

# Forecasting Legal and Ethical Paths for Minimizing Extractivism through 3D Printing Technologies

## Challenge

Many products that we regularly consume are based on damaging and unsustainable 'extractivist' practises. Extractivism is more than just (mis-)using the earth and its resources. It is a mindset dependent on, inter alia, demand of raw materials extracted in high volumes for a society that continuously demands production of new items. The recent paradigm shift towards digital manufacturing, supplemented by novel 3D printing (3DP) technologies, could potentially help limit extractivist practises. 3D printing could potentially:

- Facilitate on-demand production, in which products are manufactured only when required and in quantities needed, thereby tackling the issue of overproduction.
- Enable part consolidation and design optimization – less raw materials are wasted in comparison to traditional manufacturing.
- Enable repair, maintenance, or upgrade of existing products/machines, thus reducing demand for new products.
- Benefit local communities when locally available raw materials are turned into high-value goods close to the location of the extraction of the raw materials.

Yet, these benefits associated with 3DP technologies do not currently get enough attention. This combined with various constraints and bottlenecks in the production system are hindering its mainstream implementation across areas that have the most potential in tackling extractivism. One way to overcome these obstacles would be to support 3DP and other associated digital manufacturing tools with suitable regulatory and legal frameworks.

## The aim of this research work is to answer:

- What the alternative perspectives on extractivism and the associated production system involving 3DP in the year 2032?
  - What factors have led to these respective future states?
- How 3DP/digital manufacturing when supported by law and policy could help minimize extractivism?
  - What are the key steps that could help the actors in prioritizing goals for moving away from extractivism?

In order to achieve this, we utilized scenario planning - linking together impacting factors from wide-ranging fields into narratives on how the future will develop itself and what impact it will have on the social-ecological systems.

## Solution(s)

Initial outcome includes four scenarios that narrate alternative perspectives on extractivism in the year 2032, the associated production system with its enablers, and the consumer mindset and governmental actions that led to the respective future states. These scenarios should help challenging the prevailing mind-set of consumers and producers and help various actors with options to react to the change quickly. The final outcome, including an implementation roadmap, is being compiled into a manuscript that is due to be submitted in June 2022.