

Biodiplomacy Attractiveness in Bioeconomy Education. Case Study

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Abstract – Biodiplomacy involves searching for a delicate balance and establishing a dialogue on the necessity to achieve international goals to develop the bioeconomy. The substantive basis of biodiplomacy is understanding bioresources, technological solutions for their extraction and use, indicators, and evaluation possibilities. The article is devoted to the establishment of a biodiplomatic institution. Such institutions will help young specialists in various economic sectors to develop competence approaches, acquire knowledge and build awareness that will make them competent to solve problems related to bioeconomy development and future, looking for efficient use of bio-resources and high value-added production. The aims and objectives of biodiplomatics are ambitious, which means that forms of study training must be attractive and multi-layered. Thus, the authors have analysed formative work assessment in the form of group work. With the help of a role game, the participation of different sections of society in developing the bioeconomy in agriculture, forestry and aquaculture was simulated. The article is devoted to the situation analysis, creating a model for building competencies, awareness, and knowledge of biodiplomats, and appraising it in the formative assessment work of the Riga Technical University bachelor's study program in environmental engineering, organised as a role game.

Keywords – Agriculture; biodiplomats; competencies; post-game performance level rubric; role game

1. INTRODUCTION

Latvia, like all other European Union (EU) countries, must shape public policy in such a way as to achieve the goals set by the Green Deal, energy, climate neutrality and other binding documents. To a large extent, policies need to be subordinated in such a way as to comprehensively ensure the development of the whole economy and progress towards these goals. As this issue involves global solutions, the work of biodiplomats needs to be updated to ensure that the goals are met. Biodiplomats are international experts who will implement innovative paradigms in the bioeconomy to provide new and innovative products using new technologies and processes. [1] have studied the concept of biodiplomacy and defined the main characteristics. The main emphasis in this study is on the development of new mechanisms to promote a circular and sustainable, socially inclusive bioeconomy.

Latvia does not currently implement biodiplomacy. Therefore the question remains in which sectors it would be possible to develop it. It is necessary to find a niche against which

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Latvia's product would stand out against the offerings and services of similar countries, highlighting its unique ideas, experience, competence, and activities. It would give recognition, prestige, leadership, and state influence. Therefore, the next step in its implementation would be to incorporate legitimate strategies for niche biodiplomacy in legislative documents. Although the government currently intends to develop an action plan that would define the tasks of making Latvia attractive to exporting companies in the international environment by creating a single brand to attract foreign interest, this definition is more than an interpretation, as the government does not mention public diplomacy in national planning policy framework [2].

When creating a niche biodiplomacy, the primary goals that Latvia could offer to other countries must be set to be identified as competitive, of course, considering the country's primary interests. It should be emphasised that niche biodiplomacy would focus on a specific sector field, sifting out other areas and specifying what could lead to opposition from different fields. The implementation of positive biodiplomacy can be implemented only when successful cooperation between institutions and sectors and scientific institutions is expected in the long run because only then are the results desired [3].

In 2008, the Latvian Institute conducted a study on the image of Latvia [4]. As a result, Latvia is not ready to create an image. The main arguments are as follows: (1) geographical location outside the capital's periphery is not attractive to investors, (2) ecological and other environmental issues outweigh the promotion of industrialisation, (3) national identity challenges – it is necessary to be able to find a unifying motive for Latvia's identity, (4) Latvia's future aspirations are not in line with current assumptions, (5) Latvians generally do not support the sale of land to someone who does not have deep roots or ties with Latvia. Recognition with the capital Riga should be promoted, and the slogan used should be 'Plugged into nature'. The audience has not been enthusiastic in the international environment, and assumptions are primarily based on the past. The main cornerstones of niche biodiplomacy would be based on credibility, rationale, reputation, and value.

Considering the above, Latvia's image in the international environment would become competitive by moving in biodiplomacy and developing biodiplomats. The term biodiplomacy is linked initially to bio-education. Vlavianos-Arvanitis (1993) urges for the need of restructuring the educational framework to 'overcome the threats to the preservation of bios (life in Greek) caused by a crisis in values. International cooperation and facilitating the search for solutions to problems that require prompt and decisive action is by excellence the case in environmental issues [5]. In the following almost 20-year period, the increasingly complex challenges of governing resources in socio-ecological systems made policymakers and practitioners use more and more the so-called serious games (SG), as shown in the systematic review of relevant publications by Edwards *et al.* (2019) [6]. Concerning the ubiquitous climate change challenge, Ahamer (2013) argues that gaming serves better to shape a strategy than fighting, in the sense that the former relates to 'managing unstable equilibria while maintaining societal sustainability'. In contrast, the latter resumes to 'understanding only own standpoint, but not the standpoint of adversaries' [7]. Blanchard and Buchs (2015) illustrate the capacity of role to clarify Sustainable Development for students, a wicked concept with international ramifications, and Thomas *et al.* (2018) detail the use of role game in the case of energy-related decisions in urban and rural municipalities [8], [9]. Various stakeholders engaged as participants with energy conundrums in 6 different locations in the US, wearing the hat of others eliciting valuable insights into complex decision making. In the context of biodiplomacy and the understanding of its operation, role game in the study process provides an invaluable contribution to the training of young specialists. It can support the introduction of transdisciplinarity in the classroom, simulating and enhancing the co-

production of knowledge [10]. Role game in the study process is one of the ways to provide students with the opportunity to apply the acquired theoretical knowledge in the practical simulation of reality because the offered way provides a dynamic environment. However, a framework of preparation guidelines is issued in advance, which defines the topic and the problem; students still have to offer their solutions. Role game features among the crucial teaching tools for experiential learning in higher education programmes relating to sustainability [11], [12], [13], [14]. Relevant publications evaluate role games along with study visits or field courses as the most effective tools, especially when integrating social sustainability into the engineering curriculum in Cambridge University [15] and the Swedish Royal Institute of Technology, as seen in Björnberg *et al.* (2015) [16]. Role game was also used ‘to provide a solution to actual local problems’ in a capacity-building course to educate educators on sustainability in Monterrey Tech [17]. Role game is a handy tool when there need to solve a problem [18].

In the same track, the role game ‘Response bioeconomy strategy to COVID-19’ was organised in the bachelor study program ‘Environmental Engineering’ created by the Institute of Energy Systems and Environment of Riga Technical University, the implementation of which effective and result-based distribution of COVID-19 emergency aid (EUR 35.5 million) between the main sectors of forestry, agriculture, fisheries and aquaculture, as well as tourism.

From a pedagogical point of view, the development of competencies is directly related to in-depth learning, which various authors also call deep learning or visible learning [19], [20]. As a result of such a study process, students can develop any of the competencies to be acquired in the course ‘Biotechnomy’, which are indicated as the results in the study course. The main goal of in-depth learning is to strive for the student to gain an in-depth and conceptual understanding of complex/complicated topics [21].

The article is devoted to the establishment of a biodiplomatic institution. Such institutions will help young specialists in various economic sectors to develop competence approaches, acquire knowledge and build awareness that will make them competent to solve problems related to bioeconomy development and future, looking for efficient use of bio-resources and high value-added production. The aims and objectives of biodiplomatics are ambitious, which means that forms of study training must be attractive and multi-layered.

It is essential to organise a role game to understand biodiplomacy and analyse the results – competencies acquired by the participants. In this case study, the role of the participants in the role game, representing the agricultural group, in the field of biodiplomacy acquired in the context of bioeconomy.

2. METHODOLOGY

The methodology consists of three parts: (1) preparation, (2) role game, (3) post-game performance level rubric (see Fig. 1). In the (1) preparation part, a role game was developed in the course ‘Biotechnomy’ of the Riga Technical University bachelor study program ‘Environmental Engineering’ in the amount of 3 ECTS. More detailed information on this section will not be considered. The main emphasis in this methodology is on the role game and the section on participants’ post-game performance level rubric. (2) part is a role game that consists of current situation analysis, proposals and solutions analysis, public discussion, and decision making. The role game aims to raise stakeholders’ knowledge and understanding of sustainable development of bioeconomy, its objectives, and their achievement, as well as achieve result-based distribution of COVID-19 emergency aid (EUR 35.5 million) among three main sectors. Students are introduced to the problem situation, the game’s goal, the

parties involved, the division of groups, and the evaluation criteria of the leading offers at the current situation analysis stage. Group consists of 4 students; a doctoral student advises each group. The doctoral student is the group's consultant/mentor and motivates the group to participate in discussions, defend its position and argue its opinion. Various criteria have been compiled to prepare and evaluate proposals submitted by the sectors (see Table 1). These criteria allow one to evaluate and compare proposals, choose the most optimal and distribute the funding more efficiently.

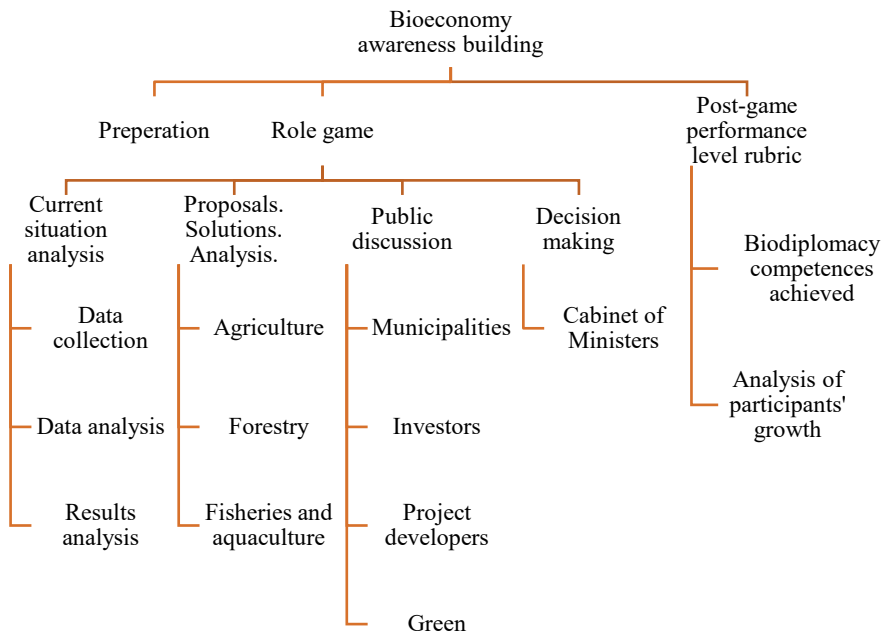


Fig. 1. Integration of role game in the modular structure of bioeconomy awareness building.

TABLE 1. MAIN PROPOSAL EVALUATION CRITERIA FOR GROUPS

Group title	Criteria	Units
	Number of persons employed in rural and urban	Thousand of people
Forestry	Increase of value-added	Thousand EUR/year
Agriculture	Added value per employee	Thousand
Fisheries and aquacultures	Contribution to GDP	%
Cabinet of Ministers	Export	Thousand EUR
Investors	Share of renewable energy in industrial and energy consumption	%
Environmental activists	Renewable energy and total (final) industrial energy consumption	GWhREN
Municipality representatives		GWhfinal

Each group has its framework and task to complete during the role game:

1. Forestry – to prepare a proposal that would include the necessity to receive the support to prevent the consequences of the pandemic, to develop bioeconomy and to achieve goals set in bioeconomy strategy; to present main difficulties that the forestry sector is facing because of the pandemic, what aspects hinder the development of the bioeconomy, what are the policy instruments could help to achieve the goals; deliver a proposal for the investment of the Emergency support funding and its necessity, what will be the results if the funding will be granted, and what are the consequences if not!
2. Agriculture – to prepare a proposal that would include the necessity to receive the support to prevent the consequences of the pandemic, to develop bioeconomy and to achieve goals set in bioeconomy strategy; to present main difficulties that the agriculture sector is facing because of the pandemic, what aspects hinder the development of the bioeconomy, what are the policy instruments could help to achieve the goals; deliver a proposal for the investment of the Emergency support funding and its necessity, what will be the results if the funding will be granted, and what are the consequences if not!
3. Fisheries and aquaculture – to prepare a proposal that would include the necessity to receive the support to prevent the consequences of the pandemic, to develop bioeconomy and to achieve goals set in bioeconomy strategy; to present main difficulties, that fishery and aquaculture sector is facing because of the pandemic, what aspects hinder the development of the bioeconomy, what are the policy instruments could help to achieve the goals; deliver a proposal for the investment of the Emergency support funding and its necessity, what will be the results if the funding will be granted, and what are the consequences if not.
4. Cabinet of Ministers – to prepare criteria for evaluation. Each group must be allocated funds as the result of fund distribution. Ask groups questions, engage in discussions, announce results: (1) actively participate in the meeting, where three primary sectors will present and argue their strategy plans; (2) main task – distribute the COVID-19 emergency support funds to 3 sectors (forestry, agriculture, fisheries and aquacultures).
5. Investors – (1) main task – ensure that the idea provided by presenters is innovative, viable, realistic and economically correct; (2) necessary support tool for investors to mitigate risks; (3) “Green channel” for investors to work in Latvia.
6. Environmental activists/NGO – (1) actively participate in the meeting, where different alternatives of bioeconomy strategy will be presented; (2) ensure that funding will be granted to the most environmentally friendly and sustainable proposals.
7. Municipality Representatives – (1) actively participate in the meeting; (2) main task – ensure that best solution for a municipality is chosen – receives the highest amount of taxes, local people are employed, and environmentally and climate-friendly solutions are used.

The methodology's last part (3) is the post-game performance level rubric used for biodiplomacy competence evaluation for the bioeconomy. Table 2 shows the general form of the rubric, which provides four levels of performance.

Fig. 2 introduces evaluation criteria for biodiplomacy competence (the authors recommend up to four criteria, as the most relevant and focused criteria for a given competence must be selected from a wide range of possible criteria).

TABLE 2. GENERAL FORM OF THE RUBRIC FOR PERFORMANCE EVALUATION

	Trying to reach / not reached	Approaching	Achieves compliance	Exceeds requirements
Evaluation criteria	1	2	3	4
	Student activity is inaccurate and approximate; performance can only be partially attributed to the acquired competence.	Student performance is general, generally related to the competence to be acquired.	Student performance is accurate; it is based on judgments about this criterion.	Student performance is accurate and convincing; it shows the limitations and complexity of competence.

<p>Category 1</p> <p>Relevance of the product / service / process to the transition from the current paradigm of increasing economic production to a sustainable bioeconomy, promoting the implementation of the Green Deal and Climate Neutrality Policy</p> <p>1</p> <p>The description of the product / service / process is partly in line with the paradigm shift, policy documents are mentioned, but the offer has no direct link to the paradigm shift.</p> <p>2</p> <p>The description of the product / service / process is fully in line with the paradigm shift, the rationale is incomplete, the importance of innovation is emphasized.</p> <p>3</p> <p>The description of the product / service / process is based on science and evidence, based on qualitative and quantitative arguments, development scenarios and trend analysis. Emphasis is placed on the limitation of innovation resources as opposed to the limitation of natural resources.</p> <p>4</p> <p>The description of the product / service / process convincingly demonstrates the contribution to the efficient and sustainable management of the planet's resources. It transcends the situation of a small community or a small area, making it possible to use it to implement a Green Deal and a climate neutrality policy on a global scale.</p>	<p>Category 2</p> <p>Reasonable and delicate dialogue and cooperation with target groups.</p> <p>1</p> <p>One-way communication in which a product / service / process is explained and presented, but no feedback is obtained and no dialogue is formed.</p> <p>2</p> <p>Two-way communication, in which point of view develops in the direction of change, the target groups find some points of contact that can serve as a basis for dialogue in the future.</p> <p>3</p> <p>Dialogue and discussions in all target groups increase social awareness of the need for change, an agreement has been reached on joint cooperation on certain issues in solving precisely agreed problems or ensuring the process.</p> <p>4</p> <p>There is a clear shift in the mindset of political leaders and decision-makers towards long-term strategies with a global vision. Strong commitment to continue the dialogue with target groups that do not accept the need for change.</p>	<p>Category 3</p> <p>In the common definition of society's goals and tasks, the awareness that we are all one, a synergistic approach to solving global problems.</p> <p>1</p> <p>Narrow definition and presentation of bioeconomy goals for the interests of one target group, which endangers the economic and political goals of other target groups.</p> <p>2</p> <p>General definition of bioeconomy goals without involving but also endangering other target groups.</p> <p>3</p> <p>Global and accurate understanding of the added value of the bioeconomy; when defining goals and objectives, the interests of all target groups are considered, they are balanced in the name of common goals.</p> <p>4</p> <p>Target groups do not feel threatened by their economic and political goals but accept the new paradigm and show a willingness to engage in the process of change. Fully synergistic state / process.</p>
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Fig. 2. The progressive performance rubric for developing biodiplomacy competencies role game in bioeconomy studies (1 – Trying to reach/not reached; 2 – Approaching; 3 – Achieves compliance; 4 – Exceeds requirements (explained in Table 3)).

Each level of performance is associated with a level of biodiplomacy competence. Competencies are assessed from 1 to 4, where a Level of 1 reflects only a small activity (inaccurate, mediocre, incomplete achievement of the competence). Level 2 already defines the direction towards the general achievement of competence. Level 3 establishes the achievement of competence, where student participation is accurate. Level 4 indicates that the student is competent in the field and can analyse complex systems. Students are given performance level sections for each competence to be developed in the study course 'Biotechnology' in preparation for the role game; the biodiplomacy performance rubric is one of the many competence development rubrics. Students use these rubrics as guides in the study process as they prepare for the role game. The role game takes place in the middle of the study course and is a formative assessment tool. The role game observer and the student, performance level assessor, are issued performance rubrics and the corresponding assessment table. It is recommended that the game be watched by several observers who calibrate their understanding of the performance level signature before the game. During the game, the assessors identify the biocompetence criteria listed in the table and determine the level of student performance. After the game, the assessors provide feedback to the students and discuss the student's performance in individual episodes, justifying the level achieved by the students with that described in the performance level rubric.

The progressive performance rubric for developing the biodiplomacy competencies role game in bioeconomy studies (adapted by [22]) is shown in Fig. 2.

The target groups mentioned in the Table 2 are representatives of other economic sectors, environmental activists, local governments, investors, politicians.

3. RESULTS AND DISCUSSION

During the role game, participants answered the key question - how to invest the COVID-19 emergency support funds to mitigate the effects of pandemic (sustainable recovery of the economy) and maintain the transition sustainable bioeconomy development. Each target group - forestry, agriculture, fisheries and aquaculture - formulated what they thought were the best solutions based on research. The Bioeconomy strategy, which defines that the most significant support is to farmers and food producers to ensure food security, must consider that the remainder will have to be shared between fisheries and forestry.

As a result of the role game, the agricultural group received the most financial support, so this group was further analysed using the post-game performance level rubric. The post-game performance level rubric for the agricultural group for the assessment of biodiplomatic competencies is shown in Fig. 3.

The post-game performance level rubric makes it possible to assess students' skills in the relevant assessment categories. Thus, for example, the competencies of students represented in the agricultural sector were evaluated in 3 categories – (Category 1) Relevance of the product/service/process to the transition from the current paradigm of increasing economic production to a sustainable bioeconomy, promoting the implementation of the Green Deal and Climate Neutrality Policy, (Category 2) Reasonable and delicate dialogue and cooperation with target groups and (Category 3) The figure shows that students have acquired competencies in the areas indicated in the specific categories, as they reach close to the highest grade in each category. In Category 1 are reached Level 3, where students present their advanced knowledge in bioeconomy and innovative tools for achieving bioeconomy goals. In Category 2, students knowledge dynamic is expressed in all four levels, which shows students dialogue development dynamic. In Category 3, students participate in role game,

leading the development of their attitude and proposed proposals for reaching common goals, wherein they finally reach Level 3 in their skills.

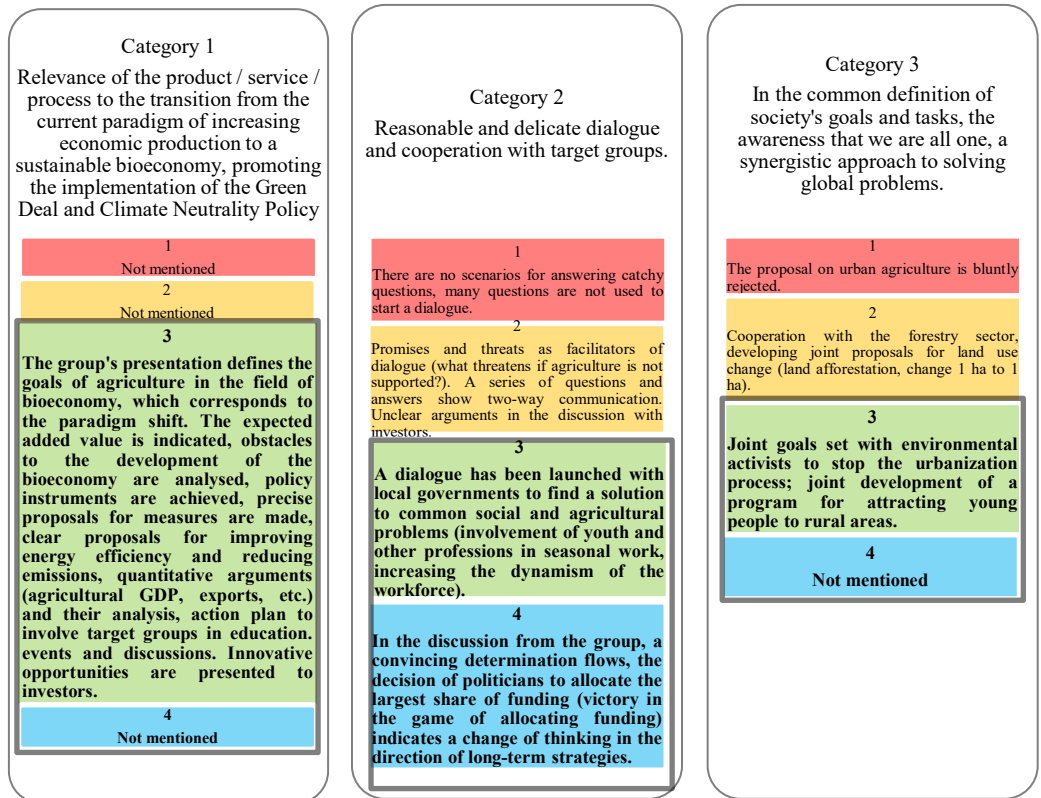


Fig. 3. Post-game performance level rubric for agricultural group.

Formative assessment achieves its objective; students know the areas that still need to be explored to acquire better competence in biodiplomacy. It was assessed that it is desirable to supplement the performance level rubric with didactic and methodological tasks that train students to delve into aspects of biodiplomacy competence, develop self-directed studies and increase competence.

4. CONCLUSIONS

The main conclusions of this case study are: (1) the goal of the role game was achieved – to distribute the funding for COVID-19 emergency recovery support, taking into account the objectives of the EU bioeconomy strategy and the impact of COVID-19 on the production and use of primary resources among the three main groups of bioresources: forestry, agriculture; fisheries and aquacultures; (2) taking into account the lessons learned, the ideas should be presented to the Cabinet of Ministers, local governments, various responsible institutions, etc.; (3) members of the agricultural group have acquired biodiplomacy competencies in the context of the bioeconomy, which characterise biodiplomats. The higher

the evaluation of the criteria in the category for the relevant competence, the more likely it is that the goals set by the Green Deal will be achieved.

Next steps: (1) together with the students, discuss the passages that show the performance of their biodiplomacy competence, compare what is shown in the passage with what is described in the performance section, draw conclusions, and make suggestions about what and how to speak, present, answer differently; (2) analyse various situations given by the lecturer with conflicts, problems, the solutions of which as action or dialogue scenarios students must invent and justify.

ACKNOWLEDGEMENT

This research is funded by the Latvian Council of Science, project Bioeconomy in the shade of Green Deal (BioDeal), project No. lzp-2020/2-0321.

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