

R&D Trends Report

# Sustainable materials for a circular economy: **R&D trends for 2024**

# Table of contents

- Authors & contributors 3
- Introduction 4
- Campaign overview 5
- Campaign methodology & results 6
- What are industry's R&D priorities for sustainable materials? 7
- What are academic institutes, startups, and biotech companies working on? 8
- What is the R&D community engaging with? 13
- Most viewed projects and technologies 15
- Most engaged projects and technologies 16

# About

Inpart is the trusted partner for scientific partnering. We provide comprehensive solutions to initiate, optimize and manage partnerships bringing science to life. Our platform is the preferred choice for scouting in more than 4,000 companies, including 25/25 global R&D-intensive firms, and over 200 of the world's leading universities.



## Authors & contributors



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# Introduction

2023 was the warmest year since modern records started, accelerated by human-caused climate change. While more than a third of the world's largest companies are committed to net zero, nearly all (93%) will fail to achieve this goal if they don't at least double the pace of reducing emissions by 2030.<sup>[1]</sup>

With the failure at COP28 to commit to a global fossil-fuel phase-out, progress is frustrating. We are continuing to release carbon into the atmosphere at unsustainable rates, extracting finite resources at an increasing pace, and polluting the environment with plastics, textiles, and waste chemicals.

Materials and infrastructure play a key role in impeding the causes and effects of climate change and environmental pollution. By emphasising resource efficiency and reducing waste, transitioning to a circular economy presents a potent strategy. Through this Global Challenge campaign, we surfaced new research, technologies, and assets in sustainable materials to accelerate the transition towards a circular economy.

1 - [Destination net zero](#), Accenture - November 2022.

**Anabel Bennett**, Communications and Campaigns Manager at Inpart

# Campaign overview

Our Global Challenge campaign on sustainable materials launched on Monday 25th September 2023 and closed to submissions on Monday 11th November 2023. This was followed by an intensive research dissemination period led by our in-house STEM experts to ensure that each new breakthrough had been reviewed by R&D teams in our global industry network and our campaign partners – Eastman, WestRock, Avery Dennison, and Ecover.

In total we received 103 submissions from 55 academic institutes, biotech companies, and startups across 6 continents. Of the 180 new conversations started through this Global Challenge, 73% were between international partners. The top trending research categories included bio-based and bio-inspired materials, new manufacturing and advanced manufacturing techniques, the upcycling of waste materials and waste valorisation, and smart design.

Alongside the campaign, we hosted online events to initiate new connections and uncover the top research priorities for academia and industry within the space. The first was a two-part set of partnering events with our industry campaign partners presenting their R&D and external innovation priorities. In our second event, academic leaders overviewed their latest sustainable materials research.

As well as exploring the impact of our partnering events and the campaign, this report aims to provide a unique snapshot of the hottest topics in sustainable materials R&D, the most promising research and breakthroughs coming out of universities and startups around the world and the current priorities of R&D intensive companies working towards a circular economy.

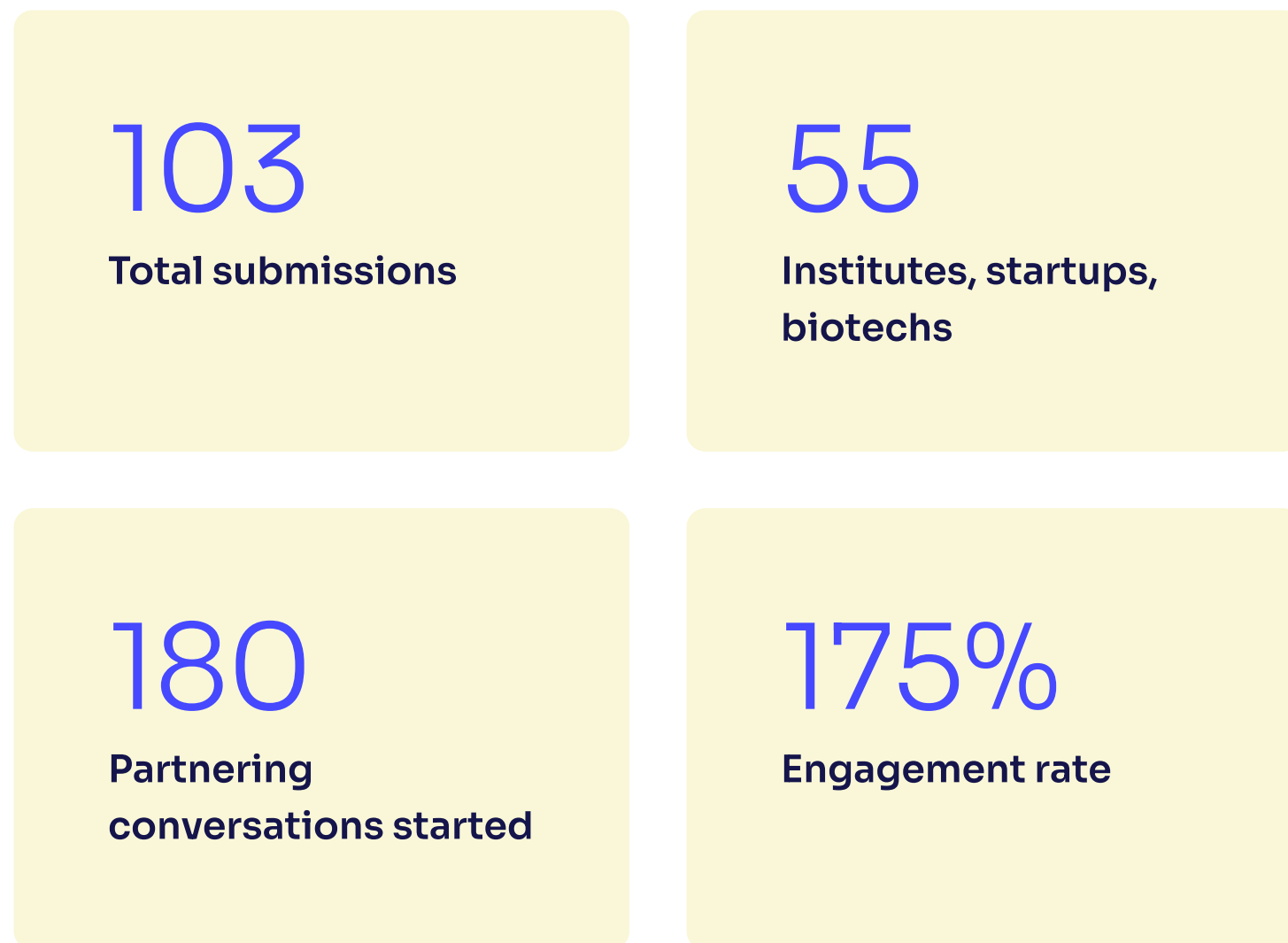
**Engage with the teams behind each project in this report, as well as 17,000+ others seeking engagement by [creating an account](#) and joining our free online partnering network.**

# Campaign methodology & results

## Timeline



## Key stats



## Campaign partners



# What are industry's R&D priorities for sustainable materials?

Our industry partners provided us with their current R&D requirements and partnering opportunities, summarized below.

## **EASTMAN**

Areas of interest in sustainable and bioderived polymers

Freshwater biodegradable polymers derived from sustainable/bio-derived source that:

- Allow for films to be cast from aqueous solutions
- Are water swellable

[View full requirements](#)

## **WestRock**

Seeking new technologies to replace plastic packaging

Paperboard replacement of plastics:

- Shape formation
- Barrier functionality
- Light weighting
- Puncture and Tear resistance
- Minimal water and energy usage
- Product visibility (clear paper)
- Consumer interactivity with the packaging

[View full requirements](#)

## **AVERY DENNISON**

Increasing the Sustainability of the Electrode Manufacturing Process

- Solvent free fabrication of electrodes
- Next generation binders to increase sustainability and durability
- In-line fabrication of separator on electrode

[View full requirements](#)

## **Ecover**

Seeking circular feedstock-derived ingredients to drive down land surface dependency

- Drop-in Surfactants from waste/side stream feedstocks (lauryl sulphates, alkyl polyglucosides, glutamates, microbial glycolipids)
- Non-Drop-in Surfactants from waste/side stream feedstocks
- Drop-in non-surfactants from waste/side stream feedstocks (ethanol, lactic acid, citric acid + derivatives)

[View full requirements](#)

Our industry partners presented these priorities and their partnering opportunities on webinars in October 2023. [Watch the recordings here: Part 1 | Part 2.](#)

# What are academic institutes, startups, and biotech companies working on?

Alongside the 100+ submissions we received from academia and startups, we hosted an online partnering event with academia on the 22nd of November 2023 with two world-leading academics in the sustainable materials field. Below is an overview of their backgrounds and current research interests.



**Dr Ericka Ford**  
NC State University

Ericka is an Associate Professor at North Carolina State University, having a joint appointment between the Department of Textile Engineering, Chemistry and Science (TECS) in the Wilson College of Textiles and The Nonwovens Institute (NWI).

Her research in fiber extrusion and textile nanotechnologies has garnered multi-disciplinary collaborations and industry funding on topics of 'green' fiber manufacturing to minimize pollution, the substitution of hazardous chemistries or those having a high carbon footprint, and the use of industrialized crops to solve today's sustainability challenges, and solutions to positively affect the 'blue' marine economy.



**Dr Agnieszka Brandt-Talbot**  
Imperial College London

Agnieszka is a Lecturer in the Department of Chemistry at Imperial College London and leads the Sustainable Carbon Solutions research team.

Her research explores creating bio-derived materials and chemicals from sustainable biomass and the application of novel tailor-made solvents for more sustainable use of carbon in our economy. She is also a co-founder and a director of Lixea, a start-up company developing an innovative biomass fractionation process using low-cost ionic liquids.

You can watch the [recording of this webinar on our website here.](#)

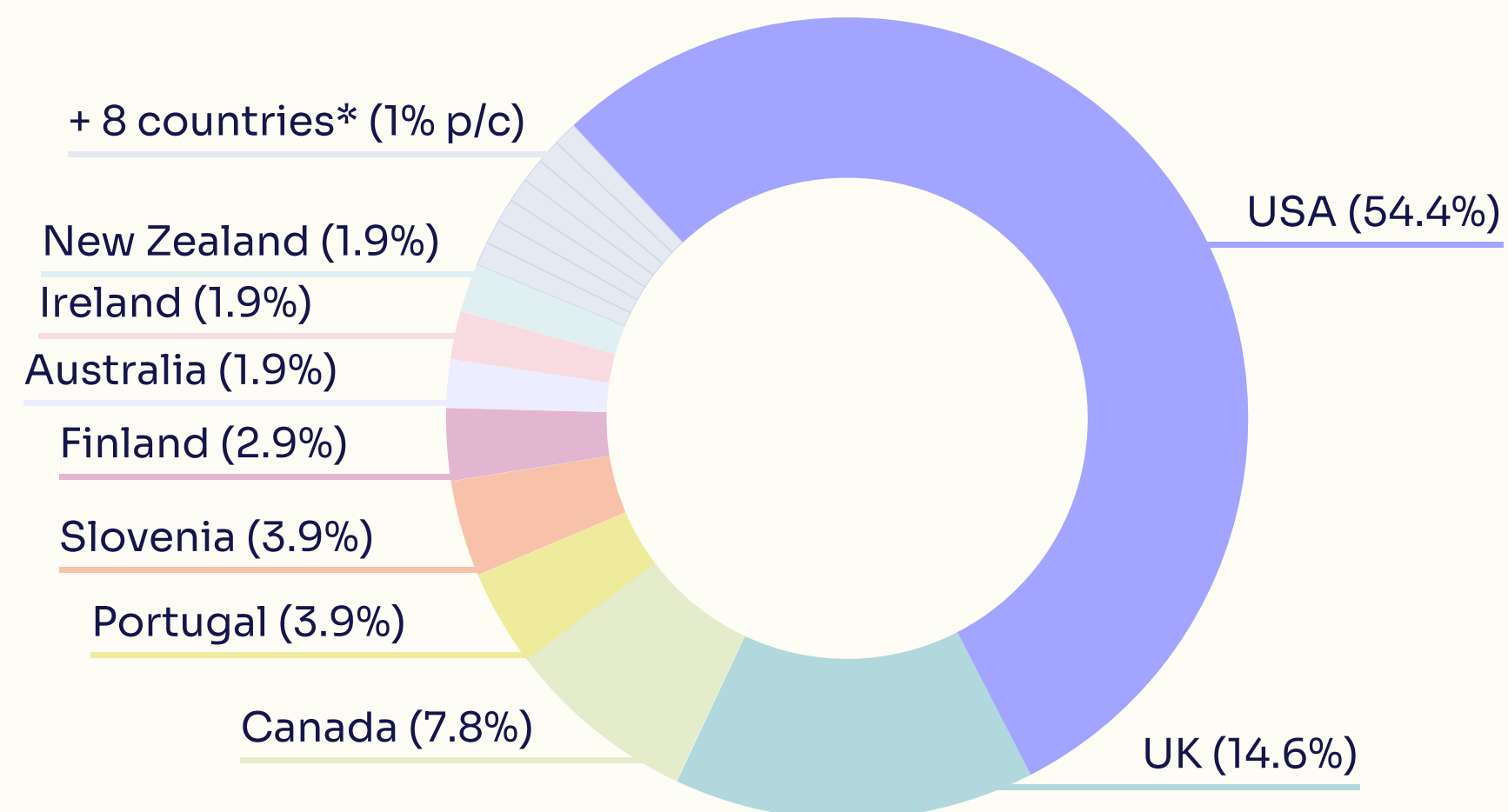


# What are academic institutes, startups, and biotech companies working on? **In numbers**

Of the 103 submissions to the campaign, the majority came from the USA (54%), then the UK (15%), and Canada (8%). Tied for 4th place were Portugal and Slovenia, with 4% each.

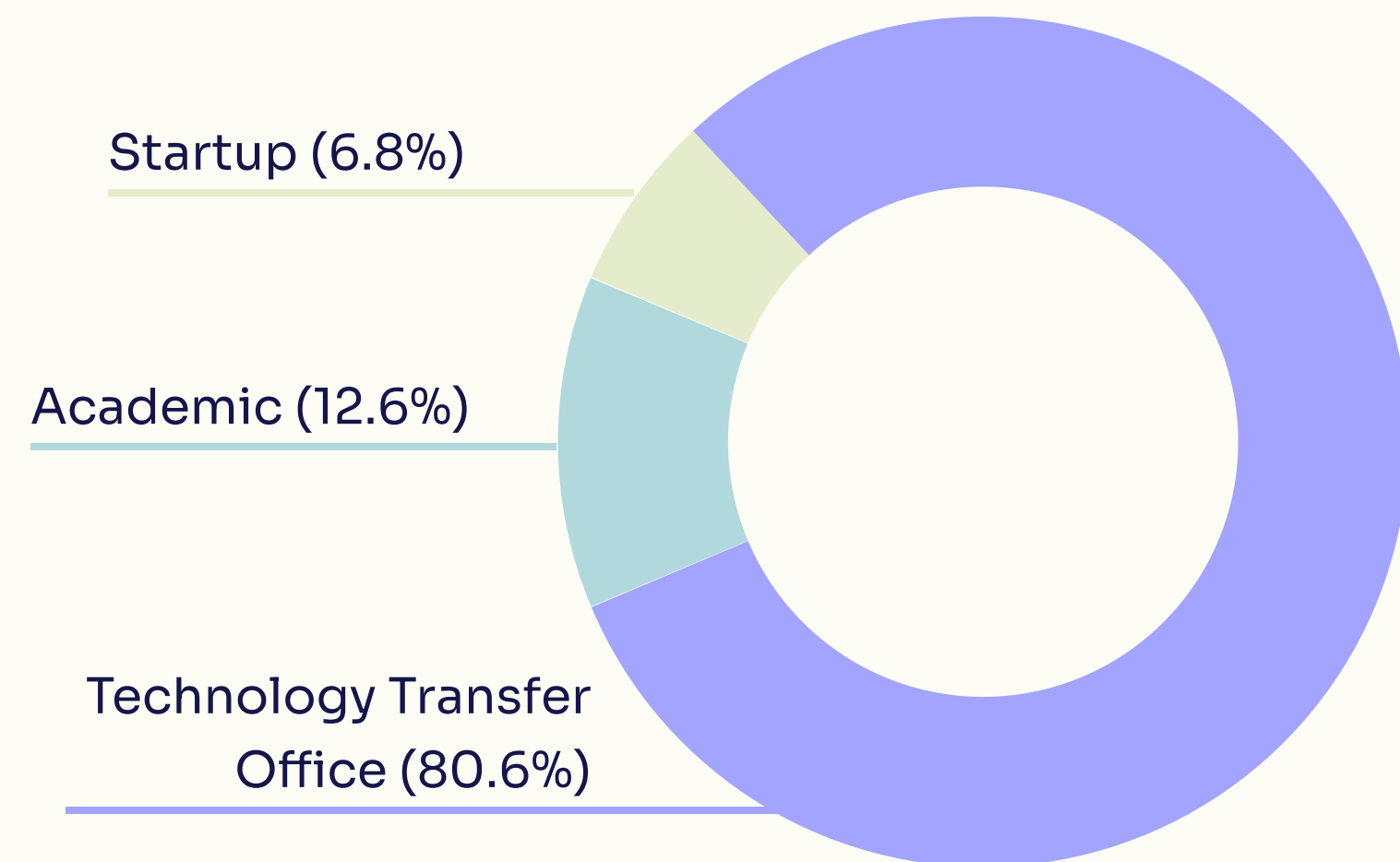
Most submissions (81%) came from technology transfer offices, or research commercialization offices in academic institutes. 13% came directly from academics, and 7% came from biotechnology or startup companies.

## Submissions by country



\* Brazil, Germany, Greece, Italy, Japan, South Africa, Spain

## Submissions by type



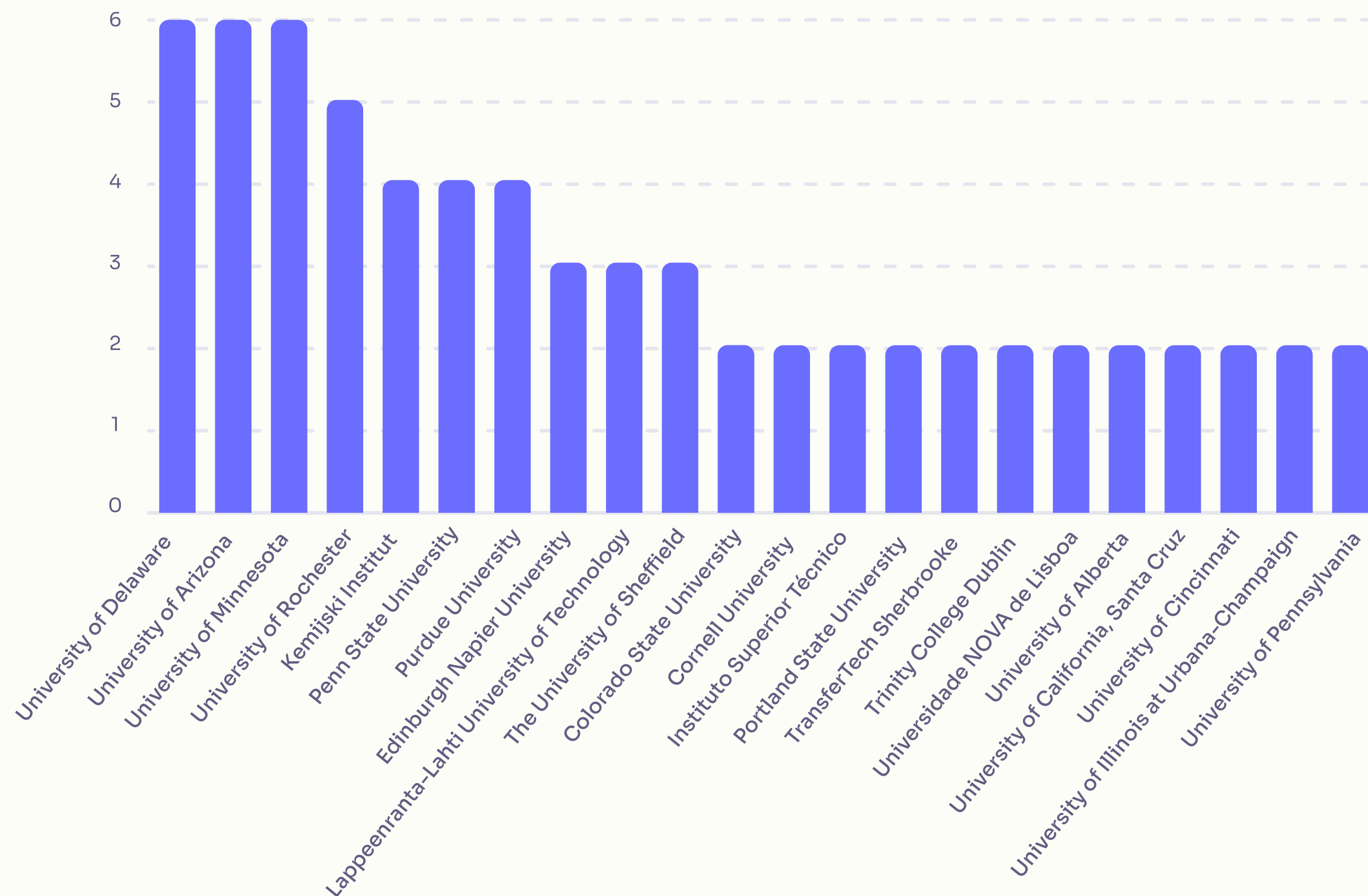
# What are academic institutes, startups, and biotech companies working on? **In numbers**

All three of the universities with the highest number of submissions are in the USA:

University of Delaware, University of Arizona, and University of Minnesota all submitted 6 technologies. The University of Rochester (USA) submitted 5 technologies.

Kemijski Institut (National Institute of Chemistry) in Slovenia made 4 submissions, as did Penn State University and Purdue University. (Note - submissions were limited to 6 per institute.)

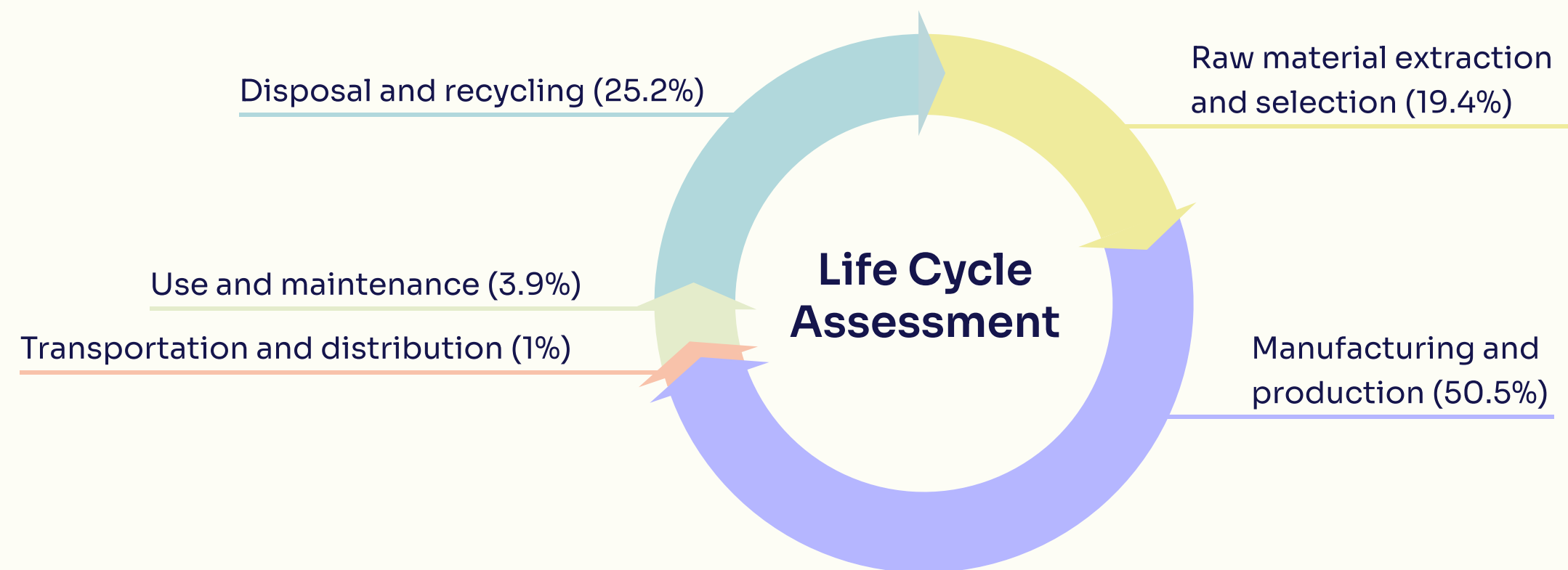
**Academic institutes with the highest number of submissions**



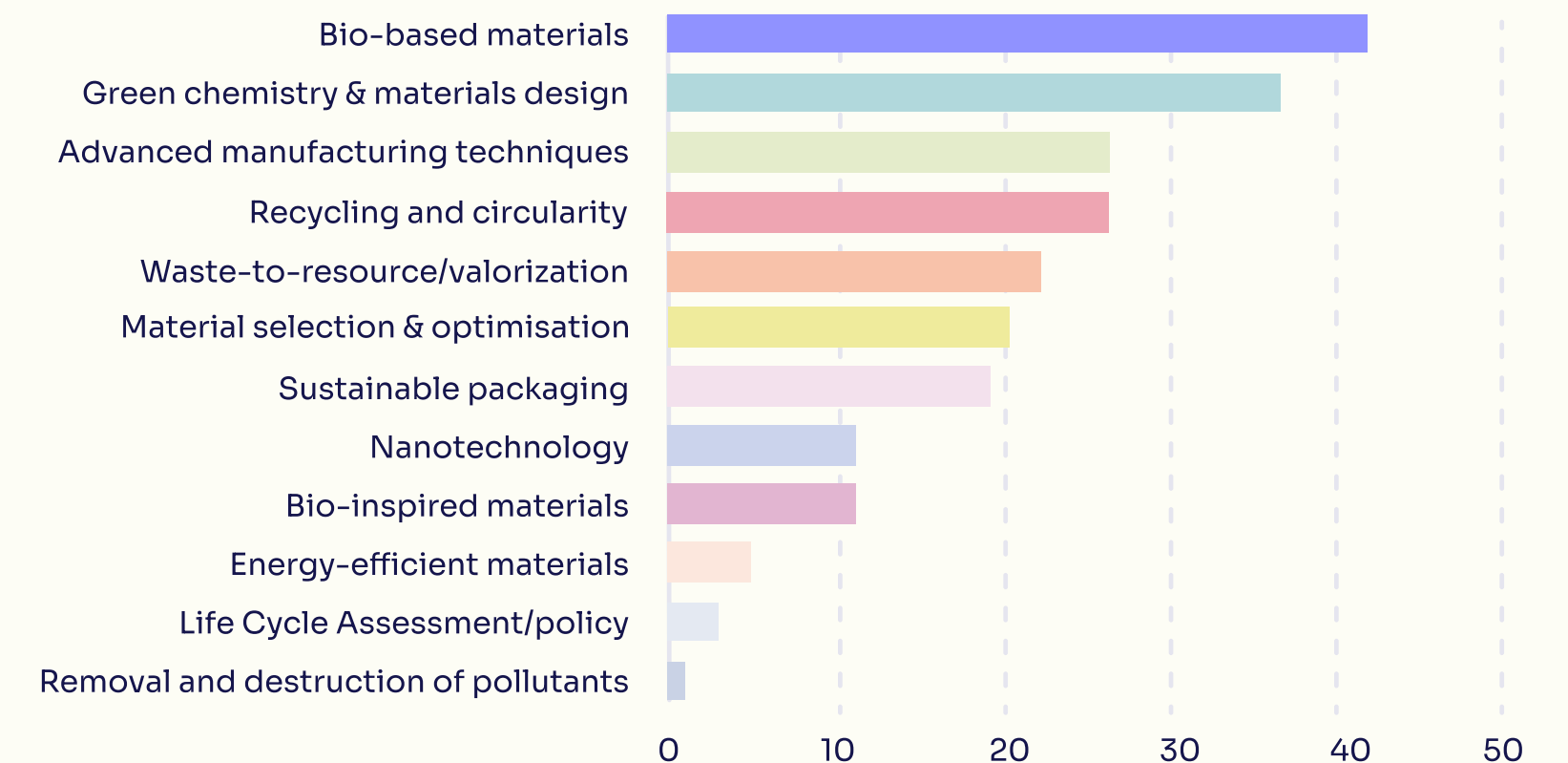
# What are academic institutes, startups, and biotech companies working on? In numbers

Of the submissions, 50% corresponded to the manufacturing and production stage of the materials life cycle. 25% were in the disposal and recycling stage, and 19% in raw material selection and extraction.

## Submissions by life cycle stage



## Submissions by specific approach



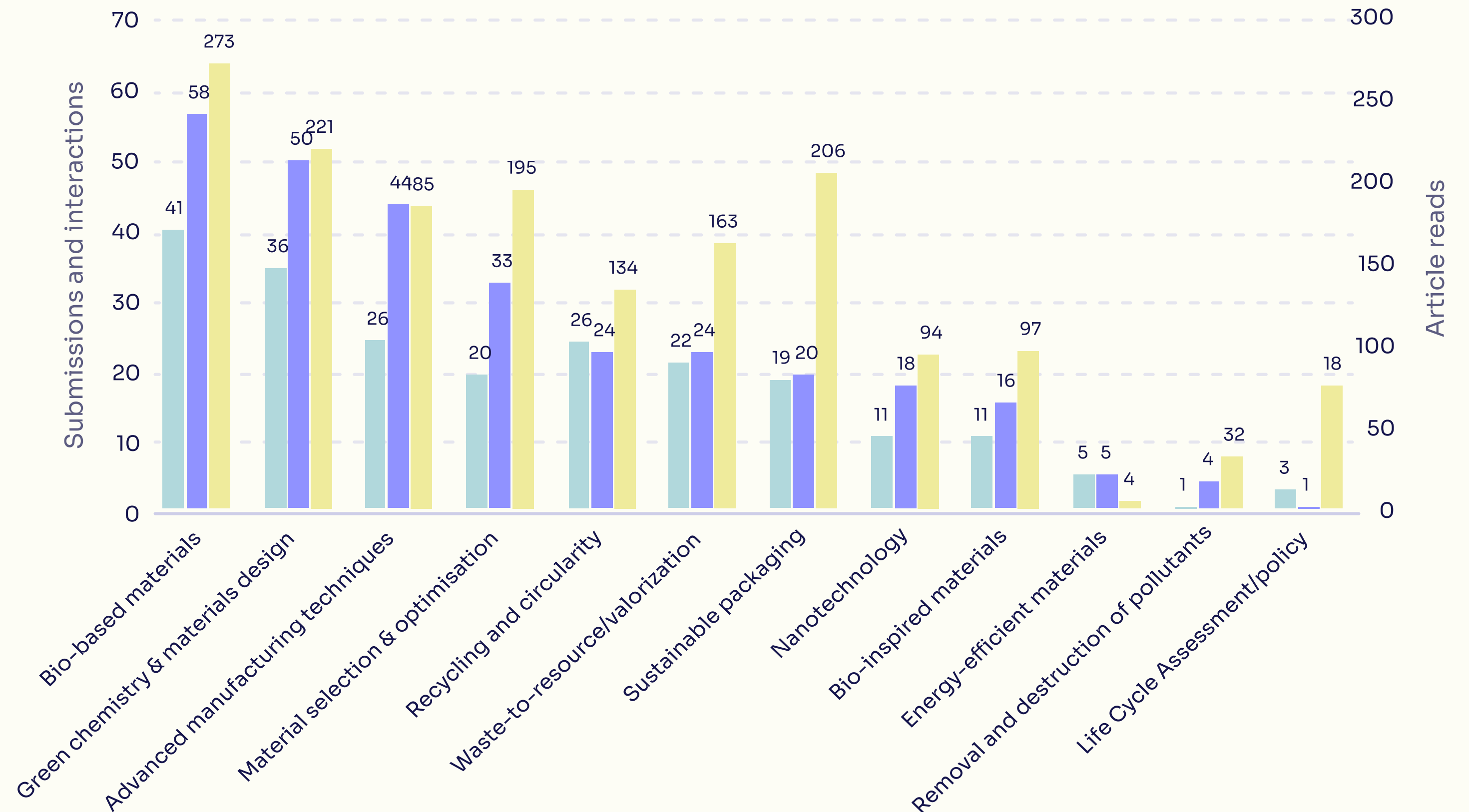
Bio-based materials, green chemistry and materials design, recycling and circularity, and advanced manufacturing are the most prominent approaches being taken by academia to address materials sustainability for a circular economy. This mirrors the submission trends from [our last Global Challenge in 2021-22](#), when the majority (32%) of submissions were relating to bio-based materials, compared to 40% in 2023.

# What are academic institutes, startups, and biotech companies working on? **In numbers**

## Submissions, interactions, reads by specific approach

In order of number of interactions

- Reads
- Interactions
- Submissions

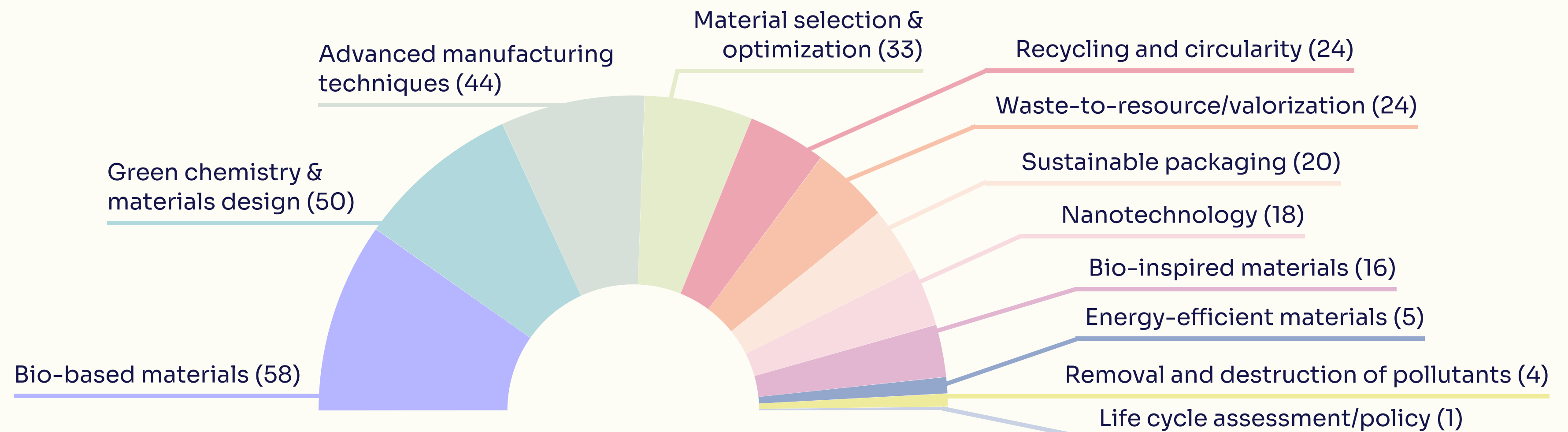


# What is the R&D community engaging with?

More conversations were started between partners in academia and industry around bio-based materials (39.8%) than any other technical approach, suggesting a shift in industry R&D priorities compared with our [2022 report on sustainable plastics](#). In 2021, our Global Challenge industry partners for that campaign (one.five, PepsiCo, Avient, and Dow) were predominantly looking for mechanical and advanced recycling technologies, as well as new biodegradable materials.

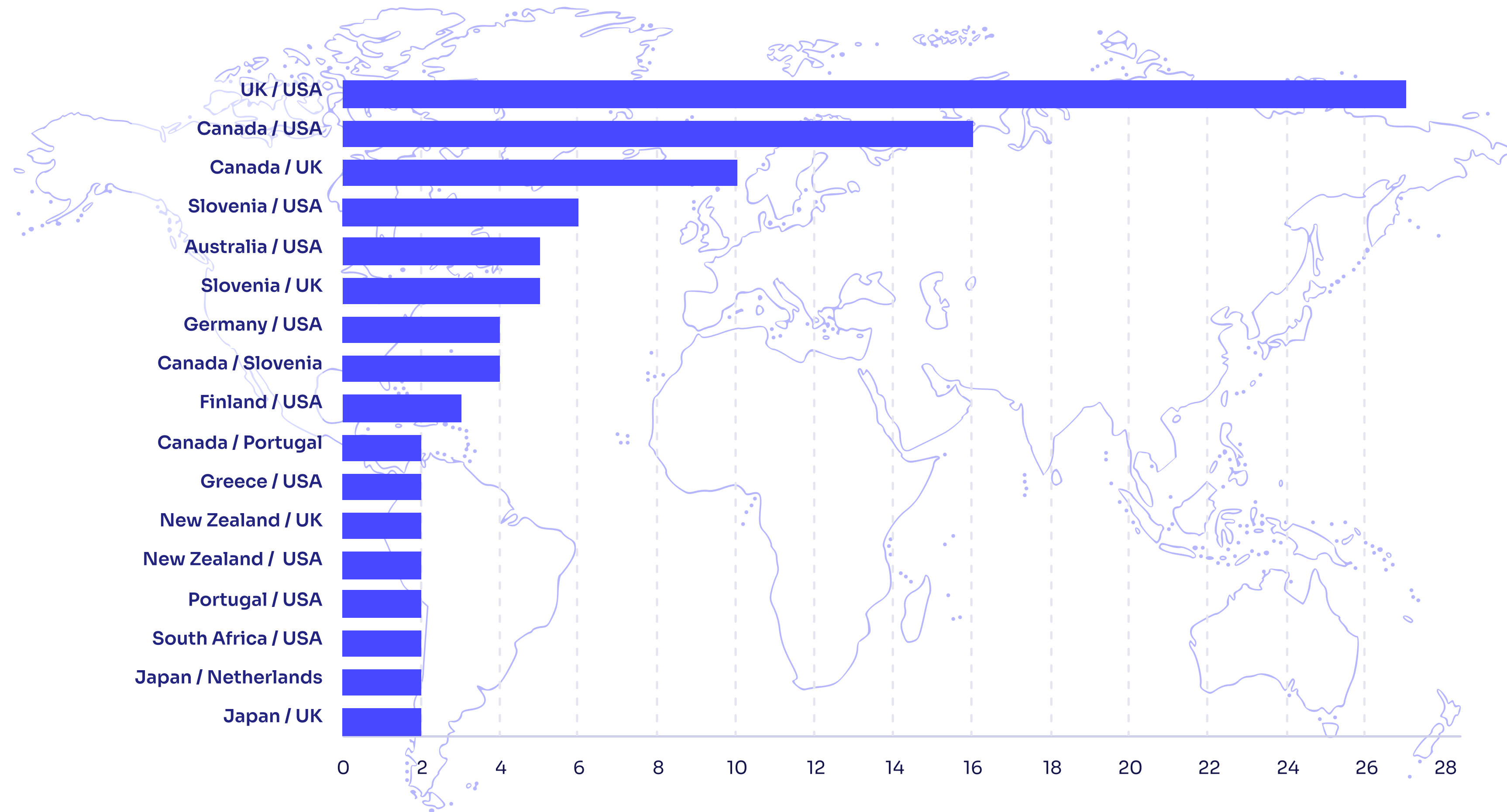
The types of technologies that were viewed the most by industry R&D professionals were bio-based materials (273), green chemistry (216), and sustainable packaging (206).

## Interactions by specific approach



# What is the R&D community engaging with?

Of the 180 new conversations started through this campaign, the majority (73%) were between international partners. The most common international connection was between teams in the USA and the UK (15%), followed by Canada/USA (9%) and Canada/UK (6%) partnerships.



# Most viewed projects and technologies

The projects and assets submitted to the campaign were matched and disseminated to R&D teams across our industry network with aligned priorities. Below, are the **9 sustainable materials breakthroughs (in descending order) most viewed** by our industry network.

NOTE: To read the full technology summary on our Connect platform, click anywhere on the technology name. If you don't already have [an account, register here](#).

No. of views

62	<a href="#">Degradable Thermosets from Bio-derived Monomers</a>	Cornell University
32	<a href="#">Natural Antimicrobial Films</a>	University of Arizona
30	<a href="#">Polymers-5B: Synthesis Biobased and Biodegradable Polymers using Monomers from Renewable Biowastes via Biocatalysis Contributing to Circular Bioeconomy</a>	Instituto Superior Técnico
25	<a href="#">Next-Generation Lignocellulosic Materials</a>	Kyoto University
23	<a href="#">Renewable Chemicals from Furans</a>	University of Minnesota
23	<a href="#">Biomufacturing of Renewable and Recyclable Fibers with High Mechanical Performance</a>	Washington University in St. Louis
21	<a href="#">Bio-based Polymer Materials</a>	University of Tasmania
19	<a href="#">Innovation in Sustainable Wall Paints and Building Construction Materials</a>	The Federal Center for Technological Education of Minas Gerais (CEFET-MG)
17	<a href="#">MATcelerateZERO: A Unique Partnership to Accelerate Climate Solutions</a>	Imperial College London

# Most engaged projects and technologies

The projects below proved the **most popular with the R&D community**, each attracting at least four interactions from industry teams, either in the form of feedback on the opportunity or connection requests to speak about potential collaborations.

NOTE: To read the full technology summary on our Connect platform, click anywhere on the technology name. If you don't already have [an account, register here](#).

No. of interactions

6	<a href="#">Bio-based Polymer Materials</a>	University of Tasmania
5	<a href="#">Degradable Thermosets from Bio-derived Monomers</a>	Cornell University
5	<a href="#">Next-Generation Lignocellulosic Materials</a>	Kyoto University
5	<a href="#">Seaweed-based plastic-free fully bio-degradable alternative to petro-chemical/plastic ingredients and coatings</a>	Edinburgh Napier University
5	<a href="#">Holistic Packaging Concepts for a more Sustainable, Circular Bioeconomy</a>	Albstadt-Sigmaringen University
4	<a href="#">Natural Antimicrobial Films</a>	University of Arizona
4	<a href="#">Development of sustainable materials to replace plastics under circular economy approach</a>	Edinburgh Napier University
4	<a href="#">Novel and Sustainable Paper-Based Detectors for Food Freshness, Agricultural and Industrial</a>	Auburn University



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No. of interactions

4

[Recycling of Polyurethane Foams by Aminolysis to Recover Polyols of Comparable Quality to the Commercial Ones](#)

Kemijski Institut

4

[Process for Producing Muconic, Hexenedioic, and Adipic Acid \(and Their Esters\) from Aldaric Acids by Heterogeneous Catalysis](#)

Kemijski Institut

## connect

An online matchmaking platform **accelerating new partner discovery** by uniting a global network over 17,000 industry professionals, academic organizations, biotech and investors.

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## deal

A partnering CRM platform tailored for deal making efficiency by streamlining the collaboration and alliance management phases of scientific partnerships.

## event

An event management platform, powers more than 50,000 partnering meetings annually at the world's most important scientific partnering conferences, including the BIO International Convention.

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