



UrBIOfuture - Boosting future careers, education and research activities in the European bio-based industry

- Focus Group Report -



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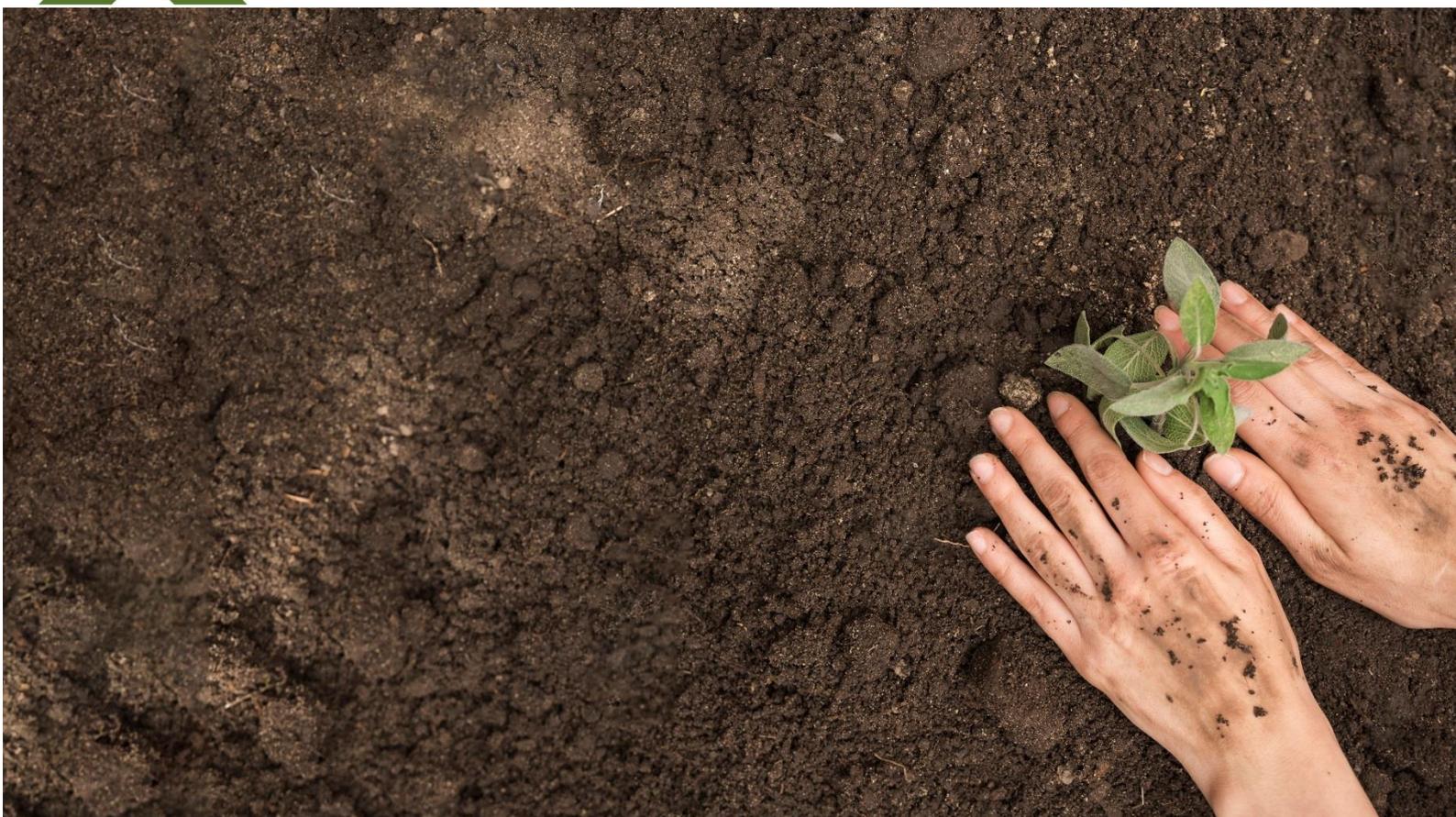
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Introduction

This document summarises the results obtained from 5 focus groups (27 participants in total) and 11 interviews to relevant agents of the Bio Industry sector carried out during the first week of May 2019 in Belgium, Denmark, Finland, Italy, Poland, Spain and The Netherlands.

The development of the focus groups and the interviews have been guided considering, on the one hand, the current scenario of the bio-economic sector and, on the other hand, the desired scenario for the year 2030, thus allowing to obtain reliable information for the design of the subsequent tools for the collection of data as foreseen in the project. Figure 1 summarizes the topics to be addressed in the development of this first phase.

The socio-demographic analysis of the data of the informants who have participated in this stage of the research allows us to affirm that they have been mostly women (approximately 65%), ranging between 30 and 65 years old, with the age group between 40 and 50 being the most represented, followed by the group between 50 and 60 years old. The under 40s group was the least represented in this phase.

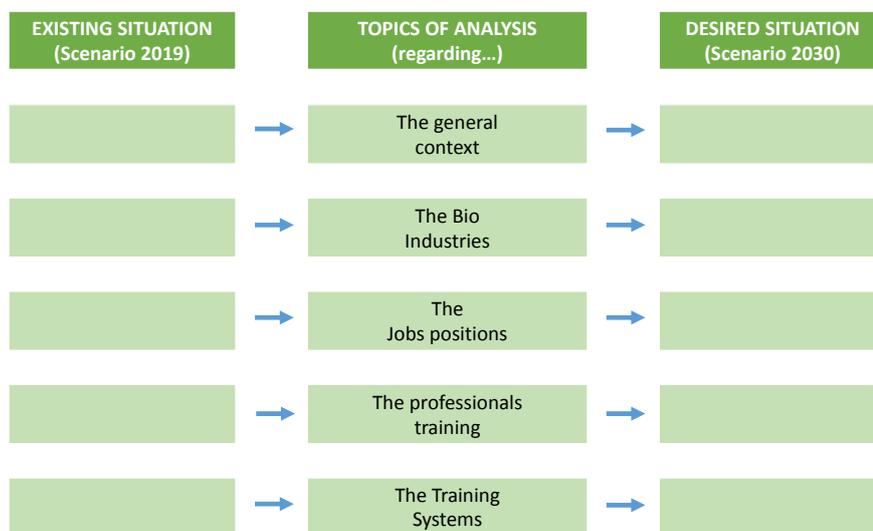


Figure 1: Scheme that should guide the focus groups.

At the academic level, interviewees were all higher education graduates, most of them with PhD or Master's degrees, followed by the group of first university degree graduates. Individuals with educational profiles below university level did not participate in this phase. Informants had educational backgrounds in the scientific and technological fields: chemistry, biology, chemical engineering, computer science and materials science. Some participants had social sciences backgrounds: business administration, marketing or finance. It is worth highlighting that some profiles have more than one degree, combining undergraduate studies and doctorate studies in a scientific field with a master's degree in the field of business management.

Regarding the number of years of professional experience in the Bio-industrial sector, we observe a concentration in the extremes, with professionals with over 15 years of experience in the sector (over 25 years of experience in some cases), and another important group with less than 10 years of experience in the sector. The main positions held by the interviewed profiles are management positions: Company CEO, Vice President of Business Cluster, Research Center Manager, Head of Industry Research Office, Technical Office Manager, Rector and Chief Executive Officer of Media Company). Other types of professionals have also participated: non- management position, but with a leading role involving team management activities: Researchers, Project Managers, ICT coordinators, team leaders, department heads. To a lesser extent, professionals from the higher education sector, as well as public administration, have also participated in this phase.

Finally, these are the specific areas of the bio-industrial sector in which participants are currently working: bioplastic, packaging, eco-compatible polymers, agro-pellets, polymer technology, Education ICT, petrochemical, textile technology, food technology, chemistry, RDI Strategy, biomedicine, public administration, genomics, medical diagnosis, pharmaceutical, agro-food, animal nutrition, microbiology, cosmetics and plant genetics.



The general socio-economic-industrial context

The participants in this phase of the study believe that industrial production will continue the decentralization tendency towards other countries in the future, so that the exact type of industry to be developed at European level must be defined, which should not necessarily evolve towards creating protectionist regulations. In this regard, the introduction of robotisation in production, the creation of more personalized products adapted to the needs of the final user (food, health, technology), a more efficient use of energy (increasingly more expensive), improving logistics processes to make them more efficient, preserving the environment and working in environments without regulatory pressure. The demand and

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dependence on products from the primary and industrial sectors shows the same trend in the coming years.

Additionally, it is considered necessary to generate a joint strategy on the bio-economy that allows to link different sectors that are strategic (new technologies, natural resources, waste management, environment, sustainable energies, health and agro-food production), considering external factors such as the increase in the cost of energy, the need to preserve the environment and increasingly complex regulations.

Collaboration between industries from different sectors will be key in the near future, being increasingly important to find strategies that allow for sharing knowledge between industries, also establishing regulations to preserve intellectual and industrial property. Finding these strategies to protect the ownership of knowledge should also be the basis of generating a culture of collaboration between different business sectors, and also within the same business sectors. The creation of consortiums, clusters and other collaborative ecosystems is a present reality, which will be expanded in the future.

Therefore, it will be necessary to have professionals prepared to work in teams and in multidisciplinary environments accordingly. In these contexts, the integration of knowledge should be the basis for the construction of new products and the design of new production processes. Among the main challenges that stand out at the socio-economic level, there is a need to find new forms of production that will provide society with the products it requires, incorporating technology that allows for the development of more efficient vertical economy processes. However, there are difficulties involved in the inclusion of technology in some sectors due to the high cost of its introduction and maintenance.

The industry will have to incorporate the necessary devices (some of them already available) to collect the data in order to be able to monitor the processes that are being developed. This implies that tools must be articulated in order to allow for working with large amounts of data to obtain information that is relevant and make it accessible to decision makers, thus helping the industry advance.

A greater integration between the research, development, innovation and production processes is necessary in order to be able to address the needs of a society increasingly demanding and competitive. It is necessary to reduce the time between each of these processes by creating new productive and business models as well.

The need to work on consumer awareness is also highlighted. New and more sustainable products appear in the market, contributing to making progress in circular economy processes and allowing for drastic waste reduction, based on efficient, sustainable and environmentally-friendly management systems.

At the social level, the following aspects are emphasised:

- Decrease of the working-age population;
- Increase in elderly;
- Greater access of the population to specialized training, which is not always related to the specific needs of the industry (distance between the education sector and the industrial sector);
- Population increasingly informed, and with greater access to communication channels;
- Interest groups that advocate for more personalized products and to preserve the environment;
- Technological facilities bring together more aware people who can lobby to introduce changes in the industrial sector and push it towards more sustainable processes;
- Need to promote entrepreneurship as a way to employ the active population.
- Population not always willing to pay for the over-cost of industrializing some sectors, or to get products through a sustainable industry.

In the Italian and Finnish context, a challenge for the coming years stands out: the transition towards a low carbon (and other non-renewable resources) economy.

In the Polish context, the importance of generating companies in the agro-food sector that do not depend directly on large international companies is highlighted.

In the Finnish context, the need for greater alignment between the education sector and the industrial sector is highlighted.

In the Danish context, it is an important to train qualified professionals to introduce technology in all production sectors (especially in agronomy).





The bio industries general activities and actions

In general terms, it is acknowledged that the sector will increase its weight in the European economy in the coming years, mainly as a consequence of the need to create new products as well as to manage waste and search for more efficient and environmentally friendly processes. From this point of view, none of the current sectors are considered to disappear from the European context, although it is agreed that all of them must evolve and grow to be more efficient. In this line, it is noted that progress must be made in the treatment of raw materials to achieve products with more added value.

In the coming years the sector will be driven mainly towards the incorporation of processes that will seek environmental protection and sustainability as well as the implementation of actions that will allow for the recovery of those environmental aspects that have deteriorated in the last century (water pollution, destruction of natural spaces, increase of waste, etc ..). Below more specific aspects that have appeared as highlights in this line:

- Changes in regulations and subsidies will affect how we understand the current Bio sector. In this sense, the regulatory pressure linked to the control of waste and the incorporation of more sustainable productive processes will increase.
- It will be necessary to implement more efficient productive processes, decreasing the use of fossil fuels, which will be more and more expensive. The idea is to reduce the consumption of these types of energy and replace them by others that avoid the greenhouse effect gases.
- Progress will be made in the implementation of circular economy models, which implies a reduction in primary products and a greater reuse of waste generated and by-products.
- The inclusion of technologies in the sector will continue to advance, requiring the incorporation of interdisciplinary profiles that are capable of providing holistic answers to complex problems.
- The importance of controlling the traceability of the processes and the quality of the products will be linked to an increase in the collection of data, which will involve establishing mechanisms that allow to treat them for decision-making purposes.
- Biotechnology will continue to be an expanding sector, also linked to the use of bioinformatics as a key element in the growth of companies in the sector.
- Designing products that are more respectful with the environment, abiding the principles of the circular economy, with a tendency to reduce waste. This will involve creating new value chains directly linked to the territory in which the companies are located.
- Increasing the production of plant products with high protein value to be used in the food sector.
- Replacing products that are currently derived from chemical processes or with high economic and environmental costs of production by others that come from the field of Bio (biomass-derived polymers, cellulose for textile, biocomposites, etc.)
- Increase the efficiency of the production of bio-sustainable materials in order to reduce their cost and increase their presence in the market. Aspects that are also linked to the awareness of consumers about this new type of products.
- Sharing knowledge will be a permanent dynamic in the future industries of the Bio sector as a basis for innovation. Therefore, it is considered vital to work on models that facilitate collaboration by exchanging knowledge and data, but at the same time guarantee the protection of industrial property.

- The integration of sectors. This implies that collaboration with industries that are currently far from the BIO sector will increase, which makes it necessary to provide mechanisms for collaboration between people from different academic and professional backgrounds.
- The improvement in value chains will somehow force the integration of industries, thus allowing for a better efficiency in the scalability of production and responding more quickly to the needs of a changing market.
- The design of products with high added value will be a direct result of the inclusion of technology and process improvement in the sector. This can also be associated with the need to personalize products.

In order to achieve the above mentioned aspects, the collaboration between companies and the public sector is considered vital. The integration of the processes between the different sectors and levels (regional, national or community) will be the key to achieve the sustainability of the aforementioned actions.

The needs of the advances in the sector will also be a facilitator for the emergence of spin-off and start-up companies, which is also related to an increase of the collaboration between the industry and the main stakeholders. Citizen participation is considered a key aspect in the generation of new products linked to sectors such as health or food, as is the incorporation of competencies linked to entrepreneurship into the educational system.

For all this, and as explained in the following points, the collaboration between the business sector and the education system will be the key to obtain the best results from the Bio industry. Likewise, we consider of vital importance the introduction of the contents linked to the BIO sector in the secondary education study programs, stimulating a greater awareness of the population regarding the consumption of products of the sector and the reduction of waste.

In the case of Denmark, it is considered that there will be no major changes in the sector in the 2030 perspective, and that the trend will turn into the search for more efficient and sustainable processes with the environment.

In the case of Italy, the importance of the bioplastic sector stands out, which will advance in the coming years to reduce the impact of polymer-based materials.

In the case of Finland, it is important to link other industrial sectors relevant to the country, such as the forestry, thus creating industrial networks that add value to forest products.





The Jobs and positions in bio industries

It is generally agreed that the future of the industry will advance towards the need for fewer professional profiles linked to manual work, but to an increase in those profiles that should control the automated production processes and generate a sustainable value chain.

Research and development is considered the fastest growing sector in the coming years, as it is related to the development of new technologies and more efficient and environmentally sustainable processes, as well as new products.



Positions related to the use of information and communication technologies will also be of vital importance, with special emphasis on positions linked to obtaining and processing data to generate relevant information for the improvement of processes and products.

Experts in bioinformatics will also be relevant in the industry of the future, in fact, they already consider a profile that is currently necessary and will continue to be so in the coming years, as a result of the need to work on programming, automation, robotics or data processing. In cases like Poland it is considered important to match the salary of this professional profile with that of other profiles in the field of information technology.

Professionals knowledgeable on regulations related to the Bio-economic sector will be necessary with the increase in the regulations that are currently being implemented in this sector.

Jobs linked to the analysis and control of quality.

Professionals specialized in the reuse of existing resources, waste management and advance in the abandonment of fossil resources and the use of biomass.

Multipurpose profiles will be necessary in the future. In a context in which changes in business and market demands can be constant, and progress through research can also involve changes in aspects of production, it is necessary for professionals to have the ability to adapt to different job positions, capable of acquire new competences easily.

In some cases, the need for jobs linked to support services (management, sales, economic analysis ...) with specialized knowledge in the Bio industrial sector is also highlighted.

Likewise, professional profiles linked to the classic engineering competences to maintain and manage industrial machinery will continue to be necessary.

In the case of Denmark, the need to have specialized professionals in Biomass production (agriculture) is highlighted, specifically in the production of feedstuff of high and uniform quality, and knowledge on production, harvest and logistics. For this reason, it is reasonable to consider that specializations should appear in the field of biology and biotechnology, in collaboration with experts in technology and automation of processes.

Eventually, the job market will change profiles to adjust to changing and flexible environments, considering the importance of teamwork and multidisciplinary, with cross-cutting knowledge that allows them to interact with other professionals and understand the whole value chain of the company.



The training of professionals working on Bio Industries

It is widely agreed that graduates of the current education system do not have the necessary skills required by the industry. Furthermore, it is also agreed that training programmes changing pace is very slow in adjusting to new industrial requirements or the progress of the sector, something that forces to generate a parallel training system within the industries themselves (when they can afford it). There is, therefore, an urgent need to increase collaboration between both sectors, which is also in the line of offering training programs that

involve students' secondments in the industry in order for the students to acquire an applied vision of the knowledge that they have acquired in the classrooms.

It also highlights the need to improve the integration of the different levels of the education system, sharing knowledge, teaching materials, objectives, methodologies, etc. Methodologies based on solving problems or challenges in the sector, and involving teamwork, multidisciplinary and multilevel, should be the basis of new training programmes.

It is necessary that training programs traditionally linked to the bio sector (chemistry, biology, physics, etc.) include content related to:

- Rules and regulations of the Bio sector.
- Technologies linked to more sustainable processes.
- Technologies to facilitate communication and management.
- Technologies related to robotization of productive processes and the use of artificial intelligence.
- Knowledge to work with data, from data data generation to use for process improvement.
- Soft skills (interpersonal relationships, communication, teamwork, writing, emotions management, etc.).
- Knowledge about human rights, ethics and philosophy.
- Optimization of processes.
- Economic and management aspects, as well as new business models.
- Knowledge of sales and marketing.
- Management of biological and industrial waste.
- Management of secondary products.
- Global vision of the value chain and the hierarchy in the use of products.
- Circular economy.
- Ecology and preservation of the environment.

It is also considered important that all studies related to the BIO sector include advanced knowledge of mathematics, computer science, physics,

Furthermore, it is considered of vital importance that the knowledge acquired at university degrees is not only linked to the knowledge of biological processes (fermentation, molecular biology, etc..) but on how these processes are used in the productive industry.

Working in a more transversal way requires that other professional profiles not directly linked to the Bio sector should understand what is done in this industrial sector. An improved understanding of the sector should facilitate multidisciplinary and team work: It is considered necessary that the following professional profiles have training programs that help them to better understand the Bio sector:



- Marketing and sales
- Information and communication technologies
- Training and communication managers
- Automation

The knowledge of the professionals of the Bio sector should also make it possible to move towards personalization processes of the products based on the information provided by the stakeholders and potential end users. In order to address the new demands of the job market, there is a need to generate modular courses that will allow for complementary trainings for professionals.

In Spain, the need for greater integration between degrees in the bio and health sector with technology has been identified. This is the case of the role currently played by qualified biotechnology professionals in the health field. Therefore it is considered important to favor greater opportunities for professionals in the field of technology to acquire knowledge of the bio sector, thereby facilitating cross-fertilization of knowledge.





The training system in general and focused on the Bio Industries

There is a lack of connection between theory and practice as an element that generates serious difficulties when incorporating new personnel into the industry. In this sense, the need for the programmes to have a more practical approach is highlighted, incorporating industrial secondments in the curriculum. This aspect is considered relevant at all training levels, from professional training to doctoral training. At PhD level, the recommendation would be to increase the number of industrial doctorate programmes that would encourage more

collaboration between universities and industry for in the education of high-level professional profiles.

Another approach to encourage collaboration between industry and the education system can be the creation of laboratories where students could participate improving their knowledge on industrial advances, at the same time that the industrial agent can test some of its productions.

Moreover, it is pointed out that the educational system pays little attention to issues such as the environmental impact of industrial processes, the integration of processes in the value chain and the notion of traceability in production. All of them are considered key elements to raise awareness among the population about the bio-industrial sector and environmental sustainability. Therefore, in some cases it is suggested that content linked to sustainable lifestyles and processes should be incorporated into the educational system, at all levels, where attention is paid to waste treatment and reuse.

The education systems must be more permeable to allow the continuous training of the employees. Likewise, the combination between work and studies should be favored, thus enabling both access to continuous education to active employees in the sector, and the possibility to practice the skills developed during the training itself.

In some cases the importance of increasing the internationalization of studies is mentioned, favoring the exchange of students and professors that allows for learning from the progress achieved in other contexts as well as facilitating subsequent work in international environments and the mastering of languages.

There is a clear need to establish mechanisms that allow for the training and updating of professionals in the education sector, both in professional training and higher education, and also to overcome resistance to the introduction of changes in training programs.

There is also a need to introduce changes in the training methodologies: more online classes (allows more freedom) and face-to-face classes focused on debate, discussion and clarifying doubts. Face-to-face activity should seek more balance between the processes of active transmission and those linked to more proactive attitudes of the participants: not only taking notes but being more collaborative and proactive. Achieving this involves working on the quality of what can be found on the Internet and the development of critical thinking and the skills to discuss, reflect, draw conclusions and proposals, etc.

In general, the need to provide tools from the educational system to train professionals with competency profiles that allow them to adapt to different situations, with the ability to learn and drive innovation within the framework of multidisciplinary teams.



By way of conclusion

Educated and experienced professionals from the bio industry sector were interviewed in May 2019 and the results obtained can be summarized as follows:

The decentralisation tendency of the industry towards third countries will continue in the coming years and the new European industrial model is being defined. Digitalisation, artificial intelligence, robotisation and automation of production will contribute to the creation of more personalised and innovative products meeting the end users' needs (health, nutrition, aging). Additional global challenges, such as climate change, sustainability and energy efficiency demand more efficient environmentally friendly processes, waste reduction and complying with increasing pressure on safety and security rules and regulations.

European leadership in circular bio-based industry requires the joint strategic effort of all the bio-economy agents in the following strategic sectors: new technologies, natural resources, waste management, environment, sustainable energies, health and agro-food production. Collaboration between industries from different sectors will be key in the near future. The creation of consortiums, clusters and other collaborative ecosystems is a present reality, which will be expanded in the future.

A greater integration between the research, development, innovation and production processes is necessary in order to be able to address to the needs of an increasingly demanding and competitive society.

The future of the industry will advance towards the need for fewer professional profiles linked to manual work, but to an increase in those profiles that should control the automated production processes and generate a sustainable value chain.

Current educational systems tend to lack significant connection between theory and practice, which generates serious difficulties when incorporating new personnel into the industry. More practical approaches are demanded by industrial agents, for example, incorporating industrial secondments in academic curricula at all educational levels, also increasing industrial doctorates. Collaboration between universities and industry is a must in the education of high-level professional profiles:

- Positions related to the use of information and communication technologies.
- Experts in bioinformatics to work on programming, automation, robotics or data processing.
- Professionals knowledgeable on regulations related to the Bio-economic sector.
- Jobs on analysis and quality control.
- Professionals specialized on waste management and advance in the abandonment of fossil resources and the use of biomass.
- Multipurpose profiles in an ever-changing business and market context, there is a need for professionals to have the ability to adapt to different job positions and capable of acquiring new competences easily.
- Support service professionals: management, sales, economic analysis ...) with specialized knowledge in the Bio industrial sector.
- Classic engineering competences to maintain and manage industrial machinery will continue to be necessary.

The education systems must be more permeable to allow the continuous training of the employees favoring the combination between work and studies. Increasing the internationalization of studies and secondments allows for learning from the progress achieved in other contexts as well as facilitates subsequent work in international environments and the mastering of languages.



There is also a need to introduce changes in the training methodologies seeking more balance between the processes of active transmission and those linked to more proactive attitudes of the participants, more collaborative and proactive, developing of critical thinking and the skills to discuss, reflect, draw conclusions and proposals, etc.

In general, the need to provide tools from the educational system to train professionals with competency profiles that allow them to adapt to different situations, with the ability to learn and drive innovation within the framework of multidisciplinary teams.



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