Transition Lab

Report & Guidelines

2019 – 2025

Innovation Space
BIOTEXFUTURE

Funded by the German
Federal Ministry of
Research, Technology
and Space

ABSTRACT

Read the Report

This report synthesises more than five years of Transition Lab, a BIOTEXFUTURE research initiative, into a set of actionable commnication guidelines for actors in the bio-based textile transition.

The report integrates perspectives from sociology, economic geography, marketing, communication and management in order to understand and actively shape how such innovations diffuse, how knowledge travels between actors, what cultural conditions enable or hinder adoption, and which ethical, legal and social aspects (ELSI) are critical for legitimacy.

Overall, the report is designed to support communication that is credible, science-based, non-misleading and socially constructive. It aims to help stakeholders communicate uncertainty transparently, frame innovation responsibly, and ultimately accelerate the socially legitimate transition to bio-based textile systems.

BIOTEXFUTURE is an innovation space on bio-based textile research funded by the German Federal Ministry of Research, Technology and Space (Bundesministerium für Forschung, Technologie und Raumfahrt, BMFTR). The project is led by the adidas AG and RWTH Aachen University.

Material Literacy | Rule and Trade | Circular Mindset | Network Effect | Social Transition | Future Textiles | Transition Lab

OBJECTIVES

Transition Lab brings together a diverse network of partners, ranging from leading German companies in the textile industry to renowned universities and research institutes. This collaborative platform unites the expertise of industry and academia to drive innovation across the entire textile value chain.

Raw Materials

A bio-based raw material for plastics and finishes that is holistically sustainable.

Industrial Application

The application in the textile industry starting at biopolymer development to producing textiles.

Societal Transformation

The overall societal transformation towards a bio-economy from a social and economic perspective.

Material Literacy

Material Literacy | Rule and Trade | Circular Mindset | Network Effect | Social Transition | Future Textiles | Transition Lab

Executive Summary

Read Insight Studies

LEARNING 1

Increasing the consumer awareness of bioplastics is important in order to promote bio-based apparel.

LEARNING 2

Use transparent communication why PFAS-free innovation matters without technical jargon. Frame alternatives as performance-equal, or superior to traditional PFAS-based options.

LEARNING 3

Align care requirements with everyday habits. Garments with realistic, flexible care needs will be better maintained and used longer.

LEARNING 4

Collaborate with industry to standardize engaging, intuitive care labels, possibly incorporating sustainability nudges.

What does bio-based really mean?

Bio-based materials are wholly or partly derived from biomass, such as plants, trees or animals. The biomass can have undergone physical, chemical or biological treatment. Materials derived from fossil sources are excluded.
Bio-based materials are not necessarily biodegradable.



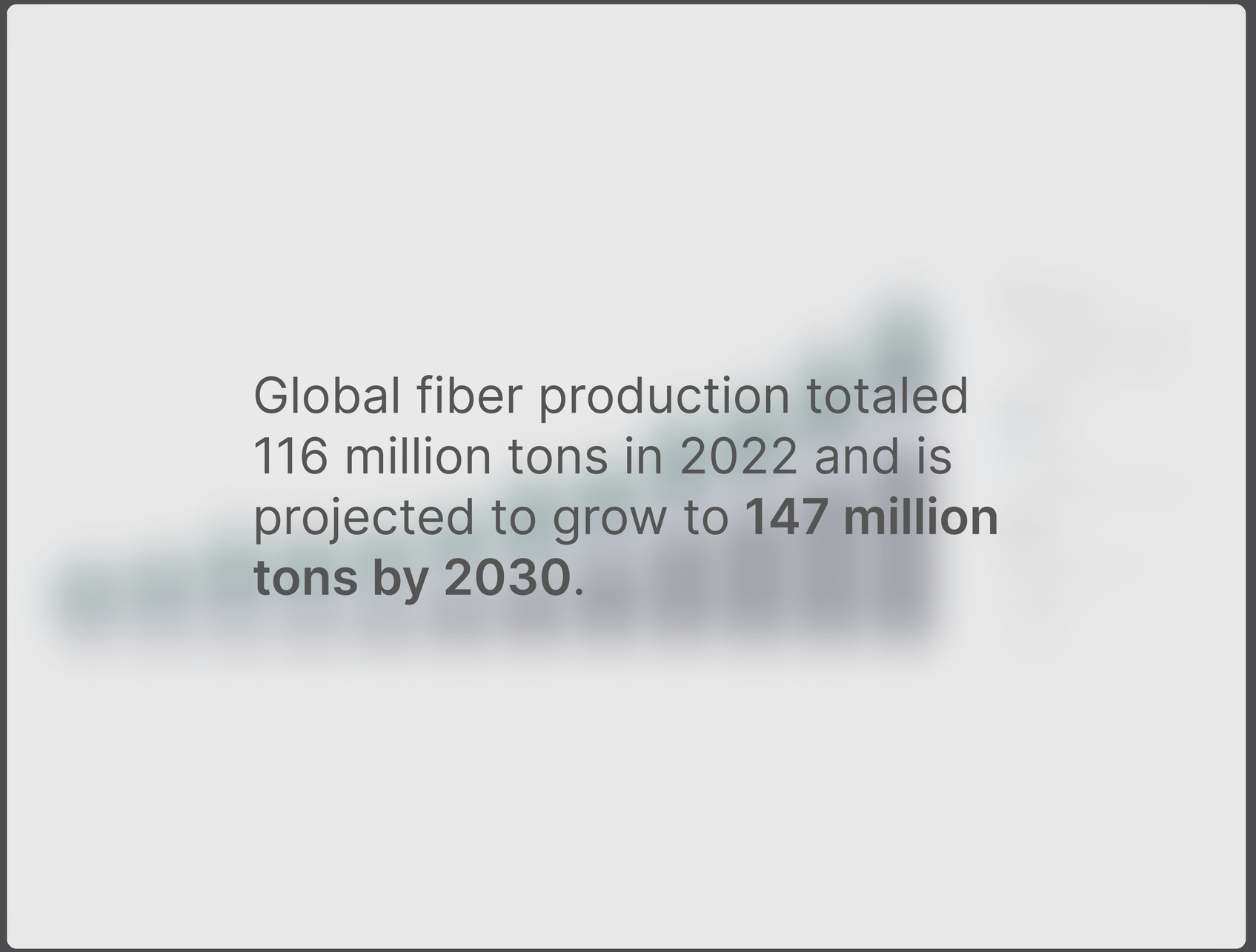
Biopolymers are not an entirely new concept.

BIOPOLYMERS FROM ORIGINS TO RENEWAL

Phase 1	EARLY INDUSTRY In the 18th century, the discovery of biopolymer materials drove a shift from rare natural materials to synthetic materials.
Phase 2	CHEMURGY MOVEMENT This development peaked in the 1930s, when Henry Ford promoted soy-based biopolymers in the automotive industry.
Phase 3	RISE OF PETROCHEMICALS World War II spurred petrochemical innovation and, with cheap oil, ended the early bioplastic era.
Phase 4	NICHE DEVELOPMENT From the 1980s, biopolymer development resumed but remained limited to niche uses, mainly in medicine and pharma.
Phase 5	RENAISSANCE With increasing awareness of plastic waste's environmental impact, interest in bioplastics for large-scale use has revived.

↗ Insight Session 11

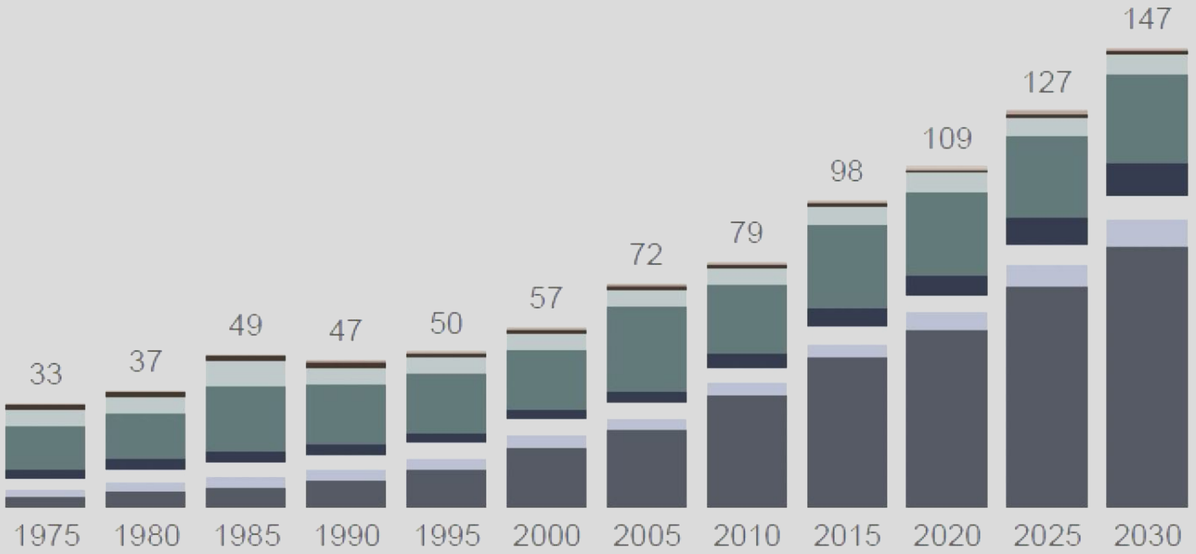
FIBER PRODUCTION 1975 - 2030



↗ Insight Session 35

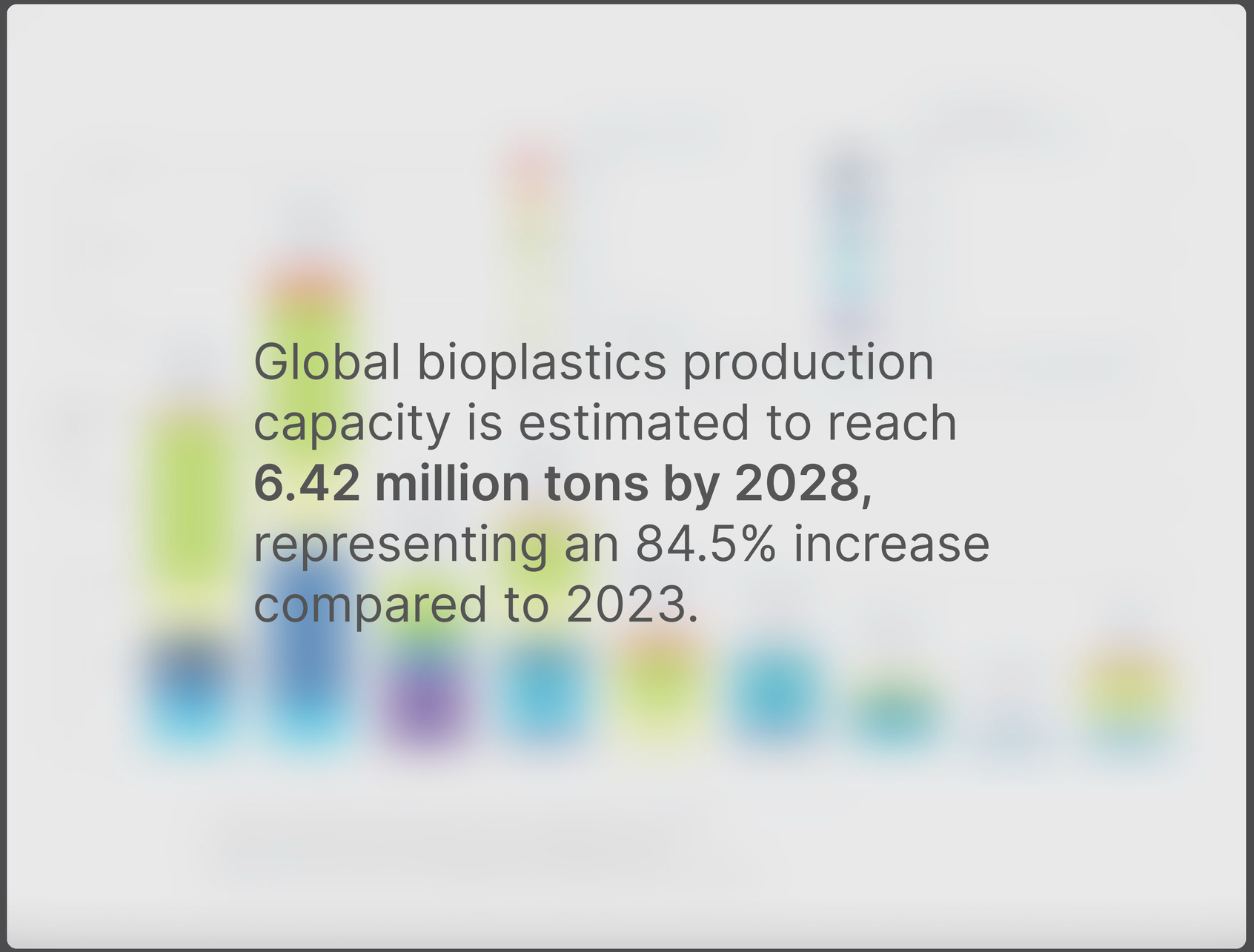
Global fiber production 1975 – 2030 (estimated in million tonnes). Source: Textile Exchange: Materials Market Report 2023. Based on data from CIRFS, FAO, ICAC, IVC, IWTO, Maia Research and its own modeling.

FIBER PRODUCTION 1975 - 2030



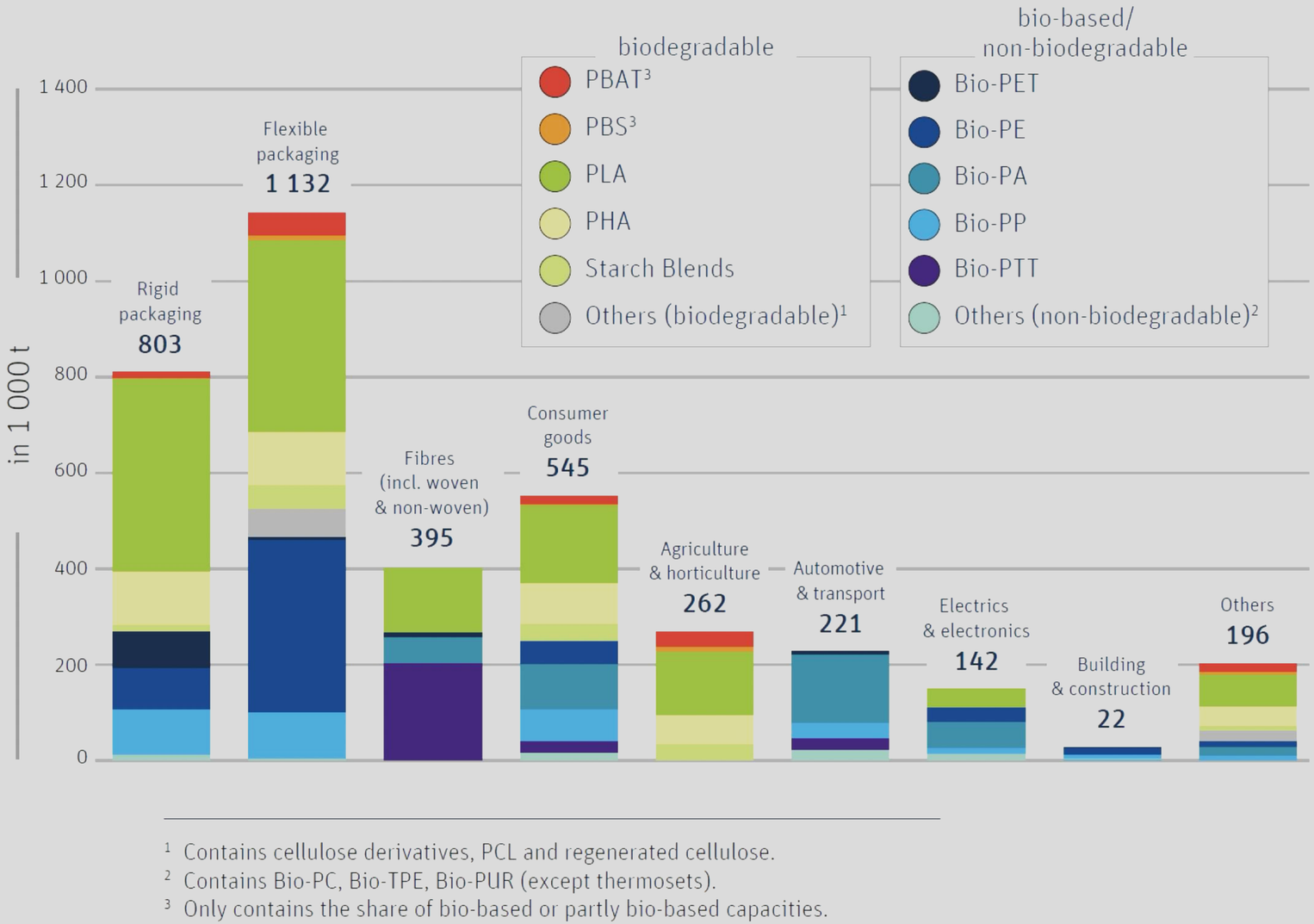
Global fiber production 1975 – 2030 (estimated in million tonnes). Source: Textile Exchange: Materials Market Report 2023. Based on data from CIRFS, FAO, ICAC, IVC, IWTO, Maia Research and its own modeling.

BIOPOLYMER PRODUCTION est. 2028



Global bio-plastics production capacities by application areas of 2028 (estimated). Source: Institute for Bioplastics and Biocomposites, Hannover: Biopolymers Facts and Statistics 2023.

BIOPOLYMER PRODUCTION est. 2028



[1] Contains cellulose derivatives, PCL and regenerated cellulose.
[2] Contains Bio-PC, Bio-TPE, Bio-PUR (except thermosets).
[3] Only contains the share of bio-based or partly bio-based capacities.

Global bio-plastics production capacities by application areas of 2028 (estimated). Source: Institute for Bioplastics and Biocomposites, Hannover: Biopolymers Facts and Statistics 2023.

Bio-Based Products

↗ Insight Session 05

Adidas AG

CONSUMER PERCEPTIONS OF BIO-BASED PRODUCTS

Type	Timeframe	Data	Method
Data Analysis	2021	16 Studies	Literature Review

The goal of this study is to summarize findings of empirical research on consumer perceptions of bio-based products.

BIO-BASED MATERIALS

MAIN FOCUS	OUT OF SCOPE
Bio-based products made from synthetic polymers.	Bio-based products made from natural materials.
Bio PET	Bio PTT	Cotton	Cashmere
Bio PA	PHA	Silk	Wool
Algae-Based Polymers	...	Wood	...

Which bio-based product attributes are important for consumers?

BIO-BASED PRODUCT ATTRIBUTES

45 %	Price
19 %	Product Certificate
14 %	Percentage of Bioplastic in Fabric
14 %	Origin of Resource
8 %	Biogenic Resource

Strong predictors of consumer preferences for bio-based apparel are prior product experience, green consumer values, and attitudes towards bioplastics. Increasing the awareness of bioplastics is important in order to promote bio-based apparel.

Bio-Based Fundamentals

Creating a better system from the outset.

SEETAL SOLANKI, 41, FOUNDER OF MATTER, UK/ NIGERIA

“We need to think about the long term effects (of new materials), what resources are we depleting instead? There is not a one size fits all solution. It’s the rate of consumption that we have to question, because I dont think we can just say – algae can replace plastic. It’s not about replacements, but finding alternatives, plural.”

Working in a state of radical transparency.

AMY CONGDON, 35, HEAD OF DESIGN INTELLIGENCE BIOFABRICATE, USA

“There’s a real desire from people to have an easy answer, like ‘bio’ must equal better. And you can’t put that blanket statement over all materials. So it’s trying to educate people to ask the right questions, to dig a little deeper to understand the technology to understand what they care about. Because everyone’s searching for that silver bullet material. And it doesn’t exist yet.”

Designing for a specific performance.

DANIEL NAVETTA, 40, FOUNDER OF FUTUREVVORLD, USA

“I don’t want to see these things in the market; if they’re gonna fall apart, they’ve got to be good. They’ve got to be competitive if we want people to really make these choices and make the better choice. We have to make sure these things are on par with or exceeding, the lifecycle of the products they’re trying to phase out.”

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Bio-Based Coatings

↗ Insight Session 45

Adidas AG

CONSUMER PERCEPTIONS OF BIO-BASED COATINGS IN RAIN JACKTS

Type	Timeframe	Data	Method
Workshop	2025	Questionnaires	Qualitative

The goal of the workshop was to understand consumer perception of bio-based and PFAS based coatings. To do so, a rain jacket was chosen as a relevant product context. Participants were informed about the purpose of the study and the SmartBioFinish project afterwards.

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SMART-BIOFINISH

PFAS are referred to as 'forever chemicals'. Regardless of their ecological or toxicological properties, extremely persistent substances pose a threat to the environment simply because they are irrecoverable and lead to environmental pollution lasting decades to centuries and eventually longer.

MOTIVATION

The upcoming EU REACH restriction will ban many PFAS in textiles from 2026, creating urgent demand for safer, sustainable alternatives.

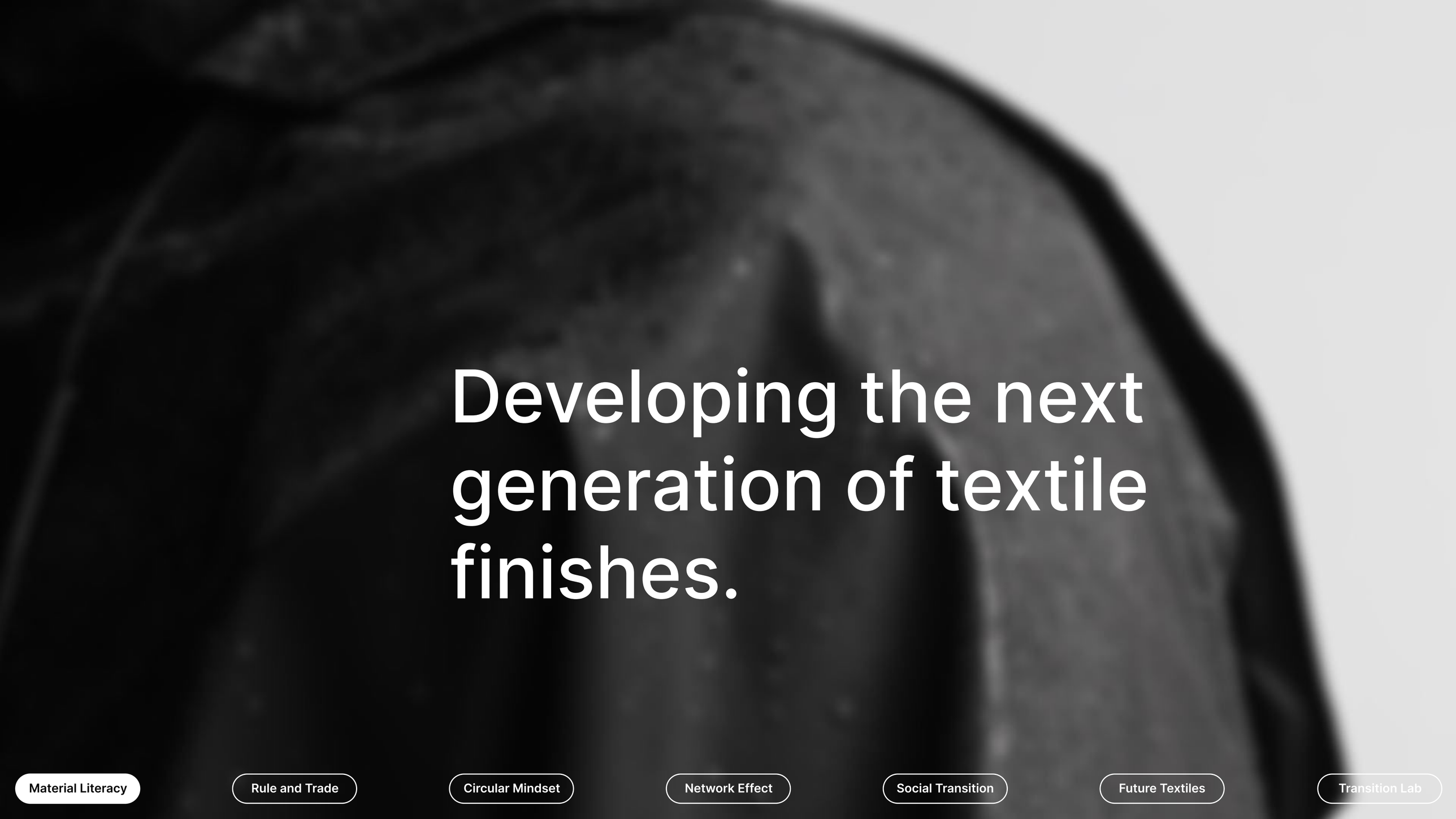
APPROACH

Developing a 100% bio-based water and oil-repellent textile finishes as a bio-based and scalable alternative to PFAS.

APPLICATION

Performance is validated in two real-world applications: sports textiles and personal protective equipment showing industrial relevance and regulatory readiness.

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Material Literacy

Rule and Trade

Circular Mindset

Network Effect

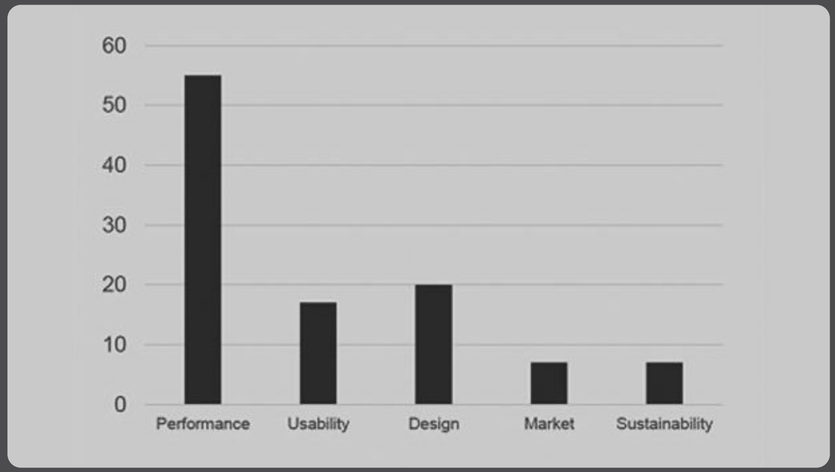
Social Transition

Future Textiles

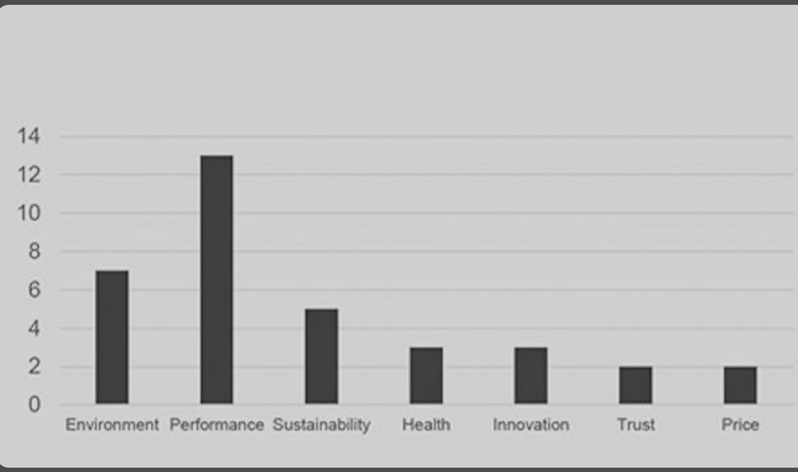
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SMART-BIOFINISH

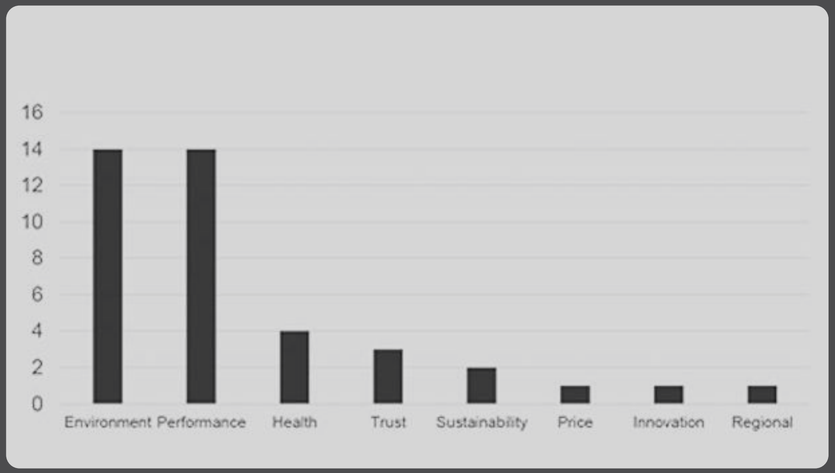
When considering the purchase of a rain jacket, what is most important to you?



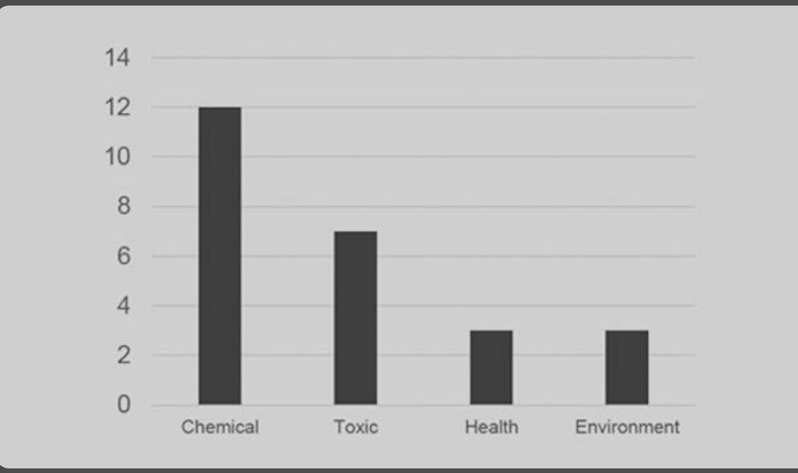
How would you feel about a bio-based coating instead of traditional synthetic options?



What are your general thoughts about bio-based coatings for a rain jacket?



What comes to your mind when you hear the words PFA or PFC chemistry?



Implication Advices

For Managers

EDUCATE BIO-BASED BENEFITS

Frame them as performance-equal, or superior alternatives to traditional PFAS-based options.

CLARIFY RISKS TRANSPARENTLY

Use transparent communication why PFAS-free innovation matters without technical jargon.

For Product Designers

CREATE FOR EASE OF CARE

Choose materials and construction that tolerate diverse care routines (e.g. machine-washable items).

BUILD FOR LONGELIVITY

Align care requirements with everyday habits. Garments with realistic, flexible care needs will be better maintained and used longer.

For Policy Makers and NGO’s

SUPPORT REGULATION

Campaigns should link product safety and sustainability to policy context.

ENCOURAGE LABEL INNOVATION

Collaborate with industry to standardize engaging, intuitive care labels, possibly incorporating sustainability nudges.

Rule

Trade

Executive Summary

Read Insight Studies

LEARNING 1

Regulation is necessary, because it works, establish trust, and provide direction (but it’s mostly coming to slow).

LEARNING 2

Transition comes down to systematic change. Behavioral and technological fixes do not work alone, because they need related changes.

LEARNING 3

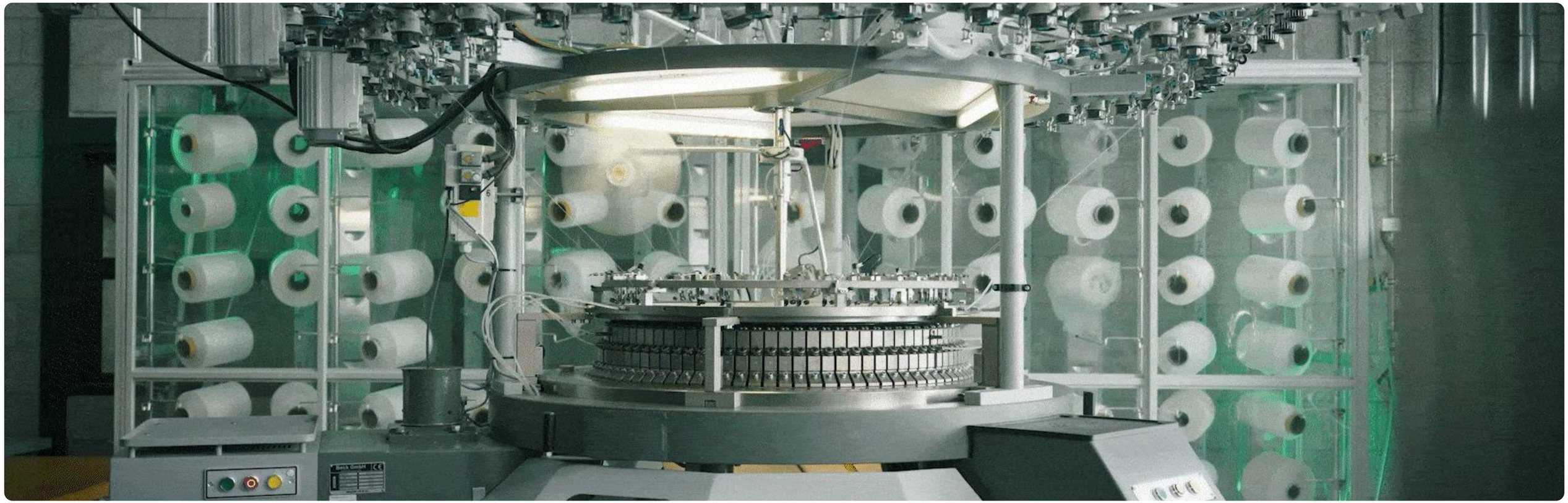
Experts are more critical in interviews, while position papers often fall into the affirmative spectrum.

LEARNING 4

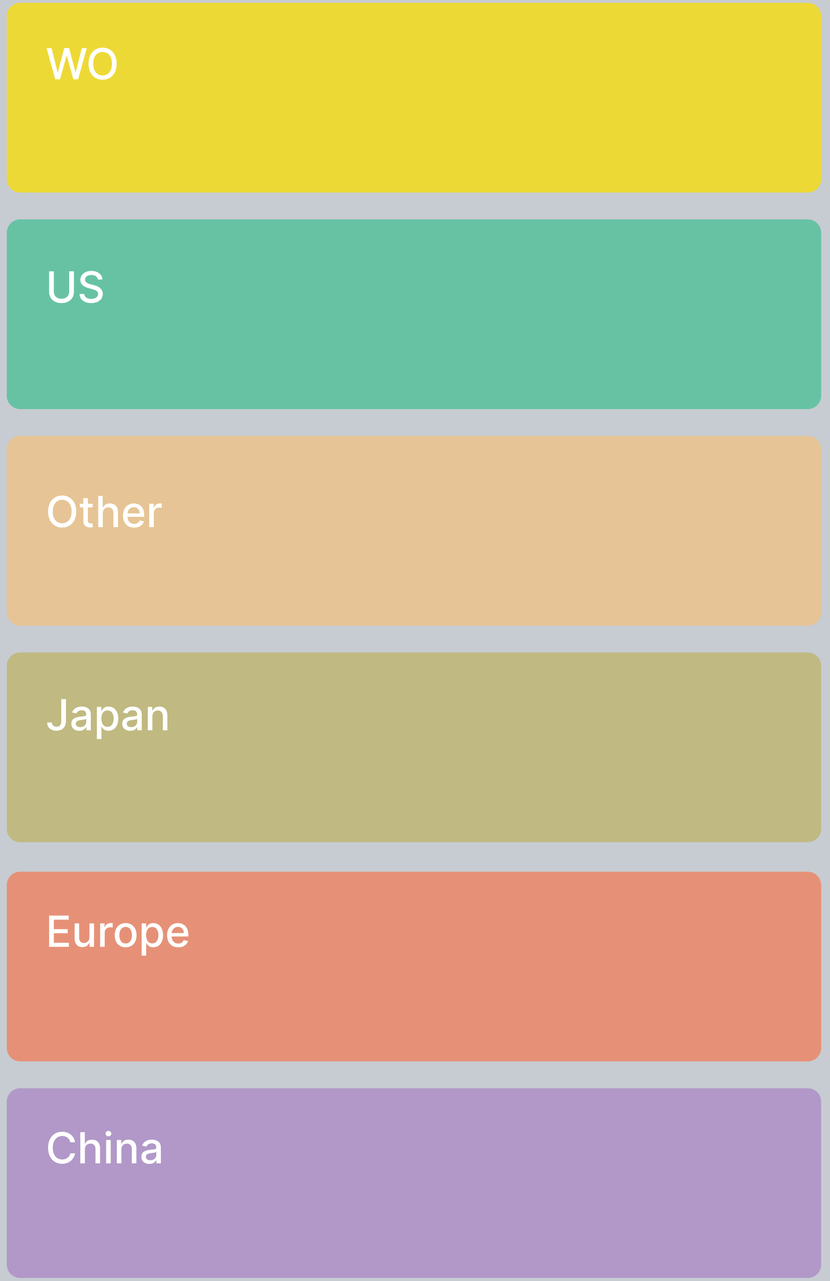
China shows exponential growth in patent applications over the last 20 years and has now overtaken Europe and the US.

How can the bioeconomy be defined?

The bioeconomy is a broad umbrella concept and funding framework that combines biotechnology, market innovation and sustainability. It aligns with the goals of the 2030 Agenda for Sustainable Development, promoting climate-neutral production, the sustainable use of natural resources and a reduced reliance on non-renewable materials.



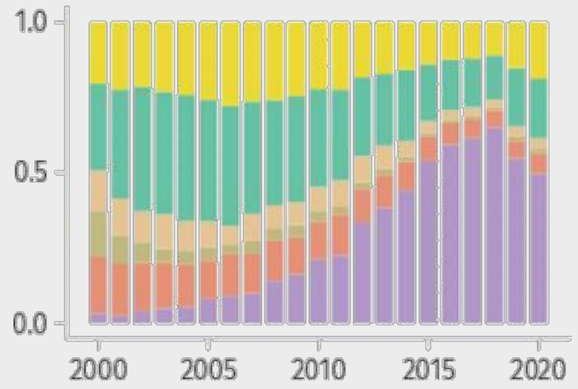
GLOBAL MARKET SHIFTS



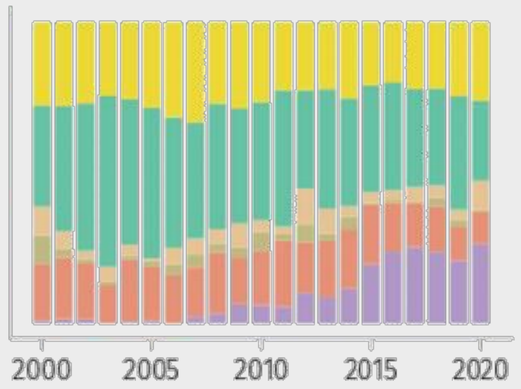
↗ Insight Session 11

Biopolymer patent applications per year are mostly steady in Europe, the US and Korea. There are signs of decline in Japan, with new applications especially for PLA decreasing over the last 10 years. China shows exponential growth in patent applications over the last 20 years and has now overtaken Europe and the US. This is especially the case for PLA and Cellulose, where around 50% of all patents are now filed in China.

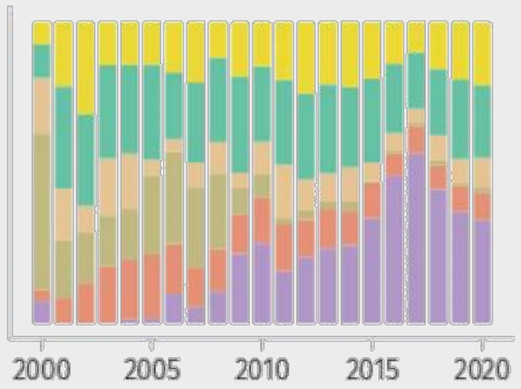
Cellulose



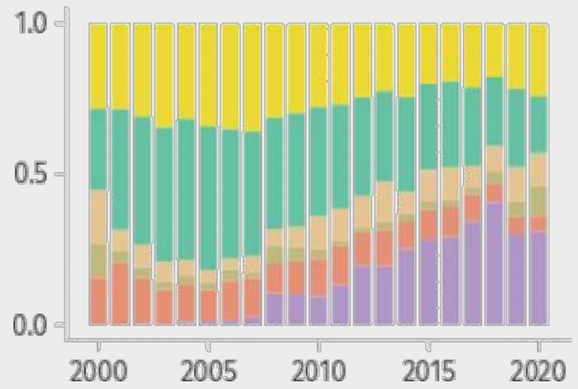
PA



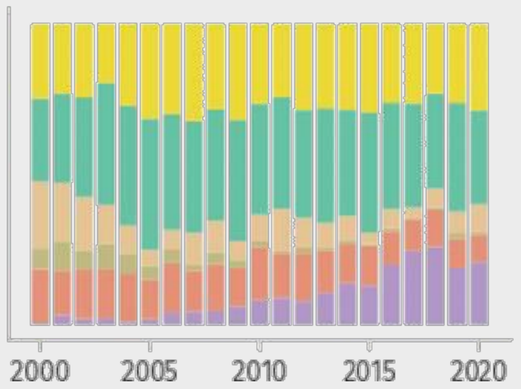
PBS



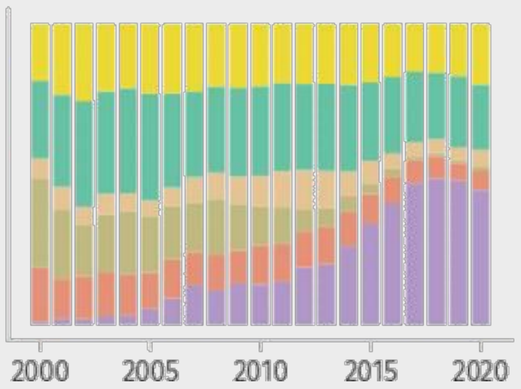
PE



PHA

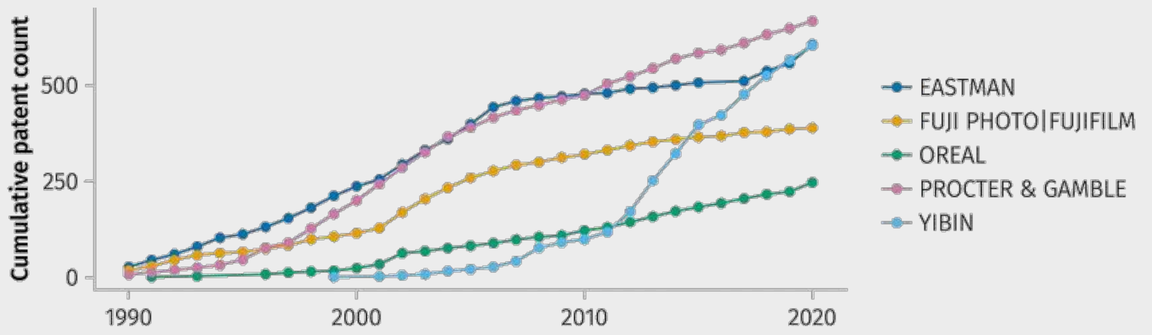


PLA

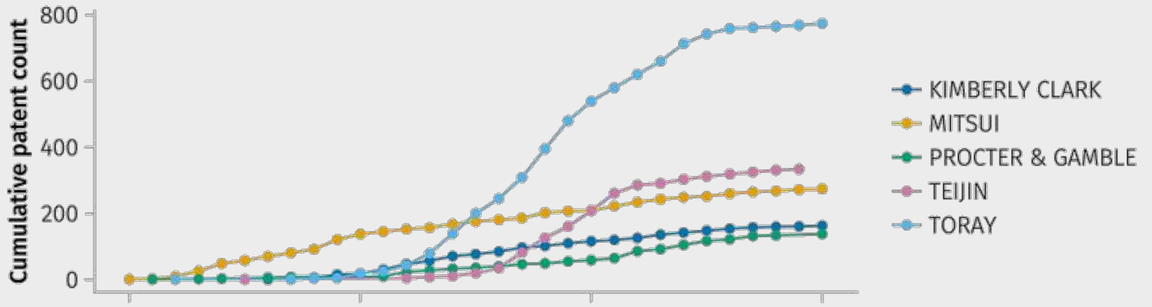


KEY POLYMER APPLICANT DEVELOPMENT

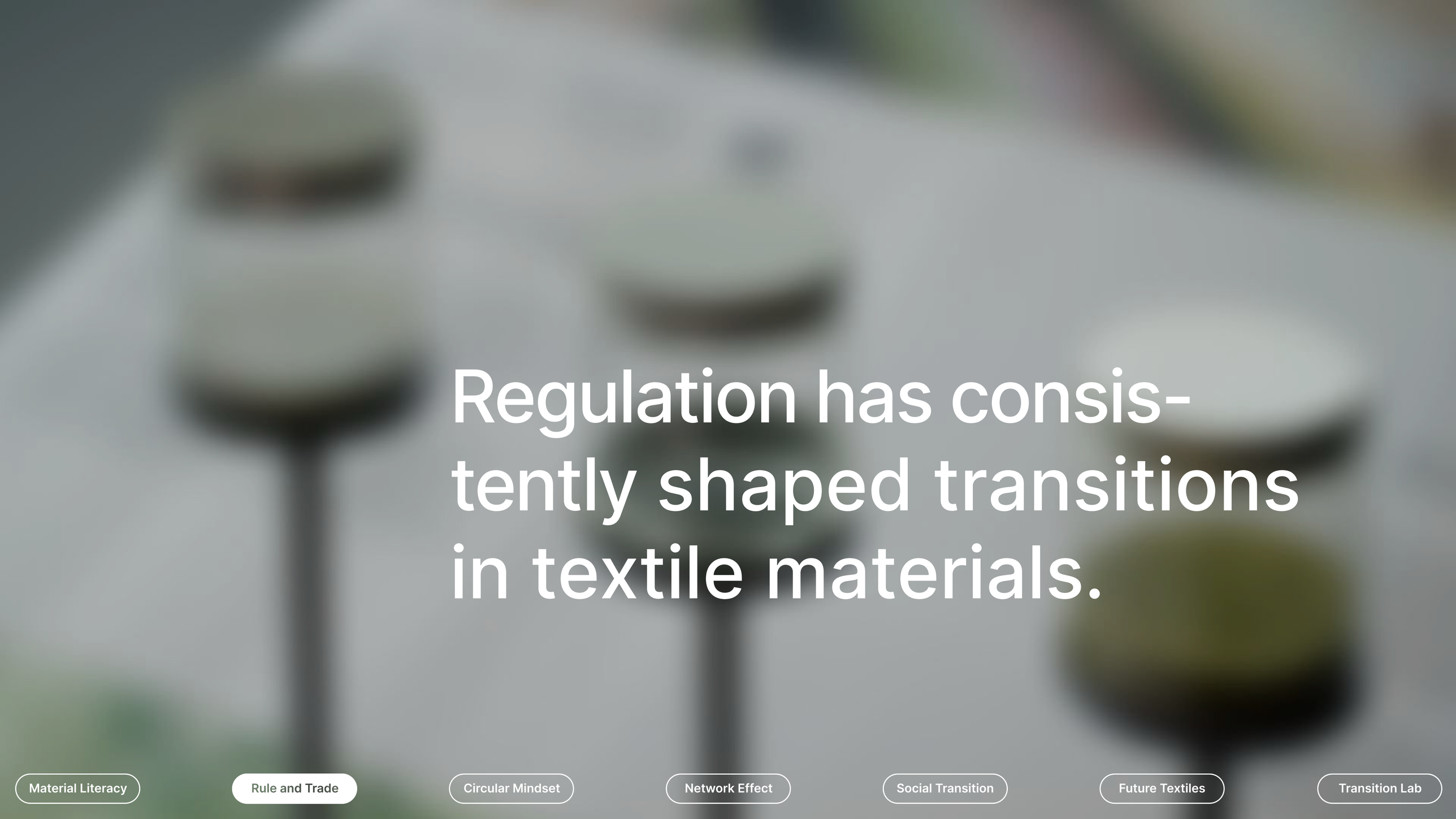
Cellulose



PLA



Cellulose patents are led by major US firms, legacy players and newcomers like Yibin Grace. PLA IP is dominated by Japanese chemical companies but shows slowed innovation. US firms also lead in niche biopolymers, while newer technologies like PEF highlight key research collaborations and application-driven players.



Regulation has consis-tently shaped transitions in textile materials.

Dependencies Regulation Drivers

↗ Insight Session 09

RWTH Aachen University

EXPERT PERSPEC-TIVES ON CHAL-LENGES FOR SUSTAINABILITY TRASNSITIONS

Type	Timeframe	Data	Method
Study	2022 – 23	14 Expert Interviews	Qualitative

The aim of this study is to summarise and consolidate the opinions and assessments of experts on bottlenecks and barriers to a bio-based future specifically for sustanainable transformation and regulation.

DEPENDENCIES AND DRIVERS

TECHNOLOGY

Dependence of biobased solutions on technology and infrastructural transformation.

ECONOMY

The Bioeconomy or even more specific biotechnology cannot avoid dealing with agriculture.

INDUSTRY

Collaboration across industries and societal boundaries is required.

SCALE UP

When decentralised production systems scale up, they influence the global economic system.

GROWTH

Either economic growth without more resources or an economy without growth.

Technological Innovation

“[...] for sustainability, technical progress is no longer everything that is new, but only that which goes in the right direction, that is my demand to research policy.”

Don´t try to change people behaviors, change value chains to be less harmful and more sustainable.

Behavioural Changes

"So we all know that, we don't have time now to always appeal to personal responsibility and to the good consumer, what else should he know?“

Role of behavioral change in sustainable transformation is seen as low, not for ineffectiveness, but because it is considered unrealistic.

System Change

”The most effective thing is the system change [...]. I don't think there is enough time left to wait for very long evolutionary processes until even the last person has realized that things can't go on like this.”

The main leverage point is system change, altering the physical infrastructure that shapes social norms and expectations.

REGULATION

Politically ensure the recyclability of products, also by specifying material properties. Persistence and inertia due to costs that do not lead to an immediate return on investment. This neglects the economic opportunities that a new way of thinking could offer. Should bio-based materials be allowed at all if there is no recycling infrastructure for them?

"Need for more regulation, because ..."

"... stricter regulations in the form of enforcement rules and mandatory requirements needed to make industry move. **Sanctions must hurt."**

"... it levels the playing field [...]."

"Regulation works, because ..."

"... local companies that subcontract the production and the political level that regulates the actions of these local companies should be **held responsible for the life cycle** of a textile product."

"... with the technological possibilities we have today, it must be possible for most things to be regulated in such a way that we no longer poison ourselves."

"Regulation works despite of ..."

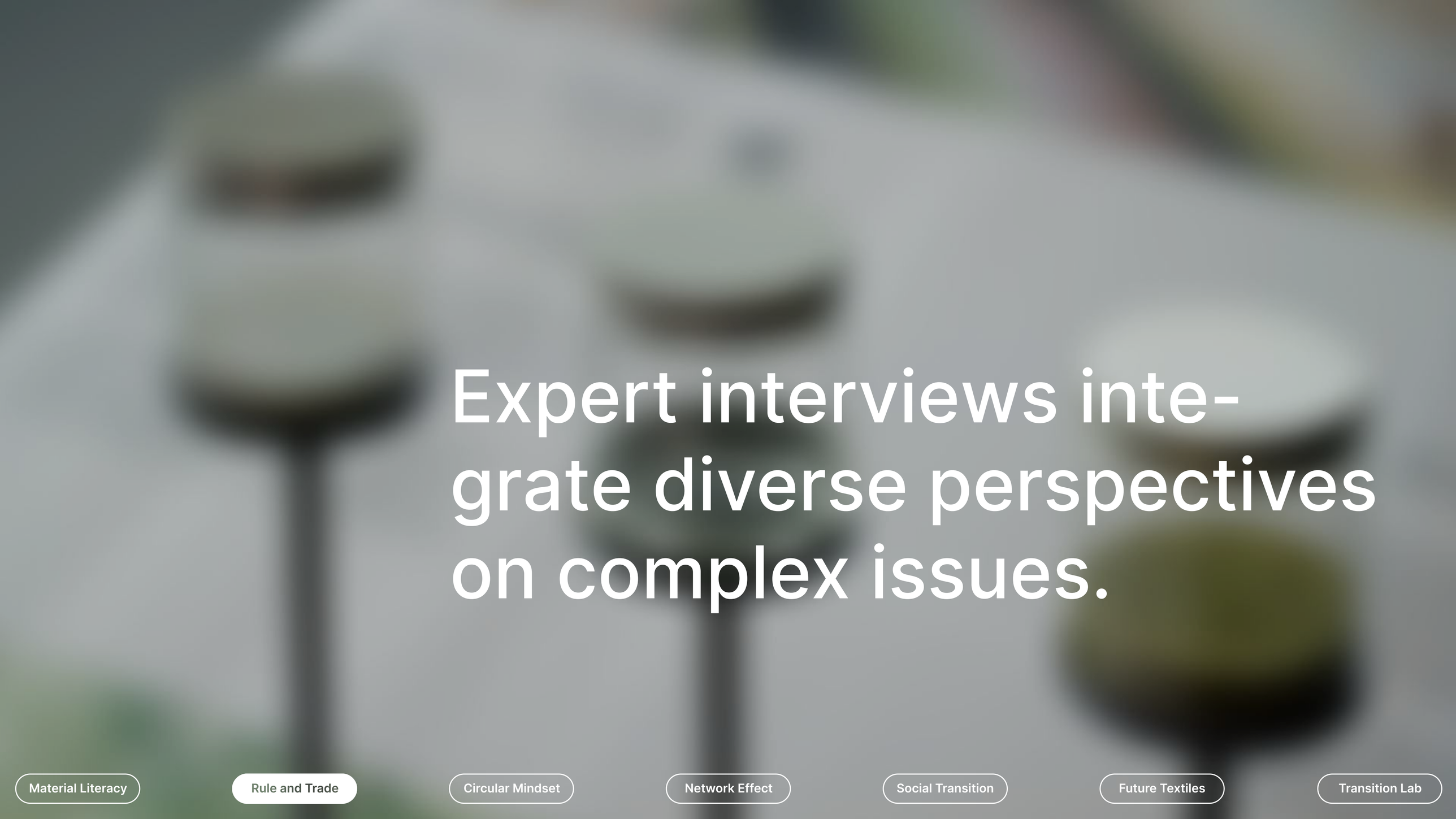
"... self-detachment tendencies from responsibility in politics and **self-regulatory tendencies** in industry ultimately lead to consumers being overwhelmed. "

"... it is unlikely that consumers can be well enough informed to collectively change their behaviour."

"... it only regulates what is already being **done anyway**."

"Regulation does not work, because ..."

"... it always takes effect **too late."**



Expert interviews integrate diverse perspectives on complex issues.

Key Learnings

Experts are more critical in interviews.

Regulation is a necessity.

Transition comes down to systematic change.

Naturalness may be a problem.

LEARNING 1

Most experts in interviews fall into the critical-pragmatic discourse, while position papers and research strategies often fall into the affirmative spectrum (eco-growth and sustainable capital).

LEARNING 2

Regulation is necessary, because it works, establish trust, and provide direction (but it is mostly coming to slow.

LEARNING 3

Behavioral and technological fixes do not work alone, because they need related changes in values, infrastructure, and business models.

LEARNING 4

Naturalness as guiding principle may hinder sustainable solutions.

Biopolymer Based Garments

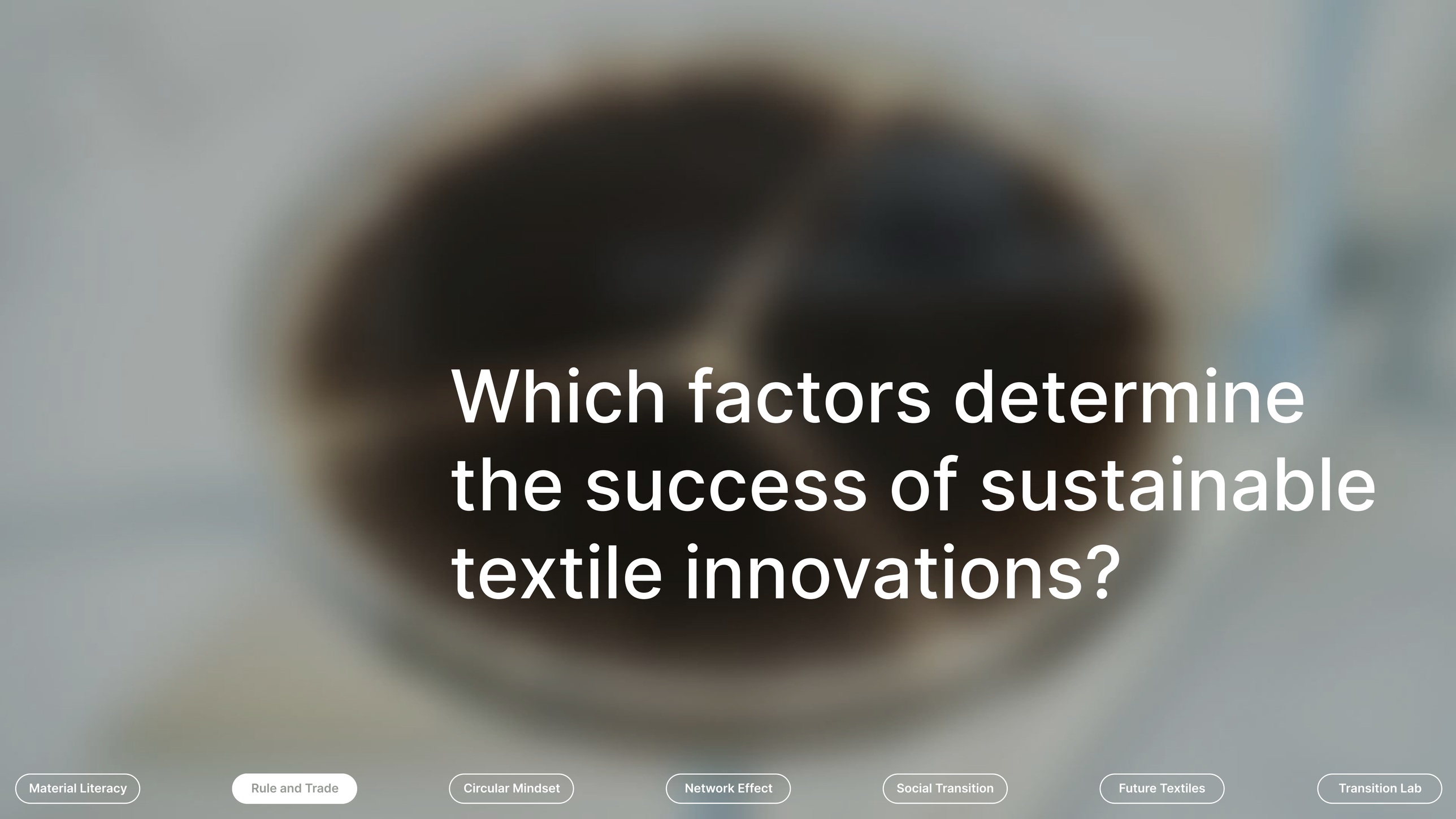
↗ Insight Session 23

University of Bayreuth

SUMMARIZING 40+ SURVEYS AND EXPERIMENTS

Type	Timeframe	Data	Method
Summary	2022 – 23	40+ Surveys/ Experiments	Quantitative Analysis

The research goal is to exploratively determine which social norms in relation to sustainable consumer behaviour in apparel purchasing can be identified based on the material, focusing on the contents, dynamics and interdependencies of these norms.


Which factors determine the success of sustainable textile innovations?

Success Factors

New product performance.

FACTOR 1

A key success factor is strong new product performance, which includes economic gains, positive image effects and environmental benefits.

Market and regulatory knowledge.

FACTOR 2

The success factors include fulfilling customer expectations, complying with laws and regulations and benefiting from financial or informational government support. Additional important aspects are understanding cultural influences on buying behavior, knowing what drives sustainable purchasing, recognizing consumption patterns of reference groups and continuously monitoring competitors.

Interfunctional Collaboration.

FACTOR 3

Success also depends on a cultural predisposition toward collaboration, supported by strong internal integration across R&D, marketing and production. Equally important is the involvement of external stakeholders such as suppliers, universities and environmental experts.

Innnovation-oriented learning.

FACTOR 4

Success is further supported by eliminating cultural barriers and building strong green competences, including proactivity, creativity and experimentation. Additionally, developing learning capabilities, especially critical and reflective analysis skills, plays an essential role.

R&D Investments.

FACCTOR 5

Success is strengthened by investing in cleaner technologies and sustainable product development methods, building a solid R&D structure and ensuring access to well-qualified human resources.

Circular Mindset

Executive Summary

Read Insight Studies

LEARNING 1

To successfully implement a circular business model, create effective incentives for consumers, combining a monetary and a social component.

LEARNING 2

A promising incentive for consumers to return their used clothing is when brands donate to charity.

LEARNING 3

Only 7 – 8% of respondents would consider using rental subscription models for sport shoes. Sustainability plays little role in their choices, labels are unimportant, while fees and total value are decisive.

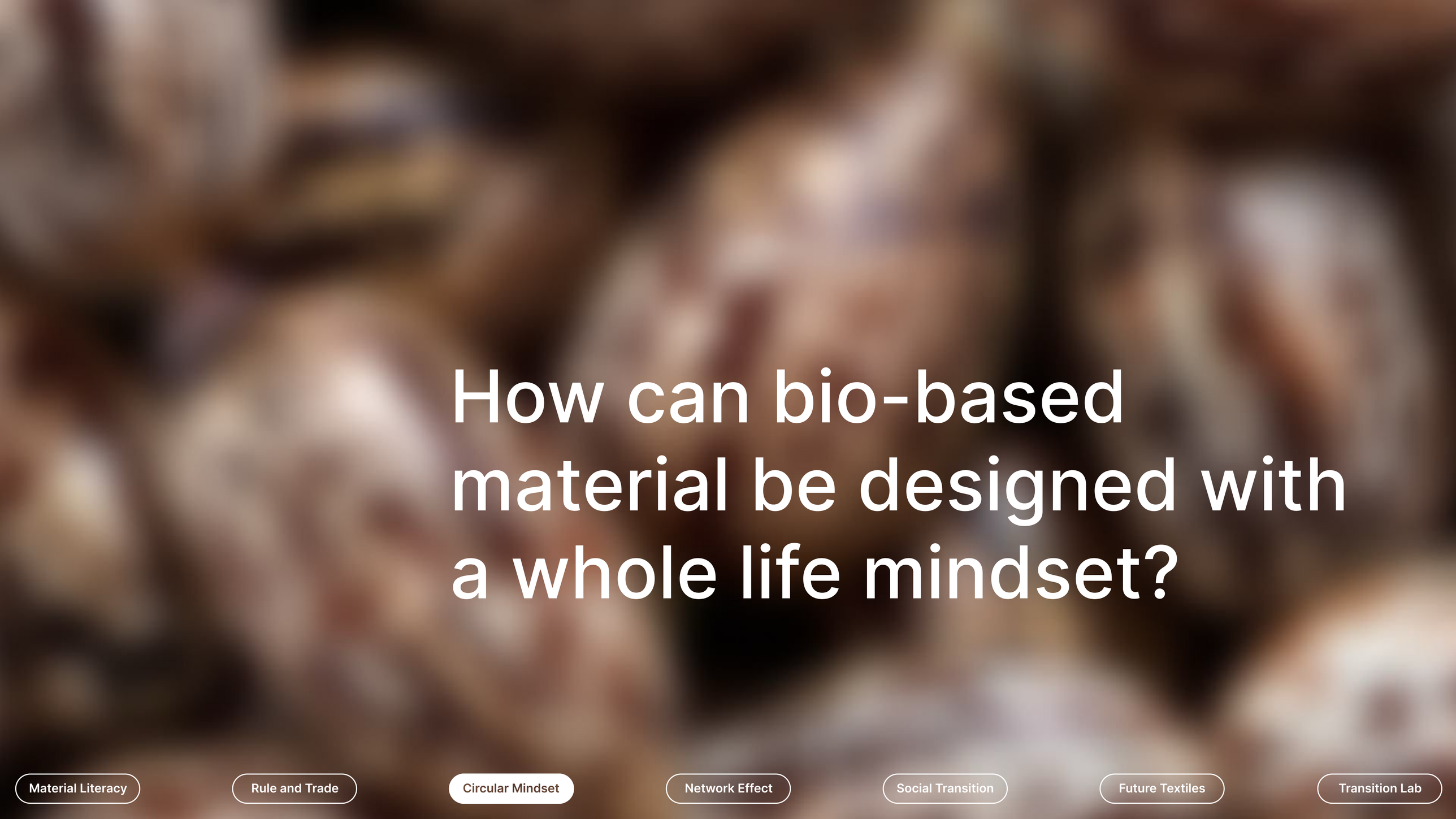
LEARNING 4

The main barrier to returning shoes remains greenwashing skepticism (77%).

What is needed for closed-loop thinking?

Two lenses must inform and shape the material life cycle, demonstrating industry-wide solutions and defining the business case and cultural positioning to adopt bio-based materials. These kind of materials need to overcome the negative impacts and offer positive solutions for the planet and the people.





How can bio-based material be designed with a whole life mindset?

CIRCULAR MATERIALS

Raw Materials

PERCEPTIONS

Where do they come from? How far away are they grown or produced? Do the alternative raw materials cause resource depletion? Can the raw materials be lab-grown, or are they still part of traditional agriculture?

OPPORTUNITIES

Utilisies the by-product of other industries. Grown in a closed-loop lab, so no wasted recources.

Manufacture

PERCEPTIONS

How are they designed, and where are they made? Who has processed the raw material? What happens to the waste at this stage? How have they been designed to be repaired or broken down for parts?

OPPORTUNITIES

Energy, textiles and water are reused within the local community. Modular design for repair with interchangeable parts.

Use

PERCEPTIONS

What is the lifespan?
How can I avoid designed obsolescence?

OPPORTUNITIES

Access over ownership. Designed for repair and reuse, keeping the value of material in the community. Modular design to update components when there are updates.

End of Life

PERCEPTIONS

Will this material outlive me? Where does it go when I have finished with it? Who is responsible for recycling? Will it break down naturally? Will it have a toxic residue?

OPPORTUNITIES

Access to recycling at a local level, with producers investing in recycling technology. Working towards making it 100% recyclable.

↗ Insight Session 07

EU CIRCULAR ECONOMIC DIRECTIVES

- Circular Economy Action Plan
- Strategy for Sustainable and Circular Textiles
- Ecodesign Directive
- Single-Use Plastics Directive
- Extended Producer Responsibility

Insight Session 02

What drives interest in repairing, reusing and rethinking products?

Bio-Based Textiles in the Circular Economy

↗ Insight Session 44

University of Bayreuth

BIO-BASED TEXTILES AND THE CIRCULAR ECONOMY THE CONSUMER PERSPECTIVE

Type	Timeframe	Data	Method
Study	2025	Multiple	Choice Experiments

The goal of the investigation is to identify the success factors of bio-based textile product innovations by examining consumer acceptance and effective communication strategies, supported by a database of studies, while exploring aspects such as the circular economy.

Material Literacy | Rule and Trade | Circular Mindset | Network Effect | Social Transition | Future Textiles | Transition Lab

REPAIR

Starting Point

Some textile companies (e.g., Patagonia, GoreTex, Jack Wolfskin) actively promote low-cost repair services and many also provide DIY repair guides and videos. Should companies like Adidas offer similar repair options for products?

Main Study

Thirty-minute interviews with 16 hikers in December 2024 explored repair needs, experiences, and preferences, with analysis based on the jobs-to-be-done methodology and grounded theory.

Results

Repair needs depend on the quality and price of the product and service. DIY is an acceptable alternative (need for instructions and videos, hikers seem to be uninformed). Repair is a positive signal („can be repaired“). Companies should at least offer DIY instructions and videos (quick wins).

REUSE

Starting Point

One-time rentals and rental subscription models are already successful in the U.S. and offered in Germany by various providers. Are such sustainable fashion rental models attractive to the younger generation (up to 34 years)?

Main Study

A main study with 364 consumers (71% female, 29% male; 38% up to 24 years, 51% 25 up to 34 years, 11% older)used discrete choice experiments in which participants repeatedly selected their preferred subscription model with varying attributes.

Results

Only 7–8% of respondents would consider using rental subscription models, primarily young women and higher-income consumers. Sustainability plays little role in their choices – labels are unimportant, while fees and total value are decisive. The surprise effect of curated versus non-curated boxes has no measurable impact.

RETHINK

Starting Point

Since 2021, Adidas has been offering the dye-less, glue-less, fully recyclable performance running shoe “Ultraboost Made-To-Be-Remade” for about 180 €. Do consumers value this concept and how should it be marketed?

Main Study

The main study surveyed 179 consumers (58% female, 42% male; 60% sports students up to 28 years, 40% employees 40–50 years) who chose their preferred Ultraboost shoe with varying attributes. This enabled estimating willingness-to-pay for key made-to-be-remade features.

Results

Results show that Adidas is largely perceived as a sustainable shoe brand, described as sustainable (84%), quality-conscious (63%), innovative (44%) and trustworthy (36%). Key barriers to buying sustainable shoes include limited information (56%), high prices (32%) and skepticism or greenwashing concerns (27%). Most consumers have never returned sneakers before (77%). The term made-to-be-remade is considered useful by a majority (79%). However, the main barrier to returning shoes remains greenwashing skepticism (77%).

RETHINK



+41,38 € Made in Germany
+40,14 € 100% Made-To-Be-Remade
+35,63 € Made in Europe
+24,79 € 100% Biodegradable Material
+24,20 € 50% Made-To-Be-Remade
+23,54 € 100% Recycable
+20,80 € Trustable Recycling Seal
+18,26 € Wearing Comfort
+17,76 € Water-Repellent
+17,01 € White
+10,61 € 50% Recycable

Acceptable surcharges for Ultraboost running shoes reflect the average additional willingness-to-pay compared to a basic model. These values indicate how much more consumers are willing to spend for enhanced or sustainable features included in the concept.

Biopolymer Based Garments

↗ Insight Session 02

Adidas AG – University of Bayreuth

CONSUMER PERCEPTIONS OF BIOPOLYMER-BASED GARMENTS

Type	Timeframe	Data	Method
Study	2021	5 Online Surveys	Quantitative

The goal of this research is to examine consumer perceptions of biopolymer-based garments by conducting five empirical studies.

STUDY OVERVIEW

STUDY 1

Which factors influence the purchase inention for biopolymer-based textiles?

METHOD

Confirmatory factor analysis in R, linear regression analysis in SPSS

KEY INSIGHT

Brand reputation has no influence on consumers' purchase intention for biopolymer-based garments. In simple words, when purchasing biopolymer-based garments, established brands do not have a 'brand advantage' compared to new/ unknown brands.

STUDY 2

Does the use of an official versus a corporate seal enhance the purchase intention for a biopolymer-based sneaker?

METHOD

Confirmatory factor analysis in R, ANOVA in SPSS

KEY INSIGHT

A corporate label can significantly increase consumers' purchase intention for biopolymer-based sneakers compared to sneakers without any label or certification. In contrast, a third-party certification does not necessarily enhance consumers' purchase intention for biopolymer-based products compared to products without any label or certification.

STUDY 3

Can content of influencers, enhance customer satisfaction and thus, help overcoming the attitude-behaviour gap?

METHOD

Kano Method

KEY INSIGHT

Blogs and product descriptions addressing environmentally friendly aspects as well as the benefits of biopolymers have the potential to educate the mainstream consumer and encourage the formation of positive attitudes for future purchases.

STUDY 4

Which incentive does consumers motivate the most to return their used garments in order to enable a circular buisness model?

METHOD

Anchored max diffusing probability scores with Sawtooth Lighthouse Studio

KEY INSIGHT

Socially oriented and monetary incentives are the best option to motivate consumers to return their used garments. Of all incentives considered, consumers are most likely to become dissatisfied when a donation to charity is lacking

STUDY 5

Which incentive enhances customer satisfaction for the return of used garments in order to enable a circular business model?

METHOD

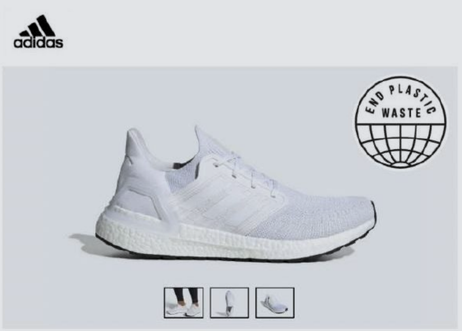
Kano Method

KEY INSIGHT

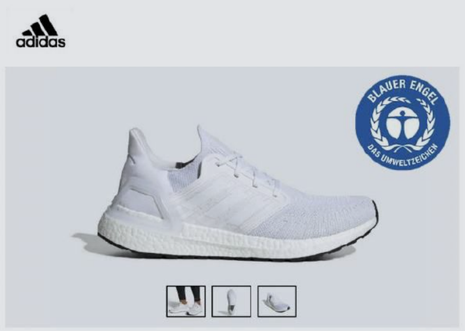
An approach could be to offer consumers the option of choosing between social and monetary incentives. A very promising incentive for consumers to return their used clothing is when brands donate to charity.

OFFICIAL OR CORPORATE SEALS?

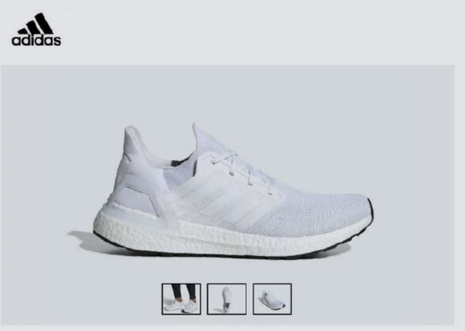
Corporate Label



Third Party Certification



Control Group



Evaluation

QUOTE

"I would purchase this sneaker if I happen to see it in an online shop."

1 Extremely Likely

5 Extremely Unlikely

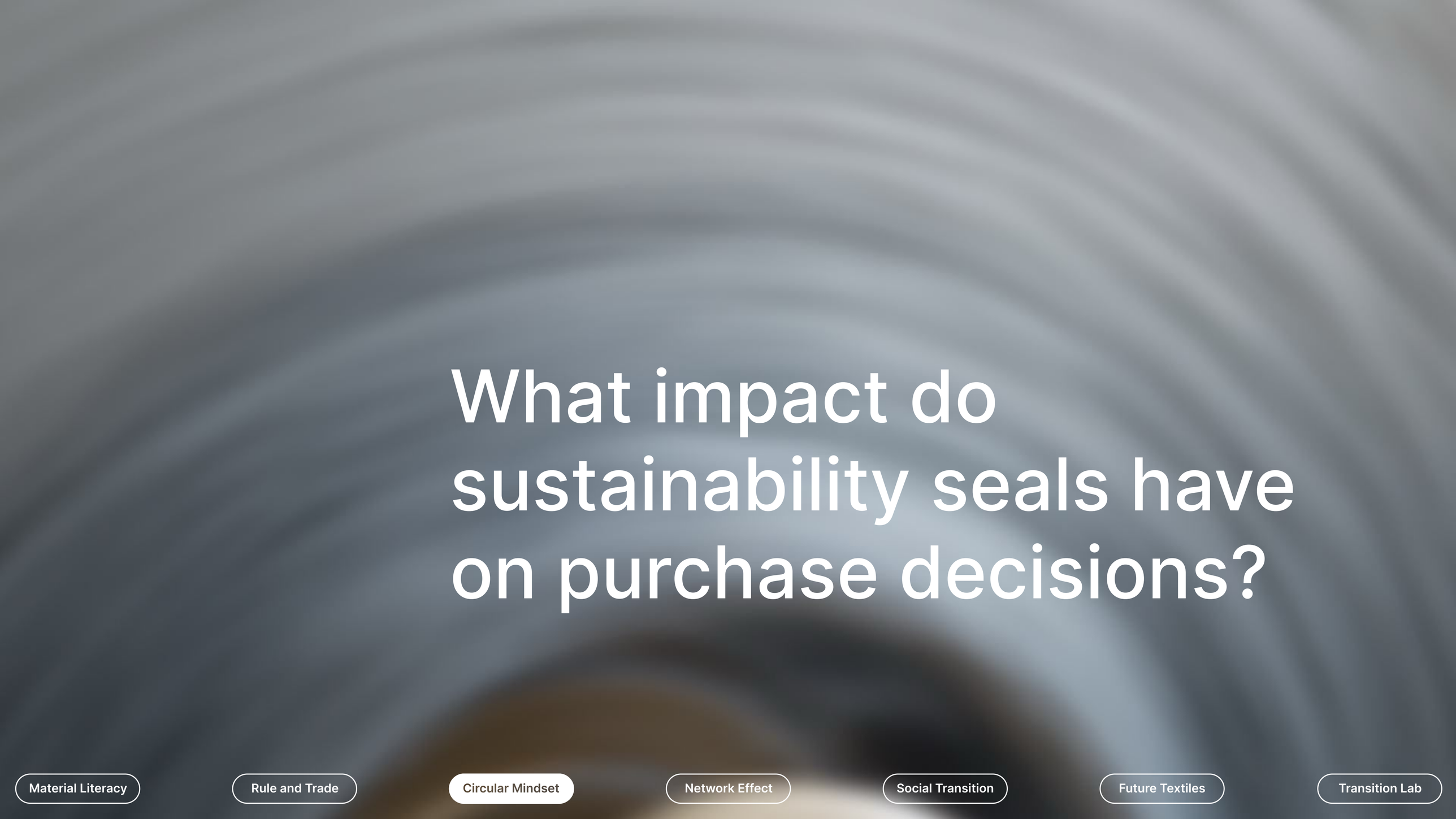
PURCHASE INTENTION



3,76 Corporate Label

3,62 Third party certification

3,38 No Label


What impact do sustainability seals have on purchase decisions?

Communication Guidelines

Visibility

GUIDELINE 1

Keep in mind that market entry barriers for new/unknown brands are decreasing, as consumers are not necessarily loyal to familiar brands when purchasing biopolymer-based products.

Transparency

GUIDELINE 2

Provide transparent and authentic information on biopolymer-based products to drive consumers' purchase decisions.

Information

GUIDELINE 3

In order to avoid negative consumer reactions, provide information on how materials of biopolymer-based garments are made and where they come from.

Labels

GUIDELINE 4

Use a meaningful sustainability label to mark biopolymer-based products as such.

Incentives

GUIDELINE 5

To successfully implement a circular business model, create effective incentives for consumers to return their used clothing that combine both a monetary as well as a social component.

Network Effect

Executive Summary

Read Insight Studies

LEARNING 1

Come together across industries in collaboration, not competition, to expedite the transition to fossil-fuel-free materials.

LEARNING 2

Inspire relationships with materials that reflect their biological potential. Stop making niche eco-collections that lack commitment and impact.

LEARNING 3

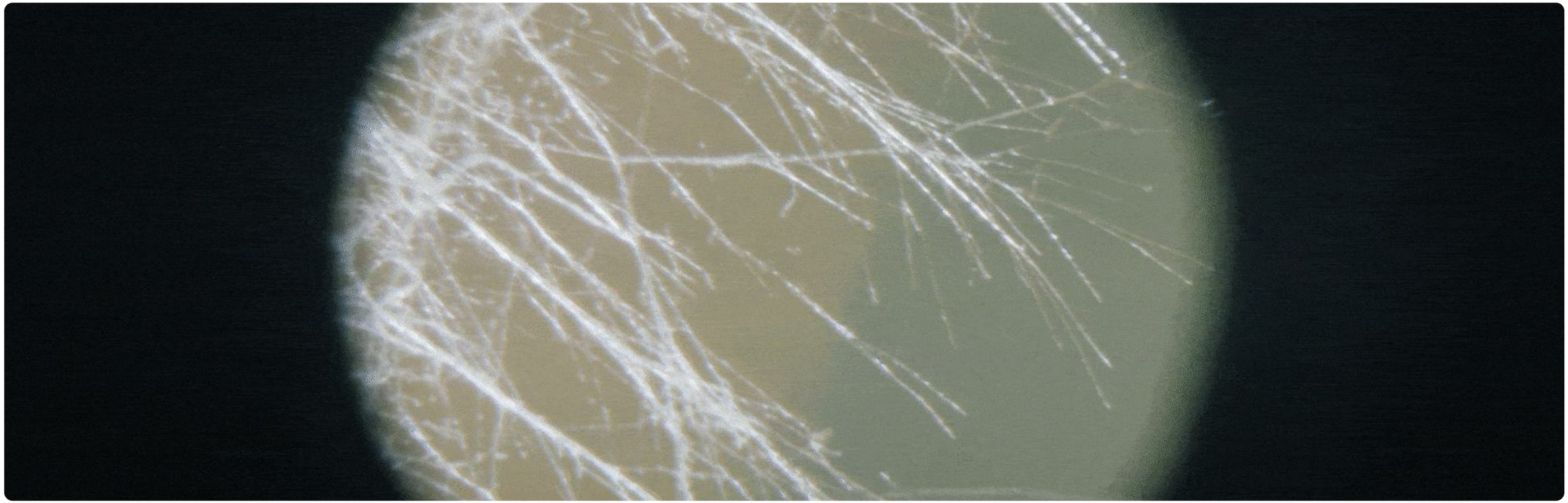
Effective sustainability communication requires a personalized approach tailored to each audience, clear storytelling that goes beyond data and transparency to build trust.

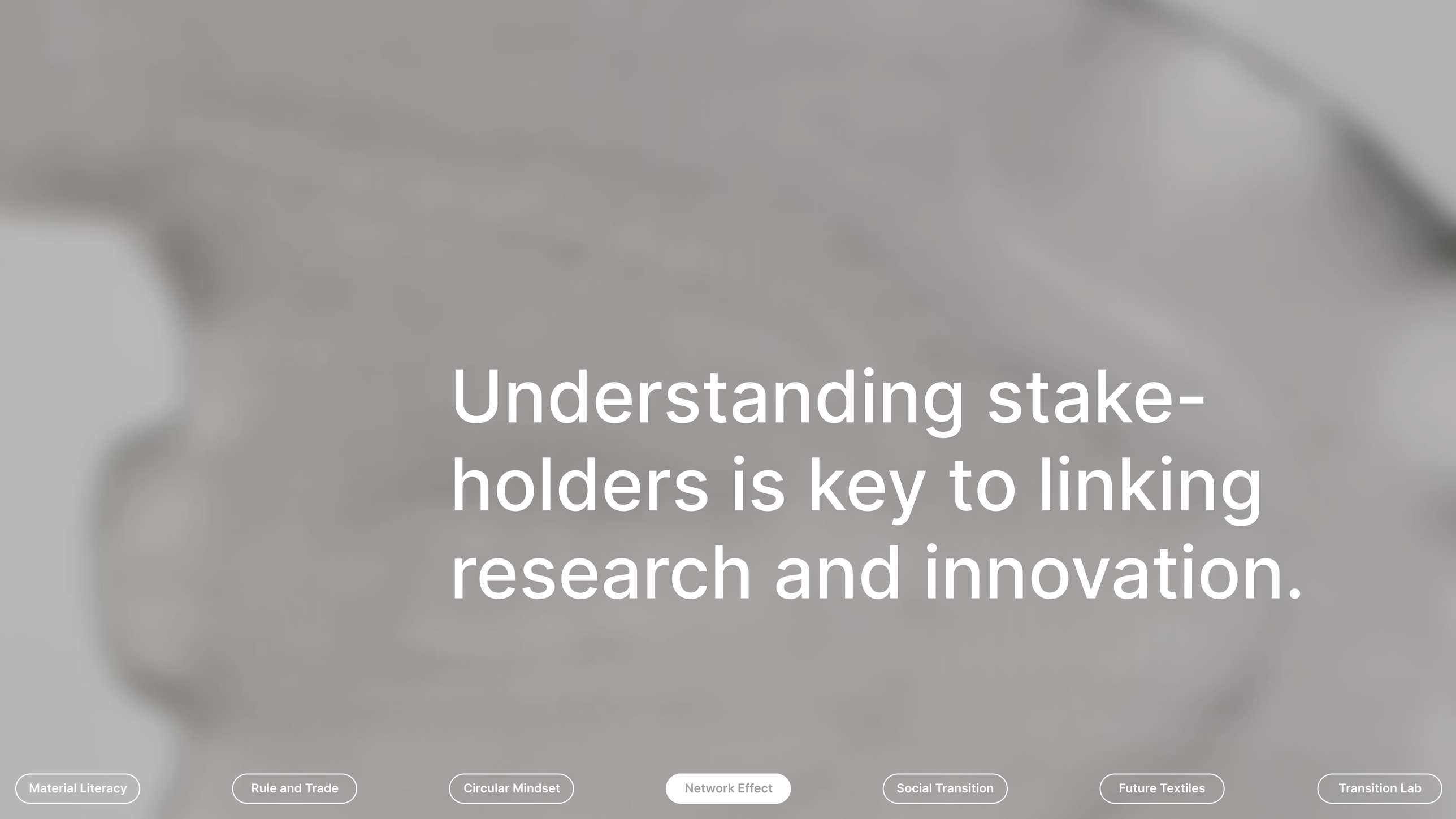
LEARNING 4

Engage in meaningful dialogue through public discussions and social media. Collaborate on awareness campaigns or joint advocacy initiatives.

How does the network drive innovation?

A network of stakeholders in the textile industry drives innovation by bringing together businesses, academia and research. Through collaboration and knowledge exchange, it connects science and practice, accelerates new developments and advances a more sustainable textile industry.





Understanding stake-holders is key to linking research and innovation.

Bioeconomy Stakeholders

↗ Insight Session 14

University of Duisburg-Essen

IDENTIFYING INFLUENTIAL STAKEHOLDER GROUPS

Type	Timeframe	Data	Method
Data Analysis	2022	11.937.720 Tweets	Quantitative Analysis

The goal of the anaylsis is to categorize influential stakeholder groups communicating about biobased textiles and sustainable fashion as well as to identify the topics these stakeholders are talking about.

STAKEHOLDER CLASSIFICATION

Private Person	88.1 %	Engaging in communication about sustainable fashion.
Company	5.2 %	Producing or selling sustainable textiles.
Other Company	2.6 %	Communicating about sustainable fashion but without producing or selling it.
Media	1.2 %	Media organizations, journalists or bloggers that report or communicate about sustainable fashion.
Movements	1.0 %	NGOs or activists related to climate or sustainability.

The stakeholder classification revealed 10 different bioeconomy stakeholder groups which are active on social media. The largest group are private persons with 88,1% of posts from them.

STAKEHOLDER CLASSIFICATION

Influencer	1.0 %	Actors with many followers and influence on organizational stakeholders through, e.g. content distribution.
Investor	0.5 %	All actors and actions of the financial market that can have an impact on sustainability efforts of a company.
Institution	0.2 %	Public institutions or organisations.
Research	0.2 %	Academical institutions or researchers.
Policy Makers	>0.1 %	All legislators who can influence a company's business operations thorugh statutory provisions or regulations.

STAKEHOLDER TOPICS

Environmental Protection

ENERGY SUPPLY

wind / solar / fossil
energy / fuel / electricity

NFTS AND BLOCKCHAIN

nft / token / crypto
community / marketing

CONSEQUENCES OF CLIMATE CHANGE

soil / weather / tree
report / year / planet

HANDMADE ORGANIC PRODUCTS

organic / vegan / leather
soap / tea / gift

CURRRENT CRISES

climate change
covid / war

CLIMATE PROTECTION

soil / weather / tree
report / year / planet

SUSTAINABLE CONSUMPTION

fashion / design / music
green / organic / nature

URBAN POLLUTION

noise / air / road
pollution / quality

Sustainable Fashion

NFTS

nfts / nft community

FASHION INNOVATION

technology / innovation
sustainability

CELEBRITIES

influencer / award
fashion icon

JEWELLERY

jewellery / necklace
gift / handmade

FASHION ON SOCIAL MEDIA

ootd / fashionista
indluencer / fashionblogger

BRAND COMMUNICATION

click bio / today
designer / collection

OUTFITS

wear / look / choice / style

SECONDHAND SHOPPING

poshmark / shopmycloset

Networks Concerning Algae

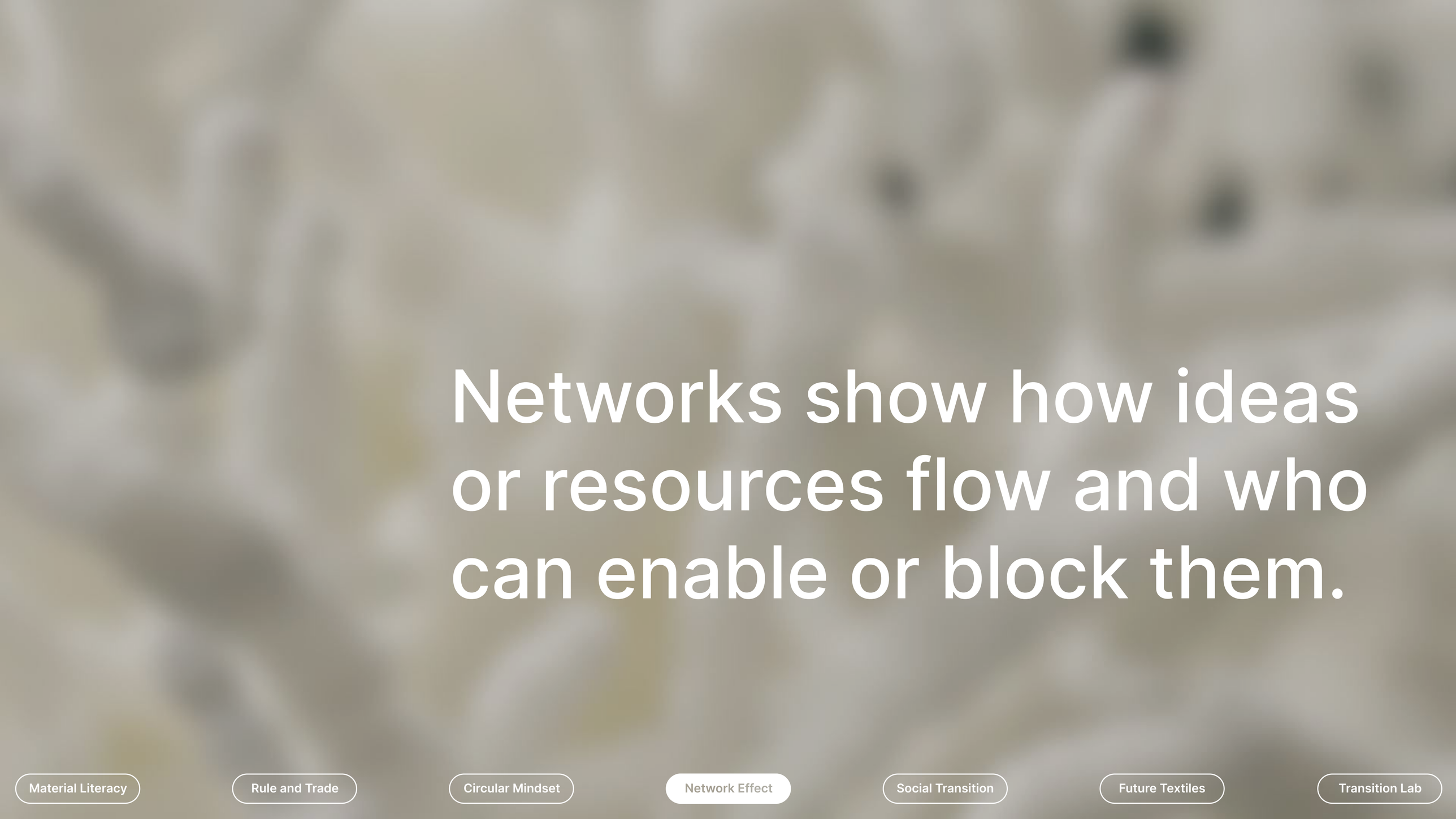
↗ Insight Session 10

RWTH Aachen University – University of Heidelberg

RESEARCH AND INNOVATION NET-WORKS IN THE BIOECONOMY

Type	Timeframe	Data	Method
Network Analysis	2019 – 22	Research Projects	Quantitative Analysis

The goal of the case study on algae was to analyze research and patent networks in the bioeconomy to uncover technological trends, key actors and bridging opportunities, with algae research used as an example to show how network data and expert insights can guide innovation and collaboration.



Networks show how ideas or resources flow and who can enable or block them.

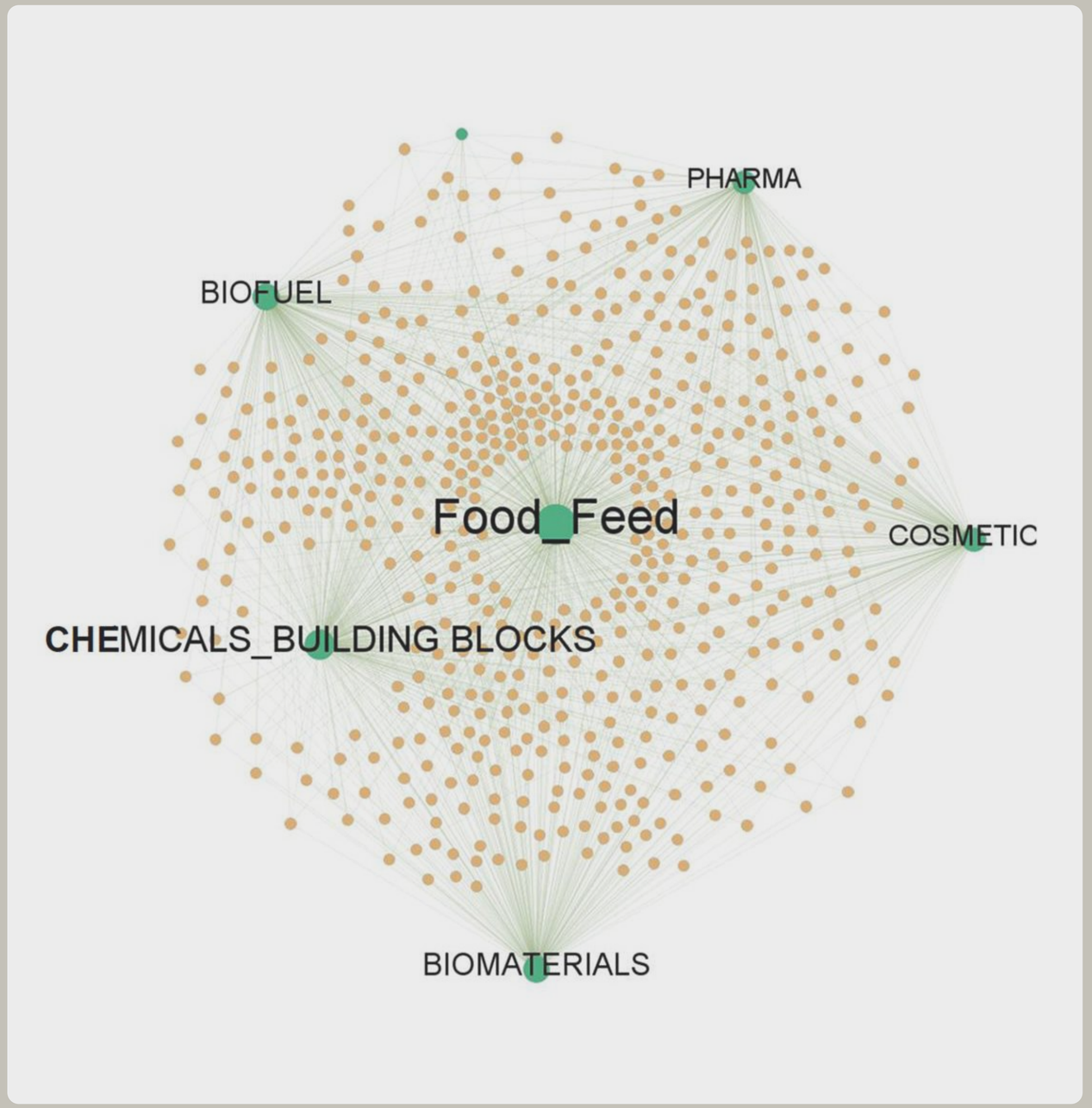
ORGANISATIONAL TIES TO APPLI-CATION FIELDS

TWO-MODE-NETWORK

Organisations and topics that use algae as feedstock for biorefinery or bioreactor technologies.

APPLICATION FIELDS

1 Food
2 Chemicals and Building Blocks
3 Biofuel
4 Pharma
5 Cosmetic
6 Biomaterials



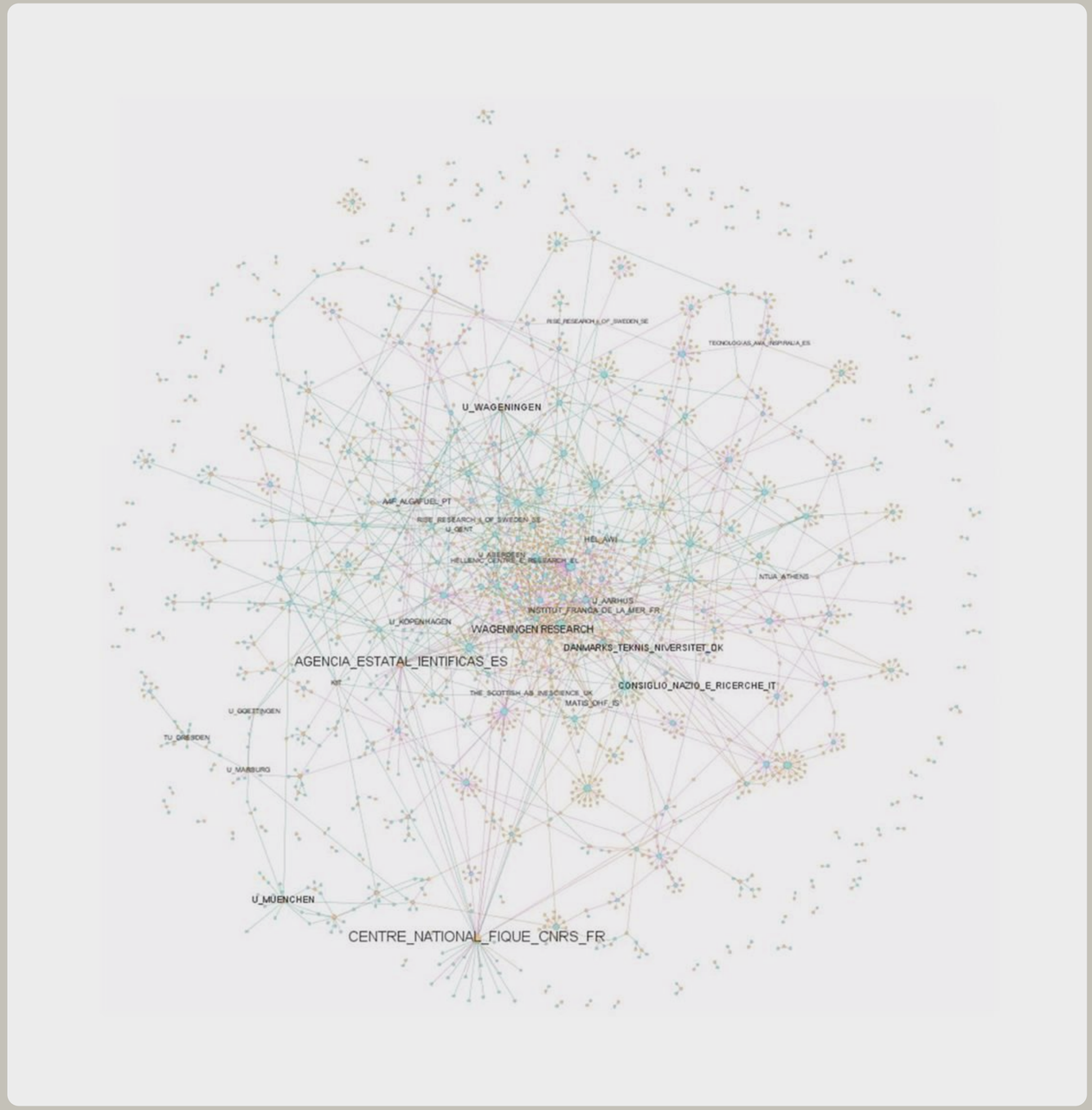
GLOBAL PERS-PECTIVE ON R&D

TWO-MODE-NETWORK

1489 Organisations
636 Projects
2010 – 2020

TYPES OF ALGAE

36,77% Algae
39,29% Micro-Algae
20,94% Macro-Algae
03,00% Micro- and Macro-Algae



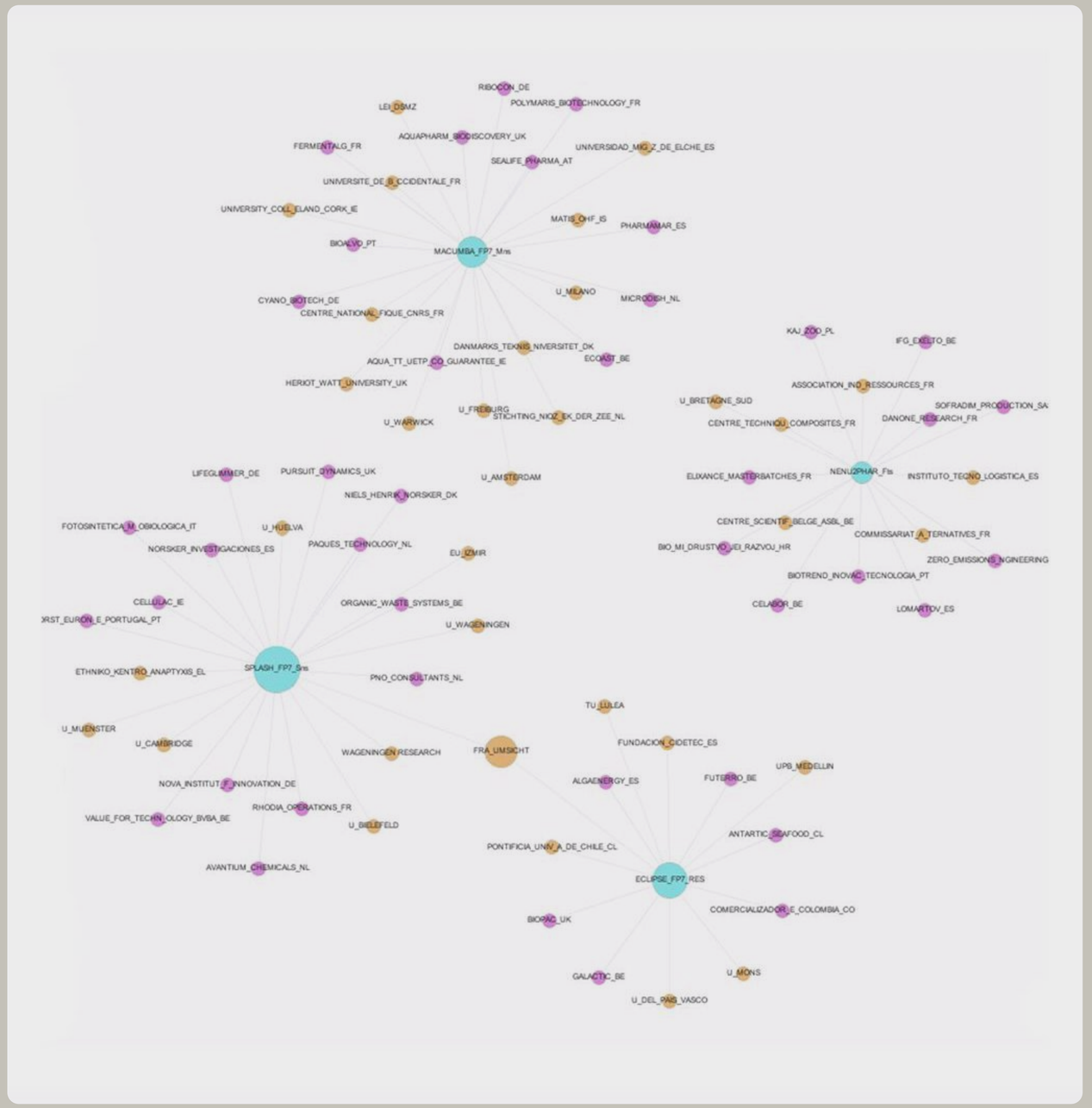
DEEP DIVE ON R&D PROJECTS

TWO-MODE-NETWORK

Research that uses micro-algae as feedstock for biorefinery or bioreactor technologies to pro-duce specific polymers (PLA, PHA and PEF).

NODES

Blue: Projects
Purple: Companies
Orange: Research Organisations



Key Learnings

Research and patent data show trends over time.

Network data shows key partners and bridging technologies.

Algae research spans low-TRL fields.

LEARNING 1

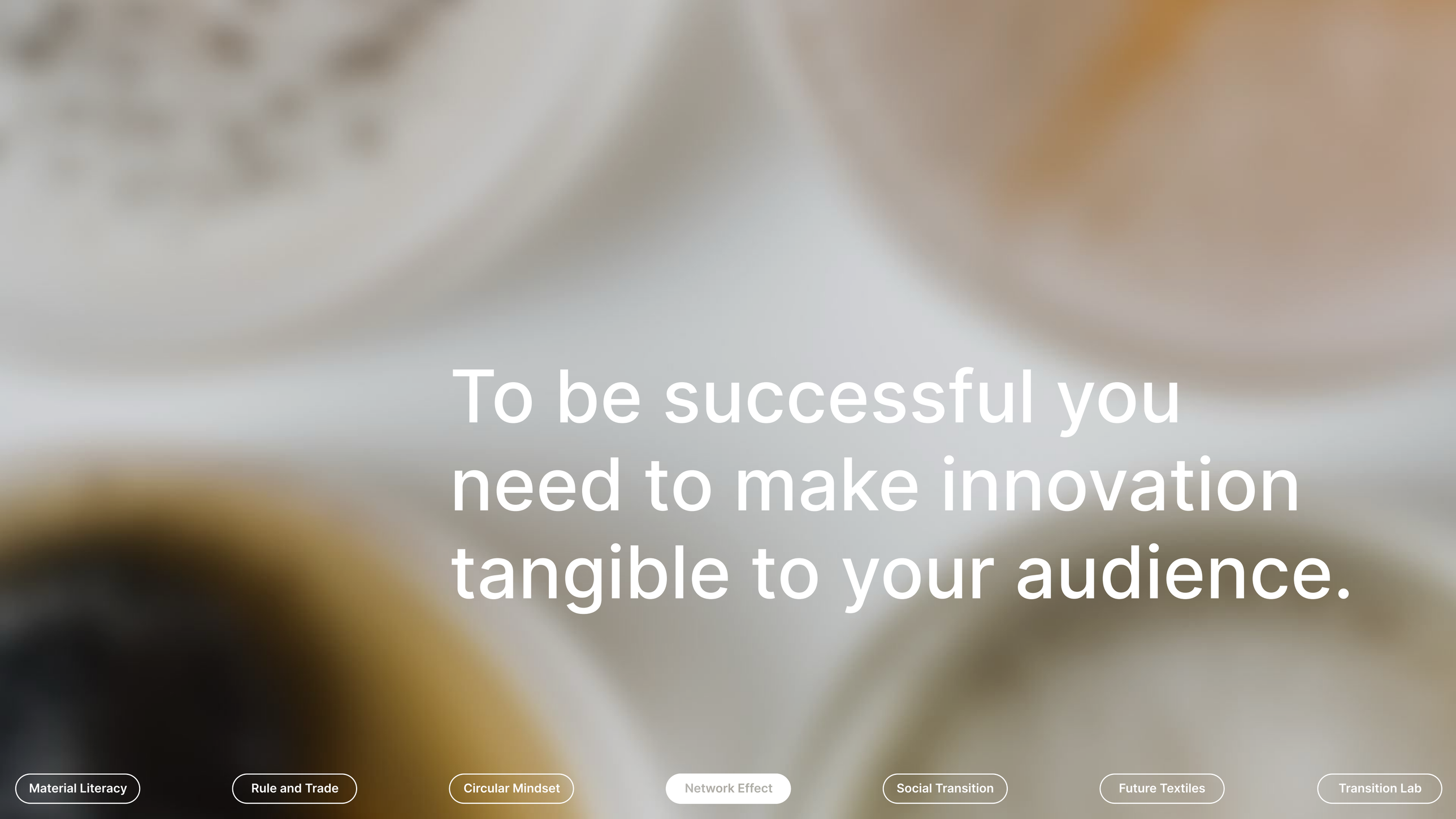
Use our data to find out research fields that are growing and learn about their direction.

LEARNING 2

Find organizations that give you access to research fields connected to your own. Identify technologies that could impcat your own lines of research or your own product development.

LEARNING 3

Look out for developments in other applications fields and for possible contributors from your research for these fields.


To be successful you need to make innovation tangible to your audience.

Cultural Opportunities

↗ Insight Session 07

Adidas AG

THE CULTURAL OPPORTUNITY FOR BIO-BASES MATERIALS

Type	Timeframe	Data	Method
Study	2021	18 Interviews	Qualitative

The goal of this study is to identify key functional and behavioural ‘deal breakers’ for the technological solutions that the materials scientists and researchers are developing to evolve and improve their bio-based materials to suit the needs and demands of culture, industry, and their audiences.

Material Literacy | Rule and Trade | Circular Mindset | Network Effect | Social Transition | Future Textiles | Transition Lab

BARRIERS TO THE MARKET

There is overwhelming support for applying bio-based materials through the frameworks outlined above among our Panel. They did, however, highlight key barriers that they perceive to be preventing bio-based materials from reaching the masses.

Awareness Gap	The lack of knowledge amongst media, editors and gatekeepers of culture limit the wider public's understanding of the potential applications for bio-based materials.
Trend Resistance	There is very little curiosity around materials. Materials do not trend (exception: GORETEX) in comparison to design or aesthetic.
Lobbying Pressure	Destructive lobbying from the fossil fuel industry has the potential to cast doubt and confusion because any material that divests from fossil fuels threatens plastics as their key growth area.
Price Competiveness	High prices mean industry buyers do not buy bio-based materials, so these materials remain in the minority of a collection, and customers rarely access and experience them.
Visibility Gap	Materials need to leave the silo and be part of culture, moving from B2B comms to B2C. Our Culture Panel believes PANGAIA is an excellent example of how to do this.

How can networks accelerate market integration of bio-based materials?

Implication Advices

COLLABORATE ACROSS SECTORS

Come together across industries in collaboration, not competition, to expedite the transition to fossil-fuel-free materials. Deepen collaboration with globally distributed knowledge and skills, stopping the global north from taking ownership of innovations and preventing the global south from participating in sustainable progress.

TRANSFORM BUSINESS MODELS

Experiment, but scale fast with the businesses' biggest sellers and stop making niche eco-collections that lack commitment and impact.

OPEN UP ACCESS

Share the journey of developing and applying bio-based materials. Make it participatory and inclusive, so people have access to the potential of new materials. People want to witness innovation, be involved in brand and industry transformation, celebrate wins, and learn from challenges.

IMPART KNOWLEDGE

Provide educational content and instructions at every touchpoint, and offer direction for people on how to correctly use these novel materials to get the most from the technology. For example, tell people what to do with the material at the end of its life, e.g. 'peel me' to remove a label that would otherwise prevent the item from being recyclable.

EVOLVE RELATIONSHIPS

Update outdated expectations of materials formed based on petroleum-based textiles and are no longer applicable to bio-composition. Inspire relationships with materials that reflect their biological potential, such as the unique qualities of microbe-grown dye.

TAKE OWNERSHIP

Demonstrate extended producer responsibility by conducting garment life cycle assessments or to offer repair services as standard. Also, as the producer, take ownership of a product across its life cycle and pay for any products discarded in the 'wild'.

CREATE COMMUNITY

Create spaces for belonging and connection on topics surrounding material innovation, as demonstrated by FutureVVorld.

DEBATE TOGETHER

Initiate conversations to build trust, beyond press releases and media. This could build on the popularity of podcasts or Clubhouse (popular in Asia). People also want to hear open discussions around the supply chain, with activists and industry leaders having unscripted conversations.

Communication Analysis

↗ Insight Session 40

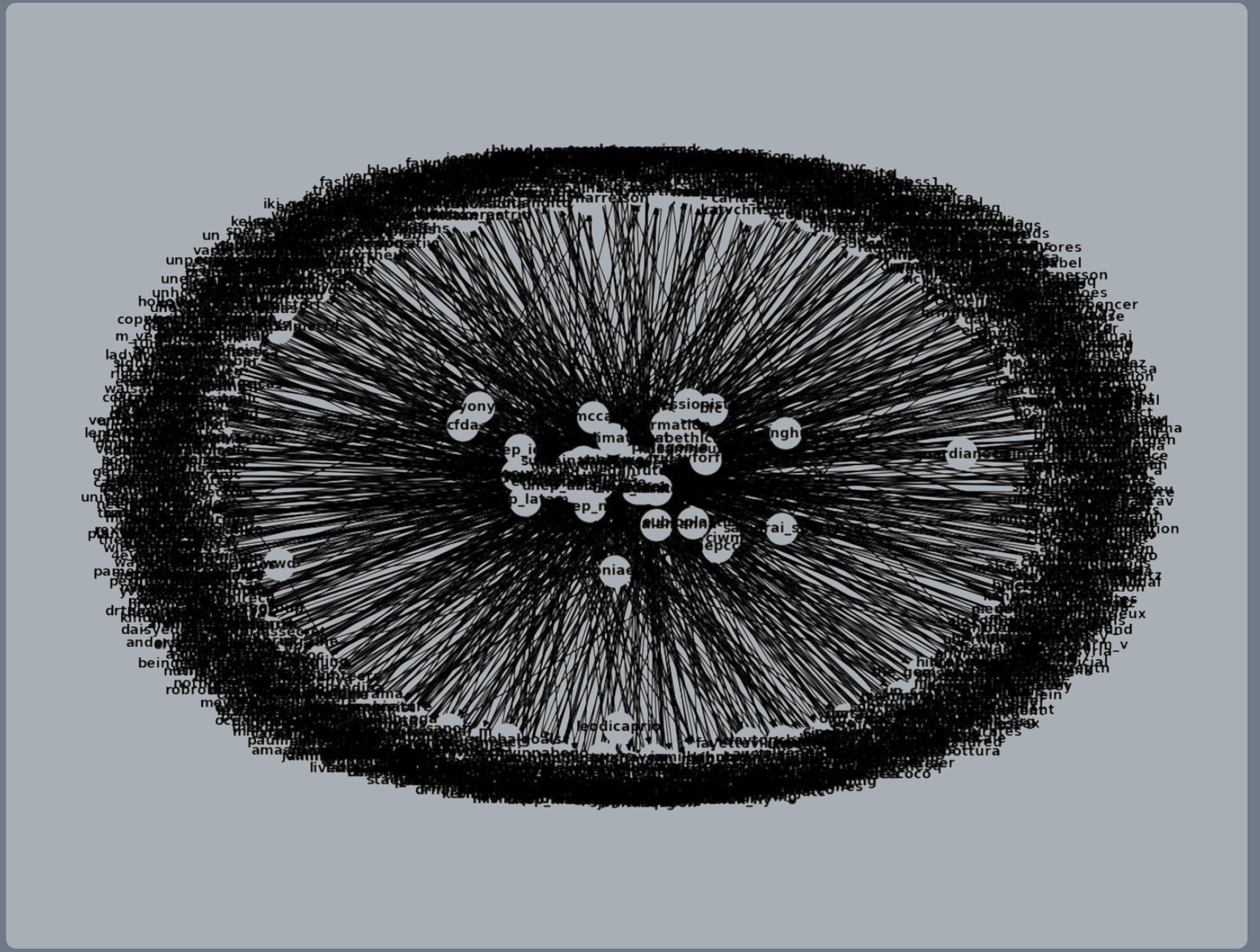
University of Potsdam

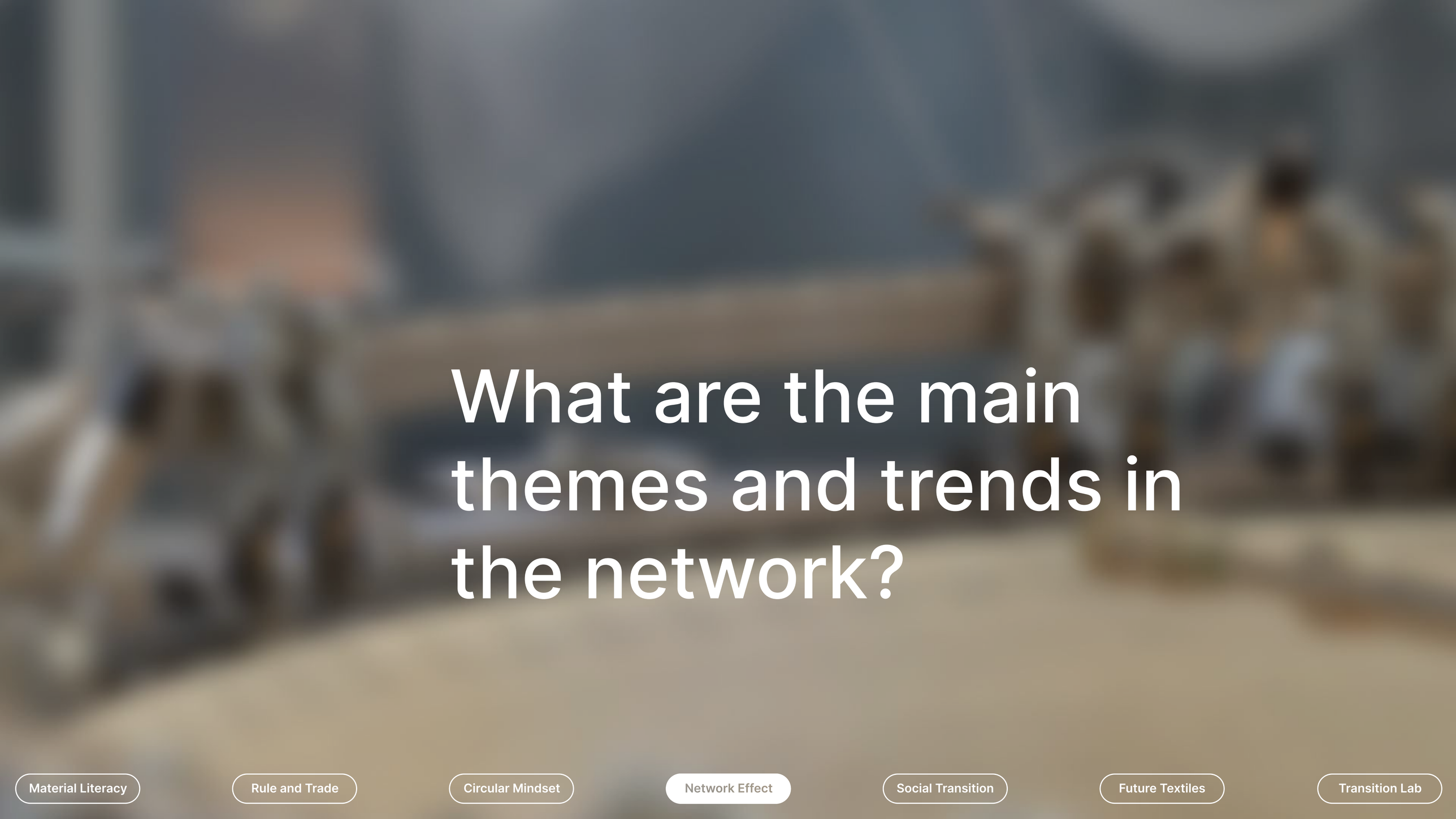
SUSTAINABLE FASHION COMMUNICATION ON X (TWITTER)

Type	Timeframe	Data	Method
Data Analysis	2025	X (Twitter)	Mixed Methods

This analysis explores how sustainable fashion is communicated on X (Twitter) by identifying key themes, trends and stakeholder networks, aiming to inform guidelines and future directions for transparent and authentic communication.

X MENTION NETWORK





What are the main themes and trends in the network?

X NETWORK INSIGHTS

CATEGORY

Industry Leaders and Key Players

DEFINITION

This category of tweets explores the key stakeholders driving the evolution of sustainable fashion, including influential brands, designers and thought leaders. It provides insights into emerging trends, new collections and community perspectives while critically evaluating sustainability initiatives within the industry. At the core of these discussions are influential individuals, communities and digital influencers shaping the discourse on ethical and eco-conscious fashion.

INISIGHT

Discussions are centered around prominent industry figures. Often emphasizing on ethical issues like cruelty free materials. Discussions are often linked to political and international figures.

CATEGORY

Business Insights and Industry Events

DEFINITION

This category of tweets focuses on significant industry events, exhibitions, and awareness initiatives within the sustainable fashion sector. These tweets primarily serve to inform audiences about upcoming or ongoing events, highlighting their relevance, objectives and impact on sustainability discourse.

INISIGHT

Events in the sustainable fashion industry focus on political regulations for sustainability and the strategies required to achieve these regulatory conditions.

CATEGORY

Sustainable Materials and Innovations

DEFINITION

This category of tweets focuses on innovations within the sustainable fashion industry, highlighting emerging materials, circular design solutions and responsible manufacturing techniques. These tweets primarily present research-backed insights and advancements, providing a knowledge-based perspective on sustainability driven technological and design process. The primary purpose is to inform and engage audiences with the latest developments shaping the future of sustainable fashion.

INISIGHT

Ethical considerations of sustainable material innovations are explored. Scaling material innovations such as bio-based fibers were discussed.

CATEGORY

Awareness and Call to Action

DEFINITION

This category of tweets serves as a platform for advocacy and education on sustainability within the fashion industry. These tweets highlight urgent calls to action, promote eco-friendly practices and critically examine industry challenges. Their primary objective is to inform and engage audiences by fostering awareness of ethical and unethical behaviors, encouraging responsible decision-making, and driving systemic change towards a more sustainable fashion ecosystem.

INISIGHT

Educational posts about climate crises and the connection to the fashion industry. Awareness posts about ethical issues in the fashion industry. Call to action to ethical consumption.

Communication Guidelines

GENERAL TIPPS

Effective sustainability communication requires a personalized approach tailored to each audience, clear storytelling that goes beyond data and transparency to build trust. Consistent engagement fosters credibility, while multi-channel outreach ensures broad visibility.

FASHION RETAIL COMPANIES

Present sustainability strategies that align with consumer demand. Offer practical tools to help integrate sustainability into business models. Develop partnerships focused on eco-friendly product lines. Share success stories of sustainable product transformations.

FASHION SERVICE PROVIDERS

Collaborate on joint sustainability projects like eco-friendly supply chains. Offer practical guidelines and best practices. Organize workshops on sustainable sourcing. Showcase suppliers' sustainability efforts in reports and case studies.

PRIVATE BLOGGERS

Engage by offering in-depth sustainability insights, expert interviews, and exclusive research. Collaborate through guest blogs and article contributions, and build long-term partnerships to enhance credibility and consistency.

POLICY MAKERS

Provide clear, data-backed recommendations on policy changes. Participate actively in government consultations and policy discussions. Align sustainability goals with national and international regulations. Publish white papers and reports that showcase best practices.

MEDIA PLAYERS

Share press releases with stories, stats, and expert quotes. Host events, webinars, or panels with sustainability experts. Offer exclusive interviews and behind-the-scenes insights. Use data-driven storytelling to highlight sustainability trends.

CONTENT CREATORS

Engage by sharing exclusive insights and behind-the-scenes content. Offer early access to sustainable collections and initiatives. Collaborate on co-branded campaigns to promote sustainable fashion and ensure authenticity by encouraging them to share their own perspectives.

SOCIAL MOVEMENTS

Collaborate on awareness campaigns or joint advocacy initiatives. Provide transparent data on sustainability impacts. Support their efforts with funding or expertise. Engage in meaningful dialogue through public discussions and social media.

Social Transition

Executive Summary

Read Insight Studies

LEARNING 1

Qualities such as the "sustainability" of products can be tested and renegotiated.

LEARNING 2

Stability and verifiability of norms play a role in evaluating the quality for which people are willing to pay higher prices.

LEARNING 3

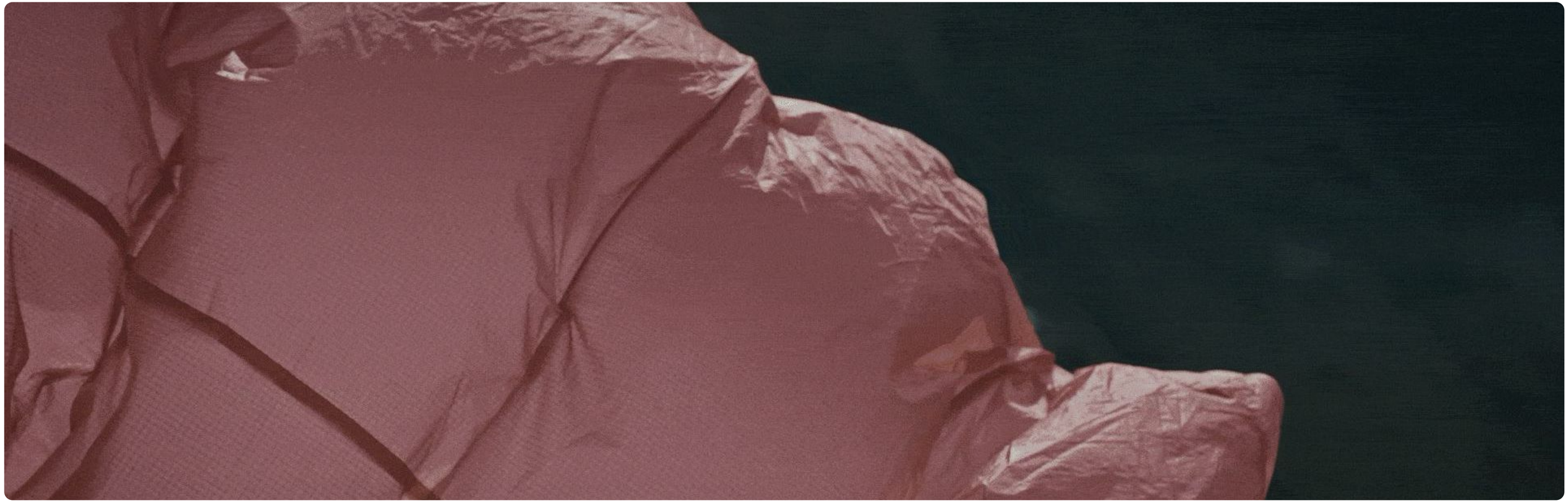
Young consumer groups such as students are not overly price sensitive in terms of buying new sustainable products.

LEARNING 4

Greenwashing is one relevant uncertainty factor among many. Social norms have a significant influence esp. in situations of uncertainty.

How does society shape innovation?

Research on social transitions tackle questions of public awareness, consumer expectations, networks of collaboration, expert insights on future developments and impacts of regulations. The social transition is generally concerned with the societal uptake and structural alignments for new technologies, materials and whole economic processes.



Material Literacy | Rule and Trade | Circular Mindset | Network Effect | Social Transition | Future Textiles | Transition Lab

Consumer Trends Relevance

↗ Insight Session 15

FAU Erlangen-Nürnberg – Symanto Research

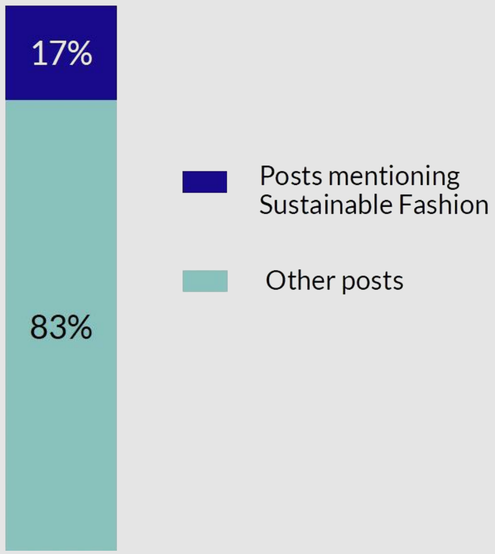
CONSUMER INSIGHTS ON BIO-BASED PRODUCTS

Type	Timeframe	Data	Method
AI Assisted Analysis	2019 – 22	274.571 Social Media Posts	Quantitative

The goal of this study was to find out how people think and talk about bio-based textile products on social media. By using Artifical Intelligence to analyze the data, consumer motivations, important product attributes as well as consumer segments could be identified.

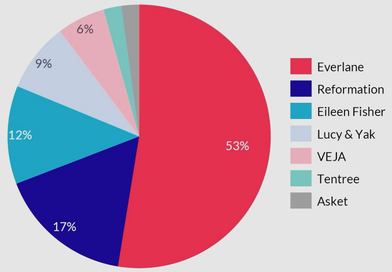
CONSUMER INSIGHTS

SHARE OF SUSTAINABLE FASHION MENTIONS IN THE FASHION INDUSTRY



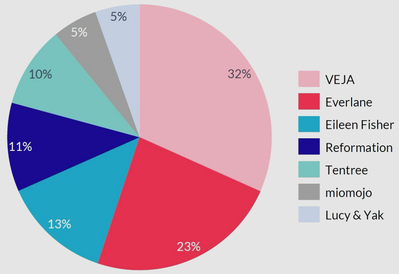
N: 187.441 conversations in fashion industry overall (UK)

DISTRIBUTION BIO-BASED TEXTILES* COMMENTS FOR TOP 7 BRANDS



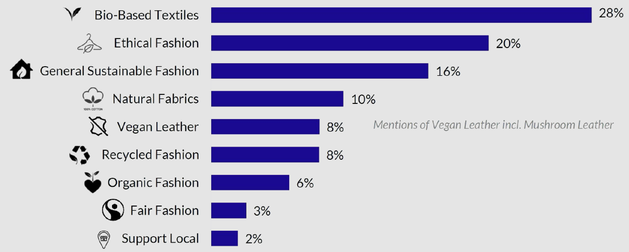
*Mentions of Bio-Based Textiles incl. Vegan Leather, Mushroom Leather and Algae Fabrics

DISTRIBUTION ETHICAL FASHION COMMENTS FOR TOP 7 BRANDS



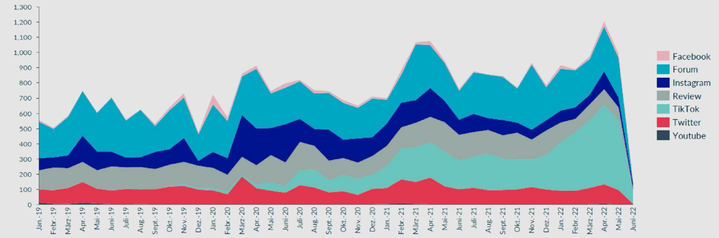
N: 187.441 conversations in fashion industry overall (UK)

TOP TRENDS IN FASHION



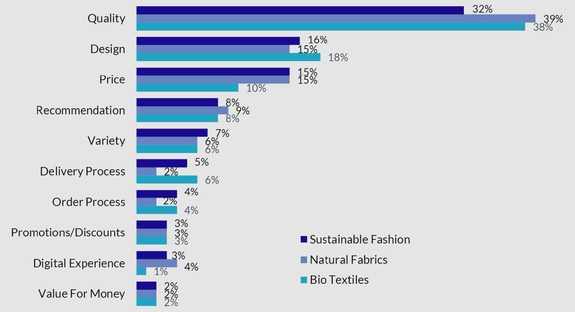
In total, 59.394 mentions of themes were identified & analyzed

SUSTAINABLE FASHION COMMENTS IN DIFFERENT CHANNELS



N: 31.865 conversations featuring Sustainable fashion 01/2019 - 06/2022

POSITIVE COMMENTS ON PRODUCT ASPECTS IN CONNECTION WITH SUSTAINABLE FASHION



N: 17.560 positive mentions of product attributes in connection with Sustainable Fashion

CONSUMER INSIGHTS

Top brands in sustainable fashion and most discussed brand in bio-based textiles.

The main trends in sustainable fashion besides bio-based textiles.

Social media, incl. **Twitter**, **Instagram** and **TikTok** are driving the sustainable fashion trend.

Sustainable fashion accounts for almost **20% of all comments** in the overall fashion industry.

Quality and price are the main product aspects discussed in connection with sustainable fashion.

Mental Models

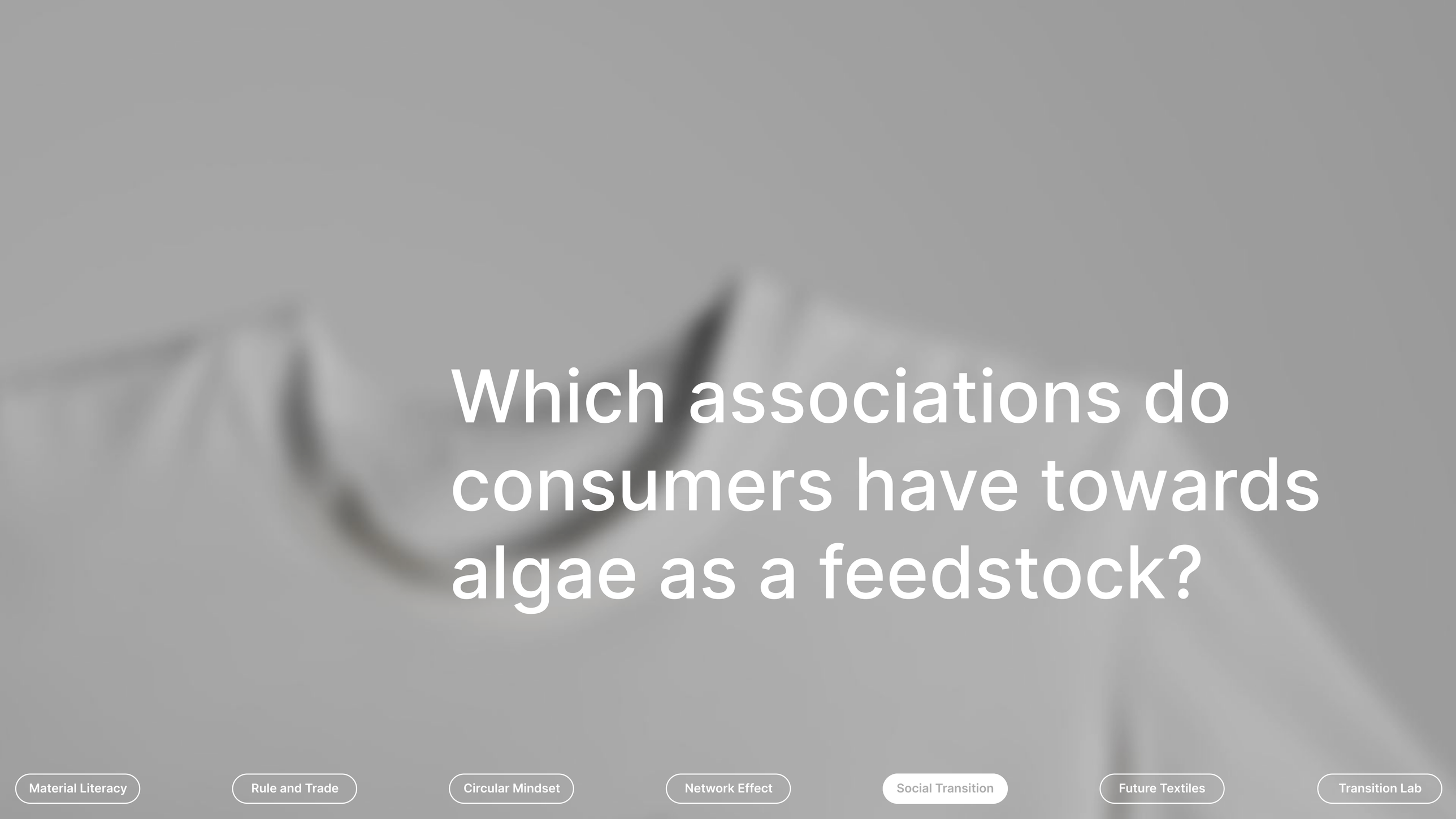
↗ Insight Session 24

Adidas AG – FAU Erlangen-Nürnberg

EFFECTS OF MENTAL MODELS ON THE SUCCESS OF SUSTAINABLE INNOVATION

Type	Timeframe	Data	Method
Study	2023	Focus Groups	5 Qualitative Studies

Mental models evolve through interaction with a target system and are often technically inaccurate. This study examines how integrating consumer feedback into bio-based product development supports product adoption.



Which associations do consumers have towards algae as a feedstock?

ALGAE ASSOCIATIONS



Positive

IMPACT

Sustainable, oxygen and healthy. Sustainability of the product and the procution process.

NATURE AND NATURALNESS

Nature and connection / link to nature. Product should be worn in nature.

COASTAL

Ocean, beach, rocks and sand. Connections to origin of material. Good for the beach or swimming etc.

Negative

WATER

Water and aquarium. Material not suited for water (e.g. could dissolve).

CONSISTENCY

Slimy, slippery, sticky and furry. Material would feel slimy and sticky on the skin.

ATTITUDE AND FEELINGS

Smelly, dirty, gross, cold, disgusting, murky, unpleasant and nasty. Material could have a bad smell or material would be disgusting.

Counteracting Design Features

FEATURE 1

Antimicrobial Finish

FEATURE 2

Luxury Signals

FEATURE 3

Dry And Soft Materials

FEATURE 4

Weatherproof Materials

FEATURE 5

Air Flow Structures

FEATURE 6

Technical Prints

FEATURE 7

Adaptivity

FEATURE 8

Performance Branding

FEATURE 9

Bright Colorways

FEATURE 10

Lightweight Materials

FEATURE 11

Loose Fit

FEATURE 12

Durable Materials

Are algae our future?

↗ Insight Session 17

Adidas AG – FAU Erlangen-Nürnberg – University of Bayreuth

EXPLORATORY FOCUS GROUPS ON CONSUMER PERCEPTIONS OF BIO-BASED PRODUCTS

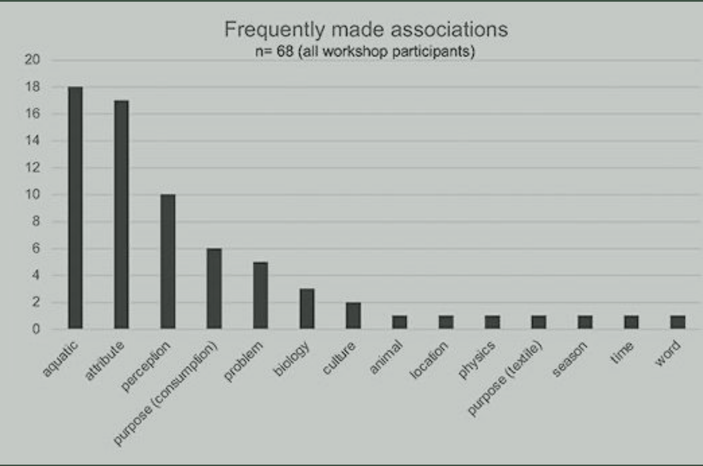
Type	Timeframe	Data	Method
Study	2022	Focus Groups Poster Research	Qualitative

This study serves as a baseline study for further research efforts related to consumer perception of bio-based products and provides highly relevant indicators on how bio-based products can become successful in the mass market and thus contribute to a more sustainable textile industry as well as society at large.

ARE ALGAE OUR FUTURE?

KEY INSIGHT

Algae is mostly associated with aquatic features, food or nature and not with the textile industry.

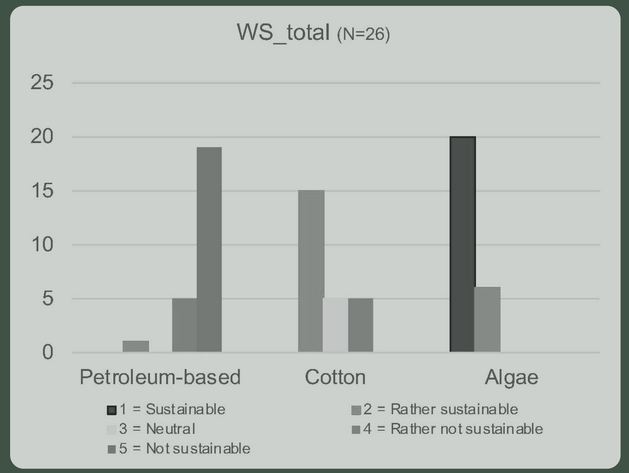


aquatic	e.g. water, ocean, beach, aquarium, lakes
attribute	e.g. green plant, long leaves, fast growing
perception	e.g. elegant, soft, slimy, fuzzy, high quantities
purpose	e.g. food, wakame salad, sushi
problem	e.g. wastage in pond/lake, problems of water
biology	e.g. photosynthesis, coccoliths
culture	e.g. Matisse, Sci-Fi
animal	e.g. mosquito
location	e.g. Japan
physics	e.g. sun
purpose	e.g. consistency of a plaster
season	e.g. summer
time	e.g. future
word	e.g. seaweed

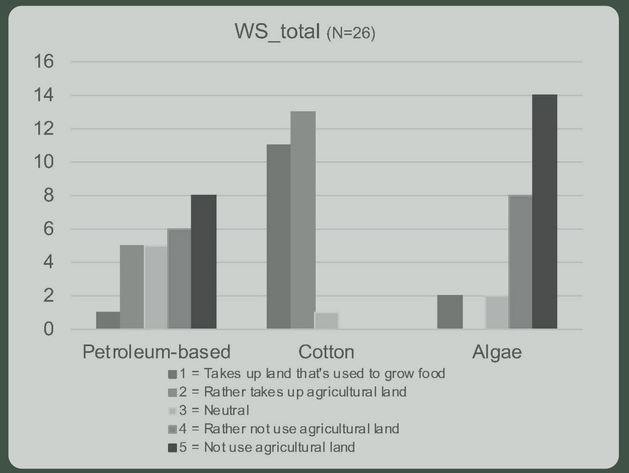
Research questoions: What do consumers associate with algae? How do consumers perceive the plant algae in terms of sustainability? What are consumer expectations towards a textile made of algae?

ARE ALGAE OUR FUTURE?

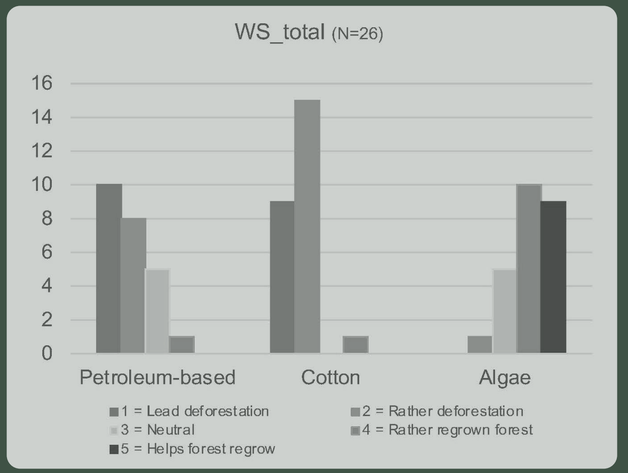
Sustainable vs. not sustainable?



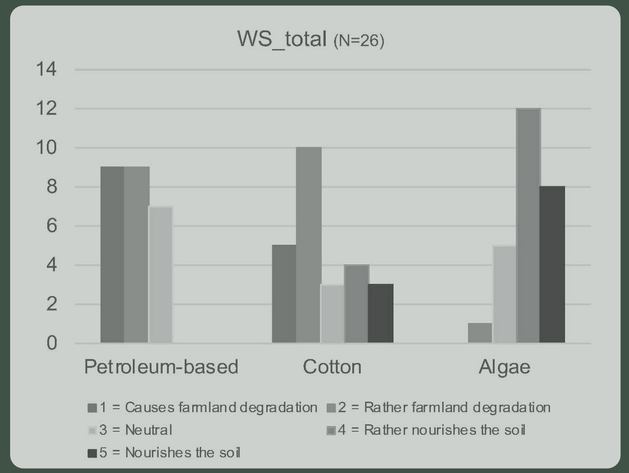
Use of agricultural land vs. no use of agricultural land



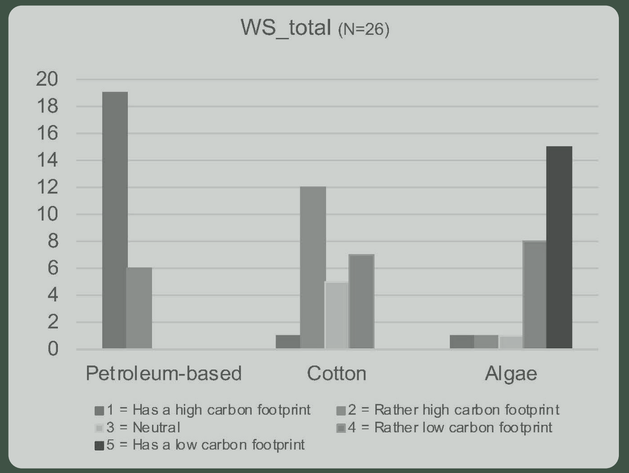
Lead of deforestation vs. helps forest degrow



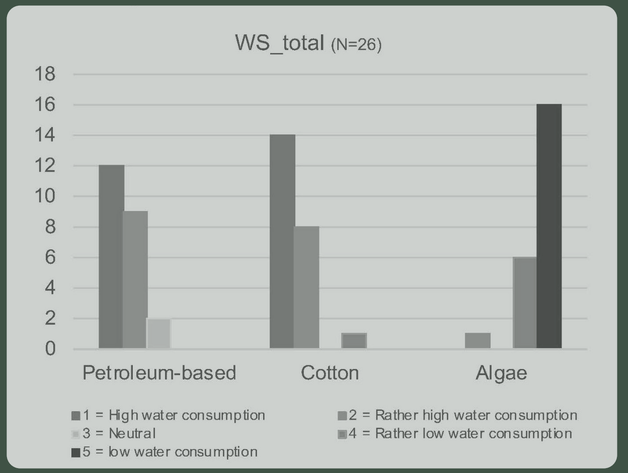
Causes farmland degradation vs. nourishes the soil?



High carbon footprint vs. low carbon footprint?



High water consumption vs. low water consumption?

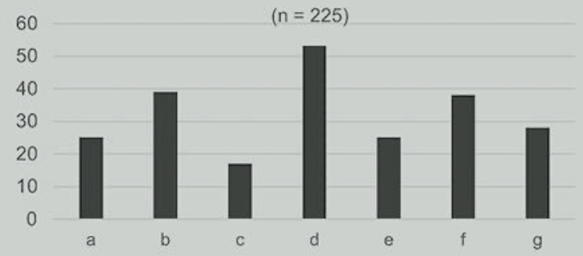


Algae is viewed more positively than cotton or petroleum.

ARE ALGAE OUR FUTURE?

KEY INSIGHT

At the end of life, consumers want an incentive to participate in circular activities of algae-based products.



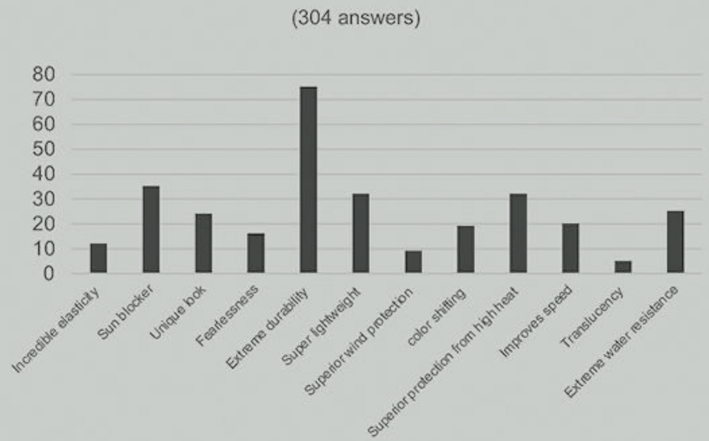
a - I return it and get a voucher for a new shirt
b - It gets turned into a new tshirt
c - Why would there be an end of life?
d - It should become soil for another product.
e - I do not care. You made it. You figure it out.
f - It returns to the ocean and dissolves.
g - I can grow flowers out of it.

PRACTICAL IMPLICATIONS

Relatively high rate of people want the product to be returned to the ocean or it to be turned into soil or a new T-shirt. It implies an interest in a circular customer journey. A clear difference between adidas and the GreenLab (non-adidas employees) could be observed: consumers ‘outside of adidas’ want an incentive; options a (voucher) and e (I do not care) were selected the most.

KEY INSIGHT

The most important product attribute of an algae-based textile is durability.



PRACTICAL IMPLICATIONS

Durability is extremely dominant over all categories and thus needs to be a focus point in both product development and communication measures. Superior protection from heat and sun blocker (similar purpose) is the second most mentioned category: people seem to associate the features of an algae-based shirt with those of a functional outdoor shirt (e.g., with cooling features). Third most mentioned is a super lightweight quality, which matches the above-mentioned associations with a functional material.

Material Quality Perception

↗ Insight Session 25

RWTH Aachen University

FOCUS GROUPS RESULTS ON SOCIAL NORMS IN MATERIAL QUALITY PERCEPTION

Type	Timeframe	Data	Method
Master Thesis	2023	2 Focus Groups	Qualitative Survey

The goal of the thesis is to exploratively identify social norms related to sustainable consumer behavior in apparel purchasing. The focus lies on analyzing the content, dynamics and interdependencies of these norms.

MATERIAL QUALITY PERCEPTION

The experiment involved two focus groups (G1: N=6, 55 min; G2: N=5, 51 min). Participants evaluated plain white T-shirts made from hemp, merino wool, undyed cotton (uCO), cotton, lyocell and polyester, ranking them by perceived sustainability. The discussion followed four rounds (R1-4): assessing the T-shirts (R1), focusing on materials (R2), reconsidering with marginal information (R3) and reflecting on purchase decisions and surroundings (R4).

Focus Group 1

	Hemp	Merino	uCO	Cotton	Lyocell	Polyester
R1	1	2	3	4	5	6
R2	1	2	3	5	4	6
R3	1	2	5	6	4	3

ROUND 1

Artificiality vs. naturalness of dyes and bleaches; effects of raw material extraction and processing.

ROUND 2

Innovation; artificiality vs. naturalness; haptics and material identification; recycling; raw material production; animal vs. plant products; animal husbandry; mass production.

ROUND 3

Disposal; degradability; recycling; raw material production and processing; social sustainability; location; transport; innovation.

ROUND 4

Second-hand clothes; consumer behaviour; cultural differences.

Focus Group 2

	Hemp	Merino	uCO	Cotton	Lyocell	Polyester
R1	1	4	2	3	5	6
R2	1	4	2	3	5	6
R3	1	4	2	3	6	5

ROUND 1

Durability; feel and stretch, thickness of the fabric, material properties; processing quality with regard to sewing.

ROUND 2

Durability; material properties; material identification; animal vs. plant products; husbandry conditions.

ROUND 3

Transport; raw material production; dyes and bleaches.

ROUND 4

Access to recycling at a local level, with producers investing in recycling technology. Working towards making it 100% recyclable.

Key Learnings

LEARNING 1

Social norms serve as validity claims for sustainable product qualities.

LEARNING 2

Further reason why e.g. sufficiency strategies might be preferred over efficiency and consistency strategies.

LEARNING 3

Stability and verifiability of norms play a role in evaluating the quality for which people are willing to pay higher prices.

LEARNING 4

Second-hand clothing offers direct verification of certain qualities with recourse to stable social norms.

LEARNING 5

Young consumer groups such as students are not overly price sensitive in terms of buying new sustainable products.

LEARNING 6

Qualities such as the "sustainability" of products can be tested and renegotiated.

LEARNING 7

Greenwashing is one relevant uncertainty factor among many.

LEARNING 8

Social norms have a significant influence esp. in situations of uncertainty.

Future Textiles

Material Literacy | Rule and Trade | Circular Mindset | Network Effect | Social Transition | Future Textiles | Transition Lab

Executive Summary

Read Scenarios

QUESTION 1

How does economic efficiency block or support the development of a bioeconomic industry?

QUESTION 2

How much should R&D be supported or mandated by government?

QUESTION 3

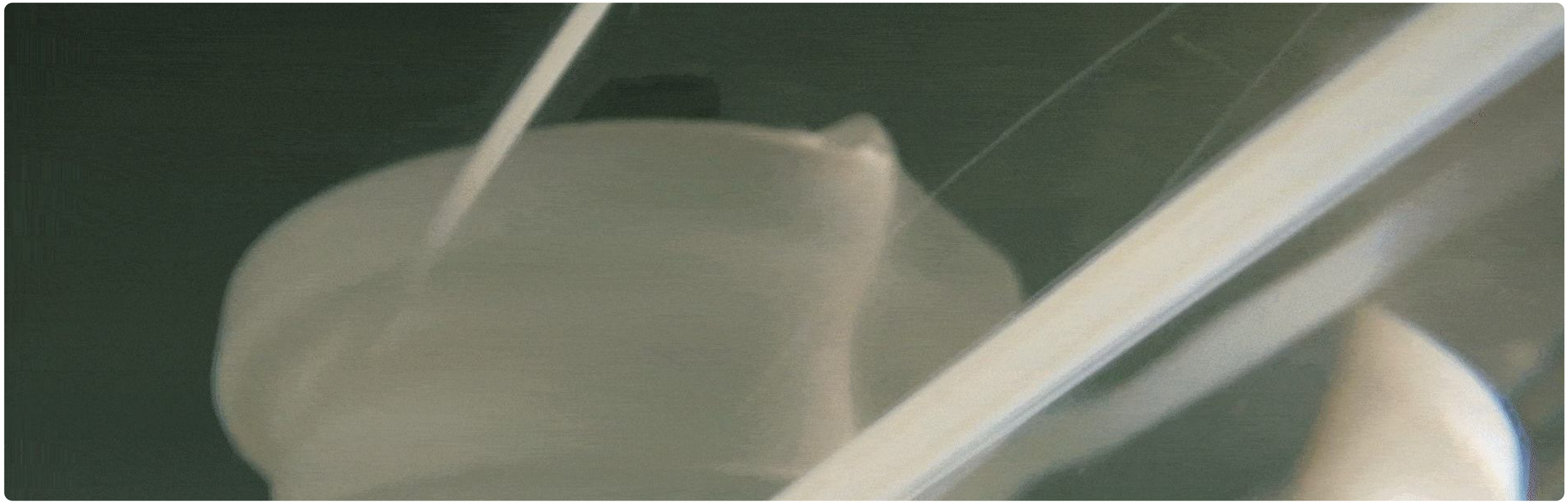
How does design for research support or block the development of a bioeconomic textile industry?

QUESTION 4

What happens when positive incentives are used primarily by legislators?

How might the textile industry evolve?

The textile industry is set to evolve through both technological innovation and regulatory change. Advances in biotechnology, circular design, and collaboration between research, industry, and policy are driving sustainable solutions, while new regulations and consumer awareness accelerate the shift towards more responsible production and materials.



Scenario Development

↗ Insight Session 29 + 39 + 43

RWTH Aachen University

BASELINE FOR SCENARIOS TOWARDS A BIO-BASED TEXTILE ECONOMY

Type	Timeframe	Data	Method
Study-Based Vision	2022 – 23	14 Expert Interviews	Scenario Development

The goals of developing the scenarios are to engage in public and transdisciplinary discourse, foster communication and visibility and establish anchor points that provide orientation and foresight for future developments.

SCENARIO DEVELOPMENT

KEY INSIGHT

Experts are more critical in interviews.

STARTING POINT

Circulation and circular economy.

SCENARIO BASELINE

Within **a cycle**, the focus is on responsibility and behavioural change. In **different cycles** or a cross cycles, the focus is on system change. In **mixed forms of cycles**, the focus is on technological innovations at the material level.

KEY INSIGHT

Regulation is a necessity.

STARTING POINT

The timing of regulation.

SCENARIO BASELINE

Different kinds of regulation:
A **standard** is already in place.
Some measure are **certainly coming** in the next years.
Additional forms of regulation **are desired.**

KEY INSIGHT

Sustainability transition comes down to systematic change.

STARTING POINT

Where systemic changes are needed.

SCENARIO BASELINE

Existing or coming regulation is mostly directed to behavioural or technological changes, while regulation to wards systemic change is desired. Talking about **one cycle** systemic change is not addressed.

KEY INSIGHT

Naturalness may be a problem.

STARTING POINT

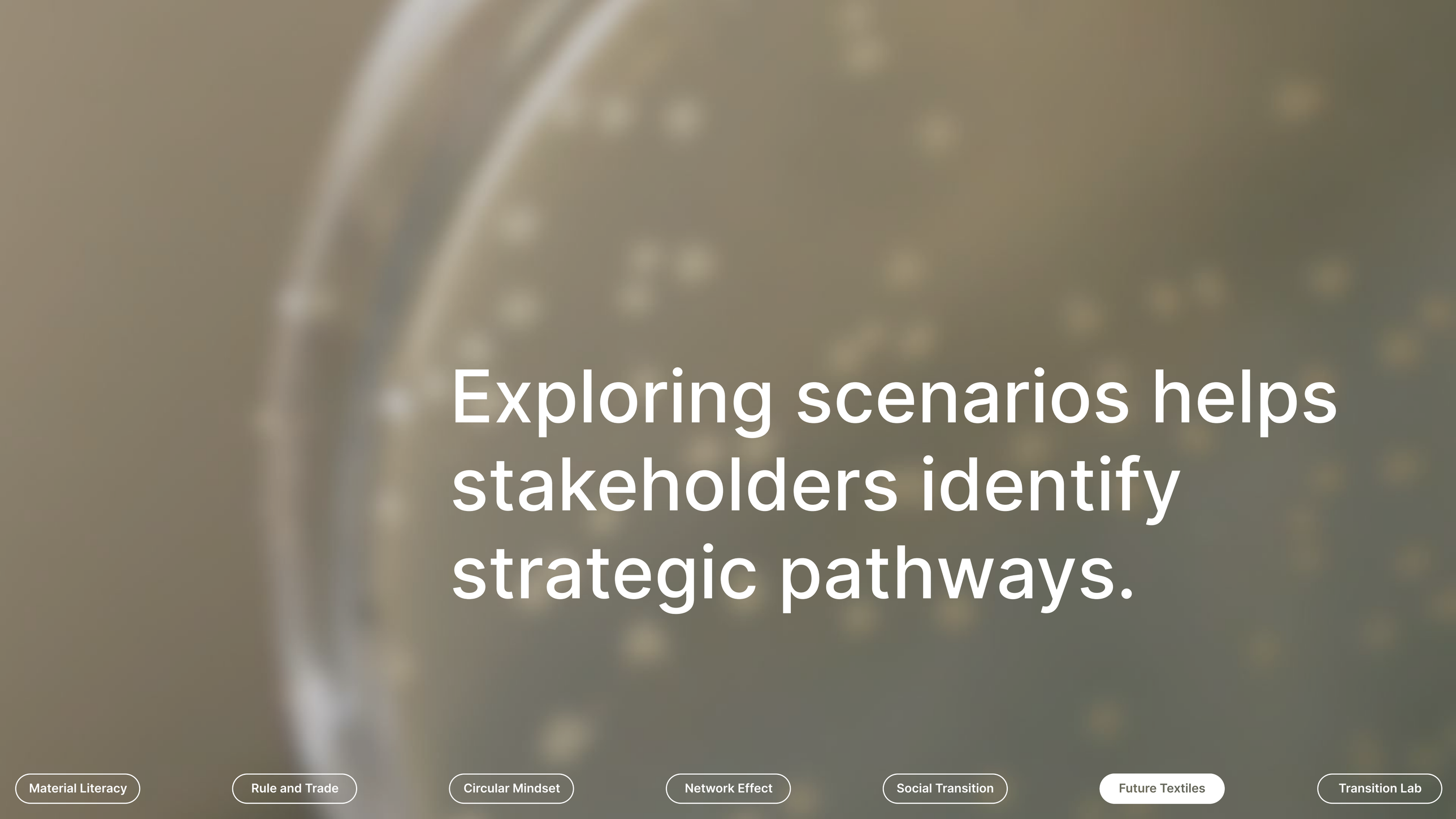
Connect and disconnect in naturalness.

SCENARIO BASELINE

Stronger coupling in expectations than in reality. To be evaluated further.

SCENARIO DEVELOPMENT

NATURALNESS What role does naturalness play in raw material selection?	A	Technological **duplicate of nature**
	B	**Origin in nature**
ECONOMY How does economic efficiency block or support the development of a bioeconomic industry?	A	Technological **duplicate of nature**
	B	**No** focus on economic efficency
GOVERNANCE How much should R&D be supported or mandated by government?	A	**High government support** for R&D
	B	**Low government support** for R&D
DESIGN FOR RESEARCH How does D4R support or block the development of a bioeconomic textile industry?	A	With **focus** on D4R
	B	**Without focus** on D4R
INCENTIVES What happens when positive incentives are used primarily by legislators?	A	Using **bans**
	B	Using **incentives**


Exploring scenarios helps stakeholders identify strategic pathways.

SCENARIO A TECHNOLOGICAL DUPLICATE OF NATURE

This scenario features rapid technological innovation and rising environmental awareness. Biotechnology and socio-technical innovations take center stage, replicating and enhancing natural processes to balance technological progress with ecological responsibility.

Companies	Transparent supply chains and circular business models.
Consumers	Naturalness vs. organically grown, long-term stability of textiles and use of chemicals.
Designers	Important role in the transformation, designing modularity for separation and fraction recycling of components.
Science	Promoting interdisciplinary approaches to materials development and curricular adaptations.
Politics	Tax breaks and subsidies for R&D programmes for recyclable material samples with natural properties and fair use of funds.

SCENARIO B ORIGIN IN NATURE

Driven by political bans, this scenario focuses on textile degradability and changing infrastructures such as waste management. Progress relies on trans- and interdisciplinary collaboration toward sustainable material cycles.

Companies	Creating closed-loop systems with biodegradable products requires innovation; the main challenge is waste management.
Consumers	Respondents wish the T-shirt to have a cooling texture, while nearly nobody wished the T-shirt to have warming features.
Designers	Naturalness means biodegrada-bility, transparency, and disposal support; high costs boost the second-hand market.
Science	Focus on socio-environmental impacts, innovation slowed by low R&D funding, more collabo-ration with industry.
Politics	Textile biodegradability system, infrastructure development for collection and disposal of used textiles.

Transition Lab Consortium

Material Literacy

Rule and Trade

Circular Mindset

Network Effect

Social Transition

Future Textiles

Transition Lab

Listing of Contributors

Institutional Overview

LISTING OF RESEARCHERS AND CONTRIBUTORS

Institutions	Researchers	Insight Sessions	Timeframe
6	27	41	2019 – 2025

The goals are to engage in public and transdisciplinary discourse, strengthen communication and visibility and provide clear anchor points that support orientation and foresight.

Adidas AG

Adidas Innovation

Adidas AG
Adi-Dassler-Strasse 1
91074 Herzogenaurach, Germany

Dr. Timm Wagner
Research Lead

Contact
timm.wagner@adidas.com

Franziska Seehausen
Research Lead

Contact
franziska.seehausen@adidas.com

Dr. Christine Anstätt
Research Lead

Contact
christine.anstaett@adidas.com

Publication List:

Baier, D.; Rausch, T.M.; Wagner, T.F. The Drivers of Sustainable Apparel and Sportswear Consumption: A Segmented Kano Perspective. Sustainability 2020, 12, 2788. https://doi.org/10.3390/su12072788

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FAU Erlangen-Nürnberg

Chair of Industrial Management

Friedrich-Alexander-Universität Erlangen-Nürnberg
Lange Gasse 20
90403 Nürnberg, Germany

Hannah Altenburg

Research Associate

Contact
hannah.altenburg@fau.de

Lauren Mackintosh

Research Associate

Contact
lauren.anne.mackintosh@fau.de

Prof. Dr. Kai-Ingo Voigt

Principal Investigator

Contact
kai-ingo.voigt@fau.de

Publication List:

https://journals.aom.org/doi/abs/10.5465/AMPROC.2025.17968abstract

Further research currently under review.

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LMU Munich

Economic Geographies of the Future

Ludwig-Maximilians-University Munich
Luisenstraße 37
80333 München, Germany

Prof. Dr. Johannes Glückler

Contact
johannes.glueckler@lmu.de

Dr. Jakob Hoffmann

Contact
jakob.hoffmann@lmu.de

Daniel Wagner, M.Sc.

Contact
d.wagner1@lmu.de

Denise Gutiérrez, M.Sc.

Contact
d.gutierrez@lmu.de

Publication List:

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RWTH Aachen University

Chair of Sociology of Technology and Organization (STO)

RWTH Aachen University
Eilfschornsteinstraße 7
52062 Aachen, Germany

Dr. Marco Schmitt

Contact

mschmitt@soziologie.
rwth-aachen.de

Svea Schöngarth, M.A.

Nadine Diefenbach, M.A.

Christoph Heckwolf, M.A.

Jannis Gruß, M.A.

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University of Bayreuth

Chair of Marketing & Innovation

University of Bayreuth
Universitätsstraße 30
95447 Bayreuth, Germany

Prof. Dr. Daniel Baier

Principal Investigator

Contact

daniel.baier@uni-bayreuth.de

apl. Prof. PD Dr. Alexandra Rese

Research Associate

Contact

alexandra.rese@uni-bayreuth.de

Stella Gkoutselis

Research Associate

Contact

stella.gkoutselis@uni-bayreuth.de

Dr. Benedikt Brand

Research Associate

Contact

benedikt.brand@uni-bayreuth.de

Andreas Karasenko

Research Associate

Contact

andreas.karasenko@uni-bayreuth.de

Dr. Theresa Rausch

Research Associate

Publication List:

Rese, A., & Baier, D. (2025). Rental clothing box subscription: The importance of sustainable fashion labels. Journal of Retailing and Consumer Services, 83, 104153.

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University of Potsdam

Chair of business Information Systems and Digital Transformation

University of Potsdam
Am Neuen Palais 10
14469 Potsdam, Germany

Prof. Dr.
Stefan Stieglitz

Contact
stefan.stieglitz@uni-potsdam.de

Dr.
Felix Brünker

Kevin Kintzel,
M.Sc.

Contact
Kintzel@uni-potsdam.de

Lea-Marie Braun,
M.Sc.

Alexander Kocur,
M.Sc.

Ali Sercan Basyurt,
M.Sc.

Publication List:

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Credits

Video Stills

ag4 medien GmbH

Contact

mail@ag4medien.de

Design, Layout and Production

WINT Design Lab

Contact

info@wintdesignlab.de

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