**THE TERMS OF REFERENCE FOR MINISTRY OF REGIONAL DEVELOPMENT AND AGRICULTURE R&D PROJECT**

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| **Research topic** |
| **Novel local breed varieties for intelligent food security** |
| **Problems that need to be solved** |
| Food security is paramount: safe and healthy food must be available. To ensure sustainable food security in Estonia, it is imperative to implement modern, flexible, and sustainable plant breeding practices that align with the green transition in food production and agriculture. This necessitates close attention to the latest advances in the field and the adoption of flexible and adaptable approaches tailored to meet the unique needs of the local environment. By doing so, Estonia can establish a robust food supply infrastructure that is responsive to the needs of its citizens and supports the country's long-term economic and social development goals. The Green Report identifies the following challenges to food security:   * Food security: primary agricultural production is overly dependent on imported raw materials. Estonia must reduce its dependence on imported inputs such as animal feed, mineral fertilisers, plant protection products, and energy. In the current situation, the supply of imported seeds is also not guaranteed - Estonian farmers have no say in which varieties are on the market and for how long. * The expectations of consumers and the manufacturing industry do not match the structure of primary agricultural production. In Estonia, 22% of agricultural land is used for organic production, but local organic production is still modest and often insufficient for the food industry. It is, therefore, necessary to breed varieties in Estonia that are durable in the local climate and suitable for both organic and conventional production. * The growth of the agricultural sector is too focused on raw material exports. Estonia exports more unprocessed agricultural products than the EU average (half of cereals and a third of raw milk) and imports more end-consumer products than the EU average. These problems are particularly acute in the cereals sector, where the Green Transition Roadmap shows insufficient valorisation of local raw materials, high dependence on imports of mineral fertilisers and plant protection products, and limited choice of these products. Therefore, for the sake of national production profitability and economic viability, we need to breed varieties with suitable characteristics for processors. Estonia lacks genomic selection, a valuable tool used in Nordic variety breeding that allows efficient selection of varieties for breeding based on genomic analysis. At present, plant breeding in Estonia is based on classical methods. Classical plant breeding mainly uses random mutation, crossing, and selection and is a time-consuming and expensive process (~15-20 years to create a variety). In the last decade, new methods have been developed for precision breeding: targeted changes at the desired location in the plant genome. These techniques, known as new breeding techniques (precision breeding), allow a new variety to be created in 4-8 years and are more precise, controllable, and cost-effective than classical methods. In several countries (e.g. Argentina, China, Canada, USA, UK, Japan, etc.), new precision breeding techniques are used in parallel with classical plant breeding, and the European Union is also moving in this direction to make the legislation more conducive to the use of new breeding techniques in plant breeding. |
| **Objective** |
| The project aims to generate and apply the know-how for modern, flexible, sustainable precision plant breeding in Estonia to ensure food security.  The sub-objectives of the project are:  **Creation of novel breeding knowledge by applying modern precision breeding methods**, e.g., genomic selection and precision breeding techniques, in crop breeding, prioritising breeding is essential for food security and public health (for example, wheat, barley, potato, fruit and berry crops). Focus on mapping gene-trait relationships in these species to identify genes affecting disease resistance and stress tolerance. Use genome-wide studies, high-throughput sequencing, trait analysis in the laboratory and the field, and digital solutions such as remote sensing (drone and satellite imagery of fields) and artificial intelligence (image and gene data analysis) to generate breeding information.  **Creation and development of a breeding toolbox.** The toolbox will comprise breeding methods and platforms for genomic selection, precision breeding techniques, prioritising breeding for resistance to plant diseases and climate resilience.  **Genomic selection models will be introduced**, following the example of the Nordic countries. Capacity for precision breeding will be developed and provision will be made for the application of new breeding techniques. Also, necessary infrastructure and tools will be developed and adapted for the precision breeding toolbox. |
| **Research questions** |
| **How can local plant breeding be made faster, more sustainable, accurate, and cost-effective by applying basic scientific information, technological competence,** and **precision breeding techniques**?  **How to more efficiently breed new crop varieties suited to the modern farmer and to local conditions and changing climatic conditions**, whose local upgrading into healthier products is also of interest to the food industry and can also be applied in the biotechnology sector (e.g. synthetic biology, materials science, pharmaceuticals, biomedicine, bio-medicine);  How can the availability and supply chain of starting seeds be improved?  Under these sub-themes, the applicant may propose more specific research questions to contribute to the abovementioned objectives. |
| **Technical requirements** |
| The call for applications is hosted in ETIS.  The call will remain open until **May 27 2024 at 17.00**. **Applications must be submitted in English**.  **A consortium of at least two R&D institutions is invited to participate in the call**. **At least one partner must be a positively evaluated Estonian R&D institution.** By accepting the application, the institution agrees to the submission of the application and to fulfil the obligations of the institution.  The **project leader may be a person holding a doctoral degree or equivalent qualification** who is employed full-time by the institution and based in Estonia at the time of the project. In exceptional cases, on application, a project leader working less than full-time in the institution may be considered eligible, provided that this does not jeopardise the successful implementation of the project.  **Requirements for applicants**  The applicant must set up a research team led by a project leader with the following minimum competencies and experience:  1. **The lead partner of the research project** must be a positively evaluated national, public or private research and development institution  2. **The leader of the research project** may be an individual:  ○ who holds a doctoral degree or equivalent qualification;  ○ who is employed full-time during the period of the research project in the applicant institution and based in Estonia;  ○ who has previous experience within the last 5 years or is in the process of carrying out a research project as a principal investigator;  ○ who has experience in leading a working group.  3. Additionally, **the senior research staff** must participate in the execution of the research project with the following competencies and experience:  ○ who holds a doctoral degree or equivalent qualification;  ○ who are employed by the applicant institution or partner institution during the period of execution of the research project;  ○ whose salary is covered in whole or in part by the research project funds.  ○ **Plant breeding competencies** must be included as critical performers in the research project:  i. a doctoral degree in plant breeding or agronomy or equivalent qualification;  ii. a degree or equivalent in agronomy or agronomy, or an equivalent qualification in agronomy or agronomy; or at least 5 years of professional experience in plant breeding.  ○ **Genetic engineering competencies** must be included in the research project:  i. PhD in genetic engineering or molecular biology or equivalent qualification;  ii. expertise in breeding techniques within the last 5 years (research projects, publications).  iii. expertise in plant genetics within the last 5 years (research projects, publications).  4. **The following infrastructure needs must be covered** either by access or subcontracting:  ○ Facilities for conducting field trials.  ○ Facilities for carrying out experiments in the greenhouse and growth chambers.  ○ Facilities for using the infrastructure necessary to operate plant tissue culture facilities.  ○ Molecular biology laboratory capabilities  The applicant shall provide competencies, experience and role descriptions of the research team members. The CVs of the members of the research team or a link to the CV in ETIS shall be attached to the application.  **If subcontractors are involved in the project, a justification must be provided**, including information on the subcontractor(s)' competence(ies).  The project **total budget of EUR 1 980 000 (VAT included) and the end date is 31.12.2027.**  Payments will be made as follows:  1. 100% of the first year's budget after the signing of the contract;  2. 100% of the second year's budget after approval of the first-year report and second year's budget and action plan;  3. 100% of the budget for the third year, after approval the second-year report and third year's budget and action plan;  4. 100% of the budget for the fourth year after approval of the third-year report and fourth year's budget and action plan;  **The timetable should preferably be presented as a Gantt chart** (Annex 3 Gantt chart sample); work can be divided into phases if necessary.  **Include a description of project management and cooperation.**  To monitor the project's implementation, the ETAG will establish a project management committee composed of representatives of the contracting authority, ETAG, and the executing agency (Annex 2 Rules of Procedure for the Project Management Committee sample (in Estonian - Lisa 2 Projekti juhtkomisjoni töökorra näidis)). The committee will monitor the execution of the project and approve the (interim) project reports.  An interim report is submitted annually with a description of the content activities and a financial report in Excel format. The interim report and the budget implementation are used to decide on the continuation of the budget and the project for the following year. At the end of the project, a final report must be submitted.  **The results of the project must be presented in the following reports** (Annex 5 Templates for the interim and final report (in Estonian - Lisa 5 Vahe- ja lõpparuande vormistamise juhend)**:**  **1. Interim report (15.12.2024 at the latest).**  ○ The interim report shall present the research results for the two research and development tasks by the timeline and action plan in the application.  ○ It will also provide an overview of the work carried out, a description of the methodologies used, and a specified project design for the subsequent phases.  ○ The project management committee must approve the interim report. If necessary, the project's focus will be adjusted after approval of the interim report.  **2.** **Interim report (15.12.2025 at the latest).**  **3. Interim report (15.12.2026 at the latest)**  **4.** **The final report (31.12.2027 at the latest)** comprehensively combines all research and development tasks and activities, results, developed methodologies and instructional materials covering research questions and activity-based financial report. |
| **Expected result/outputs** |
| The expected results of the project are:   * + **Innovative and high-quality know-how in precision breeding**, resulting in a more competitive, sustainable, accurate and cost-effective plant breeding in Estonia. By introducing modern methods and applying scientific knowledge, know-how will be acquired to create the varieties needed to meet the objectives of the Green Agreement. The know-how will be formalised in guidance materials that other researchers can use.   + **A rapid and cost-effective modern toolbox for precision breeding,** the implementation of which will result in climate- and disease-resistant breeding material for both organic and conventional production. A publicly available toolbox of methodologies and breeding information will contribute to more effective cross-sectoral knowledge transfer and the capacity to carry out specific product development in collaboration with the food sector, e.g. gluten-free products, plant-based meat substitutes, and healthier raw materials for the food industry. The toolbox is formatted as guidance material for public use. Breeding material bred during the project will be documented and available for use by other researchers. The breeding material can be at TRL levels TVT5- TVT9.   The results should be formalised in the reports above. |

**The annexes to the reference document are:**

1. Annex 1 Evaluation Guidelines and Criteria (in English)
2. Annex 2 Rules of Procedure for the Project Management Committee sample (in Estonian - Lisa 2 Projekti juhtkomisjoni töökorra näidis)
3. Annex 3 Gantt chart sample (in English)
4. Annex 4 Sample template of the financial report and activity report (in English)
5. Annex 5 Templates for the interim and final report (in Estonian - Lisa 5 Vahe- ja lõpparuande vormistamise juhend)
6. Annex 6 Sample contract (in Estonian - Lisa 6 Lepingu näidis)