

## Introduction & Background

### What is synthetic biology?

Synthetic biology<sup>1</sup> is defined as “the design and construction of new biological parts, devices, and systems, and the re-design of existing, natural biological systems for useful purposes.”

### What is foresight analysis?

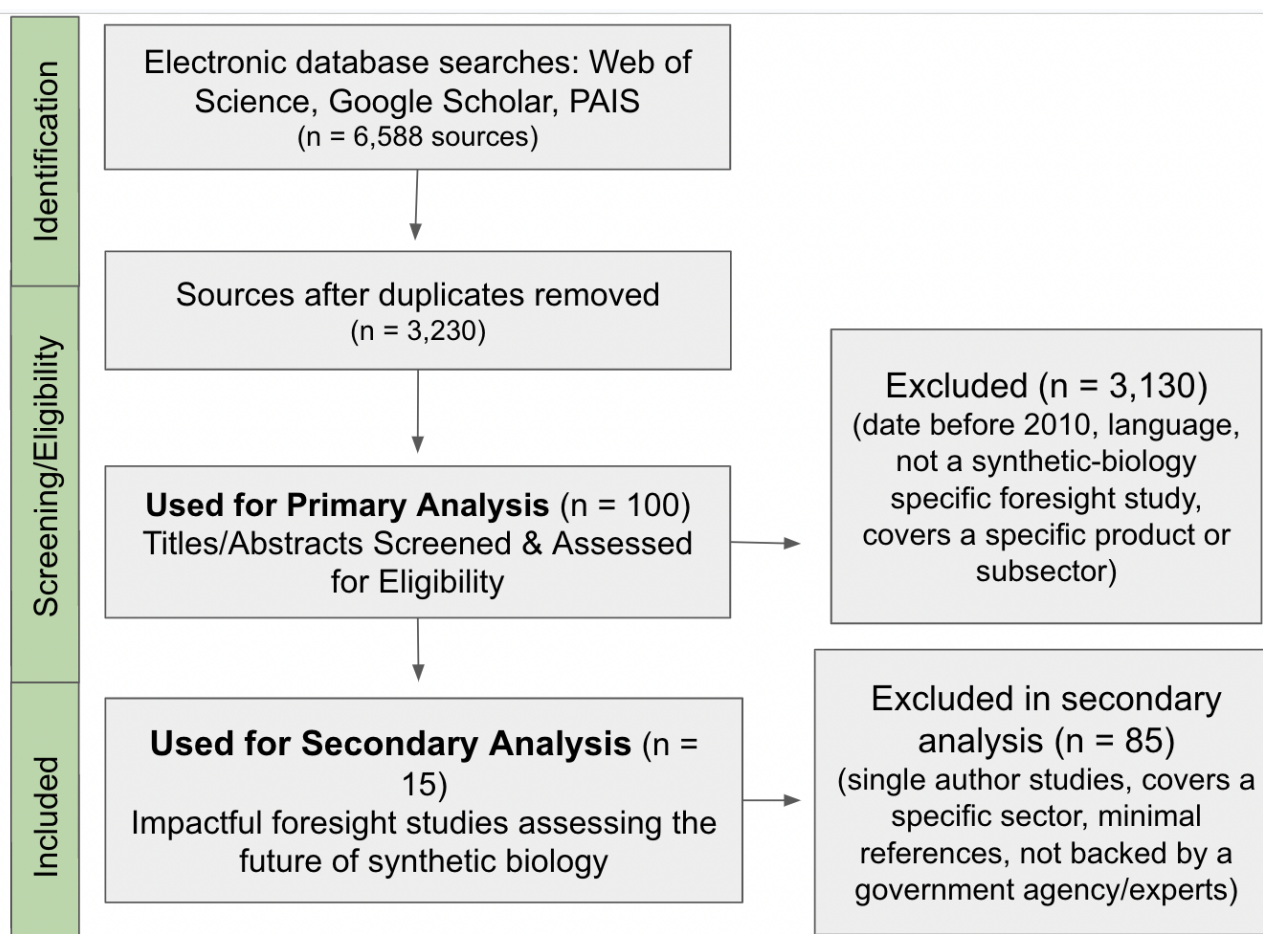
We define foresight analysis<sup>2</sup> as work which “explores the range of plausible futures that may emerge” as well as work that “makes predictions about the future based on past and present data and the analysis of trends.” Foresight analysis is critical in synthetic biology since this field is characterized by unpredictability and uncertainty due to the use of biological systems.

### Who is the OECD?

The **Organization for Economic Cooperation and Development**<sup>3</sup> is an international organization which aims to contribute original policy analysis and messages to the global community, to convene key stakeholders in the field, and to make ground-breaking proposals to policy makers. We are partnering with the OECD, specifically the **Working Party on Biotechnology, Nanotechnology, and Converging Technologies (BCNT)**, to identify and analyze synthetic biology foresight which they can build off and use to make synthetic biology policy recommendations.

The purpose of this study is to review the current foresight methodologies, challenges, and opportunities in the synthetic biology field. Our work aims to be a template for future work on foresight in synthetic biology.

## Methods

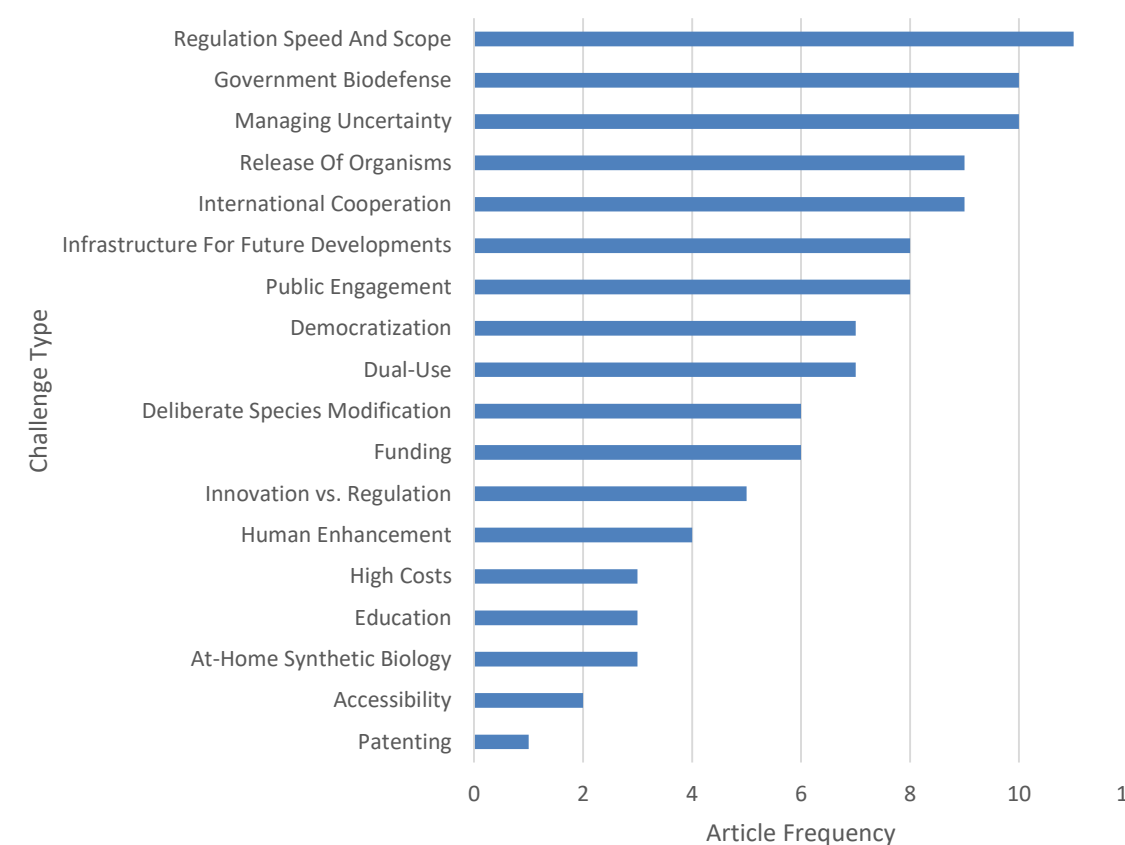


The figure above shows the methodology used to perform our meta-analysis of synthetic biology foresight articles. **Primary analysis** consisted of analyzing the foresight technique, country, author, organization, timeline, and sector for each article. **Secondary analysis** involved breaking down the forecasted challenges and opportunities for synthetic biology identified in each article.

## Challenges & Opportunities

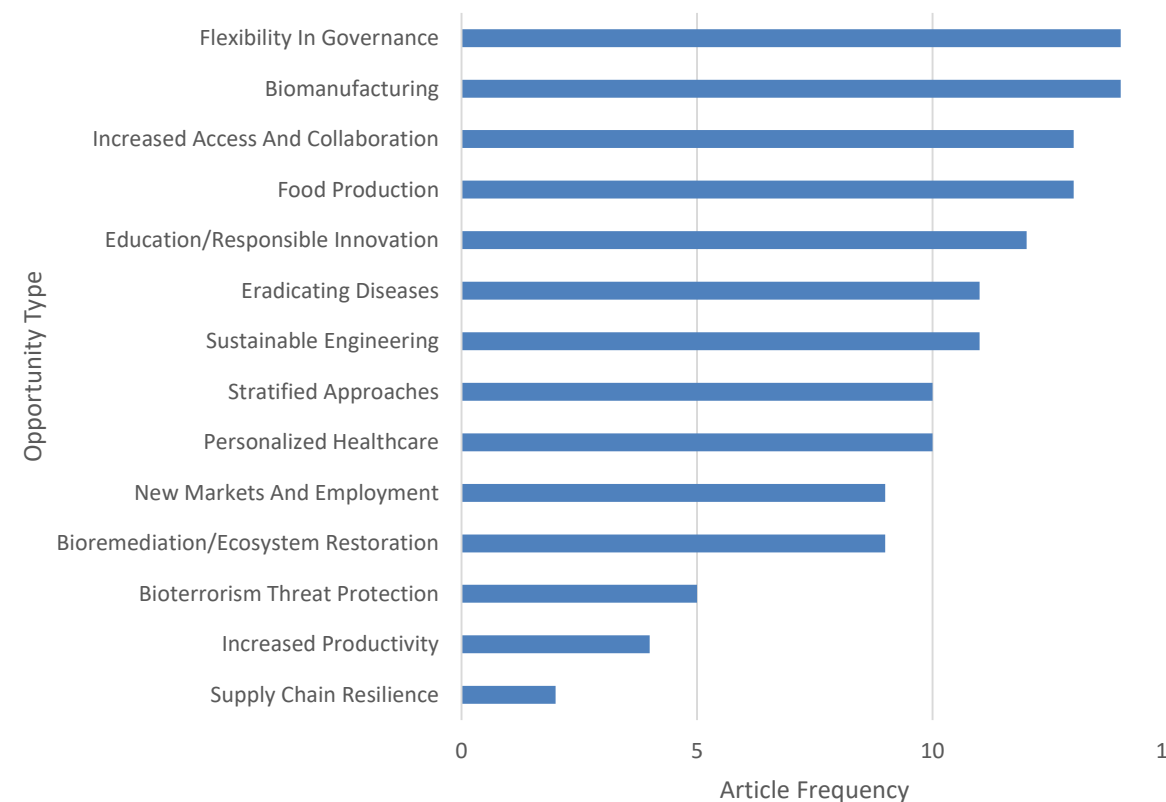
We have divided challenges and opportunities in the synthetic biology field into 5 categories or areas of shared background – Regulation, Environmental Risk, Societal/Ethical Concerns, Biosecurity, and Infrastructure. This is to facilitate the view of similarities and differences between the articles.

### Commonly Identified Challenges in Synthetic Biology:



Of all challenges identified, Regulation and Security appear to be the challenges that are given the most emphasis, as out of all challenges mentioned, **31% were regulatory challenges** and **18% were security challenges**. Therefore, we determined them to be the most critical challenges to synthetic biology advancements.

### Commonly Identified Opportunities in Synthetic Biology:

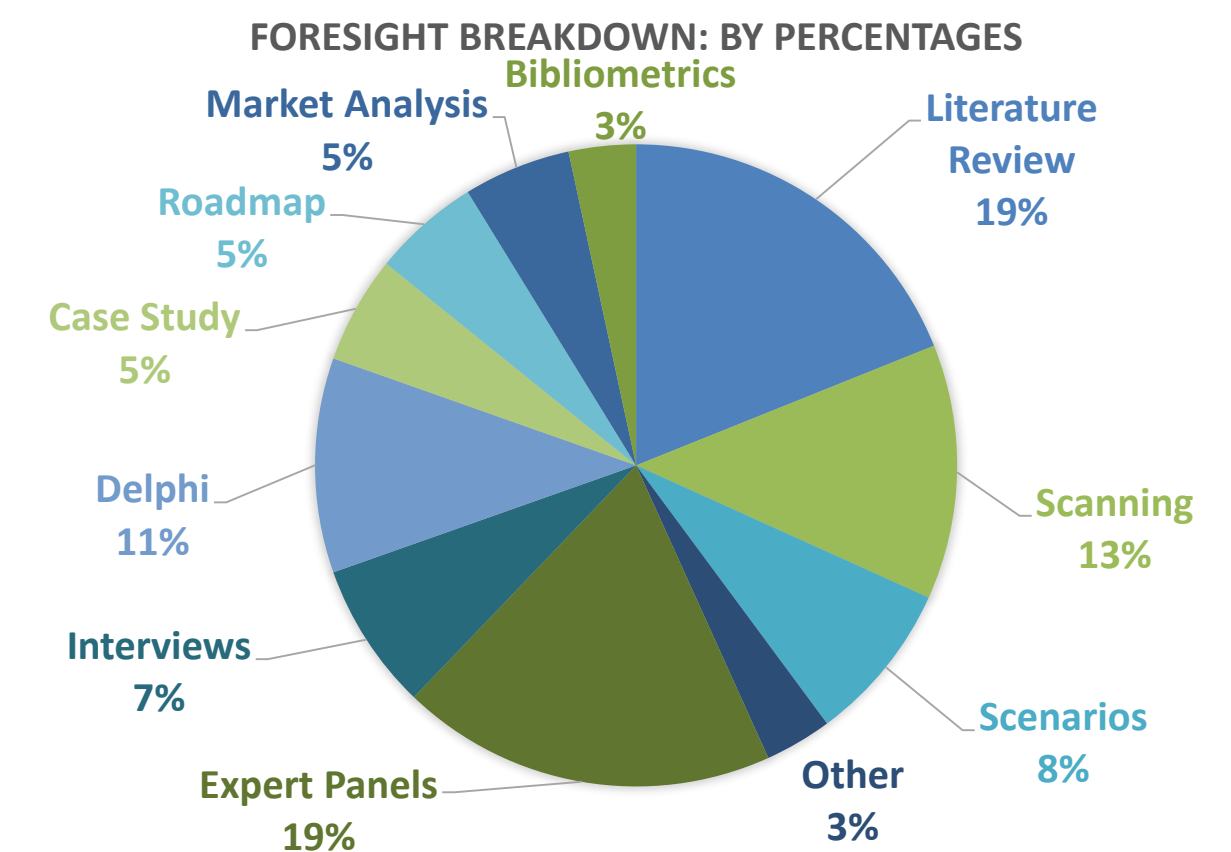


Of the opportunities, Economic and Societal & Ethical opportunities were the most frequently mentioned with **Economic being 21% of opportunities** presented and **Society & Ethics having 18%** of all opportunities presented.

These findings are based off the top 15 articles that we identified of being the most comprehensive in terms of scope, authorship, and impact of the study. We expect that for all 100 sources, regulation and environmental would remain the top challenges posed by synthetic biology. However, there is more limitation in imagining the opportunities this field may bring.

## Foresight Analysis

Of the 100 sources, the most used foresight techniques were **Literature Review and Expert Panels**. We believe that these two are most frequently used due to their relatively simple organization and reliable outcomes. Articles may have included multiple types of forecasting which we counted separately to more accurately represent how often each technique is used.



In addition, out of the 53 synthetic biology foresight articles that specified a country, **41.5% looked at the U.S.** specifically, and **18.9% looked at the U.K.** Therefore, it appears that the United States and United Kingdom are leading in synthetic biology foresight research. We expect more articles to be produced worldwide as the synthetic biology field expands.



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## References

- <sup>1</sup>“Synthetic biology articles from across Nature Portfolio”, *Nature*, accessed 25 July, 2023
- <sup>2</sup> Policy Horizons Canada: “Foresight Vs Forecast”, *Government of Canada*, 2018
- <sup>3</sup> OECD: OECD.org “About”, accessed 31 July, 2023