Deliverable 4.1. Results from the dynamic workshop fostering dialogue organization

Acronym:	**UrBIOfuture**
Project title:	**Boosting future careers, education and research activities in the European bio-based industry**
Contract Nº:	**837811**
Start date:	**01/05/2019**
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1. Executive Summary

The UrBIOfuture project main goal is to bring Europe to the forefront of the bio-based sector by:

1) identifying education needs and gaps in Europe's bio-based sector,
2) pointing to career opportunities in research,
3) involving all stakeholders in a co-creation process that will deliver the "UrBIOfuture experience" as a pivotal tool for attracting talent and providing professional orientation.

The "UrBIOfuture experience" is conceived as a journey, a progress or passage that will allow the European industry to move forward and to reach the level of excellence that new bioproducts and processes demand in such competitive sector. In order to achieve such goal, a group of materials, events and an educational programme draft will be produced. It is expected that such an output will allow the European society to advance, decreasing skills mismatch, attracting new talent and unlocking its potential.

The present document summarises the activities developed in order to organize the UrBIOfuture Dynamic Workshop (DW), one of the key project events for fostering collaborative academia-industry dialogue, validating preliminary results, and obtaining high valued feedback from the bioeconomy experts gathered by the project.

As part of the preliminary work for the event preparation, the process of creation of the UrBIOfuture Working Group (a European expert consultancy group actively involved in all the project activities, among them the DW) is detailed as the preparatory event activity.

The DW main aim has been to establish links between participants (consortium members and UrBIOfuture Working Group representatives) and creating a debate dynamic in order to retrieve information from both opportunities and gaps from the industry and the academia to boost future careers, education and research activities in the European bio-based industry.

Thus, this deliverable aims to describe the work done in order to set the UrBIOfuture Working Group and achieve the main goals of the UrBIOfuture Dynamic Workshop set in the project proposal, as well as its main results.

Just to provide a representative result obtained, here you go a sample: *"…Bio-based economy profiles of the future would be a combination of technical competences and soft skills. Availability of these profiles will make easier to get the right selection of complementary profiles needed. Having "the right people collaborating effectively" will be key to build up the bio-based economy sector of the future…*"

Content

2. Acronyms and abbreviations

DW	DYNAMIC WORKSHOP
CM	CONSORTIUM MEMBER
WG	WORKING GROUP
IEG	INDUSTRY EXPERT GROUP
BIC	BIO-INDUSTRIES CONSORTIUM
RTD	RESEARCH AND TECHNOLOGY DEVELOPMENT
VET	VOCATIONAL EDUCATION TRAINING
RTO	RESEARCH AND TECHNOLOGY ORGANIZATION

3. Introduction

The UrBIOfuture project main goal is to bring Europe to the forefront of the bio-based sector by:

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As part of the multiactor co-creation process and the "UrBIOfuture experience" delivery, a first workshop was planned in June 2019 with the participation of the project consortium (CM) and the working group (WG) members.

The main topics foreseen for the agenda were the following:

1. presentation of the UrBIOfuture project;
2. presentation of preliminary results from the mapping exercise for both opportunities and gaps;
3. feedback gathering through the implementation of a world café approach.

The outputs of the event will help to finally complete the curricula opportunities mapping and gaps analysis exercises foreseen in tasks 2.2 "Analysis of the needs and lacks among the existing professional competences and profiles in the bio-based industry" and 3.2. "Mapping of completed and ongoing educational programs involving bio-based activities to identify gaps in relation to existing training programs"

The Working Group (WG) creation has been an activity carried out during the first month of the project (May 2019) in order to have the consultancy expert group set up for the DW. Thus, it has been considered the first preparatory activity of the DW.

4. Creation of the UrBIOfuture Working Group

In order to provide the right skills for the 21st century, the UrBIOfuture project is aware that a true and strong partnership between industry, research and academia world is needed.

Hence, a part from the consortium partners, the project has reinforced his collaborative industry-academia approach by gathering high level experts from industry, academia and research centres of the bio-based sector in the UrBIOfuture Working Group so as to promote an improved and efficient alignment and interaction among industry and

educational and research institutions, focusing on the needed skills and potential job opportunities in the bio-based sector.

This group will include an Industry Expert Group (IEG) set-up by the Bio-based Industries Consortium (BIC).

These actors will work and cooperate throughout all the project duration, has been actively involved in the dynamic workshop, and will be convened to the Urbiofuture a co-creation exercise, to be celebrated the 17th of October in Seville.

For the creation of this consultancy and advisory board highly committed with the UrBIOfuture project, two main criteria have been followed:

1) A multi-actor approach, including representatives from the bio-industry, research entities, academia (at different educational levels) and public administration, as indicated in the project proposal:
    - an Industry Expert Group (IEG) set-up by the Bio-based Industries Consortium (BIC).
    - at least 2 universities
    - at least 2 RTD centres
    - at least 2 high schools
    - at least 2 VET organisations
    - at least 1 public administration

2) A wide EU geographical coverage, including representatives from as many different European countries as possible, considering also the geographical distribution of the consortium members.

To fulfil with the General Data Protection Regulation (GDPR), the involvement of the members followed a strict procedure, guaranteeing the preservation of personal data of the WG potential candidates, and avoiding its use without their express permission:

1) All the contacts with the potential candidates were initially established by each consortium member, to avoid sharing third party's personal data among UrBIOfuture partners without express permission. For this first contact, a general information email body text was prepared by CTA, reviewed by the project leader (UAB), and distributed among the consortium partners in order to guarantee a common third party's approach.

2) Once the contact had accepted the collaboration as member of the UrBIOfuture WG, an adhesion letter template performed by CTA was send to him/her in order to clearly inform him/her about the different activities in which they will be involved, the working calendar and the expected workload until the end of April 2020 when the project ends. The adhesion letters main aim was, as well, to officially obtain the permission of the WG members to use their personal data (picture, full name, country and entity) in the project's website, social media and communication and dissemination materials.

3) Finally, when the adhesion letter was successfully filled and signed by the contact, he/she officially become an UrBIOfuture WG member, and his/her contact details were shared with the project consortium members.

Being aware that building a robust and experienced WG for the project was going to be a hard and arduous job, the first contacts were made since the proposal preparation. However, it was at the beginning of the execution of the project (M1) when the effort was even intensified, mainly for identifying, contacting and involving VET and high school profiles.

The following 34 entities were contacted for being part of the UrBIOfuture WG:

Organisation	**Type of Organisation**	**Country**	**Partner that contacted**
BIC	BIC	Europe	BIC
BioVale	Industry	UK	BIC
CLIB clúster	Industry	Germany	BIC
Industrial Biotechnology Innovation Centre (IBioIC)	RTO	UK	BIC
Wageningen University & Research (WUR)	University	The Netherlands	BIC
Universita Cattolica de Sacro Cuore	University	Italy	BIC
Universidad de Valladolid	University	Spain	BIC
AGK	High School	Hungary	CTA
Secondary Medical School and College of Higher Medical Education in Ústí nad Labem.	High School	Czech Republic	CTA
Associazione Nazionale Insegnanti Scienze Naturali (ANISM)	High School	Italy	UAB
Técnico veterinario del Departament de Territori i Sostenibilitat de la Generalitat de Catalunya	Public Administration	Spain	UAB
INSA	RTO	France	CTA
RISE PROCESSUM	RTO	Sweeden	VTT
Universidade do Minho	University	Portugal	CTA
ENAIP VENETO	VET Organisation	Italy	CTA
French State Vocational Training Service for Adults (AFPA)	VET Organisation	France	CTA
Polytech Clermont	VET Organisation	France	CTA
UNESCO	Public Administration	Europe	UAB
Universität für Bodenkultur Wien	University	Austria	PRUAB
European associations of VET providers (VET4EU2)	VET Organisation	Europe	PRUAB
European Centre for the Development of Vocational training (CEDEFOP)	VET Organisation	Europe	UAB

European Vocational Training Association (EVTA)	VET Organisation	Europe	CTA
Spanish Foundation for Science and Technology (FECYT)	Public Administration	Spain	CTA
SEZNAM	High School	Czech Republic	CTA
European Association for Quality Assurance in Higher Education (ENQA)	University	Europe	UAB
Austrian Institute for Research on Vocational Training (öibf)	VET Organisation	Austria	CTA
European Forum aof Technical and Vocational Education and Training (EFVET)	VET Organisation	Europe	CTA
ENSTBB Bordeaux	VET Organisation	France	CTA
Bordeaux INP	VET Organisation	France	CTA
Bordeaux INP	VET Organisation	France	CTA
ESBS Strabsourg	VET Organisation	France	CTA
Flemish government – department of education and training	Public Administration	Belgium	VITO
Flemish Office for Employment and Vocational Training	Public Administration	Belgium	VITO
DG RTD - EC	Public Administration	Europe	CTA

From them, the following 20 entities officially agreed (by signing the adhesion letter) in being a UrBIOfuture WG member:

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BIC	BIC	Europe	BIC
BioVale	Industry	UK	BIC
CLIB clúster	Industry	Germany	BIC
Industrial Biotechnology Innovation Centre (IBioIC)	RTO	UK	BIC
Wageningen University & Research (WUR)	University	The Netherlands	BIC
Universita Cattolica de Sacro Cuore	University	Italy	BIC
Universidad de Valladolid	University	Spain	BIC
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Associazione Nazionale Insegnanti Scienze Naturali (ANISM)	High School	Italy	UAB
Técnico veterinario del Departament de Territori i Sostenibilitat de la Generalitat de Catalunya[1]	Public Administration	Spain	UAB
INSA	RTO	France	CTA
RISE PROCESSUM	RTO	Sweeden	VTT
Universidade do Minho	University	Portugal	CTA
ENAIP VENETO	VET Organisation	Italy	CTA
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Polytech Clermont	VET Organisation	France	CTA
Bordeaux INP	VET Organisation	France	CTA
Bordeaux INP	VET Organisation	France	CTA
Flemish Office for Employment and Vocational Training	Public Administration	Belgium	VITO

[1] This adhesion letter has been signed on a personal basis

The final composition of the WG achieves by far the multi-actor approach set up in the proposal.

5. The UrBIOfuture Dynamic Workshop

5.1. Date, venue and attendants of the Dynamic Workshop

As previously mentioned, the UrBIOfuture project main goal is to bring Europe to the forefront of the bio-based sector by:

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As part of the multiactor co-creation process and the "UrBIOfuture experience" delivery, a first workshop was planned in June 2019 with the participation of the project consortium (CM) and the working group (WG) members.

The main topics foreseen for the agenda were the following:

4. presentation of the UrBIOfuture project;
5. presentation of preliminary results from the mapping exercise for both opportunities and gaps;

6. feedback gathering through the implementation of a world café approach.

According to that, CTA celebrated a Dynamic Workshop the 26th of June in Brussels, in the Delegation of the Andalusian Government (Rue d'Arlon 25).

The data was set after an online enquiry for choosing the most suitable data for the project consortium and working group members to attend.

The event agenda (see Annex I), was designed to allow a 1-day trip to Brussels in most of the cases, and to fulfill with the main purposes of this task as established in the proposal:

1) To present the UrBIOfuture project
2) To present some preliminary results about the bio-industry needs and barriers when attracting skilled professionals, now and expected for 2030;
3) To gather some feedback from the attendants through the implementation of a world café approach;
4) To identify interesting lessons learnt and successful cases.

The invitation to attend the meeting was send to all the project partners, as well as the WG members and some additional guest suggested by the project officer, such as a representative from the DG GROWTH of the European Commission who's working in the area related with "Promoting education, training and skills across bioeconomy", a specific action of the EU Bioeconomy Strategy which main objective is to address the skills gaps and mismatches and promote the development of curricula and training that address the needs of bioeconomy in the long term).

All of them were asked to identify a potential substitute of their institution, in case of unavailability to attend the workshop, to have the maximum entities represented at the event.

The event was finally attended by 29 representatives of 21 European institutions:

Type of entity	Nº of entities	Nº of people
University	2	3
VET	3	4
High School	2	2
RTO	6	7
Industry/clusters	5	10
Public Administration	3	3
TOTAL	**21**	**29**

5.2. Main content of the event

As indicated in the event agenda (see Annex I) the Dynamic Workshop was structured in three sessions:

a) A first introductory session in which the attendants were informed about (see all the presentations in Annex II):

    1. The UrBIOfuture project, goals and expected impacts;
    2. The preliminary results of the bio-industry need, gathered throughout the Focus Groups sessions performed by the project partners during the first project month, and used as the basis for the bio-industry survey;
    3. The "World Café Dialogue"[2], the format to be implemented in the 2nd session of the event.

b) Followed by the "World Café Dialogue" session focused in identifying capabilities, educational levels demanded, and successful cases, in four main areas (see paragraph 5.2.1.):

    1. Soft skills, Innovation and Entrepreneurship capacities for the Bio-based sector

[2] A 'World Café dialogue' is a structured conversational process for knowledge sharing in which groups of people discuss a topic at several tables, with individuals switching tables periodically and getting introduced to the previous discussion at their new table by a "table host".

2. Competences needed for Bio-based sector Digitization
3. Competences in Circular Bioeconomy and Sustainability challenges addressing the specific technical, legal and research profiles needed
4. New professional competences and skills for Circular Bio-based business development, marketing and communication

c) And a final general presentation of the "World Café Dialogue" main outputs and an open debate among the attendants.

A lunch break was organized between the first and the second session, in order to foster the networking and ideas exchange among the attendants.

As a preparatory work, the following documents were sent to all the attendants some days in advance, in order to reinforce their knowledge of the project and the thematic, focusing the discussions in the most productive and successful way:

1) A glossary of bioeconomy common terms;
2) The Focus Group report performed by UAB in the framework of the UrBIOfuture project (aligned with the presentation in the first event session, and publicly available in the project's website);
3) Some background information about the dynamic workshop and the UrBIOfuture project;

5.2.1. The UrBIOfuture "World Café Dialogue"

The "World Café Dialogue" is an easy-to-use method for creating a living network of structured collaborative dialogue around questions that matter, in which small groups of people discuss a topic at several tables, with switching tables periodically and getting introduced to the previous discussion at their new table by a "table host".

The World Café is a creative participatory method best used for[3]:

- Knowledge exchange: The World Café creates a safe environment for sharing. The informal nature of the café enables meaningful exchange between individuals.
- Capturing collective knowledge quickly: The World Café can be used to tap into the collective knowledge of up to 30 participants on a topic of interest within 90 minutes. The method creates space for one group to explore a question or issue (within an overall topic), then invites a second and subsequently a third group to come in and provide additional insights, offer critiques and build further on the knowledge captured. The quality of experiences shared, and knowledge gathered is rich and obtained in a relatively short space of time.
- Tackling multiple related issues: Ideally the questions addressed by a World Café are related or represent different levels or aspects of an issue. The process of addressing them through multiple small groups can encourage greater participation and promote iterative thinking on key problems and challenges, more efficiently than can be done in a plenary session.
- Exploring diverse opinions on issues that matter in situations where a diversity of ideas and opinions is sought, consider inviting participants with diverse

[3] UNICED KE TOOLBOX (https://www.unicef.org/knowledge-exchange/files/World_Cafe_production.pdf)

backgrounds and/or expertise. The World Café creates a conducive environment for diverse viewpoints to be shared.

The following seven World Café design principles are an integrated set of ideas and practices that form the basis of the pattern embodied in the World Café process[4]:

1) Set the context.

2) Create hospitable space

3) Explore Questions that Matter

4) Encourage Everyone's Contribution

5) Connect Diverse Perspectives

6) Listen together for Patterns and Insights

7) Share Collective Discoveries

This structured conversational process for knowledge sharing was used in the UrBIOfuture Dynamic Workshop in order to gather some feedback about bio-industry skills needs, at the present and in 2030, at different educational level (university, VET programmes, high school education, etc), as well as some successful cases and lessons learnt the attendants may know and be already implementing.

Due to technical and organizational issues, as the number of attendants, the dialogue was structured in four thematic tables, hosted by CTA staff.

The focus group report performed by UAB, in which dozens of European bio-industries had already been interviewed about their vision of skills needs and jobs opportunities, now and in the near future (2030), was used for identifying the thematic of each table and the usefulness of the results for the "Mapping and evaluation of existing needs and lacks in professional profiles and skills in the bio-based industry" and the "Comprehensive map of completed and ongoing programmes addressing curricula in the bio-based sector", D2.2 and D.3.2 respectively.

As previously indicated, the debate tables thematic were the following:

1. Soft skills, Innovation and Entrepreneurship capacities for the Bio-based sector
2. Competences needed for Bio-based sector Digitization
3. Competences in Circular Bioeconomy and Sustainability challenges addressing the specific technical, legal and research profiles needed
4. New professional competences and skills for Circular Bio-based business development, marketing and communication

All event attendants were pre-distributed in three rounds of 20 minutes each by the CTA team, with their own personal agenda for the World Café session. This individual document was sent to all the attendants in advance with the technical documents previously mentioned.

In the "Background information document", all the tables thematic were beforehand indicated, as well as several keywords related to each of them, in order to help the topic understanding and the debate fostering.

[4] http://www.theworldcafe.com

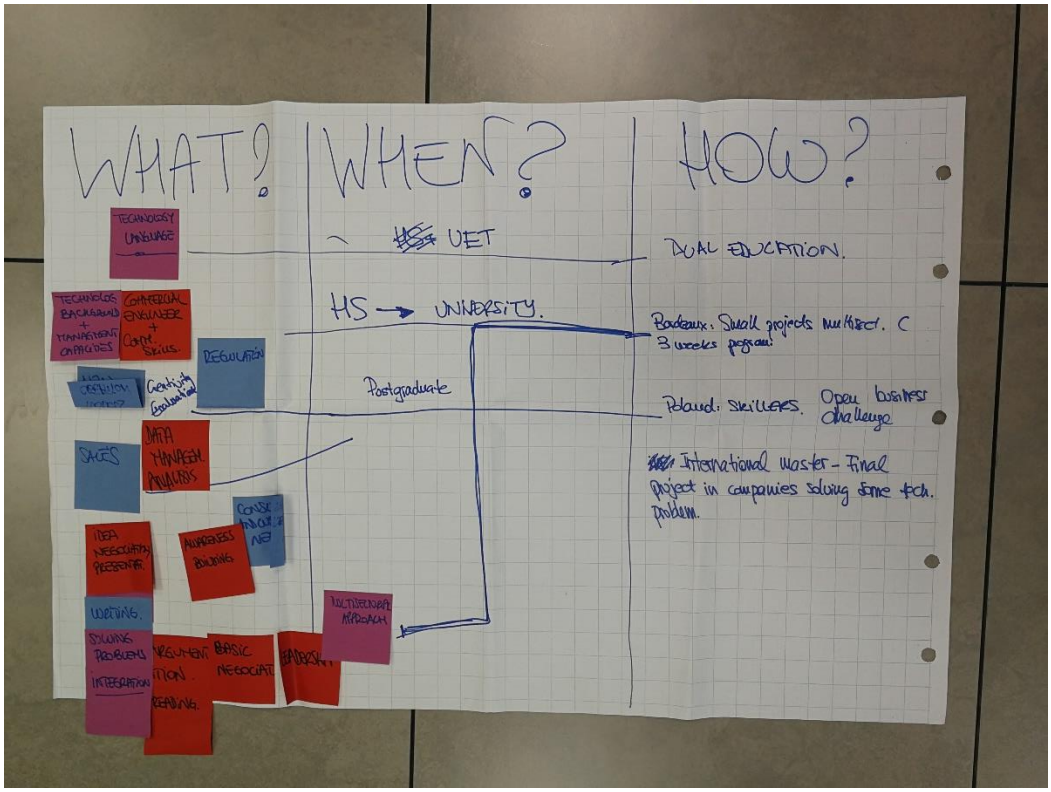
This tables distribution was elaborate following these criteria:

1. To have the maximum different entities' profiles (university. High school, industry/cluster, public administration, etc) and geographical coverage per table in each round;
2. To have different persons in each round (new thematic per round for all the attendants)

To have some homogeneity in the tables results, and facilitate the obtention of useful inputs for the project analysis and reports about capabilities and educational levels demanded by the bio-industry, as well as successful cases, a WHAT-WHEN-HOW dialogue methodology was designed by CTA team and applied as a guide during the debates in the four thematic tables by the hosts:

- *WHAT competence/s or skill should be trained to promote creativity, innovation and/or entrepreneurship?*
- *WHEN those competences/skills mentioned in the question above will need to be trained: at high school? at vocational education and training? or at university (grade, post-graduate, doctoral post-doctoral)? or at all levels?*
- *HOW that particular competence or skill should be trained at that particular level (e.g. high school or VET would be different than university), which methodology will be better at that particular education level? Could you mention any 'Success Case' you know about, related to this educational hot topic? Which*
- *where the key aspects that provide that success?*

The debate tables main conclusions were physically gathered in a flip-chart paper, used for their presentation during the final common debate plenary session. See below:


WHAT?
WHEN?
HOW?
VET
DUAL EDUCATION.
HS → UNIVERSITY.
Bordeaux: Small projects multidisc. (3 weeks program)
Postgraduate
Poland: skillers. Open business challenge
International master - Final project in companies solving some tech. problem.
TECHNOLOGY UNDERGRAD
COMMERCIAL ENGINEER + COMM. SKILLS.
DEGUSTATION
SALES
DATA MANAGEM. ANALYSIS
IDEA NEGOCIATION PRESENTAT.
AWARENESS BUILDING
WRITING.
SOLVING PROBLEMS
INTEGRATION
ARGUMENTATION
BASIC NEGOCIAT.
LEADERSH.
READING.
MULTIDISCIPL. APPROACH

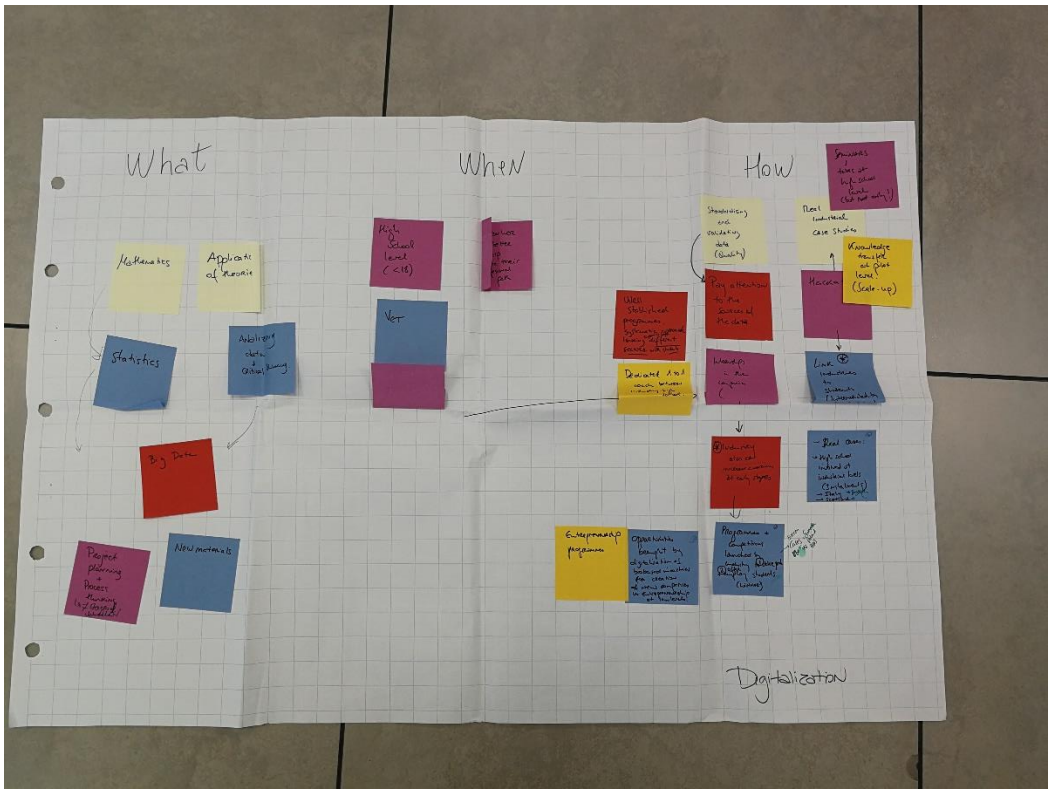

What
When
How
Mathematics
Application of theories
Statistics
Modelling state & global planning
High School level (<18)
VET
Project planning + Process thinking
New materials
Entrepreneurship programme
Digitalization

TABLE 1 - SOFT SKILLS, INNOVATION AND ENTREPRENEURSHIP

Keywords identified for this topic:

Critical thinking, problem solving, personal initiative, creativity, communication and relationship building, emotion management, teamwork and conflict resolution, adaptability, multipurpose profiles, integration of sectors, collaboration of teams with different technical background, academy & industry collaboration, entrepreneurship, industrial symbiosis, clusters development, consumers involvement, social engagement, investment and funding programmes, open Innovation, corporative responsibility.

WHAT

Some skills regarding the key words listed above were mentioned as most important, such as teamwork and conflict resolution, critical thinking, problem solving and conflict resolution. Additionally, being reflective or inclusive were other additional skills considered as important.

- An interesting dialogue appeared regarding emotion management aspects. The table discussed that nowadays young people have a huge problem managing their emotions. At the same time, stress management and resilience were also suggested as needed in every industry, since it appears not to be enough education on it and everybody on the table agreed that they were essential for developing a job of any kind.
- Self-awareness and self-confidence were also suggested. People need to know how to use their already acquired skills and learn to believe in themselves to apply them correctly. Learn how to learn is a skill completely missed in classrooms, at the same level as learning that failure is good, knowing its limits and benefits.
- Likewise, the table also identified some skills that were interrelated to the three other debate table's topics. They suggested that a well-trained professional in communication and empathy would promote business contacts and networking, therefore, they were suggesting that soft skills influence directly on the persons' entrepreneurial initiative.
- Finally, few suggestions were made with regards to innovation, as that the ability of inquiring is not enough stimulated in students. That affects to innovation and creative thinking, in the long term, being proof that it is also needed thoughtful people in this area.

WHEN

Regarding the moment when the professional should start learning the abovementioned skills, most of the time the table suggested "The earlier the better" and "Start as first as possible in education". In the same vein, it was also suggested that the industry need mixed profiles and, to achieve this goal, they need to be incentivised as soon as possible in education.

As "developing attitudes is lifelong", it may start at early stages, although people need to reinforce their skills, since society is always changing. Therefore, training courses should

be considered widely, and not only for professionals. The participants suggested that teenagers also need training courses to be able to better adapt to society.

1. Soft skills:
    a. With respect to soft skills, such as communication and teamwork, High School and VET were when it was suggested the training to start. some attendant suggested to start even before high school, at elementary school. Currently, society tend to expect soft skills from people with a high level of education and not from people with a lower level of education. At university level, while students learn their specialization, they need to reinforce and practice teamwork interaction.

2. Innovation:
    a. Concerning innovation, the participants suggested that the actual system is not suitable for training skills that promote the innovative thought in the students at any level of education. The attendants proposed high school as the period when all the innovation-related skills should be promoted.

3. Entrepreneurship:
    a. Entrepreneurship should be trained since high school, or even before, according to the participants.
    b. A Swedish practice with young teenagers and entrepreneurship was introduced: in Sweden High Schools and Compulsory schools' students can initiate a "Young Enterprise" through a politically independent non-profit education organization, and is part of the global organization "Junior Achievement". It gives children and young people the opportunity to train and develop their creativity, entrepreneurship and their entrepreneurship [1].

HOW

Training courses, academy, education in general is stiff, rigid, hard to change, and innovative ideas are usually blocked. French and Spain are countries exemplified as an example of it.

Bioeconomy is like an ecosystem, it's a joint of little systems and people, that interact among them, and there is a lot of different facts to consider in it. It is complex and the actual educational system is not prepared to train students into it.

Governments' bureaucracy is slow and complex, reducing possibilities to produce new training programmes.

Adaptability to society (in schools and industries): a change is needed at government level. Since society is always changing, the system needs to be agile and flexible to adapt to it in a fast and agile way. To produce training programmes, at different education levels, for people to adapt their knowledge to the new trends is very difficult. Authorities need to certificate competences from the trainer before giving them the approval. Although it is a good practice, the bureaucracy is intricate and complex.

Education regulatory system needs a change. "Links (learning from innovation and networking in STEM) project" [2], which suggests an "integrated model of school as

learning organization" was pointed out as a good practice to potentially solve the aforementioned problem.

1. Soft skills:
    a. Sharing objectives at industry level is a way to promote teamwork that helps to improve all group members creativity and, by interacting with the objectives, it incentivises cooperation and togetherness. Therefore, it is also a good practice to incentivise this practice at school to provide the future industry professionals with experimented background in it.
    b. Teamwork is a powerful skill that students usually don't understand. Education tries to incentivise it promoting work groups activities among students, although it does not teach how to lead a group, and occasionally students get confused and the result is that only one or two students do all the work instead of sharing the workload and support among themselves. Therefore, teamwork needs to be integrated throughout all training programmes.
    c. Internationalization experiences help students develop soft skills. Rules and regulations should be implemented to force its presence at multiple training levels.
    d. Celebrate profiles' diversity in teams, individual qualities from different profiles increase the amount of valuable skills for team success.
    e. In relation to emotion management skills, like stress management or failure acceptance, learning from other experiences at university and high school could help students. Besides, it also includes entrepreneurship knowledge.
    f. Learning how to deal with stress management problems, from mentors, coaching lessons and sharing experiences, could also be interesting. It should be learnt and practiced before academy and before entering in the labour market, to prevent in advance future problems at work. In addition, mentoring should go both ways, regardless the age, i.e., professors and students should share their experiences, and both learn from each other. Both have different knowledges, learnt in different eras, therefore helpful to improve different skills.

2. Innovation:
    a. Innovation is also promoted by mixing profiles, as well as creativity and teamwork. Additionally, it is also increased if different ages profiles are mixed since their different experiences are based on different rules and have different responsibilities at industry. Different backgrounds and knowledge promote innovation.
    b. Participants also suggested that to promote innovation, industry should consider incorporating students' ideas from high school or university. For example, letting the students learn processes with a lot of materials in a laboratory company, and at the end, incentives them to make suggestions or new ideas to the company, such as an ideas competition.
3. Entrepreneurship
    a. The attendants discussed that entrepreneurship is promoted letting students give ideas to generate start-ups. Additionally, the practice of

creation a start-up generates multidisciplinary knowledge, such as accountancy and finance knowledge.

b. As well as in innovation, challenge-base lessons are useful to help the student learn to build enterprises.
c. When education promotes students to build a start-up, teachers should not mark students with traditional grades. They should grade positively or negatively verifying if the student has acquired the competences needed to build enterprises. In this case, students should not focus on making money with the start-up, they need to focus in the creativity and in the challenge that it involves.
d. Industry experts should start teaching at university level. The problem currently is that to bring industry to university is difficult. Therefore, there is a lack of regulatory framework to hire industry people to teach university students.
e. Other good practice to follow should be that University students have every year industry practices promoting entrepreneurship.

GENERAL CONCLUSIONS

- Teamwork and communication were the most frequently mentioned soft skills as important. High school and VET were when they were suggested to be trained. Some participants even suggested before high school, at elementary school. While students learn their specialization, they need to learn and practice them, therefore, these skills need to be integrated throughout all training programmes. Teamwork and communication are linked to other skills, such as innovation ones, to improve all group members creativity and, by interacting with the objectives, it incentivises cooperation and togetherness.
- Innovation is indirectly related to other skills. The actual educational system does not create innovative minds; therefore, a system restructuration is needed.
- Entrepreneurship is a capability that need to be learned directly from industry actors and their practical experiences. The better way to promote it is by challenging the students to create a spin-off, with the main goal of learning about the process, rather than money-making.

TABLE 2 - COMPETENCES NEEDED FOR BIO-BASED SECTOR DIGITIZATION

Keywords identified for this topic:

Application of Big data, Artificial Intelligence, Internet of the things, Industry 4.0, robotics, to biomass production, biomass pre-treatment, biomass logistics, side – streams management and valorisation, water and energy efficiency management, research in Key Enabling Technologies (KETs), industrial biotechnology, nanotechnology, advanced materials, micro and nanoelectronics, photonics, and advanced manufacturing technologies for advance quality control of processes, bioprocess, traceability and logistics.

WHAT

The skills related to digitalization mentioned can be separated, on one hand, in basic sciences such as mathematics or chemistry and, in the other hand, in sciences like statistics, more related to obtaining information from data.

- On one hand, in basic sciences such as mathematics, which is needed to create the algorithms included in digital processes, or chemistry, of vital importance to understand processes needed to develop new materials. In the other hand, students need to be equipped with other more advanced capacities such as statistics, which will help them to make inferences about data and decision making.
- Other more advanced capacities where mentioned, such as big data (needed to classify huge quantity of data), project planning and process thinking, needed to understand and analyse different stages of the value chain, that will support the development of other soft skills such as critical thinking.
- Understanding concepts such as internet of things is essential to make use of computing devices embedded in everyday objects, enabling them to send and receive data.

WHEN

Participants in the table suggested that in order to provide students with tools and information necessary for them to choose their professional path these capacities should be provided “the earlier the better”.

- At high school level (<18 years), students are already capacitated to learn these skills.
- This training should evolve and be present also at VET level and/or university level.

HOW

As a common conclusion to the three rounds, it was agreed that the methods to train competences related to digitalization need must be oriented to bridge the current gap between the education system and the industrial sector.

- Some examples of good practices of knowledge transfer between industry and students are:
    - Well stablished programs of knowledge transfer where high school students are involved at industrial levels through secondments or internships. Specific success cases in the Italian and Scottish system were mentioned.
    - Programmes or competitions launched in Poland, where the industry launch and industrial problem to be solved with ideas promoted by high school or university students. The winning idea is offered a stage within the company. The advantages of this programmes are clear as they offer the industry the opportunity to confront a specific problem with good ideas and offer the possibility of the students to join the company.
    - Entrepreneurship programmes: a success case was mentioned, a Swedish programme where the students are guided through all the stages of the life cycle of a company creation during a whole academic year (from

the idea generation, the development of a business model, formalisation of the company, and its closure).

- The following ideas arose as additional recommendations for specific methodologies to train students in digitalization capacities:
    - Targeted seminars needed during the whole academic year, addressed to different educational levels. Talks at the end of the year for students from higher grades are considered to arrive late and lack impact in the student.
    - Dedicated one to one coaching between industry and high school students.
    - Involve students to industrial process at pilot scale, in order to avoid possible interferences with the day- to day activities in real scale industrial processes
    - Hackaton, an event where a company launches a programming challenge, to be solved in a collaborative way by students of computer programming.

GENERAL CONCLUSIONS

The fact that bio-based economy processes include cross-fertilization and collaboration of multisectoral companies, with the consequent need for multidisciplinary skills.

Management of quality data is considered a priority in digitalization of bioprocesses, hence methodologies for standardisation and validation of data need to be included in the education system, with focus in the source.

Digitalisation of the bio-based industries is seen as an opportunity for creation of new companies and incentivize entrepreneurship from an early age.

The role of the industry in raising awareness about bio-based economy as a growing industrial sector in terms of job creation, and growth.

TABLE 3: COMPETENCES IN CIRCULAR BIOECONOMY AND SUSTAINABILITY CHALLENGES ADDRESSING THE SPECIFIC TECHNICAL, LEGAL AND RESEARCH PROFILES NEED

Keywords identified for this topic:

Environmental regulations, circular bio-based economy regulations, technoeconomic assessment, life cycle assessment, feedstock analysis, circular bio-based economy research and modelling, bioinformatics, omics sciences, synthetic biology, efficiency in resources (CO2, biomass, urban waste, industrial side-streams), cascade valorisation. Bio-based Professional profiles: technical specialists in producing/obtaining sustainable biomass, technical specialists in primary conversion processes, technical specialist in secondary conversion processes, technical specialists in materials, products and functionalization, technical specialists in conversion and functionalization technologies.

WHAT

All the competence/skills described in the table key words list (above) where mentioned and considered by the table participants, however major attention was focused in pointing out needs of professional profiles for Life Cycle Assessment, Legal and Regulatory issues and the enormous industrial value of having professional profiles with a strong Basic Sciences background, in Physics, Biology, Mathematics, Organic Chemistry, etc...Some specialised profiles and specific soft kills were also consider relevant to take into account in the frame of table 3 topic, even knowing there was a specific table devoted to "Soft Skills" (table 1) . At the end of the table session, technical professional profiles with capacity to engage administration authorities was spotted as well as a major competence needed.

- Life Cycle Assessment (LCA) professional will be consider a key profile for Bio-based industry sector of the future, considering companies will need to reach environmental and economic sustainability, satisfy consumers growing demands on brands responsible with the environment and evolution trends towards Circular Bioeconomy.
- A discussion about potential limitation of research freedom if Legal & Regulatory issues are included in education programmes was not considered a good argument but an opportunity to facilitate academy collaboration with the industry and the society.
- Regarding the suggestion "Basic Sciences Should Stay" in first years of university degrees, so avoiding too early specialization, some specific comments were mentioned.
    - Participants had consensus in that, arguing new degree programmes where Basic Sciences have been deleted deliver professionals that do not understand the physics, the chemist or the biology behind the technics or materials they are using.
    - Lack of Basic Sciences Background prevents students/ professionals capacity to interpret results properly and also it affects negatively their creativity and innovation capacities
    - Not having a solid Basic Science involvement in careers programmes makes very difficult to develop abilities for complex problems solving and contribution to technical and materials innovative developments.
- Some specialised profiles and skills strongly demanded where mentioned:
    - need of primary conversion experts (fractionation of biomass) in biomass based electrical companies and also with different approach respect to the row material pre-conditioning and primary conversion depending on what type of professional is dealing with it (molecular biologist vs agriculture engineer, for example.
    - Also specialist in different types of row materials/ feedstocks for efficient primary and secondary conversion by cascade valorization are needed.
    - Industrial Side-Streams Valorization should exist as a technical specialization, particularly in any circular bio-based economy programme
    - Scarcity of advance materials experts in the bioindustry sector in general.
    - Need of training in skills like "Processes Thinking" and creativity. Also transversal training in business capacity building all along the basic sciences programmes should be included.

- Need of digital skills and languages in all professional profiles needed in all type or bio-based industries
- Technical professional profiles with capacity to engage administration authorities was spotted as well as a major competence are demanded by the bio-based sector in order to support legal aspects of product and market development (regulatory issues, normative development/ updating/ appraisal, standards development, certifications, audits, etc…) and also to promote or participate in public procurement processes/ projects (for example)

WHEN

Participants in the table considered that "the earlier the better".

- If the students are exposed to relevant bio-based economy topics with an appropriate educative approach, even complex subjects and topics could be delivered in secondary or even in primary school
- Starting the earliest could promote interest and motivation to deliver the best bio-based professionals for the future
- Appropriate programmes design, increasing technical and scientific contents along the different educative levels (primary, secondary VET, university, etc..) would make possible to teach complex subjects, in a similar way that is done with basic sciences
- Environmental legal issues could start to be delivered in high school and VET education programmes while sustainability issues could be introduced at earlier ages, in primary school

HOW

A common conclusion of the three table 3 topic rounds was the best methods to train technical competences must focused in be more practical and delivered preferably in an industrial environment. Started referring to VET's programmes this approach was consider important for all educational levels from secondary, under-post-graduated.

- As part of an education programme involving Life Cycle Assessment, the students should visit companies frequently (3-4 times a year at least). Some of these companies should be implementing the LCA.
- During the industrial visits relevant professionals of the company should let them know first had why the industry performs such an analysis and the impact that has on their business, on the consumers and on the social community around them and beyond, and so rising student motivation.
- In each of these visits to industries, some of the industry relevant professionals selected to train the students should always be women.
- Students would have significative practical experiences while visiting the industries, like involving them in company practical activities if possible or in activities specially designed for this particular educative purpose taking part during the visit.

- Teachers and industry personal would need to collaborate to design the whole training/educative experience in order to adapt the experience to the educative level of the students and to other relevant student profiles and interests.

Learn LCA by Intuitive and Interactive Computer Gaming would also be an option but the programmes should include not only modelling tools but also learning tools able to stimulate reflexion about LCA results interpretation.

Some examples of good practices of getting close to the industrial environment are:

- Product development Competition launched in France, where teams of postgraduate students have the challenge to develop a product ready for the market and each participant is in charge of a particular phase of the whole project from the lab to the marketable product.: The winners get a national price
- A Broad-Brush Education Approach, where programmes design, strategy, and problem solutions are tough from a global perspective rather than concentrating on details, have been reported as able to create better employees in table 3. In both educational levels, Biotech Masters (MSc) and undergraduate education in chemistry, biology, engineering and physics
- Innovative education approaches like:
    - Flexible Career Building Paths for students and also for professionals
    - Learning methodologies focused in individual or team Development of Integrated Projects where contents to be deliver are all integrated in a motivating project objective selected by the student/s, instead of sequential lecturing classes, where the students are mostly passive and not major actors of their own learning process
    - Learning methodologies focused in the Multidisciplinary Projects, integrating no just different contents related with one discipline but projects with objectives that involve contents and abilities from completely different disciplines (maths, biology, physics, etc…) in order to reach the project challenge
    - Learning methodologies based on Case Studies where, individually or in teams, the students analyse how a relevant technical problem was solved by a scientist or an inventor, for example.
    - Learning methodologies based on a combination of lectures and Students Debate Promotion, in order to build critical thinking and active learning
- Master of Science Popularization: Edinburgh University MBSc designed and lectured by professionals, to build up social awareness about science. It was mentioned as a good society awareness driven programme promoting dissemination of science added value, which is an important background needed to promote bio-based sector in Europe as well. But also, It could be a source of inspiration when implementing new

GENERAL CONCLUSIONS

Starting with the conclusion that re-thinking ad re-formulating existing bio-based economy related education programmes is needed, the following ideas arose as additional recommendations to efficiently deliver the technical bio-based economy specialists of the future:

- Bio-based economy related education programmes are mostly deliver, at the moment, by two independent education approaches that right now are not integrated: education programmes focused in bioprocesses and education programmes focused in chemistry-processes. This two "paths should be integrated in a common bio-based economy education programme involving both, bio- and chemist industrial processes approaches and their complementary and synergic interactions
- Some "traditional" professional profiles should be retained and trained where to be accurate is the most important requirement. In those, creativity should be put backwards in favour of the capacity to stick to the defined procedures & methodologies an in favour of promotion of decision-making capacities under urgent situations (operation Managers, quality control managers, etc…)
- Under the present stage of Bio-based related European education and training programmes it is mandatory getting some credits out of your faculty, so you can complete your professional bio-based profile in the short-term this way
- If it is not possible to blend two traditional paths like biology and marketing for example, then encourage a broad master like Create a Marketing Master programme specifically designed for people with chemist (or biotech) background could deliver highly interesting profiles for the bio-based sector
- Networks of technical experts interested in build bio-based community awareness & engagement. This technical experts (from private and public sector), waste mangers (public and private), citizens/ consumer associations, etc… in order to communicate both success cases or failed cases (in this cases to prevent other companies to get into potential crisis) and to involve final users in bio-products development could be a very interesting way to glue bio-based communities well informed and aware about bio-industry sector challenges and benefits
- Put attention to enhance practical capacitation so the students could learn from experience
- Have entrepreneurship experience as part of the practical capacitation and education, by creating a company at the beginning of the year just to close at the end of the year, should be part of bio-based economy programmes.
- Bio-based economy profiles of the future would be a combination of technical competences and soft skills. Availability of these profiles will make easier to get the right selection of complementary profiles needed. Having "the right people collaborating effectively" will be key to build up the bio-based economy sector of the future.

TABLE 4: NEW PROFESSIONAL COMPETENCES AND SKILLS FOR CIRCULAR BIO-BASED BUSINESS DEVELOPMENT, MARKETING AND COMMUNICATION

Keywords identified for this topic:

Bio-product standard development and regulatory issues (bio-based technical & legal-bio-based profiles), new multidisciplinar professional profiles to facilitate cross-sectorial collaborations, industrial symbiosis, bio-based value chains developers, cross-sectorial clusters promoters (Biotech-ICT, ICT-Biotech, Agro-Biotech-ICT, business brokers-bio based-ICT-legal), new business models developers based on data modelling, market developers (using big data& artificial intelligence, new marketing tools - Internet & social media, consumers demand).

WHAT

Although the table topic is devoted to business, marketing and communication competences, the debate tended to address the soft skills, as an inherent need for the profiles running this table topic skills. In particular, these skills (more or less horizontal) were mentioned:

- Technology language: although the skills the topic was about in this table were more focused with business, marketing and communication capabilities, all the attendants agreed in the basic need of a technical background allowing a technology language level according to the position demands. This technology language needs to be, at least, according to a VET training program level, in order to guarantee proper dialogue with partners and clients.
- Other skills more related with business development and marketing were new business models creation, sales and data management analysis.
- Regulatory knowledge was identified as a key element in for business development, as far as is mandatory to identify possible market constrains and opportunities in the business development and the potential diversification of markets at geographical and end users' sector level.
- Analytical skills, problems solving approach and integration capability were mentioned by the attendants and considered basic skill for the table thematic, and desirable in all industry employees in general.
- Negotiation capacities were highlighted, such as basic negotiation knowledge, argumentation skills, idea presentation methodology, leadership and awareness building.
- The capability to have a multisectorial approach was found mandatory for a business developer in the bio-industry, for technical and commercial reasons.

WHEN

As stated in the previous table reports, and considering the importance that attendants gave to the soft skills in the business development, marketing and communication capabilities identification, the main common message for the moment to start training them was "the earliest, the better", meaning that the practice of them should be included in all the educational levels, from high schools to postgraduate courses. This should be addressed from a pedagogical point of view, and included in the teaching methodologies (oral presentations, elevator pitches, group works, etc.).

However, some skill levels were specifically debated:

- Technology Language: it must be a skill training at VET level at least, for a business development responsible in a bio-industry.

- Regulation: as a specific subject, it should be included as a postgraduate course.

HOW

The dual education was identified by all the attendants in the three rounds as the key aspect for achieving a proper training in business development, marketing and communication: combining business and technological training is the priority if the aim to prepare business development profiles for the bio-industry is seek.

Some examples of successful cases where presented:

- 3-week programs for building small multisectorial projects among students from different disciplines (Bordeaux INP)
- Open business challenge in bio-industries oriented to students, in non-core activities of the company.
- Execution of final project of international masters solving companies' technological problems.

GENERAL CONCLUSIONS

- The capacities related with skills for circular bio-based business development, marketing and communication need to mix a medium level technical background with capacities linked to management and marketing.
- Thinking in the potential profile demanded by a bio-industry in charge of the business development, marketing and communication tasks, the participants agreed in a commercial engineer with communication skills, as the most appropriated one.
- It has very difficult to limit the table topic in business, marketing and communication competences without considering the importance of the soft skills (topic of table 1), thus these are horizontal pillars for the rest of the skill identified.
- According to this, the participants agreed that the moment for training most of the skills identified during the table rounds was "the soonest, the best" so from the high school level on, and that the best way to do it is by the dual education (combining technical training with practical experiences in the bio- industry context).
- As a last general conclusion, it was agreed that the identified skills could be applicable in all the industry sectors, not only in the bio-based one.

5.2.2. The "World Café Dialogue" open debate main outputs

After sharing the main outputs of the thematic tables in a plenary session with all the attendants, an open debate was foster. Some interesting reflection were shared and discussed among the event participants:

- BBI profiles' specialization and transversal skills:

  As the table topics and results could be transversal to every kind of industry, not only the bio-based one, the participant agreed that these profiles need a (bio-based economy) specialisation in specific areas (ex. the fractionation of biomass) and, at the same time, they need other transversal skills (as soft skills) to obtain properly prepared workers profiles.

- Soft skills in Agricultural Sector and Early Educational Stage:

  The bio-based economy can't forget the importance of the agricultural sector, so a change in their training profiles should also be considered. Since the primary sector is the base of the bio-based economy, as the raw materials provider, their workers have a key role in their value chain, being a must taking them into our considerations. Therefore, they should also receive scientific basic knowledge, as well as entrepreneurship skills (helpful for sales and demand trends) and other soft skills to boost business communication, networking and dealing with buyers.

  As far as the agricultural sector workers don't use to go to university, these skills should be taught at a lower educational level than the university one.

- Society responsibilities and Bio-based Economy:

  Industry needs people prepared to have wide and holistic view of the bio-base industry, i.e. planning value chains for waste management. If, for example, an industry is not aware of a waste management problem, it could end up being harmful to the environment, hence, to the local society. Therefore, well-trained people in management and logistic positions are mandatory to avoid this problem.

Also, the industry turnovers may increase if these people are aware of the possibilities (know-how & Bio-based economy innovation) of selling their wastes to other industries, proving they could raise a profitable and long-lasting industry.

The interrelation "train the expert - industry efficiency - social responsibilities" must be reinforced by introducing innovation capabilities like critical thinking, integration of sectors and academy and industry interaction.

In this sense, industry collaboration is also a key point. Cluster building and network creation among companies from different sectors is mandatory for achieving a competitive skill complementarity.

- Citizenship involvement

  Involvement of citizens in the creation of new bio-based economy value chains is mandatory to guarantee their success.

- Complementary skills for Bio-based Economy Profiles

  Considering the diversity of the bio-based economy involved fields and sectors, soft skills are needed to be taught allowing these professionals to adapt and work with different profiles (technicians, labour staff and managers for instance). This collaborative approach allows to combine workers with different technical skills as far as no person can gather all the needed knowledge, so teamwork skills should be introduced to stimulate people interaction.

- How to attract women to the bio-based industry

  Asking to the audience why women are currently less present in the bio-based industry, and how the situation could be changed by making it more attractive, the following ideas were commented:

  - It can be considered a reflection of the lack of women in STEM[5] careers, management positions and entrepreneurship areas.
  - The lack of flexibility to balance personal and work life in companies is contributing to generate this situation. In fact, in some sectors with higher self-employment and more flexible labor contracts, as the agri-food, the presence of women is higher.
  - Published studies findings proved that women are more likely to give up when the environment is more competitive. Therefore, a must in education, especially in women, is the ambition, that needs to be trained as an essential soft skill.
  - Society still needs to evolve in this sense: values need to be trained to increase the women's participation in the bio-based industry.
  - Finally, all the participants coincided that fighting for a gender balance is needed globally in the industry and the labor market.

[5] Science, Technology, Engineering, and Math

5.3. Dynamic Workshop assessment

After the debate, all the attendants were pleased to fill in a brief questionnaire about the event.

This are the final average marks of the 23 answers received (up to 5):

Venue and arrangement	4,70
Themes and contents interest	4,54
Communication with/from the organisers	4,78
General event organisation	4,83
Preparation actions: information about the purpose and main objectives of the event	4,52
Preparation actions: quality and usefulness of the preparatory documents	4,65
World café dialogue organisation	4,57
Speakers quality	4,45
Overall evaluation	4,74

6. ANNEXS