Microbiome analysis in Lithuania: overview of the global and Lithuanian ecosystem, strengths, weaknesses, and recommendations

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2025 02 28

Recommendations

Based on the analysis of global and Lithuanian microbiome research and product development trends, **we recommend the following steps to strengthen and expand Lithuania's contributions to this growing field:**

International Collaboration and Talent Attraction:

1. **Address Brain Drain:** The Lithuanian government and its institutions should offer competitive salaries and career opportunities to attract and retain international specialists. Additionally, clear career pathways should be established, ensuring long-term professional development opportunities.

2. **Attract Pharmaceutical Companies to Lithuania:** Government institutions should actively promote Lithuania as a strategic hub for world-renowned pharmaceutical companies. This would address challenges in high DNA sequencing costs, initiation of clinical trials, and the shortage of investments and infrastructure for broader R&D expansion, all of which stem from the limited presence of these companies.

Public Engagement and Awareness:

1. **Launch Public Awareness Campaigns:** To address the lack of awareness about the importance of the microbiome sector, nationwide initiatives should be launched to educate the public on its significance for health and well-being. This can be accomplished by partnering with influencers, healthcare professionals, and businesses to organize events, webinars, and workshops.

2. **Promote Healthy Food Catering Initiatives in Schools and Daycares:** Given the importance of food and diet to the microbiome, healthy eating habits should be promoted by providing organic, microbiome-friendly food in educational institutions to support better health outcomes from an early age.

National Strategy and Policy Framework:

1. **Revise National Strategies:** Revise key documents, like the *Smart Specialization Strategy (S3)* and the *Life Sciences Roadmap*, to highlight microbiome research and align with global trends, fostering growth and competitiveness.

2. **Provide Suitable Public Procurement Policies for Scientific Research:** Current public procurement policies are not conducive to supporting clinical trials and scientific research. These policies should be updated to better support scientific advancement.

3. **Promote Long-Term Projects:** Extend the duration of current projects by prioritizing long-term grants for microbiome research, particularly for high-risk, high-reward projects with breakthrough potential. Short-term projects often fail to allow full exploration of a topic, whereas a long-term focus on specific research areas will better support progress toward commercialization. Additionally, since microbiome changes can take months or even years to influence health outcomes, lengthening project timelines is essential for obtaining meaningful scientific results.

4. **Encourage Initiatives for Translating Research Into Product:** Few companies invest in research-backed, scientifically tested products. Continuing initiatives that support companies in bringing clinically tested products to market would significantly enhance innovation and the ability to commercialize R&D results.

5. **Initiate Microbiome Product Regulations:** Advocate for and establish improved regulatory pathways for food supplements and microbiome-based therapies and drugs, starting at the EU level and then extending to national regulations.

6. **Encourage Infrastructure Efficient Usage and Development:** There are currently few incentives to modernize or upgrade research infrastructure in Lithuania. However, significant opportunities remain to better utilize existing facilities, which could enhance efficiency, strengthen collaboration within the research ecosystem, and improve the translation of academic research into market-ready products.

Research and Innovation Development

1. **Develop Unique Signature Products:** Lithuania can position itself as a global leader in the microbiome sector by creating innovative products in specialized fields, leveraging its expertise in *CRISPR, microfluidics,* and *tissue engineering.* These advancements can gain international recognition, strengthening Lithuania's competitive edge.

2. **Include the Microbiome Field in Current Funding Calls**: Although microbiome research is currently covered under the broader category of life sciences, explicitly mentioning it in funding calls and programs would help address existing financing gaps. This adjustment would sustain ongoing projects and attract new researchers by providing targeted financial resources.

3. **Encourage Postgraduate Exchange Program Initiatives:** Encourage postgraduate exchange programs that promote international student exchanges, research partnerships, and collaboration, strengthening global ties and fostering expertise among Lithuania's future researchers.

4. **Develop Specialized Training Programs:** Develop targeted programs in universities to address the shortage of skilled professionals, such as investing in bioinformatics, biostatistics, and microbial science programs. The creation of the new bioinformatics program can serve as a model. This new program equips students with essential skills for emerging research in microbiome research and personalized medicine. Additionally, establishing interdisciplinary training programs combining microbiology with data science and medicine, with a focus on both human and environmental health perspectives, would strengthen Lithuania's research capabilities and attract global partnerships.