

# Biotechnology and bio-based materials for the textile industry

CARLA SILVA, CITEVE

TIFE 2026

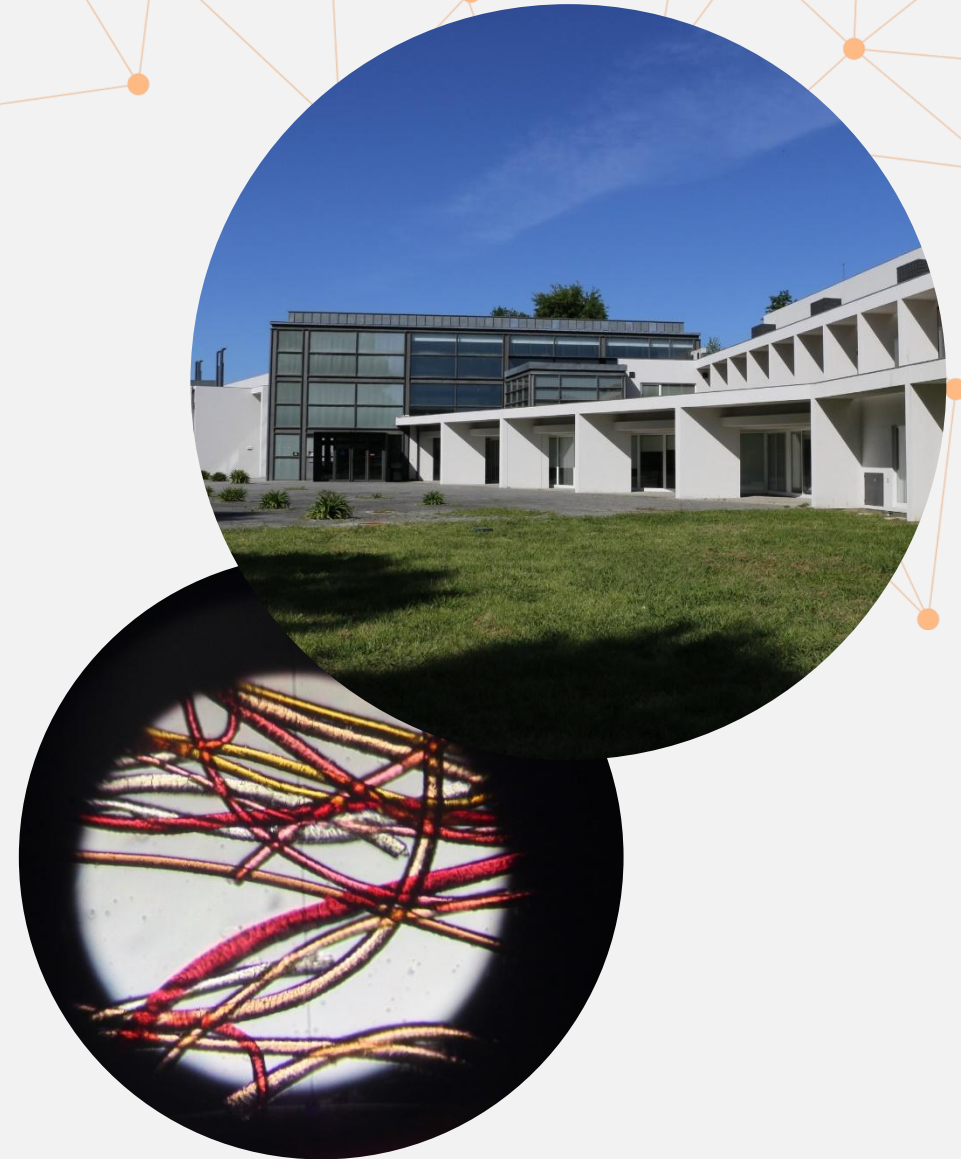
16th SEPTEMBER 2026



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# Technological Centre for the Textile and Clothing Industries of Portugal

Commitment to Quality,  
Compliance and Innovation



# Services

Testing

Product & Process Certification

Research, Technology  
Development & Engineering

Sustainability, Bio  
& Circular Economy

Manufacture Digitalization  
& Industry 4.0

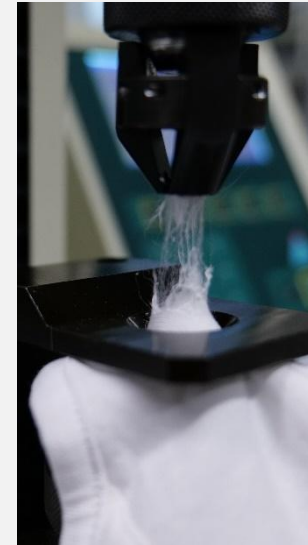
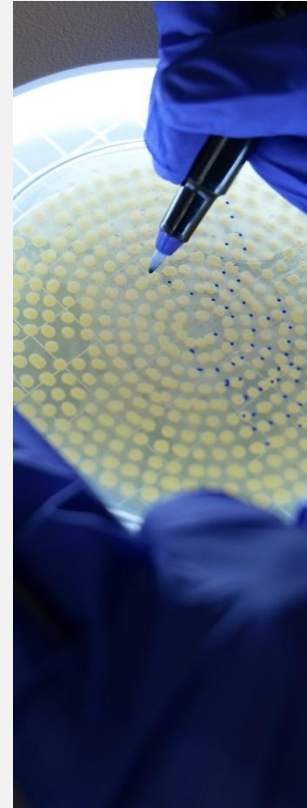
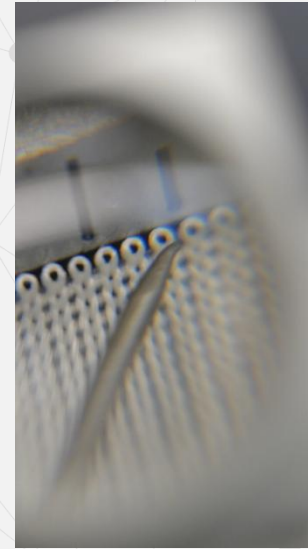
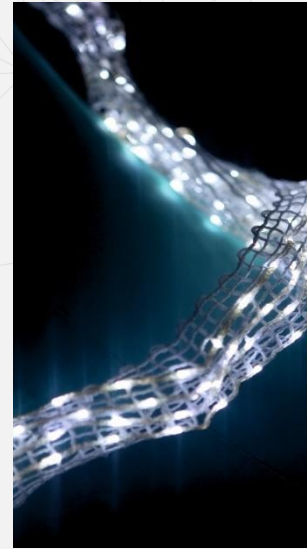
High Level Training & Coaching

Support to Innovation Capacities  
& Entrepreneurship

International Consultancy

Design & Fashion Intelligence

[www.citeve.pt](http://www.citeve.pt)



# Market oriented

Fashion

Sports

Defence and PPE

Workwear

Mobility & Transport

Health & Well-being

Architecture & Construction



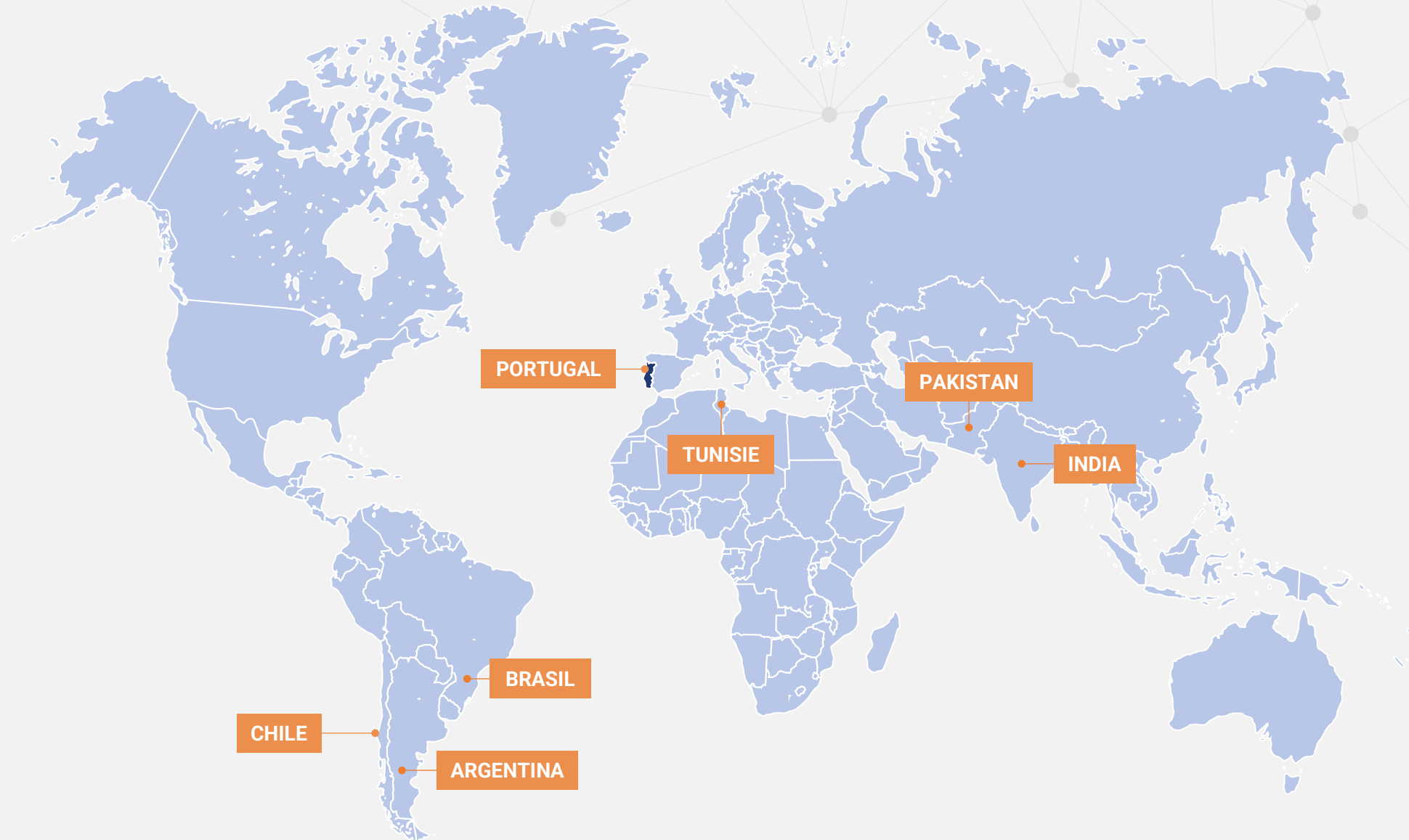
# CITEVE Group (core)

**citeve**  
TEXTILE TECHNOLOGY



# CITEVE Worldwide

**citeve**  
TEXTILE TECHNOLOGY

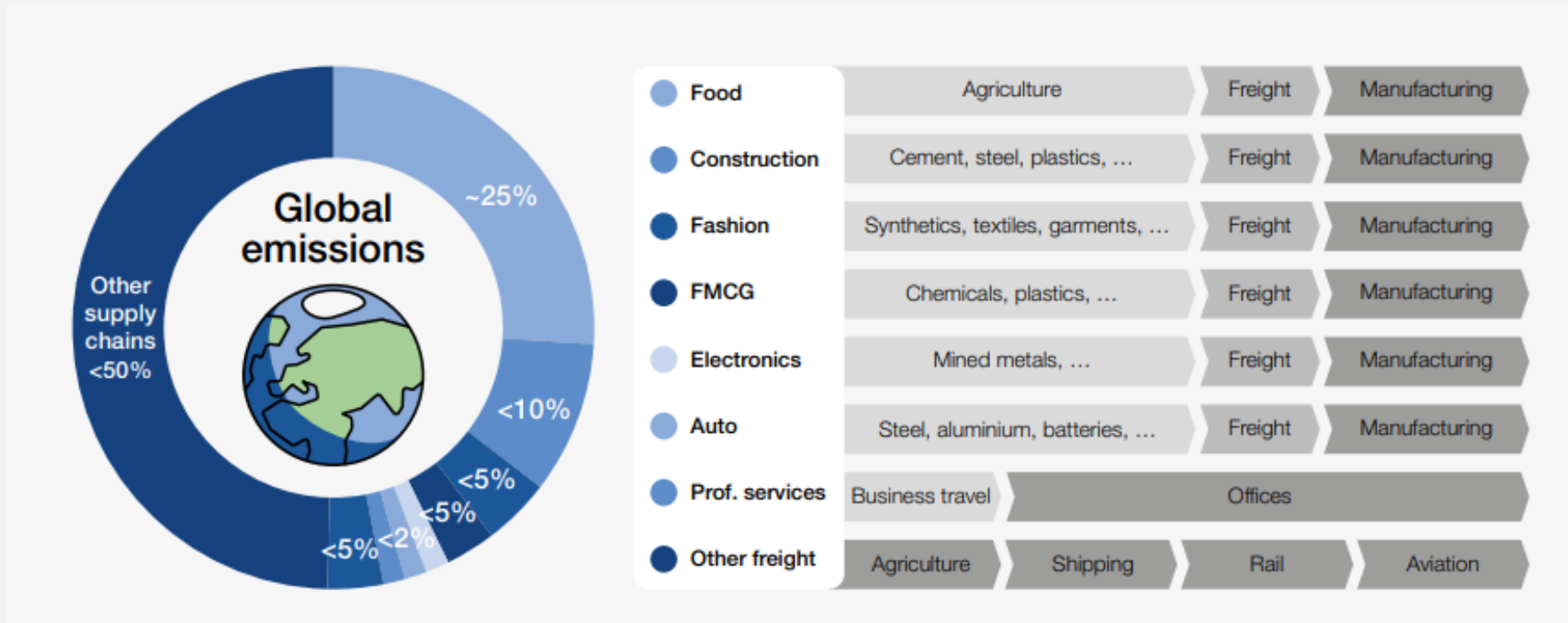


# Challenges in the T&C industry



# Global Emissions

- 8 supply chains are responsible for more than 50% of global emissions
- Fashion (T&C) is in Top 5 of the most pollutant industries



(© 2021 World Economic Forum - Net-Zero Challenge Report)

# UPCOMING REGULATIONS IN EU

(Source: EURATEX, 2023)



**Ecodesign and Digital  
Product Passport**



**Extended Producers  
Responsibility**



**Waste  
Shipment**



**Green Claims and  
Textile Labelling**



**Green Public  
Procurement (GPP)**



**Waste Legislation**



**Corporate  
Sustainability  
Due Diligence**



**Corporate  
Sustainability  
Reporting Directive**



**Industrial Emissions**



**Sustainable  
Finance  
(Taxonomy )**



**Microplastics**



**PFAS**



**Skin Sensitisers**



**Bisphenols**



**REACH Revision**



**PFHxA**

# Opportunities for the T&C industry

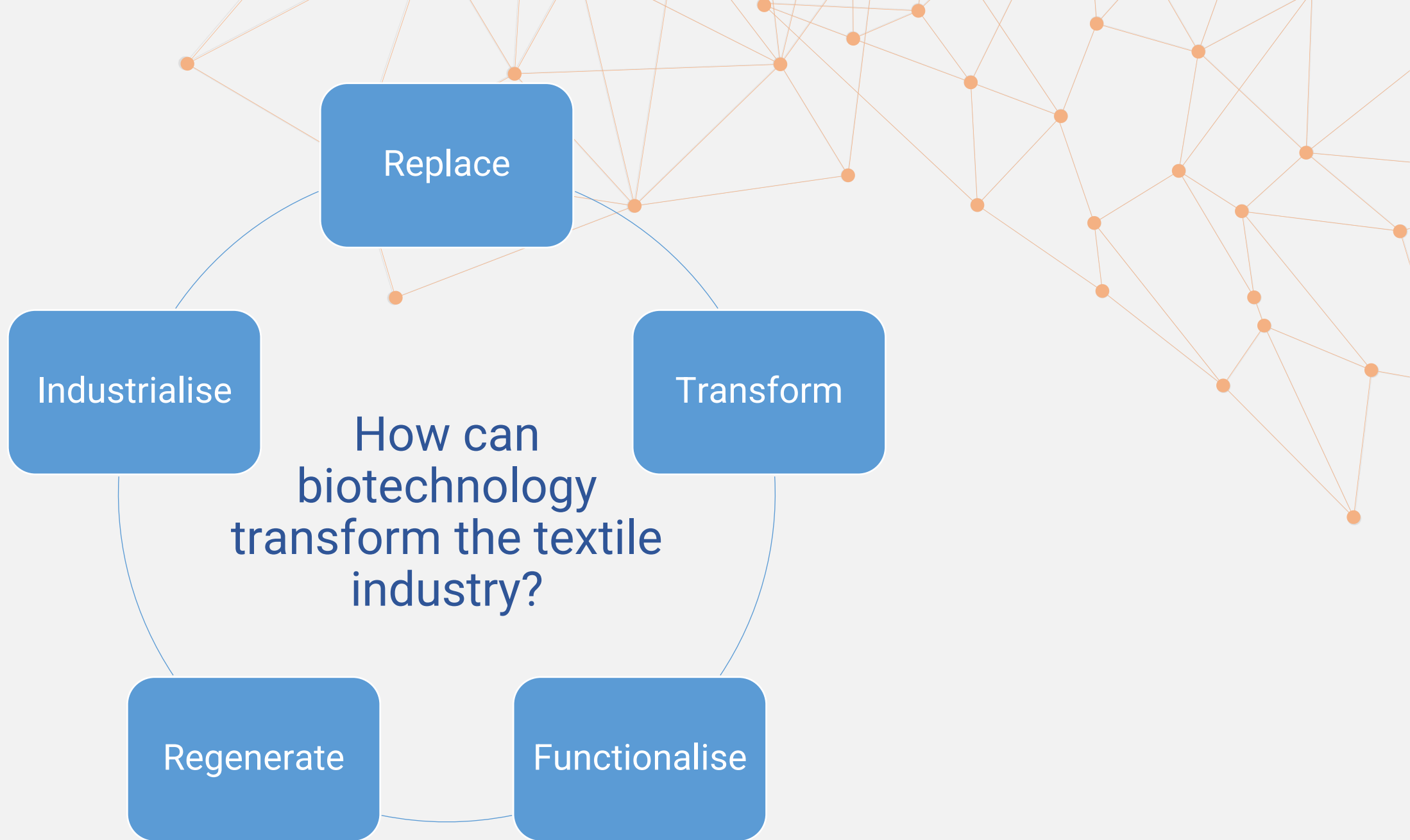
## Biotechnology

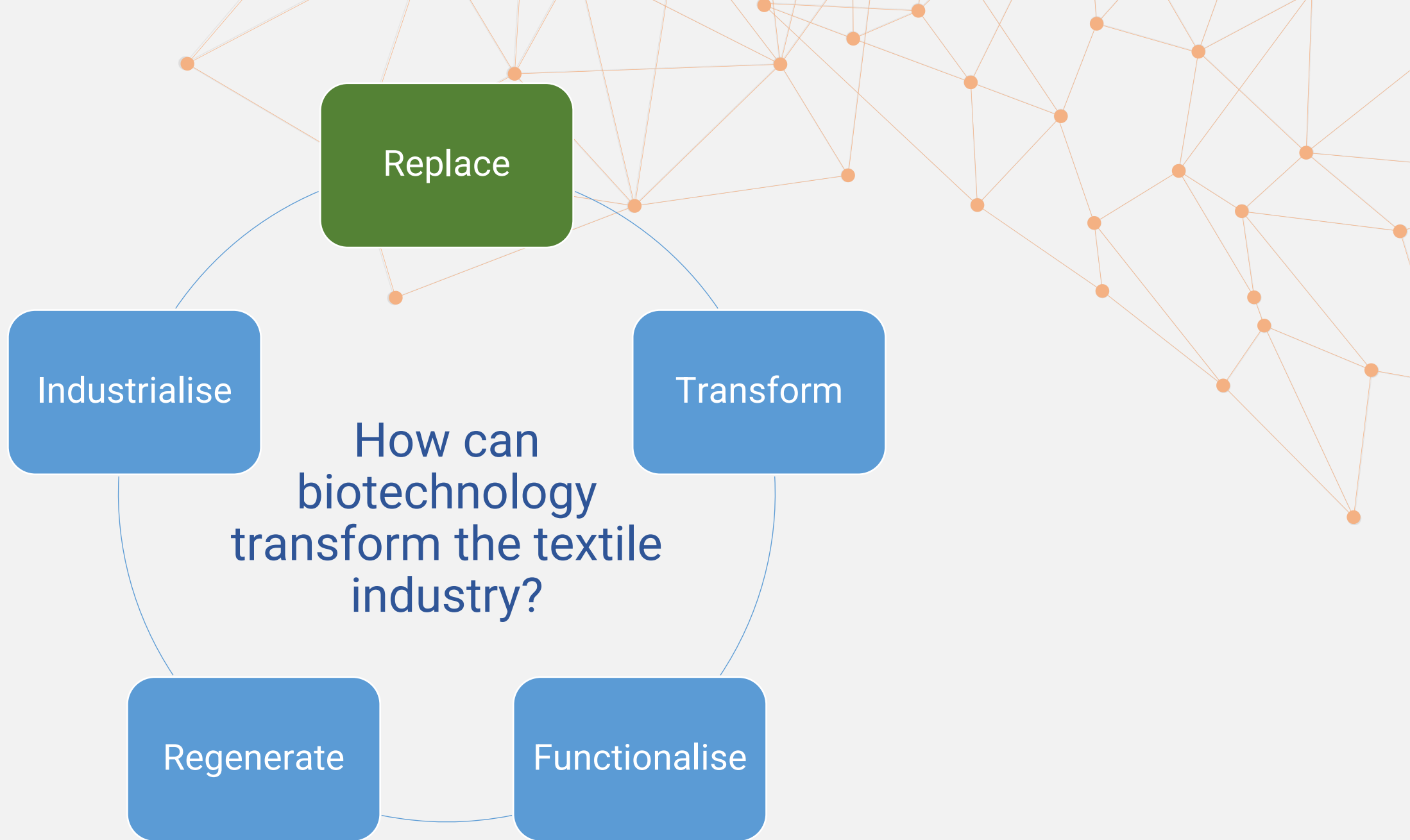




# How can biotechnology transform the textile industry?

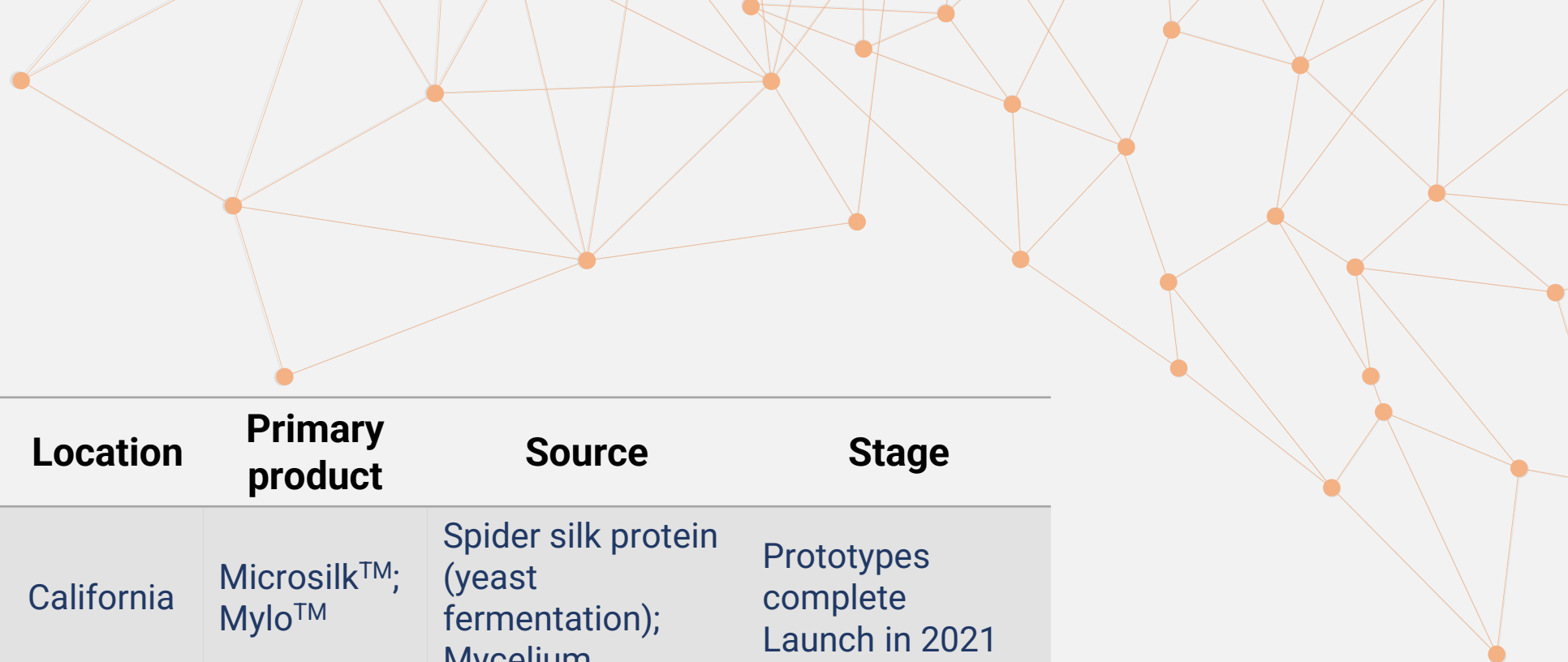




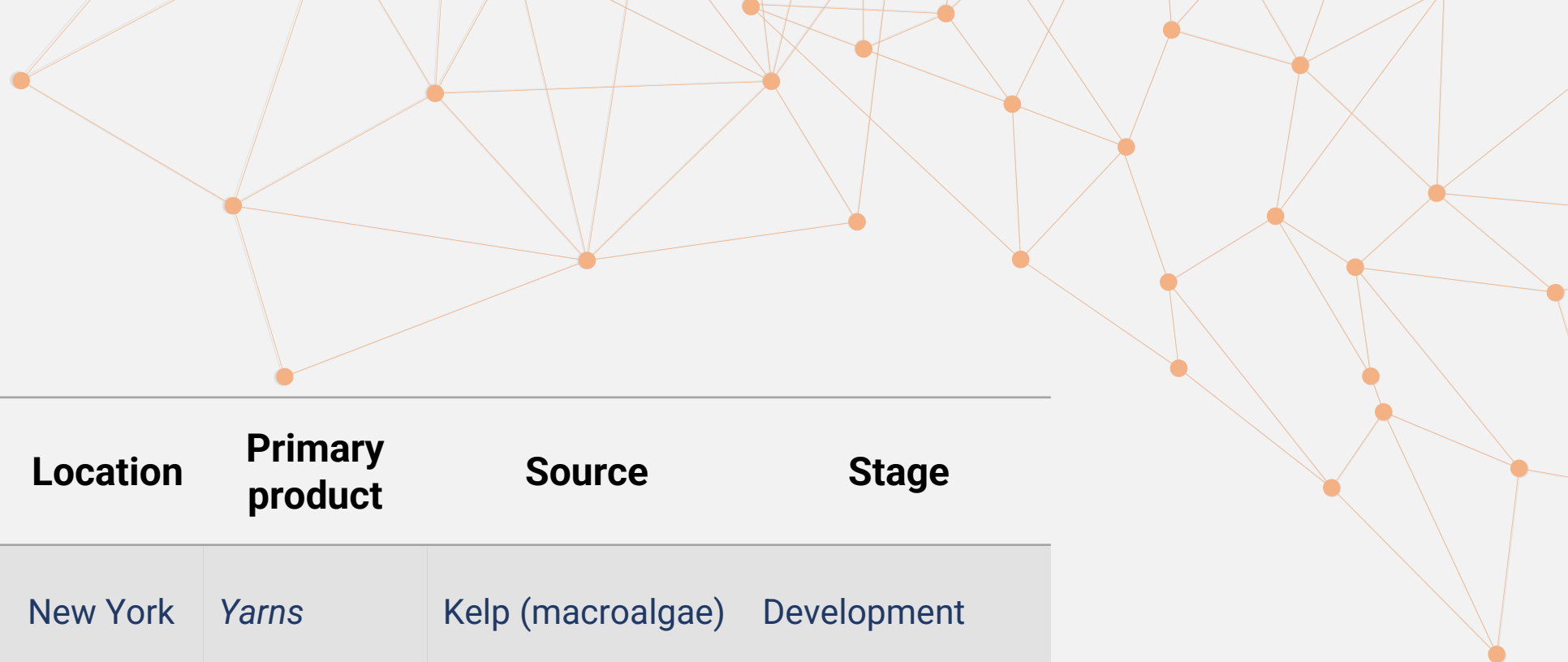


## Replace

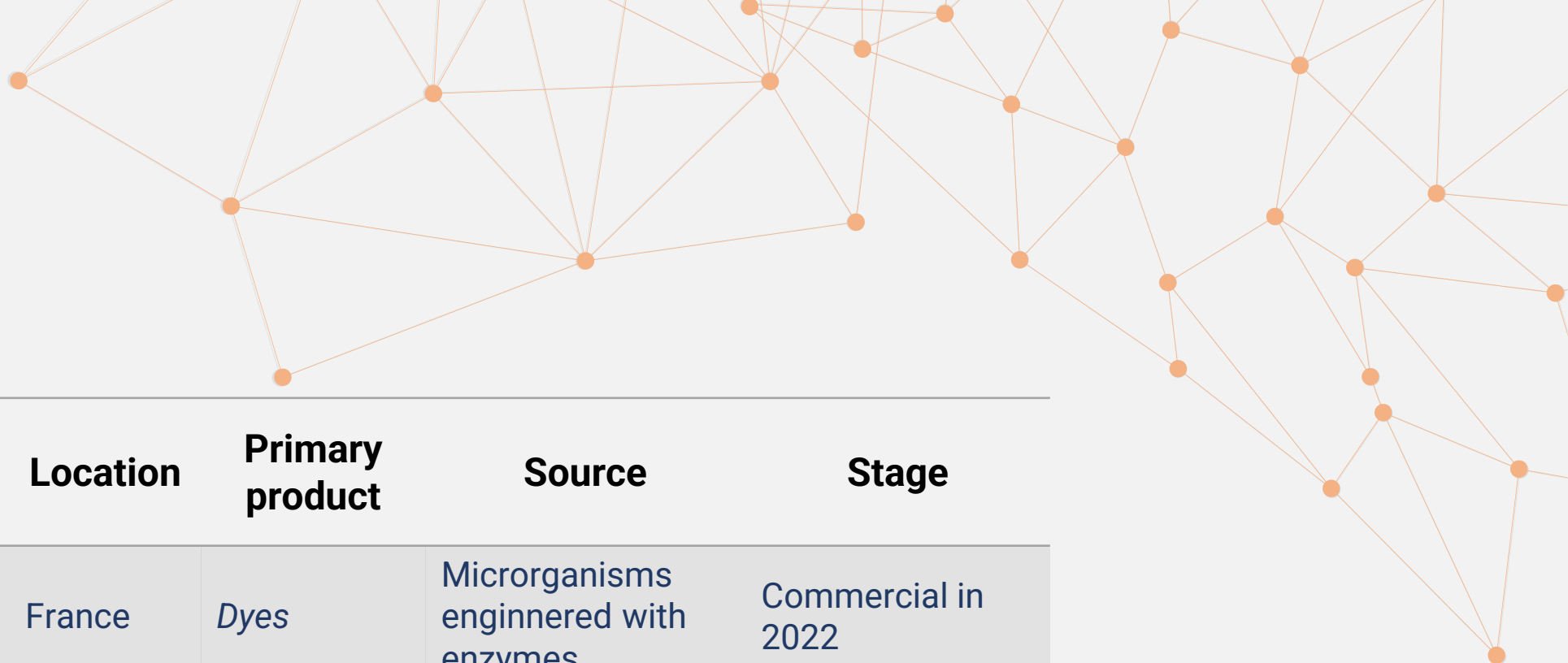
- ☐ Replace fossil-based resources with renewable biological resources
  - ☐ New fibres (in particular bio-synthetics)
  - ☐ New dyes and additives



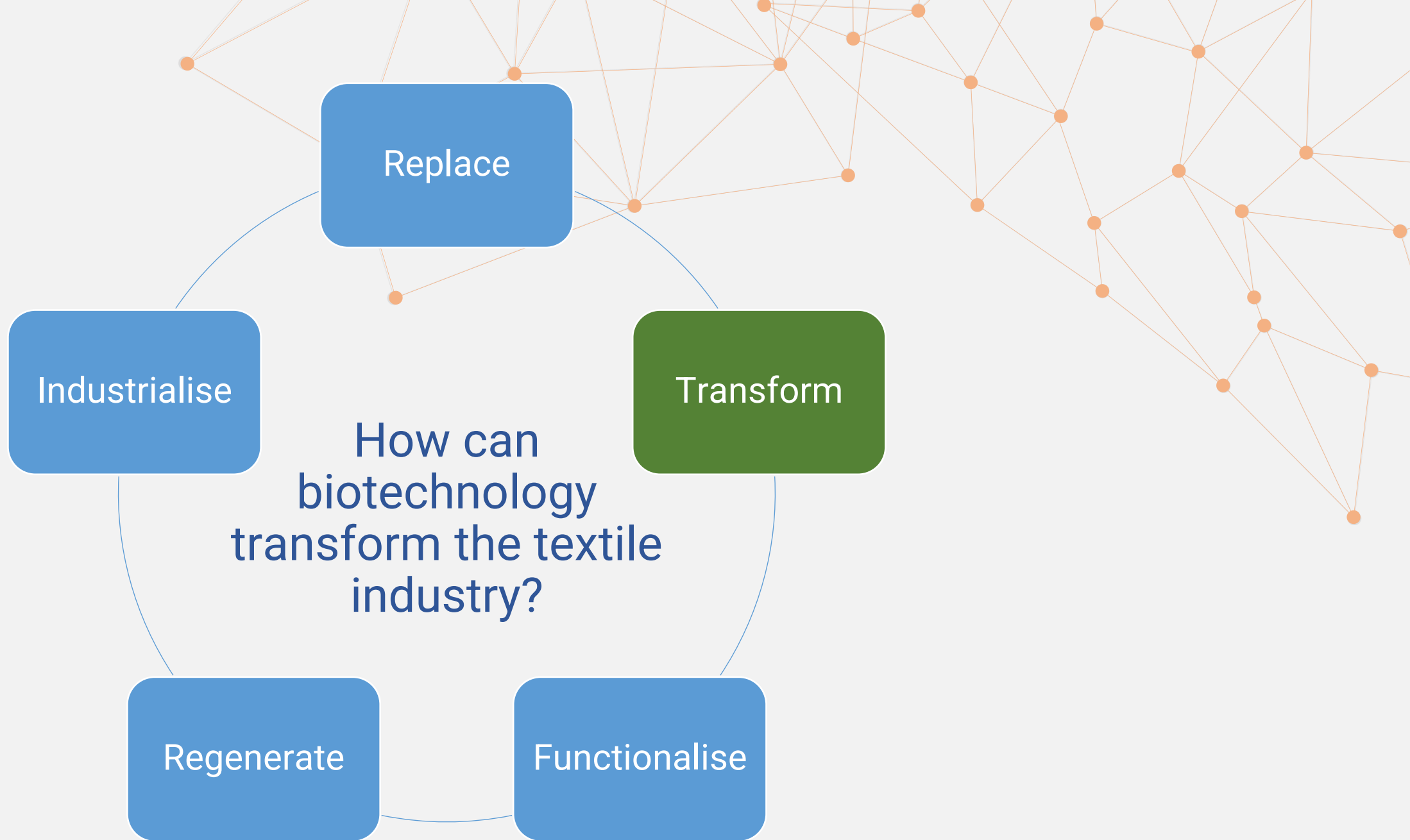
| Company                                                                                                   | Year founded | Location   | Primary product      | Source                                                   | Stage                                                |
|-----------------------------------------------------------------------------------------------------------|--------------|------------|----------------------|----------------------------------------------------------|------------------------------------------------------|
|  <b>BOLT<br/>THREADS</b> | 2009         | California | Microsilk™;<br>Mylo™ | Spider silk protein<br>(yeast fermentation);<br>Mycelium | Prototypes<br>complete<br>Launch in 2021             |
|  <b>Spiber</b>           | 2007         | Japan      | Brewed<br>Protein™   | Spider silk protein<br>(microbial fermentation)          | Prototypes<br>complete<br>Launch in 2021             |
|  <b>AMSilk</b>         | 2008         | Germany    | Biosteel®            | Spider silk protein<br>(bacterial fermentation)          | Prototypes<br>complete<br>Commercial<br>partnerships |



| Company                                                                             | Year founded | Location  | Primary product       | Source              | Stage                                 |
|-------------------------------------------------------------------------------------|--------------|-----------|-----------------------|---------------------|---------------------------------------|
|    | 2017         | New York  | <i>Yarns</i>          | Kelp (macroalgae)   | Development                           |
|    | 2014         | Australia | <i>Nullarbor™</i>     | Microbial cellulose | Prototypes complete<br>Launch 2021    |
|  | 2016         | Germany   | <i>Fiber and Dyes</i> | Algae               | Prototypes complete<br>Launch in 2021 |

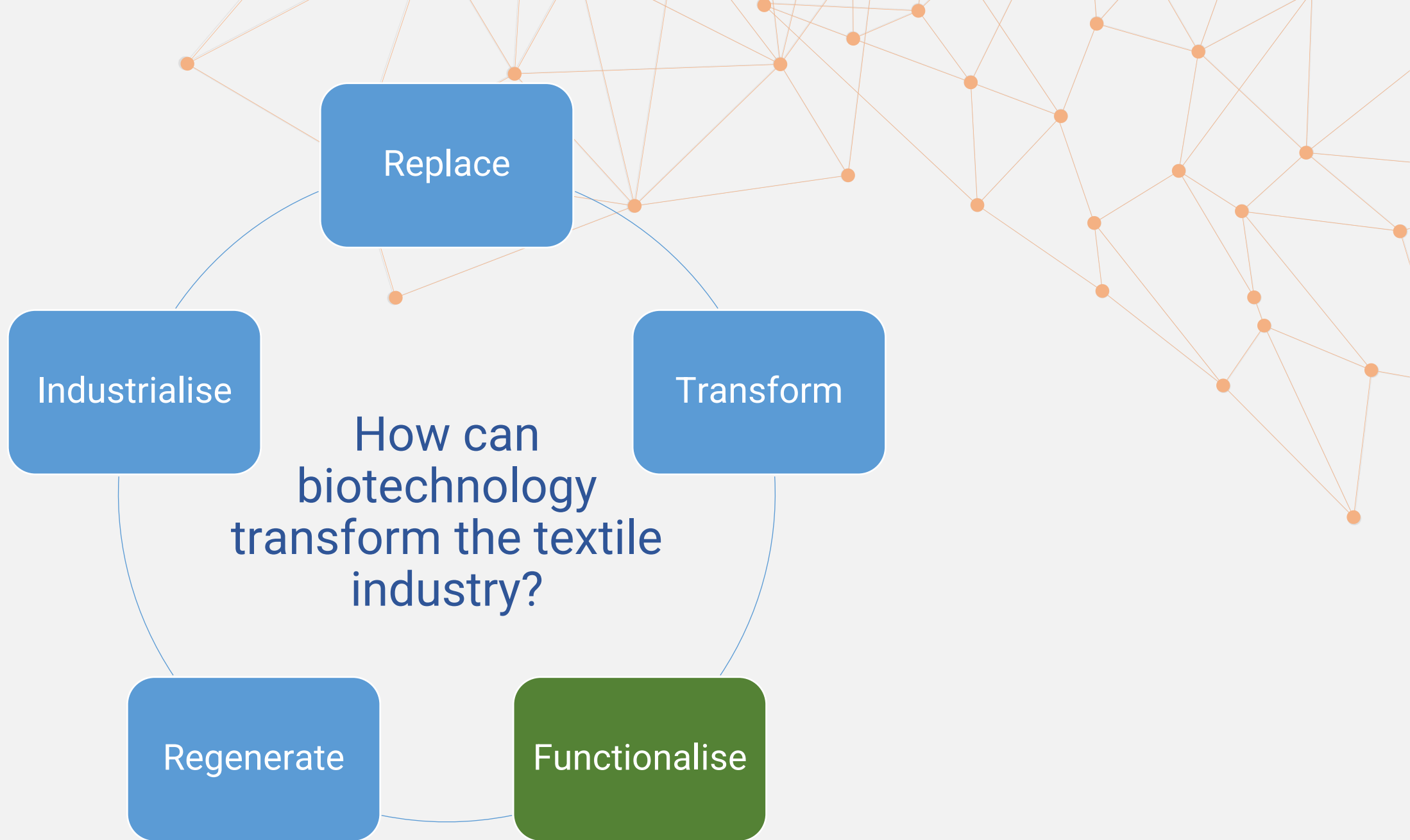


| Company                                                                           | Year founded | Location | Primary product | Source                                     | Stage                                              |
|-----------------------------------------------------------------------------------|--------------|----------|-----------------|--------------------------------------------|----------------------------------------------------|
|  | 2015         | France   | Dyes            | Microrganisms enginnered with enzymes      | Commercial in 2022                                 |
|  | 2016         | UK       | Dyes            | Engineered bacteria (used instead of dyes) | Several textile-based clients using bacterial dyes |
| (...)                                                                             |              |          |                 |                                            |                                                    |



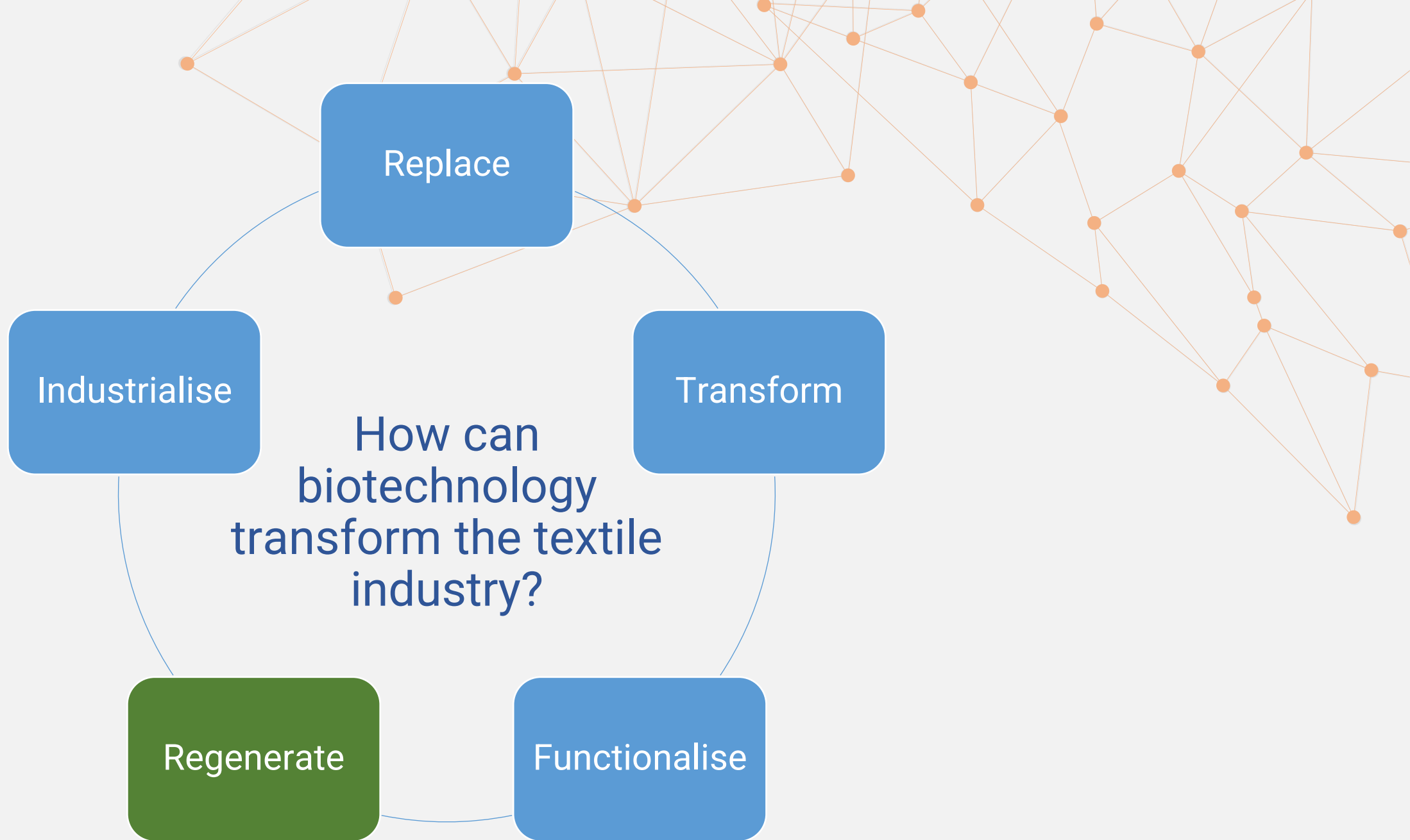
## Transform

- ❑ Biotechnology can convert low-value biomass and waste into valuable molecules and materials
  - ❑ New fibres (ex. pineapple, banana fibers)
  - ❑ New dyes and additives



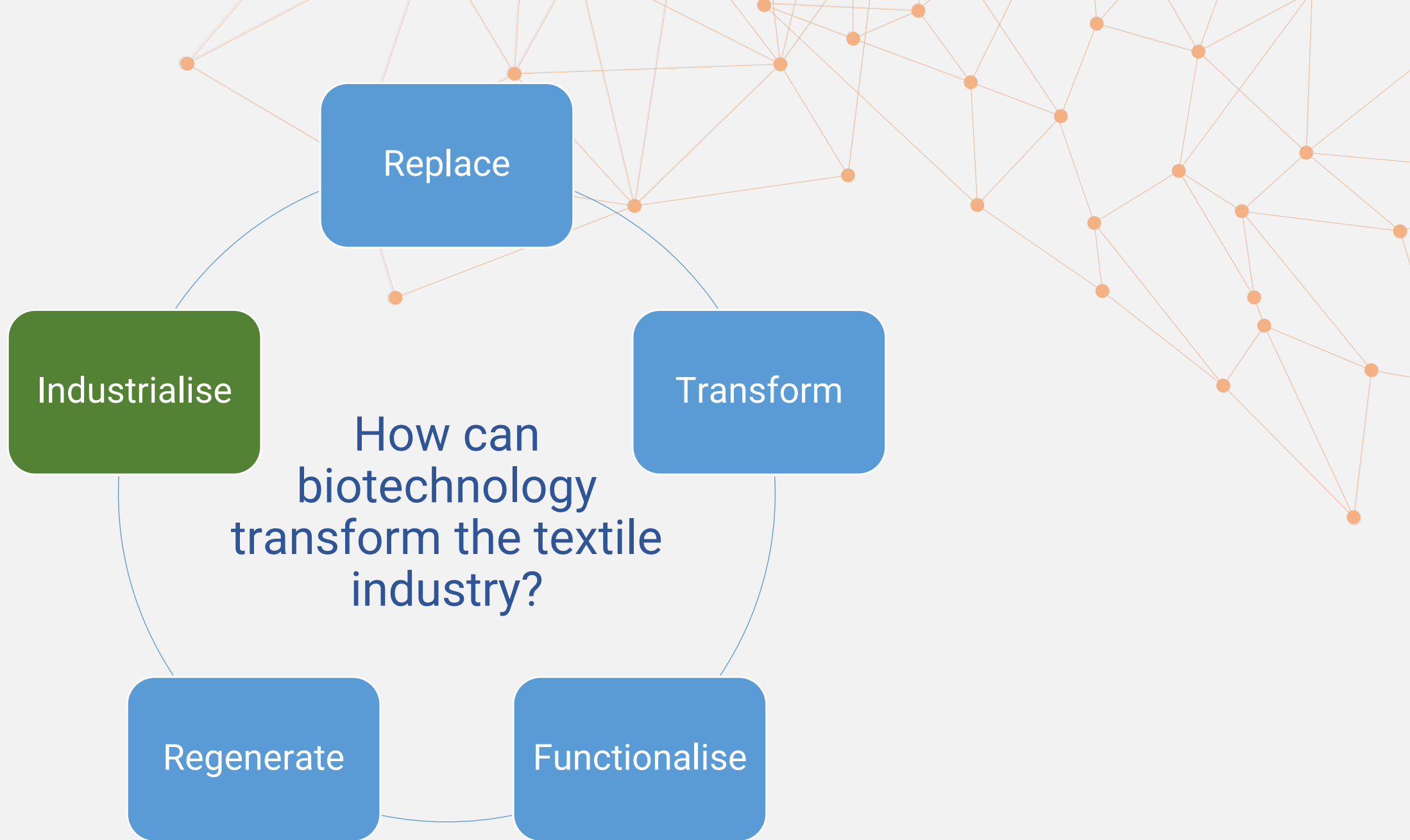
## Functionalise

- ❑ Introduce new functionalities into textile fibres and surfaces using bio-based technologies
  - ❑ Enzymatic processes for:
    - ❑ preparation of natural fibres (e.g. pectinases)
    - ❑ textile surface functionalization (e.g. oxidoreductases)
    - ❑ fibre recycling (e.g. cutinases)



## Regenerate

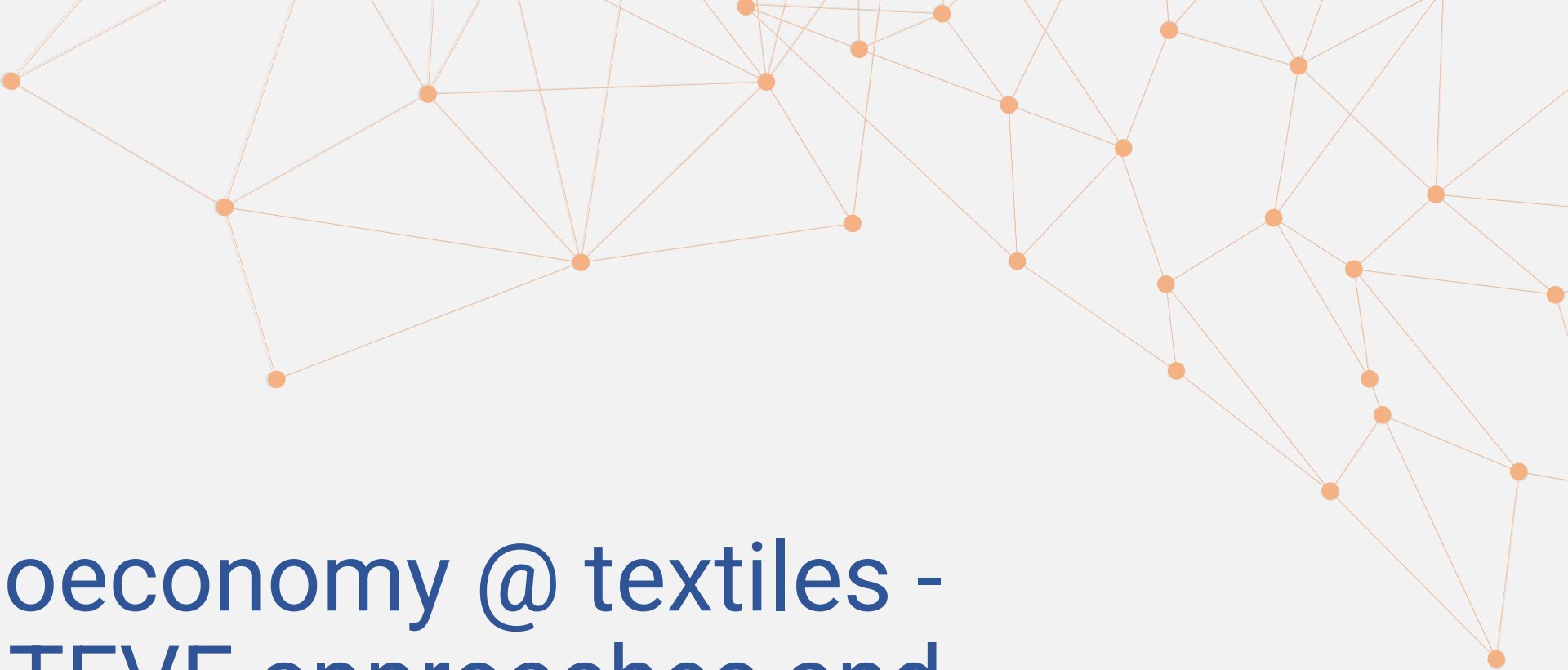
- ❑ Design textiles that are easier to recycle, reuse or safely return to biological/technical cycles
- ❑ Fully mono-material approaches (e.g. protein fibers and coatings)
- ❑ New alternative end-of-life options



Industrialise

❑ Can these solutions meet the performance, cost and scalability requirements of the textile industry?

That is the key question!



# Bioeconomy @ textiles - CITEVE approaches and achievements

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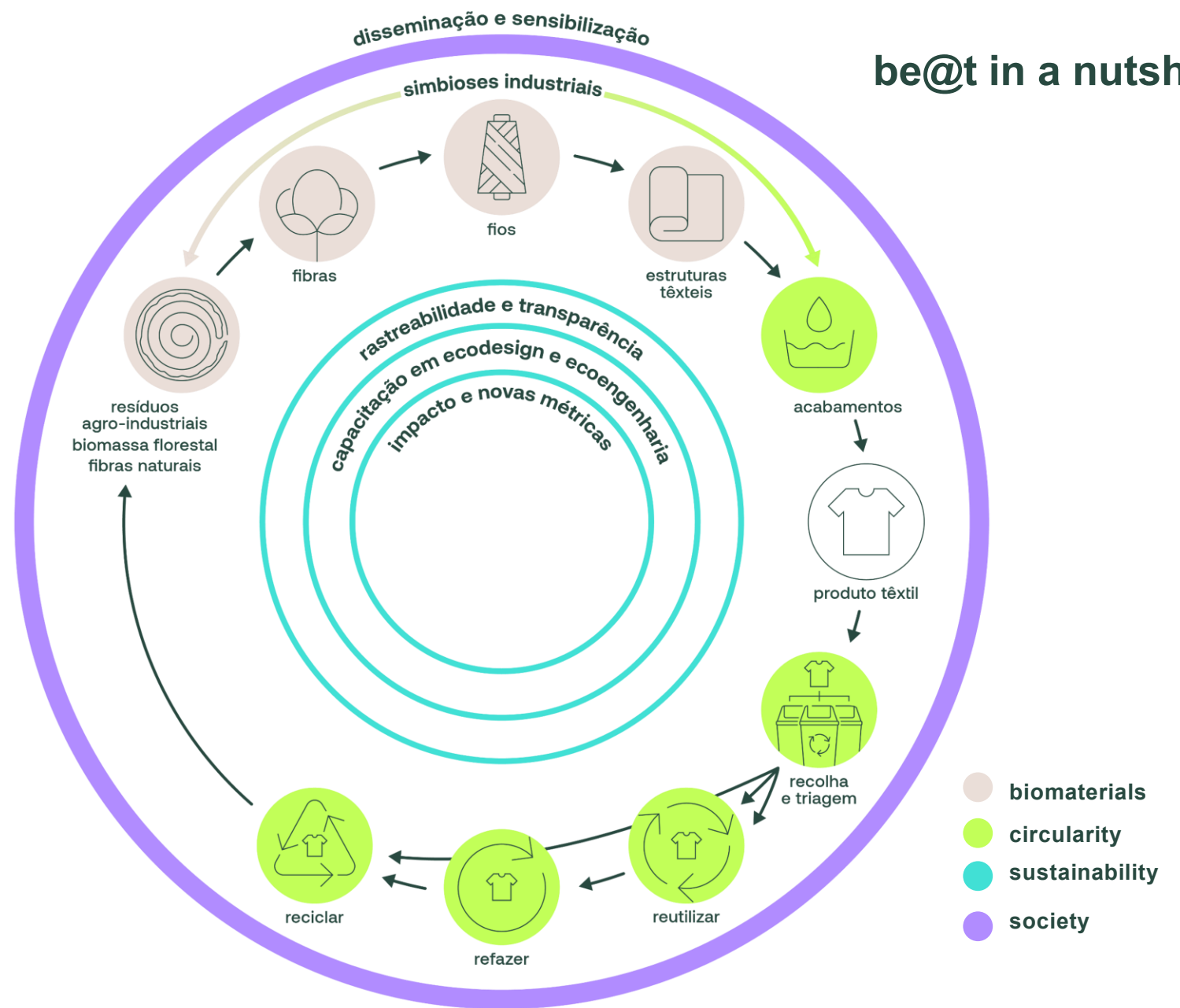
## Objective

Contribute to the generation and consolidation of an **innovative**, **sustainable** and **circular** textile and clothing sector (T&C sector) through the development of traceable textile products and materials of bio-based and renewable origin, with improved environmental credentials.

From nature, in a sustainable and circular way, to people.

136 M€ investment  
71 M€ funding  
58 Partners

4 Pillars  
9 WPs  
58 R&D projects



Replace



## Transform



## Functionalise



## Regenerate



## Industrialise



# 80 / 80+

N.º OF RESEARCH,  
DEVELOPMENT AND  
INNOVATION LINES  
(R&D + I)





# 51 / 100+

**N.º OF NEW PRODUCTS  
WITH A BETTER  
ENVIRNMENTAL  
FOOTPRINT**

# 10 / 10

N.º OF PILOT LINES WITH  
TRL 7 - 8



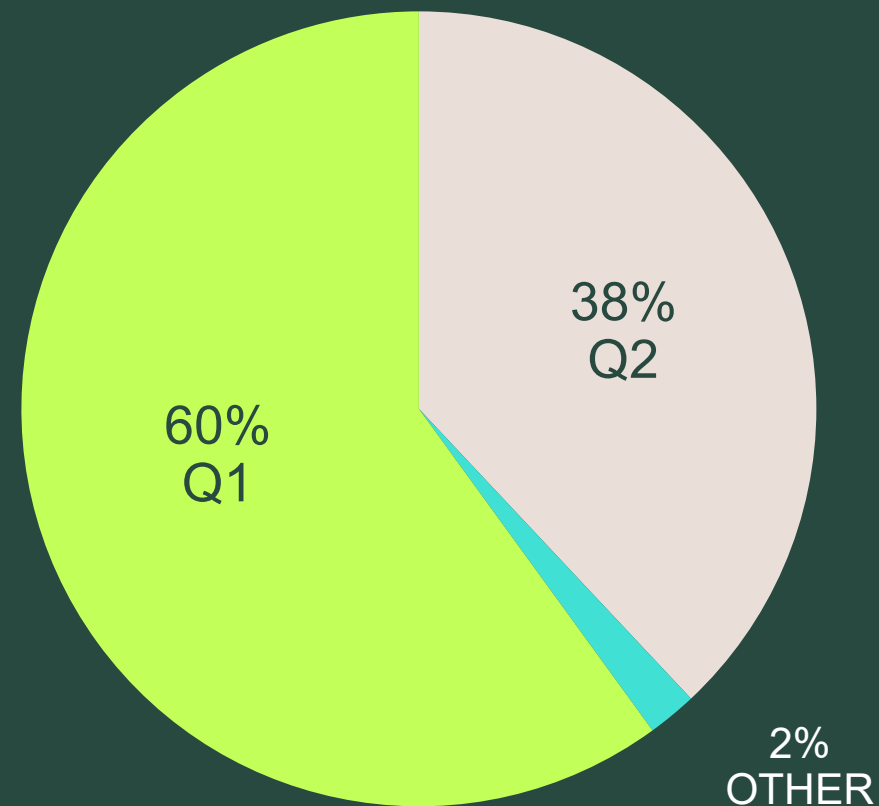


3 / 8

N.º OF LABORATORY  
PILOT LINES

70 / 120+

N.º OF SCIENTIFIC  
PUBLICATIONS

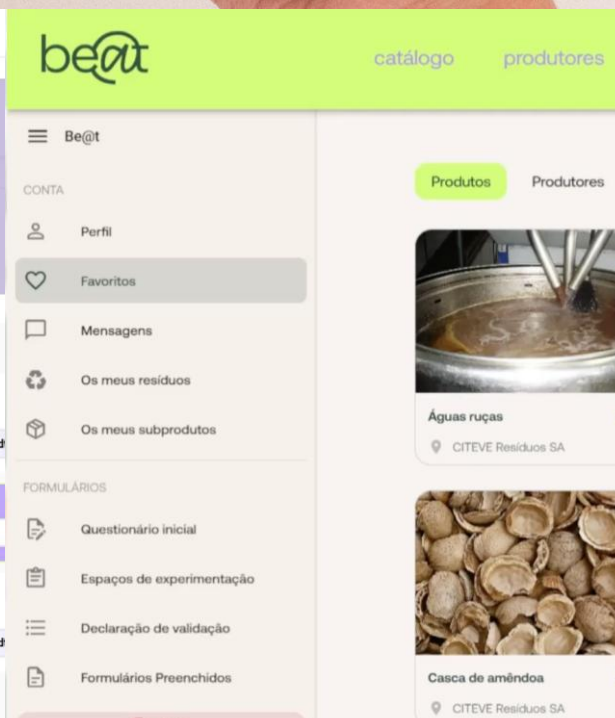
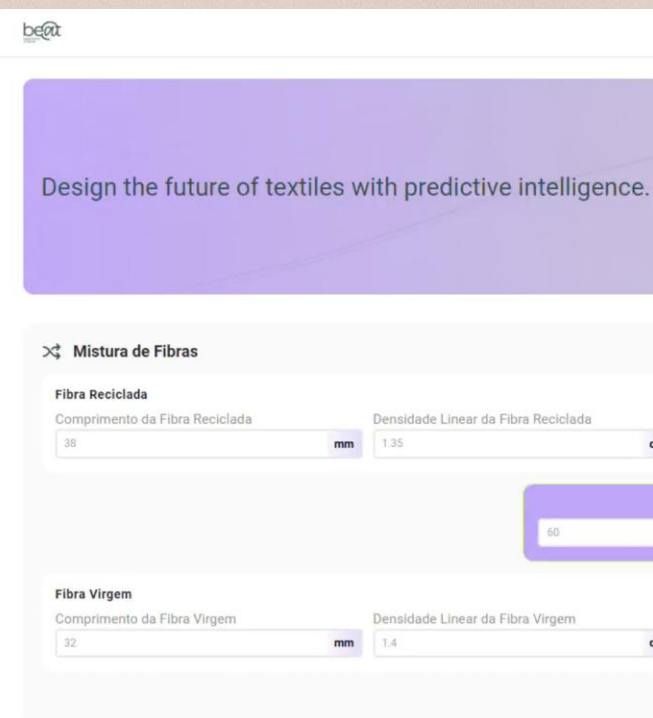


Distribution of publications by  
SCImago quartil



3 / 4

N.º OF DIGITAL  
PLATFORMS



35 / 35

N.º OF INDUSTRIAL  
SYMBIOSES



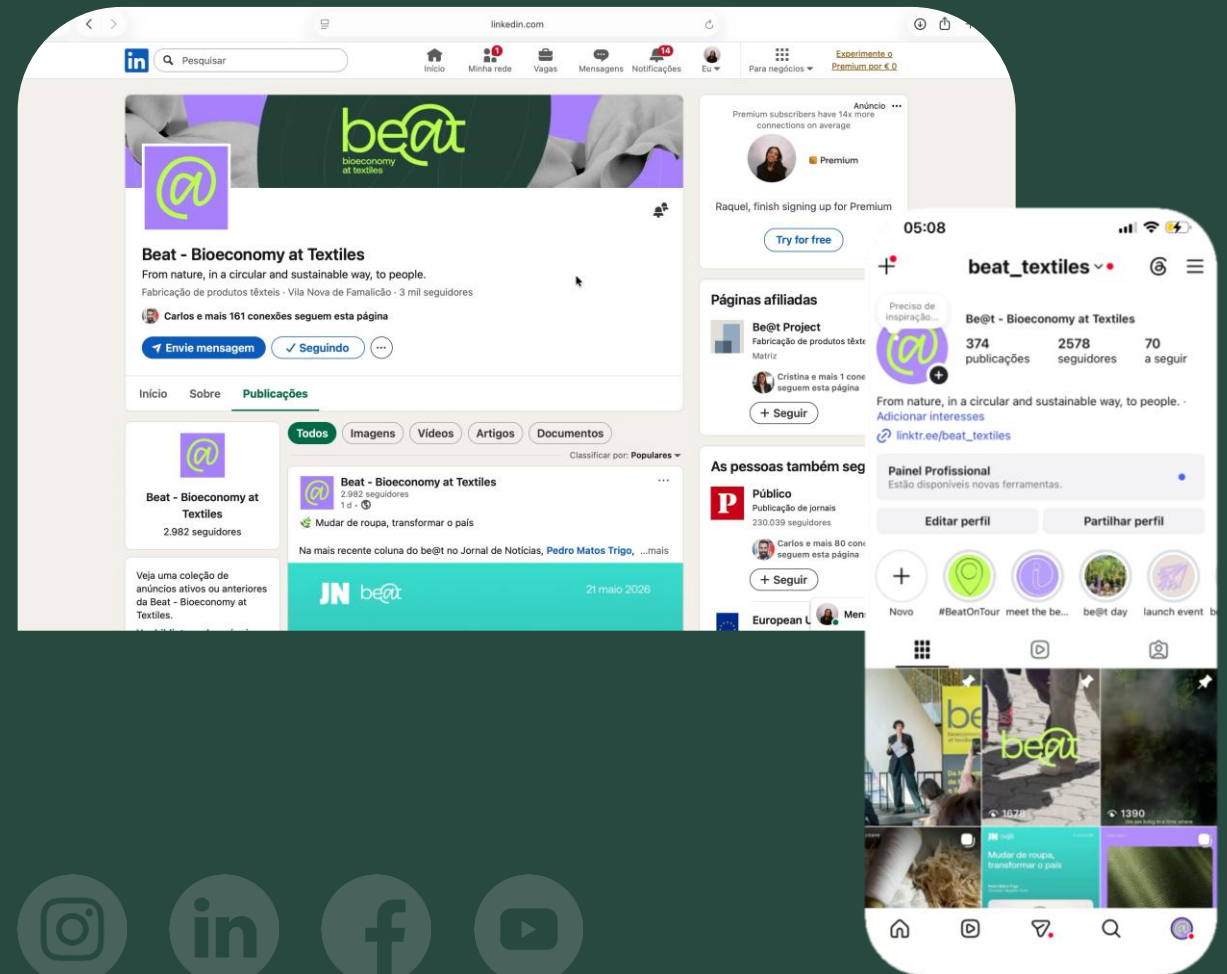


31 / 296

N.º OF DEDICATED  
TRAINING AND  
CAPACITY-BUILDING  
PROGRAMS

# 29 / 121

## N.º OF COMMUNICATION AND MARKETING CAMPAIGNS



A blue feather flag with yellow text and a background of green trees. The flag is curved and features the word 'lorenz' in a stylized font, followed by 'bioeconomy at textiles' in a smaller font. A hashtag is also visible on the right side of the flag.

lorenz  
bioeconomy  
at textiles

#boostedbyciteve



**THE FUTURE STARTS NOW**

**THANK YOU!**



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