United Nations
Educational, Scientific and
Cultural Organization

Bolstering Biotechnology Research and Education:

Building Human and Institutional capacities for the Bioeconomy

STAKEHOLDER STEERING COMMITTEE MEETING

26 SEPTEMBER 2019 • UNESCO • 7, Place de Fontenoy, 75352 PARIS, FRANCE

Table of Contents

UNESCO

The evidence is unequivocal: education saves lives and transforms lives, it is the bedrock of sustainability

Director-General

UNESCO serves as the United Nations Educational, Scientific and Cultural Organization. Its Head-quarters at the Place de Fontenoy is located near the Eiffel Tower and in the heart of Paris, where UNESCO's founding vision of building peace through international cooperation in education, the sciences and culture, was born.

Political and economic arrangements of governments are not enough to secure the lasting and sincere support of the peoples. Peace must be founded upon dialogue and mutual understanding. Peace must be built upon the intellectual and moral solidarity of humanity.

In this spirit, UNESCO develops educational tools to help people live as global citizens free of hate and intolerance. UNESCO works so that each child and citizen has access to quality education. By promoting cultural heritage and the equal dignity of all cultures, UNESCO strengthens bonds among nations. UNESCO fosters scientific programmes and policies as p latforms for development and cooperation. UNESCO stands up for freedom of expression, as a fundamental right and a key condition for democracy and development. Serving as a laboratory of ideas, UNESCO helps countries adopt international standards and manages programmes that foster the free flow of ideas and knowledge sharing.

UNESCO's founding vision was born in response to a world war that was marked by racist and anti-Semitic violence. Seventy years on and many liberation struggles later, UNESCO's mandate is as relevant as ever. Cultural diversity is under attack and new forms of intolerance, rejection of scientific facts and threats to freedom of expression challenge peace and human rights. In response, UNESCO's duty remains to reaffirm the humanist missions of education, science and culture.

Getting to UNESCO

Practical INFORMATION

Location:

UNESCO Headquarters
7 Place de Fontenoy
75352 Paris France

UNESCO has two entrances, please enter at 7 Place de Fontenoy

Transportation:

The closest metro stops are Ségur (*Line 10*) and Cambronne (*Line 6*).
Cost for a one-way metro ticket is €1.90.

Airports:

Taxi **-** Estimated costs of taxi rides from Charles de Gaulle (CDG) Airport or Orly (ORY) Airport to UNESCO is €56.

Public transport from CDG - The RER B, regional train, passes by different locations in central Paris. Travel time is approximately 50 minutes and the ticket price is €10. To get to UNESCO from CDG Airport via train, take the RER B train to *Saint-Michel Notre-Dame station*. At the station, transfer to metro line 10 towards *Boulogne Pont de Saint-Cloud* to *Ségur* station. This is a 1 hour journey.

Public transport from ORY - The OrlyBus travels between ORY Airport and the *Denfert-Rochereau* RER and metro stop. Shuttles are every 15-20 minutes starting from 5:35 AM until 23:05 PM Monday-Thursday, Sundays and holidays. The last bus on Fridays and Saturdays is at 00:05 PM. The ticket price is €8. At *Denfert-Rochereau*, take line 6 towards Charles de Gaulle Etoile to *Cambronne* station. This is a 40 minute journey.

1. BACKGROUND

Biotechnology is one of the fastest evolving and revolutionary "frontier issues" of our time. It is revolutionary in its ability to transform life itself in order to generate new products and services, with potential profound ethical, societal and economic impacts equal to those that followed the information and communication revolution. It has enormous transformational potential and will have an important impact on the work of the entire UN system, especially in relation to its work to support the achievement of the Sustainable Development Goals (SDGs).

Biotechnology is defined as the use of living systems and organisms to develop or make products, or "any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use" (UN Convention on Biological Diversity, Art. 2). Modern biotechnology, such as genetic engineering and cell fusion, is used to distinguish newer applications of biotechnology from more conventional methods such as breeding, or fermentation.Biotechnology has already made impact in improving human health, agricultural yields, food, nutrition and water security, developing alternative fuels, and reducing greenhouse gas emissions (*Afzal et al, 2016*).[1]

Agricultural biotechnology is already developing in ways that offer significant potential benefit to small farmers, inter alia through marker assisted breeding of plants, animals, fish varieties, and trees. Work on microbials and microorganisms is also contributing to plant and animal as well as human health. Lower-cost forms of bio-engineering, and combinations of biotechnology with more traditional breeding and fermentation techniques are making the genomic revolution more accessible and, in the right institutional environments, potentially more beneficial to small and medium producers. Science and technology will have to work hand in glove with institutional changes to address the many complementary needs of small-scale family farmers. In addition, new regulatory approaches will be needed to ensure that inappropriate use does not lead to expansion into unmanaged habitats, resulting in decreased global biodiversity and undesirable variation in crop yields.

Synthetic biology, genomics and gene editing have given rise to the promise of "personalized medicine" for the future in which, among other things, a wider range of drugs would be available to a greater number of smaller segmented markets, and where effective drug dosages could be more accurately calculated. The recent case of the use of programmable DNA cleavage (or gene editing technology known as CRISPR-Cas9) has enabled efficient, site-specific genome engineering in single cells and whole organisms. This is seen as the next step in eradicating certain unfavourable traits in organisms, be it plants or animals, which could fundamentally alter the natural world as we know it.

Biotechnology is considered particularly important for middle to low-income countries that are stuck in a poverty circle characterized by low productivity, overburdened health systems and high-cost unsustainable energy supplies. Developing countries may have the most to gain from biotechnology and its applications, but also the most to lose. Marginalization of countries with low technological capabilities is a significant risk, thereby potentially deepening existing inequalities. Support is needed to develop their human resources, policy and regulatory capacity, research funding and centres, including for the basic and applied sciences, and governance institutions to enable their active and equal participation in biotechnology. While significant strides have been made in biotechnology development beyond those anticipated in 1992, developing countries have increasingly remained behind (*UNESCO Science Report 2015*).

Biotechnology is also critically important for the job landscape. The UNESCO Science Report 2015 and the OECD report, "the Bio-economy 2030" estimated that the biotechnology industry generates over 90 billion USD of annual revenue, globally. In addition, the EU bio-economy provides more than 18 million jobs (European Commission 2016)[2]. Globally, the bio-based economy is projected to grow by at least 50% by 2030 (Biotechnology Innovation Organization, 2017)[3]. Middle-income and low-income countries could also take

1 Afzal H, Zahid K, Ali Q, Sarwar K, Shakoor S, et al. (2016) *Role of Biotechnology in Improving Human Health*. J Mol Biomark Diagn 8:309. doi: 10.4172/2155-9929.1000309

2 JRC Science for Policy Report, Bioeconomy Report 2016, European Commission

3 Bio (2017) *The biobased economy: measuring growth and impacts*. Biotechnology Innovation Organization. https://www.bio.org/sites/default/files/Biobased_Economy_Measuring_Impact.pdf.

advantage of the bio-economy, provided that adequate regulatory and quality measures are in place, public innovation funds are made available, and incentives for domestic and foreign direct investment are introduced (*Timmis et al., 2017*).[4]

The rationale of building a productive biotech sector or 'bioeconomy' is in part to establish a low-carbon economy and to rely less on scarce/finite natural resources, and in other part to realize economic growth and value added through innovation (knowledge-based economy). UNESCO has been traditionally engaged in promoting and supporting the biological sciences, in terms of research and education. This is demonstrated by UNESCO's various networks, centres of excellence and university Chairs. The biological sciences, biotechnology and all related fields are under the UNESCO International Basic Sciences Programme (IBSP), which focuses on capacity building in training and research in the basic sciences and science education and on promoting the use of promising advances in the basic science to address environmental challenges, meet human needs and improve the quality of life and education.

The bioeconomy is based on various interpretation *(Vivien et al, 2018)*[5]. We have three kinds of conception in this case. A bioeconomy based on agro-ecology, transformation of joint product, valorisation of biomass from low tech etc. A second one, a bioeconomy based on biotechnologies with high-tech and patents. A third one, a bioeconomy based on the use of renewable carbon from biomass.

Although the discussion on the bioeconomy has so far been restricted to few high and middle income countries, some leading world economies in Asia and South America, and many other countries in different stages of economic trajectories are investing in one way or another in biotechnology research and hence in the bioeconomy. It is therefore important to understand how these countries are putting in place policies and programmes to improve education curriculum in biotechnology or life sciences in general and what types of collaboration exist between academia and industry.

New approaches are also needed on how best to ensure public engagement with all concerned actors and stakeholders, transparent decision-making processes and informed consent. This includes decisions on how to allocate funds from both the public and private sector for research and development and university education. This is particularly important, as "the biotech industry has increasingly realized that not only regulatory schemes but also contentious public and political debate can either enable or constrain research and development" (UNESCO Inter-governmental Bioethics Committee report 2017). The ethics of the applications of biotechnology/ converging technologies also needs to be considered. This includes a reflection on both their potential positive and negative impacts, as well as public engagement and informed consent on how those applications are used.

1.1. OBJECTIVES

The objective of the stakeholder steering committee meeting is to draw out issues that are pertinent to building institutional and human capacities for the bioeconomy and to discuss the following:

- How to promote biotechnology/bioeconomy education and training in secondary and tertiary education and in research institutions both in the public and private sectors
- How to build institutional capacity building in the biotechnology/bioeconomy and the creation of centres of excellence
- Diversity of communities, diversity of technological paths and innovation system in emerging countries

The idea of this steering committee is to also advise UNESCO on the organization of a conference on this subject to advocate to Member States and to engage with them on how to strengthen programmes in the biological/biotechnological sciences. In particular, the following questions could be used to guide this proposal:

- Is your institution having a success worth presenting at the Conference in 2020?
- What general recommendation can you offer to the program of the Conference in 2020?
- Do you have a specific proposal for the future program?
- What topics should be covered as priority? And so on.

The meeting will also be used as a preparatory stage for the organization of the Global Bioeconomy Summit, scheduled in Berlin, Germany in November 2020.

4 Kenneth Timmis, Victor de Lorenzo, Willy Verstraete, Juan Luis Ramos, Antoine Danchin, Harald Brüssow, Brajesh K. Singh and James Kenneth Timmis; *The contribution of microbial biotechnology to economic growth and employment creation*; 4 September 2017.

5 Vivien, F.-D., Nieddu, M., Befort, N., Debref, R., Giampietro, M, (2019), *The Hijacking of the Bioeconomy, Ecological Economics*, 159, 189-197.

1.2. OVERVIEW ON BIOECONOMY

What is needed for a viable bioeconomy?

According to the OECD, several factors may drive the bioeconomy by creating opportunities for investment. In developing countries, increasing population and per capita income as well as the use of biotechnology to meet the challenge of environmentally sustainable production are all major drivers. This trend indicates that developing countries could be the main markets for biotechnology in primary production (agriculture, forestry, health and fishing). In addition, the increase in energy demand, when combined with measures to reduce greenhouse gases, could also create large markets for bio-based industries.

A sustainable bioeconomy should therefore be an ensemble of elements. The skills and resources required to carry out scalable biotechnology-based research and development depend on factors of increasing complexity and interconnection. Linkage between university, industry and government has been identified as a key element to jumpstart the process taking advantage of the global existing body of knowledge and know-how. Technological and logistics infrastructure, communication and energy development programmes also require supporting policies and execution thereof. The state must take a leading role in the establishment and the maintenance of a truly enabling environment, the promotion of social acceptance and the development of key economic infrastructure and services in partnership with the private sector.

What is the status of the university and industry/private sector interaction?

UNESCO Science Report 2015 analysed university-industry partnerships in 31 high-income countries and 22 low- and middle-income countries. These indicators were based on multi-sectoral industries, which include life and chemical sciences industries, but were not specific to the bioeconomy sector as a whole. However, they provide useful information for the purpose of our analyses.

The general picture is that university-industry ties are low. They are lowest in Australia (1.4% of firms), the UK (4.7%) and Italy (5.3%). Less than 10% of firms in a further eight countries reported collaboration with universities, namely Cyprus, Estonia, Latvia, Malta, New Zealand, Portugal, the Russian Federation and Spain. Even in Japan and the Republic of Korea, two countries most committed to research and development (R&D), the proportion was just 15.7% and 10.0% respectively. More than one-fifth of firms reported university–industry collaboration in just two of the countries surveyed: Finland (33.8%) and Austria (24.7%). There was a similar pattern in the 22 low- and middle-income countries surveyed. Only in the following countries did more than one in five firms collaborate with universities: Malaysia (20.7%), Hungary, (23.1%), Costa Rica (35.3%), Kenya (46.2%) and the Philippines (47.1%).

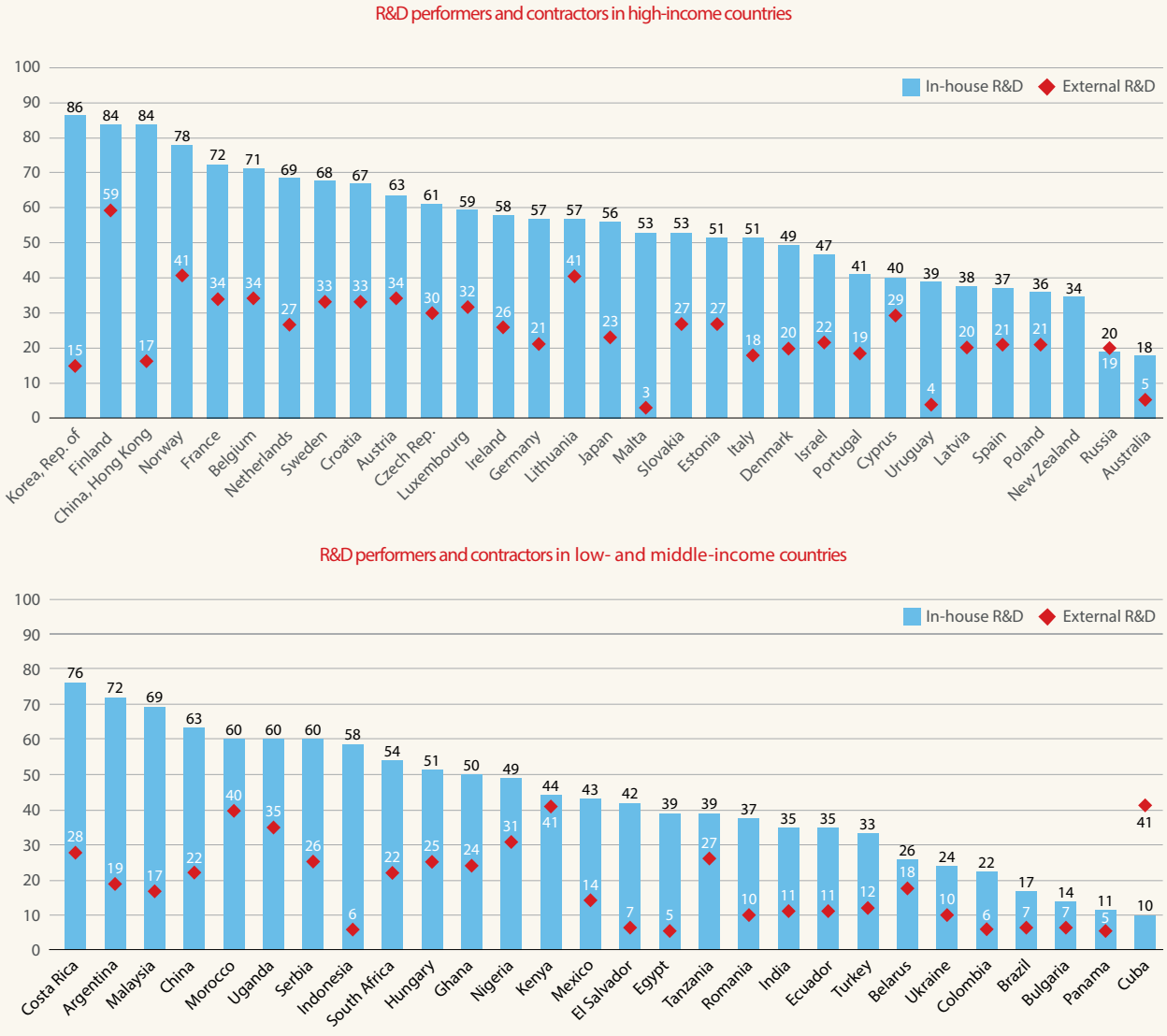
Table 2.2: **Highly important sources of information for firms**

Share of innovation-active manufacturing firms (%)

	SOURCES OF INFORMATION									
	Internal	Market				Institutional		Other		
	Within your enterprise or enterprise group	Suppliers of equipment, materials, components or software	Clients or customers	Competitors or other enterprises in your sector	Consultants, commercial labs or private R&D institutes	Universities or other higher education institutions	Government or public research institutes	Conferences, trade fairs, exhibitions	Scientific journals and trade/ technical publications	Professional and industry associations
High-income countries										
Australia	72.9	28.6	42.1	21.0	13.7	1.2	2.9	10.0	23.0	16.3
Belgium	55.1	26.7	28.7	8.4	4.7	5.2	1.6	11.7	6.7	3.1
Croatia	44.0	27.7	33.2	14.5	5.3	2.7	0.5	14.1	8.2	2.4
Cyprus	92.8	71.9	63.4	48.1	41.3	6.0	5.5	63.0	31.5	20.4
Czech Rep.	42.7	21.8	36.8	18.5	3.9	4.3	2.3	13.3	3.8	1.9
Estonia	30.1	29.4	18.8	9.3	5.8	4.2	1.1	12.7	2.0	1.3
Finland	63.4	17.3	41.1	11.7	3.6	4.5	2.8	8.8	3.4	2.5
France	51.2	19.9	27.8	9.4	6.2	3.4	3.1	10.8	7.9	5.5
Israel	79.3	17.6	19.1	7.9	7.5	3.7	2.2	13.7	6.7	2.1
Italy	35.5	18.8	17.6	4.5	15.1	3.7	1.0	9.7	3.7	4.4
Japan	33.7	20.7	30.5	7.5	6.2	5.1	4.8	4.6	2.0	2.9
Latvia	44.4	23.3	23.9	16.5	7.8	3.4	1.6	20.2	7.1	3.4
Lithuania	37.5	15.6	18.9	12.2	4.1	2.9	3.8	13.1	2.2	0.5
Luxembourg	68.3	36.5	46.1	24.6	12.6	7.8	3.6	38.3	24.0	18.6
Malta	46.0	39.0	38.0	21.0	10.0	4.0	2.0	13.0	2.0	3.0
New Zealand	86.4	51.0	76.3	43.1	43.4	10.2	16.0	45.9	48.3	21.4
Norway	79.1	50.4	78.3	30.0	9.4	7.2	10.5	10.5	16.0	30.4
Poland	48.2	20.2	19.2	10.1	5.2	5.8	7.3	14.8	10.3	4.8
Portugal	33.9	18.5	30.3	10.2	5.9	3.2	2.2	13.9	6.0	4.3
Korea, Rep.	47.4	16.1	27.7	11.3	3.4	3.9	6.1	6.7	5.2	4.9
Russian Fed.	32.9	14.1	34.9	11.3	1.7	1.9	–	7.4	12.0	4.1
Slovakia	50.5	27.2	41.6	18.1	2.8	2.5	0.6	12.4	13.6	1.4
Spain	45.5	24.2	20.9	10.4	8.7	5.0	7.7	8.7	4.7	3.9
Uruguay	52.9	24.2	40.3	21.2	13.6	5.8	–	27.1	18.0	–
Low- and middle-income countries										
Argentina	26.4	52.7	36.3	16.4	28.5	40.0	42.4	–	–	–
Brazil	41.3	41.9	43.1	23.8	10.2	7.0	–	–	–	–
Bulgaria	28.6	22.4	26.1	13.6	5.5	–	–	13.6	9.4	5.1
China	49.5	21.6	59.7	29.6	17.1	8.9	24.7	26.7	12.0	14.8
Colombia	97.6	42.5	52.6	32.1	28.4	16.2	8.0	43.7	47.3	24.5
Cuba	13.6	–	11.5	5.1	–	19.6	24.7	–	–	–
Ecuador	67.0	34.9	59.0	27.1	10.7	2.0	2.2	22.2	42.5	6.3
Egypt	75.9	32.1	16. 1	17.0	2.7	1.8	0.9	22.3	13.4	4.5
El Salvador	–	26.4	40.3	5.4	15.2	3.8	1.8	13.9	10.3	–
Hungary	50.5	26.4	37.4	21.3	13.0	9.9	3.3	16.6	9.6	7.7
India	58.5	43.3	59.0	32.6	16.8	7.9	11.0	29.7	15.1	24.5
Indonesia	0.4	1.3	1.8	1.3	0.9	0.4	0.4	0.9	0.9	0.9
Kenya	95.7	88.2	90.3	80.6	52.7	37.6	39.8	71.0	64.5	72.0
Malaysia	42.4	34.5	39.0	27.9	15.0	9.5	16.7	28.1	21.7	23.6
Mexico	92.2	43.6	71.9	44.0	19.0	26.4	23.6	36.9	24.5	–
Morocco	–	51.3	56.4	15.4	17.9	6.4	12.8	43.6	34.6	25.6
Nigeria	51.7	39.3	51.7	30.0	14.6	6.8	4.1	11.5	7.1	20.2
Panama	43.6	10.9	15.2	6.6	5.2	2.4	2.4	5.2	0.5	1.9
Philippines	70.7	49.5	66.2	37.9	21.2	10.1	7.1	21.7	16.7	15.7
Romania	42.1	31.8	33.5	20.5	5.2	3.3	2.0	14.3	10.2	3.5
Serbia	36.2	18.3	27.3	10.5	7.8	5.3	2.6	14.8	10.3	5.7
South Africa	44.0	17.9	41.8	11.6	6.9	3.1	2.3	12.9	16.7	8.4
Tanzania	61.9	32.1	66.7	27.4	16.7	7.1	11.9	16.7	9.5	20.2
Turkey	32.6	29.1	33.9	18.0	5.2	3.7	2.8	19.7	9.4	6.9
Uganda	60.9	24.8	49.0	23.0	12.2	3.2	5.0	16.4	8.3	11.3
Ukraine	28.6	22.4	21.9	11.0	4.7	1.9	4.6	14.7	9.1	4.0

Source: UNESCO Institute for Statistics, September 2014

Figure 2.7: **Firms with in-house or external R&D among surveyed countries**
Share of innovation-active firms (%)



Source: UNESCO Institute for Statistics, September 2014

If university–industry ties are so desirable, why then are so few firms interacting with universities?

One explanation for the phenomenon in high-income countries may lie in the fact that, "owing to its unpredictable nature, technology transfer is not a reliable supplement to the university's revenue compared to other sources of revenue", such as government research grants and tuition fees.

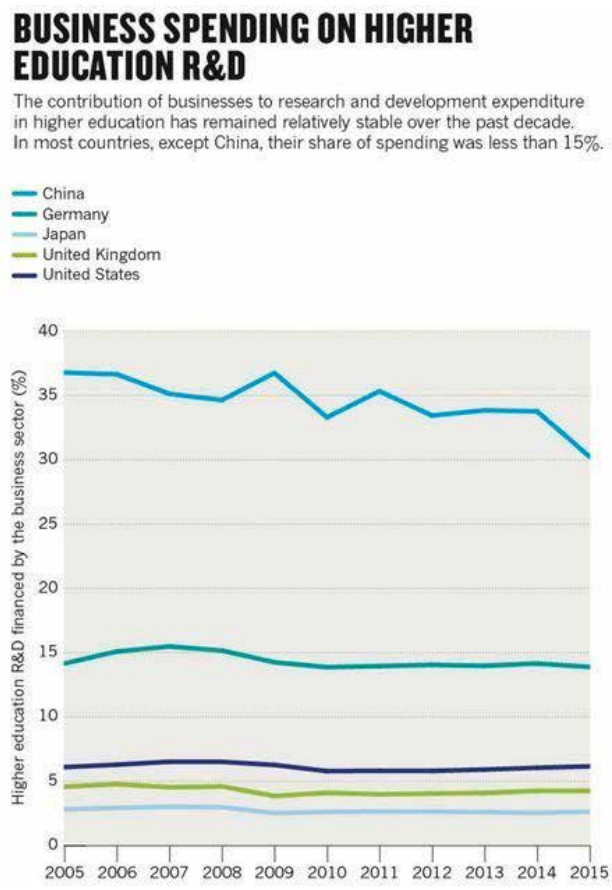
However, industry-sponsored research can be a valuable source of income in the face of government austerity budgets. In the USA, for instance, federal investment in R&D stagnated in the wake of the 2008–2009 recession. "Although industry-sponsored research accounts for only 5% of academic R&D", the UNESCO Science Report observes, "leading [US] universities are increasingly relying on research dollars from industry as alternatives to federal and state dollars". Unfortunately, the USA does not survey business ties to universities and other public institutions.

Another explanation for the low level of collaboration between industries and universities could lie in the different work cultures of the public and private sectors. The interests of academics and entrepreneurs do not always converge. "The career of academic researchers is dependent on publishing their results", observes the report, "whereas industrial partners may prefer not to publish to prevent competitors from benefiting from their investment".

The survey by the UNESCO Institute for Statistics revealed another disconcerting trend. Manufacturing firms which are active innovators tend to consider universities a minor source of information, compared to suppliers, clients or their own staff. In Brazil, for instance,

just 7% of firms ranked universities as highly important sources of information.

However, there is widespread agreement that collaborations between industry and academia are good for the businesses involved, and generally have a positive effect on the economy. Their influence on academic productivity, however, is a more ambiguous question. Some scientists worry that businesses, determined to keep intellectual property and profits for themselves, will delay the publication of studies or suppress negative results. Corporate pressure could also divert scientific efforts from fundamental studies, toward applied research. Several studies into the effect of corporate funding on scientific productivity have reinforced these fears. Some studies indicate that university-industry partnerships increase publication and citation of academics; other studies show the opposite.



The role of higher education institutions in supporting the bioeconomy

Research, innovation and education at all levels form an indispensable basis for the development of sustainable biotechnology and bioeconomy concepts. There will be "one-size-fits-all concept" of the bioeconomy. For the specification of the different job profiles of the bioeconomy human resource base the diversity of circumstances and requirements in different regions and macroregions in developing, emerging and developed economies have to be considered. Educational curricula provided by universities and vocational institutions have to meet the demands of the employers in the various biotech sectors. For universities, this requires research-based training with an interdisciplinary approach that emphasises systems thinking, strategic planning, economic performance, and evaluating environmental, ethical and social issues. For vocational training and training on the job, the diversity of practical needs is huge and efficient solutions need to be built into existing approaches. In addition to focusing on the natural, technical, economic and social sciences, the curricula should also develop innovation and entrepreneurial skills in preparing graduates for management roles to promote changes in existing industries, but also to develop and grow new ventures in the bioeconomy.

These developments require collaboration between universities, vocational training organisations, industry and policy and governance stakeholders. International cooperation can bring additional momentum and requires accepted standards in order to benchmark and sustain these initiatives for the future. It is important to understand, which are the optimal instruments (e.g. qualifications, quality assurance, mobility, accreditations, fellowships, grants and scholarships, etc.) that need to be put in place for an effective workforce for the bioeconomy sector.

In addition to targeting curricula at university and vocational training level, there is also a need to create hubs or centres of excellence/competence in bioeconomy, which can represent desired models of operation. Here, the triangle of research, education and training can grow in a way which is fostering integrative approaches by addressing the relevant stakeholders representing the different fields of the bioeconomy. Concomitant with these efforts, a campaign raising awareness is needed to reach out to educational and training activities in the entire life-long training cycle to showcase the objectives of the bioeconomy and what it entails.

1.3 OUTCOME

Outcomes of the stakeholder steering committee meeting

- Comparative analysis from different countries/ world region on how biotechnology/ bioeconomy is taught and what collaborations are in place
- Plan for the organization of a UNESCO conference on biotechnology/ bioeconomy education in the spring of 2020

2. AGENDA

Room VIII, UNESCO Headquarters, 7 Place de Fontenoy, 75352 Paris
26 September 2019

Time		
9.00 – 9.10	*10 min*	Welcoming remarks by UNESCO representative
9.10 – 9.40	*30 min*	Introduction of stakeholder members
9.40 – 10.00	*20 min*	Presentation of UNESCO programme and objective of meeting
10.00 – 13.00	*3 hours*	**SESSION I** **Presentation by members of their work in biotechnology/ bioeconomy and discussion** *Coffee served outside*
13.00 – 14:30	*1 hour 30 min*	Lunch break, 7th Floor Restaurant
14.30 – 16.00	*1 hour 30 min*	**SESSION II** **Presentation by members of their work in biotechnology/ bioeconomy and discussion** *Coffee served outside*
16.00 – 17.30	*1 hour 30 min*	Recommendations for UNESCO Biotechnology/Bioeconomy Conference 2020
17.30 – 18.00	*30 min*	Wrap up, closing remarks and vote of thanks by Director, Division of Science Policy and Capacity Building, UNESCO

3. LIST OF PARTICIPANTS

3.1 Participants of stakeholder steering committee

Prof. Hamid Ahmed,
Adviser to the Prime Minister of Iraq, Government of Iraq

Prof. Jacques Amouroux,
UNESCO Chair, École Nationale Supérieure de Chimie de Paris

Mr. Julian Barbière,
IOC-UNESCO Programme Specialist

Dr. Lee Beniston,
Head of Innovation at the Biotechnology and Biological Sciences Research Council, United Kingdom

Ms. Antonella Canalis,
Project Officer of Bio-based Industries Joint Undertaking, Belgium

Prof. Iqbal Choudhary,
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Dr. Paul Colonna,
Directeur de 3BCAR, INRA, France

Dr. Romain Debref,
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Dr. Beate El-Chichakli,
Head of Office, German Bioeconomy Council

Dr. Ahmed Fahmi,
UNESCO Chief of Section, a.i. Innovation and Capacity Building in the Natural Sciences

Dr. Yoshiyuki Fujishima,
New Energy and Industrial Technology Development (NEDO) Japan

Prof. Josef Glößl,
University of Natural Resources and Life Sciences, Vienna (BOKU)

Prof. Joan Guinovart,
International Union of Biochemistry and Molecular Biology (IUBMB) Former President

Dr. Simon Heath,
Secretary General, Association for European Life Science Universities

Ms. Rasha Kelej,
Chief Executive Officer of Merck Foundation

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Prof. Umezuruike Linus Opara,
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Dr. Peggy Oti-Boateng, Director,
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Dr. Jim Philp,
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Prof. Dr. Andreas Pyka,
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Dr. Ricardo Queiros,
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Mr. Peter Wells,
UNESCO Chief of Higher Education Section

Mr. David Winickoff,
Senior Policy Analyst, OECD

3.2 BIOGRAPHY OF THE MEMBERS

Ahmed, Hamid Ph.D.

Deputy Minister of Higher Education and the previous Deputy Chairman for the Prime Minister's Advisory Commission. He attained two Masters, an MSc in Physiology and in Higher Education Management, and completed his PhD in Biotechnology. He has worked on a number of educational programmes aimed at educational reforms through different levels in the education sector. He has worked with UNICEF, UNESCO and the World Bank on a national strategy for education in Iraq. Prof. Ahmed has published more than 60 papers in international journals and conferences, is the founder of the online journal Marina Mesopotamia Journal and is the author of four books. His latest book on higher education reform: *Teaching, Learning, and the Management of Change.*

Barbière, Julian

Head of Marine Policy and Regional Coordination Section at the Intergovernmental Oceanographic Commission of UNESCO. Educated as an environmental scientist, he has approximately 20 years of experience at the international level in the field of ocean sustainability, ocean governance and the implementation of ecosystem-based management approaches at various geographical locations. Working at the interface of science and policy, he has led a number of UN initiatives, such as the Assessment of Assessments (UN Regular Process), the inter-agency Blueprint for Ocean Sustainability, the development of international guidelines on Marine Spatial Planning.. He is currently coordinating the development of the UN Decade of Ocean Science for Sustainable Development (2021-2030).

Beniston, Lee Ph.D.

Dr Lee Beniston currently works across government, industry and academia to drive impact and innovation in the biosciences through supporting academic-industry engagement. Lee is also a Visiting Researcher at Leeds University Business School. Through his PhD and postdoctoral work, Lee developed leading expertise on how to foster creativity and innovation in innately multidisciplinary and multicultural scientific research environments. Lee has also been involved in delivering, and evaluating, innovation management training for scientists and engineers. To date, Lee's research findings and expertise have significantly aided interdisciplinary leaders, practitioners, policy-makers and researchers in a multitude of ways: to operate and innovate effectively in multidisciplinary scientific research environments and organizations; to rapidly understand how to efficiently and effectively embed and support scientific creativity and innovation in relation to research and training.

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Antonella Canalis is a Project Officer at the Bio-Based Industries Joint Undertaking, Brussels, Belgium, where she is responsible for the management of European collaborative projects in the field of bioeconomy, in the frame of the European Union's H2020 Framework Programme for Research and Innovation. As a project officer, she has experience in the area of biotechnology applied to the agri-food and health sector, as well as in clinical research in the area of non-communicable diseases. She graduated in Economics from the University of Sassari (Italy) and earned a Masters degree in Agricultural and Food Economics, Catholic University of Cremona (Italy) and the University of Guelph (Canada). She holds a Postgraduate Diploma in Health Economics from the University of York (UK).

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Director of the UNESCO International Centre for Biological and Chemical Sciences, Pakistan. He is a scientist in organic chemistry and is known for his research in natural product chemistry. He is a Karachi University graduate and undertook his Masters and PhD in organic chemistry. His work is published in more than 800 scientific research papers and holds 24 patents. His contribution in the field of organic chemistry led him to be the recipient of civilian awards of different countries and led to his title as the second most productive scientist in Pakistan.

Colonna, Paul, Ph.D.

Deputy Director of Science Sustainable Development, INRA. His roles extend to a scientific counselor for the IFP, board member of journals such as Journal of Cereal Science, the President of the Scientific Committee of the Bio Resources Action, Innovation and Performances of the ADEME.

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Associate Professor of Economics at the University of Reims Champagne-Ardenne, France. He is specialized in environmental innovation and bioeconomy. He is work-package leader of the project, BIOCA, Bioeconomy In Chapagne-Ardenne in France (PSDR4). He is the general secretary of the Research Network on Innovation (RNI) and a member of the editorial board of the Journal of Innovation Economics and Management. Dr. Debref's thesis questions the relevancy of the process of environmental innovation in the sector of the resilient flooring in Europe, which faces the challenge of sustainability. He was accredited with the Thesis Award, Honoris Causa, in 2016. He is also the author of Environmental Innovation Ecodesign: Certainties and Controversies.

El-Chichakli, Beate

Head of Office of the Bioökonomierat of the German Federal Government. She completed her studies in commercial sciences and received her doctorate in economics and social sciences at the Vienna University of Economics and Business Administration. With more than 15 years of professional experience in policy consulting, she worked mainly as a research associate, project manager and consultant for United Nations organizations in Geneva and Vienna.

Fahmi, Ahmed Ph.D.

Chief of the Section a.i. Innovation and Capacity Building in the Natural Sciences at the United Nation Education, Scientific and Cultural Organization (UNESCO). He worked in South Asia and the Asia-Pacific region on managing and coordinating the execution of the Basic Sciences, Engineering and Science Policy programme of UNESCO and was a visiting fellow at the United Nations University in Tokyo, Japan. He was involved in coordinating the International Basic Sciences Program and Go-SPIN and is currently involved in the establishment of UNESCO centres of excellence and in public private partnership in scientific research for Africa. He has a PhD in Molecular Biology and Biophysics, which he obtained in 2001 from the University of Cambridge, United Kingdom.

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Director of Strategic Planning Department at Japan Bioindustry Association. He is also a temporary NEDO Expert. As an experienced scientists he has demonstrated work focusing on bioeconomy policy, bio-diversity and the biotechnology industry. Fujishima has a BSc in Chemistry from Sophia University and his D.Phil. was in Organic Chemistry from the University of Oxford.

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Professor of Applied Genetics and Cell Biology at the University of Natural Resources and Life Sciences in Vienna, Austria. He graduated in Biology and Biochemistry and received his PhD at the University of Graz, Austria. He was appointed head of the Department in Applied Genetics and Cell Biology at BOKU University. He was a member of the Board of the Austrian Sciences Fund, a member of the European Science Foundation Standing Committee for the Life, Earth and Environmental Sciences and President of the Austrian Association of Molecular Life Sciences and Biotechnology.

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Emeritus Professor of Biochemistry and Molecular Biology at the University of Barcelona and senior group leader at the Institute for Research in Biomedicine (IRB Barcelona). He is a graduate in Chemistry and in Pharmacy from the University of Barcelona. He is the past President of the International Union of Biochemistry & Molecular Biology and was the former President of the Spanish Society for Biochemistry and Molecular Biology and the Confederation of Spanish Scientific Societies. He has held many distinctions, including the FEBS Diplôme d'honneur and the St. George's Cross of the Government of Catalonia.

Heath, Simon Ph.D.

Secretary General of the Association for European Life Science Universities (ICA). He led the development of the European Accreditation Agency for the Life Sciences, which had the primary aim of accrediting cross-border MSc programmes like the ERASMUS Mundus degree programmes. He received his Ph.D. from the University of Reading, United Kingdom. He was formerly a Senior Lecturer and Director of the Centre for Computer Based Learning in Land Use and Environmental Sciences (CLUES) at the University of Aberdeen, United Kingdom where he holds an Honorary position.

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Chief Executive Officer of Merck Foundation and the former Chief Social Officer and Vice President of Merck Healthcare. She holds a Pharmacy degree from Alexandria University and obtained an MBA from Robert Gordon University. Her initiative for the Merck Capacity Advancement Program seeks to improve access to innovative healthcare solutions and to build life science research capacity focusing on noncommunicable diseases. Her work on the Merck More Than a Mother campaign aims to reduce stigmatization of infertile women. She has been recognized for this campaign and was awarded with the Women Empowerment award in Spain.

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Professor at the University of Hohenheim holding the Chair of Biobased Products and Energy Crops. She studied Agricultural Sciences at the Universities of Göttingen and Hohenheim (DE) and completed her Ph.D. on the production of biomass crops. She has worked on various EU projects at the Universities of Hohenheim (DE) and Utrecht (NL) and for some years held the position as Global Biomass R&D Programme Manager for Shell's biomass research programme. She is Chief Bioeconomy Officer (CBO) of the University of Hohenheim and leads the international Master Bioeconomy. Presently, her research focuses on the development of sustainable agricultural biomass supply systems for a growing bioeconomy, the optimisation of biomass properties for industrial and energetic applications and the development and life-cycle assessment (LCA) of biobased value chains.

Nalecz, Maciej J. Ph.D.

Professor and former Director of the Nencki Institute of Experimental Biology Polish Academy of Sciences in Warsaw. In 2001, Prof. Nalecz was the Director of Division of Science Policy and Capacity Building, Natural Science Sector at UNESCO in Paris, France. Author and co- author of 150 scientific publications, he was the Executive Secretary of the International Basic Sciences Programme at UNESCO. He is an elected member of the Polish Academy of Sciences and Letters, awarded with the Knight Cross of Polonia Restituta, and Officer Cross of Polonia Restituta by the President of Poland.

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Distinguished Professor and DST-NRF South African Research Chair in Postharvest Technology at Stellenbosch University. He studied BEng and MEng in Agricultural Engineering at the University of Nigeria, Nsukka. He received his Doctor of Philosophy in Agricultural Engineering from Massey University, New Zealand. He focuses his research on high-level capacity building and development in postharvest technology and engineering for value adding in agriculture, food and other bio-based industries. He is the current director of UNESCO Institute of Biotechnology, University of Nsukka, Nigeria.

Oti-Boateng, Peggy Ph.D.

UNESCO Director of the Division of Science Policy and Capacity Building in the Natural Sciences Sector. Dr. Oti-Boateng holds a PhD in Food Science and Technology obtained from Adelaide University, Australia and an MSc, with a specialization in Biochemistry, from the Kwame Nkrumah University of Science and Technology in Kumasi, Ghana. She was regional thematic adviser for Africa for the formulation of policies and capacity building in science, technology and innovation. She also served as a focal point for the African Ministerial Conference on Science and Technology and was the Head of the Sciences Sector for the Southern African Development Community. Dr. Oti-Boateng was also the director of the Research Centre at the Kwame Nkrumah University of Science and Technology. She joined the UNESCO Office in Nairobi, Kenya as a Senior Programme Specialist with responsibilities in developing, coordinating, implementing and evaluating projects and programmes of activities relating to the basic sciences and science policy for sustainable development in Africa.

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Policy Analyst at OECD, specializing in industrial biotechnology, synthetic biology and biomass sustainability. He is a microbiologist and was an academic for 16 years researching environmental and industrial biotechnology. He became involved with UK government initiatives in biotechnology such as BioWise and Biotechnology Means Business. He was elected as a Fellow of the Royal Society of Chemistry in 2015 and a Fellow of the Institution of Chemical Engineers in 2016.

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Professor of Economics at the University of Hohenheim, Stuttgart. He has held the Chair for Innovation Economics since 2009. He studied Economics and Management at the University of Augsburg. For two years, he was a Post Doc at the French National Institute for Agricultural Research in Grenoble, France. Dr. Pyka does research in Bioeconomics, Computational Economics and Evolutionary Economics.

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Director of the Education Department at Institute Pasteur in Paris, France. As Director of the Education Department, she is strongly involved in creating an appropriate environment for the professional development of Master, PhD students, senior researchers, physicians, veterinarians and pharmacists by implementing high-level courses in all areas of life sciences and public health. She has several publications, including her more recent ones, on an innovative vaccination strategy based on GM yeasts to fight against malaria.

Salunke, Dinakar M. Ph.D.

Director of the International Centre for Genetic Engineering and Biotechnology in New Delhi, India. He is an immunologist and structural biologist, earning his BSc in Physics, Mathematics and Statistics, and MS in Physics from Karnataka University, Dharwad. He completed his postdoctoral research at Brandeis University, US. He has been awarded with Shanti Swarup Bhatnagar Prize for Science and Technology and was recently elected as Fellow of The World Academy of Sciences.

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Wells, Peter J

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Winickoff, David

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