technopolis group

March 2021

International Evaluation of Scientific Institutions Activity

Panel Report: Agriculture, Forestry and Veterinary Sciences

Professor Paul Struik (chairman), Professor Andras Baldi, Professor Katri Karkkainen, Professor Paolo Cherubini, Professor Qendrim Zebeli, Professor Stefano Amaducci

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Figures

[redacted]

- University of Life Sciences and Technologies Agricultural, Forestry and Veterinary Sciences

[redacted]

Articles in peer reviewed scientific edited journals and conference proceedings not included in WoS or SCOPUS; iii) Monographs; iv) Patents (Latvia) as well as v) Patents (Europe and international)

- Total funding – sum of i) Total state funding (Base funding plus Competitive state budget funding plus EU Structural Funds plus Other national funding); ii) Total international funding (EU Framework Programmes plus Other international funding); and iii) Private funding.

The analysis of each institution by the Panel is presented in following sections.

Feedback on Panel assessment received from the institutions is published in the **Error! Reference source not found.**. The Panel has reviewed the feedback and decided not to change the report.

2 Institution reports

A_1 Institute of Agricultural Resources and Economics

2.1. Institute Data and Description

Institute of Agricultural Resources and Economics	
Primary field of science	Agriculture, Forestry and Veterinary Sciences
Corresponding fields of science	Agriculture, forestry, and fisheries, Agricultural biotechnology, Social and economic geography
No. FTE academic personnel 2018	
No. FTE academic research personnel 2018	47.03
Total number of FTE academic and research personnel 2018	47.03
Articles in peer reviewed scientific edited journals and conference proceedings included in WoS or SCOPUS in period 2013-2018	197
Articles in peer reviewed scientific edited journals and conference proceedings not included in WoS or SCOPUS	112
Monographs in period 2013-2018	9
Patents Latvian in period 2013-2018	2
Patents (Europe and international) in period 2013-2018	0
New cultivars registered in period 2013-2018	12
Total no. of self-reported outputs in period 2013-2018	320
No. of WoS or Scopus outputs in period 2013-2018 per researcher in 2018	4.19
No. of all outputs in period 2018 per researcher in 2018	6.8
No of PhDs completed in period 2013-2018	6
No. of PhDs in period 2013-2018 per researcher in 2018	0.13
Total funding in period 2013 -2018 (Euros)	13.990.490
Total funding in period 2013-2018 per researcher in 2018 (Euros)	297.480

The Institute of Agricultural Resources and Economics (AREI) was founded in 2016 by merging several scientific institutions and its main focus is crop breeding and bioeconomy research. The scientific and technical staff at the Institute comprise 133 full time units of employees, including 39 researchers and lead researchers. The research centres of the Institute are located in four different locations in Latvia – Riga, Priekuli, Dizstende, and Vilani. The institute's budget average is 4.3 million EUR per year in the reporting period. AREI performs research on sustainable use of agricultural resources, agricultural economy and development of rural areas and covers seven main research areas:

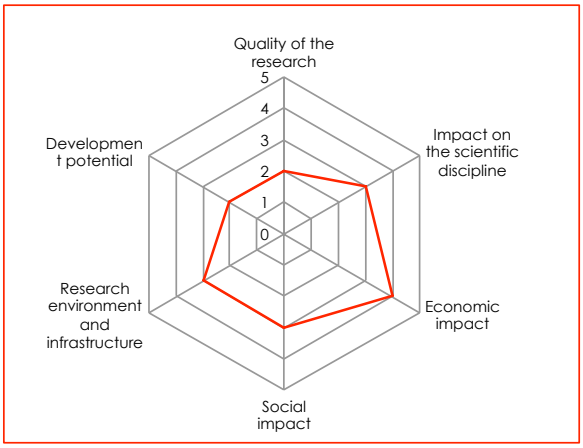
- Genetics and crop breeding for integrated and organic farming systems
- Development of sustainable crop growing technologies for different farming system
- Crop quality assessment for an effective use of potential
- Production of fodder and raw materials for feed
- Economy of sustainable development of bio-resources based industry
- Research on sustainable development opportunities in rural areas
- Efficiency of production processes and competitiveness of undertakings

2.2. Expert panel evaluation

The figure below presents the scores assigned by the Expert Panel to the institution.

Figure 1 Institute of Agricultural Resources and Economics – Scores

Criteria	Scores
Quality of the research	2
Impact on the scientific discipline	3
Economic impact	4
Social impact	3
Research environment and infrastructure	3
Development potential	2
OVERALL SCORE	**3**



Overall score

Score: 3 - good level of research

Overall, the quality of research and development potential of the Institute of Agricultural Resources and Economics (AREI) is acceptable to maintain AREI position as a national reference in the field of breeding and the bio-economy. The impact of AREI activities can be considered very relevant from an economic perspective and an important contribution to societal development in Latvia. Research infrastructures at AREI are good but the research strategy and management should be improved to increase international visibility if AREI is to be in a position to become an international player in the future. The Panel concluded that overall, AREI is a good research institution that needs to implement a more dynamic management system and a more effective strategy to promote the development plans of the Institute.

Quality of Research

Score: 2 - adequate

A major quality indicator of research performance is the level of scientific production measured by number and impact (assessed by the number of citations and the impact factor (IF) of the journals published in) of publications in scientific journals. The overall number of publications in peer reviewed journals (Scopus) was 197 during the evaluation period (33 per year); a rather low number (4,2) of papers per researcher and no upward trend in the number of Scopus/Web of Science publications. A major weakness is that – with one exception – the lead authors of high impact papers are not from AREI. AREI researchers are lead authors of papers in low impact journals. Altmetric scores seem to be rather small (0-4), indicating low impact and visibility of the online activity surrounding the given papers. The institution recognises in the SWOT analysis that the low number of international scientific publications with high impact factors is a weakness. This is aggravated by a low number of citations for the publications in which AREI personnel are the main authors. On the other hand, those papers in which AREI researchers are only contributing authors are published in high impact factor disciplinary journals.

Among the other research outputs, most notable is the number of crop varieties registered (12 during the evaluation period), which highlights a well-established breeding activity. The

involvement of AREI researchers in conferences, seminars and lectures seems mostly related to their participation in international projects. There is no evidence that any AREI researchers have been invited to speak at relevant conferences or international institutions. Two national and no international patents were filed. Prizes and awards were only obtained at a national level. Only one researcher is part of an editorial board and it concerns a Q3 journal. Available documents do not reveal if unproductive researchers affect the overall performance of the Institute nor do they highlight emerging excellent researchers.

The relatively large participation in international project consortia will further strengthen the collaboration with competitive international institutions and this, together with the implementation of motivational measures (section 1.12. of the self-assessment report), will be key in improving the quality of the research.

Impact on scientific discipline

Score: 3 - good

The main science priority focus of AREI is "research and sustainable use of local natural resources for the development of a knowledge-based bio-economy". AREI has the potential to provide a very good impact on this science priority by capitalising on its research tradition and by consolidating the integration of multidisciplinary competences amongst its researchers. The medium-term goals set out in the self-assessment report put AREI on the right path to improve its impact both on its field of science and on the economy and society.

In the evaluation period, the impact of AREI research is highlighted via participation in a good number of national and international projects. However, as AREI considers its biggest advantage to be the availability of its lands and greenhouses for trials, it suggests a role based on providing services, and not its role in advancing knowledge in collaborations. Particularly good is the number of EC financed projects in which AREI is involved, even though the average financing per project is relatively low (about 100.000 € per year). There is, however, some fragility in the structure of sources, as the share of EU structural funds is rather high, but this source will be decreasing in the future, meanwhile framework programme (FP) funding will increase, and currently this seems to be a low contributor to AREI's income. The low FP income can be improved by increasing networking and competitiveness. At an international level, AREI's research impact is low, mainly due to the limited number of high impact publications, the lack of organisation of international conferences and in general by a low visibility – for example, the English webpage is virtually offline, and appearing to be last updated in 2018.

At a national level the impact seems much more significant both on a scientific and at the economic and social level. The R&D focus of AREI has a great potential to bring economic and social benefits to agriculture for the production of food, feed and bio-based products.

Economic impact

Score: 4 – very good

Crop production is one of the important sectors of the national economy and it is one of the major contributors to exports. Consequently, the outcome of AREI research activities can have a large economic impact at the national level. Varieties registered by AREI are sown on approximately one fifth of the arable areas in Latvia and several varieties are grown in the neighbouring countries. Research on organic farming is prioritised as it is an EU policy target, and international cooperation is mostly in this field. Another important field of activity at AREI is related to regional development and to the evaluation of CAP reform. However, national and institutional projects on agroecology and sustainable farming are weaker. Breeding targets, as well as cultivation techniques, take into account climate change and the threat that it will bring about. AREI research will therefore sustain steady and resilient agricultural growth.

A good measure of the effort AREI takes to enable economic impact is demonstrated by the relatively high number of interactions with companies, merchants, farmers and processing industries.

Besides breeding activities and the registration of new varieties, there seems to be little evidence of the involvement of AREI researchers in the provision of commercial extension services to farmers or industries. There is no private funding indicated in the self-assessment report, although private partners were highly supportive on cooperation's with AREI. There is reference to activities related to sustainable agronomic practices and precision agriculture but there is no evidence of any economic impact of these activities nor of any strategy to strengthen these fields of research in the future.

Social impact

Score: 3 – good

The potential impact of AREI on society is quite straightforward. Its research activities are focused on the economic development and public welfare of rural areas in Latvia. The focus on sustainable production systems and on organic farming has an underlying impact on both the environment and the quality of the diet and as a consequence on human health. Research has focused on the reduction of greenhouse gas emissions and AREI claims that outcomes from its activities have an impact on population employment stabilisation, but there is no actual evidence of this. AREI has a wide national network across several sectors and has many national non-academic partners. The involvement of AREI experts is high in national advisory bodies; the Ministry of Agriculture specifically relies on AREI's advisory role. All these are domestic, showing strength in advising Latvian society by AREI experts. There is no upward trend in media activities, so there is no sign of better communication with the public. Meanwhile, AREI's Technology Transfer Centre organises exhibitions and promotions for the public.

Research environment and infrastructure

Score: 3 – good

Considering that a great part of the research of AREI is devoted to the improvement of cultivation techniques and evaluation of genetic material, the availability of four research centres in different environmental conditions is a great asset. 500 ha of land available for field trials is a great acreage by any international standard. Almost 20.000 m^2 of buildings for laboratories, offices and technological centres is a very large infrastructure, and this has recently been amplified with the addition of greenhouses and new laboratory equipment. A major challenge to the maintenance, and continued improvement, of the research infrastructure is the availability of adequate financing that depends on the capacity to attract resources and prepare competitive research proposals.

While the level of infrastructure seems suitable to face actual and future research challenges, the management of the research environment might represent a threat to the continuous development of AREI. The SWOT analysis highlights administrative management as a weakness and administrative hurdles as a threat. The availability of an administrative infrastructure that aids researchers in the preparation of competitive proposals, and of a managerial system that links the different branches of AREI and effectively stimulates multidisciplinary interactions, are both features in any internationally competitive research institute. It is still not achieved, e.g. 20% of papers have input from both departments. The merger in 2016 and resulting larger institution provides more resources, like better access to market, better services (e.g. lawyers), etc.

There is no increase in the number of Masters and PhD students, except in the number of Masters degrees completed, which grew from 0 to 3 in 2018, so not a big achievement. Open access publication was labelled as too expensive, thus prohibitive to publish in such journals.

The medium and long term strategy of the Institute is set in terms of specific goals, but the actions needed to achieve these goals are not clearly outlined. No clear human resource development strategy is presented not in terms of hiring of new personel nor in terms of training and professional updating.

Development potential

Score: 2 – adequate

The AREI was created out of a merger of four institutes in 2016 and targets were set for its performance and Table 1 in the self assessment report shows that AREI performed well in reaching these. Now, however, new targets need to be set to be more competitive. The SWOT analysis, in the self-assessment report, highlights that weaknesses and threats are mainly linked to economic and financial issues. To count on a reliable source of financing, to consolidate ongoing activities, to access national and international funds, and to widen the spectrum of research activities, are all of pivotal importance to the development potential of AREI. On this regard, a major challenge is to increase the capacity for preparing proposals and implementing the project activities. So far it seems that researchers at AREI cannot count on an efficient internal system of support to prepare grants and to find partners, especially for international projects. No clear strategy to increase the participation in international consortia is in place nor is it being developed.

The main weakness of AREI in terms of its potential for development is the lack of a clear strategy for its development, which probably contributes to a "business as usual" approach and a lack of dedication and motivation to continue improving. A considerable change is needed to the institute's research and financial strategy to ensure the quality and relevance of its research. Areas for change include:

- Considering that registration of varieties is one of the main actual research outputs, royalties are a critical issue. Considering that legislation is not favourable for breeders, relying on breeding activities as the main research output and as a significant source of income constitutes a threat to the development of the Insitute.
- Another pillar of AREI activities is the research and development of crop cultivation practices. At the moment it seems that extension activities are not remunerated, and anyway the financial impact of extention activities is marginal. Agroecology is in the Farm to Fork EU strategy, which targets that 25% of farmland should be organic farming, 10% should be re-naturalised, etc. leading to a great transformation of diet and land use. This will be a big opportunity for Latvian agriculture and an institute with a department of agroecology should be expected to play a significant role. AREI need to devote more effort to change, and develop beyond the classical crop breeding activities. AREI has introduced a centre of technology transfer, which should help its researchers to reach out to and support farmers. In fact, the drive towards sustainable agriculture, and in particular towards biological agriculture, calls for a continuous professional update of farmers that could be carried out by or coordinated by AREI researchers.
- In order to face technical and managerial issues related to future challenges and to initiate new research directions, AREI personnel will need continued training and suitable motivation, epecially for young researchers, where motivation and experience gained from interacting and collaborating with leading international labs is badly needed. Implementation of innovative research methodologies, both in the field of breeding and agronomy seems necessary. At the moment AREI management seems to lack the dynamic capacity needed to face actual and future challenges and fullfil the potential of this institution.

Potential to offer doctoral studies

AREI does not award PhD degrees. AREI offers PhD students its research infrastructure, mainly linked to plant breeding and agronomic sciences, but also offers topics related to agricultural economics. Of great attraction to PhD students should be a stimulating international environment, which is often linked to the availability of international projects. Despite the relatively large number of EC financed projects, AREI does not seem to attract foreign researchers and students and this might limit the attractiveness of AREI to PhD students. This said however, PhD students who have performed research at AREI have continued their research at the institute after their PhD defence as employees, which could represent an additional motivation. However, the best early career researchers need a motivating research challenge and vibrant community and not necessarily only salary.

If AREI had a more proactive strategy for competitive international research projects PhD students could be funded by these projects, which in turn would open up the opportunity for the PhD students to spend some time abroad in the partner institutions, enabling them to expand their knowledge base and their skills. This would have a knock-on effect on the research potential of AREI should the PhD students later take up positions as researchers at AREI.

Alignment with the Smart Specialisation Strategy

AREI activities seem in good alignment with the objectives, development priorities and areas of the Smart Specialization Strategy. In the self-assessment document, there are numerous references to the focus on high added-value products and high resource efficient production systems. AREI's field of expertise is centred in the knowledge specialisation area "Knowledge-intensive bio-economics" and in the following investment priorities: high added-value products, productive innovation system, energy efficiency, modern education, advanced knowledge base and human capital in this area, in which Latvia has a comparative advantage and which are important in transforming the national economy.

Conformity with state scientific and technology development

AREI research activities comply with "research and sustainable use of local natural resources for the development of a knowledge-based bioeconomy", one of the nine science priority axes defined by the Ministry of Education and Science. In the self-assessment report, AREI claims to contribute directly to all five action lines defined in order to achieve the objective of the Latvian Bioeconomy Strategy 2030:

1. Attractive business environment for the entrepreneurship in bioeconomy;

2. Result-oriented, efficient and sustainable resource management;

3. Knowledge and innovation development in bioeconomy;

4. Promotion of production in bioeconomy;

5. Socially responsible and sustainable development

While it seems correct that the research projects and activities of AREI are pertinent to these topics, it is difficult to assess the quality of AREI contributions to all action lines. A limit to the capacity of AREI to address its target topics is a limited number of researchers, particularly considering that the Institute has four research centres and a high number of actual and potential research directions. Another limit to AREI potential in addressing key problems of Latvia's research system is its low level of internationalisation.

Recommendations

The main weakness of AREI is linked to the lack of a clear strategy for its development, resulting in a "business as usual" approach and a lack of dedication and motivation to continue

improving. The recommendation is for the institute to expand its research vision and implement an internationally focused strategy as follows:

- Increase the impact of its research, in particular by increasing the level of scientific publications and international visibility, which in turn can help AREI building international networks and access European funding
- Motivate AREI researchers and offer the opportunity to update their competences and increase their ability to initiate new research directions
- Increase the capacity to join international consortia for the preparation of European proposals and increase the rate of success in national and international funding opportunities
- Implement an extension service through the centre for technology transfer in order to satisfy the industry's and farmers' demands for innovation and in turn generate financial resources to maintain infrastructures and support research.
- Attract PhD students to improve the number, composition and quality of staff

A major constraint to the implementation of a successful strategy appears to be the lack of a dynamic management, capable of turning the challenge of the recent consolidation of the institute into an opportunity to cut costs, reduce administrative hurdles and increase performance by stimulating and encouraging synergies among the different areas of the Institute.

The management of the institute would benefit from a more effective strategy to develop and promote its development plans. Participation in competitions of the EU Framework Programmes and in other research and innovation programmes should be guided and promoted by the creation of an internal research office to help researchers find suitable calls, participate in competitive consortia and manage research projects. In addition, AREI's system of motivation should (if it doesn't already) reward researchers that achieve national and international grants and projects.

A greater effort should be made to implement an extension service to disseminate the knowledge generated by R&D activities of the institute and to gather additional funding from industries, farmers' associations or other private entities. Involvement of researchers in consultancy and dissemination to practitioners will in turn inspire research activities to target the knowledge demand of national industries and local farmers.

Besides the research infrastructure and the financial resources needed for their maintenance, researchers are the main assets of AREI. PhD students are the future of this Institute and their capacity to learn and grow in a stimulating environment should be a priority. A major recommendation is for AREI to favour long visits (at least 6 months) of PhD students to prestigious international universities or research institutes. Currently, the possibility for PhD students to travel abroad is mainly limited to their participation in conferences or meetings in the frame of international collaborations. To create a more international environment AREI should aim to attract foreign students and foreign researchers. In the long term, this will improve the capacity of AREI researchers to write both impact papers and successful project proposals. In the short and medium term, AREI should promote the mobility of its researchers and encourage high-level foreign scientists to visit and collaborate with the institute. An opportunity to invite leading researchers could be the organisation of doctoral training programs, which would benefit both the PhD students and the more senior researchers. The doctoral school could organise training programs in which leading foreign researchers could be invited to hold lectures for the benefit of PhD students and senior researchers at AREI. The organisation of training and doctoral programs could be carried out in collaboration with other national institutes that share similar research objectives (e.g., Institute of Horticulture), as well as with universities in Latvia.

In light of the actual level of research and considering that AREI should strengthen the provision of extension services to farmers and industries it is suggested that research at AREI should be mainly focused on applied research and it should have a stronger link with the University of Life Sciences and Technologies. An important output of AREI research activities should be the formation of a new generation of PhD laureates that will contribute to a new dynamic management of AREI and the provision of up-to-date services to farmers and industry.

A_2 Institute of Horticulture

2.3. Institute Data and Description

Institute of Horticulture	
Primary field of science	Agriculture, Forestry and Veterinary Sciences
Corresponding fields of science	Agriculture, forestry and fisheries; agricultural biotechnology;
No. FTE academic personnel 2018	-
No. FTE academic research personnel 2018	35,45
Total number of FTE academic and research personnel 2018	35,45
Articles in peer reviewed scientific edited journals and conference proceedings included in WoS or SCOPUS in period 2013-2018	170
Articles in peer reviewed scientific edited journals and conference proceedings not included in WoS or SCOPUS	57
Monographs in period 2013-2018	4
Patents Latvian in period 2013-2018	8
Patents (Europe and international) in period 2013-2018	7
Total no. of self-reported outputs in period 2013-2018	246
No. of WoS or Scopus outputs in period 2013-2018 per researcher in 2018	4,8
No. of all outputs in period 2018 per researcher in 2018	6,94
No of PhDs completed in period 2013-2018	8
No. of PhDs in period 2013-2018 per researcher in 2018	0,23
Total funding in period 2013 -2018 (Euros)	10.835.196
Total funding in period 2013-2018 per researcher in 2018 (Euros)	305.647

The Institute of Horticulture (LatHort) is a medium-sized research unit with a strong focus on applied research and some involvement in PhD training. Its main research topics include

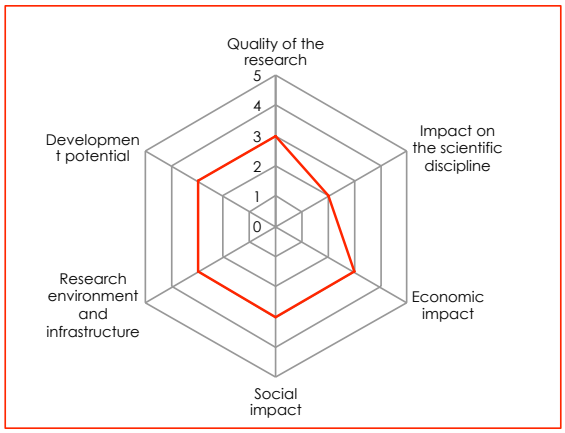
- Development and selection of cultivars of horticultural crops adapted to the Nordic/Baltic Sea region, focusing on aspects of ecological plasticity, productivity, quality, and resistance to biotic and abiotic stresses
- Designing, developing or adapting environmentally friendly horticultural production systems suitable for Latvian agro-climatic conditions; creating cultivars of horticultural crops with biological characteristics that are suitable for use in such environmentally friendly systems
- Developing processing technologies for horticultural produce and designing products suitable for commercial manufacturing
- Assessment of their biochemical composition of horticultural produce and products thereof
- Designing and evaluating storage technologies to extend the period of fruit and vegetable use
- Generating new knowledge using innovative scientific methods, promoting sustainable development of horticultural science and related areas (biology, chemistry, food science), creating a knowledge base for applied research.

2.4. Expert panel evaluation

The figure below presents the scores assigned by the Expert Panel to the institution.

Figure 2 Institute of Horticulture – Scores

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



Overall score

Score: 3 - good level of research

The Panel evaluated the Institute with an overall score of 3 as it assessed the institute as a strong national player with some international recognition for specific activities. A particular strength of the institution is that it has managed to create a research portfolio that covers the entire value chain of horticultural crops. The Institute has also found a few niches in which it demonstrates international strength such as the value chain of Japanese quince. Its role in the preservation and conservation of plant genetic resources is important; this also applies to its work on plant pathology. It has a strong connection to the horticultural sector in Latvia and is not only doing research but is also involved in extension activities. It has a strong dissemination programme (exhibitions, museum) linking up with the general public through various events which apparently attract many visitors. The Institute is endowed with an enthusiastic management team.

Quality of Research

Score: 3 - good

The Panel scored the Quality of Research with a 3, indicating that LatHort is a strong national player with some international recognition. The quality of the research is unquestionable, and the research performed is suitable for publication in international journals. LatHort made great progress in the production of scientific output compared with the previous review. The number of scientific publications has significantly increased, although the number of publications per researcher per year is still relatively low compared with international standards. In contrast to the number of publications, the quality of the publications has not increased to the same extent. Nevertheless, the Panel observed that LatHort has produced some good papers of significance, e.g., on seed oil contents of rarely used species. Furthermore, LatHort's management has put much more focus on the need to publish in international scientific journals. Despite some good examples, in general there is still room for a lot of progress with regard to the quality of scientific output as expressed by the ranking of the journals in which papers are published. However, the Panel also concluded that the nature of some of the research is very applied and therefore international scientific publications in high-ranked scientific journals might not always be a first priority.

The institute is to be commended for its value chain approach and for the well-developed combination of activities on conservation of genetic resources, breeding, post-harvest physiology, processing and product analysis. This approach makes it a strong national player and could create the base to become an important international player in niche areas in the future.

Overall, the Panel would like to stress that LatHort is entirely fit for purpose: an applied research institute focusing on the value chain of horticultural products with an open door to the Latvian horticultural industry and the general public of Latvia.

Impact on the scientific discipline

Score: 2 - adequate

The Panel scored the Impact on the Scientific Discipline with a 2, indicating that LatHort is a satisfactory national player in the development of horticulture as a science, with proper connections to other relevant knowledge institutions in Latvia. In other words, the institution occupies a stable position in the national scientific community. However, LatHort does not have a great impact on the international development of the discipline. It is active in international projects but mainly in COST-type collaborations which are very useful for international exposure but are not very productive in terms of new research. However, many of these international contacts could develop into programmes in the future, provided the level of EU-funding for research will be maintained at a reasonable level. It is also noted by the Panel that LatHort is active in these COST projects but does not lead them. So, we conclude that the position of the institution within the international scientific community is still evolving; it still has to strive for its status as a recognised member of the discipline, with, hopefully, in the future a greater role; its impact on the international scientific community could be improved, certainly in the niches in which LatHort can develop a strong international position. These have been, until now, relatively few.

The research on plant pathology seems to be of a good standard, but much of the other research topics are only regionally relevant. The institute has identified some niche areas of research that can be utilised in many ways (e.g., its value chain approach of Japanese quince; its apple breeding programme). However, it has been a very small niche with a minor international role until now. The scientific quality and international exposure of its scientists might currently also not be strong enough to be internationally competitive. There is some work to be done, but there are signs that management is in the process of developing the tools to realise this.

Economic impact

Score: 3 - good

The Panel scored the Economic Impact with a 3, indicating that LatHort is a strong national player in the development of the economy of Latvia. LatHort is well-linked to the national horticultural sector and also works directly for the sector. These ties include both the primary producers and the processing industry. The close links are not only demonstrated by activities related to knowledge creation (e.g., research) but also those related to knowledge transfer, development of technologies and stimulation of innovation processes. It was obvious to the Panel that LatHort is highly appreciated by the industry. Its very applied nature makes it possible to be closely connected to the needs and wishes of the horticulturalists in Latvia. The research of the institution is therefore important for the national economy. The institution's interactions with the private sector are at a level that is expected of recognised academic institutions. Moreover, LatHort also plays a direct role in extension activities, which is very important given the fact that a formal extension organisation is lacking in Latvia. This role was also recognised by representatives of the Ministry of Agriculture and the Ministry of Education and Science with whom the Panel discussed the review process.

Social impact

Score: 3 - good

The Panel scored the Social Impact of LatHort with a 3. This indicates that, in the opinion of the Panel, the research activities, but certainly also the other activities developed by the institution, such as the advisory services, are important for the Latvian society and the interactions with the Ministry of Agriculture are of good quality. The horticultural sector might not be large in Latvia but it is of great strategic importance. Research and extension of LatHort could support the opportunities that exist for the export of fresh and processed food items.

The institution is very proud of its interactions with the general public, and rightfully so. LatHort organises wonderful open days which have developed into special events that are highly appreciated and well attended.

From the site visit the Panel got the impression that the interactions with national NGOs are strong but this has already been highlighted under economic impact. LatHort has certainly demonstrated that it has strong ties with the Ministry of Agriculture and plays its role in advising the government and informing about agricultural policies.

Nevertheless, the social impact of the Institute could be further developed and strengthened.

The contribution to higher education is relatively small. There are good linkages with LLU, but the number of PhD students per academic staff member is relatively low.

Research environment and infrastructure

Score: 3 - good

The Panel scored the Research Environment and Infrastructure of LatHort with a 3, indicating that LatHort is a strong national player in horticulture. The Institute is very suitable for applied research and has the facilities and the management to carry out this applied research very well. Nevertheless, in comparison with the other institutions this Panel has reviewed, the investments in research infrastructure were relatively small. The amount of funding acquired per individual researcher was about average, but the self-assessment report clearly indicated that staff needed to invest a lot of time in writing grants and proposals as there was a lot of bureaucracy involved in the application processes. There were perhaps also too many small projects per individual researcher, which contributed to the overall bureaucratic burden.

The strength of the Institute is the open mentality of the staff and the willingness to become strongly involved with the sector. The institution is able to provide a research environment that is comparable with globally recognised academic institutions in its discipline, but only with a local or regional impact. The Institute has recently appointed many young staff, which will contribute positively to the quality of the research environment. The staff is, however, very much focused on Latvia or its immediate surroundings. Interactions with European partners are limited and (long-term) visits abroad are lacking. Incoming visitors from abroad could also contribute to a more internationally oriented research environment.

The Panel has the impression that the management team was competent and able to demonstrate enthusiasm for the field and commitment to science. The description of the institute's strategy in the self-assessment, however, was not very innovative.

Development potential

Score: 3 - good

The Panel scored the Development Potential of the Institute for Horticulture with a 3, indicating that the Panel has the impression that over the next 5-10 years the institution will be able to strengthen its position in the international scientific community as a convincing actor and a trustworthy partner within international collaboration networks. The Panel bases this notion on the fact that there is a new dynamic in the institution thanks to the young staff and on the

observation that there is a competent senior management team that is well aware of the strengths and weaknesses of the institution and also has a keen eye on its opportunities and threats. The senior management understands that more work needs to be done to become an international player. The management team was also convincing in its interactions with the Panel, thanks to a high level of commitment to science and a strong enthusiasm for its own role in science.

The strong relations with the Horticultural Sector of Latvia and the strong linkages with the general public guarantee a strong reason for the existence for the coming years. LatHort obviously has an important role to play at the national level. If that could be coupled with a stronger emphasis on developing international linkages then the future is bright.

Potential to offer doctoral studies

LatHort does not award PhDs. The number of PhD candidates is relatively low compared to the other institutions reviewed by this Panel. There is a strong linkage to LLU, but the very applied nature of the research activities might only be appealing to a certain category of young scientists. The scientists of LatHort are competent enough in supervising the daily research activities of PhD candidates but the research environment is not very internationally oriented and is also not very conducive to output in high-ranked international journals. It is necessary that the staff develops further in order to be a good haven for ambitious PhD candidates who want to pursue an international career in science.

Alignment with Smart Specialisation Strategy

In the opinion of the Panel, the scope, profile and the volume of the research activities and knowledge transfer and innovation activities of LatHort are very well aligned to the following RIS3 policy goals:

- Enhancing production and export structure in horticulture;
- Further growth of products with high added value.

LatHort fits in the following investment priorities:

- High added value products;
- Productive innovation system;
- Modern education;
- Advanced knowledge base and human capital in areas in which Latvia has a comparative advantage.

Moreover, LatHort is in the core of the following specialisation areas:

- Knowledge-intensive bio-economics;
- Smart materials, technologies and engineering systems.

Finally, LatHort has demonstrated that it has created capacity in participatory approaches which are considered important in the Latvian scientific strategies.

The panel also has the opinion that LatHort significantly increased its contributions to science and worked hard to strengthen the knowledge base of horticultural food production, storage of fruits and vegetables, and food processing thus supporting the realisation of the goals of the RIS3, in particular by increasing the number of publications, intensifying the knowledge transfer and stimulating innovation processes. The international orientation of LatHort has improved over the last six years but deserves to be further strengthened in the next six years.

Conformity with state scientific and technology development

The emphasis of the Latvian policy goals lies in the objective to transform the national bioeconomy in such a way that the international competitiveness is strengthened, more added

value is created, and productivity is increased. In the opinion of the panel, LatHort has significantly contributed to most of these goals during the last years. It has done so by creating success in its value chain approach, focusing on new products (e.g., on Japanese quince and buckthorn) and stimulating export of these new products. LatHort has been less successful in increasing its own competitiveness in an international setting. Although it has become a useful partner in EU projects, it has not become a leading player (yet), partly because of its focus on the local and regional value chains. A more international orientation is still necessary but can only be achieved if the Institute demonstrates itself to be a competitive player in science. It needs to do so by publishing in high-ranked journals, despite the applied nature of its research.

Recommendations

The panel has the following recommendations for LatHort

- Encourage researchers to publish in higher-ranked journals despite the applied nature of the research, thus becoming more visible in the international scientific community and enabling themselves to take up a leadership role in international collaborations.

Exchange research staff at the international level, also beyond the Baltic states / Eastern Europe

- Attract also PhD students with a more fundamental research orientation.
- Make use of the PhD students to strengthen the ties with more fundamental research institutions without losing the unique characteristics of the institute's research.
- Make use of the rejuvenation of the staff thus creating new dynamics.

Further develop the applied research agenda alongside close interactions with the horticulture and food sectors

- Encourage researchers to continue on the path of value chain development enhancing a close interaction between primary producers and processors.
- Improve the interactions with the horticultural sector and especially with the private companies in horticulture and the food industry.
- Create new public-private relations to commercialise knowledge, to become more active in commercialising research findings, and to empower the horticultural sector to innovate,
- Create new business models for knowledge transfer, knowledge valorisation, the advisory services and support of innovation processes.

A_3 Latvian State Forest Research Institute "Silava"

2.5. Institute Data and Description

Latvian State Forest Research Institute "Silava"	
Primary field of science	Agriculture, Forestry and Veterinary Sciences
Corresponding fields of science	Agriculture, forestry and fisheries
No. FTE academic personnel 2018	-
No. FTE academic research personnel 2018	93,26
Total number of FTE academic and research personnel 2018	93,26
Articles in peer reviewed scientific edited journals and conference proceedings included in WoS or SCOPUS in period 2013-2018	286
Articles in peer reviewed scientific edited journals and conference proceedings not included in WoS or SCOPUS	65
Monographs in period 2013-2018	9
Patents Latvian in period 2013-2018	11
Patents (Europe and international) in period 2013-2018	2
Total no. of self-reported outputs in period 2013-2018	373
No. of WoS or Scopus outputs in period 2013-2018 per researcher in 2018	3,07
No. of all outputs in period 2018 per researcher in 2018	4,00
No of PhDs completed in period 2013-2018	10,00
No. of PhDs in period 2013-2018 per researcher in 2018	0,11
Total funding in period 2013 -2018 (Euros)	26.728.691
Total funding in period 2013-2018 per researcher in 2018 (Euros)	286.604

The Latvian State Forest Research Institute SILAVA is the research institute in Latvia aimed at undertaking scientific research to build the necessary knowledge to advance forest research, to manage forest ecosystems and to increase the competitiveness of the forestry sector in Latvia.

SILAVA has identified five major research topics. These research topics aimed at

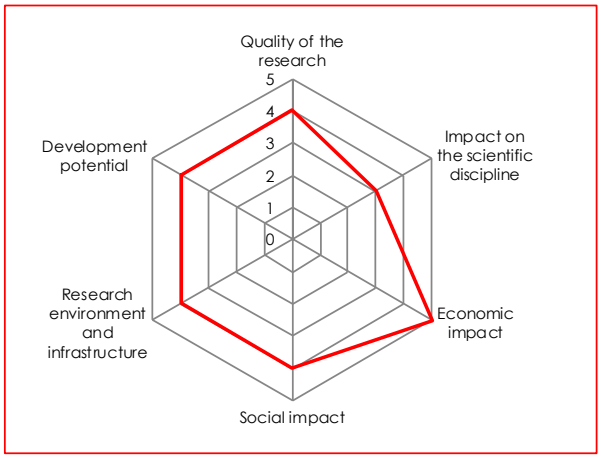
- increasing forest capital value (e.g., forest genetics and tree breeding, forest management, forest entomology and forest pathology)
- understanding forest environment and climate change (e.g., forest biodiversity, soil science, abiotic damages, carbon cycling)
- developing forestry machinery
- improving non-timber services (e.g., non-timber products, socioeconomic aspects, agroforestry)
- improving game and fauna management (e.g., wild mammal populations, habitat dynamics, environmental capacity indicators in forest ecosystems, game and fauna sustainability, and socio-economic and risk analysis)

2.6. Expert panel evaluation

The figure below presents the scores assigned by the Expert Panel to the institution.

Figure 3 Latvian State Forest Research Institute "Silava" – Scores

Criteria	Scores
Quality of the research	4
Impact on the scientific discipline	3
Economic impact	5
Social impact	4
Research environment and infrastructure	4
Development potential	4
OVERALL SCORE	**4**



Overall score

Score: 4 - very good level of research

Overall, the Panel agreed that SILAVA is a research institute of very good level, performing important and even essential research at the national level in an excellent manner, and being a good international player, with a high potential of improvement- demonstrated in the past years - to become a very strong player worldwide.

The quality of the research is very good. At the national level, SILAVA plays an important role in performing several functions delegated by the state. SILAVA is also well integrated in the European research community and can become an important liaison between Western European and Eastern European countries (including Russia). In some disciplines SILAVA is performing at an excellent level, and with its publications in international scholarly journals, it is highly visible in the international scientific community.

SILAVA is an important driver of economic development, and its research has a strong and important impact on the Latvian economy. SILAVA is a partner of primary importance among non-academic partners for research and development projects.

The societal impact of SILAVA in Latvia is also very good. SILAVA has national responsibility of several statutory services, e.g. the National Forest Monitoring Programme and greenhouse gases calculations for land use, land-use change and forestry.

The research environment and infrastructure of SILAVA is very good. SILAVA is able to provide an excellent research environment, comparable to high-level international knowledge centres.

SILAVA has a large potential for developing itself into a leading institution in forest research in the region and a strong global international player within forest sciences, as it is already in some disciplines. It is expected that over the next 10 years it will achieve an excellent level of scientific quality and will become a highly regarded partner in international collaboration consortia.

Quality of Research

Score: 4 - very good

The research of SILAVA covers many disciplines, including genetics, pathology, soil sciences, entomology, and game research. The main focus in research is on applied themes with some basic (strategic) aspects.

The research performed at the Institute is of the highest importance at the national level. It is original, published in good to excellent international scholarly journals, and of very good to excellent quality.

In some disciplines, e.g. in dendrochronology, in pathology, entomology, in genetics and in forest monitoring, SILAVA is certainly performing at an excellent level, and with its publications in international scholarly journals (including both contributions by SILAVA researchers alone, and collaborative papers together with international research groups) highly visible in the international scientific community.

SILAVA is a strong international player, well integrated in European research. National stakeholders have demonstrated great interest in SILAVA's research.

Impact on the scientific discipline

Score: 3 - good

SILAVA is a very strong national player with international recognition. The impact of the research carried out by SILAVA in the field of science is, at the national level, very good or even excellent.

SILAVA occupies a stable and significant position in the international scientific community and is considered a respected centre of competence in the region and beyond. This international recognition is demonstrated by the fact that SILAVA is attracting scholars from other countries, is well integrated and strongly involved in international European projects (FP7, H2020, Interreg, etc.) and in the organisation of international workshops, and publishes scientific papers with co-authors from several different research institutes from abroad.

SILAVA has particular links with the other Baltic countries, Scandinavia and Finland. However, its international activity and wider international scientific impact need to be enhanced by adopting a series of measures which should be supported by the agencies which support SILAVA. For example, the relationships with Latvian, Baltic and European universities could be strengthened, e.g., through the creation of common professorships, the common supervision of students, the teaching of SILAVA scholars at the universities, and the exchange of students.

Economic impact

Score: 5 - Outstanding

SILAVA's research, activities and services are highly important for Latvian economy, which renders the institute a high esteem among non-academic partners for research and development projects. The institute is an important driver of economic and societal development. The economic impact of SILAVA is outstanding.

The importance of SILAVA for economic actors and for the industry - mainly but not only the timber industry - is exceptionally high nationally, and it also has a very high international impact. Approximately 50% of the territory of Latvia consists of forests, and the scientific efforts of SILAVA directly impact at least 60% of this area. SILAVA is well connected with end users via national networking and has direct contacts with customers, stakeholders, forest and landscape managers and forestry industry companies. The institute has a high proportion of customer-funded projects (quite a big share of these come from Latvia State Forests company), and has international customers (e.g., forest technology companies from Scandinavia). Furthermore, its

14 spin-off products and the 17 patents registered and maintained by SILAVA are clear proof of the strong relevance and high economic impact of the institute.

SILAVA has a very strong collaboration with forestry companies, e.g., Latvian State Forests, which has been provided by SILAVA with tools, e.g., for modelling, with training and education, and through seminars, publications and even journals. The research activities of SILAVA are of highest importance for the companies and for the country, the forest being one of the main natural resources and forestry one of the main vital economic sectors of Latvia. SILAVA is a highly esteemed partner in research and development for forestry companies, and an important driver of development in the Latvian society. Some of the researchers at SILAVA are key to such relationships with the private sector and requested as partners - something which is key to making SILAVA's research so relevant for forestry in Latvia.

Social impact

Score: 4 - very good

At the national level, SILAVA plays an important role in performing several functions delegated by the state. Besides having these commitments accomplished, SILAVA is very active, in a very creative manner, in extension and dissemination activities, e.g., with the Latvian Forest Science Days, and has a strong link to forestry companies, and collaborations with Latvian universities.

The impact of SILAVA on the society in Latvia is very good to excellent. While its economic impact is scored as outstanding, its social impact is scored as very good but possibly could be further improved, particularly where the role of the institute in environmental education in Latvia is concerned. SILAVA could play a more proactive role in Latvian society regarding environmental health, forest and landscape ecology, and forests as recreation spaces. Although not an institute of higher education, SILAVA could implement some programmes to educate young students, children and larger parts of Latvian society. Environmental issues, e.g., climate change, are becoming increasingly important drivers in Europe, and SILAVA will have excellent possibilities to discuss the problems, could still benefit from changing attitudes in society on environmental issues, and could provide solutions and answers not only to the forestry sector but to larger parts of the society in Latvia too.

SILAVA has several statutory services, e.g., forest inventory, elaboration of reports of carbon dioxide removals and emissions from land use, land use change and forestry sector (LULUCF) with respect to climate change, tree breeding and gene resources of forest trees, and forest environmental monitoring. Research activities also provide information and solutions to Latvian State Forests or market-oriented research in the fields important for forestry and forest industry.

Overall, SILAVA's research is very good, and is very important for Latvian and European society.

Research environment and infrastructure

Score: 4 - very good

SILAVA is a strong international player, able to provide an internationally comparable excellent research environment to high-level internationally recognized scientists and should work in the future years to increase its potential to become a global leader.

The Institute has a reasonably sized scientific community with scientific staff of 220 people. Its age structure seems to be good, with many young researchers with recently acquired PhD degrees. The scientific community is active, international collaboration is lively as shown by frequent visits and collaborative research papers.

SILAVA has a well-defined research strategy that drives the research and a structure to implement it.

The research infrastructure consists of six research laboratories that seem to serve the research needs well. The institute provides a good research infrastructure which is comparable with - but

not much better than - other institutes working in the same sector elsewhere in the Baltic, Nordic and European countries. The research environment seems to be very good, the human resources particularly good to very good or outstanding. Some scientists had outstanding performance, and some laboratories were well or very well equipped. In order to apply cutting-edge techniques, collaborations with other research institutes - working in physics, chemistry or physiology - in Latvia, in the region or elsewhere else in Europe or in the world should be established.

Overall, the research environment and infrastructure of SILAVA is very good.

Development potential

Score: 4 - very good

The institute has great potential to develop as a leading institution in forest research in the region and a strong international player. SILAVA is able to establish itself as a recognised and respected player in the international scientific community within forest sciences, as it is already in some disciplines. It is expected that over the next 10 years it will achieve an excellent level of scientific quality and will become a highly regarded partner in international collaboration consortia.

More collaboration with local and other universities and other European research institutions is needed. The great potential coming from the existing long-term data sets and monitoring programmes, such as the national forest inventory, or the ICP level I or II monitoring plots, could and should be fully exploited and the role of SILAVA should be made clear. Possible interactions with universities should be established or made even stronger, based on such datasets and monitoring tools which, usually, the universities do not have. The development towards a major player in the international research community with a leading role in international projects would, however, mean investments not only focused in research excellence and infrastructure, but also in support in applying (and lobbying) for EU funding as well as in management of large consortia.

The strategic development potential was identified in several research directions recognised by the institute: research related to the role of the forest in climate change; forest cultivation and breeding knowledge; increasing potential and need for fundamental research in molecular genetics and phytopathology; increasing demand for forest ecosystem research; various forestry industry demanded emerging research directions. These seem to be disciplines where the institute has its strengths, but also fields of increasing interest of the international scientific society.

Presently SILAVA is successful in attracting national funding, but in the future, increasing international funding and stronger role in international collaboration seems possible.

SILAVA has the potential to become the leading forestry centre in several fields, attracting students and young scientists who could profit, for example, from SILAVA's experience in the laboratory and in the field, e.g., in its experimental forest plots, as well as in collecting and interpreting monitoring data. Also, international collaborations with forest research institutes should be stimulated - there are already several good examples of scientists, e.g., forest pathology group, forest genetics group, the tree-ring lab and the forest inventory group, caring about such relationships and such examples should be stimulated and promoted among the other groups.

Potential to offer doctoral studies

Presently, SILAVA scientists educate PhD students, mainly coming from and enrolled at the Latvia University of Life Science and Technologies (LLU) and Silava does not award PhDs. SILAVA offers a very good research environment which the students appreciate. They also appreciate in particular the time and devotion which is dedicated to them by SILAVA scientists. What makes SILAVA a unique training and teaching playground is the field-based experience of the

research, scientific and technical staff, the data which have been recorded and obtained in the past decades, the forest plots which attract students who would like to have hands-on experience and want to feel the experience and excitement which forest research may give.

However, in order to be more productive in terms of papers published by the students and in terms of their education, the students' PhD programme should be organised, structured and programmed in a graduate school, to be run together with the partner universities. Currently, the average time to complete a PhD is longer than the typically three or four years needed in most European countries. This fact creates problems to the young scientists when applying for Post-Doc positions, because when they finish their PhD, even if with the same experience and publication record, they might lag behind their peers from other countries who have managed to progress faster in acquiring academic positions.

SILAVA should exploit its potential by creating such a PhD programme, with internal lectures and other scientific activities.

Alignment with Smart Specialisation Strategy

SILAVA's strategy is in perfect agreement with the objectives, the development priorities and the areas of the Smart Specialization Strategy. SILAVA contributes to the national RIS3 area "Knowledge-intensive bio-economics", aimed at providing the conditions and possibilities for creating high-added value forestry production. SILAVA is a driving force for the development and innovation in the forestry sector. Collaborating with universities and higher education institutions in Latvia, SILAVA organised various extension activities for stakeholders, students and wider parts of the society. In the review period SILAVA ran research projects with 21 companies, facilitated the development of 14 spin-off products and registered and maintained 17 patents.

Conformity with state scientific and technology development

SILAVA committed itself to reaching the objectives of the national scientific and technological development policy. Through collaborations with private and state forestry companies, it improved its contribution to research and development in the forestry sector. Through collaborations with universities and higher education institutions it contributed to the education of the next generation of forest managers and engineers working in the forestry sector.

Recommendations

SILAVA already plays a leading role in forest science among the Baltic countries, along with an important role in Europe. However, it could increase its international importance further. Tighter networking with present partners, identification of joint themes with large international importance (e.g., carbon issues and peatland forestry, biodiversity, short rotation forestry with broad-leaved species, emerging pests and pathogens from southern environments northwards) would lead to an increasing number of international projects with high scientific visibility.

Following the example given by the groups at SILAVA which already established in the recent past fruitful collaborations with other European countries, other researchers in the institute should contact research partners abroad, establishing partnerships and creating consortia for international projects. For this purpose, a first step would be inviting outstanding foreign scientists, visiting them or sending them students in their laboratories, which may help in establishing such contacts.

SILAVA educated several PhD students offering a highly appreciated environment and experience for doing science in the lab on the bench, and in the field in the forest. However, the panel recommends the development of a joint doctoral programme with the Latvia University of Life Science and Technologies (LLU) with the aim of improving the quality of the doctoral studies, increasing the mobility of young scholars allowing stages in other laboratories abroad, increasing the number of students' publications, and decreasing the duration of their PhD to 3 to 4 years, as usual in other European countries.

Concluding, SILAVA's international activity needs to be enhanced by adopting a series of measures, e.g., through the creation of common professorships with universities in the Baltic region, the common supervision of students, the teaching of SILAVA scholars at the universities, and the exchange of students. SILAVA has the potential to become the leading forestry centre in several fields, attracting students and young scientists who could profit from SILAVA's experience in the laboratory and in the field. Also, international collaborations with forest research institutes should be stimulated.

A_4 Institute of Food Safety, Animal Health and Environment "BIOR"

2.7. Institute Data and Description

Institute of Food Safety, Animal Health and Environment "BIOR"	
Primary field of science	Agriculture, Forestry and Veterinary Sciences
Corresponding fields of science	Agriculture, forestry and fisheries; Veterinary science
No. FTE academic personnel 2018	-
No. FTE academic research personnel 2018	43,21
Total number of FTE academic and research personnel 2018	43,21
Articles in peer reviewed scientific edited journals and conference proceedings included in WoS or SCOPUS in period 2013-2018	200
Articles in peer reviewed scientific edited journals and conference proceedings not included in WoS or SCOPUS	13
Monographs in period 2013-2018	9
Patents Latvian in period 2013-2018	3
Patents (Europe and international) in period 2013-2018	0
Total no. of self-reported outputs in period 2013-2018	225
No. of WoS or Scopus outputs in period 2013-2018 per researcher in 2018	4,63
No. of all outputs in period 2018 per researcher in 2018	5,21
No of PhDs completed in period 2013-2018	11
No. of PhDs in period 2013-2018 per researcher in 2018	0,25
Total funding in period 2013 -2018 (Euros)	35.176.732
Total funding in period 2013-2018 per researcher in 2018 (Euros)	814.088

The Institute of Food Safety, Animal Health and Environment "BIOR" is the main center of research in these areas:

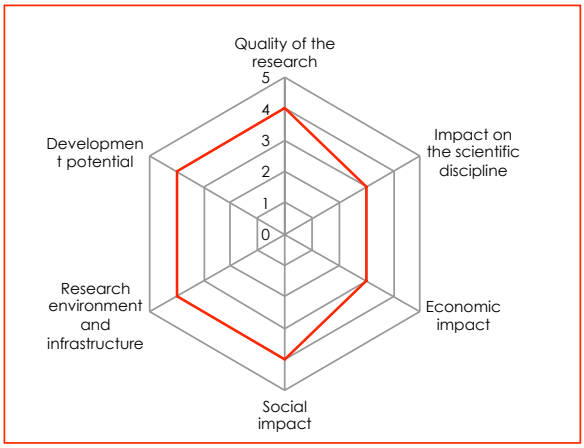
- Food safety
- Environmental health
- Fisheries
- Veterinary and public health science

The research areas of BIOR are applied, and BIOR's research is entirely dedicated towards public benefits, having direct social relevance in the fields of food safety, and animal public health aspects. BIOR also serves as the national reference institute for the European Food Safety Agency (EFSA). BIOR employs approximately 400 employees of which about 250 are directly and indirectly involved in generation of research outputs, and a 100 of which are listed in the BIOR's academic personnel. The academic staff produces internationally visible research. A key activity of a larger part of the staff is mainly serving the laboratories, providing public health-related services and tests for several state agencies. BIOR receives funding from public and private sources. Researchers of BIOR have also teaching duties at universities and supervise PhD students at the institute.

2.8. Expert Panel Evaluation

Figure 4 Institute of Food Safety, Animal Health and Environment "BIOR"– Scores

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



Overall score

Score: 4 - very good level of research

The Panel scored the BIOR with an overall score of 4. To come to this decision the Panel acknowledged the high scientific profile and social impact of BIOR's research on Latvia's science system regarding public health. The panel was impressed by the enthusiasm and professionalism of BIOR's staff at various levels, from the management to postdocs and the PhD students. Furthermore, BIOR has a research output visible at the international level in the form of lead-author papers in high-impact disciplinary journals as well as co-authorships in top journal papers. The current performance promises international leadership in the research field within a decade. The Panel also acknowledged the role of BIOR as a high-quality applied research centre of the discipline and service provider institute, having both staff with scientific international recognition, and also mainly focused on service provider branch. In the Panel's overall evaluation, BIOR has a good level of scientific achievements in the international scientific community and bodies, and it produces some strong disciplinary papers.

Quality of Research

Score: 4 - very good

The Panel scored the BIOR's research quality with a 4. The Panel credited the significant research results, published in leading disciplinary journals, with lead authors from BIOR. Also, the panel acknowledged participation in several large projects (EFSA, COST, Baltic see region, national funding etc.) dealing with broad aspects of food safety and surveillance, as well as marine food research. These projects obviously offered many oportunities for interactions and generating good papers. However, the panel examined the lack of top-journal publications in some of the disciplines represented at BIOR. A close examination of the year 2018 indicated that 43 researcher-FTE produced 49 international papers, which is around 1.1 paper/researcher – which is rather good and, considering the strongly increasing number of papers during the six years, even better.

One paper per researcher can be considered a good achievement now, yet the next step should be the expectation to go for high-impact journal papers to reach the leading international level. When comparing the groups within BIOR, it became evident for the Panel that the group around Dr Bartkevics (120 papers, h-index 20) stands out from the rest of the institution. This makes the production of high-quality international research and papers fragile

(i.e. highly dependent on one research group and one person). The Panel also acknowledged one co-authored top paper (Nature Communications) during the evaluation period. The Panel noted a weaker performance in fish related papers, considering its general importance and possibilities at BIOR for fish research (e.g, fish farm for experimental studies). The Panel discussed emerging research topics in the BIOR's area of expertise with increasing national and international importance (i.e., African swine fever, pesticide residues, etc.), thus providing good potentials for quick and high-level publications, a situation which does not exist in more traditional topics, so a good opportunity for BIOR. Also, the application of the "One Health approach" as its strategy may align BIOR with the major trends at international level and make it easier to "position" itself as an attractive partner for international researchers and organisations.

Regarding the funding level, the panel observed that the largest part (c. 80%) of the budget for research came from competitive funds, including a third from international sources (including some EU framework projects), providing further indication of the good quality of BIOR research.

Impact on the scientific discipline

Score: 3 - good

The Panel scored the impact on the scientific discipline of BIOR with a 3 i.e. the institution is a strong national player with some international recognition. BIOR's international networking and reach is strong as indicated by the number of European (mainly EFSA, COST) projects. Nevertheless, BIOR researchers are not acting as coordinators in these projects indicating BIOR's strong international presence but not, as yet, in leadership positions. While BIOR participates in European projects, BIOR is also not yet involved in the coming Horizon Europe and European Partnership developments, or in general in the development of EU's research policies. This medium level international connectivity is also visible in the foreign visits to the institute, where, as indicated in the self-assessment report, 14 are listed, with the last four seeming to be linked to one event, nine invitations to conferences. The low number of participations in high-quality journal editorships (which is 1, Scientific Reports) and low numbers of invited speeches at international conferences also suggest a rather low international impact on the discipline. The Russian language understanding was highlighted in the self-assessment report as an asset (e.g. regarding the library, and to build contacts to the East), but this report (section 5.4) only lists foreign collaborators from the West, indicating that this asset has not being efficiently utilized. Indeed, the Panel has the opinion that considering that Russia and Belorussia are neighbouring countries, some links – e.g. inviting the best researchers to BIOR – may need to be instigated or reinvigorated.

In terms of dissemination of its research to strengthen its outreach and impact beyond Latvia, the panel observed that the institute's English homepage was outdated (the last news was from March), which doesn't give the impression of highly productive research and service activity.

Economic impact

Score: 3 - good

The Panel scored the economic impact of BIOR with a 3. BIOR is the only institution of food safety and veterinary surveillance in Latvia thus its major role is focused on social impact and not economics and its research plays a good role in the economic development of the related home industries. In one hand there are some revenues generated in the form of services towards these industries (more than 500.000 Euro). On the other hand, however, the fact that Latvian food industry lacks R&D capacities, should have been better utilized by BIOR to offer the research capacities and expertise and interact with these industries that might bring better revenues and cooperation. The Panel acknowledged several good contracts with EFSA and other national and international bodies within the BIOR competence fields, which seems to

bring good revenues. Most research projects are applied, with seemingly proper goals for after-research and innovation use. While BIOR has links to and income from private companies this is on a rather small scale. This is also in line with the conclusion that BIOR has a much bigger effect for society via public benefits (diseases, zoonoses, aquaculture) than directly for the economy. Also, the BIOR is a National Reference Laboratory involved in national and international monitoring and veterinary surveillance programs. The Panel also acknowledged the fact that experts of BIOR's Fish Resource Research Department take part in research on evaluation of status of commercial fish stocks in European marine areas. The list of contract research projects shows the need from a wide range of institutions, like laboratories, state companies, biotechnology companies, for evidence-based advice from BIOR, although the sums are rather small.

Social impact

Score: 4 – very good

The Panel scored the social impact of BIOR with a 4. While recognizing that BIOR is primarily not supposed to produce patents and innovations for economy, the panel acknowledged the role of BIOR in serving the society in other important ways such as disease control, zoonoses, fish stocks – animal health, veterinary surveillances and food safety, as well as the involvement in the diagnostics of SARS-CoV-2 pandemic. These are basic activities related to public health and national security (e.g., food supply) of Latvia. The Panel acknowledged BIOR's strong commitment in fighting against African swine fever, which threatens animal health, meat production, and food security. Related to the relevance to the society, BIOR needs to build a strong link to society, to continuously convince it of its usefulness through the services provided by the institute for the wellbeing of Latvian people. BIOR has a Latvian language Facebook account, seemingly active, a good way to spread information. The EU project researchers' night, and 150 news items during the six-year period reviewed- these show a good start. As BIOR uses taxpayers' money, the feedback to the society is a key component of communication strategies, and considering the burning research topics of BIOR, it is an even more significant task, and needs continuous development.

BIOR's major partner is the Ministry for Agriculture, an intensive and strong cooperation is there, where BIOR supports the country's policy makers with analysis and evidence, e.g. test results on health issues. Researchers of the BIOR are involved in different expert working groups either at national (Ministry of Agriculture, the Ministry of Health) or international (e.g. EFSA) level.

BIOR has collaboration with the most important Latvian universities and takes part in MSc and PhD supervision so helping to provide future researchers for Latvia. Eleven PhDs were completed during the six years from three universities. The number of researchers enrolled in doctoral studies is increasing slowly, showing more early career researchers are educated in research at BIOR – a necessary step to increase the young generation and human research capacity.

Research environment and infrastructure

Score: 4 – very good

The panel scored the research environment and infrastructure with a 4. The leadership of the Institute and the principal investigators represent the interests of BIOR very well, and manage the institute effectively, including research projects, ensuring funding, maintenance and operation of laboratories.

Regarding the infrastructure, with a total area of research of more than 8000 square meters, modern computing infrastructure and modern research equipment (e.g., high resolution mass spectrometers, molecular biology equipment, next generation sequencers, aquaculture research facilities, etc.) BIOR is very well equipped and equal to leading international institutions. The large and expensive equipment is permanently (24/7) in operation, which is

rather good, as there are examples from other countries where large equipment is acquired and not used (or under-utilised) due to lack of personnel and maintenance costs. The available space, the ongoing extension of buildings and moving to one campus give further possibilities to develop lab and office spaces, conference rooms, and spaces for informal networking – which is a basic way of developing new ideas. It should also provide space for international level meetings. The €2 million infrastructural development projects have the potential for great steps to improve BIOR's physical environment.

The number of research staff - only 43 FTE - however, would appear to need to be higher to align with the building and equipment availability and developments, and important research topics. The number of enrolled doctoral students was 25 in 2018, indicating a young researcher community – a good sign of a vivid environment.

The research environment at BIOR seems to be very well balanced in terms of the shares among research staff groups (leaders, researchers, support research, and early-career researchers). BIOR trains a fairly good number of PhD students, although the efficiency of this research seems to be still low. In terms of national and international competitive funding, the institute seems to be a national leader. Regarding staff development, there are cooperation's with universities, promotion of mobility of researchers, as well as adoption of employee evaluation and salary system to motivate researchers. BIOR encourages researchers to publish in international peer-reviewed journals that are cited in international citation databases, and in particular in journals with high impact factors.

Development potential

Score: 4 – very good

The Panel has the opinion that the physical environment and infrastructure seem to be ready to support the development of BIOR in the years to come. The BIOR possesses advanced laboratory facilities and equipment for research in chemical and microbial safety and quality of foods of animal and plant origin, as well as animal infectious diseases, zoonoses, antimicrobial resistance, fisheries and biological resources in aquatic environments. The principal investigators seem to have competitive strength at the international level, but it is not entirely evident, as there is a low number of EU Framework Programme projects and related funding – an evident target for improvement. Other international sources, however, were successfully applied for support. Thus, the capability to support research is good, but with space for further steps. Long term vision was presented for the Panel for further development of research infrastructure regarding large equipment. The use of modern equipment is a good basics for collaborations. This equipment – and other research projects – requires big data analyses, and bioinformatics – a declared priority of BIOR, in accordance with international trends.

The staff is ready to provide advice on emerging issues to the society, like the needed transformational change in food systems; for example, already providing holistic approaches in fishery issues.

This development is not supported by the low number of MSc students, suggesting that the base of the pyramid is weak, although at PhD student level the number is satisfactory. Also promising is the strength in fund-raising, and raising it from a diversity of national and international sources, which promises long term financial stability. To further invest in a project office (writing, administration in English) would further support fund-raising. The attractiveness for foreign scientists, postdocs is currently rather weak, making BIOR slightly out of the circles that support scientific mobility. This is addressed in the research strategy (1.11), where an increase in international experience is explicitly mentioned. The plans for 2013-2018 clearly stated several good priorities, but not all seems to be achieved (e.g., completed MSc and PhD theses, postdocs, foreign fellows).

BIOR is the largest research institute in the area of veterinary medicine, fisheries and food and environment safety in Latvia. During the last years, several good projects were funded and many papers were published in peer-reviewed international journals. This is particularly true in the area of food contaminant research. With the equipment the institute has in place and the amount of grants received, as well as with better trained and motivated research staff (especially PhD students, postdocs & young researchers), the publishing visibility and the efficiency of the institute might increase to become a regional leader and good international partner in their area of expertise. A risk remains, that the funding is mainly dependent on the external (EU) budgets which might decrease in future and reduce the total amount of funding available. Also, the low income for researchers in Latvia might discourage recruitment of highly talented researchers (internal or abroad) in the near future.

Potential to offer doctoral studies

BIOR seems to have good basics to attract PhD students: office, large laboratory background, new equipment, international level lead researchers, projects to fund research. In addition, the panel has the impression of a rather good community and personal links. The number of students however, is not increasing in all indicators, even decreasing in MSc degrees.

BIOR organises the graduate school jointly with several Latvian Universities, obviously because it is not allowed to offer doctoral studies alone and does not award PhD degrees (BIOR is a research institute and not part of the university). BIOR already hosts a relatively high number of PhD students, and had a couple of good PhD dissertations done together with universities (e.g., Latvia University) during recent years. However, the success rate is rather low (number of staff enrolled in doctoral studies is very high compared with the finished theses). Unfortunately, good PhD theses were not converted into influential and highly cited papers. Taken together, in the future the Institute has all opportunities to offer PhD studies based on the infrastructure and academic staff, but this again needs to be done in cooperation with the Universities. It is advisable to involve international members in the PhD committees in order to further enhance the quality of the PhD program at the Institute.

Alignment with Smart Specialisation Strategy

BIOR, as a knowledge intensive research body, contributes to "high-added-value products", "advanced knowledge base" of Latvia's smart specialisation strategy, namely the "knowledge-intensive bio-economics" area. It is also good in the three criteria for public funds, although at different levels: Seems to be effective to gain net economic outcome from projects, and in human capital increase. Scientific excellence for basic science needs further development, but in applied research BIOR is successful.

Conformity with state scientific and technology development

BIOR activities in the evaluation period fit several of the national and smart specialisation strategies. Its human (researcher) capacity increased, it has good links with universities (BIOR researchers are teachers at universities) which supports development (integration of research and education). Possibly, this increases the quality of education. BIOR's scientific excellence increased (number of papers, participation in competitive European projects).

Recommendations

The Panel unanimously believes that BIOR has achieved a strong research position during the last years, providing good potential for further development, particularly at the international level. In this aspect, BIOR needs higher visibility and to become more embedded within the international research community. This could be achieved by:

- Increasing authorships in top journals, lead authorship in leading interdisciplinary journals, and leading role (coordinator or Work Package leader) in EU framework projects

- More active participation in international research bodies including high-impact journals' editorships, society board
- Increasing mobility of the researchers (in the post-pandemic era) to build personal networks (international embedding); inviting professors and other high-profile researcher for sabbaticals; inviting international postdocs for 1-2-3 years projects, etc

Furthermore, there is a need to gear up towards broader policies, including regional (Baltic), and EU level policies (e.g., Water Framework Directive) and the new EU Green Deal related areas. Also, sustainable development goas (SDGs) should be acknowledged in BIOR activities.

The Panel evidenced that although with a short history in its present form, BIOR has experienced an excellent development. However, now it is time to step into the next phase. In this respect, priority should be given to the positioning of the young researcher generation through:

- Using the recent achievements in international connections and reputations to involve or delegate young researchers to scientific bodies, organising committees, evaluation juries, etc;
- Providing a supported career development process to the best young researchers;
- Sending them to best international labs to learn cutting edge research and methods, and to meet prominent colleagues;
- Proposing them to be editors in emerging journals/issues, participate in projects, being invited speakers, give seminars abroad, etc.

In addition, the Panel considers that it would be necessary to develop more top research laboratories within BIOR, especially in the aquatic area, to reach a better scientific balance (i.e., similar quality) for different disciplines. As the equipment is operational full-time, further strategic acquisitions can also be considered, if staff and operational costs are available.

While acknowledging the key role of BIOR as service provider to the state agencies, the Panel evidenced a rather limited proportion of services to the private companies. Private companies are still weak in Latvia, they lack of R&D resources and would strongly benefit from the research capacities of the BIOR. Therefore, the Panel recommends BIOR management to strengthen this segment in the years to come, in order that BIOR can be the R&D generator the local businesses and the industries but can also encourage and support them to undertake R&D themselves.

All these activities should be accompanied by building the BIOR network of researchers and colleagues to be a coherent and happy community.

A_5 Latvia University of Life Sciences and Technologies Agricultural, Forestry and Veterinary Sciences

2.9. Institute Data and Description

Latvia University of Life Sciences and Technologies Agricultural, Forestry and Veterinary Sciences	
Primary field of science	Agriculture, Forestry and Veterinary Sciences
Corresponding fields of science	Agriculture, forestry and fisheries; animal and dairy science; veterinary science; agricultural biotechnology
No. FTE academic personnel 2018	49,59
No. FTE academic research personnel 2018	28,08
Total number of FTE academic and research personnel 2018	77,67
Articles in peer reviewed scientific edited journals and conference proceedings included in WoS or SCOPUS in period 2013-2018	569
Articles in peer reviewed scientific edited journals and conference proceedings not included in WoS or SCOPUS	596
Monographs in period 2013-2018	9
Patents Latvian in period 2013-2018	21
Patents (Europe and international) in period 2013-2018	0
Total no. of self-reported outputs in period 2013-2018	1195
No. of WoS or Scopus outputs in period 2013-2018 per researcher in 2018	7,33
No. of all outputs in period 2018 per researcher in 2018	15,39
No of PhDs completed in period 2013-2018	40
No. of PhDs in period 2013-2018 per researcher in 2018	0,51
Total funding in period 2013 -2018 (Euros)	9.335.583
Total funding in period 2013-2018 per researcher in 2018 (Euros)	120.195

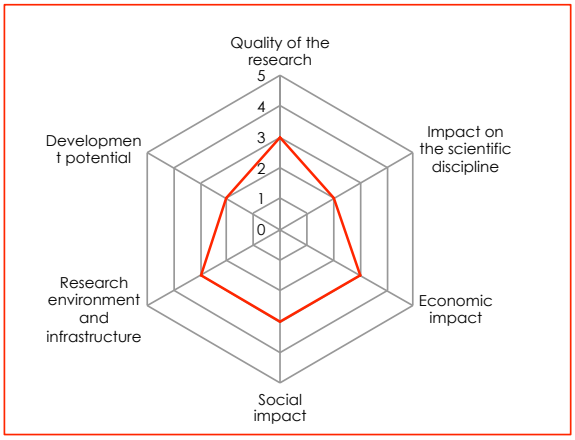
The Latvia University of Life Sciences and Technologies (LLU) is a multi-disciplinary university, devoted to teaching and research. The University consists of 8 faculties and offers 60 study programmes for a total number of 4,176 students enrolled. The life sciences of LLU include Agriculture, Forestry and Veterinary Sciences with visible research groups in:

- Important microorganisms and invertebrates in agriculture
- Plant productivity and related environmentally-friendly technologies
- Applied forest ecology
- Animal production
- Veterinary medicine

2.10. Expert Panel Evaluation

Figure 5 Latvia University of Life Sciences and Technologies Agricultural, Forestry and Veterinary Sciences – Scores

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



Overall score

Score: 2 – adequate level of research

The Panel scored the LLU with an overall score of 2. To come to this decision the Panel acknowledged the good economic and social impact of LLU's research on Latvia's knowledge system and agriculture. The Panel also considered LLU a strong national player in research; however, on the other hand, the Panel considered the international impact of the research limited, compared with some of the other institutions reviewed. Moreover, although there has been an improvement in the research environment compared with the previous evaluation, it was considered to be less than the Panel observed in the other institutions. Finally, and most importantly, the Panel expressed worries about the development potential of LLU. The Panel missed a clear vision and management strategy for LLU both in the written material, and the site visit, which are necessary to keep up with international and national developments.

Quality of Research

Score: 3 – good

The Panel scored the quality of research of LLU with a 3, a strong national player with some international recognition. The Panel acknowledged the successful participation of the LLU researchers in the acquisition a large number of national research grants from different funders, with duration of projects of 2 to 3 years, and the level of funding varying from €0.1 to roughly €2.2 million. The Panel also noted that LLU researchers have been able to create a significant network. LLU researchers also participated in several international research projects (such as Eurolegume, ERA-NET), although their contribution in these projects is sometimes relatively limited; in any case, LLU researchers are not leading in these international projects.

When comparing the publication activity of the various LLU groups, the Panel observed that a few groups such as the plant productivity team (i.e., the Bankina group) and the zoonosis and food safety team (i.e. the Kovalenko group) were slightly more internationally visible during recent years than the other groups. The Kovalenko group has published several good papers dealing with zoonoses and public health issues in Latvia. Despite the high scientific records, this

group is young (Kovalenko completed PhD in 2013) and the panel considers this group to have great development potential.

When taken as a whole, the Panel came to the conclusion that the international research visibility of LLU researchers is yet to evolve based on both the lack of influential papers and the low h-indices of the researchers, despite the significant improvement in scientific output compared to the previous review. The scientific papers presented to the Panel as the best scientific output of LLU are rather descriptive in nature. The Panel also considers the originality, innovation and importance of research at LLU, which can be measured by highly cited research papers as well as international patents, as still limited. Furthermore, the number of papers published in high-ranked journals of the disciplines that LLU covers is still very low. The most part of research is still published in local and regional journals (e.g., Research For Rural Development, Engineering For Rural Development, Agronomy Research, etc.). Although written in English and indexed in Scopus, the quality of peer-review and the impact of such journals is low in the international context. The Panel acknowledges that significant improvement has been made in this respect compared with the previous review, but also has the opinion that there still is a lot of room for further improvement.

Impact on the scientific discipline

Score: 2 – adequate

The Panel scored the impact on the scientific discipline of LLU with a 2. The institution occupies a stable position in the national scientific community and the position of the institution within the international scientific community is still evolving. The Panel came to the conclusion that the main international connections of the LLU are the participation in international conferences, bilateral exchanges with foreign Universities and Research Institutes as well as other interactions within EU programmes, which have led to joint publications and networking. The connections in the international research projects are only in the stage of participation of LLU researchers in FP7 programs; we do not see evidence of a leading role of LLU researchers in such programs. In terms of international publishing and collaboration with partners, the status of LLU therefore still leaves room for improvement. The Panel further observed that the contribution of LLU researchers in the international research projects is rather limited. There is a lack of good research papers produced as a result of projects certainly given the fact that apparently LLU researchers do participate in such multidisplinary international teams. In the few publications with international partners we observed, the LLU researchers are not the lead contributors, and this does not sufficiently strengthen the position of the LLU researchers in the respective research discipline in an international context.

An important opportunity for improving the international status through publishing common and strong research papers where the LLU researchers are key contributors has not been efficiently utilized. As such, the EU projects did not generate the required research impact for LLU (yet). In all international cooperation's shown, there is little visibility of the impact of either Latvian early-career researchers, who do not appear as first authors, or of the senior researchers, who do not appear as corresponding authors either. The Panel also evidenced that the efficiency of conversion of large projects into highly valuable scientific knowledge is low. From many research grants acquired, in which a few also included several international partners, no or only a few high-quality research papers were generated. This is true both for international multidisciplinary projects and for other significant grants funded by national funding agencies with a value greater than €2M. The Panel acknowledged that the researchers of LLU participate actively in international conferences and some Professors and Researchers participate actively in the scientific journals. However, the overall international visibility of the LLU researchers is still low, as can be measured by low participation in editorial boards of highly reputed scientific journals or conferences, invited talks at international conferences, etc.

Economic impact

Score: 3 – good

The Panel scored the economic impact of LLU with a 3. The Panel concluded that the economic impact of LLU in relevant Latvian agro-industries is increasing but still is not of an extensive and dynamic nature. Some areas like phytomedicine, soil, and dairy production have more service connections with the national agro-industries than other areas like forestry and veterinary. During the hearing, it became evident that the national industrial partners including agro-producer and farmer associations strongly rely on LLU capacities, although these stakeholders are not strong enough to contribute in a dynamic manner in this interaction. Furthermore, the potential of LLU in the commercialization of its expertise and infrastructure has been used on several occasions, although the revenues are still modest (€50,000-60,000). The interaction with the national industries is at the moment at the stage of small services such as consultation, method development, assessment analyses, and provision of expertise in the area of plant protection and cattle production. The industry partners were positive about this interaction. All in all, the Panel observed that the expertise of LLU is important for the bioeconomy of Latvia and can be considered at a level which is expected from a University with a diversity of activities related to teaching, research and service provision.

Social impact

Score: 3 – good

The Panel scored the social impact of LLU with a 3. The social impact of LLU research in Latvia is good with satisfactory levels of interaction with society. The Panel observed that the main social activities include cooperation with the Latvian ministries and other state institutions. Moreover, research results of the LLU researchers are used to improve national legislation, such as that related to the use of fertilizers and pesticides. In addition, the LLU researchers participate in different working groups as experts, thus ensuring the transformation of scientific knowledge into rules and regulations and sectoral guidelines (e.g., breeding programmes, programme on reducing antibiotic resistance, etc.). Other activities of the LLU researchers, especially by the Forestry faculty, include fostering social equality, excursions for school pupils demonstrating the growth cycle of trees, functioning of forest ecosystems and modern uses of wood.

The LLU scientists were very active in Science communication activities including articles in existing popular science literature, self-published popular science literature, media materials, radio-, TV- other media appearances (50-80 per year). Reports on research results from applied research or industry commerce, non-governmental institutions, state and municipality institutions are also produced (8-10 per year). During the visit, the members of the NGO highlighted a good interaction with the LLU in diverse topics of social interest in Latvia (forestry, environment, animal food production, etc.). The stakeholders like the Ministry of Agriculture, advisory services, cattle and sheep breeding organizations highly appreciate the role of LLU in knowledge transfer and in enhancing the agricultural production value in Latvia. However, they mentioned that it is impossible for them to co-fund common activities, thus there is no dynamic nature of interaction.

Research environment and infrastructure

Score: 3 – good

The Panel scored the research environment and infrastructure with a 3. The institution's research environment is still evolving to achieve a level that is expected in the international scientific community of a respected institution in the given discipline. The Panel has the opinion that from the perspective of the physical research infrastructures, the LLU possesses the necessary computing, supportive and research facilities required for research of the involved disciplines, comparable with other Universities worldwide. It became evident that LLU possesses a couple of well-equipped laboratories for advanced research and several research farms/stations (i.e.,

the forest research station, research and study farms «Vecauce» and «Peterlauki», Research Laboratory of Biotechnology, and a Centre of Technology and Knowledge Transfer). These would allow research and technology transfer at a high level both in basic and applied research. However, the Panel came to the conclusion that the goal orientation of the research work seems to be rather weak. Therefore, the university cannot exploit the entire potential of the physical facilities.

Although the University aims at increasing the scientific capacity by promoting the career of young scientists and encouraging them to publish the research data in indexed journals, this has not given the expected results (yet). The number of high-quality papers in which the young researchers are first authors is very limited. From the hearing, it became evident that the teaching and administrative load seems to be very high, taking into account that only 40% of the efforts from university staff were dedicated to research. Young and dynamic research groups dedicated almost entirely to research is missing. There is a new reward scheme for publications and high performance for the scientific staff so that each researcher receives a performance reward, where the amount depends on the results of the scientific work. However, in the interview it became evident that there is no supportive strategy from the university management for the staff to increase their performance. The financial incentives are not enough to enhance the performance, if they are not coupled with staff enhancement policy (support in scientific writing, hypothesis-driven research, advanced research techniques, presentation techniques, modern project management, work-life balance, etc.).

Development potential

Score: 2 – adequate

The Panel scored the development potential with a 2. The Panel considers that LLU has the potential to become a strong national player in life sciences. The Panel recognizes the current status of LLU in the Latvian agricultural knowledge system. However, in the Panel's view, LLU has not fully recognized its weakness in terms of its low scientific publication output, low conversion efficiency of research grants into high-quality publications, the need for development of young and dynamic research groups, as well as the low quality for certain research fields: all these hamper the development potential and possibly the international visibility in the near future. In the SWOT analysis, the LLU has claimed a lack of funding for basic research, although without showing any strategy how to counteract this and a vision regarding a direction for basic research. The Panel considers staff development is a weakness of the LLU. The university has recognized the risk of losing high-quality staff to emigration or to the industry without showing any evidence-based strategy on how to stop this and motivate, attract and develop young talented researchers. The Panel believes that the ability to initiate new research directions that will benefit the international visibility will depend on the capacity of the LLU to attract young and talented researchers in competition with other similar institutions in Latvia and in the region.

Potential to offer doctoral studies

From the review of the infrastructure and interaction with the current PhD students, the Panel considers the LLU has all resources required to offer doctoral studies in Agricultural and Veterinary Sciences in Latvia. The university and the nearby institutes have a cutting-edge research infrastructure, committed supervisors, opportunity for interactions with undergraduate students and peers for the PhD students, as well as opportunities for offering additional soft skills and techniques (i.e., scientific writing, experimental design, advanced statistics and presentation techniques) to the PhD students within their programs. At the moment only a few PhD theses seem to yield high quality papers.

Alignment with Smart Specialization Strategy

The Panel has the opinion that from the scope, profile and the volume of research the LLU's activities are fully oriented towards RIS3 policy goals of 1) knowledge-based bioeconomy and 2) biomedicine in Latvia. The Panel judges that the LLU has given contributions to achieving the goals of the RIS3, in particular by increasing the number of national collaborations and patents (interactions and better use of resources), increasing the knowledge transfer and the number of papers published in peer-reviewed journals and in the media.

Conformity with state scientific and technology development

The Latvian policy goals obviously aim to transform the national bioeconomy towards higher international competitiveness, higher added value and enhanced productivity. In the Panel's opinion the LLU during the last years has contributed to a limited extent to increase the internationalization of Latvian bioeconomy as well as to increase the value of Latvian biomedicine. The Panel analyzed that although the number of national patents is good, international patents are scarce (0 international patents in 6 years). This together with the low number of highly cited papers in the top journals indicate that the contribution of LLU to the innovation and increased international competitiveness of the Latvian bioeconomy-based research is still low. Also, relatively low is the commercialization of the research and implementation of the results of research in collaboration with industry partners/entrepreneurs, or support for spin-offs and other innovation projects by industry and development of innovative and competitive products.

Recommendations

The Panel has the following recommendations for LLU

- Develop incentives and encourage researchers to take the initiative for new research, based on breakthrough hypotheses in the respective field of science (both national and international funding) that could lead to influential researches/papers, rather than to merely respond to research requests from policy makers.
- Enable hypothesis-driven (bottom-up) research projects in order to establish influential research that will increase the research output in the respective scientific disciplines of LLU. More hypothesis-driven research than descriptive research. This will increase the quality and the impact of the research as well as the (international) visibility.
- Develop incentives and encourage publications in high-ranked international journals, instead of increasing the number of papers published in local or regional journals, especially for young researchers. This will increase motivation, and ensure a solid improvement of overall quality and visibility of the research at LLU in a long-term.
- Increase close cooperations with nearby institutions like BIOR and Silava in basic research.
- Open the application policy for research positions to neighbouring countries and beyond in order to encourage highly qualified foreign researchers applying for such positions at LLU.
- Create a unit of project support to assist researchers in hypothesis building, grant writing and application, scientific writing, creativity, project design and management. This is important because in the interview it became evident that there is no supportive strategy from the university management for the staff to increase their performance. The financial incentives applied at LLU are good but not enough to enhance the performance, if they are not coupled with staff enhancement policy (support in scientific writing, hypothesis-driven research, advanced research techniques, presentation techniques, modern project management, work-life balance, etc.

- Support selected talented PhD and young Postdocs under a transparent and competitive scheme (tenure-track) to initiate their own research groups focussed entirely on research and research-based teaching, without administration and minimal teaching duties.
- Stimulate the international exchange of young scientific and support staff.
- Enhance the science efficiency at the University. It is a pity that a large number of national and international cooperations in the framework of EU programmes did not yield high-quality papers published by LLU researchers, let alone the young scientists. An important opportunity for improving the international status through publishing common and strong research papers, where the LLU researchers are key contributors, has not been efficiently utilised. As such, these projects obviously generated significant data and work but failed to generate the required research impact for LLU (yet). In order to increase this science efficiency in the future, a smarter strategy is needed in the participation in joint projects, allowing generation of strong data and their publication as influential papers from those projects.
- Decrease the teaching and administrative load of groups leaders with strong research projects/profiles. From the hearing, it became evident that the teaching and administrative load seems to be very high, taking into account that only 40% of the efforts from university staff were dedicated to research. Young and dynamic research groups dedicated almost entirely to research are still missing.
- Upgrade the graduate school, giving the PhD students more rights and obligations to be involved in the research projects starting with hypothesis development, experimental design, decision to publish and first authors of at least one manuscript in their PhD theses.
- Stimulate participation of the LLU researchers in the boards of international scientific journals, at best highly reputed scientific journals or conferences, invited talks at international conferences.
- Increase the dynamics of interaction with the Latvian stakeholders (i.e., national advisory services, agro-industries including phytomedicine, animal and crop breeding organizations) to enhance the role of LLU in the knowledge transfer and contribute to transform the Latvian bioeconomy towards higher international competitiveness, higher added value and enhanced productivity.
- Establish an open policy of the expertise and facilities of LLU towards R&D of the local (and international) agro-industries, including the well-equipped laboratories for advanced research and the research farms/stations. This would allow applied research and technology transfer at high level, and better exploitation of the entire potential of the physical facilities and human know-how. Another important benefit from this policy for LLU is to secure additional funding and bridge unexpected funding gaps that might arise in the future from state or EU funding sources.

3 Summary of findings across the set of institutional evaluations

General comments

The Panel was very pleased with the self-assessment reports drafted by the institutions which strongly facilitated the Panel's review. Reports were well prepared and informative. The videos that were produced to replace the site visits were also very professional and made a significant contribution to the Panel's insight into the functioning and performance of the institutions. The on-line meetings with representatives of management, researchers, PhD candidates and stakeholders were highly appreciated: the open and frank debates really helped the Panel to understand the progress made since the previous evaluation and the challenges experienced. The organization of the on-line meetings was perfect. Moreover, the Panel noted in all these meetings that staff were very committed and highly motivated.

General observations on the quality of research

The Panel, and especially the Panel members who also participated in the previous review, were impressed by the progress made during the last six years. Many of the recommendations of the previous Review Panel have been implemented, including some of the challenging ones regarding the merger of institutes. We observed huge progress in investments in the research environment, facilities, equipment and infrastructure and a great improvement in the international visibility of the Latvian community of agricultural scientists. The output in terms of papers in international scientific journals has significantly improved across the entire field the Panel has reviewed. Participation in the international community has developed over the years and PhD studies have gained in quality. The overall evaluation of the 2020 Panel is therefore positive: progress has been significant and the research institutes are fit for purpose. Having said that, the Panel also observed that the institutes with a relatively good evaluation (i.e., higher scores) during the previous review made more progress in this respect than the institutes with lower scores during the previous evaluation, making the gap in performance wider.

The Panel also noticed that the dramatic changes in the structure of agricultural research require considerable management effort. The cultural differences between the institutes merged that were present six years ago have not been fully bridged and therefore more work needs to be done by senior leaders and management to really make use of the benefits and synergies that merging enabled. The Panel also noticed that the enormous growth in facilities and improvements in infrastructure and research environment require a matching improvement or change in staff capacity, skills sets and management.

General observations on key strengths

The research environment has greatly improved over the last years, thanks to the investments in infrastructure and facilities. This provides the Latvian agricultural science community with a huge chance to play a significant role in science, not only nationally but also internationally. There is close interaction between relevant sectors and institutes, between the institutes and policy makers and the general public and also institutes among each other. The staff are very committed and motivated.

General observations on main weaknesses

The mergers after the previous Review have taken a toll and there is still a need to work on a real integration and the establishment of a new scientific culture. Senior management in these institutes will need to invest in this during the coming years.

Decisions on funding are made for a relatively short period of time. That creates uncertainty and makes it more difficult to develop a robust research strategy. (See recommendations below.)

There is still a great need for the scientific community to improve its connections to the outer world. Some groups are active in the international community, but the Panel noticed a lack of eagerness to go abroad and to be exposed for a long duration to other scientific communities. That was true for young scientists as well as the scientists in a more advanced stage of their career. This prevents Latvian scientists from becoming leaders in the international scientific community, and also prevents them from playing a full role in the agricultural policy developments, see recommendations below.

Although both PhD candidates and supervisors were pleased with the opportunities of pursuing a PhD within the framework of collaboration between universities and research institutes, there seems to be a lack of structure in the PhD programme. Moreover, in general a PhD trajectory in Latvia takes much more time than common elsewhere in Europe without a benefit of extra quality. The level of the PhD theses is satisfactory but the same result (or better) can be obtained when the PhD programmes are structured better and supervised by a graduate school. Moreover, postdoctoral training is not always systemically planned and funded by the individual institutions. See the recommendations below.

Conclusions

In an international perspective, the agricultural science institutions in Latvia have made significant progress over the last years. There are clear signs that they are fit for purpose at the national level and provide support to the education of Latvian scientists and the general public, to the agricultural policy of the country and to the economy of Latvia. The Panel is pleased to report that some institutions have already realized a level of science that makes them excellent partners for international collaboration and significant contributors to the development of their fields in an international context.

For other institutions there are clear signs that there is the potential to grow further and become respected international partners, although further improvement is needed. Reconsidering the PhD programmes should become a major issue in the coming years. In general, continued attention of policy makers and senior management for further internationalization of the scientific community in Latvia is also needed. Moreover, there is a need to reconsider the various roles of some of the more applied institutions (strategic research, applied research, service to the public and private sector, extension to farmers and growers, interaction with values chain partners, etc.). The current diverse ambitions of the relevant Ministries are difficult to reconcile and this creates some tensions within the more applied institutes. It is not possible to expect at the same time international scientific excellence and great service to the Latvian agriculture community.

General problems and related recommendations

In the reviews of the different institutions, the Panel identified institute-specific problems and made related recommendations. However, the Panel has also identified general problems and takes the liberty to make related recommendations that will apply to the entire sector of agricultural research in Latvia:

1. First of all, the Panel noticed that there is a need for a change in basic scientific attitude. To achieve this, researchers should be encouraged to carry out more bottom-up rather than top-down research, based on breakthrough hypotheses in the respective fields of science that could lead to influential research projects/papers. At the same time, it is recommended to encourage more hypothesis-driven research than descriptive research. This will increase the quality and the impact of research as well as the (international) visibility.
2. Many institutions complained in their self-assessments or during the online site visits about the fluctuations in funding and the short term over which funding is guaranteed. The Panel noticed that the overall policy for national funding of the institutions is therefore not conducive to a stable and consistent research policy. In general, the institutions reviewed coped with this situation reasonably well, but that was also due to the enormous

investments made in research infrastructure over the last years. When these financial resources decrease, the resilience of the institutions may be affected. It is already known that the investment in research at the European level will be reduced over the coming years because of the need to invest in the economy during and after the COVID-19 pandemic. It is therefore recommended to develop a research policy that enables a longer-term funding and thus allows the institutes to better plan their research and especially their multi-annual programmes.

3. There is a need to enhance the dynamics of interaction with the stakeholders especially in the agro-industries. The Latvian agro-industries are still evolving and most do not, as yet, have their own strong R&D departments or facilities. Therefore the expertise and the facilities of the Research Institutions could be made more available to play this role for them and to develop R&D capabilities in the Latvian agro-sector. This would allow not only applied research and technology transfer at a high level, but most importantly will allow exploitation of the entire potential of the physical facilities and human know-how available at Latvian Research Institutions and bioeconomy. Most importantly, for the research institutions this will secure additional funding and bridge unexpected funding gaps that might arise in the future because of reduced EU/state funding.
4. In the opinion of the Panel, the PhD programmes are a matter of concern. Although the PhD candidates the Panel met were in general satisfied with their work, with the opportunities offered to them by their institution and positive about the interaction with their supervisors, the Panel noticed that too often the PhD trajectory takes very long. There seems to be a lack of a very strong, cohesive planning underlying each individual PhD trajectory. There is also not a clear embedding in a Graduate School that could provide specific advanced courses to PhD candidates, provide structure to their programme, support scientists in their supervision of PhD candidates, support PhD candidates in obtaining the supervision they need, provide opportunities for international collaboration and create a community of practice for PhD candidates and supervisors. The Panel recommends the creation of a more vigorous structure to the Graduate programme across the agricultural research domain and to enable a stricter time planning of the PhD trajectories. Moreover, the Panel also recommends to further enhance the interactions among PhD students. The Panel recommends the upgrading of the graduate school in such a way that it provides the PhD students more rights and obligations to be involved in the research projects starting with hypothesis development, experimental design, decision to publish as first authors of at least one manuscript in their PhD theses. Overall, the Panel recommends creation of a uniform graduate school in Latvia and the PhD students should be encouraged to write only cumulative PhD theses and publish at least one paper as first author in a high impact factor journal. To increase the quality, the Panel recommends involvement of external national and international experts in the committees.
5. The Panel noted that despite the intensification of the international contacts most of the staff are still very much oriented towards the Latvian scientific community. PhD candidates are not eager to go abroad, there is not a very active programme for international exchange of scientists, etc. This is very much in contrast to what is experienced in scientific communities elsewhere in Europe. The Panel noted that there are activities oriented towards collaboration with the neighboring Baltic or Scandinavian States and this should be strengthened. Latvia is well positioned to become a linking pin for collaboration between Northern and Southern Europe and could equally play a significant role in enhancing collaboration between Eastern and Western Europe. The staff is well trained and the capacity to speak foreign languages is well developed, therefore there are great opportunities that should not be missed. The Panel therefore recommends that more emphasis will be put on international collaboration and interaction and that researchers and PhDs are encouraged to go abroad for longer periods of time and get intensively exposed to other scientific cultures and approaches. Considering Recommendations 3 and 4: the Panel also recommends intensifying the programme for young scientists to develop

themselves after a PhD, for example through a post-doc programme with emphasis on international exchange. The Panel therefore recommends making resources available for long international visits and for stimulating other activities in relation to internationalization.

6. To enhance the international character of Latvian science, the invitation of the best researchers from abroad should also be supported, via e.g., the establishment of visiting researcher programme for prominent seniors for a few weeks visits, and a visiting post-doc program for several months, both with internationally competitive funding.
7. The Panel noticed that some of the reviewed institutions are strong in basic research but that opportunities to become leading could be enhanced by further collaboration. The Panel therefore recommends efforts to stimulate close cooperation between nearby sister institutions such as BIOR and SILAVA in basic research.
8. The Panel also noticed that there was a significant variation in management style among the various institutes. The panel also commented on the quality of management in the various institute-specific reports. The Panel recommends strengthening and modernizing management in some cases, for example by peer coaching and establishing a community of practice for up-to-date and fit-for-purpose management, thus enhancing the strength of the Latvian agricultural science community. The Panel also recommends creating a Project Support Unit to assist researchers in project design, creativity and management. This is especially important if institutes wish to increase the amount of international funding and develop their role in international collaboration from contributor towards leadership.

   The Panel noticed that, in general, stakeholders were very positive about the contribution the institutes delivered to the various agricultural sectors. Most institutions were very active in interacting with policy makers, the private sector, the general public and NGOs. Some institutes also consider it their task to provide advice to farmers, horticulturalists and growers. Usually this was done without contracts or exchange of funds. The Panel recommends that these activities are institutionalized and carried out on the basis of a fair price for the services delivered. In such a case a more professional relationship can be created that will be fruitful in delivering high-quality extension services.
9. In the opinion of the Panel, science needs a very active interaction between young, creative and enthusiastic staff members who have been exposed to the latest developments and have been trained based on the latest scientific state-of-affairs and experienced staff members with management skills and a leadership role. This is especially true for those sciences where experimental knowledge is highly relevant. The Panel therefore recommends that senior management becomes more active in stimulating this synergetic interaction as much as possible.

Appendix A Feedback on Panel assessment

Feedback received from Institute of Agricultural Resources and Economics

The Institute of Agricultural Resources and Economics (AREI) thanks the Expert Panel of Technopolis Group for their work on the evaluation of the SELF-assessment report, having discussion with researchers of the Institute and our cooperation partners, preparation of a comprehensive assessment and development of recommendations essential for the future of the Institute. From our point of view, the report demonstrates ability of Expert Panel to get deep and a clear understanding of the real situation. However, we want to focus your attention to some details in report that differ from realty in our Institute:

Conclusions in section Quality of Research: "There is no evidence that any AREI researchers have been invited to speak at relevant conferences or international institutions. Available documents do not reveal if unproductive researchers affect the overall performance of the Institute nor do they highlight emerging excellent researchers."

Facts from the Self-assessment report. Information provided in table 6.1. of AREI Self-assessment report, reveals 15 oral presentations given by the staff of the institute in international conferences and seminars (pp. 52-54). This confirms the fact that AREI researchers have been invited to give the oral presentations in conferences. Moreover, these are not the only oral presentations given at this time.

AREI Self-assessment paragraph 1.8. indicates: "Institute's researchers lecturing in the foreign institutions, for example, A. Kronberga in the Aarhus University." Moreover, the same paragraph mentions, that "Several researchers have been involved as leading persons of organisations (L.Legzdiņa – head of Low input and organic farming section at EUCARPIA, I.Skrabule – Member of Council at EAPR). M.Bleidere participated as expert in evaluation and monitoring Horizon 2020 proposals." It t reveals the expertise and excellence of the researchers of AREI.
We also want to highlight that table 5.4. at AREI Self-assessment report contains information on "Most important foreign collaborators after 2013, whereas part on International conferences workshops and seminars organised by the institution" (pp. 50-51) indicating international activities, for example, international conference organised by AREI: Two of the conferences were not project-based, with participants from 10-15 countries, as well as high-level invited speakers:

- International conference „Crop breeding and management for environmentally friendly farming: re-search results and achievements", Bille, Latvia, 04.06.-06.06.2013.
- 3rd meeting of the Section of Agronomy and Physiology of EAPR (The European Association for Potato Research), Rīga, Latvia, 26.09.-29.09.2016.

We are also continue organisation of international conferences and the nearest conference will be "Breeding and Seed sector innovations for organic food systems", 08.03.-10.03.2021[1].
Conclusions in section Development potential: "..to widen the spectrum of research activities, are all of pivotal importance to the development potential of AREI. On this regard, a major challenge is to increase the capacity for preparing proposals and implementing the project activities.". "Considering that legislation is not favourable for breeders, relying on breeding activities as the main research output and as a significant source of income constitutes a threat

[1] https://www.eucarpialiveseedconference2021.lv/

to the development of the Institute". "Another pillar of AREI activities is the research and development of crop cultivation practices. At the moment it seems that extension activities are not remunerated". "In order to face technical and managerial issues related to future challenges and to initiate new research directions, AREI personnel will need continued training and suitable motivation, especially for young researchers."

Facts from the Self-assessment report and explanations. As Expert Panel mentioned, significant work has been done since 2016 when AREI was developed. However, we want to give our view on the individual findings of Expert Panel.

The SWOT analysis covers all key aspects, including external factors that influence the R&D activities of the Institute. It is true that royalties are a critical issue for AREI. Furthermore, legislation is not favourable for breeders having negative impact on institute income. However, it is an external factor, which can't affect Expert Panel assessment of AREI development potential. The Institute has carried out a number of activities - conferences (for example, *Challenges in plant breeding: The role of plant breeding in agricultural development in the future*. Jelgava, 24.10.2019.[2]), seminars and meetings with stakeholders and authorities to discuss this issue. Therefore, issue of unfavourable legislation concerning royalties does not primarily depend on the management of the Institute.

As mentioned in AREI Self-assessment report (pp.8) research on organic farming is one of main AREI development directions. Right now, four of nine running doctoral thesis are directly devoted to organic farming (paragraph 1.14., pp. 22). The research work of AREI has been done mostly in plant breeding and crop management for organic farming. The cooperation with Wageningen University, Luis Bolk Institute (the Netherlands), Kassel University (Germany), Organic farming Research Centre (GB), NIBIO (Norway) Arhus University (Danmark) has been carried out in this field (see pp.16. paragraph 1.9.). A large number of AREI projects related to organic farming and crop management indicates importance of this research direction. The most of international projects have been connected to organic farming (see paragraph 3.2., pp. 27), for example:

- H2020, "Improve performance of organic agriculture by boosting organic seed and plant breeding efforts across Europe", LIVESEED, (2017-2021);
- FP7, ERA-NET CORE ORGANIC PLUS, "Improving soil conservation and resource use in organic cropping systems for vegetable production through introduction and management of Agro-ecological Service Crops (ASC)", SOILVEG (2015-2018);
- H2020, CORE ORGANIC COFUND, "Coordination of European Transnational Research in Organic Food and Farming Systems Cofund", (2016-2021);
- LV MES and LSC Fundamental and applied research project "Genetically diverse populations of self-pollinating cereals for organic farming: agronomic performance, effect of environment, and improvement techniques", (2018-2021).
- etc.

On the basis of the R&D activities during the evaluation period, AREI has increase the scientific capacity and prepared project proposals which have resulted in a number of international and national research projects regarding crop cultivation practices and innovative breeding methodologies, for example:

- Baltic Research Programme, NOBALwheat –breeding toolbox for sustainable food system of the NOrdic BALtic region, (2021-2023), AREI is partner;

[2] https://www.arei.lv/en/article/2019-09-20/challenges-in-plant-breeding-the-role-of-plant-breeding-in-agricultural

- European Innovation Partnership for Agricultural Productivity and Sustainability, Advanced farming systems for environmentally friendly and efficient crop production in Latvia, (2019-2023), AREI is leading partner;
- National Research Programme, Sustainable land resource and landscape management: challenges, development scenarios and proposals (LandLat4PoI), (2020-2022), AREI is leading partner;
- Postdoc, Organic Farming and New Food Values – Drivers to Sustainable and Resilient Food Systems, (2021-2023).

Overall, AREI agree with the assessment (*Overall score*) given by the Expert Panel on the scientific activities of the Institute, but it is also ask to take into account the facts mentioned above. We will incorporate recommendations for the development offered by Expert Panel into new AREI strategy that we are developing.

Director I.Stabulniece

Feedback received from Institute of Horticulture

The LatHort team highly appreciates the institute`s score, the work contributed by the evaluation panel on the performance data of the institute and especially recommendations and opinions that will allow the further improvement of the development strategy. We are also thankful for considerations of the panel regarding future development strengths and opportunities.

In addition to this, we would like to point out that LatHort permanently works on overcoming the majority of shortcomings indicated by the panel, a part of the research parameters has improved already in the year after the evaluation period, currently we are working on the institute's development strategy for strengthening and improving these achievements. These measures will be clearly indicated in the evaluation report of the next evaluation period. We are also thankful for considerations of the panel regarding future development strengths and opportunities. It will be included in the process of the elaboration of the LatHort Strategy for the next strategic period. In the following chapters we would like to elucidate our efforts and to give short explanations on some issues raised by the panel.

Quality of Research

As one of the shortcomings related to the quality of research mentioned in the evaluation is ***the low number of publications per researcher and the relatively low quality of publications***.

We agree with this statement; therefore, an important part of the institute's strategy is already devoted to solutions and tools that would increase both the number of publications and their quality. Raising the level of research and thus publications is a complex and long-term process that depends on many circumstances, incl. strength of the horticulture sector, available funding, research direction. Considering the specifics of the institute and the work with multi-year research objects, there is also a certain inertia when the research results, like publications, come out with a lag. Nevertheless, despite mentioned factors, the number of publications has increased significantly during the evaluation period, as well as the quality. This trend continues also in the indicators after the evaluation period.

Moreover, the big proportion of LatHort research belongs to applied research. This gives an impact on the level of journals used to publish the results. This was concluded also by the panel, that "the nature of the research is very applied and therefore international scientific publications in high-ranked scientific journals might not always be a first priority". Although in recent years the efforts to increase the number of publications in the journals of high quality, molecular science and the entire value chain of horticultural crops. These improvements are closely linked to the Institute's work to increase the proportion of basic science research.

Impact on the scientific discipline

The Evaluation Panel pointed out that ***LatHort does not have a great impact on the international development of the discipline.***

LatHort has for a long time positioned itself as an industry-oriented institute with a strong applied research component. This has been driven by demand from both governmental authorities and the horticultural sector, to develop this area of agriculture after regaining the country's independence. Due to this specialty of LatHort the scope of majority of research activities are region-specific and thus leading to regional (Baltic – North-East Europe, in some cases Baltic sea region) importance. We would like to indicate also that the position of LatHort within the international scientific community is evolving and there have been some leading activities in the international (regional) level. As example, leading the INTERREG project InnoFruit.

We already noticed the niches of international potential – plant pathology, biochemistry, sustainable (green) technologies. Significant elaborations are started in the using of smart technologies through involvement in two Horizon 2020 and national projects. The efforts on strengthening the capacity of areas already reached good standards takes place and are under development.

Economic impact

There were no shortcomings regarding national economic impact mentioned by the panel. LatHort was highly appreciated for its activities in collaborations with industry at national level. Nonetheless, LatHort sees its development towards the impact on the international economy through collaboration with strong international industry players. Innovation research performed in the Department of Biochemistry and Processing is of high interest for industry and is foreseen as the potential for international industry recognition. Successful collaboration is already developed with export-oriented companies "Dobeles Dzirnavnieks" - a leading food producer company in the Baltics, export experience in more than 70 countries, "Rāmkalni" a.o. The LatHort is a member of the Latvian Food Bioeconomy Cluster, which unites the most innovative and active Latvian food producers in export markets and whose activities envisage closer cooperation between science and industry in the creation of innovative technologies, development of food products and processing of their production by-products. As an economic impact of our work, we would like to emphasize breeding and its results: several raspberry and grape cultivars bred or selected at the LatHort are registered in Sweden, and blackcurrant cultivars in Lithuania; columnar apple cultivars are grown in Lithuania, and early plum varieties in Estonia, whereas scab-resistant apple cultivars from LatHort breeding program are gaining popularity in the Scandinavian countries.

Our research in breeding started to give a contribution to international economics by commercialization of several cultivars of various fruit crops, which were bred at LatHort, but propagated and sold by foreign nurseries according to the licensees of intellectual property rights. So, the apples 'Edite' and 'Ligita' are registered and propagated in Belgium as niche cultivars for growing in coldest regions. Several Lithuanian nurseries have bought the licensees for the propagation of our apple and sweet cherry cultivars, besides cherry cultivar 'Paula' has become very popular in Lithuania. The licensee for propagation of *Chaenomeles* cultivars was recently bought by Polish nursery.

Social impact

It was noted by the panel that the social impact of LatHort is of good level and is highly appreciated, nonetheless it was advised that the social impact of the Institute could be further developed and strengthened. It was pointed out that ***the contribution to higher education is relatively small. There are good linkages with LLU, but the number of PhD students per academic staff member is relatively low.***

We would like to stress that LatHort is a research institute and our mission and research priorities are not directly connected with educational activities. The involvement of students at different levels is directly related to the ability of universities to attract them to areas relevant to the institute. Nevertheless, LatHort staff is involved in the supervising of Thesis and leading the practical trainings for LLU students. We are always open in collaboration with LLU and other higher education institutions in Latvia and abroad. PhD Students from Lithuania, Poland, India and other countries have conducted research in LatHort laboratories and received recommendations from the institute's leading scientists. The lack of students in Latvia is observed for this period in general and it influences also the proportion of students interested in horticulture.

In turn, lifelong learning, training of industry and society representatives about the research findings fits into LatHort priorities.

Research environment and infrastructure

The LatHort team is a bit surprised about the statement of the panel that ***the investments in research infrastructure were relatively small.*** We could agree to the conclusion if compared with infrastructure of much higher funded institutes and universities in West European countries, but during the reporting period infrastructure was improved significantly – a completely new laboratory and office building was constructed and laboratories equipped with technique and instruments ensuring necessary technological capacity for implementing scientific tasks of LatHort. Of course, there is always a space for introducing innovations in the infrastructure to improve the research environment, but it should be in balance with available human capacity and qualifications. It should be mentioned that we are collaborating with other research institutions to ensure high-end technological solutions, if necessary.

As a very valuable resource for research should be mentioned long-term plantations (orchards) and broad collection of genetic resources owned by LatHort. These are invaluable resources suitable for implementation of different directions of research and development of new varieties, as well as for performing basic science research.

We agree that we have many small projects which sometimes creates fragmentation in research and increases bureaucratic work, while they are mostly industry-oriented projects that strengthen collaboration with farmers and producing companies and help us to raise additional funding.

Staff of LatHort is currently starting the preparations for development of LatHort Strategy for the new period and considerations pointed out by the Panel regarding increasing international capacity and research environment will be a valuable contribution in drawing the institute's development roadmap.

Development potential

Although LatHorts potential is evaluated as good, we have clear vision on improvement of our capacity and potential. There are foreseen introducing an improved staff management system and evaluation procedure to promote and increase scientific capacity and excellence.

The LatHort strengthening as an advisory institution, mentioned in recommendations, is more a matter of national level, common agricultural development and support policies. The Institute may be the initiator of this discussion, but the further development of the system depends on government policy, because the establishment and maintenance of an advisory system requires human and financial resources not available to the institute. The international network of demonstration farms, which was created in the frames of the INTERREG project led by LatHort, could serve as a good basis for further development of the advisory system.

Director
Inese Ebele

Feedback received from Latvian State Forest Research Institute "Silava"

We would like to take this opportunity to thank the members of the international review panel for their time and efforts assessing our institute. The evaluation provides guidance to improve the scientific work of SILAVA. The views of the institute are fully aligned with that of the panel and activities to increase the scientific excellence and impact of SILAVA have already been initiated.

We particularly emphasize strengthening of relationships with Latvian, Baltic and European universities and institutes, including furthering closer cooperation beyond the Nordic-Baltic region. SILAVA has contributed to significant improvements in higher forest education programs, achieved with the institute and university working in cooperation as independent institutions. SILAVA offers institute's researchers as visiting professors, anticipating that universities will be motivated to adapt and develop their management systems to facilitate these types of contributions. These collaboration aspects will be emphasised in the SILAVA strategy.

The recommendations made by the assessment panel will be implemented in to ensure that SILAVA continues to develop scientific research activities and impact, as well as human resources and science infrastructure, both at a national and international level.

Sincerely,
Latvian State Forest Research Institute SILAVA
02.02.2021

Feedback received from Latvia University of Life Sciences and Technologies Agricultural, Forestry and Veterinary Sciences

Latvia University of Life Sciences and Technologies (hereinafter referred to as LLU) has received the results of the ***evaluation of agriculture, forestry and veterinary sciences*** by *the international expert group* (hereinafter referred to as experts) and would like to express gratitude for their contribution in getting acquainted with the scientific performance and assessing the scientific activities of the university.

We highly appreciate the competence of experts but we disagree with the evaluation **"2 – *adequate level of research*"** given to LLU**, and we are writing to request a re-assessment on the basis of the following conceptual facts, arguments and explanations**:

- In 2019 LLU was ranked in *Time Higher Education* university rankings among 1000 best world universities for the first time (*THE World University Rating*), besides, as regards ***Life Sciences*, LLU was ranked among 601+ best world universities** (https://www.timeshighereducation.com/world-university-rankings/2020/subject-ranking/life-sciences#!/page/0/length/25/locations/LV/sort_by/rank/sort_order/asc/cols/stats). In our opinion, it is **a significant achievement and progress** achieved due to **observance of the guidelines and recommendations of the previous international evaluation and purposeful concentration of the resources on the implementation of the recommendations**.
- **The Faculty of Veterinary Medicine of LLU was awarded EAEVE (***European Association of Establishments for Veterinary Education)* recognition until 2026 during the **ECOVE (European Committee of Veterinary Education) meeting on December 11, 2019.**
- **The university received an internationally recognized quality management system certificate "*Investor in Excellence*" in December 2016, which is regularly updated every two years by conducting an international certification audit of the main areas of the university management. In December 2020, the quality system was repeatedly certified for the next two years (**http://www.latviaexcellence.lv/investors-in-excellence-sertificetas-organizacijas-2/**).**
- According to the RIS3 Monitoring 2nd report of the Ministry of Education and Science (hereinafter referred to as MES) (https://www.izm.gov.lv/lv/ris3-monitorings), many scientific institutions are involved in the formation of the bioeconomy research competence in Latvia. **A wide range of topics have been researched by LLU** and research institutes related to the university: the Horticulture Institute, Institute of Agricultural resources and Economics, Institute of Plant Protection Research "*Agrihorts*", Institute of Food Safety, Animal Health and Environment "*BIOR*", Latvian State Forest Research Institute "*Silava*", Latvian State Institute of Wood Chemistry, *Baltic Studies Centre*, Daugavpils University, Latvian Institute of Aquatic Ecology, University of Latvia, UL Institute of Microbiology and Biotechnology, Riga Technical University, RTU Institute of Energy Systems and Environment and Institute of Environmental Solutions.
- LLU established the Bioeconomy Research Strategic Alliance in cooperation with research institutes on 24 September, 2014. Its aim is to develop and implement the strategy for the development of research activities in Latvia in the field of bioeconomy in order to improve the performance and competitiveness of bioeconomy sectors at regional and international levels and Latvia's contribution to the achievement of the EU's common (https://www.llu.lv/lv/llu-un-bioekonomikas-petniecibas-strategiska-apvieniba).

  The information report "Latvian Bioeconomy Strategy 2030" was approved on 19 December 2017 according to the minutes No.63 65.§ of the meeting of the Cabinet of Ministers (http://tap.mk.gov.lv/lv/mk/tap/?pid=40433525&mode=mk&date=2017-12-19).

Latvia is one of the first EU member states to have the Bioeconomy Strategy, and LLU has contributed significantly to its development.

We would like to point out the following aspects **after the detailed analysis of the expert evaluation**:

1. **we believe that the evaluation is inconsistent and there is a contradiction in it** because:
   1.1. The summary of the report contains the statement that "***The Panel also considered LLU a strong national player in research***", however, the overall score is 2 (*adequate level of research)*;
   1.2. In spite of the fact that the report acknowledges an improvement at LLU compared with the evaluation of the previous period (2007 - 2012), i.e., *a)* "*there has been an improvement in the research environment compared with the previous evaluation*"; *b)"The Panel acknowledges that significant improvement in scientific output has been made in this respect compared with the previous review*", the score has not changed, it the same as in the previous period: "2 – *adequate level of research*".

2. Concerning scientific institutions (hereinafter referred to as SI), the **methodology of international evaluation envisages SI evaluation and not comparison,** however, LLU was compared with SI in the expert evaluation (*the Panel considered the international impact of the research limited, compared with some of the other institutions reviewed; there has been an improvement in the research environment compared with the previous evaluation, it was considered to be less than the Panel observed in the other institutions*), however, which institutions had been meant was not mentioned. **We hold a view that such an approach is inaccurate both conceptually and because of the following reasons:**
   2.1. **LLU has two functions**: LLU implements the study process, including doctoral study programme, and conducts research activities, which means that LLU academic staff members provide academic teaching and carry out scientific research. **We emphasize that LLU is the only university in Latvia that provides accredited doctoral study opportunities in agriculture, forestry and veterinary medicine**.
   2.2. LLU offers doctoral degree programmes which educate doctors for scientific institutions in the fields of agriculture, forestry and veterinary medicine in Latvia and worldwide ensuring the development, complementarity and achievement of higher levels for other SI.

   We would like to inform you that currently several leading researchers of the Institute of Food Safety, Animal Health and Environment "*BIOR*" (hereinafter referred to as BIOR), Latvian State Forest Research Institute "*Silava*" (hereinafter referred to as Silava) and other research institutions work as professors/associate professors at LLU, for example, Professor, Aivars Bērziņš, *Dr.med.vet.* (Director of BIOR, EFSA – European Food Safety Authority), Associate Professor Margarita Terentjeva, *Dr.med.vet.* (a leading researcher of BIOR), visiting Professor Jurģis Jansons, *Dr.silv.* (Director of Silava), Associate Professor Āris Jansons, *Dr.silv.* (a leading researcher of Silava) etc.
   2.3. **LLU is a leading partner in the development and use of research infrastructure**, thus preventing duplication and ensuring the efficient use of research equipment in the research institutions.

   LLU has been providing the implementation of the required research activities necessary for industries in cooperation with the Horticulture Institute (hereinafter referred to as HI), Institute of Agricultural Resources and Economics (hereinafter referred to as AREI), while research institutions focus on relatively narrower research areas with relevant infrastructure, accordingly.

   The research-based collaboration resulted in the establishment of inter-institutional laboratories, for example, Research Laboratory of Biotechnology, Centre of Technology and Knowledge Transfer, and more than 20 million EUR were invested in the laboratories available for all SI.

3. We disagree with the statement that "*The Panel missed a clear vision and management strategy for LLU both in the **written material**, and the site visit, which are necessary to keep up with international and national developments*" *(see Section 1.12 of the self-assessment report below).*

We would appreciate if you read the quote below from the LLU self-assessment report:

1.12. Strategy for the development of scientific personnel *(no more than 500 words)* *Describe institution's / assessment entity's strategy for the development of scientific personnel (include the strategy employed for the period of 2013-2018, as well as highlighting the priorities of the next evaluation period).*
Human resource development strategy is defined in the LLU Development strategy for 2015-2020 and is focused on improving capacity of the existing researchers and attracting young scientists. *The priorities of the next evaluation period are:* • *Continuous improvement of the research and academic capacity of the existing researchers;* • ***Continuous increasing of publications quality (the priority is publishing in Q1 and Q2 journals);*** • ***Increasing of the attractiveness of the research and academic work at the LLU, by development of interdisciplinary teams, greater involvement of foreign researchers and lecturers;*** • *Attraction of funds for research activities, doctoral and post-doctoral studies, participation in international research events.* *Measures implemented and ongoing for research HR development in the time period 2013-2018:* 1. ***The development strategy of the scientific staff is determined by the university with the assistance of its structural units.*** *In the evaluation of the research staff the scientific qualifications and the performance are taken into account. In recent years the research performance funding has been allocated for rewarding scientific staff, which serves as motivation to achieve results. The additional payment depends on the scientific staff members' performance results.* 2. ***Career development plans for academic and research staff have been designed in departments to enable each person to pursue a career.*** *Further activities include the development of the methodology for allocating performance funding, motivating scientists to develop scientific qualifications, the upgrade of infrastructure to provide better research conditions, the support of scientists in designing and implementing research projects to produce high-level scientific publications, promotion of the sustainable development of doctoral and post-doctoral studies for new generation of researcher.* *In order to ensure successful work on doctoral theses, the LLU launched the programme "Strengthening LLU Scientific Capacity" for funding doctoral students to conduct research activities and prepare publication of the obtained results. In addition, the recruitment of young scientists is also promoted by the programme "Development of Priority Research Directions", because the procedure of the project competition requires the involvement of young scientists, doctoral students and students of other levels.*

4. We would like to point out that experts had the opportunity to get acquainted with the ***LLU Human Resources Development Plan 2015-2020*** in the annex to the LLU Development Strategy 2015 -2020 (https://www.llu.lv/sites/default/files/2020-12/StrategijaLV_08_12-2020.pdf), which determines purposeful improvement of human resources management: **1) planning and recruitment of human resources; 2) retention and motivation of human resources; 3) development and professional growth of human resources; 4) renewal and succession of human resources by formation of the young generation of scientists, developing succession, increasing the number of doctoral students and their successful academic career growth.** The implementation principles of human resources policy and further scientific development in sciences of agriculture, forestry and veterinary medicine are explained in Section 1.12. of the self-assessment report.

5. We would like to mention that, according to Chapter 2.2. "*Documentary inputs to the international evaluation*" of the methodology "*International Evaluation of Scientific Institution Activity, Latvia*", worked out by the *Technopolis group* and approved by the Ministry of Education and Science in September, 2020, experts should be familiar not only with the self-assessment report, publications and bibliometric indicators, but also with the SI development strategy which was approved by the assessment commission of SI strategies formed by the Ministry of Education and Science and other documents *(General background information[3], for example, EU and national regulations, policy planning documents, development strategies of research institutions and other material will be used to provide background information to Panel Members)*.

[3]As defined in Chapter 4 of the Technical Specification, Annex 1 to contract between Ministry of Education and Science of Republic of Latvia and Technopolis Group Eesti

6. We disagree with the statement"*the Panel expressed worries about the development potential of LLU. **The Panel missed a clear vision and management strategy for LLU both in the written material, and the site visit,** which are necessary to keep up with international and national developments*".

We emphasize that LLU has a clear development vision and management strategy, which is defined in the LLU Development Strategy 2015-2020 to fulfill the **mission** of the Latvia University of Life Sciences and Technologies which is **to create an internationally competitive intellectual potential based on excellence in research, application of research results in the national economy, high quality of studies and efficient management**.

7. We disagree with the opinion expressed in the section "*Development potential*": "*However, in the Panel's view, LLU has not fully recognized its weakness in terms of its low scientific publication output, low conversion efficiency of research grants into high-quality publications, the need for development of young and dynamic research groups, as well as the low quality for certain research fields: all these hamper the development potential and possibly the international visibility in the near future*", because:
   7.1. in 2015 **the motivation system for research activities** was introduced focusing on the development strategy of scientific publications updated annually. Within the framework of the motivation system the amount of expenditures for research activities reached 1,802,248 EUR by 2021.
   7.2. as a result of the **motivation system**, the t**otal number of scientific publications has increased significantly** as evidenced by the analytical report of the research ecosystem of the Ministry of Education and Science RIS3 specialization area "Knowledge-intensive bioeconomy (https://www.izm.gov.lv/lv/ris3-monitorings), which specifies that LLU is in the first place in terms of the number of publications with almost twice as many publications as the next scientific institution (RTU), including Q1 and Q2 journals, **where LLU shows the highest result among universities and scientific institutions** (Fig.4.5, p.30). We would like to emphasize that in Section 1.12 of the self-assessment report there is a statement "*Continuous increasing of publications' quality (the priority is publishing in Q1 and Q2 journals)*".
   7.3. We would like to explain that LLU has **established an internal grant system to support young researchers** "*In order to ensure successful work on doctoral theses, the LLU launched the programme "Strengthening LLU Scientific Capacity" for funding doctoral students to conduct research activities and prepare publication of the obtained results. In addition, the recruitment of young scientists is also promoted by the programme "Development of Priority Research Directions", because the procedure of the project competition requires the involvement of young scientists, doctoral students and students of other levels*". **81 grants have approved in the amount of 693 259 EUR** since 2017**.**

8. We disagree with the statement that "*In the SWOT analysis, the LLU has claimed a lack of funding for basic research, although without showing any strategy how to counteract this and a vision regarding a direction for basic research*".

We explain that in 2019 a new research programme "Fundamental research activities at LLU" was established to ensure the fundamental research activities, thus creating new knowledge and research findings in the research directions specified by the LLU development strategy.

9. **We would like to indicate the shortcomings in the implementation of the international evaluation of the SI once again and express concern about the compliance of the international evaluation process with the principles of good practice**. The following facts are given below:
   9.1. A variant of the methodology of the RI international evaluation was received from Technopolis Group (hereinafter referred to as Technopolis) only on 29 February 2020, i.e., less than a month before the first scheduled expert visit on 16 March, and it **contained a number of significant changes which SI had not approved** (Annex 1).
   9.2. In accordance with the minutes No. 54 § 29 of the Cabinet of Ministers' meeting on 15 September 2020 on the draft regulations "Amendment to Cabinet Regulation No. 619 of 2 October 2018 regarding "Procedure for the Organization of International Evaluation of Scientific Institutions", the evaluator shall send the summaries of bibliographic indicators to the scientific institutions **for approval** not later than three weeks before the date of the visit of the group of international experts.
   On 25 September 2020, LLU sent a letter to Technopolis regarding the international evaluation visit and a summary of the analysis of bibliometric indicators. **LLU did not approve it and asked for clarification of certain bibliometric indicators**, because when **comparing the data with the indicators available at LLU**, **they differed significantly**. In addition, **differences in indicators affected further calculations** (Annex 2).
   9.3. **LLU has not received an explanation from Technopolis about the differences in bibliometric indicators in the summary.** Technopolis only explained that: "*Technopolis analysis has been performed in accordance with the evaluation methodology, **approved by the ministry** and the same approach is used for other institutions. To ensure consistency with the methodology and consistency among institutions, we **will not make any corrections to the data**.*" *(Annex 3)*

We would like to emphasize that during the evaluation period the policy defined by the Ministry of Education and Science was strictly followed by LLU, which is taken into account in the calculations of science base funding, where one of the criteria is "original scientific articles published in *Web of Science or SCOPUS* data bases, peer-reviewed scientific monographs, ... and original scientific papers published by scientific staff in publications included in international databases during the previous three funding periods ..."(https://likumi.lv/ta/id/262508-kartiba-kada-aprekina-un-pieskir-bazes-finansejumu-zinatniskajam-institucijam).

LLU holds the view that the conceptual facts, arguments and explanations explained above will enable the experts to assess all the necessary information that should have been available to the experts before the start of the evaluation in accordance with the methodology of the international evaluation of SI.

In conclusion we would like to emphasize that we highly appreciate the competence of experts and their extensive contribution, therefore, in our opinion, additional information provided in the letter is significant and will be taken into account to ensure the objectivity and fairness of the international evaluation based on the principles of good practice.

Best regards,

Rector of Latvia University of

Life Sciences and Technologies Irina Pilvere