STRATEGIC RESEARCH AND INNOVATION AGENDA

BIOECONOMY EDUCATION

THEMATIC WORKING GROUP OF THE BIOEAST INITIATIVE

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BIOEAST HUB CR

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MANAGERIAL EXECUTION

Bioeconomy offers a realistic opportunity to reconcile economic growth in a sustainable way and within an environmentally responsible frame. This development requires an interdisciplinary approach to research and innovation, for the implementation of innovative solutions achieved by a new generation skilled expert. In these perspective, tailored bioeconomy education and training are important to enhance the transition to sustainable development.

Bioeconomy Education has been a key issue on the European Strategy for Bioeconomy from the very beginning. In both Strategy documents (2012 and 2018) the issue appears as a main priority for Europe. The Bioeconomy Stakeholders Manifesto issued on 2019, places Education as a top priority for the sustainable development and growth and finally the European Commission tends to institutionalize the issue.

The Foresight Report highlighted the structural problems in the BIOEAST macro region, the lack of human resources in higher education and research is one of the main bottlenecks to accomplishing the goals of the European Green Deal. The BIOEAST Initiative fully acknowledges the importance of the coordinated approach and tackle the issue of bioeconomy education in the BIOEAST macro region, the Thematic Working Group Bioeconomy Education and Skills was established in 2020 to meet the specific macro regional education needs of the BIOEAST macro-region.

The network of Bioeconomy University was established in the Western, Southern and Northern part of Europe six years ago, the BIOEAST University Network was established in December 2022 as a structural part of the BIOEAST Thematic Working Group on Bioeconomy Education and Skills in Prague on the international conference "Bioeconomy Education: A BIOEAST Perspective" organized In Prague under the auspices of the EU Czech Presidency, December 8, 2022.

This document is identifying strategic thematic areas to tackle challenges and enhance the full potential of the bioeconomy education. The development of this Thematic Strategic Research Innovation Agenda was developed in the life time of the BIOEASTsUP project, that started two months before the Green Deal Strategy was published, five months before the outbreak of the COVID-19 pandemic; as in the last year the war in Ukraine started. EU is currently facing a lot of challenges that may require rapid response in various policies, this Thematic SRIA is therefore designed as an open document that can reflect these changes and it aims to be updated on a continued basis reflecting current issues and trends.

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INTRODUCTION

It is commonly recognized that in the new economic strength and growth, based on the principles of Bioeconomy, a substantial element for the future development will become multi-disciplinary and cross-sectorial concept that requires concerted cooperation of a large number of scientific disciplines, technical expertise and accompanied by political and economic decision-making processes. This requirement is currently changing the dynamics in business and market demands as bioeconomy becomes a priority of EU and tackles the current issues the world faces, particularly climate change, water erosion, and decreasing biodiversity. Therefore, will be indispensable, to launch education activities to provide trainings, courses for the economically active workforce and also programmes for new generation to prepare skilled working force, educated according to these needs.

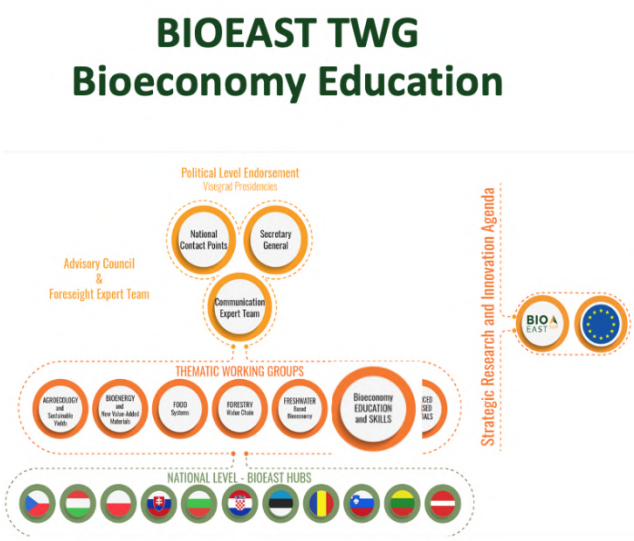
Bioeconomy transitions will also require changes in behaviour on the part of individuals and society. These changes can foster resistance in the form of psychological, non-science/evidence based opposition to new technologies and practices. Therefore, the establishment of a specialized education and training concepts, become a necessity and many high-education institutions all over the world are already working toward this effort.

The New European Economic strength and growth are building based on a new concept including the valorisation of natural resources and human manpower in a sustainable way. Those are the concepts of Bioeconomy, Biobased Economy and Circular Economy, which they become substantial elements for the future development. In the forthcoming years more and more processes will be designed on these principles. The current dynamics in business and market requirements are changing. Therefore, it is demanded a new generation of skilled working force, educated according to these needs. This education presupposes multi-disciplinarity in a wide spectrum of topics, so the competent teams can gradually be complemented by skilled individuals. The educational perspective must be aligned with European priorities for growth, offering a good potential for improvement in all levels (technological, economic social and regulatory). Considering National and Regional priorities the educational programs should be flexible enough and adjustable on a case-by-case basis according to specific demands and conditions
The Educational curricula should consider the development of soft skills in addition to disciplinary knowledge. Finally, Further Education and Life Long Learning be considered for the educators according to the new requirements.

These axes are in accordance with the current policies such as 1/ The reviewed Bioeconomy Strategy adopted by the EC October 2018 and the European Stakeholders Manifesto published November 2017. The proposed Action, besides its substantial contribution to the specific domain of Bioeconomy, will also add to the European perspective in institutionalizing the initiative, establishing an education frame without borders, enhancing networking and mobility and removing obstacles to EU-wide recognition of higher education diplomas and lifelong learning certificates.

Recently, Commissioner for jobs, growth, investment and competitiveness, Jyrki Katainen, set out several possible paths for the bloc's education future saying that "By 2025 we should live in a Europe in which learning, studying and doing research is not hampered by borders, but where spending time in another member state to study, learn or work is the norm."

CHAPTER 1. THEMATIC WORKING GROUP: BIOECONOMY EDUCATION



The BIOEAST Initiative fully acknowledges the importance of the coordinated approach and tackle the issue of bioeconomy education in the BIOEAST macro region, the Thematic Working Group Bioeconomy Education (hereinafter referred as "TWG BE EDU") was established in 2020 to meet the specific macro regional education needs of the BIOEAST macro-region. Its main goal is to maximise the efforts in increasing knowledge sharing, networking, mutual learning, development of joint activities and events.

The TWG BE EDU is serving as a platform for open discussion between key actors in the domain of Education and vocational training of Bioeconomyin order to build knowledge and capacity, discuss good practice developed in the EU projects, providing an input in any planned and/or ongoing BIOEAST initiative related to bioeconomy education and last but not least informing, inspiring, motivating and engaging regional and local actors. Structural part of the TWG BE EDU is the Network of Bioeconomy Universities in the BIOEAST macro region (hereinafter referred as "BIOEAST UNINET").

From the very beginning members[1] of the TWG BE EDU has been discussing priorities concerning the bioeconomy education in the BIOEAST macro-region and immersed developing the Thematic Strategic and Research and Innovation Agenda for the Bioeconomy Education of the BIOEAST macro-region (hereinafter referred as "Thematic SRIA BE EDU").

The following steps were determined and afterwards commenced in evolving Thematic SRIA BE EDU:

1) National priorities were expressed and assessed by TWG member in spring - summer 2021; the outline of the Thematic Study was formulated accordingly
2) The Thematic Study of the BIOEAST macro-region was developed with the support of the BIOEASTsUP project in February 2022; the full study is available online, key findings are displayed in Chapter 2.
3) Strategic priorities related to bioeconomy education were discussed among TWG members to provide an input for the BIOEAST SRIA.
4) TWG members' priorities were mapped in an on-line survey in summer 2022[2] and the following topics were identified as of a crucial importance:
    - systematic description of the bioeconomy educational potential and dynamics
    - mapping of public attitudes and perceptions on bioeconomy and its potential
    - trainings, awareness-raising of the bioeconomy potentials
    - closer collaboration with the BISC, EuropaBIO, CBE, related to strategy documents development and cooperation on awareness -raising campaigns
    - stakeholder engagement and networking
    - adopting educational priorities In accordance with other European Institutions such as "Sustainable entrepreneurship education, education In Bioeconomy finances etc.
5) Strategic priorities of updated with the reflection to the Ad 4) and Ad 5) and discussed on three validation workshops in Ljubljana, Tartu and Warsaw organised by the BIOEASTsUP project, outcomes are provided in Chapter 2.
6) The EU representative expressed a wish to organise a dedicated event during the Czech Presidency of the EU, the BIOEAST Initiative and the BIOEAST HUB CZ – the Coordinator of the TWG BE EDU acted accordingly.

[1] There are currently representatives of the following governmental bodies and research institutions involved in the agenda: Ministry of Agriculture Poland, Ministry of Agriculture Hungary, Ministry of Agriculture Czech Republic, Ministry of Education and Science Bulgaria, Ministry of Education and Science Croatia, Estonian University of Life Science, The Agricultural University – Plovdiv, Agronomic Faculty Zahřeb, Vytautas Magnus University Lithuania, Polnohospodářská Univerzita Nitra, University Ljubljan

[2] The unprecedent war conflict in Ukraine in February 2022 shaken the political and financial situation that was already jolted by nearly two years of lock downs of COVID-19, new crisis connected with security, energy joined the climate, sustainable and deepen the risk associated with social stability of the EU society. Therefore, current emerging demands were mapped.

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7) International Conference Bioeconomy education: A BIOEAST Perspective setting the BIOEAST Universities Network was organised under the auspices of the Minister for European Affairs doc. PhDr. Mikuláš Bek, Ph.D and the Ministry of Education CZ, all information are available on the web page, key findings are summarized in Chapter 2.

CHAPTER 2. BACKGROUND OF STRATEGIC PRIORITIES

This chapter is demonstrating the footing for strategic research priorities summarizing the key documents, surveys and events outlined in the Chapter 1.

Thematic study

The Thematic Study on Bioeconomy Education in the BIOEAST macro- region contributed substantially in both (i) perceiving the situation of the Bioeconomy Education in the region and (ii) providing a context on its dynamics and perspectives. At the end, the study provided suggestions structured in the form of an action plan for the improvement of this sector in the region.

More specifically, the study mapped and analyzed the needs and the expectations of several stakeholder groups, mainly from the Agri-Food sector, the Bio-based Industry the Policy makers and the public administration and the private investors and money raising groups. These needs were expressed according to their importance but also according to their validity in a forecasting perspective. Finally, they were evaluated in a detailed spectrum of various domains and therefore demonstrating a significant profile on regional and sectorial basis. Moreover, a similar analysis was conducted reflecting the existing capacity of the Educational Institutions in the whole macro-region also including all the different categories of the educational spectrum.

Next to the data collection a GAP analysis was executed considering both the needs versus the capacities. This approach gave a clear view of the potential in the current time and also in a short and mid-term basis. Finally, the study ended with a SWOT analysis evaluating Strengths, Weaknesses, Threats and Opportunities of the whole scheme.

The study concluded with a well justified action plan providing specific steps and paths for an effective strategy. This action plan provided elements for a consideration of various scenarios on a case-by-case basis providing elements on how to improve the whole Bioeconomy Education frame. More specifically, it was underlined that education must be transdisciplinary, including complex systems thinking. Diversification in education and learning requires the development of special programmes at each level of learning, from primary schools up to universities, and training and knowledge communication to public audiences. Here, three levels of education can be distinguished in Bioeconomy:

- Education in primary and high schools: teaching principles, acting local and global at the same time and raising interest;
- At universities: where a systematic curriculum is needed, combining life science, engineering, economics and marketing, and enabling the dynamics for the development of transversal skills, capable to support the students to become Bioeconomy entrepreneurs or management. Most of the universities in the BIOEAST region cover to a great extent the Bioeconomy educational aspects, but through different faculties and/or modules, thus not providing comprehensive Bioeconomy education to the students;
- Vocational training: there is a need to match requirements for skills in various sectors involving regional and local actors. Vocational training should introduce some specific concepts and illustrate some practical examples.

Besides the solutions, the challenges must be addressed sustainably also in a way that makes economic sense. Research and educational organisations should form a synergic network with business and public bodies that works together on sustainable solutions for Bioeconomy education. Some of the key areas for providing a secure future for succeeding generations are:

- Addressing the gap between the capacity of educational organisation and needs of industry, agriculture practice and policy makers;
- Investment in relevant research areas, both within each of the sectors and by encouraging multidisciplinary programmes;
- Making entrepreneurship within the Bioeconomy a desirable career option;
- Providing a skilled workforce by making the various sectors of the bioeconomy attractive career options through secondary, tertiary and vocational education;
- Encouraging innovation to make sure that more of the knowledge developments reach the commercialisation stage.

SWOT analysis rooted the following recommendations:

STRENGTHS	WEAKNESSES
The capacity of educational organisations fully addresses the following needs of the agricultural practice, industry and policy-makers: exp. in project management; exp in bio-based-market knowledge, engagement capacity to involve different types of stakeholders, exp in bio-based-market knowledge; exp. in the techno-economic assessment of bio-based processes; exp. in development of new bio-based business models, exp. in circular bio-economy approaches, exp. in the enhancement of profitability of currently used	The capacity of educational organisations does not sufficiently address the following needs of the agricultural practice, industry and policy-makers: exp in precision farming, Exp in feedstock-specific & market-driven cascade valorisation, exp in precision farming, Exp in feedstock-specific & market-driven cascade valorisation, exp in work with precision equipment for biomass harvest/collection, Exp in work with advanced ICT applications to logistic/storage, exp on advanced technologies to mildly extract or separate functional components, exp

business models, exp. in biomass potential assessment, exp. in the assessment of the geographical distribution of biomass/bioenergy potential (Exp. in GIS tools), exp. in raising social awareness for new bio-based products, exp in social innovations, exp in the social economy, exp. in attracting funding possibilities, exp. in new product design from bio-waste, exp in high productive technologies for traditional food sector.	on design and operation of market flexible and feedstock adaptable multiproduct integrated bio-refineries, exp on new processes to improve bio-product yield (biogas yield, chemical yield, etc.) from bio-waste, exp in materials based on oils and fats from plants and animals (bio-based lubricants, surfactants, solvents), exp in new (chemical) building blocks from renewable resources.
OPPORTUNITIES	THREATS
There are opportunities for educational organisations to better address the following needs of the agricultural practice, industry and policy-makers: exp. in Life Cycle Assessment (LCA), exp. in methods for efficient and cost-effective biomass' production, exp. in nano and biotechnologies to be applied in medicine, exp in advanced pre-treatments at a harvest-storage stage, exp in secondary conversion processes of bio-based materials, exp in bio-based alternatives for existing polymers and innovative polymers from new bio-based monomers, exp in extraction techniques to obtain high added-value biomolecules from marine, agrifood or forest biomass for pharmaceutical, nutraceutical and cosmetic sectors, exp. in new functional bio-based materials and products: plastics, composites, based on lignin, starch, (nano-) cellulose or carbon fibres.	There are many educational needs that are sufficiently addressed with the existing educational capacity. However, educational organisations should look for a step future and improve the capacity needed to address the needs which would arise in the following years and decades. It is to expect, that new types of bioeconomy industries will strengthen in the BIOEAST region, and there is a great threat that the existing educational organisations will not be able to address the needs of those new industries. In addition to this, the BIOEAST region has a low number of educational agencies, which are the key organisations for life-long learning.

Actions how to implement tailored training events in Bioeconomy

The ongoing transformation of labour markets and the cross-country division of labour has increased demand for work flexibility and decreased job stability. Training and education are needed to meet new skills requirements. Furthermore, informal learning activities play a role in the acquisition of entrepreneurial skills and soft skills. The completion of educational programs that respond to the training needs identified in this study require maximum collaboration between the educational organisations, agriculture practice, industry and policy makers, and business sectors, in order to achieve the best results for bio-economy development. In addition to this, joint social objectives must be defined in order to seek to achieve a higher awareness level of citizens. To support the implementation of tailored training events in Bioeconomy in the BIOEAST region, the following factors must be considered:

- The training model definition:
- The regional labour market analysis:
- Future forecast and planning:
- Educational organisation capabilities:
- Regional factors
- Awareness raising and promotion of vocational training events and lifelong learning

Conference Bioeconomy Education: The BIOEAST perspective

The conference was structured into three sections: (1) The regional perspectives of the Bioeconomy education, (2) Presentation of the universities' profiles which signed the memorandum of understanding for a network of bioeconomy universities in the BIOEAST macro-region, and (3) Panel discussion focused on challenges and some practical steps to be taken in the near future.

The discussions highlighted the most prominent problems of the countries, namely the missing national level strategic thinking and action plans. Without political and policy priorities on bioeconomy, none of the countries will be able to take advantage of the benefits of a sustainable bioeconomy. Moreover, the education system cannot thrive, the industrial sector will not be able to align with the sustainability priorities. **Six years ago, the Eropean Bioeconomy Universities alliance of bioeconomy universities from Western, Northern and South Europe, was established. The newly established BIOEAST Uni Net is meant to become a new ally.** Of course, this network Is still open to other Universities from the CEE region to join

The universities, and in general the education system can significantly contribute to the understanding of bioeconomy, but without political priority this development raises questions about the labour market development, innovation and research driven economy and societal understanding.

The conference highlighted the need to be better engaged in bioeconomy education development projects. This situation could further enlarge the disparities among EU macro-regions as a lot of activities are happening outside the BIOEAST macro-region. The European Commission supports the newly established BIOEAST Uni Net, and an encouragement to express the needs and demands was clearly conveyed. EBU and ICA-CoP declared support for the newly established BIOEAST Uni Net and offer cooperation. **The BIOEAST TWG Bioeconomy Education can advance upon the above-mentioned discussion, continue on acting and articulating the demands and specify needs, while connecting policy makers and universities from the BIOEAST macro-region with the counterparts from all over Europe**

CHAPTER 3. STRATEGIC THEMATIC AREAS

There is a need for a systemic mapping of the bioeconomy education landscape in the BIOEAST macro-region, the identification and evaluation of the existing programs and structures, as well as synergies between various educational programs in relation to the socioeconomic dynamics for the respective countries. Additionally, it is highly beneficial to align the regional educational priorities with those dominating other regions particularly in the western part of Europe, the following topics are of a key

importance: education on sustainable entrepreneurship, programmers for investors and managing authorities. To enhance bioeconomy education it is crucial to a) develop guidelines for policy makers how to implement bioeconomy education frames; b) support awareness raising and knowledge exchange activities; c) enhance training for sustainable entrepreneurship including sustainable financing, providing some case examples of place-based and context-specific circular comprehensive biobased business models to appraise added value of biobased products/services.

The BIOEAST Uni Net can strengthen the regional education arena by: i) identification of education needs both in the perspective of the entrepreneurship potential and the gaps on the labour market, ii) forecast analyses and data iii) support to the educational organisations in order to implement the bioeconomy programs including lifelong learning, coaching, peer review learning and providing supervision services for practice iv) develop tutorials to support green public procurement and other instruments and for sustainable transition towards (circular) bioeconomy.

Main Research Topics

The following key research topics were identified

RT 1. Mapping the Bioeconomy Education Landscape in the BIOEAST macro-region: Identifying existing programs and structures, as well as synergies between various educational programs, Analysing needs and expectations. Evaluating the existing programs versus the socioeconomic dynamics for the respective countries and the Impact they may have to the development.

RT 2. Identifying Regional Priorities: The regional approach Is essential for Bioeconomy applicability. IN order to specify educational programs aiming to satisfy the regional needs, many parameters should be taken In consideration such as: The existing structures and potential end-users of the region. The various clusters and regional Innovation systems. The training models to be adopted. The Regional Labour market analysis. Existing case studies, foresight, and forecasts. All the above to be considered In the prism of the regional profiles Including demographic data, Natural and Environmental factors, Socioeconomic parameters, social attitudes and characteristics etc.

RT 3. Coordination of Actions and facilitating the BIOEAST UNI NET: in particular arrange the relationship with ICA / CoP, EBU, EC, participation in international events, creating common papers, common projects (e.g. Visegrad Grands – MBA, ERASMUS+, Horizon EUROPE), preparation of a summer schools, conferences.

RT 4. Emphasizing on Vocational Training: Emphasis to be given Into the Initial and Continuous vocational training comprising a wide spectrum of target groups. Innovative approaches to vocational training in (conventional and novel) bioeconomy sectors

RT 5. Innovative Governance on Bioeconomy Education: A particular case should be considered the implementation of the Bioeconomy Education frames into the general Governance

RT 6. Awareness raising & Knowledge Exchange activities; target: general public; final consumers – both private and institutional/public (importance of public procurement for boosting demand and changing consumption patterns) Knowledge exchange; target: value chain actors – encompassing (a) primary production actors (agriculture, forestry, aquatic systems), (b) manufacturing sectors (both, existing/conventional and novel biobased sectors); (c) enabling institutions (agencies, business incubators, start-up accelerators, venture capital)3) Higher education, RDI; target: higher education institutions, research institutes, corporate sector (technology developers)

RT 7. Development of tutorials to support green public procurement and other instruments and measures for more sustainable patterns of (public) demand research on factors influencing purchase decision factors for bio-based products and services, research on environmental and social benefits of the transition towards (circular) bioeconomy

RT 8. Development of place-based and context-specific circular biobased business models;
Market valorisation of social &; environmental benefits of circular and biobased products/services/business models, identification of specific skills gap for the transition towards (circular) bioeconomy

RT 9. Sustainable entrepreneurship, sustainable financing: from sectoral to value-chain approach

Outcomes

Implementation of the above-mentioned actions will support public and industrial sector to align along the sustainability priorities with proper framework for bioeconomy education. The universities and in general the education system will have capacity to significantly contribute to the understanding of bioeconomy. The BIOEAST Initiative and its TWG will be able to advance upon the above-mentioned challenges, continue acting and articulating the demands and specify needs while connecting policy makers and universities from the BIOEAST macro-region with the counterparts from all over Europe.

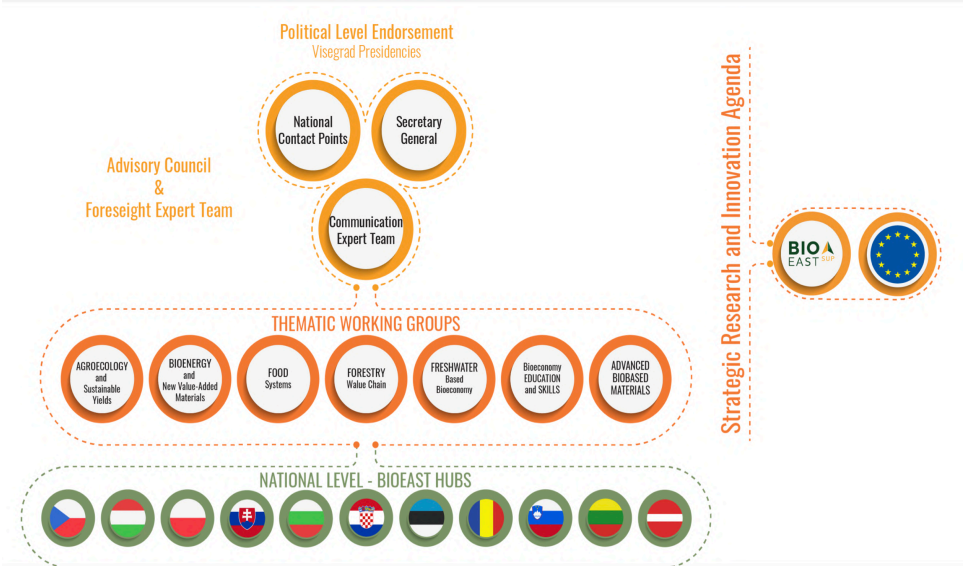
ABBREVIATIONS

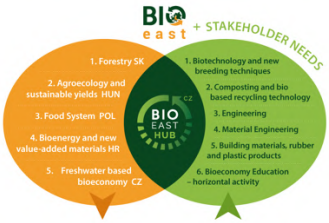
- BIOEAST Initiative - CENTRAL AND EASTERN EUROPEAN INITIATIVE FOR KNOWLEDGE-BASED AGRICULTURE, AQUACULTURE AND FORESTRY IN THE BIOECONOMY

- Thematic SRIA EDU - Thematic Strategic and Research Agenda for the Bioeconomy Education of the BIOEAST macro-region

- TWG BE EDU - Thematic Working Group Bioeconomy Education

HOW TO GET INVOLVED





Please get in touch with the TWG Leader - [BIOEAST HUB CZ](www.bio-hub.cz) (www.bio-hub.cz)