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Boosting Circular Bioeconomy in the Baltic Sea Region with a Business-Driven Inter-regional Open Innovation Process

Abstract

Implemented in 2023–2025, “BioBoosters – Boosting Circular Transition” project aims to advance circular transition of bioeconomy business in the Baltic Sea Region. As identified in the regional and macroregional strategies, the rural areas of Baltic Sea region have a great potential for bioeconomy as they have abundant natural resources. However, these regions struggle to grow the bioeconomy sectors, to provide job opportunities, and to tap into global market opportunities due to limited human capital, business networks and innovation capacity. BioBoosters Hackathon is connecting the bioeconomy innovation ecosystems of nine regions and seven countries across the Baltic Sea Region. Hence, we argue that BioBoosters Hackathons can offer a platform for inter-regional smart specialization co-operation with a business-driven approach. Hackathons have proven to offer a practical and effective open innovation method for generating and prototyping ideas as well as for collaborative and cross-sectoral learning. As a result of the BioBoosters Hackathons, we have anticipated to launch international and business-driven research, development, and innovation (RDI) projects and partnerships in the scope of circular bioeconomy. The figures and feedback survey results on the first nine BioBoosters Hackathons implemented in September 2023–May 2024 are elaborated in this article to show evidence of the scope of inter-regional connectivity and the impact to launching international co-operation boosting circular bioeconomy in the Baltic Sea Region.

Keywords: Circular bioeconomy, open innovation, smart specialization, Hackathon, entrepreneurial discovery process, inter-regional co-operation

1 Introduction

As identified in the regional and macroregional strategies, the rural areas of Baltic Sea region have a great potential for bioeconomy as they have abundant natural resources (European Commission 2021). However, these regions struggle to grow the bioeconomy sectors, to provide job opportunities, and to tap into global market opportunities due to limited human capital, business networks and innovation capacity. Innovation co-operation between regions is needed to connect knowhow, talent, and resources across the Baltic Sea Region. To strengthen the capacity for innovation of the rural bioeconomy focused regions, inter-regional smart specialization (S3) platforms and processes can play a key role. (Honkanen et al. 2020.)

As discovered also in the study conducted in the framework of the “BSR S3 Ecosystem” project, there is a growing emphasis and need for building strategic inter-regional smart specialization (S3) co-operation to make regions more competitive through innovation. The reviewed inter-regional policy learning experiments in the Baltic Sea Region (BSR) have demonstrated new ways to untap the potential of the bio- and circular economy via inter-regional innovation co-operation. The study suggests that with a more systematic inter-regional cooperation for boosting green transition and closing biomaterial loops, rural regions have the potential to extend the Entrepreneurial Discovery Processes (EDP) beyond the limited regional innovation ecosystems. (Leino 2020, 4–5.) To achieve an effective inter-regional EDP, there is a need to have the following core elements in place: 1) continuity of engagement; 2) facilitated mechanisms and instruments allowing also in-depth exploration to niche knowledge; 3) efficient organization with clear, fair, and transparent rules; and 4) adequate capabilities to effectively engage the stakeholders including the private sector (Perianez-Forte & Wilson 2021, 4, 21).

As a systematic solution to carry out inter-regional EDP and to connect the regional innovation systems to boost circular transition in the bioeconomy sectors, “BioBoosters – Boosting Circular Transition” Interreg BSR project is piloting a joint open innovation process, a business-driven Hackathon model. The BioBoosters Hackathon is connecting the bioeconomy innovation ecosystems of nine regions with a smart specialization strategy focused on circular and sustainable bioeconomy. By implementing the open innovation process in inter-regional co-operation, cross-sectoral knowledge transfer can be facilitated, and innovative solutions can be connected to the companies in the bioeconomy value chains through leveraging the wider networks on macro-regional level. (Interreg Baltic Sea Region 2024.)

Via 18 pilot cases implemented in 2023–2025, BioBoosters Hackathons will target challenges that biobased businesses are facing when developing their operational and business models towards circular bioeconomy. As outlined by Stegmann et al. (2020, 5–6): “The circular bioeconomy focuses on the sustainable, resource-efficient valorization of biomass in integrated, multi-output production chains (e.g. biorefineries) while also making use of residues and wastes and optimizing the value of biomass over time via cascading.”

The challenges tackled in the first nine of the BioBoosters Hackathons align with this definition as they can be categorized under the following three themes that represent key areas of the circular bioeconomy concept:

- Valorization of biological side-streams and development towards multi-output production chains (BioFuel Region 2023, Witenon 2024, Pärnu County Development Center 2024).
- Sustainable and resource-efficient use of bioresources via application of smart technologies and digitalization (Jamk University of Applied Sciences 2023, Vidzeme Planning Region, Sunrise Tech Park 2024).
- Discovery of biobased ingredients, materials, and products (Paper Province 2023, Pro Civis Foundation 2024, Estonian University of Life Sciences 2024).

BioBoosters Hackathon process starts by the definition of an innovation challenge presented by a challenge provider company. Thereafter, an open call is launched to attract teams (researchers, startups, SMEs, innovators etc.) with innovative solutions that respond to the need of the challenge provider. Challenge provider will select the most interesting teams and ideas among the applicants to join the Hackathon process that is operated under non-disclosure agreements. During the closed process, the teams will be guided by mentors representing research, industry, and the challenge provider company. The mentors are specialists in the technology, commercialization and innovation paths relevant to the given challenge. (Aalto & Iso-Ahola 2023.) After team selection, BioBoosters Hackathon is started with a Kick-off that brings together the challenge provider, solution provider teams, and mentors to initiate the knowledge sharing and ideation on the challenge conducted on a digital workspace prior to the Hackathon Days. On the Hackathon Days mentoring sessions support further knowledge building and offer guidance to the teams in preparing their co-operation offer to the challenge provider. Finally, the teams will pitch their solution proposals for the challenge provider and winner(s) are selected to launch innovation partnerships. (Aalto et al. 2023, 14–15, Myhrén et al. 2023.)

In the context of open innovation, BioBoosters Hackathon model can be defined as a “coupled” model – a combination of inbound and outbound innovation activities targeting to joint development or commercialization of innovations (Flor et al. 2021). The aim of the BioBoosters Hackathon is to launch a co-operation, an innovation partnership, that is mutually beneficial to the solution provider and challenge provider company. Benefits may involve e.g. co-designing a new product or service to the market, establishing a proof-of-concept, or testing and demonstrating a new technology. Overall, the open innovation process starts with inbound activities – sourcing and scouting talent, expertise, technology options and innovative ideas. In the next phase, the outbound knowledge flow is added to the process, as the challenge provider’s team of specialists connect with the solution provider teams to mentor, guide, and support the development of the solution concept and innovation partnership proposal. (Aalto et al. 2023, 14–15, Myhrén et al. 2023.)

BIOBOOSTERS HACKATHON SERVICE PATH

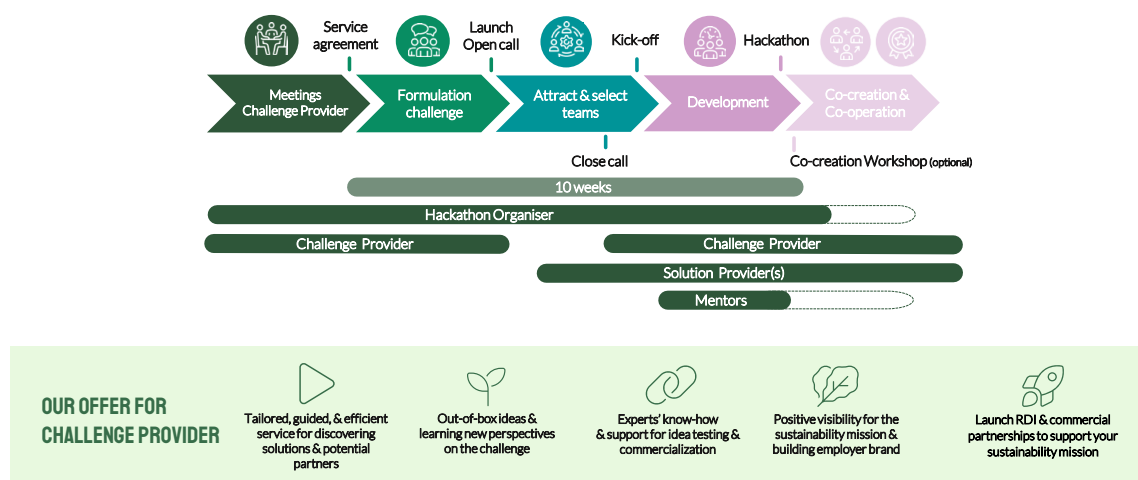


Figure 1. BioBoosters Hackathon Service Path. (Myhrén et al. 2023)

As explored in the study of Attalah et al. (2023), there is a proven impact for open innovation in the format of Hackathons. Generally, Hackathons connect participants with diverse expertise from different organizations across the innovation ecosystem to achieve results that beyond the scope of the internal R&D capacity of separate organizations. It is evident that more and more Hackathons have been emerging as tools for open innovation in response to societal issues in recent years while the conceptual framework for their open innovation process is diverse. Some of the Hackathons are focusing on idea generation while others, like BioBoosters, are engaging participants in a more in-depth collaborative learning and prototyping of the generated ideas. (Attalah et al. 2023, 275–276.) As outlined, BioBoosters Hackathon is characterized by the company initiator – a challenge provider – that is committing resources into helping to prototype the workable ideas and to taking the winning idea further by starting a co-operation for implementing the solution idea in their operations or supporting its commercialization to the market.

Apart from the co-operation opportunity for the winner, collective learning focused Hackathons generate sideways open innovation. Accordingly, ideas and co-operation opportunities are arising from the connections between participants other than the challenge provider. (Attalah et al. 2023 275–276.) This creates a better value offer for the participants, mentors and teams, making the participation more attractive. The value proposition of the BioBoosters Hackathon emphasizes the networking value, visibility value as well as the learning value from the cross-sectoral and inter-regional expertise exchange and the interaction between industry and academy experts. (Myhrén et al. 2023.) This value capturing has been observed in the Hackathons organized by Jamk University of Applied Sciences with the same open innovation process format. (Aalto et al. 2023, 11.)

2 Methods

In this article, the aim is to analyze whether the BioBoosters Hackathons show potential to offer a platform for inter-regional smart specialization co-operation with a business-driven approach. The main research questions are:

- Does the BioBoosters Hackathon work as a platform for inter-regional stakeholder dialogue? Are international participants attracted to join as solution providers and mentors? Are inter-regional innovation partnerships initiated?
- What has been the perceived value of the inter-regional interaction during the BioBoosters Hackathon process?

To analyze the potential, data on the participation and results of the nine BioBoosters Hackathons is reviewed to determine the level of international participation in the open innovation process as well as to explore the connectivity across the Baltic Sea Region. The statistical data involves the participants from all nine Hackathons, altogether 289 people and 171 organizations. (Olesiak et al. 2024.)

In addition to the statistical data, the feedback survey data is also studied to explore the responses of the Hackathon participants related to the international networking and co-operation. Tailored feedback surveys were administered to each of the target groups of the Hackathons – challenge provider companies, solution provider teams, mentors, and organizers. The survey responses were anonymous. Surveys were administered in the end of the Hackathon Days with approximately 14 days of response time. (Olesiak et al. 2024.)

3 Results and discussion

3.1 International participation

There has been a substantive level of international participation to the BioBoosters Hackathons which is a necessary starting point to demonstrate the viability as a platform for inter-regional smart specialization co-operation. Looking at Table 1., there is consistent evidence of international scope of the open innovation process. The share of international teams was 44 per cent of applicants (54 out of 123), 41 per cent of selected teams (26 out of 64), and 45 per cent of winners (5 out of 11). As shown on Table 2, the share of international mentors was 32 per cent of all mentor organizations involved in the BioBoosters Hackathons (19 out of 59). (Olesiak et al. 2024, 43–44.)

Table 1. Background of the Hackathon participants. (Olesiak et al. 2024, 43)

Teams	Applicants	Selected teams	Share of selected applicants	Winners	Share of winners from selected teams
International	54	26	48 %	5	19 %
National	60	33	55 %	5	15 %
Regional	9	5	56 %	1	20 %
TOTAL	123	64	52 %	11	17 %

When analyzing the results, it is important to note that the share of international teams and mentors does vary significantly between Hackathons. Reasons be-

hind the variation of international participation can relate to e.g. the challenge type or specific organizational challenges experienced in a particular Hackathon. In course of the piloting, the international network has also built more capacity in active scouting of teams and attracting mentors, as well as more international visibility, which has benefitted the hackathons organized later in the pilot round. (Aalto 2024.) As shown on Table 2, the last three hackathons had 67 per cent of international teams pitching on the Hackathon Days, and the share of international mentors has also increased in later hackathons (Olesiak et al. 2024, 44).

It is also notable that the drop-out rate for international teams is higher than average. While the data on national teams suggests a 16 per cent drop-out rate between the Kick-off event and pitching on the final Hackathon Day, the corresponding number for international teams is 31 per cent (Olesiak et al. 2024, 43). One explanation for this is that an international team needs to put in more work and commit more resources, especially time, to understand the operating environment related to the challenge as well as for travelling. This makes them to consider the risk-reward ratio of participation more carefully. Similarly, the challenge providers seem to consider a bit more carefully the acceptance of the international teams as indicated by the slightly lower selection rate. Overall, the findings suggest that the cost-benefit consideration is done more carefully by the challenge providers and teams alike when making the decision to start a dialogue on future co-operation with an international partner. However, this is not reflected in the share of winners, and it seems the challenge providers are ready to embark on innovation partnerships via international partners discovered via the open innovation process (Olesiak et al. 2024, 43).

Table 2. Share of international teams and mentors in the BioBoosters Hackathon of the first pilot round in 2023–2024. (Olesiak et al. 2024, 44)

BioBoosters Hackathons	SELECTED TEAMS			PITCHING TEAMS			MENTORS (organisations)		
	International	National	Share of international	International	National	Share of international	International	National	Share of international
Valio	2	4	33 %	2	4	33 %	1	6	14 %
Moelven	3	7	30 %	0	5	0 %	1	5	17 %
Holmen	0	6	0 %	0	4	0 %	1	4	20 %
Alojas	2	3	40 %	1	3	25 %	1	3	25 %
Targi Kielce	1	5	17 %	1	4	20 %	2	6	25 %
Cosun Beet	4	6	40 %	2	6	25 %	4	5	44 %
Fibenol	4	2	67 %	4	2	67 %	3	5	38 %
Nando	4	2	67 %	4	2	67 %	2	3	40 %
Võiste	6	3	67 %	4	2	67 %	4	3	57 %
TOTAL	26	38	41 %	18	32	36 %	19	40	32 %

Looking at the county background of participants (Figure 2), all partner countries are represented while the communication and marketing activities have also reached to other countries in BSR and EU. BioBoosters partnership involves two partners from Sweden which together with the larger population and market size provides partial explanations to the high participation from Sweden. Furthermore, the partners in Estonia, Latvia, and Lithuania are reporting challenges in attracting teams and mentors due to a high saturation of available open innovation platforms and competitions in their nations. (Olesiak et al. 2024, 31, 45.)

APPLIED, SELECTED & WINNING TEAMS PER COUNTRIES

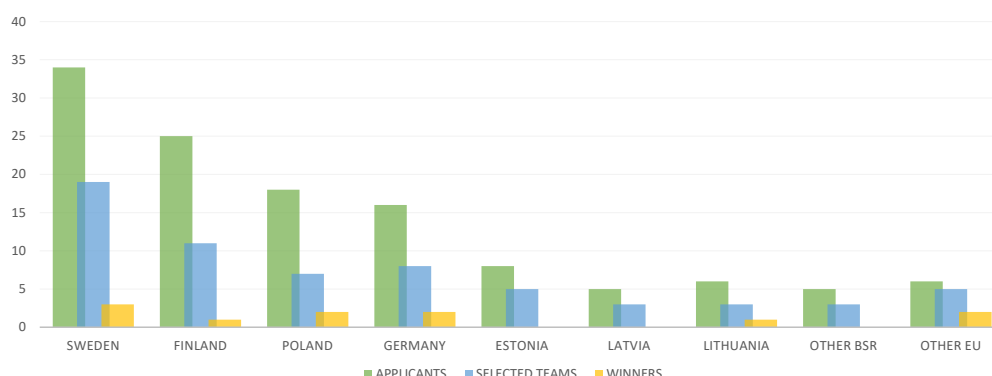


Figure 2. Country background of applicant teams, selected teams, and winners. (Olesiak et al. 2024, 45)

3.2 Feedback of the participants

The analysis of the feedback survey results indicate that the BioBoosters Hackathon participants have experienced an added value from the international scope of the open innovation process. As a response to the feedback survey, 85 per cent of challenge providers (N = 26, response rate of 57 per cent) reported to have experienced a high or moderate impact for their company from the international expertise exchange. In addition, 96 per cent (N = 24, response rate of 52 per cent) agreed totally or mostly that BioBoosters Hackathon is a good tool for a large company to grow international RDI networks. It is also worth to note that 72 per cent of challenge provider respondents (N = 25, response rate of 54 per cent) considered high or moderate likelihood that their organization would start a co-operation with a new international contact gained from the Hackathon process. (Olesiak et al. 2024, 33–34.)

Positive trend is also visible in the responses of the solution provider teams. From the teams involved in the Hackathon Days, 67 per cent of the respondents (N = 85, response rate of 59 per cent) reported to have experienced a high or moderate impact for their team from the international experience exchange. In addition, 44 per cent (N = 84, response rate of 59 per cent) considered high or moderate likelihood that their team would start a co-operation with a new international contact gained from the Hackathon process. (Olesiak et al. 2024, 35.)

Looking at the combined responses of organizers and mentors (N = 70, response rate of 59 per cent), 93 per cent considered BioBoosters Hackathon to be a good tool to initiate business-driven RDI activities in international context; and 84 per cent agreed that BioBoosters Hackathon supports exchange and transfer of best-practices across the Baltic Sea Region. (Olesiak et al. 2024, 37, 39.)

Response rate can be considered high, so the feedback survey data is expected to reflect well the general experience of the Hackathon participants. Limitations to data analysis relate to the timeline of the feedback survey administration. As

the survey is administrated right after the Hackathon days, participants are not able to reflect the practical outcomes in terms of international co-operation. Therefore, the given responses reflect the participants' perceived benefits that might be more positive (or negative) than the realized impact in the longer term.

4 Conclusions

To conclude, our findings suggest that BioBoosters Hackathon can be successfully applied as a platform for initiating inter-regional business driven RDI co-operation in the framework of circular transition in the bioeconomy sectors. Therefore, the model has potential to strengthen innovation capacity of the rural bioeconomy regions around the Baltic Sea. BioBoosters Hackathon offers a platform for inter-regional stakeholder dialogue where the business interests are in the center. BioBoosters Hackathon process offers good value for the time spent and a promising return on investment for all target groups engaged in the open innovation process.

Still, the mid-term data also suggests variation in the level of international participation between Hackathons and between countries in the Baltic Sea Region that require further assessment and analysis. As the process is tailored to the needs and priorities of the challenge provider, some variation is to be expected; however, it is also important to further study the challenge and country specific differences between the target group needs and expectations related to open innovation process. Further analysis of the achievement of the core elements of inter-regional Entrepreneurial Discovery Process (EDP) in the BioBoosters Hackathon process, and the long-term viability of the BioBoosters Hackathon activities shall be explored in greater detail with the full data available on 18 Hackathons by June 2025.

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