

Project: 2021-1-RO01-KA220-HED-000032162  
“Green education for green Biotech Enterprise” GreenBE

## **R1 Critical assessment of the teaching and learning practices in Green Biotech Education**

### **Study 1. Assessment of professors’ responsible research and innovation practices in environmental biotechnology and entrepreneurship**

#### **1. Introduction**

To align the skills and knowledge of graduates with the needs of the market for green practices, for more entrepreneurial initiatives in the field of the green economy, it is necessary to understand the phenomena that currently shape the connection between the labour market and the university education system. Because the university budgets for carrying out such research are extremely limited, there is no updated information on the concrete practices and needs of teachers in the field of responsible teaching and research practices and on how the current university system corresponds to labour market changes.

The structural equation modelling (SEM) methodology will be used in this study to achieve the previously stated objective. There are several opinions regarding the definition and usefulness of the methodology. For example, SEM is a statistical research method widely used in many fields (Rigdon, 1998; Monecke & Leisch, 2012).

The method is recommended when establishing dependence relationships between various variables chosen by researchers, for example, in studies to evaluate the degree of consumer satisfaction, situations regarding the role of different factors in economic or social phenomena and processes, the attitude of individuals towards the use of new technologies, the adoption and application of new principles in the current activity, etc.

In another approach (Sarstedt et al., 2021), SEM is a very frequently used method for identifying factors or variables that influence a specific phenomenon or attitude, such as the level of consumer satisfaction in relation to the consumption of economic goods (products or services), the degree of loyalty of a company's customers (or the loyalty of its customers), the intentions to use a new product or service, the behaviour adopted by consumers in relation to the use of certain technologies or the consumption of economic goods, etc.

The study results will be analysed using descriptive statistics and structural equation modelling approaches to determine which factors influence entrepreneurial intent and ecological behaviour. To our knowledge, such studies have not yet been performed within the European context. In addition, the inclusion of Eastern-European countries in the samples could bring added value to the study by comparison with the Western European results.

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## 2. Purpose

The recent evolution of the economic, social, and geopolitical context created the premises for the initiation and continuation of heated discussions between various interested parties (experts, researchers, decision-makers, civil society, etc.) regarding sustainable development and the factors that influence or condition the process.

Only a short time ago, certain aspects related to sustainable development were less highlighted or somewhat left on the side-lines. We refer here to the significant impact of the biotechnology industry, with all its components, as well as entrepreneurial initiatives in this field, on all segments of human activity (especially those regarding energy security, food security or even the pace of economic development as a whole).

Regarding education, we want to pay special attention to higher education, which, at present, can play a decisive role in the implementation of 'green' principles on a large scale. From this perspective, we consider two aspects.

On the one hand, we are interested in finding out to what extent teachers (or educators, tutors, mentors) are willing to adopt and apply responsible and sustainable research and innovation practices in their work without neglecting the entrepreneurial side of the biotechnology sector, especially of the 'green' component referring to environmental biotechnology. Here we are thinking about the use of educational materials, including as much as possible the 'green' principles and aspects of economic and social development, alongside those of stimulating and promoting entrepreneurial activity and the teaching methods and techniques used in the current activity.

On the other hand, it is important to find out what are the levers and/or mechanisms by which the entrepreneurial intention of students/future graduates can be stimulated or motivated, with an emphasis on the ecological/environmental segment.

Green education is a widely addressed research topic, although with few concretes, observable approaches in Environmental Biotechnology and Entrepreneurship education. Besides, education for strategies of sustainable development is heavily based on policy recommendations and qualitative research on practitioners' perceptions.

To implement responsible research and innovation in higher education, both students and educators must become actors, activists, and innovators in addressing sustainability challenges.

To this end, we proposed **a quantitative assessment of professors' responsible research and innovation practices in environmental biotechnology and entrepreneurship.**

## 3. Methods

### 3.1. Conceptual and operational definition of research variables

The conceptual definition refers to how the questions are formulated, and the operational one highlights the answer options.

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**Figure. 1. Conceptual model**

The main variables of the study were measured as follows:

**Authority in the field:** It refers to some very clear aspects, namely the **level of knowledge** of EU regulations on environmental protection for companies in the biotech field, the degree of **involvement in research activities in sustainable bioeconomy** or related fields and the position held in these activities (project manager, attracting funds for research, or involvement in partnerships with the biotechnology industry). Also, the degree of involvement and the performances obtained in research activities in the fields of **circular economy / digital economy / entrepreneurship** (involvement in research teams as a project manager or as a team member, scientific works published, funds attracted for the implementation of activities, involvement in partnerships with the biotechnology industry).

**Institution authority:** Whether the **institution has** a technology transfer programme, start-up incubator or collaboration with start-up incubators, spinoffs, mentorship programmes, industry partnerships

**Professor intentions:** Willingness to **improve** knowledge on the subjects, willingness to integrate said knowledge into student courses/mentorship programmes/business ventures, start-ups, technology transfer programmes, start-up incubators/collaboration with start-up incubators, spinoffs.

### 3.2. Research objectives and hypotheses

**Given the proposed research model, research objectives were formulated as follows:**

- O1. To investigate professors' authority in the fields of circular economy/ digital economy/ entrepreneurship.
- O2. To investigate professors' attitudes towards responsible research and innovation practices.
- O3. To investigate professors' intentions to further integrate knowledge and expertise on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship into their future work.

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O4. To determine professors’ perceptions of their institutions’ authority regarding entrepreneurial practices and green entrepreneurship activities.

In defining the study hypotheses, we will start from the idea that "consumers' intention to integrate the practices in their own work" is a manifestation of the continuity of the decision to adopt responsible research and innovation practices. The adoption of a certain behaviour can result either in continuity, when the individual continues to perform it or in discontinuity, when the individual gives up performing the behaviour in question.

Within the present model, individuals' decisions to continue using green practices will be determined by their stated behavioural intention. Intention research allows the simultaneous investigation of the influences of several explanatory variables on the stated behavioural intention.

Given the empirical evidence, we postulate the main hypotheses of the study:

H1. Most professors/researchers are knowledgeable of the national and EU regulations on environmental protection research, production, and commercial activities in the biotech field.

H2. Most professors are involved in research on topics related to sustainable bioeconomy (published papers, obtaining funds, project’s PI, partnerships with industry...).

H3. Most of the professors in life sciences and economics are involved in teaching topics related to sustainable bioeconomy.

H4. Most of the professors in life sciences and economics are involved in teaching topics related to the circular economy/ digital economy/ entrepreneurship.

H5. Most of the professors in life sciences and economics consider that responsible research and innovation practices are important for professors.

H6. Most of the professors in life sciences and economics consider that responsible research and innovation practices make sense in world development.

H7. Most of the professors in life sciences and economics appreciate that responsible research and innovation practices are beneficial to mankind.

H8. Most of the professors in life sciences and economics wish to improve their knowledge on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship

H9. Most of the professors in life sciences and economics wish to integrate their knowledge and expertise on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship into student courses.

H10. Most of the professors in life sciences and economics wish to integrate their knowledge and expertise on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship into a mentorship programme.

H11. Most of the professors in life sciences and economics would integrate their knowledge and expertise on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship into a business venture.

H12. Most of the professors in life sciences and economics would integrate their knowledge and expertise on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship into a technology transfer programme.

H13. Most of the professors have published between 1 and 5 articles on the topics of either circular economy/ digital economy/ entrepreneurship throughout their careers.

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H14. Most of the professors in life sciences and economics read between 1-5 articles in the field of circular economy monthly.

H15. Most of the professors in life sciences and economics have not published any patent applications in the last 10 years in the area (sustainable bioeconomy/ circular economy/ green entrepreneurship).

H16. Most of the professors in life sciences and economics have participated in at least one conference related to circular economy or bioeconomy in the past 5 years.

H17. Most of the professors in life sciences and economics have attended at least one course related to the fields of sustainable biotechnology or sustainable economy throughout their careers.

H18. Most of the professors in life sciences and economics have taught between 1-2 courses related to the fields of sustainable biotechnology or sustainable economy throughout their careers.

H19. Most of the professors in life sciences and economics are not members of any board active in the area of circular economy or sustainable biotechnology.

H20. Most of the professors in life sciences and economics have never had a start-up or the intention to create a start-up.

H21. The most prominent indicators of institutional authority in the field of entrepreneurship are industry partnerships, start-up incubators and collaborations with start-up incubators.

H22. For a good correlation between the academic environment and the labour market, the most appreciated entrepreneurial institutional activities are technology transfer programmes, mentorship programmes and industry partnerships.

### **3.3. Determination of sample size and structure**

The sample size was established according to the project proposal at a minimum number of  $n=100$  professors from the fields of life sciences and economics from partner universities and from others that have joined during the implementation period.

### **3.4. Questionnaire design**

The questionnaire was designed according to the funnel principle; the questions addressed moving from general to specific and composed of 56 questions, one of them being a filter question, 13 closed, one open, 13 questions measured on a Likert scale and one semantic differential scale-type question. The questionnaire contains 4 socio-demographic questions aimed at identifying the surveyed segments. The questionnaire template is attached in Annex 1. In addition, the questionnaire was presented to the UPV "Ethics in Research Committee" meeting, on May 25, 2022, and have been approved by the Committee.

## **4. Results and Discussion**

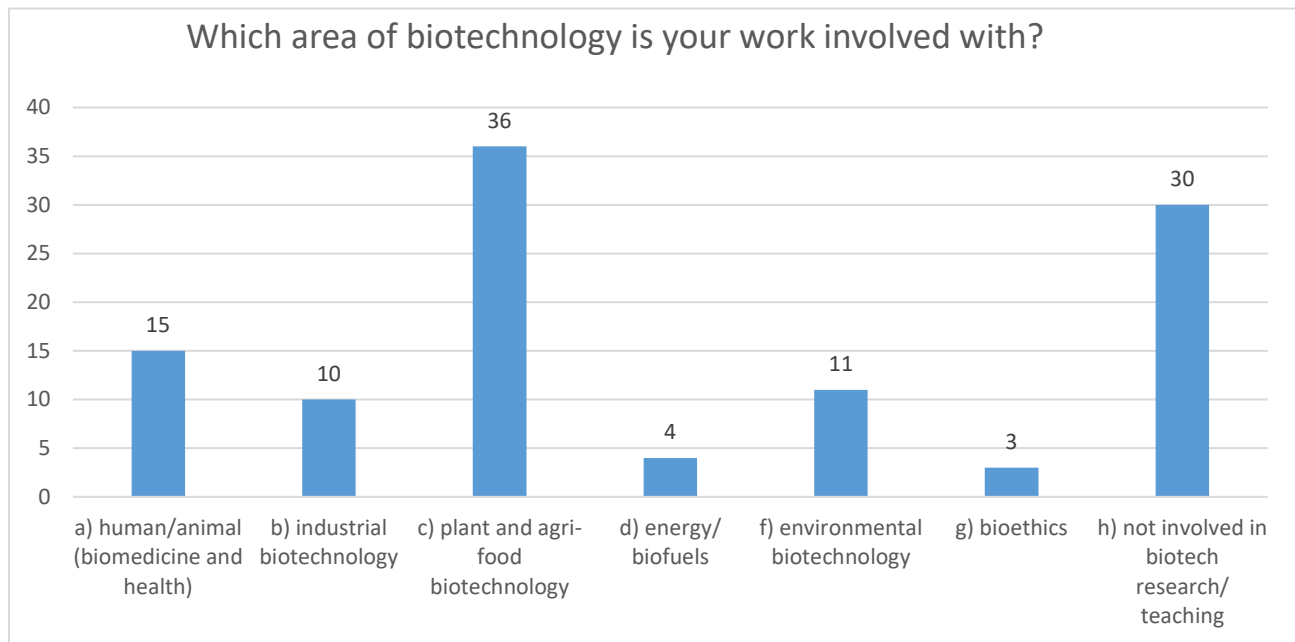
Initially, the sample considered was a minimum of 100 respondents (professors). However, this number was exceeded, with 109 completed questionnaires from professors who answered “Yes” on the filter question “Do you teach or are you involved in research in the fields of biotechnology/ entrepreneurship/ environmental sciences?”.

During the reporting period, responses to questions on study variables were analysed, comparing the frequencies of responses to each question. Next, the study results and the conclusions of the

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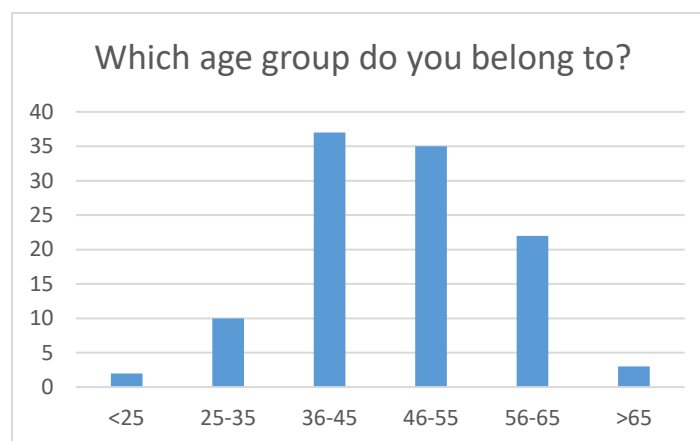
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quantitative research are presented in two parts, the first containing the presentation of the respondents’ characteristics and the second dedicated to the study of the researched variables.



**Figure 2. Q2**

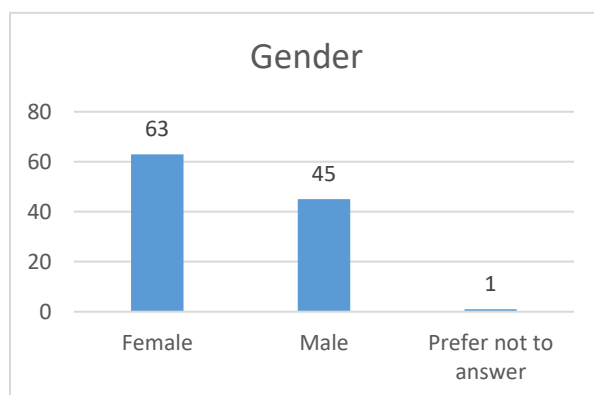
Most professors belong to the plant and agri-food biotechnology area, economics, followed by biomedicine and health, and environmental biotechnology.



**Figure 3. Q3**

As can be observed in Table 2, Appendix 2 and Figure. 3, the majority of respondents are between 36 and 55 years old, which is relevant for the investigated community.

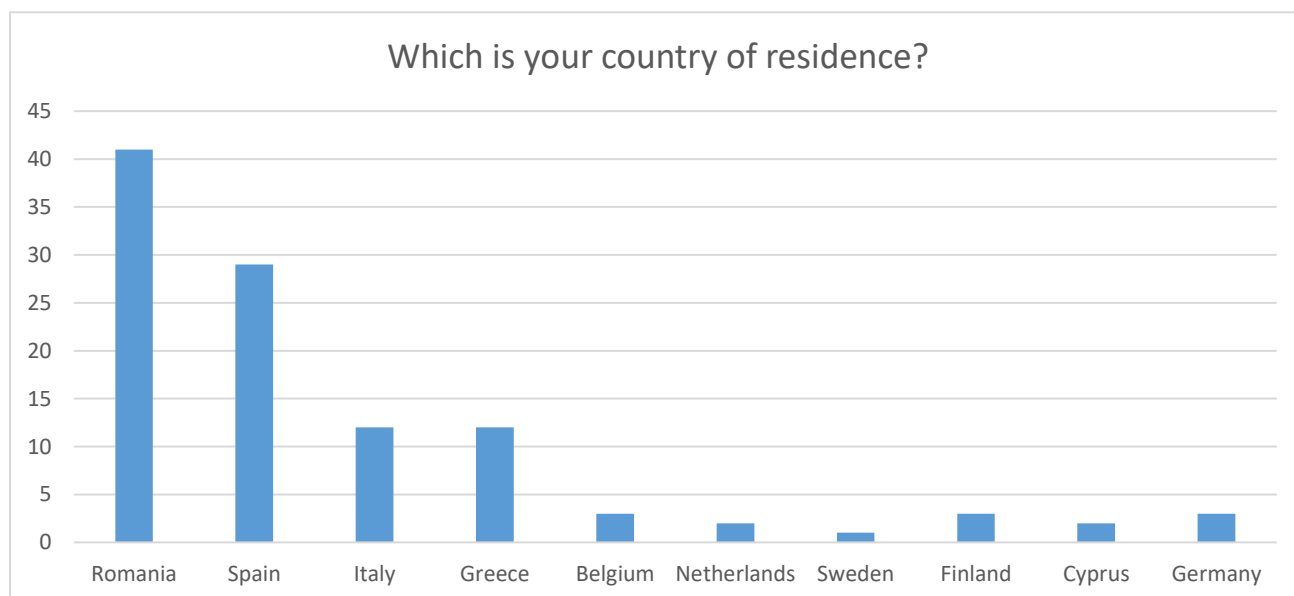
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**Figure 4. Q4**

The final results indicate the presence of respondents in all categories, but the majority of respondents are female.

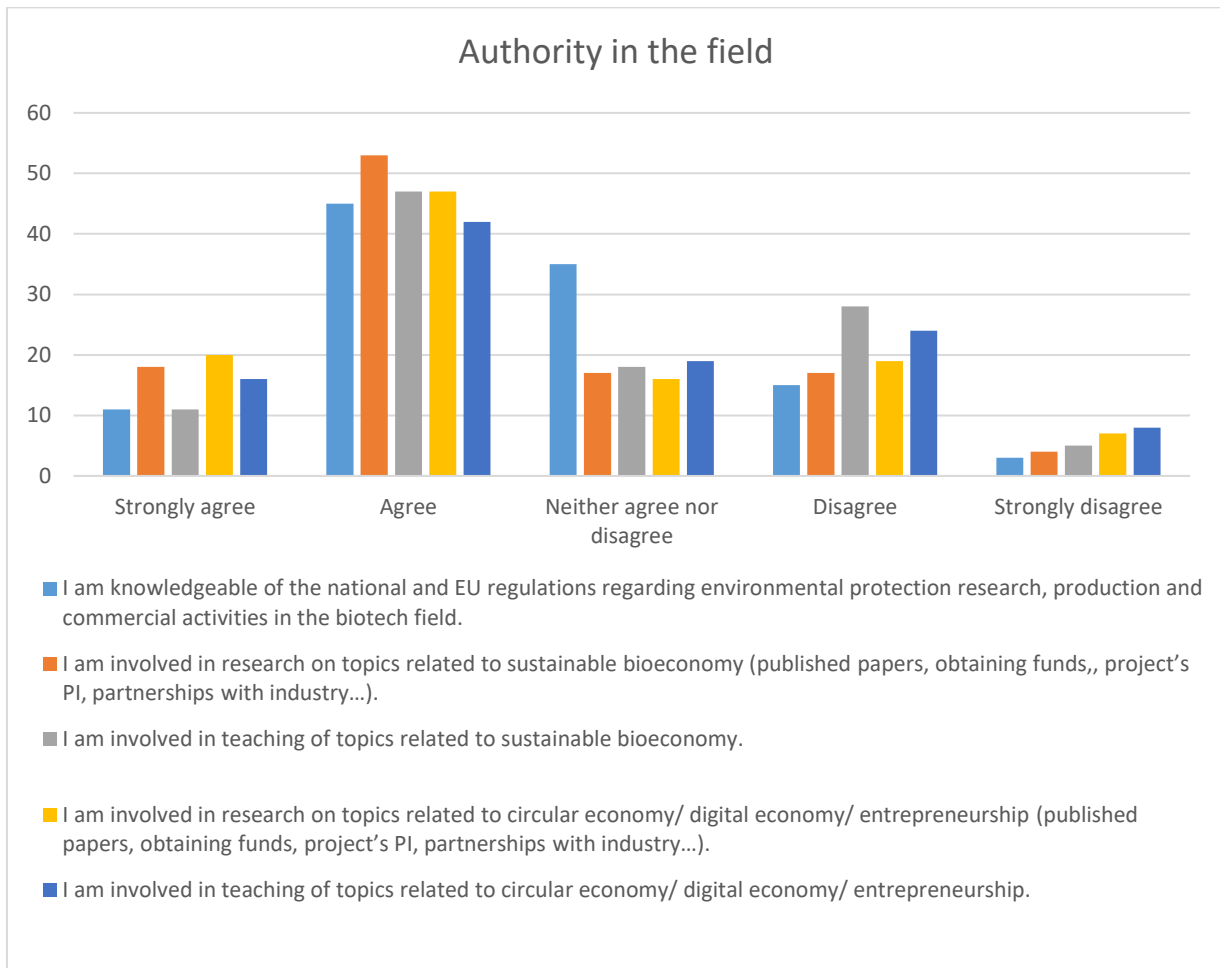
This aspect result is natural, due to the profile of most investigated teachers.



**Figure 5. Q5**

The distribution of subjects by country of residence is in the majority from Romania and Spain, followed by Italy and Greece.

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**Figure 6. Authority in the field**

The results indicate that professors almost unanimously believe that they are somewhat knowledgeable of the national and EU regulations regarding environmental protection research, production, and commercial activities in the biotech field, with a positive weighted average score that leads to agreement.

Most subjects positively assert being involved in research on topics related to sustainable bioeconomy (published papers, obtaining funds, project’s PI, partnerships with industry...).

The lowest score registered for the investigated variable, with a weighted average of 3.21, is registered for professors’ involvement in teaching topics related to sustainable bioeconomy. However, this appreciation is also positive.

An investigation on a larger sample might reveal a more accurate appreciation.

Most respondents positively value their involvement in research on topics related to circular economy/ digital economy/ entrepreneurship (weighted average of 3.5).

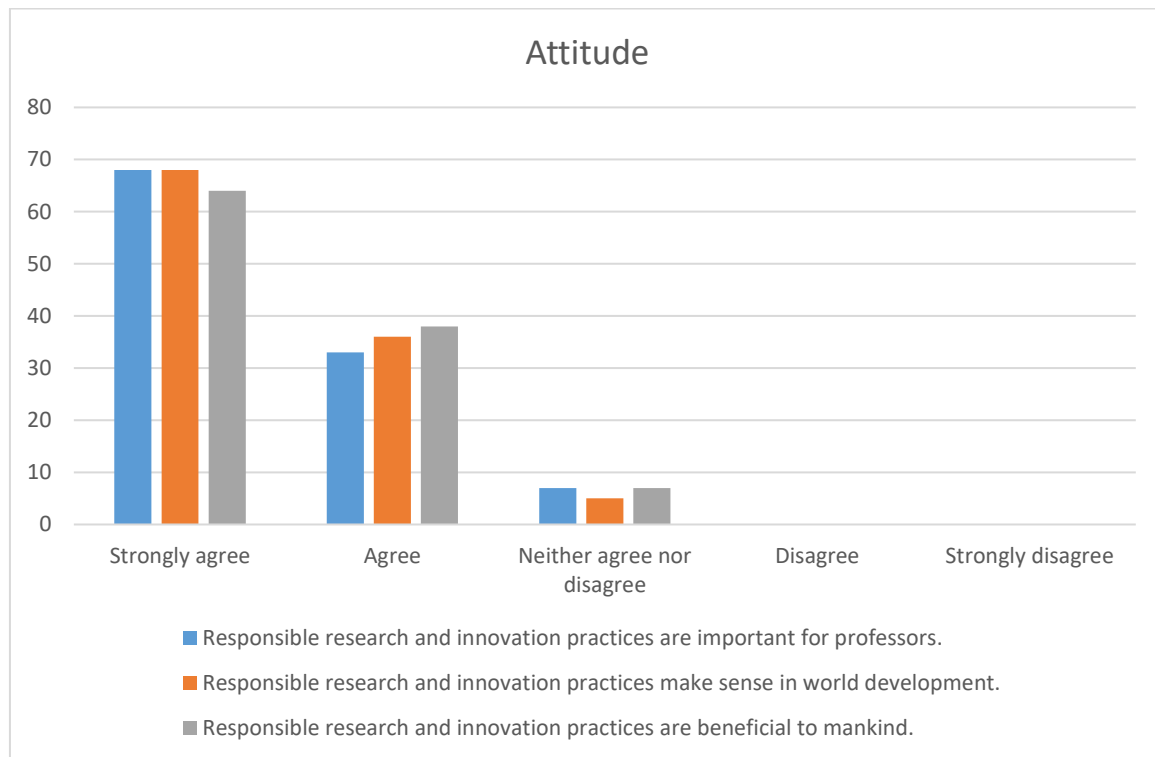


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Most professors also positively appreciate their involvement in teaching topics related to circular economy/ digital economy/ entrepreneurship.

The perception of the attitude towards responsible research and innovation practices was measured using a Likert scale, with three statements presented in Table 6, Appendix 2.



**Figure 7. Attitude**

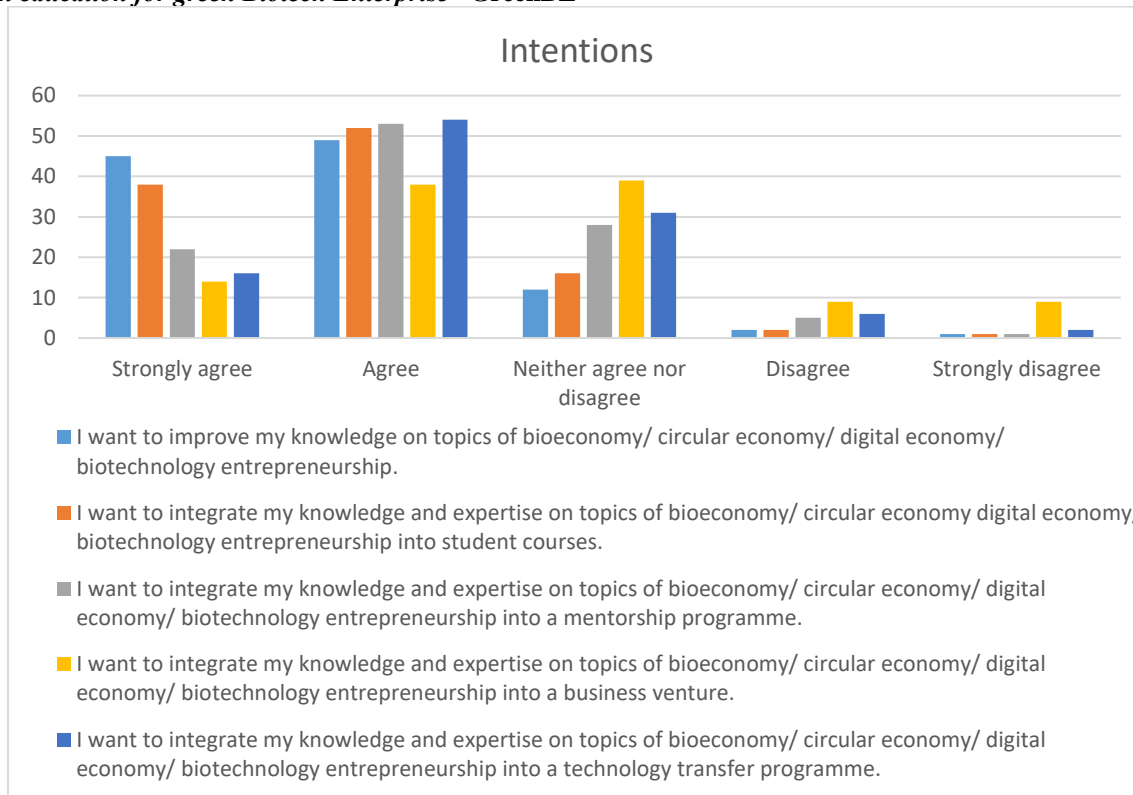
For the importance of responsible research and innovation practices for professors, at a weighted average of 4.52, results tend towards total agreement.

For the relevance of responsible research and innovation techniques in world development, at a weighted average of 4.57, results tend towards total agreement.

For the perception that responsible research and innovation techniques are beneficial to mankind, results lean towards total agreement, at a weighted average of 4.52. It is thus safe to assert that professors manifest a highly positive attitude towards responsible research and innovation practices.

Intentions were measured using 5 items on a 5-point Likert scale, measuring willingness to improve knowledge on the topic, willingness to integrate knowledge into student courses, willingness to integrate knowledge into a mentorship programme, willingness to integrate knowledge into a business venture and willingness to integrate knowledge into a technology transfer programme. The results of the intentions investigation are presented in Table 7, Appendix 2 and Figure. 8.

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**Figure 8. Intentions**

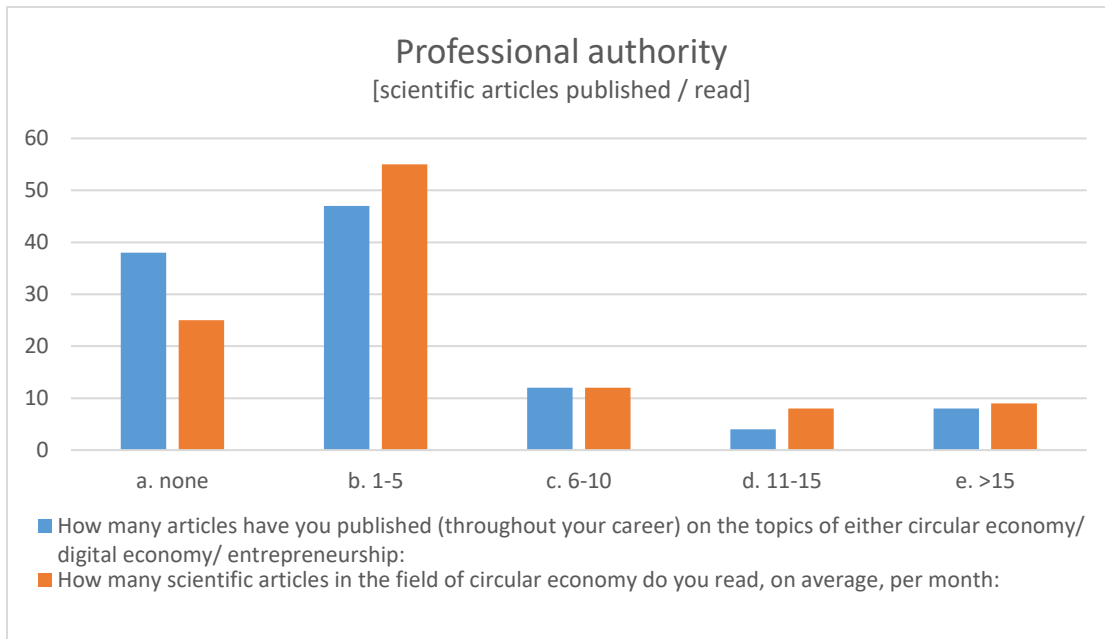
The highest weighted average of the five items measuring intentions is registered by willingness to improve knowledge on the topics (4.24), and the lowest value is registered by the intention to integrate knowledge into a business venture (3.36), although the intention measure remains positive, slightly surpassing the neutral threshold.

Willingness to integrate the acquired knowledge into student courses registers a high score, slightly surpassing agreement (4.14), while willingness to integrate the acquired knowledge into a mentorship programme (3.83) is positively appreciated, tending towards agreement.

Willingness to integrate the acquired knowledge into a mentorship programme is also positively appreciated (at a weighted average of 3.70), tending towards agreement.

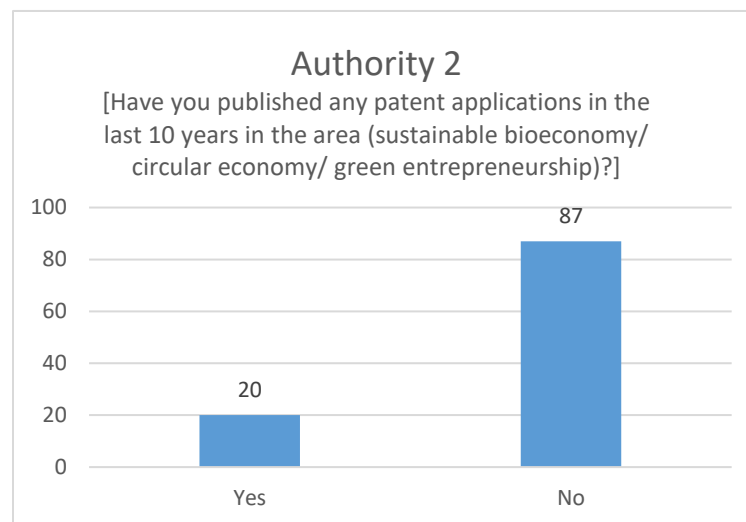
**Professors’ authority in green practices in education and entrepreneurship was measured using 8 items with closed answers, and the results are presented below.**

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**Figure 9. Professional authority**

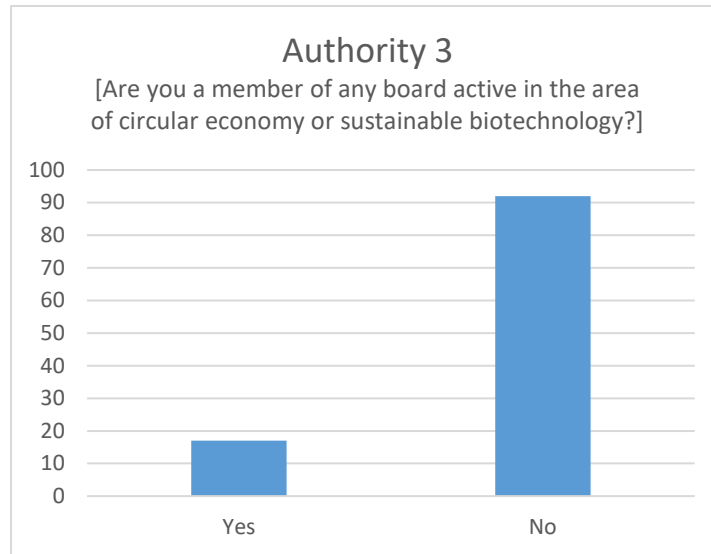
Most respondents have published between 1 and 5 articles on the topics of either circular economy/ digital economy/ entrepreneurship and read between 1 and 5 articles monthly on the same topics.



**Figure 10. Authority 2**

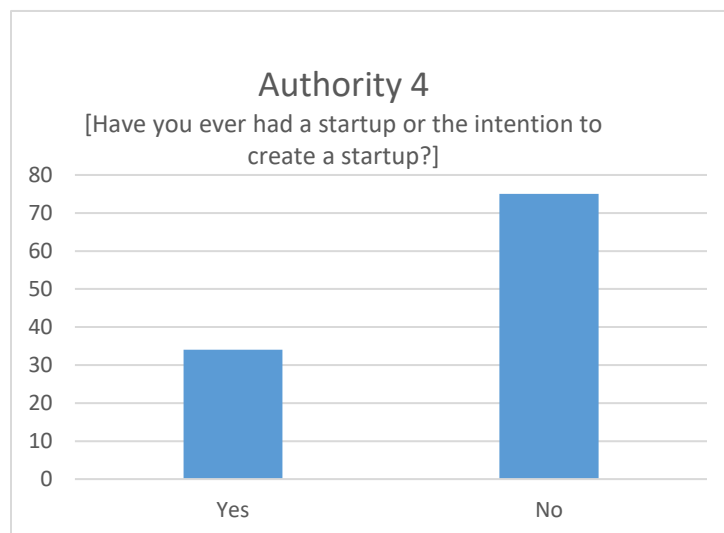
The majority of life sciences and economics professors have not published any patent applications in the area (sustainable bioeconomy/ circular economy/ green entrepreneurship) in the last 10 years.

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**Figure 11. Authority 3**

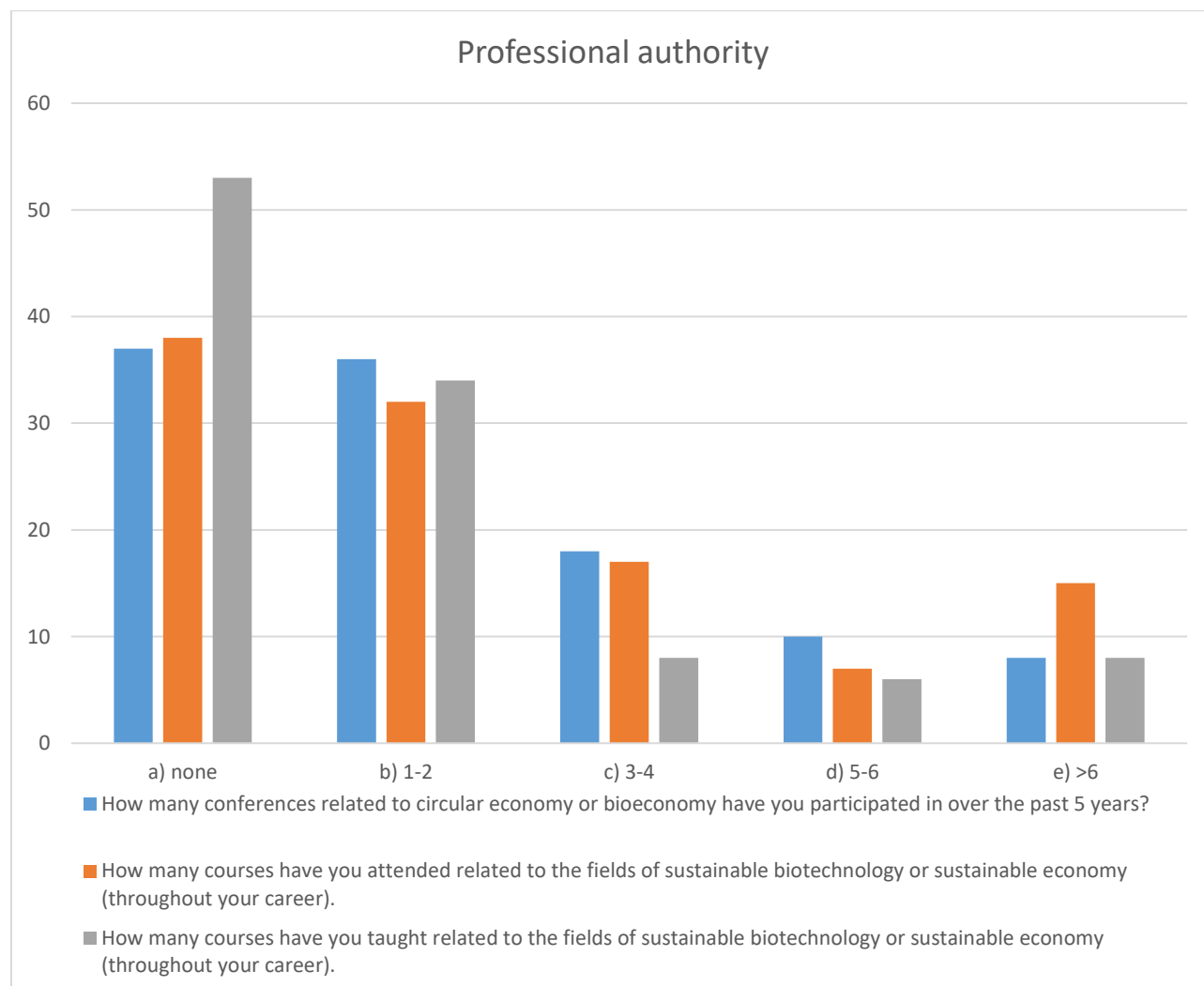
Most of the investigated subjects are not members of boards active in the area of circular economy or sustainable biotechnology.



**Figure 12. Authority 4**

Per the answers to item 26, only 31.19% of subjects have ever had a start-up or the intention to create a start-up.

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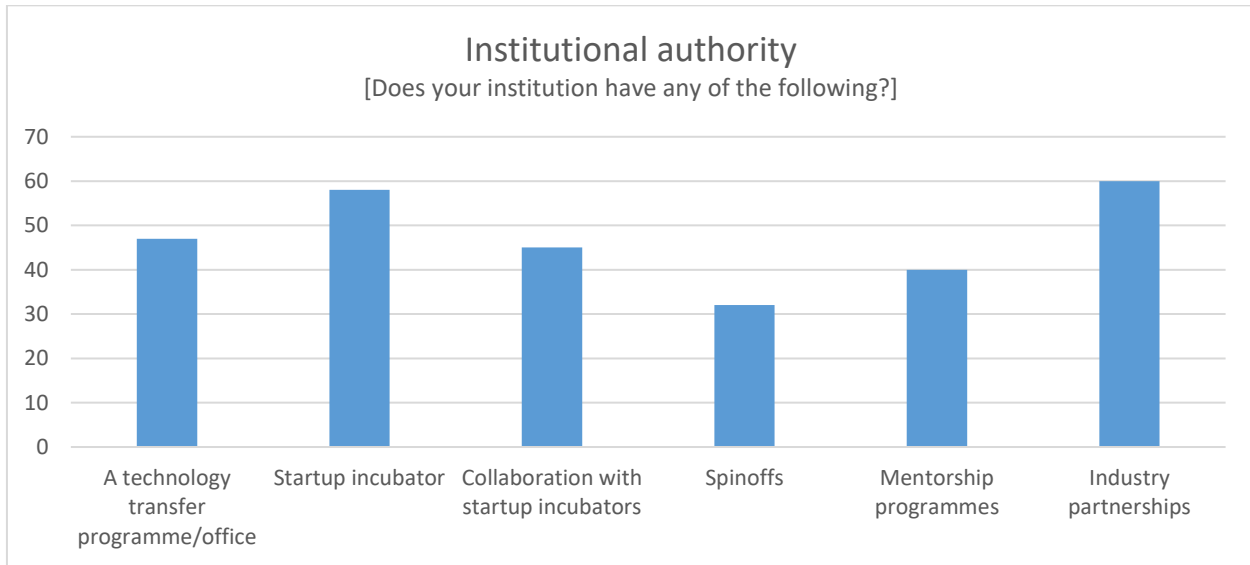


**Figure 13. Authority 5**

The highest score for this group of items (Table, Appendix 2 12 and Figure.12) is registered for courses taught related to the fields of sustainable biotechnology or sustainable economy (throughout one’s career), at a weighted average of 4.08, followed by participation in conferences related to circular economy or bio economy (3.77).

The lowest score is registered for courses attended in the field (3.65).

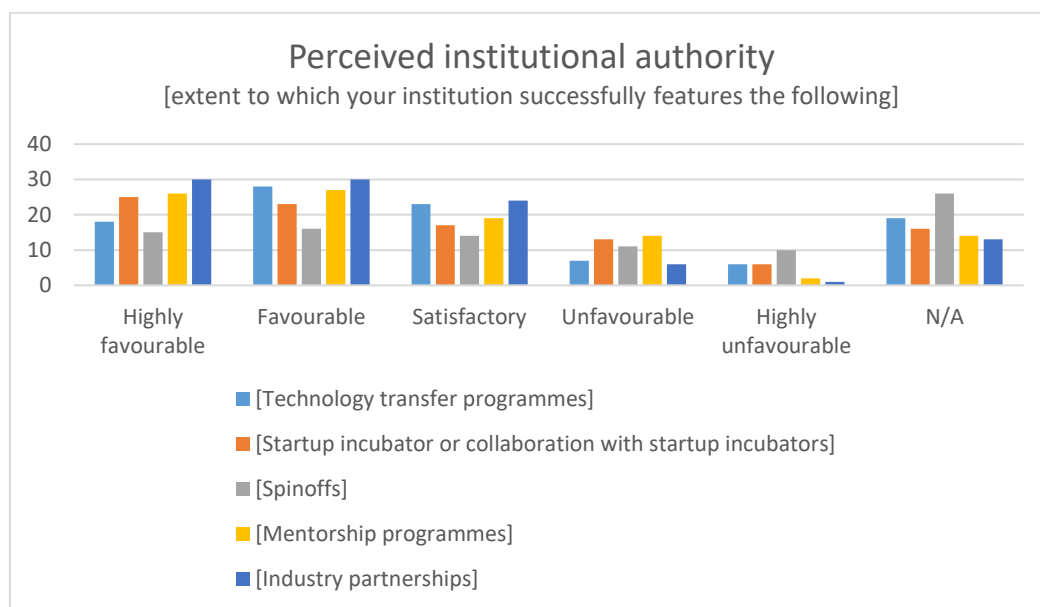
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**Figure 14. Institutional authority**

Most institutions feature industry partnerships (55.04%), followed by start-up incubators (53.21%), technology transfer programmes/offices (43.11%), collaborations with start-up incubators (41.28%), mentorship programmes (36.69%) and spinoffs (29.35%).

Professors’ perceptions of their institution’s authority in green entrepreneurship were measured on a semantic differential scale, as presented in Table, Appendix 2 14 and Figure.14.



**Figure 15. Perceived institutional authority**

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The lowest scores were registered by spinoffs (1.95), followed by technology transfer programmes (2.67). Start-up incubators or collaborations with start-up incubators registered a score of 2.75, while mentorship programmes had a score of 2.98, tending towards a satisfactory appreciation.

The highest score registered concerns industry partnerships (3.26).

## 5. Conclusion

Most of the hypotheses are confirmed, with three of them (H4, H11, H22) partially confirmed, as can be seen in Table 15.

Table 15. Hypotheses confirmation

Hypotheses	Confirmed Y/N
H1. Most professors/researchers are knowledgeable of the national and EU regulations regarding environmental protection research, production, and commercial activities in the biotech field.	Yes
H2. Most professors are involved in research on topics related to sustainable bioeconomy (published papers, obtaining funds, project’s PI, partnerships with industry...).	Yes
H3. Most of the professors in life sciences and economics are involved in teaching topics related to sustainable bioeconomy.	Yes
H4. Most of the professors in life sciences and economics are involved in teaching topics related to circular economy/ digital economy/ entrepreneurship.	Partially
H5. Most of the professors in life sciences and economics consider that responsible research and innovation practices are important for professors.	Yes
H6. Most of the professors in life sciences and economics consider that responsible research and innovation practices make sense in world development.	Yes
H7. Most of the professors in life sciences and economics appreciate that responsible research and innovation practices are beneficial to mankind.	Yes
H8. Most of the professors in life sciences and economics wish to improve their knowledge on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship	Yes
H9. Most of the professors in life sciences and economics wish to integrate their knowledge and expertise on topics of bioeconomy/ circular economy digital economy/ biotechnology entrepreneurship into student courses.	Yes
H10. Most of the professors in life sciences and economics wish to integrate their knowledge and expertise on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship into a mentorship programme.	Yes
H11. Most of the professors in life sciences and economics would integrate their knowledge and expertise on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship into a business venture.	Partially
H12. Most of the professors in life sciences and economics would integrate their knowledge and expertise on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship into a technology transfer programme.	Yes
H13. Most of the professors have published between 1 and 5 articles on the topics of either circular economy/ digital economy/ entrepreneurship throughout their careers.	Yes
H14. Most of the professors in life sciences and economics read between 1-5 articles in the field of circular economy monthly.	Yes

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H15. Most of the professors in life sciences and economics <b>have not published</b> any patent applications in the last 10 years in the area (sustainable bioeconomy/ circular economy/ green entrepreneurship).	Yes
H16. Most of the professors in life sciences and economics have participated in at least one conference related to circular economy or bioeconomy in the past 5 years.	Yes
H17. Most of the professors in life sciences and economics have attended at least one course related to the fields of sustainable biotechnology or sustainable economy throughout their careers.	Yes
H18. Most of the professors in life sciences and economics have taught between 1-2 courses related to the fields of sustainable biotechnology or sustainable economy throughout their careers.	Yes
H19. Most of the professors in life sciences and economics <b>are not</b> members of any board active in the area of circular economy or sustainable biotechnology.	Yes
H20. Most of the professors in life sciences and economics <b>have never</b> had a start-up or the intention to create a start-up.	Yes
H21. The most prominent indicators of institutional authority in the field of entrepreneurship are <u>industry partnerships, start-up incubators and collaborations with start-up incubators.</u>	Yes
H22. For a good correlation between the academic environment and the labour market, the most appreciated entrepreneurial institutional activities are technology transfer programmes, mentorship programmes and industry partnerships.	Partially

For H4, “Most of the professors in life sciences and economics are involved in teaching topics related to circular economy/ digital economy/ entrepreneurship”, the registered average (3.28), although it leads towards a positive appreciation, the score fits the “Neither agree nor disagree” category. To either confirm or reject this hypothesis, a larger sample is needed. The same goes for H11 “Most of the professors in life sciences and economics would integrate their knowledge and expertise on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship into a business venture”, with a score of 3.36.

For H22, “For a good correlation between the academic environment and the labour market, the most appreciated entrepreneurial institutional activities are technology transfer programmes, mentorship programmes and industry partnerships”, the highest scores were obtained for industry partnerships, mentorship programmes and start-up incubators or collaboration with start-up incubators, in this exact order. Technology transfer programmes occupy the fourth place for this restricted sample.



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### **Appendix 1. Questionnaire - Assessment of professors’ responsible research and innovation practices in environmental biotechnology and entrepreneurship**

This page provides you with information about the processing and protection of your personal data in Erasmus+ Project **GreenBE** (Green Education for Green Biotech Enterprise).

The result intended for this project activity is a **critical assessment of the teaching and learning practices in Green Biotech Education**. The target respondents for this particular survey are Life Sciences/Biotech professors/researchers. The aim of this survey is to provide assessment of professors' practices for responsible research and innovation inputs in Biotech Green Entrepreneurial education.

The results should provide a clearer view of which factors foster ecological behaviour and green entrepreneurial intention and how the results of professors' responsible research and innovation practices can be integrated into student courses, mentorship programmes, and existing business ventures. Our conclusions will be provided for the HEIs partners’ top management recommendations to be inserted into their strategies and further green action plans.

The results of the present study will also help us deliver the following:

- Innovative educational resources (new module course, training materials, mentoring guide, teaching/learning digital portal) for Master and PhD students in Biotech & Economics covering the topic of Biotech Green start-ups/enterprises.
- Develop specific knowledge and competences in Biotech Green Entrepreneurship by direct training of 55 teachers/tutors and 25 Master and PhD students from the Biotech & Economics areas.
- Strengthen the integration of the project’s partners into the national and European Biotech Green Entrepreneurial Ecosystem.

If you’re here, then you are at least thinking about completing this survey. The survey is relatively short—it takes a maximum of 10 minutes to complete; **your answers are anonymous and will only be used for statistical purposes**.

**Important note:** When answering the questions, do not over-think the answer. Go with your first impression. There’s no right or wrong answer to anything in this survey. And please be sure to actually select an answer for each question!

Thanks for taking this survey!  
The GreenBE Team

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Please check the following box if you agree to proceed with the survey:

*I have read this page and agree to proceed with the survey.*



1. Do you teach or are you involved in research in the fields of biotechnology/entrepreneurship/environmental sciences?

Yes    No

2. Which area of biotechnology is your work involved with:

**a)** human/animal (biomedicine and health)

**b)** industrial biotechnology

**c)** plant and agri-food biotechnology

**d)** energy/biofuels

**f)** environmental biotechnology

**g)** bioethics

**h)** not involved in biotech research/teaching

3. Which age group do you belong to?    <25    25-35    36-45    46-55    56-65    >65

4. Gender:

Male    Female    Prefer not to answer

5. Which is your country of residence?

\_\_\_\_\_

**Please check the extent to which you agree with the following assertions:**

**(Authority in the field)**

6. I am knowledgeable of the national and EU regulations regarding environmental protection research, production, and commercial activities in the biotech field.

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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7. I am involved in research on topics related to sustainable bioeconomy (published papers, obtaining funds, project’s PI, partnerships with industry...).

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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8. I am involved in **teaching** of topics related to sustainable bioeconomy.

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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9. I am involved in research on topics related to circular economy/ digital economy/ entrepreneurship (published papers, obtaining funds, project’s PI, partnerships with industry...).

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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10. I am involved in **teaching** of topics related to circular economy/ digital economy/ entrepreneurship.

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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**(Attitude)**

11. Responsible research and innovation practices **are important** for professors.

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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12. Responsible research and innovation practices **make sense** in world development.

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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13. Responsible research and innovation practices **are beneficial** to mankind.

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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**(Intentions)**

14. **I want to improve** my knowledge on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship.

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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15. **I want to integrate** my knowledge and expertise on topics of bioeconomy/ circular economy digital economy/ biotechnology entrepreneurship into **student courses**.

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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16. **I want to integrate** my knowledge and expertise on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship into a **mentorship programme**.

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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17. **I want to** integrate my knowledge and expertise on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship into a **business venture**.

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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18. **I want to** integrate my knowledge and expertise on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship into a **technology transfer programme**.

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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19. How many articles have you published (throughout your career) on the topics of either circular economy/ digital economy/ entrepreneurship:

a). none b). 1-5 c). 6-10 d).10-15 e). >15

20. How many scientific articles in the field of circular economy do you read, on average, per month:

a. none b.1-5 c.6-10 d.11-15 e. >15

21. Have you published any patent applications in the last 10 years in the area (sustainable bioeconomy/ circular economy/green entrepreneurship)?

Yes No

22. How many conferences related to circular economy or bioeconomy have you participated in over the past 5 years?

a). none b). 1-2 c). 3-4 d). 5-6 e). >6

23. How many courses have you attended related to the fields of sustainable biotechnology or sustainable economy (throughout your career).

a). none b). 1-2 c). 3-4 d). 5-6 e). >6

24. How many courses have you taught related to the fields of sustainable biotechnology or sustainable economy (throughout your career).

a). none b). 1-2 c). 3-4 d). 5-6 e). >6

25. Are you a member of any board active in the area of circular economy or sustainable biotechnology?

Yes NO

26. Have you ever had a start-up or the intention to create a start-up?

Yes NO

27. Does your institution have any of the following (multiple answers):

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- a technology transfer programme/office
- start-up incubator
- collaboration with start-up incubators
- Spinoffs
- Mentorship programmes
- Industry partnerships

(Perceived institutional authority)

28. Please indicate your opinion on the extent to which your institution successfully features the following:

<b>Opinion</b>	<b>Highly favourable 5</b>	<b>Favourable 4</b>	<b>Satisfactory 3</b>	<b>Unfavourable 2</b>	<b>Highly unfavourable 1</b>	<b>N/A</b>
• Technology transfer programmes						
• Start-up incubator or collaboration with start-up incubators						
• Spinoffs						
• Mentorship programmes						
• Industry partnerships						

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**Appendix 2. Tables**

**Table 1. Q2**

Which area of biotechnology is your work involved with	Count
a) human/animal (biomedicine and health)	15
b) industrial biotechnology	10
c) plant and agri-food biotechnology	36
d) energy/ biofuels	4
f) environmental biotechnology	11
g) bioethics	3
h) not involved in biotech research/ teaching	30

**Table 2. Q3**

3. Which age group do you belong to?	Count
<25	2
25-35	10
36-45	37
46-55	35
56-65	22
>65	3

**Table 3. Q4**

Gender	Count
Female	63
Male	45
Prefer not to answer	1

**Table 4. Q5**

5. Which is your country of residence?	Count
Romania	41
Spain	29
Italy	12
Greece	12
Belgium	3
Netherlands	2
Sweden	1
Finland	3
Cyprus	2
Germany	3

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**Table 5. Authority in the field**

Indicate your level of agreement	I am knowledgeable of the national and EU regulations regarding environmental protection research, production, and commercial activities in the biotech field	I am involved in research on topics related to sustainable bioeconomy (published papers, obtaining funds, project' s PI, partnerships with industry...)	I am involved in teaching of topics related to sustainable bioeconomy	I am involved in research on topics related to circular economy/ digital economy/ entrepreneurship	I am involved in teaching of topics related to circular economy/ digital economy/ entrepreneurship
Strongly agree	11	18	11	20	16
Agree	45	53	47	47	42
Neither agree nor disagree	35	17	18	16	19
Disagree	15	17	28	19	24
Strongly disagree	3	4	5	7	8

**Table 6. Attitude**

Indicate your level of agreement	Responsible research and innovation practices are important for professors.	Responsible research and innovation practices make sense in world development.	Responsible research and innovation practices are beneficial to mankind.
Strongly agree	68	68	64
Agree	33	36	38
Neither agree nor disagree	7	5	7
Disagree	0	0	0
Strongly disagree	0	0	0

**Table 7. Intentions**

Indicate your level of agreement	I want to improve my knowledge on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship.	I want to integrate my knowledge and expertise on topics of bioeconomy/ circular economy digital economy/ biotechnology entrepreneurship into student courses.	I want to integrate my knowledge and expertise on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship into a mentorship programme.	I want to integrate my knowledge and expertise on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship into a business venture.	I want to integrate my knowledge and expertise on topics of bioeconomy/ circular economy/ digital economy/ biotechnology entrepreneurship into a technology transfer programme.
Strongly agree	45	38	22	14	16
Agree	49	52	53	38	54
Neither agree nor disagree	12	16	28	39	31
Disagree	2	2	5	9	6
Strongly disagree	1	1	1	9	2

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**Table 8. Professional authority**

Intervals	How many articles have you published (throughout your career) on the topics of either circular economy/ digital economy/ entrepreneurship:	How many scientific articles in the field of circular economy do you read, on average, per month:
a. none	38	25
b. 1-5	47	55
c. 6-10	12	12
d. 11-15	4	8
e. >15	8	9

**Table 9. Authority 2**

Answer	Have you published any patent applications in the last 10 years in the area (sustainable bioeconomy/ circular economy/ green entrepreneurship)?
Yes	20
No	87

**Table 10. Authority 3**

Answer	Are you a member of any board active in the area of circular economy or sustainable biotechnology?
Yes	17
No	92

**Table 11. Authority 4**

Answer	Have you ever had a start-up or the intention to create a start-up?	%
Yes	34	31.19
No	75	68.8

**Table 12. Authority 5**

Interval	How many conferences related to circular economy or bioeconomy have you participated in over the past 5 years?	How many courses have you attended related to the fields of sustainable biotechnology or sustainable economy (throughout your career).	How many courses have you taught related to the fields of sustainable biotechnology or sustainable economy (throughout your career).
a) none	37	38	53
b) 1-2	36	32	34
c) 3-4	18	17	8
d) 5-6	10	7	6
e) >6	8	15	8



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**Table 13. Institutional authority**

Does your institution have any of the following	Count
A technology transfer programme/office	47
Start-up incubator	58
Collaboration with start-up incubators	45
Spinoffs	32
Mentorship programmes	40
Industry partnerships	60

**Table 14. Perceived institutional authority**

Extent to which your institution successfully features the following	[Technology transfer programmes]	[Start-up incubator or collaboration with start-up incubators]	[Spinoffs]	[Mentorship programmes]	[Industry partnerships]	Scale	[Technology transfer programmes]	[Start-up incubator or collaboration with start-up incubators]	[Spinoffs]	[Mentorship programmes]	[Industry partnerships]
Highly favourable	18	25	15	26	30	5	90	125	75	130	150
Favourable	28	23	16	27	30	4	112	92	64	108	120
Satisfactory	23	17	14	19	24	3	69	51	42	57	72
Unfavourable	7	13	11	14	6	2	14	26	22	28	12
Highly unfavourable	6	6	10	2	1	1	6	6	10	2	1
N/A	19	16	26	14	13	0	0	0	0	0	0
<b>Total</b>	<b>109</b>	<b>109</b>	<b>109</b>	<b>109</b>	<b>109</b>	<b>W. ave</b>	<b>2.67</b>	<b>2.75</b>	<b>1.95</b>	<b>2.98</b>	<b>3.26</b>