

# ¿Biosecurity in Synthetic Biology in Mexico?

## Introducción

The **Synthetic Biology** is a new investigation field that combines science and engineering. Its objective is the design and construction of biologic systems that doesn't exist naturally. Unlike the Genetic Engineering, the approach of the Synthetic Biology is to consider the performance of the whole biologic system, in other words, it is based in the study of the Complex System Biology.

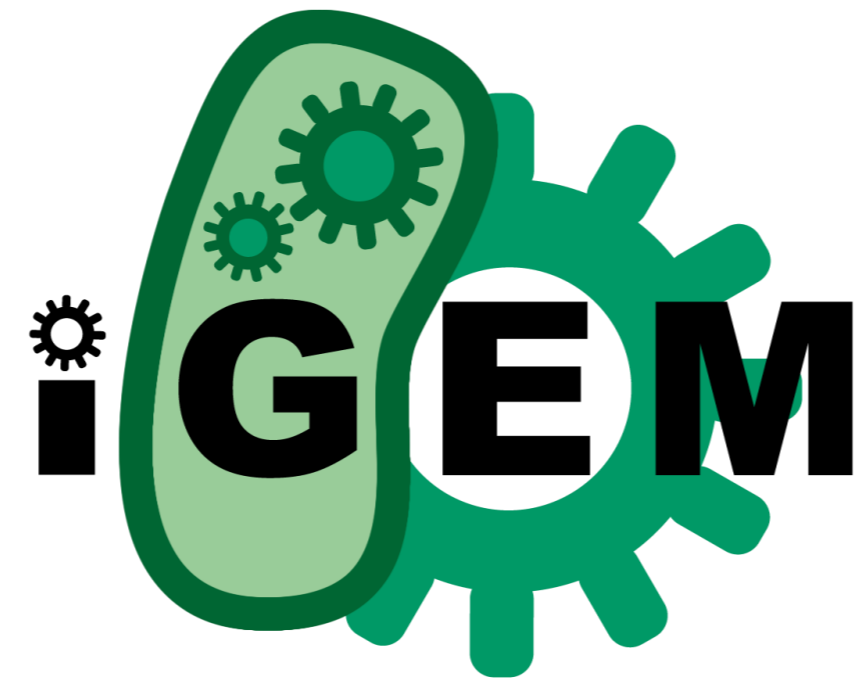


Fig. 1 Competition Logo

**International Genetically Engineered Machine (iGEM)**, is an international competition, organized by the MIT, in which participate undergraduate, and actually, high school students. The goal of this competition is to design a Synthetic Biology project using standard biologic parts that are known as biobricks. Each team receive a package with more than 2000 parts so they can work, the main advantage of working with these standard parts is that they are compatible and can join one another.

The Biosecurity of the projects is a fundamental part, each team has to draw up a report about the impact and implications of the project. This year Mexico is going to participate with 8 teams, in our team CINVESTAV-IPN-UNAM-MX we developed a method for accomplishing the aspects of Biosecurity according to the guidelines that are applied in Synthetic Biology.

The tool QFD (Quality Function Deployment) or Quality House, is a process developed by Yoji Akao at Japan in 1960 and 1970. This is a method of quality management based in transforming the demands of the user in the quality of the design, implementing methods for achieving design quality in subsystems and components, and ultimately to the specific elements of the manufacturing process. Actually, QFD is a technic that is applied in several areas and has showed satisfactory results because it allows better processes.



## Objective

To utilize the technique QFD for evaluate the actions and measurments of Biosecurity that are made in the projects of Synthetic Biology, specially in the iGEM Competition, and to establish a method for accomplishing the necessary requirements

## Experimental Design (QFD)

For establishing the criteria of Biosecurity that the project of Synthetic Biology must accomplish and that the team members wish to reflect on its report the Technique of Quality QFD was used.

- A brainstorming was made in order to stablish the requirements or criteria that have to be accomplished according to the national normativity and international guides for projects of Synthetic Biology. With the same tecnique, the proposals of the team members of CINVESTAV-IPN-UNAM\_MX for the project Rhodofuel Factory were established.

- The main matrix was constructed with the needs and proposals in order to define the score of priorities according to the members.

- The dependence and correlation between the needs and proposals was defined with an scale of relative score. From these values, the tecnique of Pareto Diagram was used for signaling the measurments of more importance as necessity or proposal.

- The Pareto Diagram was divided in three parts for its analysis.

- Making use of the previous result together with the matrix of interactions (roof of the quality house), an impact-effort diagram was defined to verify the functioning of the performed analysis..

- The result of aplying the QFD tecnique is to use the impact-effort diagram in order to implement the improvement measures of Biosecurity issues for the project of Synthetic Biology.

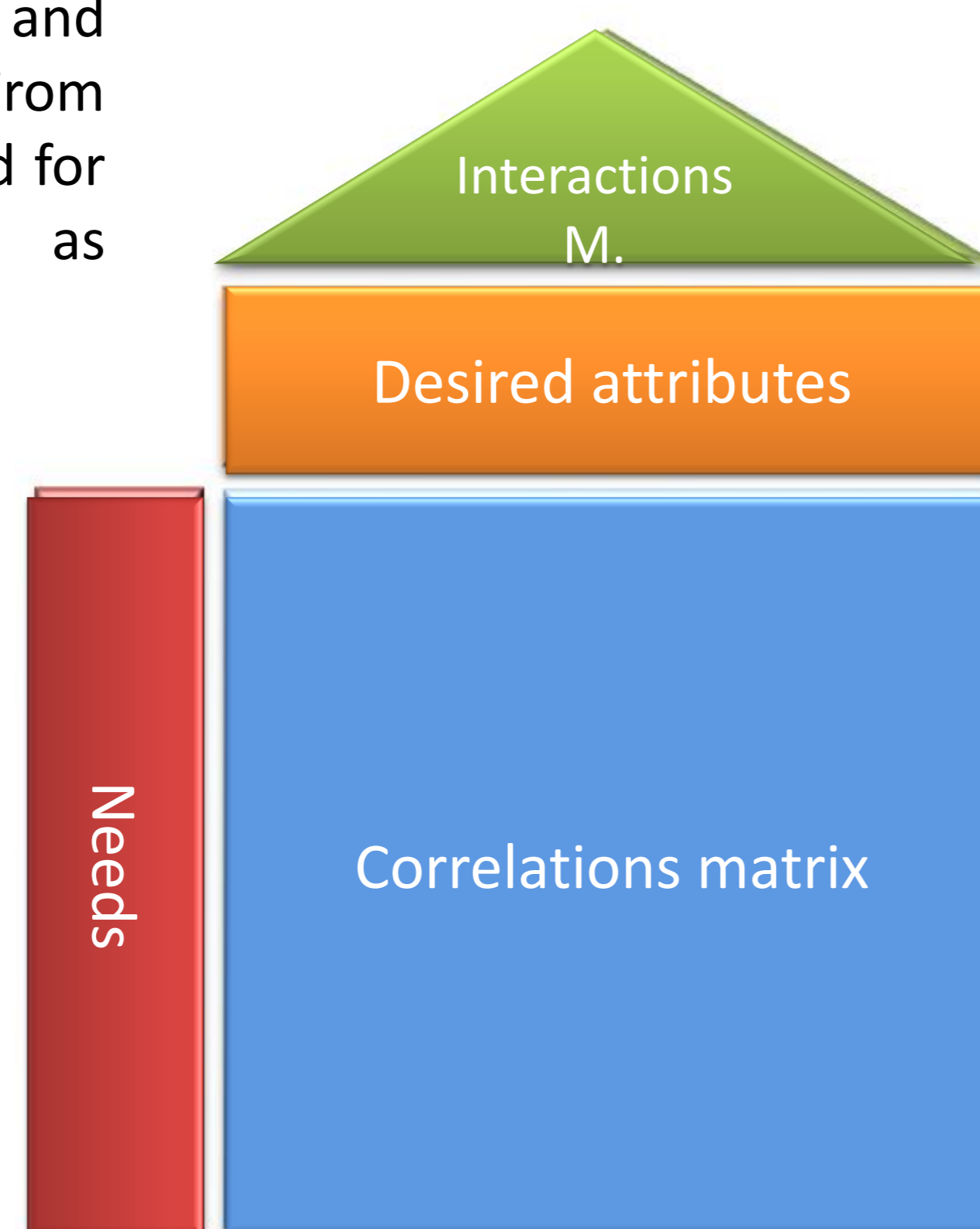


Fig. 2 Structure of the QFD diagram.

## Results

The following QFD diagram was built from the establishment of the needs and the ideas which were defined by the Synthetic Biology team for our project.

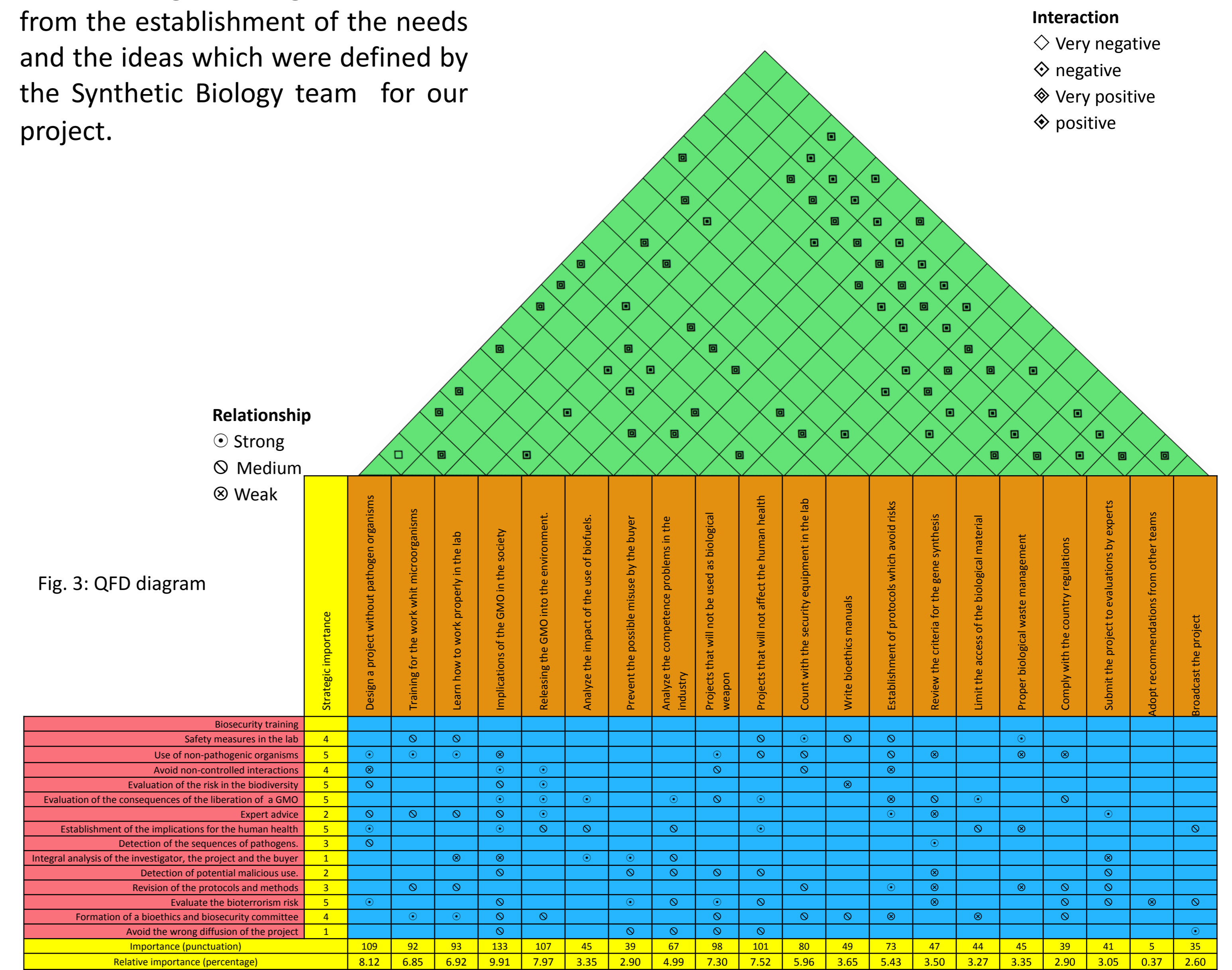


Fig. 3: QFD diagram

The Pareto diagram shows the priorities, established by the team, to work in Biosecurity, the most important are: Design a project without pathogen organisms, the implications of the GMO in the society and the implications about releasing the GMO into the environment. The effort vs. impact diagram shows the team interests and orders the ideas as a conclusion.

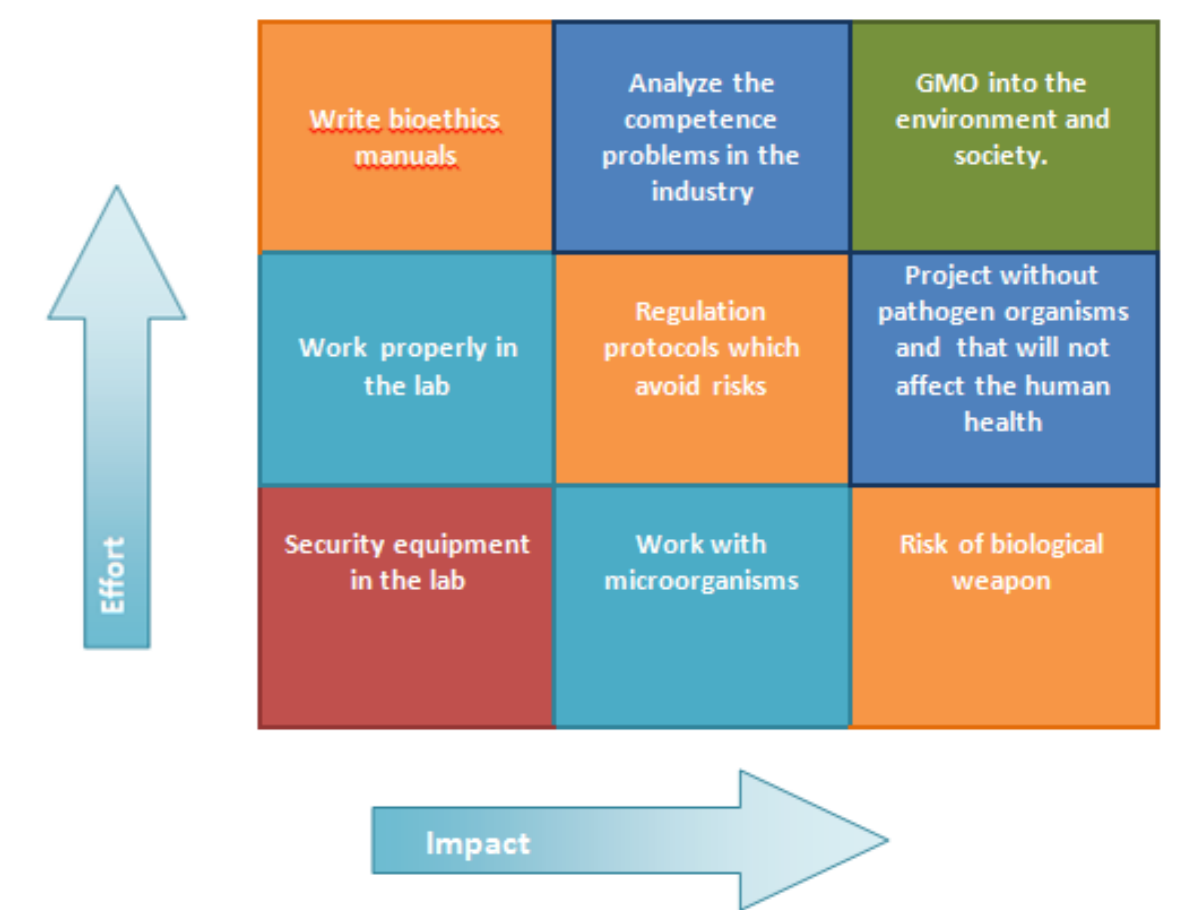


Fig. 4 Effort vs. Impact diagram

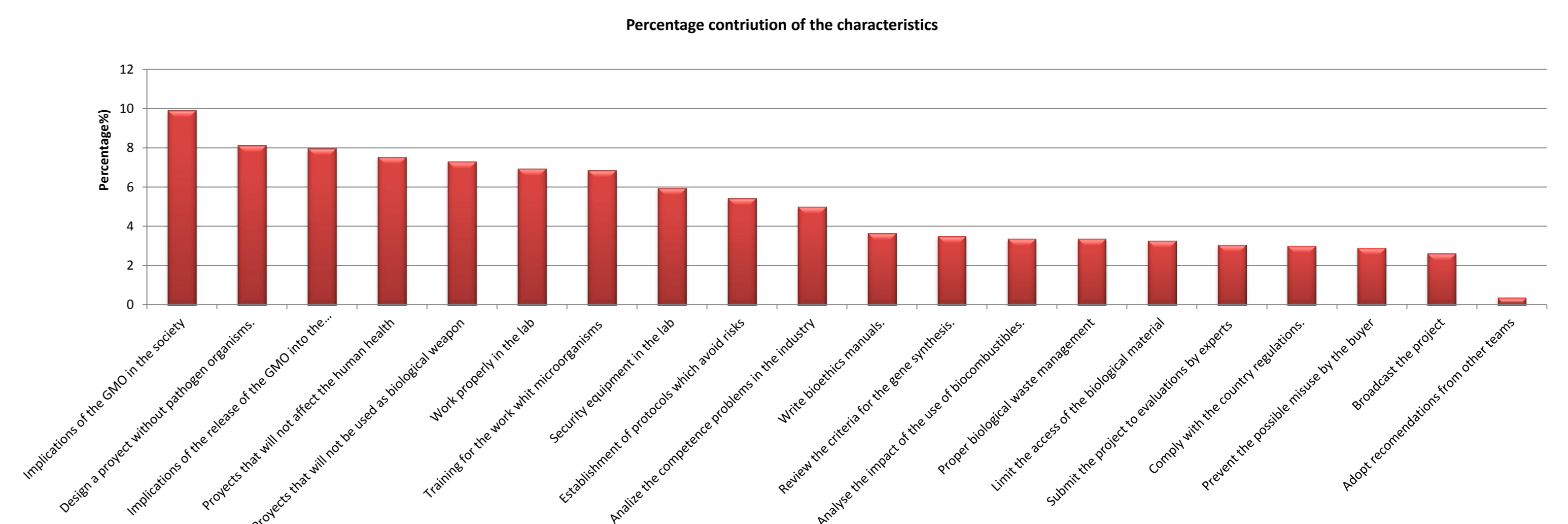


Fig. 5 Pareto diagram

## Conclusions

In this work we used the QFD because it defines our ideas and also involves compliance with the regulations of the Synthetic Biology projects. With the obtained diagrams, we decided that the iGEM project will be defend, in biosecurity, considering the impact of the GMO in the society and the enviroment in addition to define an approach that follow the criteria according to the percentage of importance, impact and effort..

## References

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## Aknowledgments

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