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International Evaluation of Scientific Institutions' Activity

Expert Group Report: Agriculture, Forestry and Veterinary Sciences

Professor Quendrim Zebeli (chair), Professor Andras Baldi, Professor Inge Broer, Professor Pasi Puttonen, Professor Harry Wu, Professor Silvia Pampana

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List of abbreviations

SILAVA – Latvian State Forest Research Institute
BIOR – Institute of Food Safety, Animal Health and Environment
LBTU – Latvia University of Life Science and Technologies
PhD – Doctor of Philosophy
ICT – Information and Communication Technology
COST – European Cooperation in Science and Technology
RIS3 – Research and Innovation Strategy 3
AREI – The Institute of Agricultural Resources and Economics
FTE – Full Time Employment
CAGR – Compound Annual Growth Rate
EU – European Union
ICR – International Collaboration Rate
LU – University of Latvia
CAP – Common Agricultural Policy
ISO – International Organisation for Standardisation
IEC – International Electrotechnical Commission
S&T – Science and Technology
ERC – European Research Council
MCSA – Marie Sklodowska-Curie Actions
WGS – Whole Genome Sequencing
FWCI – Field Weighted Citation Impact
EU NRL network – European Union National Reference Laboratories network
ICES - International Council for the Exploration of the Sea
HELCOM – Helsinki Commission (The Baltic Marine Environment Protection Commission)
EFSA – The European Food Safety Authority
SWOT – Strength, Weakness, Opportunity, Threat
SARS CoV 2 – Severe Acute Respiratory Syndrome Coronavirus 2
WHO – World Health Organisation
IT – Information Technology
DIVA – Differentiating Infected from Vaccinated Animals
BioPhoT – Biomedicine and photonics
LatHort – The Institute of Horticulture
EUFRIN – The European Fruit Institutes Network
EUVRIN – European Vegetable Research Institutes Network
ISHS – International Society for Horticultural Science
ECPGR – The European Cooperative Programme for Plant Genetic Resources
VAT – Value Added Tax
NGOs – Non-Governmental Organisation
R&D – Research and Development

HCP10 – Highly Cited Publications
ICR – International Collaboration Rate
SLU – Swedish University of Agricultural Sciences
GDP – Gross Domestic Product
R&D&I – Research, Development, and Innovation
LVM – Latvia's State Forests
MSc – Master of Science
KPIs – Key Performance Indicators
RI – Research Infrastructure
ICOS – Integrated Carbon Observation System
LIMS – Laboratory Information Management System
IP – Intellectual Property
TRL – Technology Readiness Level
MRL – Market Readiness Level

1 Introduction

This document is one of a series of reports in the International Evaluation of Scientific Institutions' Activity, 2025. It presents the findings of the Agriculture, Forestry and Veterinary Sciences Expert Group about the research performance and international competitiveness of the five units in scope to it. It also considers the units' socio-economic impact and their potential for future development. These results of the evaluation are intended both to provide inputs to policymaking and to recommendations to help the units to improve their performance.

The Agriculture, Forestry and Veterinary Sciences Expert Group evaluated the following five units:

- Latvia University of Life Sciences and Technologies, Agricultural Sciences, Forestry, and Veterinary Sciences
- Institute of Agricultural Resources and Economics
- Institute of Horticulture
- Latvian State Forest Research Institute 'Silava'
- Institute of Food Safety, Animal Health and Environment 'BIOR'

The Exert Group evaluated the units using the following criteria:

- Quality of the research
- Impact on the scientific discipline
- Economic impact
- Social impact
- Research environment and infrastructure
- Development potential

The evaluation of each unit involved a documentary review and a site visit by the Expert Group to the units. The final evaluation of each unit published here represents the collective view of the Expert Group.

The analysis of each unit by the Expert Group is presented in the following sections.

Feedback on the Expert Group assessment received from the units is published in Appendix A. The Expert Group has reviewed the feedback and decided not to change the report.

2 Institution reports

A_1 Latvia University of Life Sciences and Technologies/ Agricultural sciences, Forestry, and Veterinary Sciences

2.2.1 The unit

The Latvia University of Life Sciences and Technologies (LBTU) is one of Latvia's four science universities and the only university with core research in agriculture, forestry, and veterinary sciences. Its vision is to be a modern, nationally and internationally recognised leader in bioeconomy innovation and sustainable natural resource use within the Baltic Sea region. The Agricultural sciences, forestry, and veterinary sciences unit focuses on advancing knowledge and technology to improve public and animal health, food security, environmental sustainability, and overall quality of life. The unit emphasises the 'One Health' approach, biodiversity preservation, sustainable management of soil and water resources, and the development of digital and smart solutions for agriculture, forestry, and veterinary medicine. The unit attracts competitive research funding, increases international collaboration, and maintains links with industry and policymakers.

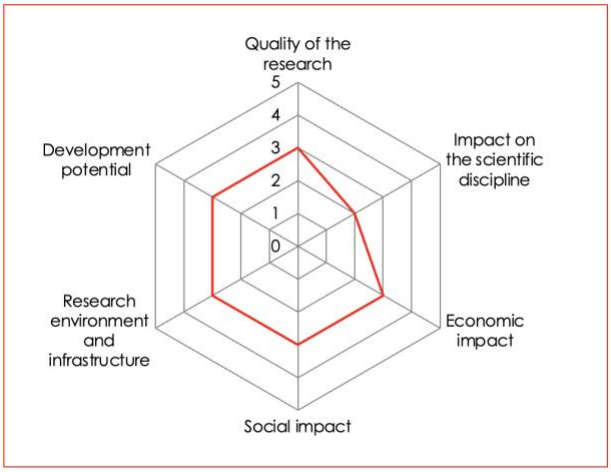
The research activities of LBTU span fundamental and applied sciences across agriculture, forestry, and veterinary medicine, with four areas of strategic specialisation: implementing the 'One Health' concept in the context of climate change; protecting biodiversity in agricultural and forest ecosystems; ensuring sustainable use of land, soil, and water for the bioeconomy; and developing technologies for high-value products and veterinary applications.

2.2.2 Expert Group evaluation

The figure below presents the scores assigned by the Expert Group to the unit.

Figure 1 Latvia University of Life Sciences and Technologies/ Agricultural sciences, 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	3
OVERALL SCORE	**3**



Overall score
Score 3: good

The Expert Group allocated the LBTU an overall score of '3'. LTBU covers a broad research area across agriculture, forestry and veterinary science, but the science output and quality are relatively low compared with internationally leading and strong universities and research

organisations. It lacks international or regional leading publications. Industry collaboration and funding could also be greatly improved. The Expert Group acknowledged the important economic and social impact LBTU has at the regional and national levels in Latvia, and the progress the unit has made towards reaching the international level in the last evaluation period. Nevertheless, the Expert Group still considered the international impact of the research to be limited. A good and important social impact was mainly seen on the educational side, which is to be expected for a university. However, the impact on the public and the government could be improved. Most importantly, LBTU still lacks a clear specification of its specific strengths and competitive advantages, and a convincing vision for the future. Such clarity is indispensable if LBTU wants to establish and exploit a specific role in the international scientific community. The university management recognises this weakness, and it has devoted a great deal of effort recently to organising and improving the organisation.

Quality of Research

Score 3: good

The Expert Group assigned a score of '3' to the quality of research. LBTU is seen as a strong national institution and covers research areas including integrated livestock, plant and human health, biodiversity, agriculture sustainability and technology for agricultural product development. Nevertheless, its international recognition is still low, and the output and quality of its research are below international standards for a strong international university, though the Expert Group consider LBTU a strong national player with some international recognition, as is evident from the levels of publications, citations, international funding and joint projects. The publication level is still medium to low, but increased in the last period, and the proportion of Q1 and Q2 publications also increased. There are approximately four full-text publications / researcher/ year, which is good, but could be increased, considering the high number of research and technical staff. The publications seem to be mostly published in journals with regional influence. LTBU has established a significant research network. There are a number of collaborations with international partners; several researchers are active in international committees and scientific boards, but the role and contribution of LBTU in the projects are not easy to identify.

LTBU was able to attract significant funding in competitive research projects (more than €13m), which is more than double the basic funding and represents an increase of 52 % compared to the previous assessment period, though only approximately €2m originates from international sources. The research topics are interesting for the scientific community and focus on applied research; basic research is underrepresented.

Without doubt, significant improvement has been made compared with the previous review, but there is still room for further improvement. The establishment of multi-disciplinary teams would improve the research quality.

Impact on scientific discipline

Score 2: adequate

The Expert Group scored the impact on the scientific discipline '2'. There seems to be limited basic and fundamental research, and there is a lack of outstanding publications in leading international journals. Although its participation in international conferences, bilateral exchanges with foreign Universities and Research Institutes, as well as the role LBTU scientists engage in international collaborations, show that LBTU is obviously internationally recognised, there is no evidence that it is leading such projects. Nevertheless, taking part is already a way to connect with the international community and to advertise LBTU's specific competencies.

This could be improved if LTBU researchers appeared as leading authors in high-impact publications that result from the collaborations.

LTBU's role in the national scientific community is of great importance. There is a lot of collaboration with local institutes and LTBU could have a role as a central coordinator of collaborative local projects. Nevertheless, the research lacks focus. LTBU needs to identify its specific strengths in order to become an interesting partner for national and international scientists. This might also increase the number of visiting scientists and foreign PhD students, and support LTBU's visibility and impact if more international researchers were invited. The conferences organised by LTBU also increase the institution's impact; nevertheless, they are mostly focused on the Baltic region. The participation of scientists of the LBTU in international conferences is relatively low; further increasing this might support the international visibility of the university.

Economic impact

Score 3: good

The Expert Group allocated the economic impact a score of '3'. According to the report, LBTU collaborates with industrial partners, mainly providing field studies for plant and animal production. The partners present at the site visiting meeting stressed LBTU's important role and how much they rely on its contributions. Main fields of support were veterinary medicine, climate change, forest management, biodiversity and digitisation. Nevertheless, the industry contributed only about €700k to LBTU's budget. This was explained by the small size of the enterprises. It is therefore hard for the LBTU to improve the financial side of this collaboration. In addition to the official projects, LBTU provides the industry with expertise and infrastructure, consultation, method development, assessment analyses, and provision of expertise in the area of plant protection and animal production.

The protection of genetic resources and the plant breeding of national varieties is an important example of its contribution to agriculture and the local economy. Some economic contributions are evidenced, such as the development of herbal extract for the prevention of parasitic infestation, industrial research of the artificial intelligence-based system COWOW, development of the autonomous laser weeder platform for agricultural enterprises, and prototype and technology of microbiological and organic fertiliser for farming, and advice from experiments on biosecurity protocols at poultry and pig farms.

In addition, the LBTU supports local industry by developing various guidelines (e.g. biosecurity guidelines for poultry, guidelines on containment of infectious diseases in animals and plants), and industry is involved in curriculum development to support the applied nature of the education.

There are many projects that are meant to lead to commercialisation. Although none of outcomes is on the market today, there is one spin-of company (Weet bot) which is an improvement compared to the last evaluation period and seems to be quite successful. The industry partners were very satisfied with the collaboration and emphasised the important role of LBTU in the Latvian economy. Such strong collaboration with the industry is unusual for a university, but is appropriate to the very applied nature of the research and education.

Social impact

Score 3: good

The Expert Group scored the social impact '3'. The main contribution is from teaching, but LTBU's research also has provided significant contribution to social development, including integration of research outcomes into LBTU study curricula, and development of green technologies and bioeconomy. The LBTU also addresses diverse sustainability issues, covering

environmental aspects, regional and rural development perspectives to enhance food security and support regional/rural development. One example is the 'One Health' framework to address public health threats and to improve biosecurity, as well as to ensure preparedness for health crises, protect food supply chains, and safeguard Latvia's agricultural exports from disease. LBTU researchers also contribute their expertise and time to many non-scientific organisations and projects. They provide guidelines and breeding programmes, support information exchange, and participate in joint projects. This includes collaborations with Latvian ministries and other state institutions. They help to improve national legislation and participate as experts in various working groups.

Further, the LBTU claims to have intensive contact with the public via talks and training courses. The amount of science communication activity has increased in the last few years. These are important contributions to closer contact and better understanding between science and society. Nevertheless, LBTUs' impact on the public could be improved.

Research environment and infrastructure

Score 3: good

The Expert Group allocated the research environment and infrastructure a score of '3'. The management team seems very enthusiastic – it signalled strong ownership of the management approach and a commitment to supporting research excellence. Management provided concrete examples of institutional investments made during the evaluation cycle. However, the research lacks focus on LBTU's specific expertise. A long-term vision for the research and its financing is needed. The new and improved concept for PhD funding will allow the PhD students to focus on their topics and thereby finalise their thesis in an internationally comparable time.

LBTU's research facilities and infrastructure satisfy the needs of current research projects, including extensive ICT infrastructure and a scientific data repository. Basic equipment such as a hyperspectral camera, spectrophotometer, pathology lab and field sites in agricultural science, and drones with sensors in forest science. Veterinary science includes the premises of the Experimental Animal Stable, and newly acquired equipment such as CT, and the assisted reproduction laboratory for farm animals. However, modern infrastructure such as an auto-phenotyping platform, metabolomics and genomic facility, genetic transformation and gene editing facility, and cloning facility would be needed for more adventurous research, but are not mentioned.

In order to profit from its current infrastructure, the University needs more focus on specific opportunities. In addition to their high teaching load, the senior scientists are involved in administration and policy consulting. Close contact with the Ministry of Agriculture and the industry leads to a strong focus on very applied work, which impedes the performance of more hypothesis-driven research. In the context of four other research institutes in the fields of Agriculture, animal health, forestry and biotechnology, which have a clear applied research mission, LBTU could become a national centre delivering basic science data necessary for real innovation. However, this would depend on having greater freedom for research in the frame of a common goal, e.g. sustainable agriculture based on all necessary modern technology (including e.g. genetic modification, organic farming and precision agriculture and forestry). The incentives the university provides for scientists to focus on more basic research are a good first step. It is also important that mobility has increased compared to the last evaluation period, but it is still not sufficient to establish younger and more innovative research groups, The University should enlarge the programme to support international exchange in cooperation with the other four institutes.

LBTU supports open access publication with several activities. As a result, 45.6 % out of total LBTU publications were published in Open Access databases.

Development potential

Score 3: good

The Expert Group scored the developmental potential with '3'. LBTU is an important player in Latvia, and based on its infrastructure and the motivation of the young scientists, it can develop into an important centre of basic research that delivers data for applied innovation in the other institutes. It has started to do so since the last evaluation, but this still needs to increase. Its developmental potential is dependent on funding, recruitment of good researchers, including postdocs and PhD candidates, and a good research culture and environment. Although LBTU started several activities to improve the age profile of the staff, the average age of LBTU researchers and academic staff has not changed significantly. The unit has the potential to do more fundamental research if more funding is available. For applied research, focus on EU 'One Health', and interdisciplinary studies of microorganisms and invertebrates in agriculture, and the introduction of molecular (or genomic-based) designed breeding programmes in both agriculture and forestry will advance new variety development. It is important for LBTU to focus on its strengths and support international exchange not only for students in veterinary medicine but for all levels and in all disciplines to identify its niche in the scientific community. LBTU needs to present its specific strengths to the international community in projects, papers and international initiatives like COST actions in order to increase its attractiveness for international cooperation and projects and to attract international PHD students. These interactions would also help LBTU identify which of its capacities are unique and attractive to potential collaborators.

Potential to offer doctoral studies

The University can provide all necessary equipment and infrastructure to support innovative doctoral studies. The academic staff is motivated to teach, and the PhD students expressed their gratitude and satisfaction with the ongoing programme. The modified financing of PhD studies seems to be an important step to allow the PhD students to focus on their topic and to finalise their thesis on time. This is of great importance when the graduates compete with graduates from other countries and when the university competes with other universities to attract the best students from all over the world. Recently, a new Doctoral school has been established, and a total of 35 doctoral students completed PhD training in Agriculture, Forestry and Veterinary sciences in the last 6 years. These numbers are moderate considering a total of 50 academic personnel (potential supervisors) and about 190 total active academic and research personnel if benchmarked with strong international universities, and there is great potential to expand the PhD programme to attract domestic and international PhD students. The university offers programmes to focus on soft skills and supports participation in international conferences and visits to international laboratories. Promoting contact between PhD students at LBTU and other Lavian agriculture and forestry research centres would additionally be helpful.

LBTU would be particularly attractive for PhD training if it were linked with other Latvian Agriculture, Forestry and Veterinary focused research institutes, such as Latvian State Forest Research Institute SILAVA, to create a joint doctoral school. The opportunity to do experiments in the other four particularly well-equipped institutes would provide another highlight for PhD students.

Alignment with the Smart Specialisation Strategy

The Expert Group believes that the topics addressed by LBTU's research are fully aligned with the RIS3 policy goals of knowledge-based bioeconomy and biomedicine in Latvia. LBTU has supported the achievement of RIS3 goals by increasing the number of papers published in

peer-reviewed journals, national and international collaborations and patents and strengthening the knowledge transfer to the industry and the media. Examples include promotion and adoption of more sustainable agricultural and forestry practices in two major areas of Latvia's bioeconomy: agriculture and forestry. LBTU also promoted interdisciplinary research for the development of smart materials, technologies and engineering systems. One example in the promotion of innovative biotechnology is the development and application of new biomedical materials in animal models for further application in human medicine (e.g., valved fontan in sheep model).

Conformity with state scientific and technology development

Scientific activity of LBTU conforms to the national science, technology, innovation and education development policies. The Latvian state's scientific and technology development aims to increase the productivity and the international competitiveness of the national bioeconomy. LBTU has contributed to this development, mainly via applied research to boost domestic companies via international collaboration and building innovation capacity aligned with Latvia's Science, Technology Development, and Innovation Guidelines. LTBU also promotes progress on the National Development Plan of Latvia via the establishment of a Doctoral School and the development of doctoral studies to strengthen education and research capability. Nonetheless, this contribution could be increased, as could the number of Q1 papers produced. LBTU has produced only one national and one international patent in six years. The main contribution is the registration of cultivars, demonstrating that LTBU's strength lies in breeding and not in the development of new technologies. Nevertheless, the establishment of the company WeedBot is a good contribution to the Latvian bioeconomy.

Together with the general improvement of the research outputs, LBTU's contribution has increased compared to the last evaluation period, but there is still room for further improvement.

Recommendations

The Expert Group has the following recommendations for LBTU:

- Identify the specific strengths, niche of the University aligned with its research infrastructure and in collaboration with the other scientific institutes in Latvia and the industry partners.
- Do more hypothesis-driven research and make efforts to produce influential international publications.
- Increase the number of early-career researchers to maintain or increase research personnel by allocating more resources from the administration to research.
- Increase industry collaboration and funding by establishing a long-term alliance with an individual industry or a consortium of industry sectors.
- Increase participation in the development of new international research programmes, such as the COST actions
- Attract international scientists and PhD students with specific programmes unique to LBTU and its infrastructure
- Open the graduate school to international candidates and involve international peers in its committees
- Support the participation of LBTU scientists and students in international meetings, competitions and collaborations via information about important events, financial and organisational support and incentives.
- Increase the visibility of the veterinary clinical research via better cooperation between clinical and paraclinical expertise at the Faculty of Veterinary Medicine
- Foster cooperation with the Scientific Institute of Food Safety, Animal Health and Environment BIOR or other similar institutions, in aspects of using animal models in

biomedical, food safety and/or vaccinology research, which can help generate national research alliances in the field with potential for basic research

A_2 Institute of Agricultural Resources and Economics

2.2.3 *The unit*

The Institute of Agricultural Resources and Economics (AREI) is a crop breeding research institute and a centre for bioeconomy research. Founded in 2016 through the merger of several institutions, it builds on over a century of experience in plant breeding, agrotechnologies, agroecology, rural economics, and sustainable development. Its vision is to be a significant research hub for the sustainable growth of Latvia's bioeconomy, supporting food security, environmental resilience, and innovation. AREI's mission emphasises applied and fundamental research along the agricultural and food supply chain, with a long-term goal of advancing bioeconomics through improved knowledge transfer, cooperation, open science, and integration of digital tools. With a regional presence across multiple research centres, AREI maintains links with farmers and industry.

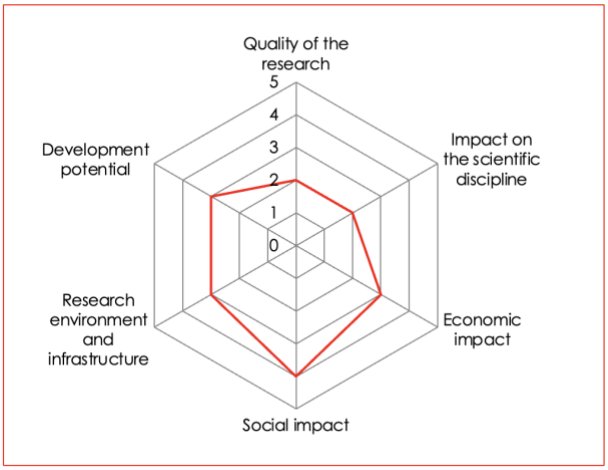
AREI's research is structured around three main priorities: (1) productive and diverse field crops, focusing on genetic resource conservation, breeding for climate resilience, and crop performance improvement; (2) sustainable agrotechnologies, including soil health, nutrient cycling, and innovations in plant-based raw materials; and (3) sustainability of rural areas and bioeconomy sectors, addressing circular economy models, agri-food innovation, and socioeconomic modelling of rural development.

2.2.4 *Expert Group evaluation*

The figure below presents the scores assigned to the unit by the Expert Group.

Figure 2 The Institute of Agricultural Resources and Economics – Scores

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



Overall score
Score 3: good

The Expert Group gave AREI an overall score of '3'. This mostly reflects the economic and social importance of AREI's research for the Latvian bioeconomy and society. AREI has been able to develop a high-quality research infrastructure with several modern research facilities and equipment. Applied research predominates in most research areas of AREI, driven by the state-assigned mandate to reflect the needs of the stakeholders for agricultural and bioeconomy development. Hypothesis-driven basic research is almost absent. The research environment is challenging in terms of organisational structure and management, but it would be critical to

the further development of the institution. The scientific excellence of AREI, in the sense of the quality of research and its impact on the field and relevant disciplines, is still developing. In particular, while AREI is viewed as a strong national research player within its specific discipline areas, it has yet to reach the level where it is internationally visible.

Quality of Research

Score 2: adequate

The Expert Group allocated the quality of research presented by AREI a score of '2'. AREI is rated as a key national player that covers unique research areas in Latvia, such as sustainable utilisation of plant breeding and genetic resources, agricultural and environmental resource economics, as well as rural development. However, while there are minor differences noted among disciplines covered by the institute, overall AREI's research quality is fairly weak and is not yet at a level where it would gain much international recognition. This is reflected in the number and quality of the publications presented to this evaluation. Although the total number of scientific articles is adequate, a relatively large share of the publication output consists of conference papers, which undergo less strict peer-reviewed processes and get little attention internationally. This leads to a rather low number of original research articles generated (around 1.4 articles/FTE researcher). In order to enhance their international visibility, AREI researchers need to prioritise original research papers over conference papers. The number of articles has fallen in the last six years (CAGR = -8.5%), and, while the share of Q1 papers has increased, it is still considered low from an international research quality point of view. Few AREI researchers have published peer-reviewed papers in highly reputed scientific journals. In fact, AREI has listed several papers from journals published by MDPI, which is often considered a predatory publisher with a compromised review process. AREI should increase the quality of its research by evaluating its publication policy and identifying journals or publishers with a stronger international reputation. In terms of interdisciplinarity of its research, AREI's publications cover mainly agricultural and biological sciences sectors (32.9%), followed by engineering (15.7%), whereas economics (1.2%) is less well represented.

Impact on scientific discipline

Score 2: adequate

The Expert Group gave the impact on the scientific discipline a score of '2'. The scientific impact of AREI's research is considered strong at the national level, given the involvement in several national research projects such as the Soy Project Handbook, SUDAT, Digital Landscape Atlas of Latvia, Landscape Assessment Handbook & GIS planning tool. Some research projects have received national awards. The self-assessment report indicates that the institute is linked with around 40 international research institutions and is a strong collaborator, mainly in the fields of plant breeding (barley, wheat, potatoes). AREI has also organised several international conferences, and its researchers are also active in 11 international scientific committees and boards. However, the international recognition of the AREI's scientific work is considered rather low. This is reflected in several science indicators, including a rather low international collaboration rate (ICR 18.8%), no highly cited papers that belong to the top 10% most cited publications in its specific research field (HCP10), no invited talks at scientific conferences, and no memberships in international scientific journal boards. Other indicators of impact and recognition within the scientific discipline, such as citations in scientific journals, indicate that they are also low (2.3 average citations; 2 citations/paper), with no highly cited papers and generally low citation impact metrics. The Expert Group recognises the efforts of AREI in organising various international symposia and conferences, which are important in bringing visibility and cooperation. AREI has listed participation in several EU Horizon programme funded research projects. However, AREI researchers appear to be partners in those projects, not leaders. They obtain relatively small budgets, especially in the competitive EU framework research funding (€217k over 6 years), which prevents them from having substantial research activities.

The Expert Group rates the institute's impact on science as not yet fully developed. The impact of research is still evolving, being in an early stage of development. With only 20 PhD researchers, its contribution to the discipline is currently limited. This is further compounded by the fact that the institute's activities are practice-oriented, while its research dimension, based on hypothesis-driven theoretical approaches, remains weak.

Economic impact

Score 3: good

The Expert Group scored the economic impact as '3'. Based on the self-assessment report and the interaction with stakeholders during the site visit, the Expert Group found AREI research important for the national agricultural economy, in particular in the field of plant breeding. AREI has been able to commercialise several products and perform several market-oriented research projects, including international cooperation, and maintains strong links with non-academic stakeholders (i.e. farm cooperatives, non-academic societies, German, Dutch, Finnish Companies). These stakeholders altogether provided €1.6m funding to AREI, which is a considerable contribution to the budget, but still low compared to the overall government competitive funding of more than €14m. Obviously, these are rather applied projects (ingredients from potato for cakes, oat varieties for production), and 1 registered cultivar (cultivated plant) per year. There are no patents registered and no cutting-edge scientific services, which might increase the economic impact. Still, there are academic papers published on these collaborations with industry. According to AREI reports, around 20% of arable lands in Latvia use AREI-developed crop varieties, and the institute is working on providing new varieties for a changing environment. As recognised by the stakeholders, AREI provides services for a wide range of practical stakeholders, being economically important for the relevant national industries, bioeconomy and policymakers.

Social impact

Score 4: very good

The Expert Group scored the social impact '4'. Being Latvia's major crop breeding scientific institution, AREI's research has a key role in providing food and feed security under climate change conditions (e.g., seed sovereignty). Especially AREI's research on the sustainable development of rural areas and bioeconomy has a direct socioeconomic impact. AREI's research is essential for the socioeconomic development of Latvia, especially in agriculture and food sectors, which are important for the national economy and employment in rural areas. AREI's interactions with the public sector stand out in terms of their extensive and dynamic nature. Stakeholders indicated that AREI's interactions with the public sector are extensive and dynamic. Besides breeding, AREI educates farmers, assists stakeholders, and provides outreach to society. AREI accomplishes these tasks by actively communicating its findings in popular science journals (Lopkopis, Bioloģiski, Agrotops, Saimnieks, etc.), via annual Field Days, presentations at non-scientific meetings, fora, consulting workshops, as well as on its home page and social media. Moreover, in terms of engaging citizens and children, AREI has focused on engaging with schools to raise awareness among the younger generations about organic farming, seed production, and related topics. AREI's scientists are involved in agricultural education at two Latvian universities (University of Life Sciences and Technologies, University of Latvia) and also influence policymaking. AREI's researchers are involved in many related Latvian expert and advisory bodies (especially for the Ministry of Agriculture and the Ministry of Economy). AREI developed the Digital Landscape Atlas, which supports land use policies in Latvia. As manager of the Latvian FADN database, AREI contributes to the development of the EU Common Agricultural Policy (CAP), and it also advises on CAP directly to regional development authorities in Latvia. Altogether, the Expert Group rates the AREI's research and the related services as very important for the Latvian society.

Research environment and infrastructure

Score 3: good

The Expert Group gave the research environment and infrastructure a score of '3'. The research infrastructure of AREI supports the needs of current research programmes and is able to provide a research environment comparable to similar institutions in the AREI's disciplines. AREI is a newly established institution, formed from several existing and highly dispersed institutes in 2016. The Group of Experts recognised this aspect as an additional difficulty and challenge in terms of the overall institute's management. Regarding financial planning, a detailed roadmap is given, indicating that both public and private funding are planned to increase. While such multi-source funding is beneficial for stable resources over the years, the strategy and measures taken to ensure an increase in funding are not clear enough. The low share of Horizon Europe funding seems to be acknowledged as a problem, as the institute plans to triple its amount. The dispersed nature of the unit means it is a big challenge to develop a community of researchers, which would be needed to boost creativity. However, the age structure of the institute is young, with many early-career researchers. This may provide a modern, vivid social environment.

AREI has made massive investments in infrastructure. Its land, experimental fields, greenhouses, and lab equipment provide a strong base for high-level international research. The supporting infrastructure of AREI also seems to be in very good condition. An accredited Grain Technology and Agrochemical Laboratory (ISO/IEC 17025), a Technology Transfer Centre, and three technical hubs have been established, offering equipment maintenance, trial support, and seed processing. Based on the rather low scientific output highlighted above, the Expert Group had the impression that these positive resources are not fully utilised yet. AREI would benefit more from its infrastructure by focusing on its scientific strengths, prioritising its resources, enhancing the excellence of staff, and/or approaching (national and international) qualified researchers.

Development potential

Score 3: good

The Expert Group scored the developmental potential '3'. AREI has been able to secure a modern infrastructure, especially via international funds. This offers development opportunities, but the high maintenance costs of scientific equipment and facilities also pose a risk if research funding is not secured.

Approximately 80% of AREI's budget comes from applied research. While this is a significant success, it also means it can be hard to maintain the right balance between applied and curiosity-driven research. Although applied research is the main source of funding for the institute, excellence-driven research has several strategic advantages. It provides the scientific credibility and recognition that establishes AREI as a leading institution at both the national and international levels. The outcomes of excellence-driven research are visible internationally, whereas applied research tends to be less prominent on the global stage, despite its undeniable practical value. It is not clear from AREI's research strategy to what extent and how the level of excellence in research is going to be increased. The management is encouraged to develop an internal reliable development strategy with measurable and realistic goals and tools that might include indicators like basic research established, level of Q1 papers to be reached, number of patents or cultivars to be developed, highly competitive grants or similar to be acquired, and establishment of a regional centre of excellence.

Another key aspect of development potential is talent attraction. The management has improved the age structure and developed incentives to retain and support excellence in

research. This is a good first step, but not enough to reach excellence without appropriate targeting of relevant international excellence funds. The presence of excellence-driven research helps to attract young, talented researchers, especially when the institute hosts internationally recognised scientists, particularly from the younger or mid-career generation. Such researchers serve as magnets: students and postdocs are more likely to join an institution where they believe they can learn from someone well-known in their field. Without such visible figures, it is much harder to attract top international talent.

Therefore, it is of strategic importance that AREI not only excels in applied research but also maintains a strong portfolio of internationally visible excellence research, which enhances the institute's reputation and attractiveness. The available research infrastructure (fields, greenhouses, climate chamber) may be used more efficiently to develop innovative hypothesis-driven research in the core areas of AREI, such as crop breeding and bioeconomy.

Potential to offer doctoral studies

Although AREI is not currently entitled to award postgraduate degrees, the Expert Group believes AREI has the potential to offer doctoral studies in cooperation with the Universities. It has the necessary infrastructure and attractive research environment to offer advanced training and research options for doctoral students. Each year, six to seven students are enrolled on doctoral studies with AREI. However, the number of students graduating is rather low (one per year), likely due to the fact that many PhD students are fully employed at AREI and do not have time to focus mainly on their PhD project. This leads to extended completion times of up to seven to eight years, loss of the focus needed to finish the PhD project in time, and potentially loss of interest from some of the PhD students to publish the data and look for the next career step. Another disadvantage of doctoral studies in AREI is that talented international PhD candidates are lacking, probably due to legal constraints. The Expert Group learned that early career researchers are involved in project planning, thus gaining experience on projects. The weakness is the low international embeddedness of AREI senior researchers, which hinders PhD students from reaching an international level. Also, the remoteness of some units is probably not attractive for young researchers. AREI is encouraged to offer programmes that increase soft skills and interaction among the PhD students in the framework of the doctoral school, as well as support the involvement of international peers as committee members.

Alignment with the Smart Specialisation Strategy

AREI's research activities comply with the objectives of the national science, technology, and innovation development policy as well as the Latvian Smart Specialisation Strategy (RIS3). This includes smart breeding tools and digital agriculture measures, as well as more recently developed initiatives in urban agriculture. In knowledge specialisation areas, 'Knowledge-intensive bio-economics' is well embedded in AREI's core activities. Thus, AREI also contributes to the growth of human S&T capital, as there is a slight increase in researchers. Although the scientific quality is still weak internationally, leaving room for improvement, on the financial side, AREI's research has a good, though mostly domestic, application success rate.

Conformity with state scientific and technology development

AREI complies with state scientific and technology development in several areas, like (i) seed sovereignty and crop variety breeding – ensuring food and national security; (ii) sustainable farming systems – research on organic farming, agroecology, and urban agriculture; and (iii) efficient use of resources – e.g. plant-based raw materials. In these areas, AREI is a strong contributor to the Latvian development.

The institute has the capacity to attract new early-career researchers and PhD students, and increase their numbers from six to thirteen since 2020. However, the units' remote localities and lack of international collaborations are still a challenge. This is being addressed by AREI, as it is planning more Horizon Europe participation, EU expert group memberships, hosting conferences, and providing mobility support for researchers.

The research activities of AREI are aligned with Latvia's policy objectives. In particular, AREI's work corresponds to the Latvian Bioeconomy Strategy 2030, which emphasises sustainable use of biological resources, seed and food security. Furthermore, AREI's focus on crop breeding, sustainable agrotechnologies, and rural bioeconomy development directly supports the National Science, Technology and Innovation Development Policy and contributes to the goals of RIS3, namely fostering a knowledge-intensive bioeconomy, promoting efficient resource use, and strengthening Latvia's international competitiveness.

Recommendations

The Expert Group found that AREI has limited scientific performance and quality. Thus, its prospects to develop into an internationally recognised research institution need an effective strategy. On the other hand, AREI's research is recognised as a significant contributor to the Latvian bioeconomy and society. Any further strategy should prioritise maintaining and fostering the Latvian significance, while further developing the research excellence.

The Expert Group has the following recommendations for AREI:

- In order to maintain the leading role in Latvia in a changing socio-economic environment, AREI needs to further develop **its research areas** as (i) strong research-based expertise makes the difference to breeding and advisory companies, and (ii) a strong research secures that AREI staff are aware of the newest scientific evidence through research and scientific networks.
- To increase the chances for stronger and influential publications, it is recommended that AREI identify key fields and enhance hypothesis-driven basic research, especially in those research areas of AREI's core expertise that have such potential, and where AREI may have comparable advantages
- Development in **international scientific collaboration** is critically needed. Here, the help from the Ministry of Agriculture may have a role, e.g. delegating AREI experts to EU and international expert bodies, or supporting AREI to organise high-level international meetings, or sessions at larger international congresses. AREI has a lot to offer for potential international collaborators, for example, regarding its research infrastructure
- AREI needs to develop tools to attract high-profile, ambitious researchers. One option might be establishing a special funding scheme, probably funded **from the ministry** or similar funders, in order to provide internationally competitive salaries and research grants to establish one's own research group and project. This scheme may resemble the ERC funding, but may be tailored to Latvian needs and conditions
- The competitive **EU Horizon funding** level is low and needs improvement. The EU support system has several keywords or hotspots that may fit well with AREI, such as Living Laboratories or agroecology. For the latter, there is a partnership with specific countries. AREI is a potentially strong actor in these aspects. For example, AREI can easily establish additional Living Labs (LLs) through its local stakeholder networks, which can then join the European LL network. This allows potential partners to easily find them, potentially inviting AREI to submit proposals. For being the coordinator of any consortium, AREI may still need more experience and visibility, which can be obtained by more frequent participation as a consortium member
- **Doctoral training**: AREI can increase its reputation in doctoral training in two aspects: (i) providing the facilities and infrastructure, including supervision, and (ii) supporting PhD students and early career researchers both monetarily and by office environment. The latter

includes sending students to selected international meetings and lab visits, and also networking get-togethers and excursions, stimulating students' thinking, creativity, and discussion of their own ideas with fellow students. To complete the capacity for doctoral training, it is also necessary to enhance the level of scientific excellence of AREI. Here, cooperation with high-ranking national universities or involvement in international graduate schools (e.g. MCSA networks) may help

A_3 Institute of Food Safety, Animal Health and Environment 'BIOR'

2.2.5 *The unit*

The Institute of Food Safety, Animal Health and Environment 'BIOR' works in veterinary medicine, food and environmental safety, and fisheries. Its vision is to strengthen public and animal health, food quality, and environmental sustainability by providing internationally recognised research, laboratory diagnostics, expertise, and knowledge transfer. BIOR operates as a National Reference Laboratory and plays a central role in national and EU-level monitoring and surveillance programmes. The institute applies the 'One Health' concept, integrating human, animal, and environmental health research.

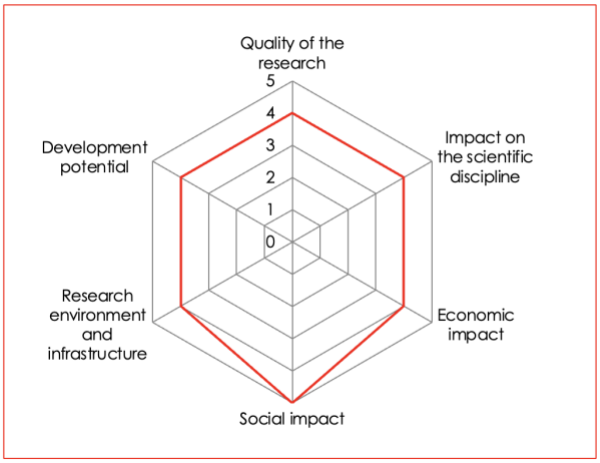
Research at BIOR spans food safety, veterinary medicine, environmental health, biotechnology, and fisheries management. Its activities include investigating foodborne pathogens and contaminants, zoonotic diseases, aquatic resource sustainability, and the effects of climate change and pollution on health.

2.2.6 *Expert Group evaluation*

The figure below presents the scores assigned by the Expert Group to the unit.

Figure 3 The Institute of Food Safety, Animal Health and Environment 'BIOR' – Scores

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



Overall score
Score 4: very good

The Expert Group awarded BIOR an overall score of '4'. This results from the progress made by BIOR over the last few years, mainly in increasing the quality and impact of its research activities, as well as enhancing the research environment and infrastructure. Notably, BIOR has established advanced laboratory facilities and equipment, as well as promoted an effective research environment that has stimulated a high level of research performance with international visibility. The impact on the scientific discipline has also improved when benchmarked with other similar international research centres. Applied research still dominates in most research areas of BIOR, probably driven by the state-assigned mandate to reflect the needs of policymakers for risk assessment and monitoring in animal and public health. To reach the next level, the Expert Group suggests that BIOR enhances its efforts in stimulating bottom-up and hypothesis-driven basic research, together with high-impact lead author papers, while

promoting stronger collaborative links with industry to better diversify funding and support high-level research.

Quality of Research

Score 4: very good

The Expert Group scored the quality of research as '4'. BIOR is rated as a strong international player in the research areas of food safety and environmental health. This is especially true for the scientific disciplines around analytical method development that prevail more than the others. These have stronger research performance and are supported by advanced analytical facilities and equipment, especially in mass spectrometry, WGS and NGS. The quality of the research performance, as measured by the quality of the publications presented, journals and publishers involved, is very good to excellent in some areas, such as analytical chemistry method development. The output of research with 227 articles during the evaluation period has considerably increased compared with the previous evaluation period. The quality of research has also significantly increased since the previous evaluation. BIOR researchers have published peer-reviewed papers as lead authors in highly-reputed scientific journals, covering environmental health, marine health, epidemiology and infectiology, all BIOR's core competencies. As many as 66% of the papers are published in Q1 journals, a level comparable with similar research centres globally. However, few papers presented in the self-assessment report as main publications appear in journals of MDPI publishers, which, according to some accreditation agencies, are labelled as predatory publishers. BIOR is encouraged to reevaluate the publishing strategy in order not to diminish the research credibility.

In terms of interdisciplinarity of its research, interdisciplinary publications span subject areas, with agricultural sciences and environmental sciences being the most represented areas. BIOR could benefit further from its unique research standing in Latvia and the Baltics, as well as the interdisciplinary nature of its research. This would help extend its interdisciplinarity further towards other core areas of BIOR, such as Veterinary Sciences/Epidemiology/Infectiology, Biomedicine or Toxicology/Pharmacology. Also, although the management of the institute recognises that applied research is the cornerstone of BIOR's mandate, and less room for basic research, for BIOR to further increase the level of quality of the research, it is important to delve more into the hypothesis-driven basic research. Indeed, bottom-up basic research is rather limited in many speciality fields of BIOR, including food safety (molecular food-borne pathogens, food residues and contaminants, biomedical models, vaccinology), these areas might offer potential for excellent research grants. BIOR has both infrastructure and scientific manpower to identify such areas of research and stimulate its strengths for reaching excellence. This may also increase the visibility of the research by generating groups that produce highly cited and influential papers, offering BIOR as a focal research site for excellent research cooperation in certain research areas.

Impact on scientific discipline

Score 4: very good

The Expert Group scored BIOR's impact on the scientific discipline as a '4.' It rated BIOR as internationally recognised in the discipline of food safety. This is reflected in various indicators of the recognition from international peers, including impact and citations of the papers/research created by BIOR, involvement in collaboration projects, internationalisation metrics and the national and international standing of the BIOR researchers. The impact on the scientific discipline, when measured by the international collaboration rate (ICR; 57.3%), the number of citations (15.2 average citations), citation impact metrics (ARC 1.52; FWCI 1.47), is rated very good. BIOR's role in the national scientific community is regarded as essential. BIOR is a National Reference Laboratory involved in national and international monitoring and surveillance programmes, being a critical element in the acquisition of research data and the

advancement of related academic questions. Its researchers are also strongly involved in various research-related, teaching/academic, and other regulatory and advisory boards. They are frequently invited as speakers to international conferences and to join the scientific boards of conferences and peer-reviewed journals. BIOR is regarded as a strong partner in international research projects and scientific networks, collaborating closely in European food safety and veterinary surveillance networks (EU NRL network, ICES, HELCOM, EFSA), providing scientific expertise and advice. In addition, BIOR was involved in several national, regional and European research collaboration projects dealing with various aspects and considered impactful in the area of expertise of BIOR.

Economic impact

Score 4: very good

The Expert Group scored the economic impact of BIOR as '4'. Based on the self-assessment report and interaction with stakeholders during the site visit, the Expert Group rated BIOR research as important for the national bioeconomy and public health. The most economically impactful activities have been in the field of control of infectious diseases and zoonosis, epidemiology, as well as fish stock restoration and fish processing. Although many of BIOR's activities are non-commercial in nature, these activities are seen as vital for the development of the existing economic sectors related to food safety and security, as well as public health in Latvia. The management of BIOR has recognised in the SWOT analysis that the connection between research and the industry/economy is weak, so the Institute is encouraged to invest more effort in attracting private economic stakeholders (domestic and foreign) to interact closely with BIOR. BIOR could commercialise adequate services and know-how (e.g. in areas of laboratory testing and diagnostics), which may increase the revenues and funding for research and development from (international) industry and private sector. Further, research innovations, including national patents issued to BIOR researchers (21 in this evaluation period), could be better used for licensing or other forms of industry involvement, which might help both in supporting new economic sectors and having an improved financial impact for BIOR. Efforts should be made to extend Latvian patents to international coverage in the future.

Social impact

Score 5: outstanding

The Expert Group scored the social impact of BIOR as '5'. BIOR is rated as highly important for society, because many of the research disciplines of BIOR have had important impacts on societal development in Latvia. A clear example was the role that BIOR played in successfully implementing the national wastewater surveillance for SARS-CoV-2 during the pandemic years. Through this innovative approach, BIOR enabled early detection and helped monitor the spread of the virus across the country. Another example of the way BIOR took on its societal role is by integrating multiple scientific disciplines focused on human, animal, and environmental health ('One Health' concept), a highly important aspect that requires broad public commitment. BIOR has also played an important role in implementing and increasing public awareness of antimicrobial resistance in Latvia. These societal developments have been supported by very active media engagement, internet and TV broadcasting (e.g. 11,000 online media news). Important aspects of fisheries, infectious diseases, zoonoses, food and feed safety, nutrition, and public health, as well as coverage of critical events such as water or feed contamination incidents, have been reported, highlighting the high social impact of BIOR research. Further, WHO Europe acknowledged BIOR's important role in these social aspects. The BIOR researchers are highly esteemed partners in development projects outside the academic environment. Staff members of BIOR are in high demand as experts in the public sector, having held important counselling and advisory positions in Latvian policymaking, civic society and other public circles. The highest national prizes and awards have been given to BIOR researchers thanks to their scientific and social engagements. Altogether, BIOR is viewed

as an important driver of societal development in Latvia in the areas of food safety, nutrition and public health.

Research environment and infrastructure

Score 4: very good

The Expert Group gave the research environment and infrastructure of BIOR a score of '4', rating BIOR as an institution able to provide an internationally comparable excellent research environment to high-level international scientists in its discipline. Through good organisation, efficient structure and good capacity building, the management team and the scientific board have been able to establish an excellent environment with outstanding research infrastructure, technical support staff and IT that supports interdisciplinary and multidisciplinary research in the main fields of BIOR's research operations. BIOR's new main building, upgraded research infrastructure and facilities in the evaluation period, including ISO certificates, have improved the ability of BIOR to compete internationally, as well as collaborate with leading institutes and universities in the EU.

Applied research still dominates in most research areas of BIOR, and is likely to be driven by the state-assigned mandate to reflect the needs of policymakers for risk assessment and monitoring in animal and public health. This has considerably increased the visibility of BIOR as a research partner in applied research. The coming BIOR's strategy targets the implementation of the One Health concept. This is intended to increase long-term public and private demand for high-quality scientific evidence in the fields around One Health. For BIOR to benefit more from this positive environment and networking, it needs more bottom-up research initiatives in its core disciplines, which would enrich the institute further and enable new innovations. In terms of human resource development strategy, BIOR has a good base with a supportive environment that fosters researchers' creativity, motivation (for example, through bonus payments), communication training, and, most importantly, a friendly atmosphere. BIOR has been able to establish a good balance with various schemes to support scientific development and the inclusion of young scientists. In this respect, however, tools need to be developed for promoting the exchange and practical training by creating opportunities for young researchers to undertake internships or research stays at foreign scientific institutes. Such opportunities can be exploited through MSCA internships or other similar fellowship programmes. BIOR has established support schemes for open science, including open access publications, sample and data exchange.

BIOR has been able to secure a significant increase in funds from competitive projects since the last evaluation. Its revenue mainly comes from state and EU funding, having experienced a 42% growth over a six-year period, which is a positive development as it helps to sustain active research performance. This has allowed improvement of the infrastructure and growth in the personnel. The main revenues consist of funds for state-delegated functions related to research data acquisition, as well as income from paid services. Other important funds came from international sources other than the EU framework programmes. In the medium term, the large maintenance costs of the infrastructure may pose a threat, especially if the international funds, including EU structural funds, are going to be decreased in the coming years. It is therefore important that BIOR further diversifies its funding sources, aiming to increase competitive EU framework funding from the rather low current level (€372k in six years). Weak support from industry is recognised as a threat in the SWOT analysis, negatively affecting the continuity and long-term sustainability of research. It is commendable that management has planned to invest efforts and a portion of the institute's income in securing foreign and private funding for research and development projects. Establishing a professional office that helps researchers develop links with foreign and private entities, promotes capabilities and assists project management would be a good step in this direction.

Development potential

Score 4: very good

The Expert Group scored the developmental potential '4', recognising BIOR's potential to become a strong international player in food safety and bioeconomy. BIOR's vision is to become a competitive research institute at the international level. This seems to be challenged by a lack of long-term planning in national research policy and funding, as well as the comparatively low salaries of the research personnel in Latvia. The latter seems to jeopardise the ability of BIOR to retain and attract new talented researchers. To avoid this, the management has diversified its funding to pay for research personnel through cooperation with industry and lab services. This is a good start. Here, obviously, changes in legislation and publishing vacancies internationally are also needed to make the use of foreign researchers easier. The management must also develop attractive tools or packages using the existing links with international institutions and networks to attract foreign researchers. BIOR improved international visibility and recognition with considerable success. For example, there are a few positions in high-level bodies, like EFSA management board member (2021-), European One Health Association board member (2024-), and national delegate to the Int Council Exploration of Seas (2017-). On other aspects, however, there is still room for improvement, like being a coordinator of Horizon Europe projects or a leader of ERC grants.

Nationally, BIOR is well-positioned to attract students, doctoral candidates, young researchers/Postdocs from various life science universities in Latvia. The management has recognised the high mobility of the young researchers as threatening the continuity of research. But the strong international networking, high scientific standing, well-equipped research infrastructure and inspiring social environment can also help in attracting potentially international researchers in the fields of food safety, environmental sciences, fisheries, veterinary, and public health. The group structure of BIOR seems appropriate, with a good share of senior researchers and research assistants, supporting research staff, and young researchers (PhD students, Postdocs).

One of the strategic goals of BIOR for the coming years is to promote the sustainable use and application of evidence-based knowledge, combining the institute's areas of expertise – public and environmental health, chemistry and environmental chemistry, veterinary medicine, and the preservation of water biological resources - within the implementation of the 'One Health' concept. This strategy is appropriate for generating long-term public and private demand for high-quality scientific evidence to support new policy planning documents and regulatory issues, mandated by the 'Development Strategy 2022-2027'. However, for increasing the impact of research, more bottom-up and curiosity-driven research aspects are needed. It is highly positive that BIOR is also actively developing new research directions, particularly in molecular biology and bioinformatics, and so aiming to enhance the quality and scope of interdisciplinary research. This is a good first step, but this policy needs to be fostered further by stimulating talented researchers in open and competitive international procedures. This research strategy should also aim to develop basic research options that can absorb excellent research grants and establish such excellent groups at BIOR.

Potential to offer doctoral studies

BIOR is not entitled to grant degrees, but can offer doctoral studies in cooperation with relevant universities. It has the necessary infrastructure, environment and senior researchers to offer advanced training and research options for doctoral students, providing a strong research environment. In addition, BIOR researchers are involved in teaching at universities, and this further facilitates the interactions and functioning of the doctoral school. The number of doctoral students has increased in recent years, up to 22 students enrolled for doctoral studies with BIOR. However, the number of students who graduated is rather low (0 to 3 per year),

which indicates a low success rate or slow completion rates. During the site visit, some PhD students said that they were involved from the beginning in planning the experiment, which is positive. However, some also said they were very busy with project work, with little or no time for soft skill development. It appears that many PhD students are fully employed at the Institute and do not have sufficient time to focus primarily on their PhD projects or develop other essential skills. This may lead to extended graduation times, lack of focus, and potentially loss of interest from the PhD students to publish the data and look for the next career step in a competitive way. It is also advisable that BIOR opts for participation in international doctoral schools (i.e., MSCA doctoral networks) with intensive exchange of students and doctoral experiences.

Alignment with the Smart Specialisation Strategy

Based on the information provided, the Expert Group finds that the topics addressed by BIOR's research are fully aligned with the RIS3 policy goals of knowledge-based bioeconomy and biomedicine in Latvia. BIOR reports direct involvement in several activities related to RIS3 objectives, including 'Knowledge intensive bioeconomy' and 'Biomedicine, medical technologies, bio-pharmacy and biotech human technologies'. There was a large increase in research personnel from 2018 to 2019, thus the S&T capital increased considerably. Further contribution in the Smart Specialisation Strategy was the development of the DIVA vaccine for African Swine fever, the prevention of zoonoses by implementing a novel rapid point-of-care system, as well as the contribution to pandemic preparedness and responses. Although obviously still in the initial phase, the BIOR's research platform in biomedicine and photonics (BioPhoT), aiming to create innovative products, fits well in specialisation areas Biomedicine, Medical Technologies and Pharmacy, and 'Smart materials, technologies and engineering systems'.

Conformity with state scientific and technology development

BIOR is a research institute providing high-added-value products, applying modern ICT, and sustaining modern education from the priority investment areas. Scientific activity of BIOR matches the national science, technology, innovation and education development policies. BIOR seems to have a key role in several specialisation areas in the national science, technology and innovation development policy, namely 'Knowledge-intensive bioeconomy'. BIOR research contributes to the transformation of the national bioeconomy towards higher international competitiveness, higher added value, productivity and more effective usage of resources. Thanks to its high scientific standing, favourable location and positive social impact, as well as the high internationalisation of its research and networking, BIOR has also had a substantial impact on education and innovation development policy in the Latvian bioeconomy. If the ties with industry and other commercial actors had been better, it is expected that the impact on the technological developments would have also been higher. Therefore, management should take further steps and develop tools to intensify collaboration with industry and related stakeholders.

Recommendations

The Expert Group has the following recommendations for BIOR:

- Further increase the research quality level, fostering hypothesis-driven basic research. This is viewed as vital as bottom-up basic research is rather limited in many speciality fields of BIOR, including food safety (molecular food-borne pathogens, food residues and contaminants, biomedical models, vaccinology, fish breeding and restoration)
- Foster research cooperation with neighbouring institutions of biomedicine and health, which could better optimise the use of resources for research (e.g. animal, ex vivo or in vitro facilities), which BIOR lacks but could upgrade the research options of the institute

- Support the development of research groups that produce highly cited and influential papers, attracting foreign visitors and collaborations
- Make BIOR attractive to foreign students to join its teams for one to several years. It contributes to the development of an internationally excellent research environment
- Develop tools for promoting exchange and practical training by creating opportunities for young researchers to undertake internships or research stays at foreign scientific institutes. Such opportunities can be exploited through MSCA internships or other similar fellowship programmes
- Devise a policy to determine the proportion of 'high risk-high gain' vs. 'business-as-usual' research
- Enrich the scientific board of the institute with internationally recognised members of any key discipline who are involved in the development of the research strategy
- Establish an office for the commercialisation of the innovations and links to projects and industry
- Establish a professional office that helps researchers develop links with foreign and private entities, promotes capabilities and assists project management
- Promote incentives for all forms of innovations
- Urge changes in legislation to make it easier to attract applications from foreign researchers
- Establish an ombudsperson office that acts as an independent, confidential point of contact to assist PhD students and staff in resolving issues related to their research, such as conflicts, academic misconduct, or problems with administrative processes
- Commercialise certain services (e.g. testing, diagnostics) towards the (international) industry and private sector.
- Commercialise more research innovations (i.e. patents) through licensing or other forms of industry involvement.
- Diversify the financing sources, especially by aiming to increase competitive EU framework funding
- Develop fishery studies to contribute to marine and freshwater restoration, according to the Nature Restoration Regulation of the EU
- Involve public/society engagement through activities such as open days, summer schools, citizen science, and kids in research would further increase the societal impact
- The functioning of the doctoral school needs to be based on international standards (international committees, regular meetings, progress reporting, journal clubs, soft skills development, career development, conference visits and presentations)
- It is advisable that PhD students are focused fully on their PhD studies
- The graduation time of PhD studies should be limited to 3-4 years, and barriers to it should be alleviated
- Promote participation in international doctoral schools (i.e., MSCA doctoral networks) with intensive exchange of students and doctoral experiences

A_4 Institute of Horticulture

2.2.7 *The unit*

The Institute of Horticulture (LatHort) is a research centre for horticulture, operating across two campuses with a strong focus on plant breeding, plant genetics, pathology, cultivation technologies, processing, and biochemistry. LatHort's mission is to advance smart and sustainable horticulture to improve food security, public health, and environmental quality, while promoting equality, social inclusion, and public awareness. It positions itself as both a scientific hub and a practical resource for farmers and industry, integrating research excellence with training, consulting, and innovation. The institute aligns its work with EU and national strategies such as the Green Deal, Smart Specialisation Strategy, and Sustainable Development Goals.

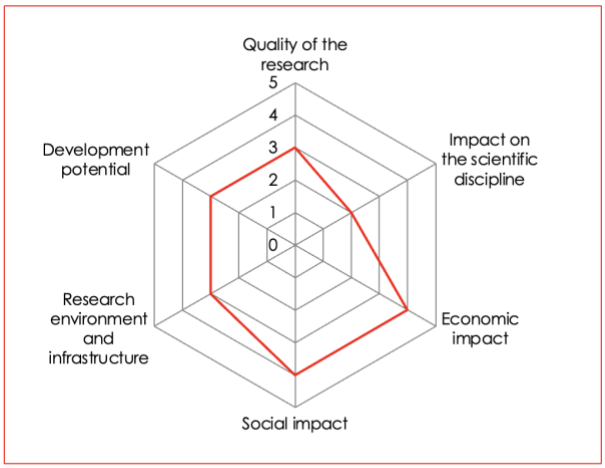
LatHort's research spans four main areas: (1) genetics and breeding, including cultivar development, germplasm characterisation, resistance gene discovery, and AI/drone-based phenotyping tools; (2) agronomic research and variety testing, focused on climate-resilient cultivation systems, sustainable soil management, and smart irrigation; (3) plant pathology and entomology, tackling underexplored pathogens, pest dynamics, and resistance breeding; and (4) processing and biochemistry, developing bio-based packaging, functional foods, biorefining methods, and sustainable extraction technologies.

2.2.8 *Expert Group evaluation*

The figure below presents the scores assigned by the Expert Group to the unit.

Figure 4 The Institute of Horticulture – Scores

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



Overall score
Score 3: good

The Expert Group gave the Institute an overall score of '3'. LatHort is rated as a strong national institution, gaining international recognition, particularly in horticultural crop breeding, genetics, and plant pathology, though the agronomic unit's impact remains limited. The institute has a significant social and economic impact, particularly in covering the entire value chain of horticultural crops and engaging actively with the public, industry, and farmers.
Although its nationally-orientated applied research restricts international engagement, significant progress has been made in securing competitive funding and increasing the number of high-impact publications since the previous evaluation period. LatHort is essential for conserving plant genetic resources and managing pathogens, with an emphasis on local research needs like developing new varieties. LatHort's staff is extremely enthusiastic, which fosters a highly supportive and inspiring environment. This positive atmosphere not only motivates staff internally but also plays a crucial role in strengthening the institute's partnerships with external stakeholders, as reflected by local farmers who demonstrated authentic enthusiasm for working with the institute during the visit. By fostering collaboration and encouraging innovation, LatHort's team helps drive the institute's mission forward and supports its ambitions for greater international engagement and influence.

Quality of Research
Score 3: good

The Expert Group scored research quality '3,' recognising LatHort as a strong national player but with limited international recognition. The Expert Group recognised the impressive publication growth of the Institute, increasing from 170 in the previous period to 218 in this evaluation period. Thus, the LatHort's 'High-Level Publications Incentive System' has yielded positive results: Q1 publications increased by 36% since the last evaluation, while papers in lower-ranked journals declined. LAtHort scientists are first or last co-authors in high-ranked publications.

In general, the number of papers published in higher-ranked journals is relatively high, given that the applied aspect of the research is complex and time-consuming, which brings difficulties to publish such results. The average number of publications per scientist increased to 20. The proportion (29%) of papers published in international collaborations also increased, highlighting the growth in international collaborations. However, it must also be taken into consideration that the lower teaching and administrative burden of researchers in LatHort compared to academic scientists allows the allocation of more time to research, publications and research proposals.

The research topics addressed are very applied and thus lack scientific novelty, but this matches the role and mandate of the institute in the national scientific landscape. The concentration of the institute on the whole value chain and rare species in combination with the conservation of genetic resources is an excellent way to create a unique specialisation. Conversely, the field-research activities demonstrate lower performance. While the experiments offer positive contributions to the landscape, there are certain limitations from an agronomic perspective, primarily due to soil and meteorological variability, and the agronomic research unit appears less efficient than LatHort's other units (i.e., Genetics and Breeding; Plant Pathology and Entomology; and Processing and Biochemistry). This is evident in the scientific outputs, as the most prestigious publications are linked to these units. However, the Expert Group notes that publishing applied agronomic research (e.g., like the excellent publication on cabbage intercropping) is difficult and time-consuming.

Impact on scientific discipline

Score 2: adequate

The Expert Group scored the impact on the scientific discipline '2', considering that the overall international impact of the research is still evolving. Nevertheless, some progress since the last evaluation is recognisable. LatHort has established itself nationally and expanded its presence in the Nordic/Baltic region, where it sometimes has collaborations and joint projects. LatHort participated in international research networks such as EUFRIN, EUVRIN, ISHS, and ECPGR and it has taken on coordination roles in some Horizon Europe proposals but has not consistently served as the lead organisation in large-scale international programmes to date. The institute is in contact with international research units; for example, there is one PhD thesis together with a German university, a French PhD student, and others have been mentioned during the site visit.

The institute is more internationally recognised for plant pathology and the genetics and breeding units, two research areas where it plays a specific role in the scientific community. In 2021 the institute also organised the 4th International Scientific Conference on Sustainable Horticulture. Some of the members were also invited to international conferences, mainly in the Baltic region. Some members serve on editorial boards—one person is particularly active. Although these journals are not the most influential, they closely match the institute's research interests. Recognition of senior scientists has significantly increased from the last evaluation, and researchers at LatHort received some peer recognition, as evidenced by awards, editorial board memberships, and keynote invitations from senior researchers. Based on this increased impact of the scientists and the progress in the numbers and quality of publications, it is to be expected that the international recognition of the institute will increase, too.

While LatHort has begun to develop distinctive research niches (e.g. resistance breeding, germplasm and pathogen collections, AI-based phenotyping, novel crops such as Japanese quince and blackcurrant), its presence in high-profile international consortia and top-tier scientific debates is still limited. The institute focuses on the collection of varieties and genome sequencing. It might be useful to include metabolomics and new breeding technologies.

It is of great importance that the institute focuses on the specific strengths and the opportunities it has in collaboration with LBTU and the other institutes.

Economic impact

Score 4: very good

The Expert Group scored the economic impact '4', indicating the unquestionable role of LatHort as a very important player in the Latvian fruit and vegetable industry, with a key role in the development of the bioeconomy of Latvia. The industrial partners present during the site visit were very satisfied with the collaboration and the input they regularly receive from the institute. Interestingly, LatHort cooperates with primary producers and the processing industry. Farmers at the meeting expressed enthusiasm and gratitude for the Institute's continuous advice. LatHort's close connection to the needs and wishes of all partners of the value chain can have a very positive influence on the process. This level of connection exceeds what is seen for similar institutes in the rest of Europe.

LatHort's active role in national impact policymaking contributed to the reduction of the Value Added Tax (VAT) rate for fruits and vegetables and to a seasonal worker support programme.

The interaction with industry and producers is also supported by some EU and national projects, as well as exhibitions and conferences, which also support the development of industrial partners. In addition, LatHort generates €600k per year for itself by selling leftover fruit and vegetables.

Social impact

Score 4: very good

The Expert Group scored the social impact '4', recognising that the social impact holds significant importance for the institute. In particular, the garden area that is open to the public and requires a lot of input is a highlight. The open days organised by the institute are well attended and appreciated by the public, enhancing the social impact. The institute's involvement in the national self-sufficiency initiative is another contribution to society. The institute is not only connected to the Ministry of Agriculture but also to the Ministry of Defence. Its contribution to a logistic plan in times of crisis is of importance for a country in a situation like Latvia. The urban gardening project and the garden history project contribute to the same goal. In addition, LatHort collaborates with and supports several NGOs. LatHort is engaged in collaborations with four higher education institutions.

Notable efforts in education and outreach include the 'School Fruit' programme, the establishment and growth of cooperatives, support for irrigation system implementation, and the creation of 16 DEMO-farms.

In conclusion, LatHort demonstrates significant social impact, and the researchers' commitment to public engagement and knowledge dissemination is commendable and was also evident during the site visit.

Research environment and infrastructure

Score 3: good

The Expert Group scored the research environment and infrastructure '3', recognising LatHort has a good infrastructure and equipment, as well as adequate land for its activities. The Institute has a substantial number of technical personnel, which is essential to support its operations. Such infrastructure serves as a critical foundation for both the scientific and social impact of the Institute. All necessary facilities are in place to conduct research, and the management is structured effectively to enable applied research. This solid base ensures that LatHort can continue to fulfil its research objectives. Investment in infrastructure has been identified as an area with potential for further enhancement.

In 2019-2024 LatHort attracted significant funding from very diverse sources. While the main funds originate from Latvian governmental institutions, there are some small projects from the EU (averaging between €130k and €80k) and resources from the industry. Increasing resources in this domain could contribute to continued improvement in the institute's performance and its ability to meet future research challenges.

LatHort aligns with the Latvian Open Science Strategy 2021-2027, as its 2022-2027 strategy emphasises open-access publishing. Project budgets include standard open-access fees, and this has resulted in an increase in open-access publications, from 58% in 2019 to 79% in 2024 (with an average of approximately 71% over the reporting period).

Although the number of PhDs completed decreased from eight in the previous evaluation period to six in the current period, it was clarified during the visit that this reduction was primarily attributable to personal circumstances rather than institutional factors. The young and motivated staff create an open and inspiring atmosphere that is essential for innovation, and it should not be hindered by a large administrative burden. While the primary emphasis remains on Latvia, numerous initiatives are underway to foster international engagement. The institute facilitates international visits of varying lengths in both directions, but this still needs improvement.

LatHort's future strategic and financial resource planning, combined with its human resource development strategy, provides a strong platform for ongoing success. For example, the

institute's ability to attract and retain talented personnel is a key strength, supported by effective management and the continued development of technical staff.

Development potential

Score 3: good

The Expert Group scored the development potential of LatHort '3'. The institute's international visibility has increased in recent years, and staff members plan to continue these efforts. However, the institute currently lacks a clearly articulated vision supported by innovative scientific questions, because the research strategy seems to be mainly influenced by the needs of the collaborators (farmers, ministries and industry). A bottom-up research development strategy with hypothesis-driven research questions is missing.

Both the self-assessment and the visit highlighted that the institution is aware of its strengths and weaknesses. However, the capability for LatHort to gain international importance and scientific merits, and consequently the ability to raise funding that is awarded competitively, are linked to its ability (and willingness) to develop a structured vision. The Expert group recognises that this could lessen its currently strong national economic and societal impact. For instance, research questions arising from the local needs could not be answered if the long-term strategy identifies strategic research priorities. Formulating innovative scientific questions and anticipating emerging trends and challenges in horticultural science could help LatHort increase its competitiveness and visibility on the international stage.

On the other hand, the current collaboration among all five agricultural entities for sustainability and modern technology represents a significant opportunity for each organisation involved. Through this collaborative approach, the strengths and resources of each entity can be leveraged, fostering innovation and advancing sustainable practices within the sector. In this context, LatHort holds a particularly important role, acting as both a contributor and a facilitator within these joint initiatives, also because of the proactive and positive attitude of the staff. This demonstrates the institute's value to both the national government and industry and indicates growing international recognition that will likely enhance future collaborations. By actively participating in such partnerships, LatHort can develop its impact, support the integration of advanced technologies, and help drive progress toward shared goals in agricultural sustainability, but this could be at the expense of international visibility.

Potential to offer doctoral studies

Although LatHort does not award PhD degrees, PhD students represent more than 25% of the research staff. This is only possible in collaboration with LBTU and other universities in Latvia and other European countries. The topics of the thesis are very applied, based on the applied nature of the institute's research, but the staff claims to be open to different topics even without direct connection to LatHort projects. The staff is competent to supervise PhD students in collaboration with a university, the infrastructure is sufficient, and the atmosphere is supportive – research personnel are open and available to consult the PhD students regularly. The PhD students express their gratitude for the conditions they find at LatHort. When integrated with the foundational scientific training provided by universities, research conducted within the institute represents a significant contribution to PhD education.

Alignment with the Smart Specialisation Strategy

The Expert Group finds that LatHort's objectives and activities, which include research, knowledge transfer, and product sales, align with all three Latvian RIS3 goals: i.e., production and export structure in horticulture; future growth of existing horticultural sector in products with high added value (*Processing and Biochemistry unit);* potential to transform the national

economy through increased resilience to climate change and emerging plant pathogens of Latvian horticultural production obtained by the applied *Agronomic Research and Variety Testing activities.*

Based on the context provided, LatHort aligns most clearly with several of the investment priorities and knowledge specialisation area as follows:

- High added value products: LatHort's activities, particularly in the Processing and Biochemistry unit, directly support the development and growth of horticultural products with high added value (for instance, *they developed delicious fibre-rich snacks, plant-based probiotic drinks, convenient vegetable soups, non-alcoholic protein drinks, and breeding and registration of improved varieties)*.
- Productive innovation system: its collaborative approach with other agricultural entities and the young research staff demonstrates a commitment to fostering a productive innovation system.
- Modern education: Although LatHort does not award PhDs, its involvement in supervising PhD students, providing supportive infrastructure was evident during the visit.
- Advanced knowledge base and human capital: The presence of highly qualified staff, engagement with PhD students, and a supportive research environment indicate the ongoing development of an advanced knowledge base and the cultivation of human capital in horticultural science, an area in which Latvia has a comparative advantage.

Regarding the knowledge specialisation areas, LatHort fits best with Knowledge-intensive bio-economics, focusing on applied agronomic research, variety testing, and contributions to sustainable horticultural production.

Thus, the Expert Group agrees with the self-assessment stating that LatHort's research aligns with current RIS3 priorities, focusing on Increasing sustainability, developing new biomaterials, implementing precision and digital agriculture, creating innovative foods, and promoting efficient resource use.

Conformity with state scientific and technology development

LatHort's objectives are consistent with Latvia's agriculture and environment policy, which aims at 'increasing the competitiveness of farms, raising farm income and contributing to the achievement of environmental and climate objectives'.

Furthermore, the Latvian strategic Plan aims to 'foster the development of vibrant rural areas, promote knowledge-based entrepreneurial capacity and maintain sufficient food security'. Undoubtedly, LatHort plays a key role in the Latvian rural networks, supporting farmers through knowledge transfer.

The objectives of LatHort research are also aligned with EU policy priorities such as the Green Deal, Farm to Fork strategy, and Smart Specialisation; however, its competitiveness in international funding calls should be further enhanced.

Recommendations

The impact of the Institute on the economy and society is reported to be above average.
The Expert Group encourages LatHort staff to:

- Further increase the number of publications in highly ranked journals in the next six years, to improve its impact on and recognition in the scientific field
- Develop and implement a clearer research vision and strategy for the institute
- Develop hypothesis-driven research projects and provide a structured approach to scientific enquiry, and foster innovation. To achieve this, the Expert Group suggests:

    - Beginning with an internal assessment to identify core strengths and areas of expertise within LatHort
    - Then focus on selected research areas that align with both national and EU priorities
    - Ensuring that efforts are concentrated where the institute can have the greatest impact
- Regularly review progress and update the research vision to maintain the institute's relevance and competitiveness
- Engage stakeholders in the vision development process to ensure that the strategy is robust, inclusive, and forward-looking

At present, LatHort does not have the right to provide doctoral training. However, many PhD, master's, and bachelor's students complete their theses in collaboration with LBTU, highlighting LatHort's active involvement in student training at the doctoral level. The Expert Group trusts that a more formally recognised joint doctoral programme could further reinforce this partnership and acknowledge the role the LatHort staff is playing in the next generation career development.

The Expert Group also recommends LatHort to:

- Enhance financial support for international PhD students through LBTU and/or other universities, which will further strengthen LatHort's attractiveness.
- Implement student Exchange programmes with universities offering suitable infrastructure, accommodation, and support (like the one presented during the site visit)
- Develop strong administrative support to increase successful EU project applications
- Support EU initiatives such as COST to enhance LatHort's international profile and highlight its research strengths.

A_5 Latvian State Forest Research Institute 'Silava'

2.2.9 *The unit*

The Latvian State Forest Research Institute 'Silava' (LSFRI Silava) is a forestry and wood-technology research centre, tasked with ensuring the sustainability, innovation, and global competitiveness of Latvia's forest sector. It oversees national mandates such as the National Forest Inventory, the Forest Genetic Resource Database, and greenhouse gas accounting, making it a central evidence provider for government policy.

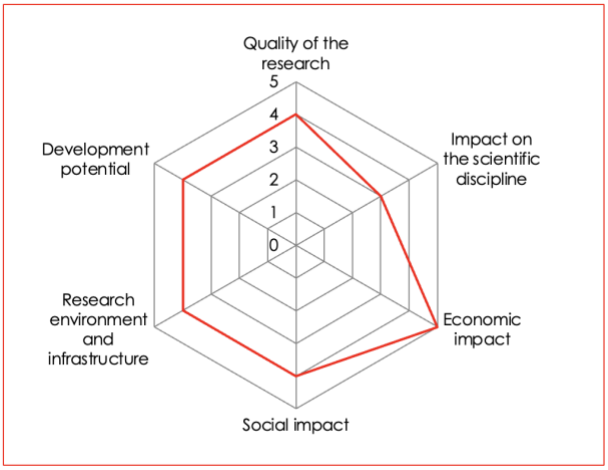
Silavas' research is structured into five main categories: forest-capital value (genetics, breeding, silviculture, forest protection); forest environment and climate change; forestry machinery and technologies; non-timber forest services (bioenergy, recreation, agroforestry); and game and fauna management. The institute's Vision 2030 is to become the Baltic Sea region's premier forestry research hub and a Northern European centre for climate-smart forestry, leveraging decades of data, strong Baltic-Nordic partnerships, and cutting-edge infrastructure.

2.2.10 *Expert Group evaluation*

The figure below presents the scores assigned by the Expert Group to the unit.

Figure 5 The 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

The research institute SILAVA is a strong international player; the Expert Group gives it a score of '4', indicating a strong and very good research institute. The quality of the research at the institute is very high, evidenced and supported by several high-impact co-authored publications and several first-authored publications in top-ranked forestry and ecology journals. Enhanced international collaboration and funding over the last few years also facilitated a large increase in publications and the delivery of high-quality research at the institute, supported by an average of about 10 citations per publication among the total 417 scientifically cited journal publications. Although several research studies (e.g. climate change and biodiversity) by SILAVA have a very good standard of originality and importance, the

relatively low funding for fundamental science research with a focus on applied forestry research renders the overall impact of the research on science moderate.

SILAVA mainly delivers applied research with practical solutions and tools for forestry industries and knowledge for government policy development. This focus has made an outstanding economic contribution and high-level social impact on Latvia. Examples include the establishment of a clonal seed orchard for increased forest plantation productivity, the development of biological agents for biocontrol of pathogens, contributions to national and EU GHG policy, and national carnivore conservation policy and practice. It has spearheaded the development of Latvia's official species conservation and management action plans. SILAVA's research not only contributed to productivity increase but also to bioeconomy priorities, reinforcing policy development and climate resilience.

SILAVA has an excellent research environment, including the implementation of new national and international goals and standards, organising a strategy for the development of early-career researchers, establishing a Scientific Council to monitor and guide publication and project development, and project management. Although SILAVA has organised interdisciplinary teams to co-design experiments with an improved research environment and infrastructure since the last evaluation, the research infrastructure still requires improvement to support cutting-edge interdisciplinary projects in omics science. The recent addition of a 40 m eddy-covariance station in a peatland forest may greatly assist GHG research.

With National mandates and increased high-quality publications, enhanced international collaboration and funding, there is great development potential for SILAVA. The research focus is RIS3-aligned and balanced for an applied forest research institute. The new joint doctoral school in forest sciences, a collaboration between SILAVA and the Latvian University of Life Sciences and Technologies, will facilitate high-level training and delivery of cutting-edge forestry sciences. It is envisioned that SILAVA would be the Baltic Sea region's top forestry research hub and a Northern-European centre for climate-smart forestry if it strengthens international cooperation, enhances basic science research on forestry, attracts international Postdocs, deepens Baltic-Nordic partnerships, invests in people and facilities, and smart use of 70 years of data into actionable innovation.

Quality of research
Score 4: very good

The Expert Group gave the quality of the research a score of '4', indicating that SILAVA is a strong international player. SILAVA continues to be a very strong international actor in forest sciences, where its research focus includes five strategic directions. Forest-capital value is the largest, encompassing breeding and genetics, silviculture, forest health, growth and carbon models, with 50% of R&D resources allocated. The second largest focus, with about 35-40 % resource allocation, is in the Forest environment & climate change, including GHG cycling, ecosystem processes, soil water interactions, and biodiversity. The remaining three directions - *Forestry machinery & technologies, Non-timber forest services and Game & fauna management* – each are resourced at a level of 4-5 % of the total budget. The five research focus areas are composed of ten subject areas that include 35 active research, development and innovation projects. The research portfolio does not cover the entire value chain of forestry and the forest industry, but nevertheless, it contributes significantly to the know-how needs of practical forestry and the forest industry.

As recommended by the previous evaluation (2019) and subsequently set as the new publishing goal by SILAVA, international peer-review publishing has clearly increased. Especially, the compound annual growth ratio of publications is more than 10%, the proportion 63 % of Q1 journals is very good (tripled during 2020-2024), and the proportion of highly cited publications (HCP10) and international collaboration rate (ICR) have increased as well.

Implementation of motivational measures, such as support for early-career researchers and attracting international researchers, will support SILAVA´s upward trend in international high-quality publishing.

The selected full-text publications show that SILAVA participates internationally in basic research underlying many complex (wicked) global problems, such as climate change, biodiversity, genetic diversity and its loss, and forecasting ecological consequences. The most important publications include good examples from the four focus areas, except for *Forestry machinery & technologies.* Despite its low budget share, the topic is very important for practical forestry and is important for industry collaboration. Research and development in forest engineering, technology and wood procurement logistics is very active and strong in the Nordic countries, hence finding a research niche is important for SILAVA. The Expert Group concludes that since the previous assessment, SILAVA has become a stronger international actor and is becoming better integrated in European research.

Impact on scientific discipline
Score 3: good

The Expert Group scored Impact on the field science '3', indicating that SILAVA is a strong national player with some international recognition. Since the previous evaluation (2019), SILAVA has systematically increased and broadened its collaboration with new and old European partners in many funding programmes, as shown in the above-average indicators in most of the bibliometric metrics. Increased international collaboration is evident in the list of the most important publications, where nearly all articles have international collaborators. However, to improve impact, the number of lead authorships in general and especially in Q1 journals should increase.

The benefits of diverse international collaboration are significant. It allows new access to diverse expertise, contributes to increased research quality and impact, provides access to new funding and resources, creates broader dissemination and global relevance, deepens and widens capacity building and skill development, creates potential for greater innovation through cultural exchange, strengthens global scientific networks and helps address global challenges.

Considering the total number of publications, bibliometric collaboration metrics indicate that the disciplinary diversity of co-authors and the disciplinary diversity of references are rather low and could be improved.

SILAVA has collaborations with three Latvian universities (Latvia University of Life Sciences and Technologies, University of Latvia, Riga Technical University) and several international universities (SLU Sweden, Tartu in Estonia, University of Turin, Linnaeus University and Cartagena in Spain). European research institutes and universities are competing for the same research funding, and today, universities are increasingly involved in innovation activities that will support their missions for societal impact. Within the research focus areas of SILAVA, there are still opportunities for collaboration in research-based innovations, e.g. with Nordic universities, particularly to increase the exchange of PhD students. Participation in editorial and reviewer boards of scientific journals is still mainly focused on national or Baltic journals, such as Baltic Forest.

SILAVA has coordinated two EU projects showing regional leadership and has had leader and member roles in several work packages. SILAVA should continue ongoing efforts to increase wider European recognition of its research expertise and capacity, especially in its research infrastructure, which can help to attract more responsible project management, especially in coordinator roles.

The institute has made very good progress in peer-reviewed publishing, built new collaborations and networks with international partners, but the Expert Group finds that further developments and achievements will be needed to reach a strong international status over the next 5-10 years, where SILAVA would possess a very good standard of quality in terms of originality and importance.

Economic impact
Score 5: outstanding

The Expert Group scored Economic impact with a score of '5', indicating that SILAVA is a highly important research and highly sought-after R&D Partner by non-academics. The economic impact of the Institute is outstanding. The research of the institution is highly important for the economy, and the institution is a highly esteemed partner in research and development projects outside the academic environment. Staff members of the institution are in high demand as experts in the private sector, and the institution is an important driver of societal development.

The economic impact of SILAVA continues to be outstanding. SILAVA's significant national contribution can be seen in the GDP, export income and employment. Research and knowledge-based innovations play a major role in enhancing the well-being of people and society. SILAVA has been very active and forthcoming in innovation ventures by transforming research results and new ideas into a wide range of solutions, products, and services for the benefit of society, the economy and the environment. The institute collaborates actively with the government and their agencies, the private sector, research institutes, academia, associations, networks, NGOs and other stakeholders to strengthen interdisciplinary research and innovation.

The collaboration with 'MNKC' in the R&D&I process from research to value-added products and services is recognised as an example of an invaluable development, a systemic innovation. The public technology-license auctions have been a success.

Since the last evaluation (2019), SILAVA's research-industry links have improved, and the Institute seems to have firm R&D contracts with Latvian companies, including a 5-year programme with LVM and a 10-year plan with SC. The partnerships are mostly established in the research focus area of forest capital value. Research-based start-ups have been founded (Peltman, Farmeko). An industry budget share of approximately 30%, alongside over €11 million in contracts (2019–2024), indicates the strong relevance of SILAVA's research to the private sector.

For the economic impact of SILAVA to continue be at this high level and be relevant to science community, practical forestry and forest industry and society, the Expert Group recommends that SILAVA should analyse its future research role for the value creation for forestry, forest industry and society, including non-economic benefits, in collaboration with all its stakeholders and formulate and update its research strategy.

Social impact
Score 4: very good

The Expert Group scored Social Impact '4,' indicating that SILAVA is a Very Important Research and Sought-after R&D Partner by Non-academics. Research of the institution is very important for society. The institution's interactions with the public sector/the public stand out in terms of their extensive and dynamic nature. SILAVA's research is highly important for society, where the Institute's economic and social impacts act jointly. The social impact is very good to excellent. The state has delegated several functions to SILAVA, and the Institute is responsible for carrying out several essential statutory services for national forestry policy and management and EU-level reporting. The Institute's research outputs continue to have strong and wide-

ranging policy influence. For example, SILAVA's contributions are pivotal in national carnivore conservation policy and practice. It has spearheaded the development of Latvia's official species conservation and management action plans. Recently, the science-policy interface has been strengthened by a Policy Advisory Unit to facilitate continual discussion with the ministries. Sector-specific policy briefs will also be launched. SILAVA continues to serve society via flagship events and is increasing the number of events involving outreach to the public, industry, school children and pupils, and many other stakeholders. The Institute has a substantial role in maintaining cultural stewardship for nature and forests in Latvia.

SILAVA has implemented several changes in higher education that will advance the education of young scientists, e.g. by hosting MSc students, doctoral researchers, and post-doctoral researchers, and improving their career development by clear incentives. Establishing a joint doctoral school between SILAVA and the Latvia University of Life Sciences and Technologies has been a significant development with positive long-term effects. The effectiveness of higher education is slow by its nature – it takes a decade to educate a professional - but education is a necessary condition for progress in R&D&I.

Many key performance indicators (KPIs) reported in the self-assessment report show firm social impact both in the long-term changes and in annual achievements, for example, increases in the number of funded commercialisation projects, new industry partnerships, and RDI funding. In conclusion, SILAVA is a very important actor in Latvian societal development.

Research environment and infrastructure
Score 4: very good

The Expert Group gave the Research environment and research infrastructure a score of '4', indicating that SILAVA is able to provide an excellent research environment comparable to that of high-level international scientists in the given discipline. Since the last evaluation (RAE 2019), SILAVA has implemented several significant changes, amendments, and alterations that have considerably improved the research environment and research infrastructure for meeting the mission goals of the ambitious vision of SILAVA. The Institute's research environment and RI are very good to outstanding.

SILAVA has maintained a very good research environment by implementing new national and international goals, organising a strategy for developing early-career researchers, establishing a Scientific Council to monitor and guide publication and project development and management, and enabling interdisciplinary teams to co-design experiments.

The research infrastructure is organised into nine functional categories, which include the elementary R&D&I requirements of six core laboratories, field infrastructures, data assets, support services and staff. Strategic material investments in labs (four scientific laboratories) and field installations have been strong and will continue to improve international collaboration. International connections and alignment with national and EU strategies are purposefully described. The ongoing process to become a member of the ICOS network (Integrated Carbon Observation System), which is a European Research Infrastructure for quantifying and understanding greenhouse gas emissions and sinks, will strengthen SILAVA's role in European climate change research.

The research infrastructure management plan, as an integral part of the overall strategy, is comprehensible in terms of its content and long-term plans and timelines. The well-acknowledged research infrastructure plan includes statements about the Institute's and national governance, quality framework, access policy of users, co-utilisation guidelines of equipment and infrastructure, training and support of technical staff, data stewardship and laboratory information management system (LIMS), which stores data properly, and, very importantly, sustainability financing for RI renewal.

The modernised research environment and infrastructure management have and will strengthen SILAVA's international collaboration capacity considerably, and it could, as planned, serve as a technology testbed in the Baltic, Nordic regions and Europe. Especially accredited laboratories and standardised methodologies of the Institute can increase collaboration with academic and industry partners. However, SILAVA should not become only a provider of functional RI but maintain relevant independent research programmes that demonstrate strong European leadership and attract collaboration.

Development potential
Score 4: very good

The Expert Group scored the Developmental potential of the institution as '4', indicating that SILAVA is a strong international player. There is further development potential for SILAVA with national mandates and increased high-quality publications, increased international collaboration and funding. Since the 2019 evaluation, the many substantial changes made in the research environment and infrastructure have improved SILAVA's capacity to function as a leading forest research institution in the Baltic region, Nordic countries and Europe. The improved capacity, that has already by now produced a multitude of new outputs, outcomes and potential impacts, is planned to be based on 1) enhancing international visibility and participation, 2) increasing research infrastructure capacity and quality, 3) strengthening industry collaboration and innovation output, 4) improving the research environment and internal governance and 5) promoting early-career development and PhD throughput. Next, effective implementation of these goals is important and will strengthen SILAVA's role as a key knowledge provider for the value chains of forestry, bioeconomy and ecosystem services chains nationally and internationally.

SILAVA's competitive funding supports mostly interdisciplinary and applied research that is aligned with national and EU policies and strategies, forestry and industry needs. The proportion of basic science is reported to be about 10 % of the total budget. This low proportion of basic research can prove to be a long-term constraint on the development of the forest discipline. Both types of research are needed for the development of SILAVA and to increase its international impact.

During 2022-2024, the Institute has managed to increase its national base funding substantially. This was one of the key recommendations of the previous evaluation (RAE2019). Base funding now amounts to about 35% of the total budget, providing better continuity and stability for the Institute. The volume of competitive projects has also risen, especially from EU funding, and amounts to about 35% of the total, leaving a considerable amount of about 30% coming from private funding and industry. The goal of generating 10% revenue from services and intellectual property contracts (IP) would clearly diversify the source of income, but may be a rather demanding goal that requires resource allocation.

SILAVA's functions already include strong international elements. An important additional element would be to establish an International Scientific Advisory Board with a mandate to support the strategic planning of SILAVA by providing an international external perspective on issues related to the leadership and management of research and researchers and development of research-based education at doctoral and master's levels.

SILAVA has made important improvements in the working conditions of its scientific staff, including a unified pay system, clear promotion criteria, and performance-based rewards. SILAVA has a clear, well-reasoned human resource development strategy as presented in 1.12 and 1.14 of the self-assessment report.

Research, development and innovation are fundamental drivers of the forestry and forest industry's continuous renewal, and SILAVA has a clear focus on diverse innovation activities as described in the self-assessment report. Successful innovations require strategic alignment to the organisation's overall strategy, leadership support and sponsorship, organisational culture that encourages creativity, experimentation, and collaboration, and lastly, focus on relevant customer benefits.

SILAVA's research focus is RIS3-aligned and balanced and proportional for an applied forest research institute. It is envisioned that SILAVA would be the Baltic Sea region's top forestry research hub and a Northern-European centre for climate-smart forestry if it strengthens international cooperation and attracts international Postdocs, deepens Baltic-Nordic partnerships, invests in people and facilities, and makes smart use of its 70 years of data to support actionable innovation. The Expert Group recommends that SILAVA, due to its strong commitment to innovations, should formalise its internal innovation approach and plan to build innovation ecosystems with industrial and other partners. Adoption of non-discipline specific measurement systems, e.g. Technology Readiness Level (TRL) and Market Readiness Level (MRL), can help to indicate progress of particular technology, product or service from basic scientific research to an actual system proven in an operational environment.

Potential to offer doctoral studies
A major change and development has been the establishment of a formal joint doctoral school in forest sciences, a collaboration between SILAVA and the Latvia University of Life Sciences and Technologies. The graduate school conforms to European higher education guidelines for incoming and outgoing exchange students.

The topics of PhD dissertations completed during 2019-2024 cover a wide field. The topics are very relevant and timely in contemporary forest sciences, and at the same time, contribute well to SILAVA's research focus areas. The Institution's supervision/co-supervision continues to be important not only for doctoral studies but also in post-doctoral stage supervision, as the graduates are potential future researchers at the Institute. Lately, the Institute has shown additional commitment to support early-career researchers by starting six postdoctoral research projects, all in different subject areas, with EU funding. The previously proposed development of an Industrial PhD scheme is still worth pursuing.

In forestry and the forest sector, there is an increasing need for interdisciplinary research that could provide science-based, broad know-how for decision-making. The aim would be to identify new interdisciplinary research ideas that will lead to new collaborative research and externally funded projects.

A few PhD students have been rewarded for the very good quality of their dissertations and articles. However, a larger proportion of doctoral graduates exceed the normative/recommended time to the degree. The expert Group assumes that the time to graduation will decrease during the coming years when the new doctoral school is brought fully up to date. However, a common and strong academic education concern is not to substitute speed for the quality of education.

The new doctoral school with a common European programme structure would have assumed interest and an increase in the number of PhD students, particularly for overseas students. Unfortunately, the number of PhD students of the last two years has somewhat decreased. A European demographic phenomenon exists in higher education where different study programmes and science fields are competing for the same students.

Alignment with the Smart Specialisation Strategy

SILAVA's strategy and its outputs, outcomes and impacts continue to be in perfect agreement with the objectives, development priorities and areas of the Smart Specialisation Strategy. The Institute contributes broadly to the national RIS3 area 'Knowledge-intensive bio-economics' that aims at providing the conditions and possibilities for creating high-added value forestry production, products and services. SILAVA is a leading organisation generating new knowledge and innovations for the forestry sector. The Institute collaborates nationally with universities and higher education institutions and increasingly more with international partners, funding agencies and industry to accomplish the strategic goals. It plays an active role in building Latvia's scientific capacity by engaging in international conferences and research networks that facilitate knowledge transfer and enhance Latvia's bioeconomy profile.

SILAVA has played a core role 'Knowledge-intensive bio-economics,' by developing advanced methods and products that drive innovation in forestry. In the review period, SILAVA ran research projects with over 20 companies, facilitated the development of 10 new spin-off products and registered and maintained 20 active patents.

In the 'Knowledge base and human capital' area, SILAVA's interdisciplinary research continues to provide relevant and up-to-date knowledge to various stakeholders. As an actor of the national innovation ecosystem, SILAVA contributes to the education of researchers and forestry professionals by collaborating with universities and co-supervising MSc and PhD students. SILAVA maintains and redevelops important research infrastructures (e.g. research sites, labs, long-term data archive). SILAVA has continued to organise various and comprehensible extension activities for stakeholders, students and wider parts of the society.

In the 'Production of higher value-added products and services' area, SILAVA has developed biocontrol methods and agents, applied forestry technology and services, and wood products with the industry. In the 'Innovations in forestry' area, SILAVA contributes significantly to the digital transformation of forestry.

Conformity with state scientific and technology development

SILAVA is the primary institute developing state science and technology in forestry and associated education, aligned with the 'Sustainable bioeconomy'. It implements four state-delegated functions, supplying the datasets that ministries use for climate-neutrality scenarios, biodiversity targets and seed-quality control.

SILAVA delivered R&D to Latvian companies, directly in commercial practice and thus fulfilled the objective of the State scientific and technological development.

During 2019–2024, SILAVA delivered R&D output, including tree breeding, mechanised planting, and compact harvesters to Latvian companies worth more than € 12 million, which fulfils RIS3's 'knowledge into growth' requirement. Joint 5-year programmes with the state forest company (LVM) were aligned with the national science and technology policy to increase the economic well-being of Latvian society.

Although only universities can confer doctoral degrees, SILAVA is the core platform for forest science PhD training. A joint doctoral school with Latvia University of Life Sciences & Technologies (LBTU) has been created; this has fulfilled the objective of forestry education. SILAVA has advanced every pillar of Latvia's science, technology and education strategies related to forestry.

Recommendations

- SILAVA's research focus areas have remained practically the same since the evaluation in 2019. Since the focus and subject areas are rather wide, it provides SILAVA flexibility, for example, when new funding or a partnership becomes available. However, based on the documentation, it seems that the focus areas have practically been the same for over ten years, which would give reasons to review and update the focus areas. There are clear megatrends and drivers of change in the European and global operating environment of the national forest-based sector. These should be analysed to explore how societal needs are changing. The technological drivers of change can then provide a basis for developing scenarios and a new research strategy
- Recognise, encourage and stimulate bottom-up initiatives and increase cutting-edge research, such as genomic-based breeding and precision forestry
- Strengthen and diversify interdisciplinary research to expand SILAVA's and the country's capacity in forest research and development. Use financial incentives (e.g. seed money, allocation of internal PhD resources, etc.) to promote collaboration among disciplines internally, nationally and in a European setting
- Encourage the participation of researchers in editorial and reviewer boards of internationally respected peer-reviewed journals
- Pursue curiosity- and problem-driven research and lead authorships, especially in Q1 journals
- Continue its efforts to increase wider European recognition of SILAVA's research expertise and capacity by exchanging PhD students and researchers with leading European research organisations
- To continue its outstanding economic impact, SILAVA should analyse its future research role in the value creation for forestry, forest industry and society, including non-economic benefits, in collaboration with all its stakeholders and formulate and update its research strategy
- Organise an annual forestry open day to show the Institute's research and extension programme to the public
- Utilise science writers for high-feature European funding calls
- Jointly organise monthly or weekly seminars with universities to communicate and update students and researchers on outcomes and new developments.
- Further improve research infrastructure for cutting-edge research in precision forestry and '-omics' (genomics, proteomics, lipidomics, etc.) research
- Since research plays a major role in knowledge-based innovations, SILAVA, due to its strong commitment to innovations, could formalise and strengthen its internal innovation approach, and plan to build innovation ecosystems with industrial and other partners
- Attract international researchers, doctoral students, post-docs, and senior scientists by establishing a joint research centre with a leading European research institute or setting a pilot programme to fund international researchers or post-docs
- Establish an International Scientific Advisory Board
- Try out a proof-of-concept call for diversifying and increasing the interdisciplinarity, the internal funding call for young researcher grants, could be opened as a proof-of-concept call to find new collaborative research projects among researchers from two to three different disciplines
- Consider establishing a joint Extension service in the forest and forest industry sector with universities and other institutes
- Analyse and find ways to stabilise or increase the enrolment of PhD students

- Increase further collaboration with Baltic, Nordic and European doctoral programmes
- The complexity of regulations and compliance requirements hinders scientific activity, undermines research efficiency, and reduces competitiveness

3 Summary of findings across the set of unit evaluations

The general level of quality of research

Across the evaluated institutions - Latvia University of Life Sciences and Technologies (LBTU), Institute of Agricultural Resources and Economics (AREI), Institute of Food Safety, Animal Health and Environment (BIOR), Institute of Horticulture (LatHort), and Latvian State Forest Research Institute 'Silava' — the overall quality of research is **good at the national level but uneven and only partly competitive internationally**.

The institutions form the backbone of Latvia's agricultural, forestry, and veterinary science system. Collectively, they demonstrate a **solid capacity for applied and practice-oriented research**, responding to national needs in food security, animal and plant health, forestry, and bioeconomy. Several institutes, notably BIOR and Silava, approach **international standards in selected subfields**, while others, such as LBTU and AREI, remain primarily **nationally oriented** with modest international visibility.

BIOR stands out with higher scores (4–5) for its advanced laboratory infrastructure, analytical excellence, and social relevance. Silava similarly performs strongly in forestry-related applied sciences. LBTU, LatHort, and AREI demonstrate clear progress since the previous evaluation period, particularly in publication output and collaboration; however, they remain constrained by an insufficient focus on hypothesis-driven basic research and a scarcity of highly cited international papers.

Overall, the Latvian agricultural science sector is in a **phase of gradual internationalisation**. Most institutions have established robust infrastructures and partnerships, but **research excellence and originality still lag behind leading European counterparts**.

Key strengths

- **Strong national relevance and applied orientation**
  All five institutions deliver tangible benefits for the Latvian economy, agriculture, forestry, and food safety. Their applied research effectively supports policymakers, farmers, and industry, reflecting clear alignment with national priorities and RIS3 specialisation areas (bioeconomy, sustainability, biomedicine)
- **Solid infrastructure and research environment**
  BIOR and Silava maintain state-of-the-art laboratories and analytical facilities. AREI and LatHort possess extensive experimental fields, greenhouses, and processing units that enable full-chain research from breeding to product development. LBTU benefits from improved ICT infrastructure and research equipment across agriculture, veterinary, and forestry
- **Active collaboration with industry and ministries**
  The evaluated units maintain strong working relationships with governmental bodies and industrial partners, ensuring the transfer of knowledge, adoption of technologies, and feedback from end-users. This collaboration has notable societal and economic impact, such as, for example, veterinary innovations from LBTU and BIOR
- **Contribution to education and capacity building**
  The institutions play a vital role in educating the next generation of agricultural and veterinary scientists.

Main weaknesses

- **Limited international visibility and scientific excellence**
  Few institutions have established themselves as international leaders or coordinators of high-profile EU projects. The volume of publications in Q1 journals remains low in most cases, and highly cited papers are rare.
- **Insufficient hypothesis-driven and fundamental research**
  Basic, curiosity-driven research - essential for innovation and academic impact - is weak or in some units absent
- **Dependence on national funding and a limited competitive EU grants**
  Reliance on state-assigned or service-based income restricts flexibility and innovation. Horizon Europe participation is low, and external industrial funding remains modest in most institutions
- **Ageing staff and weak recruitment of early-career researchers**
  The share of postdoctoral and early-career scientists is insufficient to ensure renewal. Mobility schemes and international recruitment remain limited due to administrative and financial constraints

Conclusions

In the **international context**, the Latvian agricultural, forestry and veterinary science institutions operate at a **solid regional level**, with a few internationally competitive niches. Compared with strong European institutions (e.g., SLU, Wageningen University, or the Finnish Natural Resources Institute), Latvian institutions still lag in research intensity, publication impact, and talent attraction.

However, the **trajectory is positive**:

- Research outputs are growing both in volume and quality
- International collaboration is expanding
- Modernisation of infrastructure and PhD funding mechanisms has created favourable conditions for future progress

The system's comparative advantage lies in its **integration with national priorities**, its ability to conduct **applied research of societal relevance**, and its **alignment with EU sustainability goals**. The challenge is to **complement this applied excellence with high-impact scientific contributions**, enabling Latvian institutions to participate as equal partners and leaders in European consortia.

If current momentum continues, coupled with targeted policy measures and institutional reforms, the sector can evolve into a **recognised contributor to the European Research Area in bioeconomy and 'One Health' fields within the next decade**.

Recommendations

- **Define clear institutional niches and centres of excellence.**
  Each institute should articulate its unique scientific strengths and focus resources accordingly (e.g., BIOR in 'One Health' and analytical sciences, Silava in forest ecosystems, LatHort in horticultural genetics, LBTU in veterinary and sustainability research, AREI in agroeconomics and plant breeding)
- **Strengthen hypothesis-driven and basic research**
  Introduce targeted national programmes to support curiosity-driven research and cross-institutional PhD/postdoc projects with international mentors

- **Develop joint doctoral schools and shared infrastructures**
  Create inter-institutional doctoral programmes across the five institutes, pooling supervision capacity and equipment, and aligning with European standards for research training

Appendix A Feedback on Expert Group assessment

Two units, the Institute of Agricultural Resources and Economics and SILAVA, requested to publish its feedback on the Expert Group report alongside the report's publication. The feedback is presented in the following sections.

Feedback from the unit 'Institute of Agricultural Resources and Economics'

Riga

10.10.2025. No.1.2-11/N300A

Technopolis Group Baltic

The Institute of Agricultural Resources and Economics (AREI) expresses its sincere appreciation to the Expert Panel of the Technopolis Group for their thorough work in evaluating the self-assessment report and engaging with AREI's researchers and partners. We are grateful for the comprehensive assessment and valuable recommendations that will guide the Institute's future development.

Following the results of the previous international evaluation (2013-2018), AREI took advantage of the review period to build upon the observations and challenges identified by the group of experts. Significant reforms in the governance and strategy of the Institute were thus undertaken, and we were pleased to note, through the results of the evaluation covering the period 2019-2024, that only a small number of the previous remarks were reiterated. Naturally, new recommendations emerged from this most recent evaluation. They will serve as a foundation for defining and implementing new strategic directions for the development of AREI. We wish to express our sincere gratitude for the relevance of the analyses and the value of the constructive remarks provided by the experts. We would, however, like to take the liberty of commenting on some of them, in order to complement and enrich the reasoning presented in the evaluation report.

Regarding the 'Impact on Scientific Discipline' pillar, AREI has shaped its improvement strategy in direct response to the points raised in the previous evaluation. At that time, the experts highlighted the Institute's limited role in advancing knowledge through collaborations, the fragility of its funding structure due to a high reliance on EU structural funds, as well as the modest international impact resulting from a limited number of high-impact publications and the lack of organisation of international conferences.

During the 2019–2024 period, AREI placed particular emphasis on diversifying its funding sources, thereby reducing its reliance on EU structural funds as previously recommended. The Institute has succeeded in tripling its share of state budget funding for competitive research programmes, while also increasing funding from other international sources and from private stakeholders. This demonstrates improved competitiveness over the evaluation period.

AREI has also focused on strengthening its international visibility through the organisation of high-level international conferences. As noted in the report, the Institute has participated in and hosted among the largest international events in agricultural science happening in Latvia such as:

- EUCARPIA low input and organic section conference, 175 participants from 30 countries (2021);
- International Barley Genetics Symposium (IBGS), 185 participants from 27 countries (2022, on-site), where AREI scientists served as the main organizers of both the scientific program and the event logistics, and also participated as speakers. IBGS is a

major global scientific event, held every four years since 1963, bringing together leading scientists to share the latest research and advances in barley genetics and breeding.

- IFCN Dairy Research Conference, 35 countries and 150 participants (2023, on-site). AREI, as partner of the global IFCN network for research and consultancy in the dairy supply chain, served as the organizer of conference and provide as well dairy economic data, insights, and innovation.

These achievements illustrate AREI's commitment to gaining stronger international momentum and improvement over the last period of evaluation.

Nonetheless, it must be acknowledged that the COVID-19 pandemic and the war in Ukraine had a significant impact on the Institute's activities and financial resources, inevitably slowing the pace of progress, particularly with respect to increasing the number of internationally recognised, high-impact publications. While these figures may not yet fully reflect our strategic shift toward prioritising quality over quantity, nor the marked increase in the number of collaborating institutions in our publications (now reaching 116), we concur with the Evaluation Panel's observation regarding the still modest HCP10 index and relatively low International Collaboration Rate (ICR). However, we question the rationale for assigning this pillar a score of 2, given that it was previously rated as 3 and the evaluation methodology appears to have remained consistent.

Similarly, the score awarded for the 'Economic Impact' pillar raises important questions in view of AREI's substantial progress in contributing to the Latvian agricultural economy since 2019, both in measurable outputs and in strategic alignment with future policy directions. As noted during discussions with experts, AREI's economic expertise is deeply embedded in multidisciplinary research, which explains why economic papers account for only about 1.2% of AREI's publications. This relatively low share reflects the fact that economic analyses are integrated within agricultural, agrotechnological, and social science research themes, often through cost–benefit analyses, making them less directly visible in databases such as Scopus or Web of Science.

This commitment is already evident in our research themes, which are designed to cover 52% of the production types in the Latvian agricultural sector. This alignment makes our work highly relevant to national agricultural priorities that together account for over half of Latvia's agricultural output, including cereals, legumes, rapeseed, and potatoes (Figure 1). Our developed crop varieties are cultivated on approximately 20% of Latvia's arable land, clearly demonstrating AREI's significant contribution to national agricultural productivity and food security.

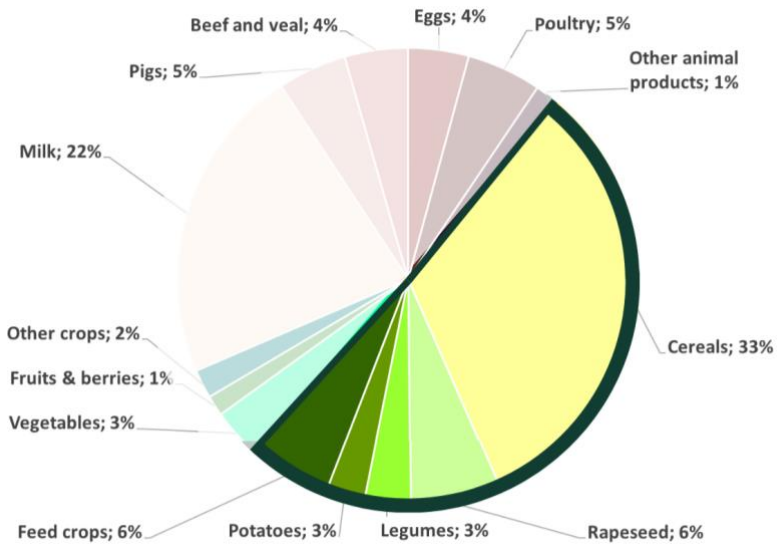


Figure 6: AREI's research contribution to the Latvian agricultural sector

AREI is the only institution in Latvia engaged in breeding plant varieties specifically adapted to organic farming, a sector of major importance, as Latvia ranks among the European countries with the highest share of utilised agricultural area under organic production. This work is of strategic significance, given that in future under the EU Organic Action Plan, all crops grown within certified organic systems must originate from certified organic seed. In addition, AREI has taken a leadership role in the rapidly expanding field of plant-based protein crops. In recent years, Latvia has seen a sharp rise in the cultivation of peas and field beans, supported by investments from companies such as ASNS Ingredient (pea protein processing) and Aloja Starkelsen. AREI is actively involved in breeding new high-protein pea varieties and conducting agrotechnological trials for both conventional and organic farming systems.

AREI has also successfully carried out applied, market-oriented research in partnership with major industry stakeholders as for the project *'Progressive agricultural system as the basis for environmentally friendly and efficient crop production in Latvia'* in which AREI provided an evaluation at the national scale. We would like to highlight key collaborations with nationally and regionally important partners, including: Dobeles Dzirnavnieks JSC, Latvia's largest grain processor and exporter (focus on durum wheat and oat varieties); Aloja Starkelsen, producers of plant-based protein ingredients and starch; Bioefekts Ltd., biotechnological inputs for agriculture; and the VAKS cooperative, which represents more than 400 farmer members.

Finally, AREI's importance in the national economy is highlighted by its production of high-category seed material, which plays a vital role in ensuring national food sovereignty. By maintaining domestic capacity to produce certified seed of locally adapted varieties, we reduce reliance on imports, protect against supply chain disruptions, and strengthen the resilience of Latvia's agricultural system, particularly in the face of climate change, geopolitical instability, and biosecurity risks. However, the royalty system, which is intended to reward AREI for developing new crop varieties essential to the success of national agriculture, is outdated and limits the institute's ability to gain proper recognition for its intellectual property. This issue is also directly related to the low level of private funding highlighted by the experts, as such funding largely originates from the royalty mechanism. Yet, because the system of variety royalties in Latvia remains unregulated, AREI currently receives only a fraction of the funding it should be entitled to for its crop varieties cultivated on farms. Despite this, the share of contract work and royalty income in AREI's total budget remains comparatively high among

Latvian scientific institutions, reflecting both the institute's strong applied orientation and the economic value of its research outputs.

Hence, with regard to the assessment of the 'Economic Importance' pillar, the 2025 evaluation reiterates several strengths already recognised in 2021, particularly AREI's role in plant breeding and applied research, yet assigns a lower score despite demonstrable progress. The reduction from score 4 to 3 raises concerns, as it appears inconsistent with the Institute's growing national influence and expanding economic impact.

Except for the points raised above, AREI concurs with the overall evaluation results provided by the Expert Panel regarding the Institute's scientific activities and acknowledges the recommendations as valuable contributions to the ongoing improvement of our strategy. We kindly request that the considerations mentioned above be taken into account and respectfully submit these observations for your consideration, trusting that our comments will be duly acknowledged.

Director I.Stabulniece

**THE DOCUMENT IS SIGNED WITH A SECURE ELECTRONIC SIGNATURE AND CONTAINS A TIME STAMP*

Feedback from the unit SILAVA

The Latvian State Forest Research Institute ‘‘Silava’’ (SILAVA) has reviewed the evaluation report prepared by the expert panel. We would like to inform you that the scientific staff of SILAVA are fully satisfied with the consolidated assessment. We thank the experts for their thorough work, high-quality discussions and objective report. We are especially grateful for the recommendations provided by the panel, we respect them as an external perspective and will continue to work on implementing them.

We are particularly pleased that the expert panel has appreciated SILAVA's work in the international scientific scale. In accordance with the founder's vision and mandate, SILAVA is an institution of the Latvian forest sector, supporting its expertise with scientific information in this complex era of green deals and climate change. However, the international dimension is also very interesting and important for our scientists, and the institute as a whole devotes and will devote significant financial, personnel and infrastructure resources to it.

However, without prejudice to the overall assessment and recommendations of SILAVA, we would like to comment on the assessment in the criterion *"Impact on the scientific discipline"*. In the previous assessment, prepared by TECHNOPOLIS, SILAVA in this criterion received the lowest score. SILAVA carefully studied the recommendations and tried to promote the improvement of the work. During the evaluation period, we have noted the following improvements:

- SILAVA has become the lead partner of two international consortia (https://www.silava.lv/petnieciba/petijumi/life-orgbalt un https://www.silava.lv/petnieciba/petijumi/life-is-salaca), in addition to conventional forest science, successfully developing competence and significant international visibility in new scientific directions (riparian forestry, climate smart forestry, peatland carbon storage);
- SILAVA has been invited as a cooperation partner in consortia, scientists have been entrusted with the management of international events and sessions (IUFRO congress field trip https://iufro2024.com/excursions/pre-and-post-congress-excursions/the-baltic-countries-green-jewels-of-europe/, SILAVAS employees have been invited to lead 2 scientific sessions 11th ESP World Conference ‘’From global to local ecosystem services: pathways to Nature-based Solutions’’ Darwin, Australia, 2025 https://www.silava.lv/en/news/lsfri-silava-participates-in-the-international-ecosystem-services-conference-in-australia; SILAVA has been entrusted with the organization of 2 international conferences, which took place in 2025 (https://www.silava.lv/en/events/12th-baltic-theriological-conference-latvia and https://www.eurodendro2025.lv/).
- SILAVA has invested and mobilized resources in the creation of significant publications, the total number of publications in Q1 issues 2020-2024 155 publications, of which more than half or 92 publications were lead authors from SILAVA; for comparison - in 2015-2019 Q1 journals there were only 9 SILAVA original publications in total https://www.webofscience.com/wos/woscc/smart-search). Our previous work is in line with the panel's 2025 recommendation – *‘’however, to improve impact, the number of lead authorships in general and especially in Q1 journals should increase’’.*

- In addition, SILAVA confirms full access and support for international postdoctoral studies and the exchange of PhD students, as soon as the state creates public funding mechanisms for them or does not limit the use of existing mechanisms. We emphasize that SILAVA doctoral students also study in doctoral programs in other countries, for example, a dissertation was defended at the University of Tartu in 2025 (https://www.silava.lv/en/news/phd-thesis-by-pauls-zeltins-on-modeling-the-growth-of-pine-spruce-and-birch-using-genetically-improved-planting-material). SILAVA emphasizes that during the reporting period, SILAVA's researcher has been elected as the editor-in-chief of the leading forestry journal (indexed in WoS and SCOPUS) in the Baltic region (https://balticforestry.lammc.lt/bf/index.php?option=com_content&view=article&id=8&Itemid=108).
- In the field of soil research, SILAVA is a member of the GLOSOLAN and EUROSOLAN soil laboratory networks, our employee serves on the EUROSOLAN steering committee and is one of the coordinators of the research group developing FTIR (Fourier Transform Infrared Spectroscopy) methods for soil analysis. This ensures direct involvement in the harmonization of international methodology, strengthening SILAVA's scientific influence and cooperation with the world's leading soil research centers (more about GLOSOLAN and EUROSOLAN here https://www.fao.org/global-soil-partnership/glosolan/en/ and https://www.fao.org/global-soil-partnership/glosolan-old/regional-soil-laboratory-networks/eurosolan/en/).

SILAVA would certainly be grateful if the panel could review the assessment of this criterion and consider the possibility revising the assessment to reflect the improved indicators in line with our efforts and contributions. This would also motivate SILAVA scientists to continue their growth, considering the much more precisely formulated recommendations of this assessment. Our call, of course, does not affect the overall assessment, which is adequate, understandable and relevant. If this is not possible to do for procedural reasons, **SILAVA supports and coordinates the report.**

Sincerely,

LSFRI Silava