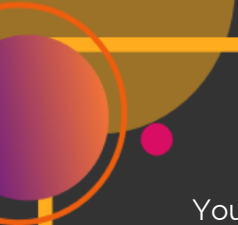# Thinking beyond:

A guide for the Evaluation of iGEM Pojects

iGEM Team TU Darmstadt 2021

You have a project with great potential, but you fear that you might be unaware of consequences or potential misuse of your idea? These Guidelines might help with the assessment of your project and with the identification of possible shortfalls in your project planning and impact consideration process.

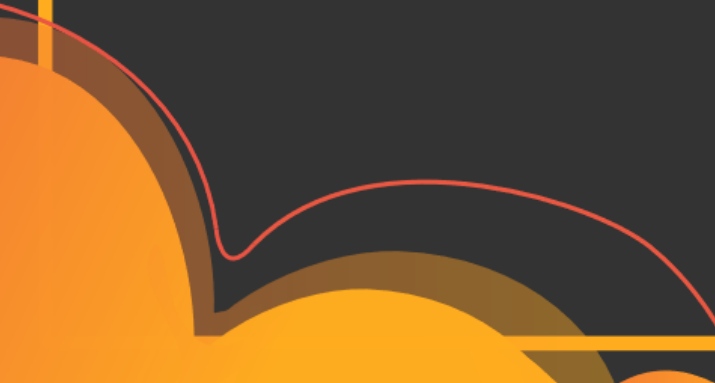1. Step: Critical Reflection of your project
   - Are there any specific parts or aspects of your project that might be a threat for the community or could be turned into one? Even things you would not directly/immediately consider dangerous might have a great impact on our natural system (e.g. toxins, genetically modified organisms, ...). Write down everything that comes to your mind.
   - Are there any national and international governmental regulations you have to fulfil in order to work in the lab or to actually be able to realize your project?

2. Step: Research
   - Consider what needs to be done to ensure the safe implementation of your project.
   - Find out everything about the laws and regulations on a national and international level regarding your project. Which regulations and laws as well as why and to which extent you need to fulfil them? What would you actually have to do in order to fulfil them?

Idea Box:

Useful sources, pages and contacts you should consider for your research:

- government pages (like federal ministries)
- ethics councils
- security councils
- national regulations
- international regulations (like the United Nations or the European Union)
- political discussions

3. Step: Expert/stakeholder interviews
- Consider and map out the relevant stakeholders, that could be relevant for the scientific background, the impact areas and the ethical aspects of your project.
- Select and write to those experts and ask them for their expertise.
- Prepare a catalogue of questions for them that includes all you can think of regarding your project.

Idea Box:

Contacts you should consider:

- Ethicists
- Scientists
- Politicians
- Government officials i.e., the federal ministries, government agencies or government advisors
- Journalist
- Influencers
- NGOs
- Former iGEMers

Idea Box:

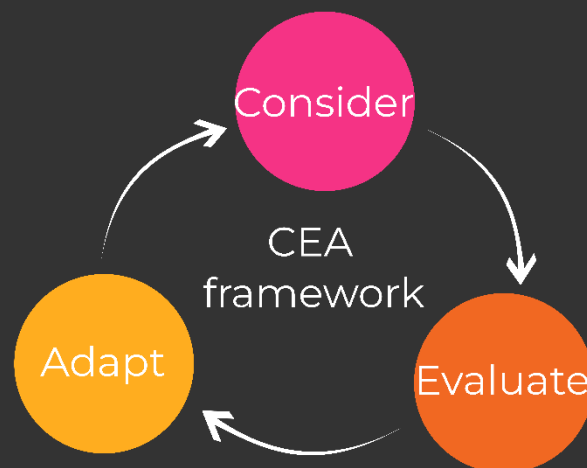What questions you should consider:

- Which regulations and laws apply to your project on a national and international level?
- Which safety protocols do you have to fulfil and what are the reasons for it? --> might reveal aspects you have not identified yet or clear up uncertainties about why they need to be fulfilled!
- Which test mechanisms and control mechanisms would be necessary to ensure the safety of the environment, when you are using genetically modified organism or unintended by-products, for example toxins?
- How to inscribe or transport certain substances that are needed for your work in the laboratory?
- What to consider when planning your time in the lab?
- What to consider when planning on actually realizing your project?
- Risk- Benefit Consideration (i.e., Would the benefit be worth the risk of possible GMOs release? Do we benefit more from the realization of the project than we would lose? Is the danger containable?)
- Is there a possible implementation with a low maybe even with no risk potential?
- **Most important**: Ask if they have questions, recommendations, advice, thoughts or feelings about your project!

SPECIAL TIP: Try to start a discussion/conversation, this often opens up train thoughts, you have not thought of yet or would not have thought about otherwise and gives you new perspectives about your project to consider.

4. Step: Conclusion

With the CEA framework that is inspired by the already prominent AREA framework and its namesake CEA framework that is implemented in many management methods, most prominently in the agile project management, you can structure and evaluate how your project is **received by the general public and by relevant stakeholders**. Their input, whether it is fear, advice or approval, needs to be included into the evaluation and the execution of your project.

For our Human Practice work in general and especially for our integrated human practice work the **CEA framework** (short form of Consider, Evaluate and Adapt) formed the scaffold for the organization and the subsequent presentation of our integrated human practice work and can do the same for you.

Schematic overview of the CEA framework. CEA stands for Consider, Evaluate and Adapt and it was used to structure and present our work in Integrated Human Practices. This framework describes the system behind the assessment process of the impact on the society and the world of our project PHYRE BIRD.

- With **Consider** the first to steps of the AREA framework "Anticipate" and "Reflect" are combined. In it not only the possible impact areas of our project PHYRE BIRD but also potential stakeholders are being mapped out.
- During the next step **Evaluate** the focal point is the interaction with the previously mapped out stakeholders by scheduling and being part of conversations with scientists, ethicists and government officials and by conveying a survey for the general public. All this to be able to get outside input (feedback, recommendations, etc.) on our project and to assess ways to develop it.

- In the final step of the CEA framework **Adapt** what has been collected from the previous two steps of the framework is taken into consideration to decide how to pursue the project. During this phase of the cycle, one can also stumble upon new angles and perspective of the project that haven't been thought of before. Due to this a new cycle begins.

Round up-suggestion:

To understand problems and fears of people from a non-scientific background whether it is during a pandemic or not it is reasonable to conduct a survey. Outside of a pandemic the classical interviews on the street are of course a good way to reach a broad spectrum of people.

If you want to conduct a survey, you can use for example soSci. You can use any survey tool of your liking, only make sure it is a reliable and verified one. Maybe your university or school provides one for you.

But what information to ask for? What do you want to know? Simply think about what you want to analyze in the end and what you can learn from the received information. To give you an idea how you could structure your survey or your questionnaire, we wrote down an exemplary survey structure:

1. **Main information**
   - Age
   - Gender
   - Living area (City/country)
   - Education
   - area of work
2. **Personal opinion about...**
   - Synbio/Genetic research/GMOs (genetically modified organism)-> association with the words, feelings towards the words like fear, progress etc.
   - Ask about how they feel about the use in different areas of applications e.g. in the food industry, the medical field, etc.
   - Repercussions they fear about the different aspects of your project

SPECIAL TIP: Try to add explanations for not commonly known words. Give options when asking questions aimed at the feelings or thoughts about synthetic biology or genetically modified organisms. This gives the people an idea of what they can write.

3. **Your own project**
   - Explain in plain language what your project is about and what you want to achieve with it. Afterwards you can ask them about your project.
   - What do people associate with it?
   - What do people think about it?
   - What they fear it might lead to?
   - What questions do they have about it?
   - Would they support it?

SPECIAL TIP: Provide areas where people can freely write their thoughts and opinions. You might receive some unexpected and controversial opinions which might help you to discuss and evaluate their fears.

In general: Before uploading a survey, you have to make sure to **not ask biased** set up questions. Meaning do not ask questions that **lead to a certain answer** and phrase clear questions.

- For example, instead of asking "How good was our project?" ask "How did you like our project on a scale from 1 to 10".
- Also never combine two questions in one that is rather confusing.
- As well do not use absolute words like "Always, never, all" in the possible answers they can choose. Use instead adjectives like "important, interesting…" and instead of "yes/no" answers "agree/disagree" that way you will be able to receive valuable feedback for your evaluation.

Evaluation: It is important to reflect and examine why certain people do answer in a certain way. Is there a connection of age, education, living area or maybe gender? Do they have a need for more communication? What can we learn from the given answers for the future? Which approach towards a solution is reasonable? Also filter out dubious or unreliable answers.

LAST TIP: Have fun and always ask yourself, how can we help society and improve science!!!

Your iGEM Team TU Darmstadt 2021

Sources:
(1) https://epsrc.ukri.org/research/framework/area/ (Accessed Oct 7, 2021)

(2) https://epsrc.ukri.org/about/people/richardowen/ (accessed Oct 7, 2021)

(3) Atiyah M., Science for evil: the scientist's dilemma, *BMJ,* 319; 448-449, 1999, DOI:10.1136/bmj.319.7207.448