

SYN BEE

D1.1 QUESTIONNAIRES FROM 4 TYPES OF ECOSYSTEMS



Funded by the European Union under the Grant Agreement No 10100509.
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Grant Agreement: 101100509

DOC. REFERENCE	D1.1 Questionnaires from 4 types of ecosystems
WORK PACKAGE No	1 – SWOT Analysis
RESPONSIBLE	Delft University of Technology – TU Delft
AUTHOR(S)	Sindhu Naik (TU Delft)
REVIEWER(S)	All Partners
DATE	26/04/2023
STATUS	DRAFT
DISSEMINATION LEVEL	CONFIDENTIAL

VERSION	DATE	RESPONSIBLE	DESCRIPTION
Version 1.0	26/04/2023	TU Delft	First version for review
Version 2.0	28/04/2023	TU Delft, eureKARE	Final version



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INTRODUCTION

The field of synthetic biology has been growing rapidly over the last decade, and it has the potential to revolutionize the way we approach a wide range of problems, from health and medicine to energy and the environment. As a result, there has been increasing interest in developing strong innovation ecosystems to support synthetic biology research and development. Such ecosystems are characterized by a range of stakeholders, including industry, universities, policy makers, and non-profit organizations, working together to create an environment that fosters innovation and entrepreneurship.

The purpose of SYNBEE project amongst other objectives is to conduct a SWOT analysis of the innovation ecosystems in the field of synthetic biology across Europe. By doing so, we aim to identify the strengths, weaknesses, opportunities, and threats facing these ecosystems and to determine what works best in leading and strong innovation ecosystems versus moderate and emerging ecosystems. To achieve this goal, we have developed a survey questionnaire that targets multiple stakeholder groups in the synthetic biology ecosystem.

In this report, we will provide a background on the existing literature and reports that were used as a basis to create the survey questions. We will also discuss the methodology used to create the survey and the stakeholder groups that we will target. We will then present the survey questions and explain how we plan to conduct the analysis of the responses.

The findings of this SWOT analysis will be useful for policy makers, industry leaders, and researchers in the field of synthetic biology who are interested in developing and supporting strong innovation ecosystems. By identifying the gaps between the different ecosystems, we hope to provide insights into what factors contribute to the success of an innovation ecosystem and what strategies can be employed to overcome the challenges faced by emerging ecosystems. Ultimately, we hope that this report will contribute to the growth and development of the field of synthetic biology, and help to accelerate the pace of innovation in this important area.



BACKGROUND

Synthetic biology is an interdisciplinary field that merges biology, engineering, and computer science to design and build novel biological systems for a variety of applications. In recent years, Europe has emerged as a hub for synthetic biology research and innovation, with many European countries investing heavily in this field. The purpose of this literature review is to provide a comprehensive overview of the current situation and debates regarding the potential benefits of innovation in the field of synthetic biology, with a particular focus on Europe. This review has given us many themes and basis we can cover in our questionnaire to be able to identify trends and patterns in different eco-systems.

Europe is experiencing a bio-revolution with many biological innovations for complex problems in our world. Synthetic biology has the potential to revolutionize various industries, including medicine, energy, agriculture, and environmental management. For instance, synthetic biology is enabling the development of new treatments for diseases, including cancer, and the production of sustainable fuels, among others [1].

Moreover, Europe's synthetic biology market is expected to grow significantly, with estimates indicating a market value of €14 billion by 2025. The growth of this market is driven by the increasing demand for sustainable and environmentally friendly products and processes [2]. However, there are concerns regarding safety, ethics, and regulatory frameworks. While synthetic biology can offer many benefits, it also poses potential risks to the environment, public health, and safety [3]. As such, there is a need for robust safety and ethical guidelines to ensure that synthetic biology is used responsibly.

Europe's innovation ecosystems vary from strong and leading to moderate and emerging [13]. Strong innovation ecosystems are characterized by high levels of investment, research and development, talent, and supportive government policies. In contrast, moderate and emerging innovation ecosystems are characterized by limited investment, inadequate infrastructure, and regulatory and bureaucratic hurdles.

According to McKinsey, the bio-revolution could transform the competitive landscape, but navigating turbulent times requires strategic investments and collaborations in research,



development, and commercialization [4]. The report highlights the need for partnerships and collaborations between the private and public sectors to create a thriving ecosystem for synthetic biology innovation.

To identify gaps and challenges in innovation ecosystems, a survey needs to be conducted. The European Union is working towards creating an innovation ecosystem to achieve technological sovereignty in critical technologies [5]. The European Commission's strategic approach to foster innovation in synthetic biology is based on addressing regulatory and societal challenges. The European Parliament has also highlighted the need to balance the risks and benefits of synthetic biology [6].

There are various debates and challenges in the field of synthetic biology in Europe. One of the primary challenges is ensuring the responsible use of synthetic biology. A report by the Rathenau Institute highlights the need to involve policymakers and societal stakeholders to achieve responsible innovation in synthetic biology [11]. The report notes that synthetic biology poses potential risks to the environment and public health, and there is a need to address these concerns through transparent and inclusive policymaking [7].

In the UK, a strategic plan for synthetic biology has been developed, focusing on bio-design for the bioeconomy. The plan aims to foster innovation in synthetic biology by addressing challenges related to regulation, research, and development, and education [8].

Regulatory challenges in Europe have been addressed by the European Union, focusing on the safe and responsible use of synthetic biology. The European Commission has developed a framework to regulate synthetic biology, which includes risk assessments, oversight mechanisms, and ethical considerations [9]. However, more needs to be done to address societal and ethical concerns, including engaging the public and stakeholders in discussions on the use of synthetic biology and its potential risks and benefits [10].

In conclusion, synthetic biology has the potential to transform multiple industries, and Europe is seen as a key player in the field. However, the ecosystem is still in its early stages, and there are significant challenges that need to be addressed, including regulatory barriers and funding gaps. The EU has recognized the potential of synthetic biology and has taken steps to support its development. However, increased investment and collaboration are needed to drive innovation and create a robust innovation ecosystem.



METHODOLOGY

The methodology used for arriving at the survey questions for this report is based on the guidelines provided by Pew Research Center for writing survey questions [14]. The survey questions are designed to be closed-ended with an option for respondents to provide additional comments for each question. Some of the questions requires the respondents to provide an opinion by rating scales. The questions were edited multiple times, incorporating comments from beneficiary partners in the consortium to ensure they are clear and understandable.

The conception process of the survey questions started with a brainstorming session where the key areas to cover by a thorough literature review were identified. The initial draft of the questions was created and shared with all project beneficiaries on 3rd April 2023, after which the partners had weekly meetings to update, refine and validate the questions. During these meetings, the partners discussed comments on questions and suggested changes to improve clarity and avoid ambiguity. The questions were also assessed for their relevance and suitability for the target respondents.

The survey questions are aimed at gaining insights into the gaps and challenges in the different innovation ecosystems of European countries in the field of Synthetic Biology. The target respondents for the survey are individuals and organizations involved in the innovation ecosystem in Europe. These include researchers, entrepreneurs, investors, policymakers, and other stakeholders involved in innovation activities.

In order to identify the stakeholders for the innovation ecosystems in the field of synthetic biology, the lead beneficiary conducted a thorough analysis of the current landscape and potential opportunities for innovation. The stakeholders for the innovation ecosystems in the field of synthetic biology have been identified and categorized into the following groups:



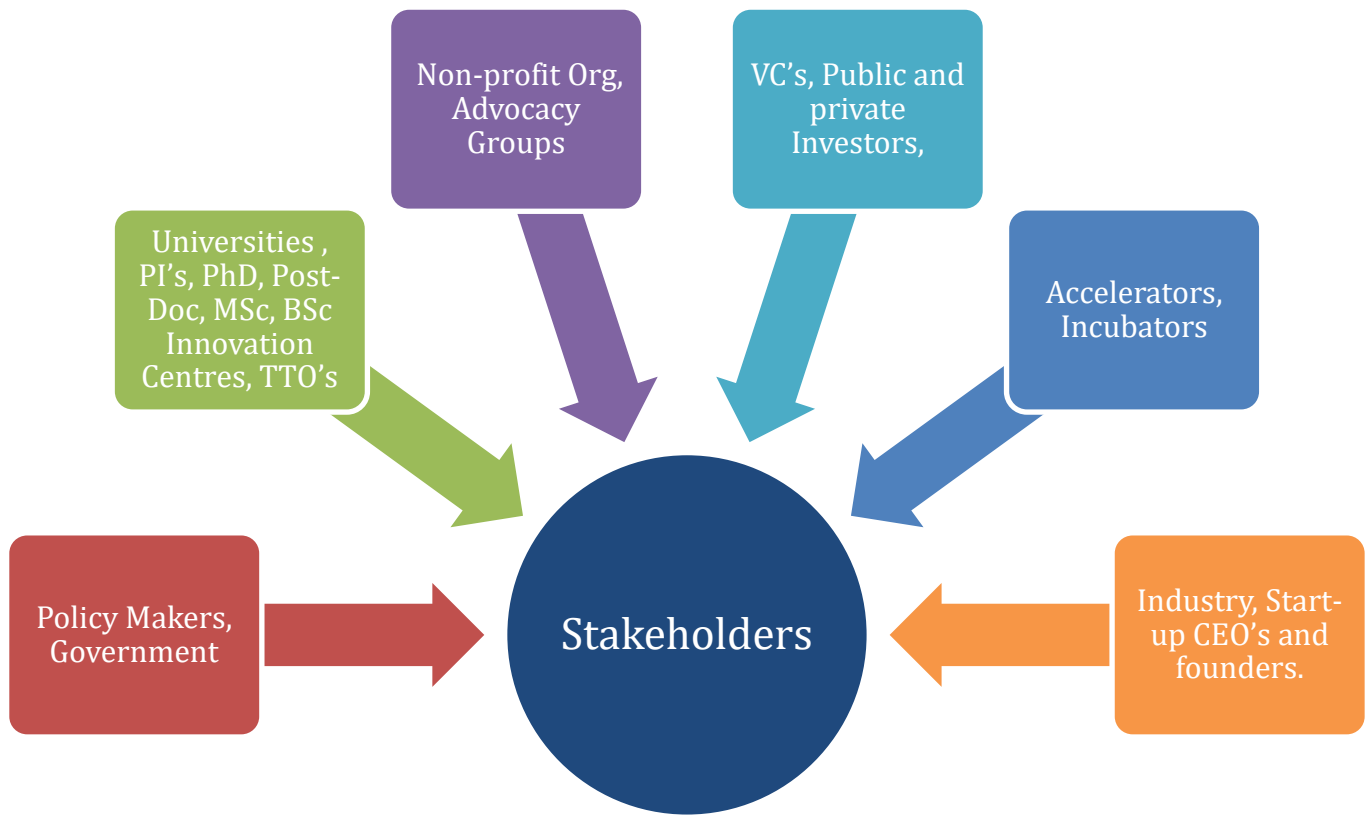


Figure 1: Sub-groups of Stakeholders

1. **Policy Makers, Government:** This group includes policymakers, government officials, and regulatory bodies that oversee the implementation and development of policies related to synthetic biology. They have an important role in shaping the regulatory and legal framework that enables innovation in synthetic biology.
2. **Universities, PI's, PhD, Post-Doc, MSc, BSc, Innovation Centres, TTO's:** This group includes academic institutions, professors, researchers, students, and technology transfer offices (TTOs) that focus on research, development, and commercialization of synthetic biology. These stakeholders provide expertise, research infrastructure, and funding for the early-stage development of new innovations and technologies in the field.

3. Non-profit Organisations, Advocacy Groups: This group includes non-profit organizations and advocacy groups that promote the use of synthetic biology for the betterment of society. They often provide funding and resources to support research and development, as well as advocate for policies and regulations that promote innovation and protect public health and safety.
4. VC's, Public and private Investors: This group includes venture capitalists (VCs), private equity firms, and other investors that provide funding for startups and companies in the field of synthetic biology. These stakeholders are critical from early-stage through R&D and validation, to commercialization and scaling of new innovations, and their investments can help drive growth and development in the industry.
5. Accelerators, Incubators: This group includes accelerators and incubators that provide support, mentorship, and resources for startups and companies in the field of synthetic biology. These stakeholders can play an important role in helping companies navigate the complex regulatory landscape, as well as providing access to funding and expertise.
6. Big industry, SMEs, Start-up CEO's and founders: This group includes established companies and startups that develop and commercialize products and services in the field of synthetic biology. These stakeholders drive innovation in the industry and can provide valuable insights into the challenges and opportunities for growth and development.

Within each of these groups, there are a number of sub-groups that represent specific interests or perspectives. For example, within the VC's, Public and private Investors group, there are sub-groups such as Angel investors, Venture capitalists, Private equity firms, Family offices, Corporate investors, Government funding agencies, Philanthropic foundations. Similarly, within the policy maker and government group, there are sub-groups such as Local government officials, State government officials, Federal government officials, Regulatory bodies, Legislators, Policymakers in relevant domains.

It is important to engage with stakeholders from each of these groups in order to get a comprehensive understanding of the innovation ecosystems in the field of synthetic biology. This will help to identify the key challenges and opportunities for innovation, as well as to develop effective policies and strategies to support innovation and promote competitiveness



in the sector. The survey was designed to target stakeholders from each of these groups, with the aim of getting a broad range of perspectives on the key issues facing the synthetic biology innovation ecosystem.

The survey questions aim to gather insights into various aspects of innovation ecosystems, including funding mechanisms, policy frameworks, infrastructure, and collaboration among stakeholders. These questions cover a wide range of topics and are designed to elicit responses that shed light on the current state of innovation activities. Additionally, the survey seeks to identify potential risks and opportunities for innovation by examining the regulatory environment, including laws, regulations, and policies that govern innovation. Another critical area of focus is the landscape of intellectual property (IP) protection to identify areas that may present challenges or opportunities for innovation. The survey also aims to understand the education and training of individuals with skills and expertise in synthetic biology and related fields. This understanding can help identify potential gaps in training and the challenges faced by stakeholders while presenting opportunities for improvement.

In this deliverable we would like to present multiple types of relevant potential questions. Some questions (slightly adapted) can be sent to different types of stakeholders to understand vision of the same aspect from different angles (for example from a perspective of representatives from academia, industry and a PhD student currently enrolled in synthetic biology course at a University X). Some questions will only be sent to a specific stakeholder type. The consortium is progressively coming to a consensus on what questions should be sent to which stakeholders. Based on this consensus, the list of questions will be rearranged into complete questionnaires.

These questionnaires will be tested with the associated project partners to identify any misunderstanding/misinterpretation in May 2023. Following their feedback, the questionnaires will be adjusted and sent to a small group of stakeholders external to the consortium to test again. Based on this new feedback, if necessary, the questionnaires will be adjusted again, to then be sent to the target focus groups.

The provisional timeline for the survey is set to be launched on 1st of June 2023 and will be open for responses for a period of four weeks. We anticipate a need to send reminders to assure higher response rate. If four weeks are not sufficient, we have planned some weeks of margin to be able to extend the deadline for replies, if necessary.



The tool chosen to collect responses is Qualtrics XM, which provides a secure and user-friendly platform for survey administration.

GDPR AND DATA POLICY

At TU Delft, all research projects that involve human participants need to be approved by the Human Research Ethics Committee (HREC). Therefore, a request was submitted to the HREC committee to conduct a survey for the purpose of SWOT analysis for the SYNBEE project, along with all the necessary supporting documents. It was agreed by all parties involved that the survey would be kept anonymous and that no personally identifiable data would be collected from the respondents, except in cases where the respondent provides such information, agreeing to a follow-up meeting or an interview on the subject of innovation ecosystems in Europe as a subject matter expertise. The survey will be conducted by Qualtrics^{XM} platform which is approved by TU Delft. As an employee of TU Delft, we can utilise the licensed version of this software for our purpose. All the survey responses will be collected by TU Delft and stored securely on the internal drive of TU Delft.

The HREC committee has approved the request to conduct this survey, and all the associated documents are attached to this report. The documents have been reviewed and approved by all the consortium members. Please refer to Annex 1 for the enclosures.



LIST OF QUESTIONS

Stakeholder type: SME / start-up / industrial company

RESPONDENT CHARACTERISTICS

- Gender
- Age
- Background of the respondent in synthetic biology (years of experience)

COMPANY DESCRIPTION

History/genesis

- organisation name
- date of creation, location
- main steps in development (spin-off?)
- support received (funds, expertise)
- Turnover
- Growth

Description of the activities

- Main products/services (business model)
- Budget for R&D
- IP portfolio
- Activities linked to synthetic biology

Description of the sector (market, technology)

- Main targeted market
- Main actors (competitors/partners)
- industry
- research
- ecosystem (clusters, incubators, accelerators, investors, etc.)
- Opportunities
- Barriers



- Degree of innovation
- International context (pioneering, leading, follower)

Infrastructure

- Offices, laboratories, tech platforms
- Type of building: incubator/ own facilities
- Main R&D equipment

RECRUITMENT / EMPLOYABILITY / ENTREPRENEURSHIP IN SYNTHETIC BIOLOGY

1. Does your company often interact with local, national, international academic community?
 - a. Yes, we host students for (short/long) internships.
 - b. Yes, we have visiting researchers for synthetic biology-related research projects.
 - c. Yes, we invite scientific experts as Executive or Scientific Advisory Board members.
 - d. No interactions, but would be interested to host students.
 - e. No, but would be interested to have visiting researchers.
 - f. No, but would be happy to identify and invite relevant experts for the board(s).
 - g. Other (Please specify).

2. How do you attract talents for synthetic biology-related job profiles? Please select all that apply:
 - a. Company website.
 - b. Job postings on online job portals.
 - c. Job advertisements in Nature, Science, or other scientific journals.
 - d. Referrals from current employees and personal network.
 - e. Recruitment agencies.
 - f. Networking events and conferences.
 - g. Campus recruitments.
 - h. Euraxess job platform.
 - i. LinkedIn.
 - j. Other (please specify).



3. Do you often have to look for talents for synthetic biology projects outside of your country?
 - a. Yes, frequently (Please specify where).
 - b. Yes, occasionally.
 - c. No, we have sufficient local talent.
 - d. Other (Please specify).

4. What specific areas of training are currently lacking to enable success in synthetic biology entrepreneurship? Select all that apply:
 - a. Thorough understanding of synthetic biology concepts including knowledge of gene editing, genetic engineering, and DNA synthesis.
 - b. Data science and statistics to deal with large amounts of data.
 - c. Regulatory affairs and compliance requirements relating to biosafety, biosecurity, and environmental protection.
 - d. Intellectual property (IP) law with basic understanding of patent law, trademarks, and copyright to protect inventions and technologies.
 - e. Project management.
 - f. Business management, business development.
 - g. Fundraising.
 - h. Communication and presentation.
 - i. Team building.
 - j. Other (please specify).

5. In your opinion, how can entrepreneurial skills be enhanced among students conducting synthetic biology academic research in your country?
 - a. Offering entrepreneurship courses such as project management, finance and marketing.
 - b. Hosting start-up idea/ pitch competitions such as BIO-Yes competition.
 - c. Providing mentorship from successful entrepreneurs.
 - d. Enhancing networking opportunities.



- e. Encouraging participation in accelerator programs.
 - f. Encouraging interdisciplinary collaborations.
 - g. Strengthening co-operation between universities and companies by performing joint research projects.
6. Which soft skills are lacking in current students' training, which could form successful synthetic biology entrepreneurs, or facilitate their recruitment by a private company in your country? Select all that apply:
- a. Hypothesis formulation.
 - b. Practical laboratory skills.
 - c. Leadership and management.
 - d. Networking and relationship-building.
 - e. Problem solving.
 - f. Creativity and innovation.
 - g. Resilience and adaptability.
 - h. Other (Please Specify).
7. In your opinion, how can students' employability in synthetic biology be improved in your country? Please select all that apply:
- a. Introducing more practical training programs such as field work and wet-lab experience.
 - b. Offering more transversal skills training, such as IP training, management skills, financial planning, etc.
 - c. Including industry professionals for mentorship.
 - d. Encouraging student participation in industrial internships.
 - e. Offering more job placement services.
 - f. Guidance in curriculum design.
 - g. None of the above.
 - h. Other (Please specify).



COOPERATION

8. Have you collaborated with a research non-profit organization on any synthetic biology-related activities? Select all that apply:
- a. Yes, multiple times on research and development (R&D) projects.
 - b. Yes, once on an R&D project.
 - c. Yes, on a spin-off project.
 - d. Yes, in recruiting Principal Investigators (PIs) for the board.
 - e. Yes, by regularly hosting interns from academia.
 - f. Yes, by involving scientific experts on the company board.
 - g. Yes, by collaborating with academic labs on R&D projects.
 - h. Yes, by recruiting scientists as a Chief Science Officer (CSO), Chief Technology Officer (CTO), or other team members.
 - i. Yes, as an academia spin-off with all of the above ways of academia involvement.
 - j. No, but I would like to collaborate.
 - k. No, and I am not interested in doing so.
9. In your opinion, in general, which of the below allows start-ups to better/easier collaborate with academic researchers and institutions to drive innovation in your country?
- a. Joint projects and partnerships with clear IP ownership and licensing terms.
 - b. Opportunities for knowledge-sharing and exchange by accessing the relevant research networks and communities.
 - c. Incubator programs that integrate academic research.
 - d. Access to relevant public funding schemes.
 - e. Access to relevant infrastructure.
 - f. All of the above.
 - g. None of the above.
 - h. Other (please specify).



10. How do you think Synthetic Biology research can be better integrated with other research areas to foster innovation in your country? Please choose the options which are most lacking in your country.
- Collaboration with other researchers from interdisciplinary fields.
 - Encouraging interdisciplinary research in grant applications by funding agencies.
 - Promoting cross-disciplinary training in university curriculums.
 - Open data sharing to access and analyse data from other fields, which can lead to new insights and discoveries.
 - Encouraging trans-sectoral (public-private) research through grants with better funding ratio for start-ups spin-offs from academia.
 - Other (please specify).

FUNDING

11. Which of the following types of funding is currently available in your country to support synthetic biology research and innovation? Please select all that apply.
- Generalist/bottom-up basic research funding (i.e., funding for basic research in a range of scientific fields).
 - Synthetic biology-targeted basic research funding (i.e., funding specifically for basic research in the field of synthetic biology).
 - Proof of concept generalist funding (i.e., funding to test the feasibility of a new idea or technology in a range of scientific fields).
 - Proof of concept synthetic biology-targeted funding (i.e., funding to test the feasibility of a new idea or technology specifically in the field of synthetic biology).
 - Validation funding (i.e., funding to support the validation and testing of a new product or technology, either in the field of synthetic biology or in a range of scientific fields).
 - Scale-up funding (i.e., funding to support the scaling-up and commercialization of a product or technology, either in the field of synthetic biology or in a range of scientific fields).
12. In your view, which stage of synthetic biology research is the most difficult to fund in your country? Please select the option that best represents your view:



- a. Basic science research (i.e., fundamental research to understand the underlying principles of synthetic biology).
- b. Applied early stage research (i.e., applied research to develop and optimize new synthetic biology technologies).
- c. Proof of concept (PoC) (i.e., testing and validation of the feasibility of a new synthetic biology technology or product).
- d. Validation (i.e., further testing and validation of a new synthetic biology technology or product, including clinical trials).
- e. Growth or scale-up (i.e., scaling up production and commercialization of a synthetic biology technology or product).
- f. Internationalisation (i.e., expanding the reach of a synthetic biology technology or product to global markets).

13. What sources of funding for synthetic biology are available in your country?

- a. National/regional/local public funding agencies, please specify: _____.
- b. European Union (EU) funding [E.g.: Horizon Europe, European Research Council (ERC)] please specify: _____.
- c. Private foundations (E.g.: Welcome Trust, Gates Foundation) please specify: _____.
- d. Industry (please specify): _____.
- e. Investors' community (please specify): _____.
- f. Crowdfunding (please specify): _____.
- g. I am now quite aware about local funding opportunities.
- h. Other.

14. How popular are EU funding programs for synthetic biology research and development in your country? Please select one of the following:

- a. Very popular.
- b. Somewhat popular.
- c. Not very popular.
- d. Not at all popular.
- e. I don't know.



15. What types of public funding are available in your country to support the synthetic biology community? Please select all that apply.
- National PhD fellowships.
 - National PhD fellowships in collaboration with industry.
 - National postdoc fellowships.
 - National R&D project funding for academia.
 - National R&D project funding for industry (SMEs).
 - National collaborative trans-sectoral calls for proposals between academia and industry.
 - International collaborative R&D funding programs.
16. Please select the range of available public funding for synthetic biology projects in your country (or generalist funding that can be used for synthetic biology projects):
- Up to 300k€
 - 300k€ - 1m€
 - 1-5m€
 - >5m€
17. Which of the following types of private funding are currently available in your region/country to support synthetic biology research and innovation? Please select all that apply:
- Business angels.
 - Venture capital (VC).
 - Corporate venture capital (CVC).
 - Family offices.
 - Private equity.
 - Other (please specify):
18. Which of the below allow synthetic biology start-ups/SMEs to better connect with investors and funding opportunities in your country? Select all that apply:
- Networking events and conferences.



- b. Online platforms and resources.
- c. Incubators and accelerators.
- d. Introductions and referrals.
- e. A centralised platform with information regarding all funding opportunities.
- f. Other (please specify).
- g. Would you like to see a particular method added or developed for this purpose, please specify:_____

19. In your opinion, what start-ups need to do to better attract investors in your country?
Select all that apply:

- a. Develop clear and concise messaging of their company mission, vision, purpose and value today and in the future.
- b. Pay attention to ESG/ impact.
- c. Leverage social media and digital marketing to reach wider audiences.
- d. Participate to relevant events and present on a regular basis at pitch sessions, networking events.
- e. Identify relevant investors depending on their investment criteria (thesis, previous investments), to avoid being too early or too late (out of scope).
- f. Have strong feasibility/preliminary data convincing potential investors.
- g. Solid business plan.
- h. Solid IP case.
- i. Strong ties with excellent academic institution.
- j. Strong team, with key tech expertise.
- k. Facilitate negotiation with the Technology Transfer Office (TTO).
- l. Ideally previous non-dilutive funding, or potential to obtain some in the future.
- m. None of the above.
- n. Other (please specify):



POLICY CONSIDERATIONS

20. In your opinion, are policy makers in your country well-aware of the potential benefits of synthetic biology to maximize innovation?

- a. Yes, I have constant support from my country’s policy makers. Eg: Meet them in conferences, have special schemes and grants available specifically for synthetic biology field.
- b. Partially, I still have to explain the potential benefits of the field to get their engagement.
- c. No, synthetic biology/bioengineering is not the current priority of the policy makers. It would be great to implement dissemination activities to better promote/explain benefits of the synthetic biology for local and global economy and environment.

21. How does your national/regional/local government support synthetic biology start-ups? Please select all that apply:

- a. By providing funding opportunities (subsidies, grants, tax incentives).
- b. By providing tax incentives for investors (please specify any improvements that could be made to these incentives to better support equity financing).
- c. By creating regulatory frameworks that promote innovation and growth (please provide an example).
- d. By providing guidance and support on compliance with relevant laws and regulations (please specify which laws and regulations, and any improvements that could be made to the guidance).
- e. By establishing and supporting incubator and accelerator programs to help start-ups grow and succeed (please provide details on how these programs are established and supported, their impact on start-ups, and any need for further support such as grants or tax incentives).
- f. Strategy and policy preparation with relevant stakeholders.
- g. Allocation of resources for entrepreneurship training and other relevant competence development activities.
- h. None of the above.
- i. Other (please specify).



22. What kind of policies or regulations do you think are currently lacking but necessary to support the growth of synthetic biology start-ups in your country? Select all that apply:

- a. Expedited intellectual property protection for innovators, such as copyright, trademarks, patents.
- b. Streamlined regulatory processes to make market entry easier.
- c. Easier and timely access to substantive funding for innovation and entrepreneurs.
- d. Tax incentives for investors such as tax breaks for R&D, reduced corporate tax rates for synthetic-biology start-up companies.
- e. Improved conditions for Initial Public Offerings (IPO's) to allow a more secure and easier exit for investors.
- f. None of the above.
- g. Other (please specify).

23. On a scale from 1 to 5, where 1 is "not at all" and 5 is "very much," how much do you think government regulations affect innovation in synthetic biology in the following ways? Please select one answer for each of the five options:

- a. Funding opportunities.
- b. Licensing processes.
- c. Intellectual property protection.
- d. Import and export restrictions.
- e. Compliance costs.

OTHER QUESTIONS

24. What are the biggest challenges facing synthetic biology innovation in your country? Select all that apply:

- a. Lack of public funding (grants, tax incentives).
- b. Lack of private funding (venture capital, private equity).
- c. Government regulations creating barriers to enter the market.
- d. Ethics and safety concerns.
- e. Lack of trained personnel from transdisciplinary synbio perspective.



- f. Lack of trained personnel knowledgeable in entrepreneurship.
- g. Lack of public awareness.
- h. Other (please specify):

25. Which of the following activities should be organised (but currently miss) by the government to better communicate the potential benefits and risks of synthetic biology to the public in your country? Select all that apply:

- a. Investing in public education (e.g., workshops, lectures, or outreach programs).
- b. Creating awareness campaigns (e.g., social media campaigns, public service announcements, or advertising campaigns).
- c. Partnering with media outlets to promote synthetic biology (e.g., social media influencers, celebrities, or thought leaders).
- d. Creating public forums for discussion and feedback (e.g., public hearings, town hall meetings, or online discussion forums).
- e. Collaboration with stakeholders such as academic institutions and industry. (e.g., research collaborations, funding programs, or public-private partnerships).
- f. Regulation and oversight by setting clear ethical guidelines, safety standards, and risk assessments. (e.g., establishing ethical review boards).
- g. Other (please specify).

26. How do you see the future of the below domains of synthetic biology in Europe in the next 5-10 years? Please provide your opinion on each of the below (ranging from "highly promising", to "moderately promising", "uncertain", "not very promising", or "don't know").

- a. Human health and performance.
- b. Agriculture and food.
- c. Environmental remediation.
- d. Consumer products and services.
- e. Materials.
- f. Energy.



27. What kind of support or resources do you think synthetic biology start-ups need in order to succeed in your country? Select all that apply:

- a. Access to public funding.
- b. Access to broader pool of investors and/or bigger tickets per round.
- c. Mentorship and guidance from industry experts (IP, scale-up).
- d. Access to talent and expertise.
- e. Regulatory and legal support.
- f. Access to infrastructure with relevant equipment and facilities.
- g. Other (please specify).

28. Which of the below is currently lacking in your country to inform and engage the public regarding synthetic biology to boost innovation? Select all that apply:

- a. Public events, such as workshops and lectures by experts for general audience.
- b. Information is disseminated and awareness is raised by social media, journalists.
- c. Use of educational materials, such as videos, documentaries and brochures, to explain Synthetic Biology innovation in simple terms to the public.
- d. Workshops at schools by synthetic biology community.
- e. Policymakers and regulators informing the public about the potential benefits of Synthetic Biology innovation.
- f. Universities engaging with non-profit organisations to promote students' participation in Synthetic Biology events such as iGEM competition.
- g. Setting up synthetic biology clusters at national level. Eg: BaSyC Consortium in the Netherlands.
- h. Other ideas to promote synthetic biology innovation, please specify below:



Stakeholder type: Academic institution*¹

1. In your opinion, how does your academic institution support education on Synthetic Biology? Select all that apply:
 - a. By developing a curriculum on Synthetic Biology.
 - b. Creating educational materials like courses, videos, infographics, and brochures on Synthetic Biology.
 - c. Organize workshops (bio-hackathons), pitch competitions and academic seminars on Synthetic Biology at national level.
 - d. Organize international conferences to help students engage with the international community.
 - e. Collaborate with other institutions or organizations to share Synthetic Biology resources and expertise in the form of mandatory internships as part of the curriculum.
 - f. Establish a Synthetic Biology club or organization on campus to promote education and awareness.
 - g. Encourage students to participate in Synthetic Biology research projects if not part of the existing curriculum.
 - h. Host guest speakers or experts in Synthetic Biology more than twice a year.
 - i. Use social media to share information about Synthetic Biology research at the university.

2. Have you collaborated with a private for-profit organization(s) on any synthetic biology-related activities? Select all that apply:
 - a. Yes, multiple times on research and development (R&D) projects.
 - b. Yes, once on an R&D project.
 - c. Yes, we our lab /team hosts industrial PhDs from time to time.
 - d. Yes, on a spin-off project.
 - e. Yes, I serve on a board of a private company.
 - f. Yes, our team regularly sends interns to private company(ies).

¹ We only add here additional questions dedicated to “Academic institution” stakeholder type, which are not present in the questionnaire “Stakeholder type: SME / start-up / industrial company”.



- g. Yes, in parallel with my academic activities, I am a Chief Scientific Officer (CSO), Chief Technology Officer (CTO), or occupy a similar position in a private company.
 - h. No, but I would like to collaborate.
 - i. No, and I am not interested in doing so. No perceived benefit in engagement.
3. Which of the following are available at/relevant for students interested in pursuing a career in Synthetic Biology at your institution? Select all that apply:
- a. One-on-one mentoring program with faculty members who specialize in Synthetic Biology, providing personalized guidance and support.
 - b. Access to cutting-edge Synthetic Biology research facilities and equipment, allowing students to conduct independent research projects.
 - c. A dedicated Synthetic Biology club or student organization, providing opportunities for peer mentorship and collaboration on projects.
 - d. Involvement in a Synthetic Biology competition or challenge, providing a platform for students to showcase their skills and knowledge.
 - e. Regular opportunities for networking with Synthetic Biology industry professionals, allowing students to make connections and learn about potential career paths.
 - f. Support for attending Synthetic Biology-related conferences or events outside of the institution, providing exposure to a wider range of perspectives and opportunities.
 - g. Training in the ethical and societal implications of Synthetic Biology, preparing students to consider the broader impacts of their work.
 - h. Opportunities for public engagement and science communication related to Synthetic Biology, allowing students to share their research and knowledge with a broader audience.
 - i. Support for pursuing entrepreneurship or starting a Synthetic Biology-related business, including access to funding, mentorship, and other resources.
 - j. Internship programs specifically focused on Synthetic Biology, providing students with practical experience and industry connections.
4. What resources such as state-of-the-art laboratory facilities and equipment are available for Synthetic Biology research at your institution? Select all that apply:



- a. There are new or renovated lab facilities equipped with specialized Synthetic Biology equipment available for use. Ex: Robotics for high-throughput screening and liquid handling.
 - b. My institution has collaborations with industry for access to cutting-edge equipment and technology.
 - c. My institution has applied or obtained grants to purchase new equipment specifically for Synthetic Biology research. Please specify the funding agencies you have applied or obtained grant from: _____.
 - d. We have access to shared facilities available for interdisciplinary research across departments or institutions, including those that may be used for Synthetic Biology research.
 - e. We have partnerships with other institutions for resource and expertise sharing, specifically for Synthetic Biology research.
 - f. We have access to a biofoundry facility which enables us to carry out our synthetic biology research project in a high-throughput manner. Ex: CompuGene, TU Darmstadt (Germany)
 - g. Other (please specify)
5. In your opinion, are policy makers in your country well-aware of the potential benefits of synthetic biology to maximize innovation in your country?
- a. Yes, I have constant support from my country's policy makers. Eg: Meet them in conferences, have special schemes and grants available specifically for synthetic biology field.
 - b. Partially, I still have to explain the potential benefits of the field to get their engagement.
 - c. No, the policy makers are unaware of the benefits from synthetic biology research.
6. In your opinion, what are the biggest challenges facing Synthetic Biology innovation in your country? Select all that apply:
- a. Lack of public funding (grants, tax incentives).
 - b. Lack of private funding opportunities (Venture Capitalists, Private equity).
 - c. Government regulations creating barriers to enter the market.



- d. Ethics and safety concerns.
 - e. Lack of education and public awareness.
 - f. Other (please specify)
7. What specific areas of training or education do you feel are currently lacking to enable success in Synthetic Biology research? Select all that apply:
- a. Molecular biology and biochemistry for gene and DNA manipulation.
 - b. Bioprocess engineering for designing and optimizing biological systems for commercial applications.
 - c. Data science for dealing with vast amounts of data.
 - d. Programming and automation using laboratory equipment and tools for high-throughput ability.
 - e. Ethics to understand the associated ethical considerations.
 - f. Interdisciplinary communication to effectively communicate with colleagues from various backgrounds.
 - g. Other (please specify)
8. What role does industry play in promoting Synthetic Biology research in your country? Select all that apply:
- a. Fund research projects by collaborating with academia.
 - b. Providing infrastructure and resources for academic researchers.
 - c. Providing training and education opportunities.
 - d. Technology transfer by providing expertise in scaling up and commercializing new products.
 - e. Advocate for policies and regulations that support the development and commercialization of Synthetic Biology technologies.
 - f. All of the above.
 - g. None of the above.
 - h. Other (please specify):
9. Do you often have to look for talent outside of your country for synthetic biology projects due to a lack of local talent?



- a. Yes, frequently (Please specify where).
- b. Yes, occasionally.
- c. No, we have sufficient local talent.
- d. Not applicable, we do not have synthetic biology projects.
- e. Other (Please specify):

10. How do you attract talent for synthetic biology-related job profiles? Please select all that apply:

- a. Company website.
- b. Job postings on online job portals.
- c. Job advertisements in Nature, Science, or other scientific journals.
- d. Referrals from current employees and personal network.
- e. Recruitment agencies.
- f. Networking events and conferences.
- g. Campus recruitments.
- h. Euraxess job platform.
- i. LinkedIn.
- j. Other (please specify).

Stakeholder type: Investor²

- 1. What are the biggest challenges you face when investing in Synthetic Biology start-ups in your country? Select all that apply:
 - a. Strict regulatory barriers such as GMO regulation.
 - b. Lack of market demand and awareness among the public, policy makers, and regulators.
 - c. Limited access to talented individuals.
 - d. Tax system that favors debt financing over equity.
 - e. Insufficient non-dilutive funding to mitigate investment risks.

² We only add here additional questions dedicated to “Investors”, which are not already present in the questionnaire “Stakeholder type: SME / start-up / industrial company”.



- f. Limited number of "applied" projects or translation.
 - g. Majority of investors have limited knowledge of the field due to its high complexity.
 - h. Academia's limited understanding of the investment process and philosophy, with a focus on thesis, strict timelines, and the obligation of financial outcomes.
 - i. Limited access to funding and investment opportunities.
 - j. Lack of government support and incentives for the industry.
 - k. Challenges in scaling and manufacturing processes.
 - l. Intellectual property challenges and patent disputes.
2. What do you think are the most significant obstacle that can deter investors from investing in a particular synthetic biology start-up? Select all that apply
- a. Regulatory compliance issues.
 - b. Intellectual property concerns.
 - c. Financial risks.
 - d. Technical feasibility.
 - e. Lack of industry experience in the team.
 - f. Public perception.
 - g. Market competition.
 - h. Commercialization challenges.
 - i. Long development time.
 - j. Others (Please specify):

Stakeholder type: PhD student / Postdoctoral researcher³

1. In your opinion, how can students' employability in synthetic biology be improved in your country? Please select all that apply
- a. Introducing more practical training programs such as field work and wet-lab experience.
 - b. Including industry professionals for mentorship and guidance in curriculum design

³ We only add here additional questions dedicated to "Students", which are not already present in the questionnaire "Stakeholder type: SME / start-up / industrial company".



- c. Encouraging student participation in industrial internships.
 - d. Offering more job placement services.
 - e. Offering more transversal skills such as IP training, management skills, financial planning and forecasting.
 - f. None of the above.
 - g. Other (Please specify):
2. In your opinion, how can entrepreneurial skills be enhanced among students conducting synthetic biology academic research in your country?
- a. Offering entrepreneurship courses such as project management, finance and marketing.
 - b. Hosting start-up idea pitch competitions such as BIO-Yes competition.
 - c. Providing mentorship from successful entrepreneurs and allow networking opportunities.
 - d. Encouraging participation in accelerator programs.
 - e. Encouraging interdisciplinary collaborations to develop skills in communication, collaboration and creativity.
 - f. Strengthen co-operation between universities and companies by performing joint research projects.
3. In your opinion, which skills are lacking in students' education to become a successful synthetic biology entrepreneur outside of their scientific studies in your country? Select all that apply:
- a. Creativity and innovation.
 - b. Practical laboratory skills.
 - c. Business management.
 - d. Leadership and management.
 - e. Communication and presentation.
 - f. Networking and relationship-building.
 - g. Resilience and adaptability.
 - h. Hypothesis forming.
 - i. Problem solving.



- j. Fundraising.
- k. Others (Please Specify):

4. Are entrepreneurship training courses, IP training, mentoring, etc. available for students as credited courses, rather than just optional workshops or certificates?

- a. Yes, for credit.
- b. Yes, but not for credit.
- c. No, but available as optional workshops or certificates.
- d. No, not available at all.

5. Which aspects of the entrepreneurial activities are you most comfortable with?

- a. Idea generation.
- b. Funding.
- c. Business planning.
- d. Marketing.
- e. Development.
- f. Validation.
- g. Market launch.
- h. Growth/Scale-up.

Stakeholder type: policy maker⁴

1. Which of the below activities are available in your country to make synthetic biology research more accessible to the public to promote better understanding and engagement? Select all that apply:

- a. Students participating in outreach activities presenting their research projects to public (E.g.: Pint of Science)
- b. Open dialogue with policymakers and regulators.

⁴ We only add here additional questions dedicated to “Policy makers”, which are not already present in the questionnaire “Stakeholder type: SME / start-up / industrial company”.



- c. Providing greater transparency in research practices by regular dissemination and communication.
 - d. Increasing public participation in research projects by hosting museum exhibits, open labs, Science festivals.
 - e. Other (please specify)
2. How does your country's government support synthetic biology start-ups to boost innovation? Please select all that apply:
- a. By providing funding and grant opportunities.
 - b. By providing tax incentives for investors (please specify any improvements that could be made to these incentives to better support equity financing).
 - c. By creating regulatory frameworks that promote innovation and growth (please provide an example).
 - d. By providing guidance and support on compliance with relevant laws and regulations (please specify which laws and regulations, and any improvements that could be made to the guidance).
 - e. By establishing and supporting incubators and accelerator programs to help start-ups grow and succeed (please provide details on how these programs are established and supported, their impact on start-ups, and any need for further support such as grants or tax incentives).
 - f. Strategy and policy preparation with relevant stakeholders
 - g. Allocation of resources for entrepreneurship training and other relevant competence development activities
 - h. None of the above.
 - i. Other (please specify)
3. What kind of policies or regulations do you think are currently lacking but necessary to support the growth of Synthetic Biology start-ups in your country? Select all that apply:
- a. Expedited intellectual property protection for innovators, such as copyright, trademarks, patents.



- b. Streamlined regulatory processes to make market entry easier.
 - c. Easier and timely access to substantive funding for innovation and entrepreneurs.
 - d. Tax incentives for investors such as tax breaks for R&D, reduced corporate tax rates for synthetic-biology start-up companies.
 - e. Improved conditions for Initial Public Offerings (IPO's) to allow a more secure and easier exit for investors.
 - f. None of the above
 - g. Other (please specify)
4. On a scale of 1 to 5, where 1 is "not at all" and 5 is "very much," how much do you think government regulations affect innovation in Synthetic Biology in the following ways? Please select one answer for each of the five options.
- a. Funding opportunities.
 - b. Licensing processes.
 - c. Intellectual property protection.
 - d. Import and export restrictions.
 - e. Compliance costs.
5. In your opinion, what are the key strengths of synthetic biology research and entrepreneurship in your country? Please select all that apply:
- d. Well-funded research initiatives.
 - e. Strong academic institutions with expertise in synthetic biology.
 - f. Supportive government policies and funding.
 - g. Availability of skilled labour force.
 - h. Vibrant startup ecosystem.
 - i. Access to investment capital.
 - j. Other (please specify):



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ANNEX 1

LETTER OF APPROVAL:



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HREC CHECKLIST



11_HRX-checklist
for human research_

HREC APPLICATION



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