its international visibility and recognition.

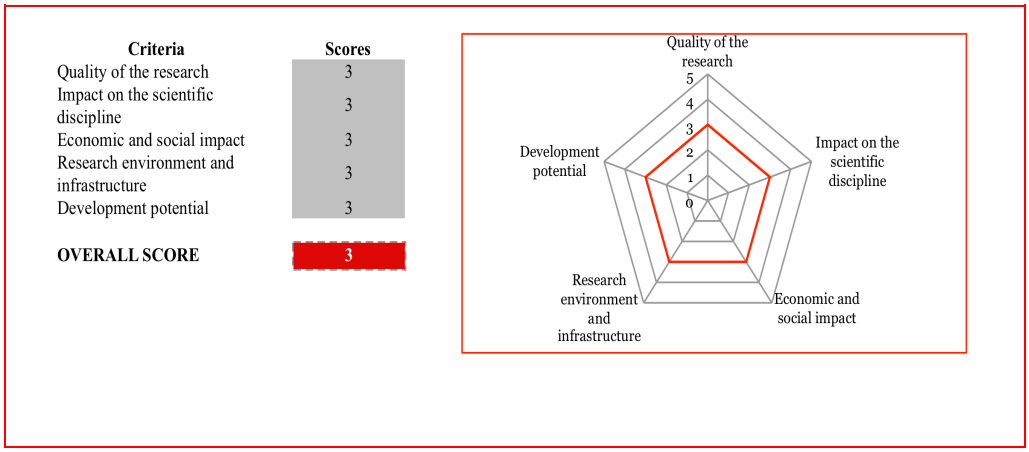
35. E_34 RTU Institute of Biomedical Engineering and Nanotechnologies

Name of the institution	RTU Institute of Biomedical Engineering and Nanotechnologies
Name of university	Riga Technical University (RTU)
Type of institution	University

The Institute of Biomedical Engineering and Nanotechnologies is part of RTU Faculty of Transport and Mechanical Engineering. Research activities are performed in two main areas:

- Qualification methods of digital medical technologies
  - Methods for the diagnostics of human skeleton and movement pathology
  - New biomaterial such as nanostructured percolated hydroxyapatite ceramics
  - Novel express testing methods of blood compatibility of biomaterial
  - New assessment methods for thin film and nano-scale properties
- Assessment of digital X-ray and analysis of nano-dosimetry.

Figure 34 Scores: E_34



Overall Score

The Institute is a strong national player with some international recognition.

Its international recognition can be increased by more ISI publications and citations.

Quality of Research

The Institute is a strong national player with some international recognition. They have conducted research in the fields of nano-objects and nano-structures. They contribute to the characterisation (electronic properties) of nano-objects and nanostructured materials, in the frame of molecular radiobiology and for the improvement of quality in radiology. Their research is multidisciplinary and requires close cooperation with physicians, microbiologists and materials technology specialists. During the reference period, they published results in local, regional and international journals and conferences. In the latter case, the papers are mostly written in collaboration with various Latvian or eastern and western European teams in good to high impact factor

peer reviewed journals (J. Appl. Phys., Physics Condensed Matter, Radioprotection, etc.). Among the best papers they report, one paper is first authored by the Institute in Radioprotection, a journal with an impact factor of 4.9. The total number of citation is modest, though this might increase rapidly if the initiated effort is sustained. A limited number of ISI publications in recent years. Hirsch-index of Institute staff is not very high (e.g. h-index=4) but still among the highest in the Latvian research community.

Impact on the scientific discipline

The Institute of Biomedical Engineering and Nanotechnologies has gained some awareness in eastern and western Europe for its knowhow in radiobiology and nanostructured materials. They established sustained collaboration with other institutions in Latvia and Europe (UK, Russia, Portugal, Germany, Israel, etc.). Their network is a good opportunity to be invited to conferences (10 invited talks), to EU FP and Eureka programmes, access to high impact factor peer reviewed journal papers and ease contacts with industry. Nevertheless, no such output is reported involving industry. The team, despite its small size, can be attractive enough to provide a PhD programme. Given the number of researchers the Institute has a good publication record. The Institute could increase the international impact and exposure through more ISI publications.

Economic and social impact

The Institute has a well sustained Master students programme (about 10 /year), whereas new PhD are more hazardous (no new PhD started from 2008 to 2010). The Institute's effort in successful the PhD defences is worth noting (6 in the reference period), considering the staff count (4 researchers in 2012). A consistent number of patents has been filed (8) for such a team .The establishment of new contacts with industry by the Institute of Biomedical Engineering and Nanotechnologies are possible, via the various networks and bilateral cooperation at the national level (4 state owned companies and 3 private companies) and at the international level as well (Germany, Russia and Israel). Nevertheless, these companies provide no funding. The collaborations and contacts with universities and institutes worldwide are numerous.

Research environment and infrastructure

The Institute of Biomedical Engineering and Nanotechnologies shares common tools with other teams. The size of the team is not compatible with the maintenance of a heavy equipment infrastructure. However, synergy with other teams in Biology or Biotechnology or Medical engineering should be considered and cooperation emphasised to access large tools. The Institute has a good balance of funding. The overall level of funding can be improved by commercialisation of the results (see SWOT), which would enable the improvement of the infrastructure.

Development potential

The topics addressed by the Institute of Biomedical Engineering and Nanotechnologies have great development potential (i.e. research on nano-objects and nanostructures for non-contact analysis and functioning; digital medical technology quality test methods; methods of human support system and skeleton movement pathology diagnostics). The team brought new ideas in the field of nanomaterials to living cells interface which might pay off in the future. Nevertheless, the team is very small and would suffer in its development from access to larger and more ambitious projects. That step can be overcome by: 1) increasing the team's visibility at the international level; 2) including the team in a bigger organisation, with members chosen by excellence. The resulting setup would benefit from new competences and the research team would increase its potential by access to larger facilities. Other opportunities would be to spin off activities in the field of Biomedical engineering. These scenarios are possible, because the Institute of Biomedical Engineering and Nanotechnologies has built a good network at the national and European level with universities, institutes and companies. The Institute should formulate a clear strategy with measurable milestones and objectives for this approach.

Through the good contacts with European researchers and institutes, international funding should be explored more.

Conclusions and recommendations

The Institute should formulate a clear strategy with measurable milestones and objectives in order to increase its potential and develop its activities. Through the existing contacts with European researchers and institutes, international funding should be explored more. Various opportunities would be possible to expand the activities of the research unit through collaborations with other Latvian research units in the field of biomedical engineering or medical faculty. The team could then access larger technical means and research tools. Spinning off activities in the field of biomedical engineering could be another possibility.

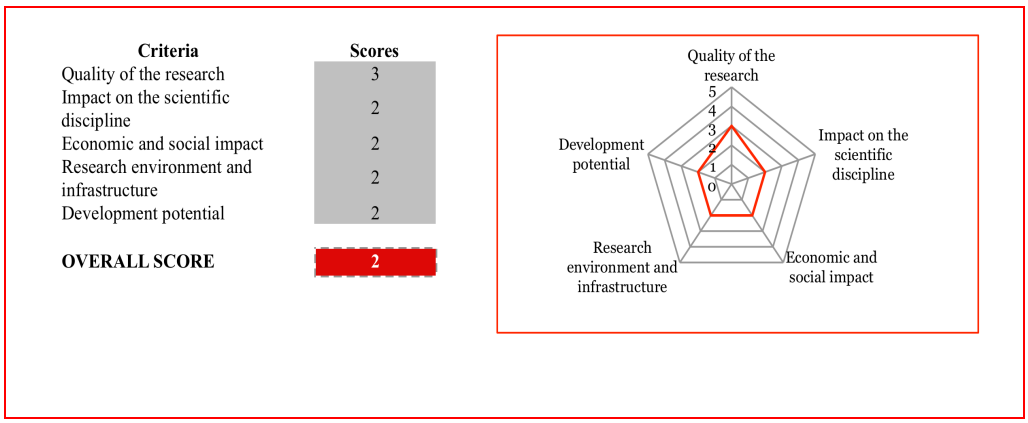
36. E_35 RTU Institute of Mechanics

Name of the institution	RTU Institute of Mechanics
Name of university	Riga Technical University (RTU)
Type of institution	University

The Institute of Mechanics is part of RTU faculty of Transport and Mechanical engineering.

It is active in the following areas: Theoretical Mechanics and Strength of Materials, automation of Production and Processing Technology, Machine and Mechanism Dynamics, and nonlinear Phenomena of Vibrating Systems.

Figure 35 Scores: E_35



Overall Score

The Institute is a satisfactory national player.

The Institute should develop a long-term strategy to ensure continuity and viability.

No clear objectives and milestones have been formulated.

Quality of Research

The Institute is a strong national player with some international recognition. From the submitted publications, 2 are chapters of a book and 3 are proceeding papers (2 in Engineering for Rural Development – Latvia). These are not high quality papers, even though 97 papers are given in Scopus. Thus the number of publications in Scopus is very high (97) and with a more than average number of citations (1.6). The percentage of not cited papers is 77.3 %. The Institute has a good publication record but relatively few SCI publications. This is improving. However due to the number of publications in Scopus and the number of citations, the score of 3 (good level) can be given for this criterion.

Impact on the scientific discipline

The Institute is a satisfactory national player. The Institute is part of the Faculty of Transport and Mechanical Engineering (FTME) and 4 research directions are given. Following the tables, 32 co-authors are from other countries. This is difficult to believe since no list of these countries is given and within foreign collaborations only two universities are indicated. The number of visits abroad is limited to 4 (Finland, Italy, France, Portugal) and only one foreign visitors (Finland) stayed with the Institute for 2 months The output /researcher is average 12.7 and 5 of the 24 started PhDs have been

completed. The Institute has poor national collaboration with universities and higher schools, only 4 for research and science and with enterprises, only 2. However, a weekly (mechanics) and a monthly seminar (committee for mechanical engineering) are organised. International collaboration is limited to 2 universities in the international project Filose and none with enterprises. The Institute could increase its international impact and exposure through more ISI publications.

Economic and social impact

Low level of interaction with non-academics. Despite the limited number of collaborations with national enterprises (study process, science of rolling stock), many patents are given without further information on the application domain. Non-academic collaboration are poor with only 3 guest lectures, limited invited presentations (1), memberships of boards of scientific journals (3), prizes (1), and little membership of primarily academic nature (only 2 as expert). In the social impact section, it is claimed that the activities of the Institute have facilitated the development of Latvian science in the field of mechanics, but without much proof to sustain this claim. Given the number of staff members, the number of students and PhD could be larger. The majority of projects is at the request of national enterprises.

Research environment and infrastructure

The Institute is a satisfactory national player. From the total 21 FTE staff, 5.8 are academic staff and 15.3 research staff, all with fluctuations across the years 24 – 39 -22. There is no administrative personnel and the number of technicians is changing from 5 – 12 – 4. For the relation with leading scientific competitors it is only mentioned that two new academician will be elected. A list of equipment is given together with the available software packages in the section related to research infrastructure. The out-dated equipment and insufficient room space are given as a weakness of the Institute that contributes to insufficient research infrastructure. By increasing the overall level of funding this structural problem can be addressed.

Development potential

The Institute has the potential to become an international player. The main scientific research directions of the Chair of Theoretical Mechanics and Strength of Material, the Group of Automation of Production and Processing Technology, of the Laboratory of Machine and Mechanism Dynamics and of the Laboratory of Nonlinear Phenomena of Vibrating Systems are presented only as a list without any discussion. A clear long-term strategy is missing. The Institute has low non-state and international funding, the total budget fluctuating as 100 – 220 – 115. The state budget and framework programme projects are the major funding contribution for the development of the Institute. An extended list of strengths, weaknesses, opportunities and threats is given in the SWOT evaluation. The weaknesses and threats are the same as for all institutes in Latvia: lack of administrative and technical personnel, personnel has to combine two or more jobs, insufficient collaboration with other universities and enterprises, negligible involvement of foreign researchers and doctoral students, insufficient funding and decrease of governmental funding, decrease of the number of students, small number of publications in SCI journals, etc.

Conclusions and recommendations

The Institute has the potential to become a strong national player. To achieve this, the Institute should develop a long-term strategy with clear objectives and milestones. Furthermore the Institute should become actively involved in European and international collaborations to improve this international visibility and recognition.

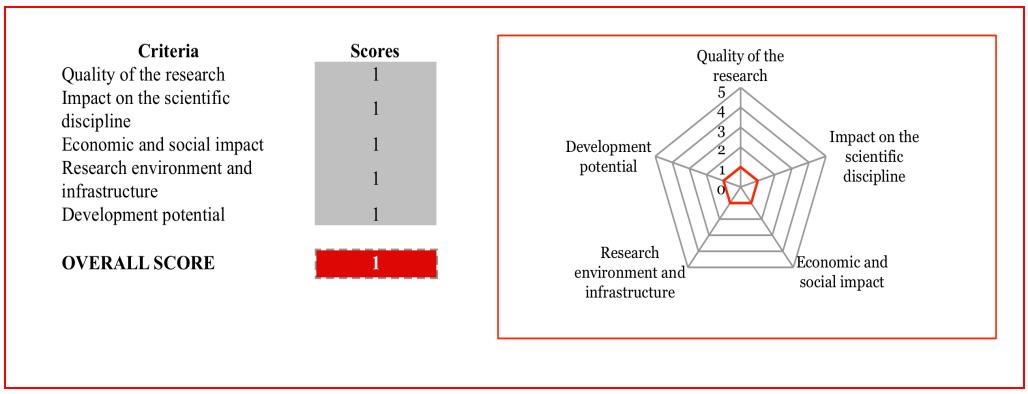
37. E_36 RTU Institute of Road Transport

Name of the institution	RTU Institute of Road Transport
Name of university	Riga Technical University (RTU)
Type of institution	University

The Institute is part of RTU Faculty of Transport and Mechanical Engineering. Four research fields constitute the focus of activities: traffic safety, ecological aspects of roads and traffic, biofuels for road transport, and passenger and cargo transport.

From 2006 till 2010 there was only one professor in the Institute. In 2010 and 2011 the number of professors and associate professors is zero.

Figure 36 Scores: E_36



Overall Score

The size of the Institute is critical. The SWOT analysis is very succinct and general. Many sections of the document are not completed.

Overall the Institute is a poor national player.

Quality of Research

The Institute is a poor national player. There are no original articles in ISI journals for the period 2006 to 2011. From the submitted papers, 2 are published in Journal Transport (from Teniska University), 2 are published in Scientific Journal of RTU and 1 is a conference paper. In the list of publications of researchers, only 8 are given (all national) and nothing is provided in The copies of institution best publications. The number of publications in Scopus is 5. The output/researcher is low (3.7).

Impact on the scientific discipline

The Institute is a poor national player. No description of the Institute's research is provided in. The organisation of national or international conferences/workshops is not given or non-existent. Nothing is written on the outcome of this. There are no visits abroad and no visitors at the Institute. There is one PhD completed and 9 started.

The number academic staff is quite low and fluctuating (9 in 2006 and 2007, 12 in 2008 and finally 6 in 2011). But as already mentioned in the short description of the Institute in 2010 and 2011 there are no professors or associate professors in the Institute, only assistant professors, lecturers or assistants. The other related indicators are very poor.

Economic and social impact

The Institute has no or little interaction with non-academics. The evaluation contains no information on the social impact. There are no patents, no popularising output. Collaboration with national enterprises is only 1 and there is no international cooperation. There are 4 non-academic collaborations, but still poor with only consulting and guest lectures. The majority of the research staff is involved in advisory boards or councils.

Research environment and infrastructure

The Institute is a poor national player. The evaluation report contains no information on the organisation of the management, the long-term strategy, and the goal orientation of research work. No information on the research infrastructure but in table 6.1 (SWOT) is given as a weakness: the: laboratory equipment is not satisfactory. Also FTME laboratory housing construction is seen once as an opportunity, but FTME laboratory housing construction process is a threat?? Administrative personnel are zero, only 1 technician (fluctuating during the reported period as 2 – 4 – 1). The funding is very low (state, non-state, international) with limited sources and irregular funds, nothing for 2006, 2008, 2011. The presented amount of funding is not clear, once it given as 7750 and twice it is 1000 LVL. Unclear financing for development is given as a weakness.

Development potential

The Institute has very limited scope for developing its research quality and reputation. The main problem is that the evaluation report of the research performance from the Institute of Road Transport is incomplete for reviewing, thus totally insufficient. Nothing is written in the chapters 2.1, 2.4, 4.5, 6.2, 6.3, 6.4, 6.6, 7.2 of the evaluation report. For the self-assessment only table 6.1 is given (SWOT), without any further discussion on leading scientific competitors, research activities, social impacts, etc. Marginal to very low activities in national and international collaboration, non-academic collaboration, scientific and social activities, memberships and prizes.

Conclusions and recommendations

In the actual situation, without professors in the Institute and the poor research output and not significant national and international collaborations the Institute cannot survive. There are no indications that it will become better in the future. The Institute has to merge with other institutes, such as the Institute of Railway Transport.

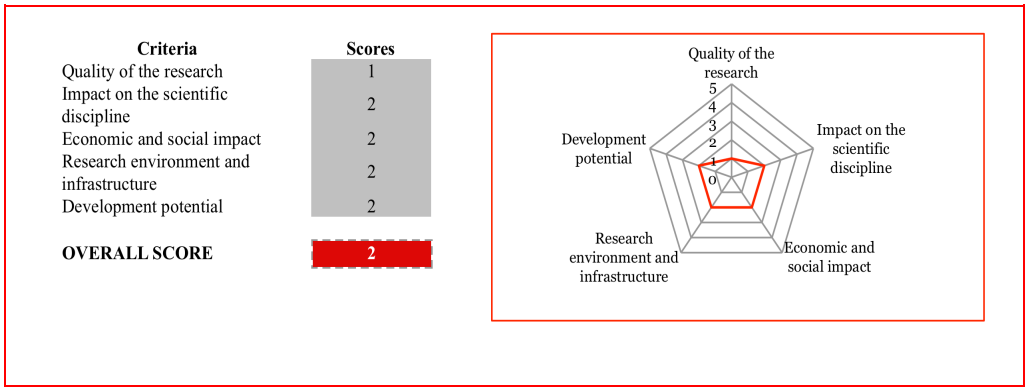
38. E_37 RTU Institute of Railway Transport

Name of the institution	RTU Institute of Railway Transport (IRT)
Name of university	Riga Technical University (RTU)
Type of institution	University

The institute is part of FTME, Faculty of Transport and Mechanical Engineering. Activities are focused on 7 research fields, including: new products and technologies, standards, vibrodiagnostics, non-destructive control, communication and information systems, etc.

23 laboratories are listed in the self-assessment report. The number of active academic and research staff (in 2011) decreased to half of the number in the year 2009 and before.

Figure 37 Scores: E_37



Overall Score

The planned research projects are in the skills of the current staff but the SWOT analysis omitted the critical mass necessary to achieve the future goals.

The aging staff is also a barrier, the current rate of the PhD defences is not sufficient to guarantee renew.

Funds are available from EC side. The creation of a dedicated institute will help to realise the objectives of thematic enlargement and impacting the railways international research.

Quality of Research

The Institute is poor national player. From the submitted papers, 1 is a journal paper, 3 are conference papers and 1 is published in a non-English journal. References in the papers are in Russian or not readable. Some papers are given without an indication of where it is published. The publication list of researchers includes mostly publications in Scientific Proceedings of RTU (in Latvian), but the output/researcher is quite high (14.5). The Institute has only 3 publications in Scopus, with zero citations, and thus 100 % not cited papers. Countries with co-authors are zero.

There are no common published papers issued from the collaboration with foreign entities.

The bibliometric data is not significant.

Impact on the scientific discipline

The Institute is a satisfactory national player. There have been 3 national conferences/workshops and 1 international conference yearly (International scientific conference of the Riga Technical University, environmental technology section) organised. A very low number of completed Ph.D., only 3 and 4 have been started. No visitors from abroad, no foreigner visits are included in the report. Collaboration with national universities is non-existent, while 5 with international cooperation in conferences or international projects are given. The research results improved the safety of railway transport and the efficiency of the transportation system as well as promoted the competitiveness of the holding company Latvijas Dzelzsces. The cooperation with this national company is in Latvian.

The impact from the academic point of view is not visible due the weak bibliometric indicators. The variety of the research subtasks is not a guarantee of success because the critical size of the Institute is not sufficient.

However, knowing the quantity of the scientific problems due to technologic locks, there is a great potential. The Institute has a significant activity of national publishing.

Economic and social impact

The Institute has a low level of interaction with non-academics. Only 2 collaborations with national enterprises as student internship and bilateral cooperation and also 2 international cooperations. From the 3 completed PhDs, 2 persons are working in industry. Non-academic collaboration are poor, only 2 (contract work, design of a new CTC centre). There are 4 patents (but not described in the report) and zero popularising documents. No invited presentations, low number of memberships in scientific journals and 5 members of staff are invited as experts. Four researchers have been awarded. The scientific and academic personnel of IRT have been conducting extensive research in railway transport commissioned by the Latvian Railways (social impact). This can be seen as a good increase of the social impact of their research since the development of (rail) transport is one of the research priorities in Latvia.

Research environment and infrastructure

The Institute is a satisfactory national player. The infrastructure consists of 23 laboratories, but there is no description of equipment in each laboratory. The total number of staff is 5.5 FTE, but fluctuating in the years (from 13.75 in 2007 to 6.5 in 2011 including 1 visiting). There are 2 administrative personnel and 2 technical personnel, also fluctuating drastically (from 10.5 in 2009 to 2 in 2011). It is hard to believe that 23 laboratories can be organised by the low number of staff and technicians (no evaluation report for 2012 and the reviewers do not know the actual situation). The imbalance of number of state funded students to the real number of students is seen as a threat.

The IRT gives its ambition for the next five years, as creation of spin off or joint companies. The planned research projects are too optimistic regarding the current human resources. The Institute framework seems to be able to support such projects.

Development potential

The Institute has potential to become a strong national player. The funding is low for all sorts of funding: total, state, non-state and international (although 6 EU framework programme projects are listed). The funding is mainly contract research and the total is fluctuating a lot (24.100 LVL in 2006 to an extreme high (for the institute) 94.600 in 2008 and again 23.200 in 2011). The Institute is the only educational institution in Latvia providing education in rail transport specialisations. Activities are planned to improve the cooperation with the national state stock company of the Latvian Railways, which employs more than 25.000 people. This cooperation can be in the form of scholarships, practice placement and specialised research in the area of rail transport. They comment that the decrease in basic funding leads to the situation that a professor has to do all the additional administrative work and have any time left for research. With the distribution of research funds (the PhD student receives 400 LVL, but the supervisor

only 100 LVL) they feel that a doctoral student conducts more quality scientific work and greater volume than the professor (who should be the driving force in the research). Of course it is the professor who set out the research lines and defines the research topics but the doctoral student should do the measurements, calculations, modelling under strict guidance of the professor.

Conclusions and recommendations

The bibliometric data is poor, but the Institute is a satisfactory national player for the impact of the research on the development of the scientific discipline.

The planned research projects are too optimistic regarding the current human resources although the Institute's framework seems to be able to support such projects. The Institute has the potential to become a strong national player when maintaining or improving the cooperation with the national state stock company of the Latvian Railways.

No evaluation report is given for 2012. The review is done on the self-evaluation report of the Institute, no visit of the reviewers to the Institute has been executed.

39. Summary of the Institutional Assessments

39.1 The general level of quality of research in Latvia in the fields

The Panel examined 37 research units across a wide range of engineering topics and assessed the research units on the following criteria:

- the quality of the research
- the impact on the scientific discipline
- the economic and social impact
- the research environment and infrastructure
- the development potential

As a result of a detailed examination of the submitted material and visits to over half the research units the Panel assessed the research of these research units as follows:

- 3 research units were operating as strong international players
- 9 research units were operating as strong national players with some international recognition
- 17 research units were operating as satisfactory national players
- 7 research units were poor national players
- 1 research unit was not conducting research.

39.2 Key strengths, areas of particular interest

The Panel was impressed by the research that was taking place at the following research units and regarded the research of particular interest:

- Institute of Electronics and Computer Science E-01 is a strong leader in Latvia and is becoming an internationally recognised player in the field networks engineering science and signal processing (e.g. NASA's International Laser Ranging Service use their event timer).
- Faculty of Computing at the University of Latvia E-12 has a range of computer science research topics including both theoretical and practical. Of particular note is the work in quantum computing, specifically algorithms designed for quantum computers. The quantum-computing group is particularly well established and carries out research with an impressively broad interdisciplinary scope.
- Transport and Telecommunications Institute E-19 is recognised in its field of expertise at the national and regional level and has some international recognition. They provide a very good framework and infrastructure in the field of transport logistics modelling and simulation research, education and professional training.

39.3 Main weaknesses, areas of particular concern

In general the Panel felt that there were similar weaknesses for many research units, namely:

- the limited ability to attract high-level doctoral students and scientists from abroad;
- the level of government funding is inadequate and thinly distributed;
- difficulty in attracting EU research funding;
- career progression of staff not sufficiently defined and rewarded;
- lack of high quality publications in international reputable journals;
- lack of study programmes in English.

All these issues make it difficult for a unit to become a strong international player.

39.4 The potential for consolidation of research institutions in order to reach critical mass in particular research fields

The Panel discovered that there is a high degree of fragmentation and overlap between many of the units. There are some obvious cases of duplication but others will require a closer examination. Thus a major weakness of the Latvian research system is due to the high partitioning of efforts in small units. This situation, in turn, affects the level of publication, especially in the engineering areas, and is not successfully attracting new and young staff to the unit.

In the field of telecommunications there are too many small units working in that field which will lose their relevance to the scientific community if they do not work together under the same umbrella to define a common strategy. An Institute of Telecommunications Science and Engineering including wireless, RF, radar, optical, electrical, etc. could be created by the fusion of the topics of the Institute of Telecommunications E_06, the Institute of Radioelectronics E_07, the Transport and Telecommunication Institute E_19 and the Institute of Computer Control, Automation and Computer Engineering E_29. This would benefit the visibility of Latvian research in this area at the international level.

In the field of materials and structures, the Institute of Materials and Structures E_23, the Institute of Structural engineering and Reconstruction E_24 and the materials-related activities in the Institute of Transport and Infrastructure Engineering E_25 could merge under a joint theme (e.g. materials and structures) and administrative structure.

In the field of computer science, the Institute of Information Technology E_04 and the Institute of Applied Computer Systems E_05 should consider joining forces.

In the field of transport, part of the Institute of Transport and Infrastructure Engineering E_25 and Transport and Telecommunications Institute E_19 should work together in the area of activity that they have in common.

In the environment field, the ecological issues of Institute of Road Transport E_36 could be merged with the Institute of Energy Systems and Environment E_10 and the safety part of their activities could be merged with Department of Transport Electronics and Telematics E_30.

The Institute of Energy Systems and Environment E_10 is a leader in Latvia and other researchers could join them.

Finally, the RTU Institute of Heat, Gas and Water Technologies E_03 has some overlap with the RTU Institute of Energy Systems and Environment E_10 and could be combined.

These recommendations should be accompanied by supporting measures such as a strong PhD programme to attract good students and by including opportunities to spin off start-up companies with associated financial incentives and incubation facilities inside the unit.

39.5 General Comments on the Latvian Research System

39.5.1 Research units

There does not appear to be a consistent terminology used to describe research units in Latvia, the terms institutes, centres, departments etc. should be defined and aligned as used in similar units in the European Union. For example, some of the groups that are called institutes appear to be research groups rather than real institutes; the term institute is thus not appropriate and not what is expected or accepted internationally. There are only a few institutes in Latvia, such as, the Institute of Electronics and Computer Science E_01 and the Institute of Mathematics and Computer Science,

Computer Science E_17. A consistent terminology and organisational structure needs to be developed for research units at national level to ensure consistency with international definitions.

39.5.2 Students

There is a relatively high dropout rate among PhD students, which seems to be due to a lack of funding and issues with funding continuation for the duration of a PhD. The Panel met with PhD students who worked in one or two different jobs to support their funding. There is therefore a real need to support PhD students with scholarships for the duration of their PhD study to enable them to concentrate solely on their research activities. The number of scholarships should be sufficient to cater for the number of highly qualified graduating students wishing to undertake a PhD.

Many of the Master students commented that they did not feel prepared for a PhD which should be corrected.

Successful PhD candidates should be encouraged to take up a post-doctoral position abroad to consolidate and expand their understanding of international research. This is important to develop and establish contacts, which is a crucial component in promoting international research within Latvia. Conversely if Latvia is to enhance its research activity and reputation it needs to attract more international research students and postdocs and to ensure that the main scientific language of English is used wherever and whenever possible.

39.5.3 Publications

The Panel observed that in general units are operating satisfactorily at a national level, but that publications in high quality Science Citation Information (SCI) journals are relatively few and this is only slowly improving. The Panel discovered that the majority of publications are mainly in conferences and regional journals, publications in high quality Science Citation Information SCI journals are only few.

Publishing in international reputable journals is the lifeblood of innovative and substantial research and this is lacking in the majority of units that the Panel visited and assessed. The Panel accepted that it was not a bad strategy to publish in proceedings of conference as an initial strategy – in this way contacts can be made and possible project partners identified. However to truly engage internationally the major journals should be the target and focus for Latvian researchers. The Panel were told there was a strategy to launch and index local journals in Scopus. The Panel were not convinced that this was a good use of resources and that existing journals should be the main conduit for Latvian research.

In summary, publications are mainly in conference proceedings and are below average quality, as per international standards.

39.5.4 Patents

The Panel was surprised by the link between funding and national patent submission and do not feel that this is the best type of incentive to encourage international research activity and strong inventions that would protect Latvian companies and their products. The core funding received by the research units should be partially linked to the number of patents extended outside Europe, after examination by the European patent office, and not the total number of patents. Moreover, an incentive should be given based on a measure of the number of employees from spin off companies in Latvia against the number of patents filed.

39.5.5 Industry

The Panel feels that there is strong background in academic disciplines such as mathematics and physics at the scholarly level in Latvia. However, in the field of applied

research, an entrepreneurial spirit is needed to be able to realise and make accessible the products of research activities. This dimension is absent in the strategy of most units.

The Panel did not find a strong record of entrepreneurial spirit in the units and this needs to be addressed by the government introducing incentive programmes. The Panel observed that at present, industry approaches researchers and ask them to solve particular problems, which are often short-term and without providing any funding. The commitment of local industry is not strong and their involvement needs to be nurtured in order that they value research, new applications and new markets. What is needed is better coordination between the different stakeholders and the government is best placed to encourage the interaction between universities and industry. The Latvian Government should implement a matching fund scheme to incentivise research funding by industry.

39.5.6 Funding

The Panel observed that the core government funding is insufficient to fund university research activities at the international level and that research units rely on competitive funding. The basic funding for universities needs to be guaranteed because the current funding situation is not sustainable. This lack of continuity in funding is a major issue as the current way research is funded affects the ability of Latvia to compete internationally.

There has been some success in the units in terms of EU funding but there is a need to distinguish between funding received from the competitive Framework research programmes and the European Regional Development Fund programme, which mainly supports infrastructures and equipment.

All research units should become more involved at the European level and aim to be part of future programmes like Horizon 2020. As mentioned previously more collaboration and cooperation with industry and commerce in joint projects, spin offs and technology transfer should be part of the funding strategy of a unit.

39.6 Conclusions and recommendations

The Panel examined the submissions from 37 research units (RU) from across Latvian University and Research Institutions and visited 18 of those units. The submissions varied greatly in the level of detail and the content of which made assessment difficult in some cases. Three research units have achieved a score of 4 and are judged to be operating at the international level. The Panel recommends that:

- The RUs with a score of 4 should continue and are performing well.
- The RUs with a score of 3 should be analysed from a size point of view and reinforced.
- The RUs with a score of 2 should be analysed to consider the opportunity to combine with other RUs.
- The RUs with a score of 1 should be terminated.

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