

SYN BEE



Funded by the European Union under the Grant Agreement No 10100509. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Innovation Council and SMEs Executive Agency (EISMEA). Neither the European Union nor the granting authorities can be held responsible for them.



Grant Agreement: 101100509

DOC. REFERENCE	D1.4 Matrix of Best Practices
WORK PACKAGE No	1 – SWOT Analysis
RESPONSIBLE	Delft University of Technology – TU Delft
AUTHOR(S)	Sindhu Naik (TU Delft)
REVIEWER(S)	All Partners
DATE	29 th April 2024
STATUS	FINAL VERSION
DISSEMINATION LEVEL	CONFIDENTIAL

VERSION	DATE	RESPONSIBLE	DESCRIPTION
Version 1.0	May 10, 2024	TU Delft	First Version for Review
Version 1.0	May 13, 2024	TU Delft	Final version



Table of Contents

Contents

I.	Executive Summary	3
II.	Introduction	4
1.	Understanding Synthetic Biology's Landscape.....	4
1.1	Key Areas of Application.....	5
1.2	Challenges.....	5
1.3	Opportunities.....	6
2.	Best Practices across the Eco-systems.....	6
2.1	Innovation Hubs and Accelerators.....	6
2.2	Collaborative Networks.....	10
2.3	Funding Mechanisms.....	12
2.4	Talent Development:	17
2.5	Regulatory Frameworks.....	20
3.	Adapting Best Practices to Synthetic Biology.....	22
3.1	Analyzing Best Practices.....	23
3.2	Implementation Roadmaps	23
3.3	Considerations	23
III.	Conclusion	24



I. EXECUTIVE SUMMARY

The field of Synthetic Biology is rapidly evolving, offering transformative opportunities across various sectors. By blending biology, engineering, and computer science, Synthetic Biology aims to create and redesign biological systems, with applications in healthcare, agriculture, and energy. However, its growth brings challenges, including regulatory hurdles, funding difficulties, and talent shortages. This report explores strategies to address these challenges and capitalize on emerging opportunities through a multi-sectoral approach.

Key takeaways from the report include:

- **Innovation Ecosystems:** Synthetic Biology benefits from best practices in various sectors. The tech industry's innovation hubs and accelerators, biomedical accelerators, and biotech clusters provide models for fostering growth, collaboration, and entrepreneurship in Synthetic Biology.
- **Collaborative Networks:** Successful collaboration between academia, industry, and government is crucial for driving advancements. Examples from tech, biomedical, and biotech sectors demonstrate how partnerships can facilitate innovation and regulatory compliance.
- **Funding Mechanisms:** Access to diverse funding sources is essential for the growth of Synthetic Biology. Venture capital, grants, and non-dilutive funding opportunities from organizations such as the National Growth Fund (Netherlands), SPRIN-D (Germany), and others support research, development, and commercialization. Although we have seen most of the funding available for a high technology readiness level (TRL), which is not feasible for synbio research as the earlier stages of research is very much at a lower TRL level. We would need more funding agencies set up to support entrepreneurs with low TRL ideas for development.
- **Talent Development:** Skill-building initiatives from various ecosystems, such as Codecademy, Coursera, and SynBioBeta help cultivate talent in Synthetic Biology.



Cross-sector training programs and accelerators also contribute to nurturing a diverse talent pool.

- **Regulatory Frameworks:** Synthetic Biology must navigate regulatory and ethical concerns. Global frameworks, including the EU's Horizon Europe and the US's Coordinated Framework for Regulation of Biotechnology, guide innovation while ensuring safety and compliance, although there is still a lot of work that still needs to do to make the regulations as streamlined and easy to navigate for everyone across the globe.

II. INTRODUCTION

Synthetic Biology is an emerging field with immense potential to revolutionize various industries, including healthcare, agriculture, and energy. It combines the principles of biology, engineering, and computer science to create new biological systems and redesign existing ones. As this field evolves, so does the need for an entrepreneurial ecosystem that can foster innovation, collaboration, and sustainable growth.

This report aims to provide a matrix of best practices from various sectors and industries worldwide, which can be applied to the field of Synthetic Biology. The insights in this report are derived from survey responses from 80 participants, supplemented by interviews with eight key stakeholders. We will explore practices that have been successful in other domains and analyze how they can be adapted to create a thriving entrepreneurial ecosystem in Synthetic Biology.

1. UNDERSTANDING SYNTHETIC BIOLOGY'S LANDSCAPE

Synthetic Biology, a multidisciplinary field combining biology, engineering, and computer science, is gaining momentum globally. This field aims to create new biological systems and redesign existing ones, with applications spanning across healthcare, agriculture, energy, and beyond. The current landscape of Synthetic Biology reflects significant growth, with numerous startups, research institutions, and industry players entering the field.



1.1 KEY AREAS OF APPLICATION

Healthcare: Synthetic Biology has paved the way for innovative therapies, including gene editing and cell-based treatments. It's also revolutionizing diagnostics, vaccine development, and personalized medicine.

Agriculture: The field is addressing food security challenges through genetically engineered crops, biopesticides, and biofertilizers, contributing to sustainable agricultural practices.

Energy: Synthetic Biology plays a crucial role in the development of biofuels and other renewable energy sources, providing environmentally friendly alternatives to traditional fuels.

1.2 CHALLENGES

Regulatory and Ethical Issues: The rapidly evolving nature of Synthetic Biology poses significant regulatory challenges, with concerns around biosafety, biosecurity, and ethical considerations. Clear guidelines and frameworks are needed to ensure responsible innovation.

Funding and Investment: While the field has seen increased investment, access to sustained funding remains a challenge for startups and smaller entities. Securing long-term funding is crucial for continued research and development.

Talent and Skills: The interdisciplinary nature of Synthetic Biology requires a diverse skill set. The lack of specialized education and training programs hampers the growth of skilled professionals in this field.

Public Perception: Synthetic Biology's advances raise ethical and societal concerns, affecting public acceptance. Engaging in open dialogues and educational initiatives is essential to foster understanding and potential acceptance.



1.3 OPPORTUNITIES

Collaboration: The intersection of academia, industry, and government presents opportunities for collaborative initiatives. Research partnerships, innovation hubs, and accelerator programs can drive advancements in Synthetic Biology.

Technological Advancements: The integration of technologies such as CRISPR, automation, and artificial intelligence with Synthetic Biology offers new opportunities to streamline research, scale up production, and innovate.

Expansion in the EU: Emerging & Moderate eco-systems present untapped potential for Synthetic Biology, particularly in Baltic regions with growing interest in entrepreneurship. Expansion can lead to diversified applications and wider market penetration.

2. BEST PRACTICES ACROSS THE ECO-SYSTEMS

To foster a thriving entrepreneurial ecosystem in Synthetic Biology, it's crucial to learn from successful strategies implemented across various sectors. This section explores best practices from different eco-systems, providing actionable insights for Synthetic Biology.

2.1 INNOVATION HUBS AND ACCELERATORS

Here below some best examples which can be applied to the field of Synthetic biology across eco-systems:

Biomedical & Biotech Eco-system: The biomedical & Biotech sector has leveraged specialized accelerators that support early-stage life science startups, providing seed funding, lab space, and mentorship. This model encourages cross-disciplinary collaboration, allowing synthetic biology startups to learn from experts across various biomedical fields, accelerating development and commercialization. Examples include:

- **IndieBio (USA):** Focuses on early-stage life science startups, offering seed funding, lab space, and mentorship to accelerate development.



- **[Biomed X \(Germany\)](#)**: A Heidelberg-based accelerator that connects academic research with industry, providing funding, lab space, and mentorship. It fosters collaboration between researchers, industry experts, and investors.
- **[Cydan \(USA\)](#)**: A rare disease accelerator based in Massachusetts, supporting companies that develop therapeutics for rare diseases. It provides funding, strategic guidance, and operational support.
- **[MedTech Innovator \(Global\)](#)**: A global accelerator program for medical technology startups, providing funding, mentorship, and networking opportunities. It connects startups with investors, industry partners, and key opinion leaders.
- **[Biopôle \(Switzerland\)](#)**: Located in Lausanne, Biopôle is a leading life sciences campus, hosting a variety of biotech and biomedical companies, as well as research institutions. It offers an ecosystem of incubators, accelerators, and networking opportunities for biotech startups.
- **[Oxford BioEscalator \(UK\)](#)**: Situated in Oxford, this innovation hub provides lab space, mentorship, and funding opportunities for biotech and biomedical startups. It facilitates collaboration between academia, industry, and government, driving innovation in life sciences.
- **[Science Park Amsterdam \(Netherlands\)](#)**: This park offers a thriving ecosystem of research institutions, startups, and companies across various sectors, including biotechnology and biomedical sciences. It provides lab facilities, accelerators, and networking opportunities.
- **[Y Combinator \(USA\)](#)**: While known for its tech focus, Y Combinator also supports biotech startups, providing seed funding, mentorship, and access to a global network.
- **[Johnson & Johnson Innovation \(Global\)](#)**: Offering incubators like JLABS, Johnson & Johnson Innovation supports biotech startups worldwide with mentorship, resources, and collaboration opportunities.
- **[BioCity \(UK\)](#)**: A biotech incubator and accelerator with locations in Nottingham and Glasgow, providing lab space, mentorship, and networking opportunities for biotech and life sciences startups.



Synthetic Biology Eco-system: The synthetic biology sector has seen a rise in specialized hubs and accelerators supporting its growth. Examples include:

- **[SynBioBeta \(USA\)](#):** A prominent platform for synthetic biology startups, SynBioBeta offers networking events, funding opportunities, and industry insights, fostering collaboration within the synthetic biology eco-system.
- **[Ginkgo Bioworks \(USA\)](#):** A synthetic biology company that also serves as an innovation hub, providing resources, lab facilities, and mentorship to synthetic biology startups through its Ferment Consortium.
- **[Biotechgate \(Global\)](#):** An online platform connecting synthetic biology startups with investors, industry partners, and resources, supporting the growth of synthetic biology enterprises globally.
- **[BIOMADE \(USA\)](#):** A Manufacturing Innovation Institute that focuses on advancing bioindustrial manufacturing. BIOMADE supports synthetic biology startups by providing access to manufacturing facilities, mentorship, and networking opportunities.
- **[Genopole \(France\)](#):** A major hub for biotechnology and synthetic biology in France, offering incubator services, lab facilities, and funding opportunities to startups and researchers.
- **[TWB \(France\)](#):** Toulouse White Biotechnology (TWB) is an innovation hub that supports the development of bio-based solutions. It offers funding, mentorship, and collaboration opportunities, connecting startups with industry partners and researchers.
- **[Entrepreneur First \(Global\)](#):** A global talent investor with programs in multiple countries, including the UK, Germany, France, and Singapore. EF supports talented individuals in forming startups by offering mentorship, resources, and networking opportunities. Its programs foster interdisciplinary collaboration across sectors such as tech, biotech, and healthcare, contributing to the growth of entrepreneurial ecosystems worldwide.

Tech Eco-system: The technology sector has established numerous innovation hubs and accelerators worldwide, creating supportive environments for startups to thrive. These hubs



provide access to mentors, resources, and a network of like-minded innovators, fostering a culture of collaboration and innovation. Examples include:

- **Silicon Valley (USA):** A vibrant ecosystem of investors, tech companies, and accelerators, offering mentorship and networking opportunities.
- **Tech City (UK):** Providing coworking spaces, events, and networking opportunities, fostering collaboration and innovation.
- **Shenzhen (China):** A global tech hub known for its rapid growth in hardware and electronics startups. It offers an ecosystem of accelerators, innovation labs, and manufacturing facilities, attracting tech entrepreneurs worldwide.
- **Tel Aviv (Israel):** Home to a thriving tech ecosystem, with a range of incubators, accelerators, and venture capital firms. Programs like The Junction and The Hive TLV provide seed funding, mentorship, and access to global networks.
- **Berlin Cluster (Germany):** Berlin has emerged as a prominent tech hub in Europe, offering accelerators such as Techstars and Berlin Startup Academy. These programs provide mentorship, seed funding, and networking opportunities for startups in technology and various other sectors.
- **Station F (France):** Located in Paris, Station F is the world's largest startup campus, hosting a wide variety of accelerators, incubators, and co-working spaces. It serves as a hub for startups across diverse fields, including technology, biotech, and e-commerce.
- **Startup Sauna (Finland):** Based in Helsinki, Startup Sauna is an accelerator offering mentorship, networking, and funding opportunities for early-stage startups. It focuses on supporting tech companies in the Nordic region and beyond.
- **Startupbootcamp (Denmark):** Located in Copenhagen, Startupbootcamp offers accelerators across different sectors, including fintech, health tech, and smart cities. It provides mentorship, resources, and access to investors for startups.

Cross-Sector Innovation Hubs:

- **InnoEnergy (EU):** A European accelerator focusing on sustainable energy startups, InnoEnergy supports companies developing renewable energy solutions, smart grid



technologies, and other sustainable products. It offers funding, mentorship, and access to a network of industry partners and investors.

- **[TechQuartier \(Germany\)](#)**: Based in Frankfurt, TechQuartier serves as a hub for startups across various sectors, including fintech, health tech, and digital transformation. It provides co-working spaces, mentorship, and access to networking opportunities.
- **[EIT Food Accelerator Network \(EU\)](#)**: This program provides support for startups in the agrifood sector, offering mentorship, funding, and collaboration opportunities across Europe. It connects startups with industry partners, research institutions, and investors.
- **[X TU Delft \(Netherlands\)](#)**: Based at Delft University of Technology, X TU Delft offers an innovation hub that supports student-led startups across various sectors. It provides co-working spaces, mentorship, and access to university resources, facilitating the growth of tech, biotech, and other startups.
- **[Planet B.io \(Netherlands\)](#)**: A bio-incubator based in Delft, Planet-Bio supports biotech startups by providing lab space, mentorship, and networking opportunities. It fosters collaboration between academia, industry, and government, contributing to the growth of the biotech eco-system in the Netherlands and beyond.

2.2 COLLABORATIVE NETWORKS

Biomedical:

- **[Innovate UK \(UK\)](#)**: This government agency supports research and innovation projects across various sectors, including biomedical sciences. It provides funding and networking opportunities, facilitating collaboration between academic researchers, industry partners, and government entities.

Biotech:

- **[Fraunhofer Institute \(Germany\)](#)**: A network of research institutes that collaborates with academia, industry, and government across various sectors, including biotechnology. The Fraunhofer Institute for Interfacial Engineering and Biotechnology focuses on projects that develop bio-based solutions, collaborating with universities, companies, and government bodies.



- **BioValley (France, Germany, Switzerland):** A tri-national biotech cluster that connects research institutions, biotech companies, and government organizations across France, Germany, and Switzerland. BioValley promotes collaboration, facilitating projects that bridge academic research and biotech industry needs.

Synthetic Biology:

- **Synthetic Biology for Growth(UK):** A research consortium that connects academic institutions, industry partners, and government organizations. The center focuses on developing synthetic biology solutions for various sectors, including healthcare, agriculture, and biofuels, promoting collaboration and knowledge exchange.

Technology:

- **EIT Digital (EU):** A digital innovation and education organization that connects academia, industry, and government across Europe. EIT Digital facilitates collaboration through its network of research institutions, startups, and established tech companies, promoting the development of digital technologies and solutions.
- **CERN (Switzerland):** The European Organization for Nuclear Research (CERN) has a history of fostering collaboration between academia, industry, and government. Its partnerships with universities, research institutes, and private companies have led to innovations in computing, data storage, and other tech fields, including the development of the World Wide Web.

Cross-Sector Collaboration:

- **Horizon Europe (EU):** The European Union's flagship research and innovation program promotes collaboration between academia, industry, and government across various sectors, including technology, biotech, and synthetic biology. Horizon Europe funds research projects, supports partnerships, and facilitates knowledge exchange.
- **SBRC Nottingham (UK):** The Synthetic Biology Research Centre (SBRC) in Nottingham collaborates with universities, industry partners, and government bodies. It focuses on



developing bio-based solutions for various sectors, including biofuels and healthcare, fostering collaboration and innovation.

2.3 FUNDING MECHANISMS

2.3.1 VENTURE CAPITAL

Biomedical:

- **OrbiMed**: A leading global healthcare venture capital firm, OrbiMed invests in companies across the life sciences and healthcare sectors. It provides funding, strategic guidance, and operational support, helping companies navigate clinical trials, regulatory approvals, and commercialization.
- **F-Prime Capital**: A venture capital firm specializing in healthcare and life sciences investments. F-Prime Capital supports companies in pharmaceuticals, diagnostics, and medical devices, offering funding, mentorship, and strategic guidance.

Synthetic Biology:

- **SOSV**: A global venture capital firm that invests in various sectors, including synthetic biology. SOSV's IndieBio program focuses on early-stage synthetic biology startups, providing funding, lab space, mentorship, and access to a global network.
- **Fifty Years**: A venture capital firm that invests in synthetic biology companies and other mission-driven startups. Fifty Years provides funding, mentorship, and strategic guidance, supporting companies that aim to address global challenges through innovation.

2.3.2 GRANTS

- **Global Innovation Fund**: A nonprofit organization that provides grants to startups and organizations across various sectors. The fund focuses on projects that aim to address



global challenges, offering financial support, mentorship, and resources to startups and established companies alike.

- **Innovate UK:** The UK's innovation agency provides grants to support research and innovation across multiple sectors, including technology, life sciences, and synthetic biology. Innovate UK offers funding, mentorship, and networking opportunities, facilitating collaboration between academia, industry, and government.
- **National Science Foundation (USA):** The NSF offers grants to support research and development projects across various sectors, including technology, life sciences, and synthetic biology. The NSF's Small Business Innovation Research (SBIR) program provides funding to startups, helping them bridge the gap between research and commercialization.
- **Eureka Eurostars:** A European program that offers grants to support innovative projects across various sectors, including technology and life sciences. Eurostars provides funding to collaborative projects involving startups, research institutions, and industry partners, promoting cross-sector innovation.

2.3.3 NON-DILUTIVE FUNDING

Biomedical:

- **Wellcome Trust (UK):** A charitable foundation that provides non-dilutive funding to support biomedical research and innovation. The Wellcome Trust offers grants to research institutions, startups, and companies in the healthcare and life sciences sectors, facilitating the development of medical technologies and treatments.
- **NIH Research Grants (USA):** The National Institutes of Health (NIH) offers a variety of grants to support biomedical research and innovation projects. These grants provide non-dilutive funding to startups, universities, and research institutions, helping them advance medical research and develop new therapies.

Biotech:



- **European Innovation Council (EU)**: The European Innovation Council (EIC) offers grants to support research and innovation projects across various sectors, including biotechnology. The EIC provides non-dilutive funding to startups, companies, and research institutions, aiding the development of bio-based solutions.
- **Bio-Innovation Institute (Denmark)**: An innovation hub that offers non-dilutive funding to support biotech startups. The BioInnovation Institute provides grants, mentorship, and resources to companies developing bio-based solutions, facilitating their growth and development.
- **EU Biotech Act (EU)**: This initiative provides grants to support biotech projects across Europe, fostering collaboration between academia, industry, and government. The EU Biotech Act promotes the development of bio-based solutions across various sectors, including healthcare, agriculture, and environmental sustainability.
- **IBISBA (EU)**: The Industrial Biotechnology Innovation and Synthetic Biology Accelerator (IBISBA) offers non-dilutive funding to support synthetic biology and biotech projects across Europe. IBISBA provides grants, mentorship, and resources to startups and research institutions, facilitating the development of bio-based solutions.
- **CBE JU (EU)**: The Circular Bio-based Europe Joint Undertaking (CBE JU) provides non-dilutive funding to support bio-based projects across Europe. CBE JU offers grants to startups, companies, and research institutions, promoting the development of sustainable and circular bio-based solutions.

Cross-Sector Non-Dilutive Funding:

- **SBIR/STTR Programs (USA)**: The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs offer non-dilutive funding to support research and development projects across multiple sectors, including technology, biotech, and synthetic biology. These programs provide grants to startups and small businesses, helping them bridge the gap between research and commercialization.
- **Horizon Europe (EU)**: The European Union's Horizon Europe program offers grants to support research and innovation projects across various sectors, including technology, life sciences, and synthetic biology. These grants provide non-dilutive funding to startups, research institutions, and companies, fostering collaboration and innovation.



- **[SPRIN-D \(Germany\)](#)**: SPRIND wants to build the bridge between the spirit of research and entrepreneurship and create new disruptive innovation from Germany.

Synthetic Biology-Specific:

- **[SynBio Fund \(UK\)](#)**: This fund provides non-dilutive grants to support synthetic biology research and development in the UK. The SynBio Fund offers funding to startups, research institutions, and companies, promoting the advancement of synthetic biology projects across various sectors.
- **[DARPA Biological Technologies Office \(USA\)](#)**: The Defense Advanced Research Projects Agency (DARPA) funds synthetic biology projects through its Biological Technologies Office (BTO). DARPA BTO provides grants to startups, companies, and research institutions, supporting synthetic biology research and development with a focus on national security and bio-based innovations.
- **[SynBio LEAP \(Global\)](#)**: The Synthetic Biology Leadership Excellence Accelerator Program (SynBio LEAP) offers non-dilutive funding and mentorship to synthetic biology researchers and innovators worldwide. SynBio LEAP focuses on advancing synthetic biology projects that address global challenges, supporting collaboration between academia, industry, and government.

Foundation-Specific Funding:

- **[Novo Nordisk Foundation \(Denmark\)](#)**: The Novo Nordisk Foundation offers grants and funding opportunities to support research and innovation in biotechnology, including synthetic biology. The foundation provides non-dilutive funding for projects that advance knowledge and technology within the life sciences, including areas such as healthcare, biopharmaceuticals, and sustainable biotechnology solutions. Through its grant programs, the Novo Nordisk Foundation aims to foster collaboration between academia, industry, and government, supporting projects that have the potential to make significant contributions to society.
- **[Gates Foundation \(USA\)](#)**: The Bill & Melinda Gates Foundation offers grants and funding opportunities to support research and development projects in global health, agriculture, and other areas. The foundation has supported synthetic biology initiatives



aimed at addressing challenges such as infectious diseases, food security, and environmental sustainability.

- **[Wellcome Trust \(UK\)](#)**: The Wellcome Trust provides grants and funding to support biomedical research and innovation, including projects related to synthetic biology. The trust offers non-dilutive funding for research projects that have the potential to improve human health and well-being, fostering collaboration between researchers, [institutions](#), and industry partners.
- **[Simons Foundation \(USA\)](#)**: The Simons Foundation supports scientific research across various disciplines, including mathematics, physics, and biology. The foundation offers grants and funding opportunities for synthetic biology projects that advance our understanding of biological systems and contribute to scientific knowledge.
- **[Howard Hughes Medical Institute \(USA\)](#)**: The Howard Hughes Medical Institute (HHMI) supports biomedical research and education initiatives, including projects in synthetic biology. HHMI offers grants and funding to researchers and institutions conducting innovative research in areas such as genetics, molecular biology, and bioengineering.
- **[Chan Zuckerberg Initiative \(USA\)](#)**: The Chan Zuckerberg Initiative (CZI) funds scientific research and technology development projects aimed at advancing human health and well-being. CZI supports synthetic biology initiatives focused on areas such as disease prevention, diagnostics, and therapeutics, providing grants and funding to researchers and organizations.
- **[European Molecular Biology Organization \(EMBO\)](#)**: EMBO provides grants and funding opportunities to support research in the life sciences, including synthetic biology. The organization offers non-dilutive funding for projects that advance our understanding of biological systems and contribute to scientific knowledge, fostering collaboration between researchers across Europe.
- **[European Research Council \(ERC\)](#)**: The ERC offers grants and funding to support pioneering research projects across various scientific disciplines, including synthetic biology. The ERC's funding programs provide non-dilutive support for innovative research ideas that have the potential to make significant contributions to science and society.
- **[European Science Foundation \(ESF\)](#)**: The ESF supports collaborative research initiatives and funding programs across Europe, including projects in synthetic biology. The



foundation offers non-dilutive funding for research projects that address key scientific questions and challenges, promoting collaboration between researchers and institutions across different countries.

- **[Marie Skłodowska-Curie Actions \(MSCA\)](#)**: MSCA provides funding and support for researchers at all stages of their careers, including early-stage and experienced researchers working in synthetic biology. The program offers non-dilutive funding for research projects, training opportunities, and international mobility grants, fostering collaboration and knowledge exchange across Europe.
- **[European Foundation Centre \(EFC\)](#)**: The EFC is a network of foundations and philanthropic organizations across Europe, including those that support research and innovation in synthetic biology. The EFC provides funding opportunities, grants, and resources for projects that address societal challenges and contribute to scientific progress.

2.4 TALENT DEVELOPMENT

Biomedical Eco-system:

- **[BIO Talent Connect](#)**: The Biotechnology Innovation Organization (BIO) offers Talent Connect, a program that connects students and job seekers with internship and career opportunities in the biotech industry. Through Talent Connect, participants gain access to industry-specific resources, mentorship, and networking opportunities.
- **[Biotech Primer Courses](#)**: Biotech Primer provides online and in-person courses on various topics in biotechnology, including biopharmaceuticals, molecular diagnostics, and regulatory affairs. These courses cater to professionals seeking to deepen their understanding of the biotech industry and advance their careers.
- **[BioTechEco Joint Master's program](#)**: The international BioTechEco Master in Industrial Biotechnology and Processes for a Bio-Based Economy is a newly conceived master's degree offering a cross-disciplinary educational program that includes life sciences, chemical and bioprocess engineering, bioethics, sustainability, economics, and environmental regulations. BioTechEco master's program is included in EUR BIOECO,



supported by the French State and managed by the French National Research Agency (ANR)

Synthetic Biology Eco-system:

- **[Synthetic Biology Summer School at TU Darmstadt](#)**: Centre of synthetic biology, hosts an annual Synthetic Biology Summer School, offering lectures, lab sessions, and hands-on experiments in synthetic biology. Participants learn about cutting-edge research and technologies in synthetic biology while gaining practical skills in the laboratory.
- **Synthetic Biology Webinars by [SynBioBeta](#)**: SynBioBeta, a leading synthetic biology industry platform, hosts webinars on various topics related to synthetic biology entrepreneurship, innovation, and technology. These webinars feature experts from academia, industry, and startups, providing insights and knowledge-sharing opportunities for professionals in the field.
- **[Summer School on Synthetic Biology/Biological Production of Green Hydrogen in Porto](#)**: University of Porto hosts an event organized by the EU project PhotoSynH2. This unique opportunity is open to all EIC's Green Hydrogen Portfolio early stage researchers/students who are eager to delve into the fascinating world of synthetic biology and/or green hydrogen production (June 19-20, 2024).

Tech Eco-system

- **[Codecademy](#)**: Codecademy offers interactive coding courses in various programming languages, web development, data science, and more. Their hands-on approach allows learners to practice coding skills in real-time, making it a popular choice for beginners and experienced programmers alike.
- **[Coursera](#)**: Coursera partners with universities and organizations to offer online courses, specializations, and degrees in technology-related fields. Learners can access courses in areas such as machine learning, software development, and cybersecurity, gaining valuable skills through self-paced learning.

Cross-sector programs



Funded by the European Union under the Grant Agreement No 101100509.
Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Innovation Council and SMEs Executive Agency (EISMEA).
Neither the European Union nor the granting authorities can be held responsible for them.

- **[Entrepreneurship Program with Biotech \(Denmark\)](#)**: Copenhagen Bio Science Forum (CBSF): CBSF is an entrepreneurship program in Denmark focused on fostering innovation and startups in the biotech sector. The program provides mentorship, networking opportunities, and access to funding for aspiring entrepreneurs looking to launch biotech ventures. CBSF connects participants with industry experts, investors, and potential collaborators, supporting the development of innovative biotech solutions.
- **[BioInnovation Institute \(Denmark\)](#)**: The BioInnovation Institute (BII) in Denmark supports early-stage startups and entrepreneurs in the life sciences and biotech sectors. BII offers an accelerator program providing funding, mentorship, and access to state-of-the-art facilities and networks to help transform innovative ideas into successful businesses.
- **[Novo Nordisk Foundation's BioInnovation Institute \(Denmark\)](#)**: The Novo Nordisk Foundation's BioInnovation Institute (BII) supports entrepreneurship and innovation in the life sciences and biotech sectors. BII provides funding, infrastructure, and expertise to startups and researchers, helping them develop and commercialize groundbreaking biotech solutions.
- **[Synbio Powerhouse \(Finland\)](#)**: Synbio Powerhouse is an initiative in the Finland focused on promoting entrepreneurship and innovation in synthetic biology. The program offers support to startups and entrepreneurs in the synthetic biology ecosystem, including mentorship, networking events, and access to funding opportunities.
- **[Health Axis Europe \(Germany/Netherlands/Belgium\)](#)**: Health Axis Europe is a cross-border initiative that supports entrepreneurship and innovation in the health and life sciences sectors. The program offers support to startups and entrepreneurs in areas such as biotech, medtech, and digital health, including access to funding, expertise, and collaboration opportunities across multiple European countries.
- **[Mass Challenge HealthTech \(USA\)](#)**: MassChallenge HealthTech is a digital health-focused accelerator program based in the United States. It provides startups with access to mentorship, resources, and networking opportunities to accelerate their growth and innovation in the healthcare sector.
- **[JLABS \(Global\)](#)**: Johnson & Johnson Innovation's JLABS program provides incubation space, resources, and mentorship to early-stage companies in the life sciences,



including biotech, pharmaceuticals, and medical devices. With locations across North America, Europe, and Asia, JLABS offers a global network for biotech entrepreneurs.

- **Start-Up (Chile)**: Start-Up Chile is a government-sponsored accelerator program that supports startups from around the world. It provides funding, mentorship, and networking opportunities to entrepreneurs across various industries, including biotech and healthcare.
- **BioCity (Australia)**: BioCity Australia is a life sciences incubator and accelerator program that supports biotech startups and entrepreneurs in Australia. It offers access to lab space, funding, business support, and connections to industry partners and investors.
- **Entrepreneur First (Global)**: Entrepreneur First is a global talent investor that supports individuals in building deep technology startups from scratch. It provides funding, mentorship, and access to a global network of experts and investors, with a focus on areas such as biotech, AI, and cybersecurity.
- **Innovation Quarter (Netherlands)**: Innovation Quarter is an economic development agency that supports innovation and entrepreneurship in the Netherlands. It offers funding, advice, and connections to startups and scale-ups in various sectors, including life sciences and biotech.
- **Bio Create Program (Canada)**: The Bio Create Program is a biotech-focused accelerator program in Canada that supports early-stage companies in the life sciences sector. It provides funding, mentorship, and access to industry networks to help startups commercialize their innovations.

2.5 REGULATORY FRAMEWORKS

Biomedical: In the biomedical sector, regulatory bodies such as the Food and Drug Administration (FDA) and the European Medicines Agency (EMA) provide frameworks for drug and medical device approval, ensuring safety while allowing innovation. These models offer a blueprint for Synthetic Biology, guiding the development and commercialization of bio-based products and solutions.



Technology: The tech eco-system has seen various regulatory frameworks that balance innovation with safety and compliance. Examples include the European Union's General Data Protection Regulation (GDPR), which governs data privacy while allowing technological advancements, and the USA's Federal Communications Commission (FCC) regulations, which ensure compliance across various tech sectors.

Here below are some examples across different jurisdictions and aspects of the regulatory landscape that have been impactful within the synthetic biology sector:

United States

- **[Coordinated Framework for Regulation of Biotechnology](#):** This framework, established by the U.S. government, involves three regulatory agencies: the FDA, the Environmental Protection Agency (EPA), and the Department of Agriculture (USDA). It's designed to ensure the safety of biotechnology products, including those developed through synthetic biology, while supporting innovation.
- **[Synthetic Biology Specific Guidelines by the NIH](#):** The National Institutes of Health (NIH) has guidelines for research involving recombinant or synthetic nucleic acid molecules, which address synthetic biology projects. These guidelines aim to promote safe research practices (April 2024).

European Union:

- **[Horizon Europe](#):** The EU's key funding program for research and innovation includes initiatives and calls specifically targeting synthetic biology. Horizon Europe facilitates synthetic biology research by providing funding and setting regulatory standards for projects.
- **[EU's Novel Food Regulation](#):** This regulation is relevant for synthetic biology products intended for food use. It requires that any new food must be approved after a scientific safety assessment by the European Food Safety Authority (EFSA), ensuring consumer safety and fostering public trust in new biotechnologies.
- **[EU Biotech Act](#):** The EU Biotech Act aims to streamline regulations related to biotechnology, including synthetic biology. By providing clear regulatory pathways and



standards, the EU Biotech Act supports innovation while ensuring safety and compliance.

United Kingdom:

- **Synthetic Biology Leadership Council (SBLC)**: The SBLC provides strategic direction for the development of synthetic biology in the UK. It helps create a regulatory environment that supports innovation while ensuring safety and ethical considerations are addressed.

Canada:

- **Genomic Research and Development Initiative (GRDI)**: This cross-government initiative coordinates federal research and policy-making efforts in genomics, including synthetic biology. The GRDI supports the development of regulatory frameworks that foster innovation and ensure public safety.

Global Initiatives:

- **International Genetically Engineered Machine (iGEM) Competition**: While not a regulatory body, iGEM plays a significant role in promoting safe practices and ethical considerations in synthetic biology among young scientists and engineers globally. It provides a platform for showcasing innovative projects within a framework that emphasizes biosafety and biosecurity.

These examples demonstrate how various regulatory frameworks and initiatives across the globe are designed to support the safe and ethical development of synthetic biology. They balance the promotion of innovation with the necessity of addressing safety, ethical, and environmental concerns.

3. ADAPTING BEST PRACTICES TO SYNTHETIC BIOLOGY



3.1 ANALYZING BEST PRACTICES

Drawing from successful models across various sectors, the best practices highlighted in the previous section can be tailored to suit the specific needs of synthetic biology. Innovation hubs and accelerators, for example, have demonstrated effectiveness in fostering startups by providing essential support such as funding, mentorship, and laboratory space. These models can be adapted to synthetic biology by creating specialized hubs focused on bio-based innovation, enabling startups to access necessary resources and expertise.

Collaborative networks have also proven crucial for advancing research and development. By facilitating partnerships between academia, industry, and government, synthetic biology can benefit from shared knowledge, resources, and expertise. This approach aligns with the interdisciplinary nature of synthetic biology, where collaboration is key to driving innovation.

3.2 IMPLEMENTATION ROADMAPS

To implement best practices, synthetic biology stakeholders can develop tailored roadmaps for each strategy. For innovation hubs and accelerators, this may involve creating sector-specific programs that address the unique challenges of synthetic biology, such as regulatory hurdles and funding limitations. Establishing partnerships with universities, research institutions, and industry players can facilitate access to talent, resources, and expertise.

For collaborative networks, stakeholders should identify potential partners and establish mechanisms for knowledge sharing and joint initiatives. Creating cross-sector networks can enhance innovation by leveraging diverse perspectives and expertise.

In terms of funding mechanisms, synthetic biology can adopt a diversified approach, combining venture capital, grants, and non-dilutive funding. Engaging with potential investors and funding agencies early on can help secure the necessary financial support. In our project SYNBEE, creating such a roadmap is our next step and already in progress.

3.3 CONSIDERATIONS



When adapting best practices to synthetic biology, unique considerations should be addressed. Regulatory and ethical challenges require careful navigation to ensure responsible innovation. Developing clear guidelines and frameworks can help manage these concerns while fostering public trust and acceptance of green solutions in forms of modified products.

Additionally, talent development is critical for the growth of synthetic biology. Creating specialized training programs and initiatives can address the field's specific skill requirements, ensuring a robust pipeline of skilled professionals.

III. CONCLUSION

Synthetic Biology has immense potential to revolutionize industries, yet it faces challenges that require a multifaceted approach. Collaboration across sectors, funding mechanisms, talent development, and regulatory frameworks play key roles in nurturing a thriving entrepreneurial ecosystem. By learning from and adapting strategies across sectors, the Synthetic Biology industry can overcome obstacles and harness its transformative potential for sustainable growth and innovation.

To ensure its successful trajectory, the field must:

- **Foster Interdisciplinary Collaboration:** Encouraging collaboration between academia, industry, and government is essential for advancing research and commercialization. Such partnerships can facilitate knowledge transfer, innovation, and comprehensive strategies to tackle challenges.
- **Diversify Funding Sources:** To sustain growth and development, the Synthetic Biology sector must explore various funding options, including venture capital, grants, and non-dilutive funding opportunities. This will support startups, research projects, and commercialization efforts.
- **Develop Specialized Talent:** The interdisciplinary nature of Synthetic Biology requires a diverse skill set. Training programs, accelerators, and educational initiatives from



various ecosystems are essential for cultivating talent, ensuring that the field has a robust pipeline of skilled professionals.

- **Navigate Regulatory Landscapes:** Synthetic Biology must address regulatory and ethical concerns to ensure responsible innovation. Clear guidelines and frameworks, such as the EU's Horizon Europe and the US's Coordinated Framework for Regulation of Biotechnology, can help the industry comply with regulations, build public trust, and advance bio-based solutions.

By integrating these strategies, the Synthetic Biology sector can create a thriving entrepreneurial ecosystem, drive sustainable growth, and unlock its transformative potential across industries. The field's continued evolution and its positive impact on healthcare, agriculture, and energy depend on its ability to balance innovation with ethical and societal considerations.

