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 For Bio-Based Materials
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PROJECT OBJECTIVES

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.

METHODOLOGY

Eighteen in-depth qualitative interviews with Activists, Advocates, Changemakers and Makers across the US, UK, Germany and Asia.

THE OPPORTUNITIES

As an emerging category, bio-based materials have the opportunity (and burden!) to create their value chain from the ground up. In order to deliver real solutions, it must be built on the following three fundamental propositions:

- 1. Create an entirely new textile system from the outset. One that does not "drop-in" to the existing system, but instead solves the entrenched environmental and societal issues by defining new processes and relationships with textiles;
- 2. Build a value chain that is radically and verifiably transparent. This is something that citizens worldwide are demanding from our traditional textiles market, but it is too established, complex and fragmented to implement at scale, and;

3. Design the material for a specific performance, functionality or lifespan. Amplifying the potential of the biological characteristics to suit cultural and industry use cases, rather than aiming for a replacement to a material (of plastic or animal origin) that is already available.

Once this foundation is in place, two additional lenses must inform and shape the material life cycle, demonstrating industry-wide solutions, and defining the business case and cultural positioning for the adoption of bio-based materials:

- A. Design bio-based materials with the <u>planet</u> in mind, shifting from fueling the waste crisis to leading with a whole life mindset, and;
- B. Design bio-based materials with <u>people</u> in mind from "farmer" to maker to consumer to end of life, shifting from systemic exploitation to social justice

About This Report

- RESEARCH CONTEXT
- CULTURAL CONTEXT
- THE FINDINGS

• RESEARCH CONTEXT



BIOTEXFUTURE commissioned this research, a research program funded by the Federal Ministry of Education and Research in Germany, co-led by adidas and the RWTH Aachen University.

The vision for <u>BIOTEXFUTURE</u> is to transform the textile industry from petroleum-to bio-based. They work with 20+ partners from research, SMEs, and other large scale corporate organisations on material solutions to reduce the use of fossil fuel-based materials.

In September 2021, 'TransitionLab' within the BIOTEXFUTURE team commissioned The Akin to explore consumer perceptions of bio-based materials.

Although there is a growing research base around bio-based materials (also called bioplastics or biopolymer-based materials), consumer insights still only scratch the surface. Therefore, it is essential to get a much deeper understanding of how people think about these bio-based materials and products, particularly in the textile industry, to shape innovation.

The key objective of this research was to identify key 'deal breakers' for the technological solutions that the materials scientists and researchers are developing so they can evolve and improve their materials to suit the needs and demands of industry and their audiences.

Methodology

Interviews were conducted throughout October and November 2021. Each interview was a one-on-one session conducted over Zoom for two hours, allowing for an open space to discuss unprompted and unbiased opinions and attitudes towards bio-based materials.

This report will refer to the participants collectively as our Culture Panel.

The Parameters and Limitations —

The team selected people to participate in the interview process based on a varying knowledge scale and engagement with bio-based materials. It was important for this research to reflect objective views of the material industry and provide insight into the practitioner's expertise.

The critical limitation of this research is the number of people who participated. Eighteen interviews across multiple countries is a small sample but provides an initial lens into key attitudes and behaviours. Quantitative research planned for Q4 2021 will interrogate the findings of this report at scale.

THE CULTURAL OPPORTUNITIES FOR BIO-BASED MATERIALS

RESEARCH CONTEXT



Alec Leach, 33, founder of Future Dust, Germany



Amy Congdon, 35, head of design intelligence Biofabricate, USA



Anastasia Pistofidou, 38, co-founder of Fabricademy and Fabtextiles, Spain



Bianca Foley, 34, co-host of SustainablyInfluenced, UK



Carlo Delantar, 29, founder of Altum, Philippines



Daniel Navetta, 40, founder of Future V Vorld, USA



Isaias Hernandez, 25, founder of <u>QueerBrownVegan</u>, USA



Kamonnart Ong, 30, bio designer and country coordinator for Fashion Revolution, Thailand



Liz Ricketts, 35, co-founder of The OR Foundation, USA/Ghana



Lydia Bolton, 27, founder of Lydia Bolton, UK



Max Moinian, 30, co-founder of Future Earth, USA



Rune Orloff, 37, co-founder of fashion rental POOL, Germany



Sabine Zetteler, 39, founder of Zetteler, UK



Samia Dumbuya, climate justice activist, UK



Sebastian Kommer, <u>furniture designer</u>, Germany



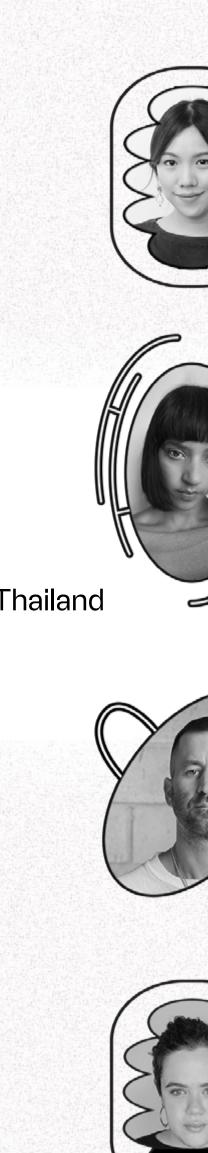
Seetal Solanki, 41, founder of Matter, UK/Nigeria



Suzanne Lee, 52, founder of Biofabricate, USA



Tammy Gan, 23, writer at Bad Activist Collective, Singapore



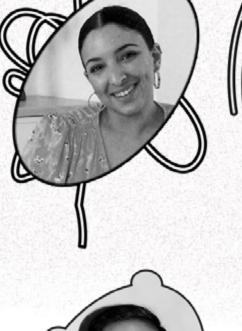














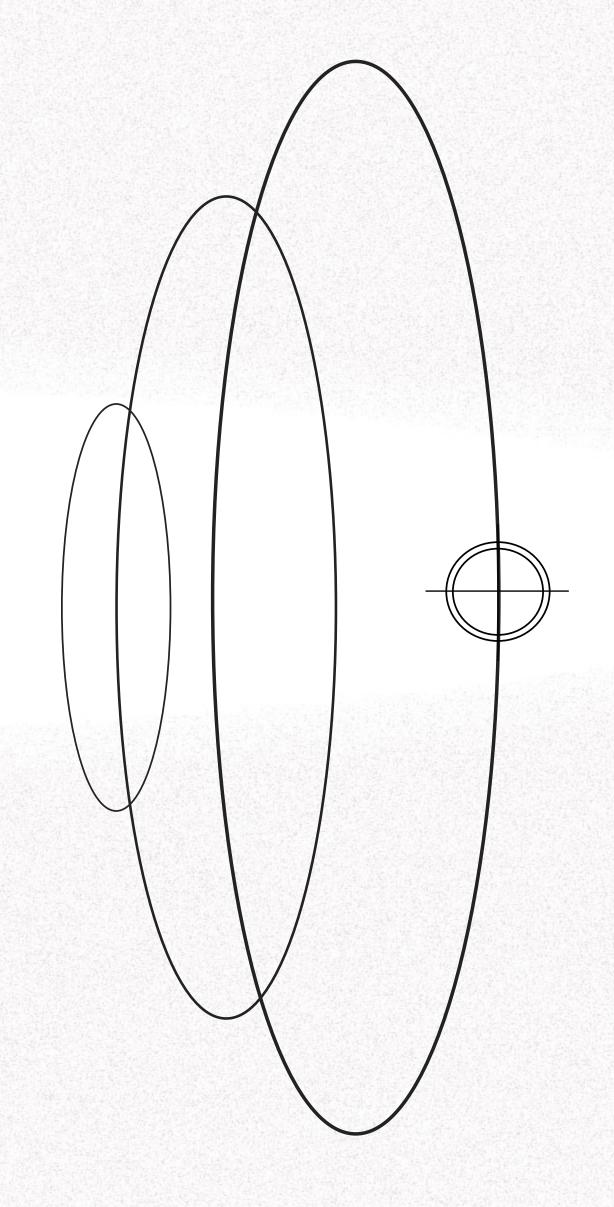






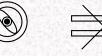


To avoid the research findings being positioned within an industry bubble or silo, we must set the scene and ground the report in the cultural environment and broader sustainability movement current at the time of the research. The following factors are the culmination of both desk and field research.









We Have Reached Trust Exhaustion —

There is a global decline of trust in government, business and media: Trust in institutions of power is at an all-time low, including governments and their fellow citizens. Furthermore, while public trust in business leaders is higher than in regulators, scepticism is growing because of the decades of empty promises made by politicians and industry. Scientific truths used as political talking points, and distant sustainability pledges, means people are tired of empty promises and "blah blah blah".

This is coupled with shady business practices, such as ghost instagram stores where the facade of the stores replicates favourite brands but products are sourced from Shein, AliExpress, or Amazon, adding to the sense of unease and that nothing is what it seems.

Thirdly, there is increasing frustration with traditional media outlets such as news and national newspapers. Journalists are unwilling to offer uncensored reporting on climate science in order to appear "impartial."

Media business models mean that advertising revenue influences which difficult questions are asked of whom, specifically the Media's key customers - the businesses and brands advertising in their pages. This results in frontline scientists and indigenous leaders not being invited to the table to balance the Media's pro-business agenda. Moreover, with the likes of Murdoch, a climate denier, owning so many of the news channels, people feel the information is warped or not reported.



Samia Dumbuya, climate justice activist, UK

"They just say what you want to hear @ and don't commit too much."

Processing All The Information Is Not Possible —

The climate crisis is a complex problem, but not complicated (we already have solutions ready to scale). However, pro-carbon governments, media, and businesses have made the issue complex to navigate due to the lack of trust mentioned above. There is too much information for people to process and interrogate to uncover the truth when struggles with personal mental and physical health, basic survival, and security need prioritising.



Tammy Gan, 23, writer at Bad Activist Collective, Singapore

"It's the constant barrage of bad news and the way mainstream media has framed it as doomsday, \oplus and naturally people want to get off these platforms... they're just tired of learning 🕀 because every other news article is just another way of saying, "we're so fucked."

Hope Of A New Post-Covid Era Is Collapsing —

People realise that, despite the historical events of 2020 seemingly moving society forward, we are returning to business as usual and not, in fact, a new era of business and society that was promised. According to IEA's Sustainable Recovery Tracker, only 21% of recovery spending (and only 3% in covid-related expenditures) has gone to green investments despite the rhetoric that recovery investment would transform the low carbon transition.

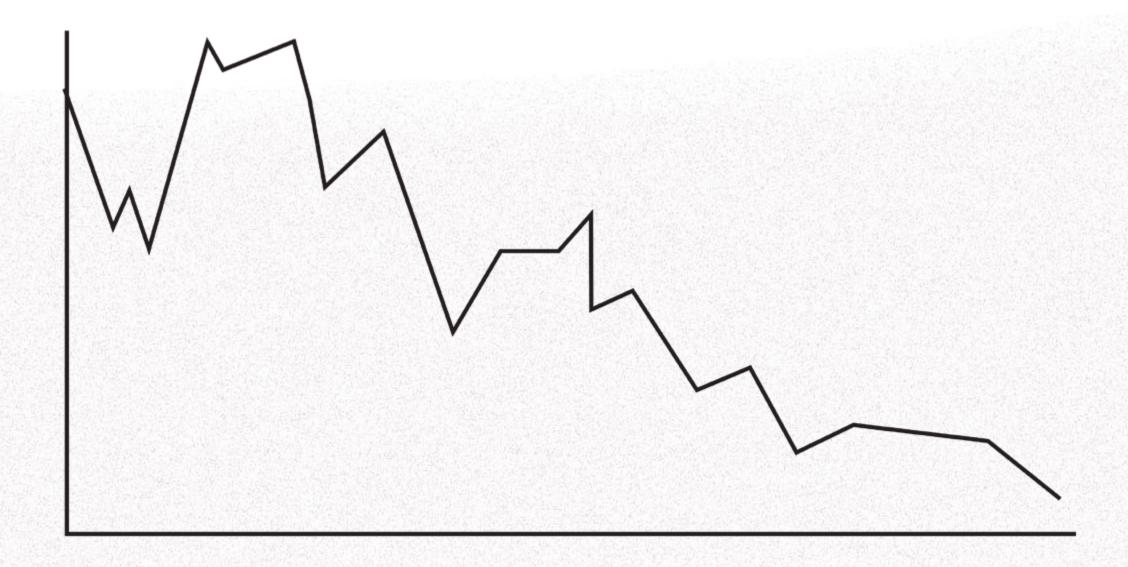
Climate Policy Summits Are Now Pop Culture Moments (Cop26) —

The 2021 United Nations Climate Change Conference, more commonly referred to as COP26, took place as our research was conducted. Many of our Culture Panel were actively engaged in organising and attending the events in Glasgow. Furthermore, for those who were not present, independent platforms such as FutureEarth, EarthRise and Slow Factory, reported coverage across social channels, making the science accessible and offering climate-positive solutions. Their popularity and success demonstrate the growing engagement within the mainstream of topics such as divesting

from fossil fuels and reducing carbon emissions. It also highlights the resilience and persistence of people-powered action.

Activism Burnout

However, with all of this turbulence and fight, many of our Culture Panel, particularly those in the activist space, are feeling tired from the weight of responsibility for holding businesses and politicians accountable for their actions and asking them to do what is necessary to protect people and the planet.



We interviewed a wide selection of people for this research based on their varying expertise, location of practice, and different levels of knowledge of bio-based materials. Despite this variety, there is much common ground and thus consistent overarching issues within the material industry that need to be considered.

Industry-Level Issues —

There is low material literacy in the public domain and the media. This means there is little to no knowledge of the composition of materials or how materials are made, both in public and in the media (with exceptions being the experts in the material industry).

Editors, who are positioned in the media as representatives between the makers and the consumers, in the majority do not prioritise the material when considering trends. Instead, they choose styles based on pop culture. This means materials are never trending, limiting exposure and opportunities for education around material composition, characteristics and innovation. Many new materials (often those described as bio-based) have been in development for over a decade. Since raising awareness about their potential several years ago, they are now deemed 'hype' rather than reality. This has caused impatience as well as scepticism amongst industry and culture.



Max Moinian, 30, co-founder of Future Earth, USA

"People were asking, Why are there plastic bottles in my activewear and my bathing suits, because these people had no idea that all of those fabrics were petroleum based products . So there was this complete misalignment of where consumers were at in terms of their education on these issues. The transparency isn't there... that is what we need from brands first and foremost"



Alec Leach, 33, founder of Future Dust, Germany

"Fashion editors think about pop culture, not the craft, or material reality . No one understands how clothes are made which is why they are so easily misled with phoney sustainability ."



Sabine Zetteler, 39, founder of Zetteler, UK

"Magazine editors are the people that have been able to shift culture a lot. So making sure that editors are educated in what the possibilities [of materials] are , because they all talk about "sustainable" but they're still planning their shoots around what looks beautiful"

MATERIAL CONTEXT







Amy Congdon, 35, head of design intelligence Biofabricate, USA

"When we first started, it was getting people aware that you can even grow materials using living organisms, that bio-based materials were a possibility (1), and that we have the technology to do that. And I think all of the media coverage has since tipped over into hype"



Suzanne Lee, 52, founder of Biofabricate, USA

"Some of those companies [bio-material innovators] who were viewed as the early pioneers of the space are perhaps perceived as having overhyped or over promised, and under delivered. And so now, I think you'll find that many people are asking questions, whether they're investors or brands, is this real? How long does it take? What are these things going to be like when they come to market? What is the timeline to achieving scale, and real price parity, or at least some kind of realistic pricing (**) **Text** Provided the space are perhaps and under delivered as having overhyped or over promised, and under delivered. And so now, I think you'll find that many people are asking questions, whether they're investors or brands, is this real? How long does it take? What are these things going to be like when they come to market? What is the timeline to achieving scale, and real price parity, or at least some kind of realistic pricing (**) **Text*** Provided the space are perhaps are provided to the space are perhaps are provided to the space are perhaps are perhaps as a space are perhaps are perhaps as a space are perhaps are perhaps and the space are perhaps are perhaps as a space are perhaps are perhaps are perhaps as a space are perhaps are perhaps as a space are perhaps are perhaps are perhaps as a space are perhaps are

Consumer-Level Issues —

Sustainable processes, language and terminology surrounding them are being overused, or worse, used in the wrong context, saturating the marketing and causing apathy. We specifically tested the level of understanding about the term "mass balance" within bio-based material production, which no one understood.

Additionally, the complexity of language (scientific or otherwise) causes materials to feel exclusive and confusing.

The complexity, and lack of understanding of the material supply chain and life cycle, is due to oversimplification by industry and media. The <u>Out of Sight</u> report from Fashion Revolution (2021) documents the limited transparency within the textile industry, with brands only publishing tier 1 of their supply chains (the production) and not details of key suppliers responsible for processes such as printing, weaving or growing raw materials.



Daniel Navetta, 40, founder of FutureVVorld, USA

"Regenerative and circular are the most important terms right now. But they are getting used incorrectly "



Seetal Solanki, 41, founder of Matter, UK/Nigeria

"Currently how these materials are described feel very foriegn to the everyday person, (3) it feels very futuristic. It needs to be desirable to get people on board. It needs to feel relatable."

Bio Based Cheat Sheet

- ASSUMPTIONS
- DEFINITIONS

The use of terminology and definitions in the materials industry is often confusing, even for those working within the industry, due to the many different variations and compositions of a textile. To bring alignment to what we collectively mean by bio-based and the role we believe it can play, let us first tackle the basics and call out the common assumptions we heard in our research so that we can correct these misconceptions.



ASSUMPTIONS

The following were unprompted associations and assumptions towards the word 'bio-based material':

New

Advanced

Beneficial

ositiv Vegan

Natural

Higher environmental standards, due to bio-being used in the food category and in proximity to organic

Biodegradable



Samia Dumbuya, climate justice activist, UK

"Natural, green, plant based, not unbreakable plastics,



Bianca Foley, 34, co-host of SustainablyInfluenced, UK

"For me, bio-based means that there's science behind it, it means it is engineered in a way so that it is made almost to mimic a biological process, but done in a way that is lower impact that won't cause harm to humans, plants, 2000 the environment, the air... but it's misleading to people 🧶. They need to make something that is biodegradable, something that won't still be here 200, 300 years down the line"

Confusing

It's just another thing

Negativ Misleading

Difficult to recycle or worse contaminates recycling

Frustrating because it creates more problems

Expensive

Linked to plastic, with bio-plastic being their first interaction with a bio-material material



Seetal Solanki, 41, founder of Matter, UK/Nigeria

"Oil is bio . Everything is biological when it comes to materials. At what point does it change from being natural to unnatural 22."

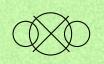


Tammy Gan, 23, writer at Bad Activist Collective, Singapore

"Bio Base has no meaning. Natural? Organic? Renewable? Who knows! All I know (3) is that some sort of like watered down version of sustainable. It feels like it's supposed to be positive, but it's not"

THE CULTURAL OPPORTUNITIES FOR BIO-BASED MATERIALS









• DEFINITIONS

Work is being done to address these misunderstandings. In response to the lack of guidelines and standards in the emerging field of bio fabricated materials, <u>Biofabricate published a research report (2021)</u> to demystify information for brands, media and investors and unify industry behind a standard definition of bio-based which is:

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', excluding those derived from fossil sources.

When we shared this definition with our Panel, their collective feedback highlighted the importance of the following factors in communicating bio-based materials:

Clarity: Each bio-based material needs a specific and nuanced definition to overcome the murky world of sustainability and co-opted language. This definition should outline the composition and origin of the raw materials and the processes it has undergone, and any chemicals used.

Focus: Bio-based innovation should be straightforward, it should be clear what specific problem the innovation seeks to solve and the steps it takes to do that. Our Panel resonated with BIOTEXFUTURE, seeking to remove fossil fuels from the material composition. They also wanted to know whether fossil fuels would be removed from the entire supply chain of the material.

Fossil-Fuel Free: A definition that highlights the exclusion of fossil fuels demonstrates people's lack of awareness of the composition of many materials and fibres and is a critical prompt for curiosity and learning.



Tammy Gan, 23, writer at <u>Bad Activist Collective</u>, Singapore

"Is it really fixing a problem?
And what problem is it that they're identifying? I don't care about the buzzwords but I care about what exactly they're in it for
"""



Suzanne Lee, 52, founder of Biofabricate, USA

"The demand for these materials far outweighs the number of material innovators in the world right now. So the challenge [for material innovators] is not finding the brands who will sign some kind of partnership agreement. That really is not where people should worry or put their focus . They need to put their focus on developing technologies and materials that are really achieving something that is better for humans and the planet ."

The Opportunities For Bio-Based Materials

- THE FUNDAMENTALS
- THE CULTURAL EXPECTATIONS

For all future bio-based materials to be successful, they must consider the cultural demands of both the material characteristics and the producer.

The entry point for all new materials needs to shift from the current state of play to new standards.

THE FUNDAMENTALS





There are three fundamentals all bio-based materials must have:

- 1. A reimagined system
- 2. Radical transparency
- 3. A specific performance

Creating A Better System From The Outset

The textile industry is associated with many systemic issues at the forefront of today's cultural discourse, such as environmental degradation, social inequalities and resource depletion. McKinsey research shows that the fashion sector was responsible for some 2.1 billion metric tons of greenhouse gas (GHG) emissions in 2018, about 4 percent of the global total, while cotton is perceived to be a water-hungry crop and negatively impact ecosystems (however, the latest report from the Transformation Institute (2021) seeks to correct this misinformation, only serving to demonstrate the complexity of information as referenced in Cultural Context.) The recent report (Nov 2021) demonstrating the automotive industry's demand for leather links to deforestation in the Amazon only further documents the unravelling of the textile industry's destructive practices.

In the eyes of our audience, the current system is broken.

As consumers are introduced to new materials and begin to learn about bio-based materials, they, first and foremost, want to know how it is better than what is already available.

Many have already changed their purchase habits to consider sustainable alternatives such as recycled content, secondhand, or rental.

Awareness and acceptance for recycled materials have grown, brought to the mainstream and legitimised by many plastic bottle brands committing to being 100% recycled, off the back of the plastic pollution campaigns in 2018. Ocean plastic material has also become a recognised textile across categories, being used by both multi-national and independent brands, meaning most people have been exposed to the quality and performance of these materials.

The resale market is growing at a rate 11× faster than traditional retail, as documented in a 2021 report from ThredUp and GlobalData. People have become more open to buying second-hand items. These shopping behaviours are the norm amongst our changemakers who rent out their own wardrobes and default to Depop or Vestiare for new purchases.

These new shopping behaviours are a step away from the traditional textile value chain and, therefore, cut ties to societal and environmental issues. This leads to a more critical view towards any material innovation that would 'drop in' to the old, broken system. How do we know this bio-based material is not just creating the same problems and not solving anything?

Climate activism plays a key role in demanding a new textile system. We heard from many of our Panel that a transition to a new way of growing, sourcing, making and using must happen rapidly to avoid climate breakdown and surpassing a 1.5 degrees increase in global temperature. They want and expect companies to start now.

CREATING A BETTER SYSTEM FROM THE OUTSET



Alec Leach, 33, founder of Future Dust, Germany

"Cotton is literally trashing [so many things], like farmers being bankrupted and committing suicide, desertification, deforestation, pesticides obliterating biodiversity. It's very stupid question to ask which fabric is better because none of them are good or bad. It's the volume that's bad ""



Liz Ricketts, 35, co-founder of The OR Foundation, USA/Ghana

"We have an oversupplied linear economy . So literally every new garment is waste until proven otherwise."



Clover Hogan, climate activist at COP26

"Anything that isn't transformational is tokenism @ and there is no hope with another 10 years of tokenism."



Rune Orloff, 37, co-founder of fashion rental POOL, Germany

"Are we just creating another monster?" W Description (1) (1) (2)



Sabine Zetteler, 39, founder of Zetteler, UK

"We have a way of taking something bio or something natural and absolutely depleting it read out of existence, or mass producing it and creating other problems in future. It might not be petroleum based but how is it better ?"



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."



Daniel Navetta, 40, founder of FutureVVorld, USA

"It's more meaningful to keep your products alive for as long as humanly possible (), as opposed to buying the new thing that someone told you is sustainable with quotation marks around it ..."



Working In A State Of Radical Transparency

Overall there is frustration with the lack of accountability for all brands across all industries. This lack of transparency means material alternatives are confusing and perceived as an opportunity to mislead.

For any new product, transparency is considered the golden ticket and the basis for trust within culture. It shows commitment to taking responsibility at every stage of the supply chain. Transparency is also a critical component of material innovation to demystify processes and educate consumers.

From our research, our Panel believed transparency should encapsulate everything. It should go beyond a tick box exercise, covering company values, the supply chain, the workers and manufacturing processes down to the material composition. The information about the material should cover all characteristics and metrics to address intersectional values and connect to different people who enter sustainability from other cultural moments or interests. Whilst provenance may be a priority for one, vegan may be necessary for another, and providing information for both these criteria is necessary. As a consequence, people will feel they can make an informed choice.

As the depth of knowledge of the conscious consumer is increasing and consumers become more aware of the questions to ask of brands, it is vital that material labelling (and websites) should showcase this depth and breadth of information, or brands risk looking lazy or sneaky.

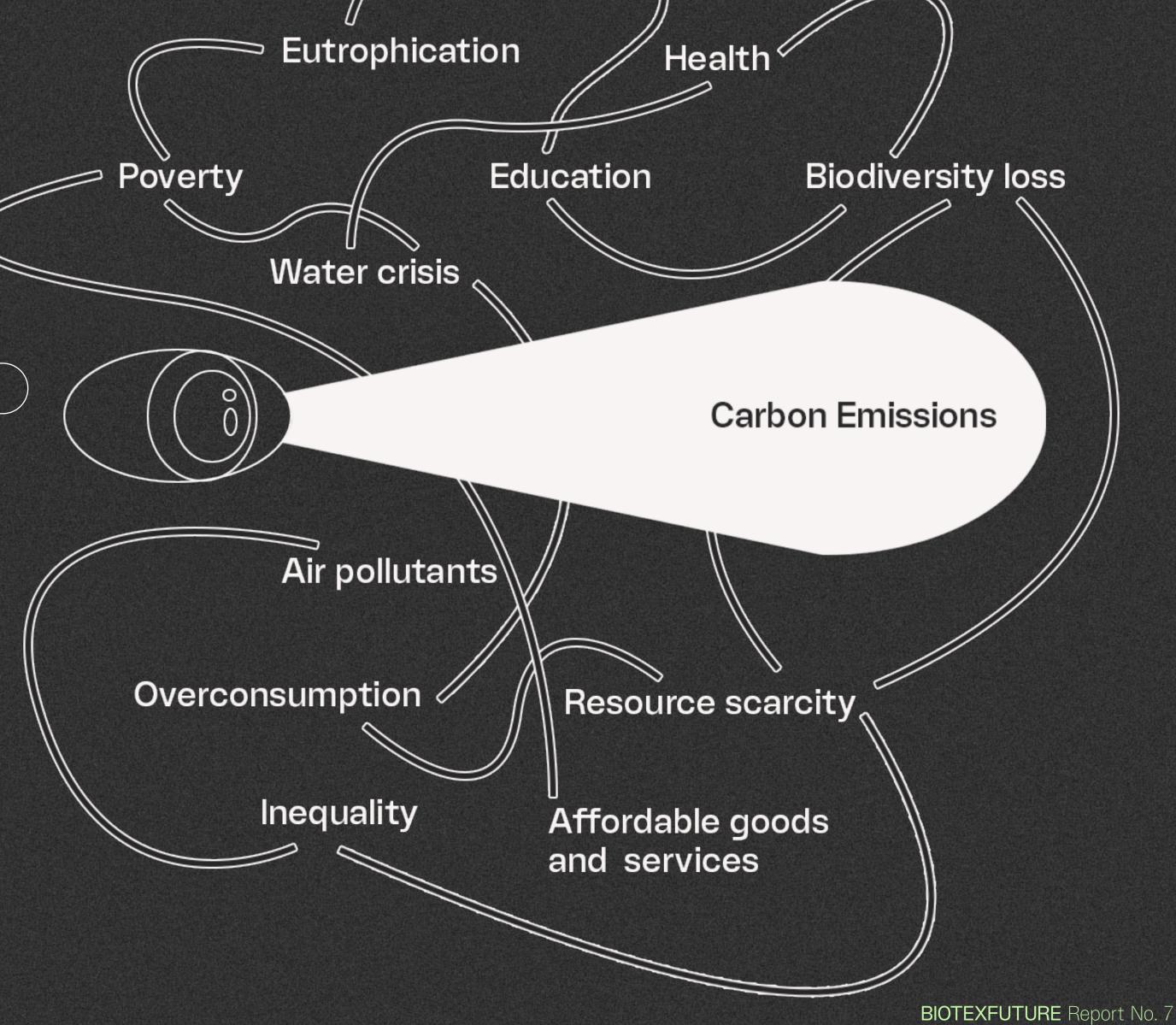
Radical transparency also means being honest about having a growth agenda and documenting sustainability objectives, targets, goals and showing progress against these. Several of our changemakers referred to blockchain technology, used by emerging brands across many categories, setting a precedent for expectations of access to traceability and data sharing.

There are calls for democratic, unified and independently verified labelling across industries to enable people to make informed and direct comparisons. Carbon footprint is the most recognised option currently available. While carbon is a relevant metric (increasingly due to the influence of carbon zero pledges of COP26), very few people understand what a 'good' carbon footprint score is. A carbon footprint is also limited in what it measures and does not cover all the factors that people care about that make up the diversity of sustainability.



Isaias Hernandez , 25, founder of <u>QueerBrownVegan</u>, USA

"Carbon is the emergency everyone is focusing on right now \(\psi\)"



Ecotoxicity





Max Moinian, 30, co-founder of Future Earth, USA

"It's complex, whether you're interested in labour rights or chemicals, there's so many different labour issues, environmental issues, feminism... they all intersect \(\phi \)"



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 (3) to understand what they care about. Because everyone's searching for that silver bullet material. And it doesn't exist yet. So as a brand, for example, what do you care most about? Is it water (1)? Is it carbon (2)? footprint? Is it the chemistry that's used as the end of life and you care about all of those things? But what are your top priorities (1), if you can't get something that that hits all of those perfectly?"



Daniel Navetta, 40, founder of Future VV orld, USA

"I can look at a food label on some bread and it tells me all the 98 pingredients. I know I can make an informed choice, but I can't pick up a box of sneakers and get real meaningful facts and information pike, like what these materials are, how long it's going to take for them to break down and a regulated mandated clear carbon footprint. We're so overdue this type of accountability piece."



Liz Ricketts, 35, co-founder of The OR Foundation, USA/Ghana



Designing For A Specific Performance

As selected by our Panel, a key criteria for all materials was performance. This was in the context of being fit for use (e.g. in sportswear vs suiting) and durable; being easy to care for, and long-lasting.

Our Panel wants bio-based materials to be designed to suit the product's purpose and have a clear use case. This should be suited to the material characteristics, so if it were going to see a lot of wear and tear, then the material would need to be durable and resistant or be light on resources and biodegradable if it is designed for a short life span. This creates opportunities for new ways of framing the material qualities based on the biological capabilities and not the existing materials we are accustomed to, which currently cause direct comparison.

Designing with a short-, mid-, and long term lifespan could inspire a new relationship with our clothes, interior products, and other textiles and herald the start of behaviour change towards the materials we use to better reflect its qualities and potential.



Seetal Solanki, 41, founder of Matter, UK/Nigeria

There's so much demonising of plastic, and it feels like the material is at fault, rather than the human at fault ①. Our behaviours towards materials need to change dramatically."



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"



Suzanne Lee, 52, founder of Biofabricate, USA

"We also need to move from this mindset of trying to mimic a synthetic or an animal material into embracing the different characteristics that these new technologies can offer; challenging our creatives, designers and product developers to work with those characteristics rather than against and embracing those opportunities. o if we think about the colour of leaves on a tree, they are all different shades of green and it's beautiful because of that, why do we want to force biology to do the same thing \(\phi\)?"

THE CULTURAL EXPECTATIONS



Once this foundation is in place, two additional 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.

Our Culture Panel wants to know how do bio-based materials overcome the negative impacts and offer positive solutions for:

- 1. Planet
- 2. People

Planet

People are increasingly aware of overconsumption. Fast fashion brands continue to grow, and the number of items made every year multiplies (despite our knowledge of their destructive processes).

The reality of these numbers is coupled with reports on deadstock shredding and burning and textiles being exported and ending up in landfills in the Global South. There is also increased awareness of the textile waste being shipped around the world, thanks to documentaries like <u>Dead White Mans Clothes</u> and the work by The OR Foundation.

Our Panel immediately wanted to understand what happened to the bio-based material at the end of its life. Many assumed bio-based materials are biodegradable. With many bio-based materials, fibres are blended from multiple sources, or additives like resin are used to enhance an otherwise biodegradable material, limiting the material's capabilities to be recycled or remade. Biodegradability is primarily desirable because it suggests the material has no toxic additives and can return to nature. However, many recognise the complexity and the need for industrial infrastructure to offer this. In all instances, proof that alternative end of life solutions have been designed and incorporated into the material life cycle from the outset is essential. Increasingly they were thinking about the material in the context of their lifetime and whether it will still be in the environment in 50+ years.

There is hesitation towards recycling bio-based materials at the end of life due to recent experiences and challenges of the complexity of recycling of other products, where recycling differs in every country and often means sending the item somewhere else without any traceability.

If recycling were the end of life solution, then preferences would be for it to be accessible at a local, community level, with opportunities to keep the value of the material in the community. Investment into recycling technology should be initiated simultaneously as materials are being developed. To be truly circular, no new virgin materials would be created, and this should be reflected in the producers goals to phase out all virgin materials.

Additionally, to create bio-based material with a whole life cycle mindset, the design needs to address cultural obsolescence that causes products to be discarded or wasted.

Repair hubs in communities and stores are expected to be standard for all innovation - bolstered by the Patagonia Remake initiative and the recent GANNI and Sojo partnership.

THE CULTURAL OPPORTUNITIES FOR BIO-BASED MATERIALS









Lydia Bolton, 27, founder of Lydia Bolton, UK

"Sustainability is about not producing more and more. We've already got enough , we've already got enough clothes for the next six generations, imagine that we never produced another virgin material and everything was made from what we've already got "







Kamonnart Ong, 30, bio designer and country coordinator for Fashion Revolution, Thailand

"A lot of brands have claimed themselves as circular (), but they haven't really closed the loop. They're just using () upcycled material. And at the end, you cannot send the shoes () back to them to compose or to disassemble"



Anastasia Pistofidou, 38, co-founder of Fabricademy and Fabtextiles, Spain

"Design until the product closes the loop ."



DOES THIS FUEL THE WASTE CRISIS?

Perceptions and associations of bio-based materials which challenge its success

24

HOW CAN BIO-BASED MATERIAL BE DESIGNED WITH A WHOLE LIFE MINDSET?

Opportunities and potential for bio-based material through the lens of social justice

RAW MATERIALS

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?

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?

MANUFACTURE

What is the lifespan?

How can I avoid designed obsolescence?

USE

END OF LIFE

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?

Utilises the 'waste' product of other industries

Grown in a closed-loop lab, so no wasted resources

Energy, textiles and water are reused within the local community.

Modular design for repair with interchangeable parts 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

Access to recycling at a local level, with producers investing in recycling technology

Working towards making it 100% recyclable

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HE CULTURAL EXPECTATIONS









People

In order to offer solutions to cultural demands, bio-based materials must address the social justice issues embedded in the existing textile industry, from farmer to maker to consumer to end of life.

The increasing awareness of the 'dirty side' of the industry means our Culture Panel were quick to question the human impact of bio-based material innovation. All our interviewees highlighted the lack of consideration towards the workers in the supply and manufacture of bio-based materials. This growing awareness reflects the success of campaigns such as Fashion Revolution's global initiative "Who Made My Clothes?", Remake advocating for the recent Garment Workers Protection Act (SB62) passed into US law, and more controversially, basketball player Enes Kanter calling out Nike for supporting forced labour in China.

These campaigns are starting to close the existing knowledge gap, which disconnected the many hands that played a role in making a textile - connecting the end consumer with the skilled farmers, craftsmen and designers throughout the supply chain.

By making these links, they want to see a fair treatment of the workers and respect for the communities who play pivotal roles in these multi-billion-pound industries. As we have seen in the climate movement, highlighting the issues not just on a planetary level but on a human level shows the violations that continue to exist despite disasters like Rana Plaza over eight years ago and during the pandemic as many global retailers refused to pay workers for products already made.



Samia Dumbuya, climate justice activist, UK

"It doesn't make sense for brands to earn so much profit 💢 when the people who literally make the clothes don't see 1% of that. Sustainability has three pillars, the environment, the social and the economy 🖂 Because it's all well and good to source your materials from a good place, but if no one's being paid well or they're being mistreated, then that's not sustainable, is it ??



Liz Ricketts, 35, co-founder of The OR Foundation, USA/Ghana

"For me circularity "isn't about material preservation at all." It's about remembering why we need one another. It has to be about redistributing more than material resources, it has to be about redistributing wealth and power, so that there is more agency throughout the supply chain so people can make more autonomous decisions"



Isaias Hernandez, 25, founder of QueerBrownVegan, USA

"The idea of just looking at resources siloed away from the community 🔀 does no justice in creating a more sustainable future, it doesn't make any sense"

WHAT IS THE HUMAN COST?

Perceptions and associations of bio-based materials which challenge its success

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HOW CAN BIO-BASED MATERIAL BE A POSITIVE SOCIAL JUSTICE SOLUTION?

Opportunities and potential for bio-based material through the lens of social justice

RAW MATERIALS

Are these renewable biomass just another form of monocrops from BigAg, which is destructive for subsistence farmers and communities that depend on the local ecosystem's health?

Will these raw materials be grown using chemicals (fertilisers and pesticides) that will leach into the local drinking water and food chain?

Is the farming of raw materials destroying the communities of the global south?

Support smallholdings, regenerative agriculture, and work with marginalised communities

Create respectful and safe working environments, pay the living wage and commit to long term job security. Work with locals and natives, not controlling or owning land with an equitable Partnership

MANUFACTURE

Does this innovation block those in the global south and exclude marginalised communities from success and progress?

Is this material made using exploitative labour which lacks infrastructure?

Will the diversion of manufacture negatively impact minority communities dependent on the current industry for work?

Valuing indigenous wisdom who have long term experience working on biomaterials

Support the Clean clothes campaign through fair wages and championing garment workers, and allowing unions

USE

Will this material contaminate my, or others, community and natural ecosystem, e.g. plastic shedding when worn or washed?

END OF LIFE

Will this material uphold waste colonialism?

Provide explicit care guidance to avoid environmental and societal degradation, such as drinking water contamination or air pollution. Collaborate with second-hand clothing markets to develop solutions for the textile waste

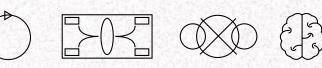
Material Decision Tree

The purpose of this decision tree is to demonstrate the multifaceted approach to considering materials and highlight people's lack of awareness around fossil fuels' role in the material industry – because bringing this into more cultural conversations will support the transition from petroleum-based to bio-based alternatives.

Implications for Industry

- BARRIERS TO MARKET
- RECOMMENDATIONS FOR MANUFACTURERS,
 SUPPLIERS AND BUSINESS

BARRIERS TO 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:

- 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.
- There is very little curiosity around materials. Materials do not trend (exception: GORETEX) in comparison to design or aesthetic.
- 3 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.

- 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.
- 5. 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.

• RECOMMENDATIONS FOR MANUFACTURERS, SUPPLIERS AND BUSINESS

- 1. **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.
- 2. **Transform Business Models** Experiment, but scale fast with the businesses' biggest sellers and stop making niche eco-collections that lack commitment and impact.
- 3. **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.
- 4. **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.
- 5. **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.

- 6. **Take Ownership** Demonstrate extended producer responsibility by conducting garment life cycle assessments 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'.
- 7. Create Community Create spaces for belonging and connection on topics surrounding material innovation, as demonstrated by FutureVVorld.
- 8. **Debate** 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.

THE CULTURAL OPPORTUNITIES FOR BIO-BASED MATERIALS

• RECOMMENDATIONS FOR MANUFACTURERS, SUPPLIERS AND BUSINESS



Max Moinian, 30, co-founder of Future Earth, USA

"I want to see you innovate your long standing bestseller. Not just an offshoot collection... Because I know you're not really making a difference unless you're changing the most important part of your supply chain."



Lydia Bolton, 27, founder of Lydia Bolton, UK

"I don't think that brands should be criticised when they are making small changes. 10% shift in material composition is huge for a brand which produces millions ."



Samia Dumbuya, climate justice activist, UK

"It shouldn't just stick within our echo chambers of environmentalism, but the whole point is to get people on board, especially people who do not even know that much about the environment ..."



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