TRANSFORMERS FOUNDATION

UNLOCKING EQUITY IN INNOVATION

BALANCING THE SCALES IN SUPPLY CHAIN PARTNERSHIPS

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* EXECUTIVE SUMMARY

(1) WHAT'S THE REPORT ABOUT?

This year, the Transformers Foundation Deep Dive Report, ***Unlocking Equity in Innovation: Balancing the Scales in Supply Chain Partnerships*** focuses on innovation pipelines and supply chain equity, exploring the current innovation landscape and highlighting the vital and undervalued role that manufacturers and other suppliers play in scaling new technologies, chemicals, materials, and processes.

The report draws on in-depth, semi-structured interviews with key informants representing 32 global stakeholders across fashion's supply chains, representing global manufacturers, innovators, fiber producers, technology providers, brands and retailers, investors, consultants, multi-stakeholder initiatives, and nonprofits. By teasing out common themes and linking them between each stakeholder group, we have identified three fundamental barriers to scaling sustainable product solutions, the opportunities to overcome these challenges, and case studies on industry initiatives exploring a new way forward for fashion.

(2) WHAT'S THE PROBLEM?

The fashion industry needs to scale products and processes that have the potential to displace incumbent methods in order to reduce its planetary impact. The last decade has seen a boom in innovation racing to solve the industry's biggest climate hotspots, from textile waste to a systemic reliance on fossil fuels for textiles, dyes, and machinery, to air and water pollution and decarbonization of supply chains.[1]

Despite a saturating startup market, there are systemic challenges which almost all players are struggling to overcome, including fundamental knowledge gaps between stakeholder groups that lead to misaligned expectations, and an uneven tolerance for risk between these groups that puts undue pressure on a small number of first-movers.

A lack of coherent policy settings and an industry wide ecosystem to support innovation plagues progress. However, at the core of these challenges, is a typically top-down approach to supplier engagement taken by innovation startups, brands and retailers, and investors. Despite being a critical linchpin to the validation and implementation of innovative solutions, supplier expertise can be undervalued, hindering the adoption of climate-related product-level innovation.

(3) THE PURPOSE OF THIS REPORT

Unlocking Equity In Innovation: Balancing The Scales In Supply Chain Partnerships explores the risk imbalances and knowledge gaps between supply chain actors which is preventing meaningful impact in scaling innovation. While it's important to acknowledge existing power imbalances[2] that lead to uneven capacities for risk and mismatched expectations, this report doesn't seek to point fingers at brands and retailers or label suppliers as victims. We seek to unpack and identify the complex, often conflicting priorities that brands and retailers, investors, suppliers, and innovators are facing as they navigate climate, geopolitical, economic and consumer behavior demands.

Innovation comes in many forms, echoing the complex and multi-layered makeup of fashion's supply chains. This report explores innovations such as next-gen and recycled materials, recycling technology, bio-based chemistry, dyes and their associated processes, as well as innovations that seek to reduce the industry's water, carbon and waste footprints. Innovation, for the purposes of this report, is produced by two distinct stakeholder groups: startups and suppliers.

Innovation requires long-term commitment and investment between stakeholders in an industry that traditionally operates on short term demands and transactional relationships.[3] Brands and retailers are under pressure to invest, participate, and initiate innovation partnerships, but often lack the in-house technical expertise, internal buy-in, supply chain visibility, and demand foresight, among other obstacles,[4] to make the right decisions for their business. This is an inherently unnatural fit between the two, leading to a glut of short-term pilot projects that don't result in wide-scale adoption, unreliable commitments that can fail to materialize when it matters most, and a fragile innovation market where viable solutions struggle to thrive.

Supply chain actors, therefore, typically shoulder considerable risk and burden, be it financial or through time and resources. The report explores this power dynamic to understand how partnerships are negotiated and contributions are rewarded. It offers opportunities for both radical structural change and realistic adjustments that all stakeholders can adopt to align the industry on its innovation ambitions.

(4)

A SUMMARY OF FINDINGS

Unrealistic expectations on costs, performance, and speed to market. Suppliers and innovation startups alike are often collaborating with stakeholders that expect quick results, be it financial or volume capacity. Investors unfamiliar with the climate innovation sector are used to shorter returns on investment, and can lose interest in an innovation that could take decades to reach commercial scale. This can cause innovators to run out of financial runway in the crucial scale-up phase. Similarly, brands and retailers that have set environmental impact reduction targets may put pressure on solution providers to scale quickly, but financing can only speed up processes so much. This points to a broader issue in the landscape:

Fundamental knowledge gaps between collaborators. Beyond investors and brands & retailers misunderstanding of typical timelines of innovation, knowledge gaps exist at all stages of stakeholder relationships. Often, early-stage innovators lack access to or familiarity with fashion supply chains, creating solutions that don't fit the market. Investors that are unfamiliar with the nuances of the fashion industry might finance solutions that are not aligned with the industry's collective targets, spreading funding dollars too thinly without creating meaningful impact. Because suppliers are often excluded from industry target setting initiatives, they aren't always able to share their knowledge or contribute to conversations that directly impact their work. This is a missed opportunity because:

Suppliers are the catalyzers and value creators of the industry. Suppliers bring technical knowledge, networks, funding, and other resources that are leveraged by innovators, brands and retailers to realize their ambitions. In recent years, they have been increasingly viewed as strategic partners by the climate innovation startup scene, while continuing to independently invest in in-house innovation.

Despite this, a cohort of leading suppliers, notably vertical mills and manufacturers, often fuel innovation research and development with sweat equity—with both financial and human capital—with no guarantee that this investment will be rewarded with orders or long-term commitments. It's also uncommon for suppliers to be compensated for testing and sampling, which can disrupt or delay their production lines. Pressure to produce a novel or comparable product for a cost-competitive price means that suppliers are faced with conflicting demands from brands and retailers.

Suppliers are innovators in their own right. All of the suppliers interviewed for this report shared details of their company's internal innovation departments, many of which reinvest millions of dollars annually into resourcing experts and developing sustainability-linked solutions. Suppliers see this as necessary for maintaining a competitive advantage, irrespective of whether brands and retailers ask for or adopt these developments. It speaks to the untapped knowledge held by suppliers that, if given a seat at the decision making table with brands and retailers and innovators, could help drive faster and more effective solutions into the market.

Low brand appetite for price premiums, investment and risk is stalling progress. Most interviewees acknowledged the brand and retailer-led power dynamic that shapes the industry. Brands and retailers set more than fashion trends—they have the power to shore up supplier adoption and investor confidence through their commitments. Even what some in the industry might view as largely symbolic commitments, like letters of intent, signal to the broader market that an innovation has commercial potential, but many brands and retailers still favor short-term flexibility over long-term commitments. This pushes the bulk of the risk and costs further into the supply chain and impacts a solution's capacity for scale.

Financing isn't evenly distributed through the supply chain. Suppliers based in manufacturing regions are typically self-funding the testing of new solutions, while innovators that sit in 'consumer' markets like the U.S. and European Union[5] have access to a wealth of funding channels from venture capital to accelerators, schemes, banks, and brand-related investment funds. However, despite proximity to financing mechanisms, some innovators interviewed expressed frustration at the investment world's interest in seed funding new inventions instead of supporting viable solutions through the scaling process. There is a clear funding gap in the 'Death Valley Curve'[6] between proving a solution's potential and reaching commercial scale.

More equitable pathways for scaling innovation exist. Each stakeholder interviewed for this report made it clear: the barriers preventing progress are not insurmountable, but they will require radical structural shifts in these relationships to enable a more equitable distribution of risk. New partnership models that bring all stakeholders into decision making processes can unlock the true potential and value of the climate innovation sector, and enable a just transition for all of the industry. This report will explore not only theoretical solutions, but real-world examples of initiatives that seek to address these barriers to scale.

(5)

THE CASE STUDIES

To provide real-world examples of solutions and collaborations that illustrate our findings, this report is supported by a series of case studies. Each case study aligns with a barrier identified in the report to demonstrate that efforts to address these exist, being put into practice by forward-thinking coalitions and companies.

(6)

THE READINESS CHECKLISTS

One way to plug the knowledge gaps is to understand each stakeholder's drivers, risks and expectations. We have developed three readiness checklists for this purpose. One for brands and retailers, suppliers and innovation startups. If you're a brand, do you know what to consider when asking your suppliers to provide innovative solutions? If you're a supplier, are you communicating the costs of in-house R&D with your brand customers and startup partners? If you're an innovator, have you established what investment—resource and capital—your solution requires from suppliers? Use these checklists to facilitate transparent decision making and collaboration.

01

INTRODUCTION

Since it was established in 2020, the Transformers Foundation has set out to be a champion and unified voice of suppliers in the denim value chain.

Over the last five years, our annual Deep Dive reports have highlighted a fundamental problem that undermines the industry's sustainability initiatives: a systemic underrepresentation and exclusion of supplier perspectives.[7] Previously, this has been explored through the lens of cotton misinformation,[8] decarbonization[9] and multi-stakeholder initiatives,[10] demonstrating the ways in which this powerful undercurrent is pulling the industry away from its ambitions.

A common truth threads these reports together: if suppliers are not invited to take an equal seat at the table to participate in decision making and co-design, the industry will not succeed in its goals to reduce its environmental and social impact, establish equitable relationships between all stakeholders, or advance preferred practices and materials to commercial scale.

In this year's Deep Dive report, we explore this position further by addressing the product innovation landscape.

Fashion has a complex relationship to innovation. There has never been more solutions offered to the market than today, with concepts seeking to optimize every link in the fashion supply chain, from next-generation materials and bio-based chemicals and dyes, to novel technology and process machinery. But the deeply entrenched business norms of the industry mean that innovation is an unnatural fit, creating considerable barriers that stymie widespread commercialization of solutions.

Through in-depth, semi-structured interviews with key informants representing industry stakeholders, we have uncovered that despite a saturating innovation market, there are systemic barriers that stakeholders are struggling to overcome, including fundamental knowledge gaps that create misaligned expectations, a lack of equitable relationships, opacity of commitments and uneven risk distribution putting undue pressure on a small number of first-movers.

A lack of coherent policy settings and an industry wide ecosystem to support innovation plagues progress. However, at the core of these challenges, is a typically top-down approach to supplier engagement taken by innovation startups, brands and retailers, and investors. Despite being a critical linchpin to the validation and implementation of innovative solutions, supplier expertise can be undervalued, hindering the adoption of climate-related product-level innovation.

The startups and suppliers participating in this report are creating solutions in a number of key impact areas for fashion. We spoke to emerging startups involved in textile-to-textile (T-2-T) recycling, petroleum-free chemicals and dyes, energy and water efficient dying and finishing machinery, as well as incumbent Manmade Cellulosic Fibers (MMCFs) and next-generation pulp producers. In addition, we interviewed global denim and apparel suppliers that are not only heavily involved in bringing innovation to life with startups, but have significant internal R&D departments that work on sometimes dozens of solutions a month to offer the industry. The suppliers represented in this report are based in India, China, Vietnam, Pakistan, Sri Lanka, Indonesia, and Bangladesh, while innovators are based in Europe, the U.S. and the Asia Pacific.

WHY PRODUCT INNOVATION?

The potential for innovation across all tiers of fashion's supply chains is profound. Innovation is necessary to optimize production processes that limit water use, reduce resource consumption and waste, and replace finite raw materials with alternatives but the challenges are complex. Given the focus amongst brands and industry organizations for a reduction in Scope 3 emissions, where the lion's share of the industry's carbon footprint occurs,[11] we have sought to understand the challenges facing the transformation of inputs and processes behind our products. This builds on our previous research on decarbonization and the barriers to achieving facility-level energy savings.[12]

The existing linear and extractive model has been supplanted with a drive towards circularity and decarbonization at all tiers of the supply chain,[13] though it currently lacks the cohesion to deliver its intended impacts. As we'll explore in this report, the innovation startup landscape is in a state of flux[14] as it attempts to graduate from niche to mainstream.[15] Many innovations are yet to reach commercial scale and demonstrate their true potential.[16]

Innovation is a broad concept that encompasses a number of ideas, from innovation in process to innovation in outcome.

It is also dynamic. What was considered innovative only a few years ago might no longer be so today, as research evolves and new processes are developed. As chemical recycling T-2-T solutions come to the fore,[17] we only have to look at the scrutiny around mechanically recycled rPET-derived polyester,[18] sourced from recycled plastic bottles, to understand how quickly the industry is readjusting the parameters of what is considered the best use of resources and what can deliver the greatest impact.

Whilst startups continue to pilot and compete to obtain finance and industry backing, a lack of consensus surrounding impact measurement, lack of policy cohesion and incentives, limited market demand, and financial shyness results in ongoing debate around prioritization of efforts, and fragmented supply chain capabilities.[19] Does the industry have what it takes to innovate? From a technical perspective, maybe. From a convincing business case point of view, maybe not yet.

One thing is for sure:

bringing new solutions into existence will be necessary to evolve beyond fashion's status quo and tackle its climate-related issues. This report doesn't seek to debate or compare the environmental footprint of specific innovations and methods. Instead, we will address the systems driving innovation, and the dynamics that influence, and at times hinder, its widespread adoption. Following extensive research and interviews with key informants representing key stakeholders around the world, we have identified three fundamental barriers to innovation success, along with a number of opportunities to drive progress forward. Structural change is necessary to ensure that this burgeoning sector doesn't repeat the systemic imbalances that the industry has perpetuated since the 1970s, when fashion brands began offshoring production.[20]

WHY NOW?

While fashion's exact contribution to global warming is extremely challenging to calculate,[21,22] it's clear that the $1.9 trillion[23] industry is growing rapidly out of step[24] with known planetary boundaries and established industry targets.[25] Unsustainable business practices, including a reliance on finite natural resources, excessive use of water, petrochemicals and coal power, and a dearth of scaled solutions to deal with overproduction and textile waste, have created a multi-headed monster that the industry must find a way to confront.[26]

According to the *2025 Apparel Impact Institute Report* on the industry's emissions, textile processing remains the largest source of emissions at 55 percent, followed by raw material extraction at 22 percent.[27] The global fiber basket is expected to grow from 116 million tonnes in 2022 to 160 million tonnes by 2030 under a business-as-usual scenario.[28] Every year, between 10–40 percent of clothing made is never sold.[29] This scale of overproduction is dominated by an abundance of low-cost synthetics that made up 67% of all fibers produced in 2023.[30]

The long term security of the industry is under threat.[31] By 2050, average export earnings from major fashion manufacturing regions — Bangladesh, Cambodia, Vietnam and Pakistan — are projected to be roughly 70 percent lower under high heat stress scenarios than if climate adaptive measures are taken. By 2030 alone, this could mean a combined loss of $65 billion in export earnings and nearly 950,000 jobs that the four countries will fail to create unless they adapt, according to a 2023 report by the ILR Global Labor Institute.[32]

In recognition, the industry has formed multiple initiatives and signed commitments to transform supply chains where the greatest share of emissions are generated. These, in turn, have incentivized the push for solutions at the facility and product level, requiring implementation by the supply chain.[33]

It would seem that there's never been a stronger market opportunity for innovation. But in recent years, as geopolitical, supply chain, and economic instability has continually rattled the foundations of fashion[34], a worrying trend has emerged. Companies that made bold Environmental, Social and Governance (ESG) commitments have quietly pushed out their self-imposed deadlines or tempered their ambitions,[35] blaming external pressures that have created a tumultuous business environment.[36] EU legislators have watered down environmental policies under the European Green Deal,[37] while in the US, environmental protections have been rolled back at an unprecedented rate.[38]

Despite this, many key informants representing industry stakeholders interviewed for this report testified to the power of regulation to drive adoption of an innovation that might have otherwise sat on the shelf. One thing is for sure: long-term sustainability shouldn't be deprioritized for short-term distractions. There will never be an ideal business climate to lean into ESG investments. The right time is now.

Whilst the business case for innovation may be clear for some, it's not the case for all in an industry increasingly risk-averse and largely fixated on immediate returns over long-term resilience. Regulation, a critical and powerful driver of innovation adoption, must be designed well to live up to its potential and save the industry from itself. Without regulation,accountability from industry organizations, and even consumer pressure, action is still left to the will of individual suppliers, brands and retailers taking the lead.

These stakeholders must create equitable partnerships to overcome the significant hurdles to scale and supply much-needed solutions to the industry. This report examines why this is necessary, and makes suggestions for how it can be achieved.

KEY DEFINITIONS

For the purpose of this report, we have defined the following terms and stakeholder groups to make clear distinctions between what sits inside and outside of the research scope. In covering broad subjects like innovation and sustainability, it is necessary to convey the parameters of our research.

(1) Innovators & Innovation

Innovation is the ability to produce a new process, concept, or product that solves a problem.[39] In fashion, climate-related innovation is often conflated primarily with next-generation material startups.[40] For this report, the scope of innovation covers novel fibers, dyes and finishes as well as washing processes designed to address environmental concerns including the use of petrochemicals, excess water, material scarcity and textile waste. Our research considers solutions that are:

- **Developed in-house by established suppliers** such as mills, dye houses, chemical developers, laundries, fiber and pulp producers, including vertical operations.
- **Developed by climate innovation startups**, such as T-2-T recycled and next-generation materials, chemical developers producing bio-based/derived dyes, and associated process creators including dyeing and finishing machinery. This encompasses companies classified as hard tech or deep tech providers at both the early and late stages of maturity and referred to in this report as startups or innovators.

Innovators, whether from inside or outside the typical supply chain are solution providers.

References to the 'climate innovation sector' throughout this report includes both groups of key informants. However, certain barriers and opportunities address structural dynamics which are particular to relationships between innovation startups and the rest of the value chain. Whilst in-house innovation faces many of the same challenges, coming from within the fashion system, these dynamics can differ. Though suppliers are part of the climate innovation sector given their own in-house developments, we typically refer to them in their role of partnering with innovation startups. Suppliers work with startups by taking solutions such as plastic pellets, sheets of dissolving pulp or fabric dyes and turning these into yarns, fabrics and wash recipes. We have differentiated between the two where necessary.

*ORIGINS OF CLIMATE-RELATED PRODUCT INNOVATION

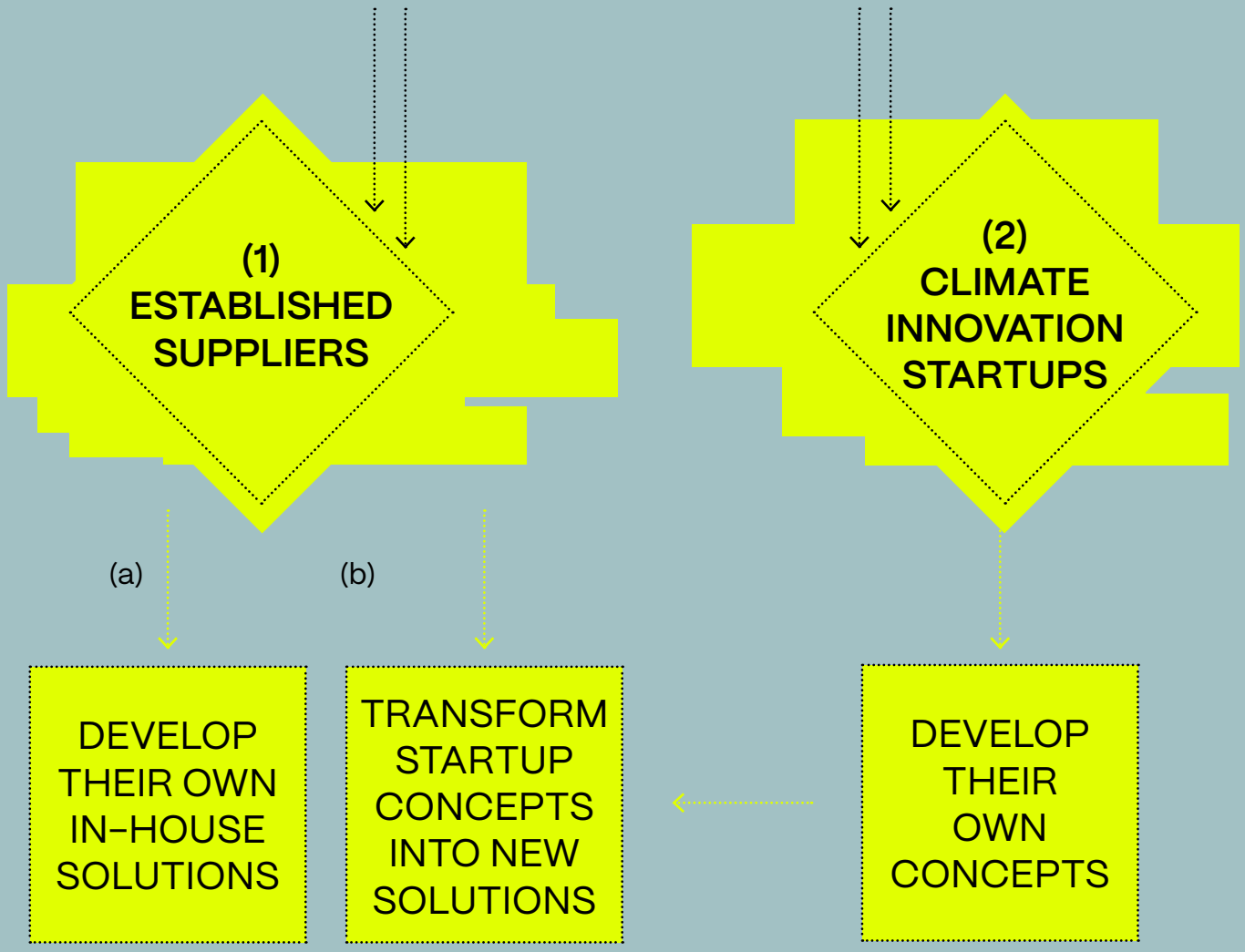


Figure 1
Diagram showing two origin pathways to climate-related product innovation: concepts developed by suppliers as well as startups.
Source: Transformers Foundation

(2) Suppliers

'Suppliers' refers to companies (and their employees) that directly or indirectly produce products, components, raw materials, or finished goods for global fashion brands and retailers. In this report, a supplier, also referred to as a manufacturer, mill or vertical supplier, is a facility or factory that operates within fashion supply chain tiers one (finished product manufacturing) to four (raw material production and primary processing).[41] We have gained insights from seven large and long-standing suppliers as they work with the world's largest brands and retailers, and have more financial power and resources to invest in innovation than small suppliers.

Suppliers, in addition to being innovators in their own right, are value creators.

(3) Brands & Retailers

For the purpose of this report, we focus on global brands and retailers that have the biggest supply chains, the financial capacity to invest in sustainability innovation, and the most significant environmental impact in their upstream operations. Less emphasis has been given to small or medium size brands and retailers that, by nature, have a comparatively small environmental impact and capacity to invest in large-scale innovation solutions.

There is a small cohort of brands and retailers, some with associated investment funds that are first movers in the innovation startup landscape, often partnering with and investing in multiple solutions. This cohort is not limited to the largest of brands and retailers, rather they are at both ends of the revenue scale. They have in common a shared appetite to take the lead on behalf of the broader industry in helping support the commercial viability of novel solutions.

Brands and retailers fuel the innovation pipeline.

(4) Industry Organizations

Industry organizations refer to groups that sit outside of fashion supply chains from a production standpoint, but are heavily involved in convening stakeholders around common ambitions. This includes Multi-Stakeholder Initiatives (MSIs) which are voluntary collaborations and platforms for engagement between businesses, civil society, and other stakeholders that seek to address issues of mutual concern, including human rights and sustainability.[42]

We also explore the role of philanthropic foundations that are responsible for funding and supporting a number of sustainability innovation initiatives, non-profit organizations, research institutes, and innovation accelerator platforms.[43]

Industry organizations are innovation facilitators.

RESEARCH LIMITATIONS

In researching for this report, the Transformers Foundation team approached 8 global brands and retailers known for their engagement with sustainability innovations to share their insights. A low response rate resulted in only one participating in the report. Therefore, the report does not sufficiently represent brands. We attempted to address this gap by asking other stakeholders to share their experiences working with brands and retailers.

Similarly, we acknowledge that the suppliers interviewed for this report represent the top one percent of supply chain actors in regards to scale, production volumes, revenue, resourcing and brand customers. We explore the concept of supplier privilege, recognizing that suppliers are not a monolith. Supplier insights shared in this report don't reflect the reality of all suppliers in fashion's value chains.

Innovation is a broad topic. Agendas and appetites are hugely variable and the fashion supply chain lacks a co-ordinated effort to steer adoption. This report documents a range of perspectives. We offer it as a resource to inform and frame subsequent debate, inviting a more rigorous investigation of each position. Whilst we cannot innovate our way out of the climate crisis, we believe the field of innovation is a critical one to our collective ambitions. As such, it warrants an even deeper level of scrutiny as it continues to attract substantial levels of investment. We hope the findings and recommendations we have shared spark further dialogue towards systemic change and a more equitable and structured ecosystem from which commercialization can materialize.

CONTRIBUTORS

This report is the result of 32 in-depth, semi-structured interviews with stakeholders across fashion's value chain, with a particular emphasis on the supplier perspective. To understand the issues from all angles, the following were included:

Brands and Retailers	1
Brand Investment Arms	1
Brand Related Foundations	1
Industry Non-Profits	2
Innovators / Innovation Startups	10
Innovation Platforms	1
Investors / Investment Platforms	2
Industry Experts / Consultants	5
Philanthropic Platforms	1
Sourcing Agents	1
Suppliers	7

We conducted interviews with organizations focusing on climate innovation, as well as a thorough literature review of industry reports to contextualize our findings. These publications include those published by *Fashion For Good,*[44] *Apparel Impact Institute,*[45] *Sustainabelle,*[46] *Textile Exchange,*[47] and *Sourcing Journal,*[48] among others.

02

THE INNOVATION ECOSYSTEM

There are ***six*** core stakeholder groups participating in innovation, each with their own priorities, challenges, and responsibilities to consider. To understand where the opportunities for change exist, we must first understand the ways in which these groups intersect and collaborate. Below, learn about the roles and realities of ***innovation startups***, ***suppliers***, ***brands and retailers***, ***investors***, ***regulators***, and ***industry organizations***, to contextualize the interconnected barriers and opportunities they face as a collective.

UNDERSTANDING THE INNOVATION LANDSCAPE

The fashion innovation space as we know it is nascent.

Innovators in the past weren't exposed to the same time, environmental, regulatory, and financial pressures that modern businesses face today.[49] Synthetic indigo dye, for example, was invented in around 1880,[50] and took 17 years (and $2 million in R&D, the equivalent of $63 million today[51]) to find commercial success. Polyester fibers were first created in the 1940s but it wasn't until the 1960s that production boomed and prices dropped.[52]

One of the most recent 'new' materials to reach commercial scale, Lyocell, was first developed in the 1970s.[53] After a decade of development and pilots, the first commercial scale facilities were opened in the 1990s.[54] It began to achieve widespread adoption after Lenzing AG acquired the TENCEL™ brand in 2004.[55]

The lesson is: bringing innovation to scale and commercialization takes time. But can the industry reconcile this with another important truth: *we don't have time to lose.*

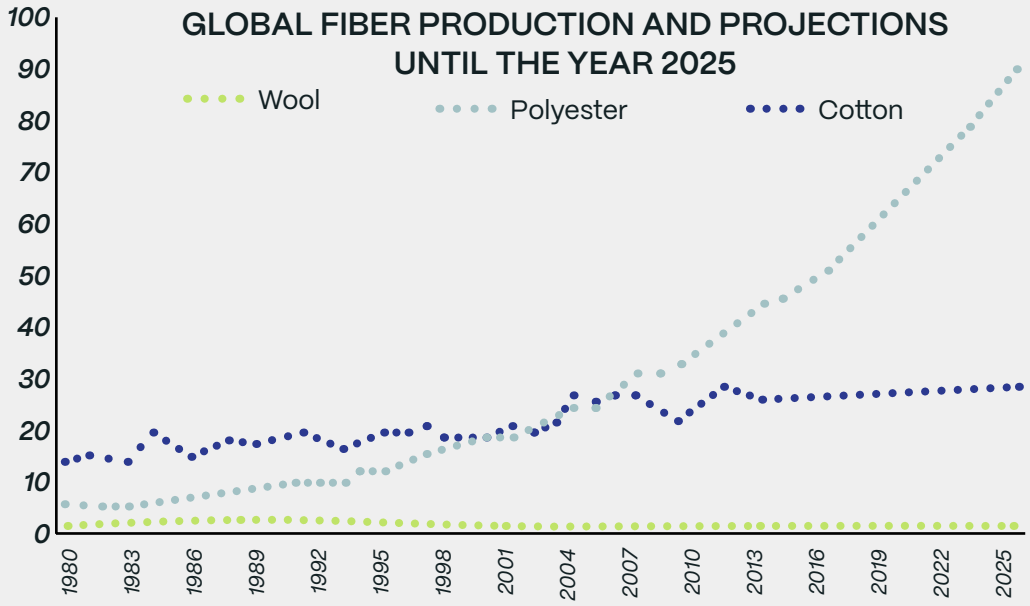


Figure 2
Global fiber production and projections until the year 2025.
This figure, created by Tecnon OrbiChem, was published by the Food and Agriculture Organisation of the United Nations (FAO) as part of the FAO Fisheries and Aquaculture Technical Papers Series, in a report titled "Microplastics in fisheries and aquaculture: status of knowledge on their occurrence and implications for aquatic organisms and food safety" by Lusher, Hollman, & Mendoza-Hill in 2017.[56]

A representative from a next-gen fiber innovation startup put it simply:

> "We have run out of time, and so the speed of getting solutions into the market and rapidly deployed is important."

In recent years, prominent innovators which seemingly had all the right ingredients for commercial success—high profile and highly publicized brand partners, millions in investment dollars to build facilities, pilot projects that demonstrated efficacy, supply chain partners and more—have failed to scale their fiber solutions. Notable examples include Bolt Threads,[57] Renewcell,[58] and Natural Fiber Welding.[59] Additionally, through our research, the Transformers Foundation has been informed of other technically viable solutions, including those developed in-house by suppliers, which have thus far been unsuccessful at gaining traction. The reasons vary, including challenges related to funding gaps, supply chain integration, performance, capital intensity, high unit economics and inconsistent brand appetite. As we discover in this report, the barriers to achieving commercial viability for novel inventions are substantial, underpinned by uneven risk burdens and misalignment on various fronts.

It is a critical moment for the fashion industry, with under five years left to meet a number of climate targets amid a rapidly changing regulatory landscape. While there is no shortage of innovators racing to prove the viability of their solutions,[60] as we show in this report, the industry doesn't have any more time or resources to waste on innovations that aren't able to demonstrate a strong business case.[61]

A representative from a global innovation platform said:

> "Something we've heard from a number of stakeholders is the need to go deep rather than wide with innovation to be able to scale and get the cost curve down quickly."

* FASHION'S 2030 TARGETS

- **Sustainable Development Goals:** The 2030 Agenda for Sustainable Development, adopted by all United Nations members in 2015, created 17 world Sustainable Development Goals.[62]

- **Science Based Targets:** Commits corporate signatories to a framework for setting targets and limiting global warming to 1.5°C in alignment with the Paris Agreement.[63]

- **The Fashion Pact:** Achieving 100% renewable energy across own operations by 2030.[64]

- **UK Textile Pact (WRAP):** *Formerly Textiles 2030*, the UK voluntary agreement guided by a Textiles Circularity Roadmap includes targets of a 50% reduction in the overall carbon footprint of new textile products and a 30% reduction in the overall water footprint of new textile products by 2030.[65]

- **Textile Exchange:** Climate+, is the organization's goal of guiding the fashion, textile, and apparel industry towards reducing greenhouse gas (GHG) emissions from fiber and raw material production by 45% by 2030 in line with the Paris Agreement and keeping global warming to a 1.5°C pathway.[66]

- **Apparel Impact Institute:** An ambitious target of reducing 100m tonnes of CO2 emissions from apparel and footwear supply chains by 2030 through solutions funded via the organization's Fashion Climate Fund.[67]

- **The UN Fashion Charter for Climate Change:** A vision to achieve net-zero emissions by 2050, in line with keeping global warming below 1.5 degrees. ***Notable commitments include***: "Source 100% of priority materials that are both preferred and low climate impact by 2030, ensuring that these do not negatively affect other sustainable development goals. This includes pursuing materials that are closed loop recycled, deforestation- and conversion-free in their origins, apply regenerative practices, and that relevant verification and impact measurement mechanisms have been applied."[68]

Alignment of investment and adoption will be needed to scale the most commercially viable solutions.

While the urgency of the climate crisis is undeniable,[69] many startups interviewed for this report agreed that expectations of scale, speed to market and price parity remain unrealistic and premature given their lack of maturity.

Another next-gen fiber innovation startup founder describing the situation said:

> "There is pressure from brands and there is pressure from capital partners because we want the solution, and it has to be done in the right way. Fundamentally, this isn't an unsolvable problem, we're not creating new physical laws, we're not trying to invent a new element. And if we take our time now to really solve it, to set a strong foundation, then the future can really be circular."

They also described the perceived knock-on effect for the wider innovator landscape if their solution doesn't scale:

> "One of the big challenges is, like some of our past peers in the industry, if we fail, not only do we fail, but we then disincentivize others from trying."

Individual brand efforts to increase recycled materials, transform material portfolios, or implement climate-related processes in dyeing and finishing have made headway. However, the industry lacks a collective approach to drive adoption at scale in the way that the Science Based Targets initiative aligned industries on decarbonization targets.[70] Industry organizations have had some success in bringing brands and retailers, innovators, investors and suppliers together to achieve this collective action, however the pool of brands and retailers willing and ready to participate remains shallow.[71] According to our 2024 Deep Dive report, participation in MSIs can be expensive and these groups tend to expect results without understanding — or factoring in — context and on-the-ground realities of suppliers.

Without volume commitments from brands and retailers, innovators and their suppliers take on the lion's share of the risk to develop and scale solutions.

It's a catch-22: overwhelmingly, brands and retailers won't buy in until they have certainty from innovators of price, performance, and scalability. Suppliers, tasked with implementing a solution in their facility, won't buy in until they see brand support to demonstrate market demand. Investors want proof from both, to ensure a return on their investment. Innovators are often stuck in the middle, trying to secure one commitment that will open the door to another.

Illustrating the conflicting priorities of key stakeholders, the founder of a technology startup explained:

> "Brands move so slowly in their adoption of something new, and the investors and the industry expect us to succeed so quickly. They're in contrast to each other."

Climate performance is vital, but definitive guidance on impact modelling is required.

Climate-related innovations must demonstrate a lower environmental impact than the conventional alternative. Some innovations are designed to reduce impact in some areas such as water, but not others such as emissions.[72]

Life Cycle Assessments (LCAs), the standard methodology for measuring impact[73] are especially important when innovators go into their series B funding round, where investors expect proof of a fully fledged business case, says one expert from a brand investment arm. But as a bio-based dye innovator told us, they have their limitations. For one, the information needed to conduct an LCA, such as standardized and centralized data, is often inaccessible or non-existent.

This creates an initial hurdle in achieving something that is considered by other stakeholders, notably suppliers and brands and retailers, to be vital:

> "It is very difficult to access industrial process data. Experts tell you it is polluting, you estimate the impact with the most relevant public knowledge available, but in reality, the data remains opaque. Even leading international brands may not be able to access primary data. And logically, clients and investors ask for comparative life cycle analyses. Various estimates from mainstream LCA databases can be very far from the reality, strongly underestimating emissions and impacts, especially for chemical products."

The cost of conducting an LCA can present another hurdle for cash-strapped innovators. Comprehensive LCAs can cost between $50,000 to $100,000 or more per product,[74] depending on its complexity, and will only give a snapshot measurement based on one iteration of the solution. As soon as an innovation evolves, that LCA will no longer apply. We heard one example of a brand paying for an innovator's assessment, however the burden is typically on the innovator to pay for LCAs.

Whilst historical data gaps and a lack of standardization can prevent comprehensive comparisons from being conducted, stakeholders agree that greater transparency around LCAs, consistent methodologies, sufficient replacement rates and honest discussion around trade-offs—such as energy use, feedstock compatibility, and end-of-life outcomes—are critical to establishing trust in these technologies. Recently, industry organization Textile Exchange has sought to bolster the effectiveness of LCAs by releasing more comprehensive and holistic guidelines, attempting to bring the industry into alignment for more rigorous results and data capture.[75]

BRANDS FUEL INNOVATION PIPELINES

Interviewees for this report were all asked the same question: *who holds the power in innovation relationships*?

They answered unanimously: brands and retailers. This is hardly surprising—it mimics the traditional power dynamics that are typical of fashion supply chains. Although some noted that this dynamic was beginning to shift, it's generally understood that brands and retailers have undue power because they have something startups and suppliers don't: direct access to consumers.

A denim sector consultant described the power imbalance bluntly:

> "Because the brand has the cash, they have all the power and influence over the suppliers and innovators to decide the success and the failure of everything."

While this top-down power dynamic creates its own challenges that we'll unpack further in this report, innovators can also struggle to connect on common ground with brands and retailers. Transactional buying relationships, seasonal cycles, and intense margin pressures dominate relationship dynamics in the fashion industry,[76] but these are sub-optimal conditions for innovation to scale.[77] Additionally, innovators are often fashion industry outsiders,[78] meaning they might not have the supply chain access or know-how necessary to create a solution in line with what the industry needs—we'll explore this issue in the next chapter. Both innovators and suppliers benefit from long-term strategic partnerships, purchase commitments, knowledge exchange and collaboration with brands and retailers to build enough momentum to take a concept from seed to scale.[79]

Brands and retailers are often distanced from their suppliers,[80] and it's unsual to have visibility of their supply chains beyond direct tier one facilities.[81] The 2024 Fashion Transparency Index, produced by Fashion Revolution, stated that while 52 percent of the world's 250 largest brands and retailers disclose tier one manufacturers publicly, only eight percent disclose any of their raw material suppliers.[82]

It's still uncommon for a brand to have direct dealings with dye houses, chemical suppliers, or fiber processors as these interactions are typically managed by trusted supply chain partners.[83] So while brands and retailers are critical to the commercialization of innovations by signaling market demand and instilling stakeholder confidence, many lack the in-house technical knowledge and experience in deeper supply chain tiers where these innovators operate to know how to engage.

As one ex-sourcing director for a global brand puts it:

> "The biggest challenge this industry has today is the lack of manufacturing understanding. Western brands and the Western thinkers live in a world which is extremely far away from the reality of manufacturing."

Both innovators and suppliers noted the challenge of navigating the typically siloed nature of departments within a brand, which creates misaligned internal priorities and ambitions—a common issue for internal sustainability teams too.[84] Cross-functional buy-in is vital for innovation to stand a chance,[85] but often the teams responsible for driving sustainability agendas and product innovation aren't the same people unlocking financing and other resources to flow to innovators.[86] When key decision makers aren't aligning and communicating internally, this friction can create a time-consuming headache for innovators.

An executive of a textile recycling company shared their experience:

> "Quite often, you engage with the innovation team, and you go a long way with the innovation team. And then when it comes to doing an offtake, they'll bring in the commercial team. And you often then have to start educating the commercial [team] because the commercial team will come with a 'you're just another supplier' mindset, and it's like 'well, no'...the innovation team is different to the commercial team, different to the supply chain team, and they don't always talk."

When it comes to signing contracts, this can be a dead-end for innovators if they're engaging with the wrong person in a brand, says one bio-based dye innovator:

> "Signing first commercial contracts – mandatory to raise more money – can be a dead-end if you are not talking to the right people within an organisation. The decision-making process is critical. Most of the companies, brands or suppliers, are not familiar with complex contract schemes (including milestones, suspensive conditions, commitments, take or pay, etc.). People can be afraid of signing such contracts or even don't have the mandate to do it. Purchasing teams may not be used to suspensive conditions or long term deals, innovation teams may not have the right to contractualize with material suppliers, sustainability teams may not have the budget to engage in a multi-year product supply agreement, especially with young and fragile companies."

Adding to this are the shifting internal priorities and tendency for some brands and retailers to lack long-term vision, largely connected to the revolving door of leadership and internal personnel. Large company CEOs typically last just over seven years, according to McKinsey research,[87] and if sustainability goals aren't intertwined with the overarching strategic ambitions of the business, the teams responsible for sustainability and innovation can be seen as non-essential[88] during cost-cutting exercises.[89] For innovators, this can be a devastating blow to vital relationships built over several years within brands. We discuss the importance of ownership level mandates as an opportunity in the following section, Opportunity #1: Close the Knowledge Gaps.

As a former consultant from the textiles research space explains:

> "Even at the CEO level, there is significant insecurity about how long the leadership will be in place... So then the new CEO or the new vice president of supply chain comes along, and all of a sudden you throw everything out and start from scratch again."

SUPPLIERS ARE THE LINCHPIN OF INNOVATION

Suppliers play a pivotal role in the innovation landscape, and one that is often under-recognized. As the bridge between raw innovation and commercial success, not only is their expertise leveraged to test, develop and scale concepts, but suppliers actively refine and transform innovation into consumer-facing products.[90] Most critically, they also validate the credibility of an innovation; a trusted supplier's tick of approval and support can carry significant weight with brands and retailers as they navigate the saturated and complicated startup landscape.

The sustainability director of a large manufacturer told us:

> "For the big brands that we work with strategically on innovation, when they get approached by certain startups, they have started saying 'why don't you work with [the manufacturer] and then come to us."

We heard from some suppliers that they are also tasked with translating how technical developments will impact the end product's cost and performance. Their on-the-ground proximity and experience means they end up educating brands and retailers on the feasibility or impact of an innovation. Often, before an innovation hits the market, this work comes at their own cost and effort. One supplier told us that this process can last as long as three to six years.

But suppliers interviewed for this report recognize that to stay competitive, they have to be innovators too.

Three major vertical suppliers explained that they reinvest between $2 to $6 million of revenue per year into their own R&D department, working on up to 40 new sustainability innovations a month in some instances. We heard from suppliers who explained that as brands and retailers become less technically proficient, they are increasingly relied upon to bring them new innovations in processing, materials, and chemistry. Coupled with the demand for solutions being driven by industry commitments such as Canopy's Next Gen Now[91] and CanopyStyle[92] Initiatives, this effort is seen as vital to building trust with customers as well as gaining competitive advantage, but it's done without any guarantee that they will adopt these solutions.

The managing director of a vertically integrated manufacturer said:

> "It's the risk we take in developing. We pick projects we know are serious, knowing that it may not succeed, but we have enough business with these customers where even if this development does not succeed, it strengthens the relationship and makes us more reliable partners. That's how we see it. It's an investment we make in the relationship."

The potential payoff for suppliers can be increased or continued business with those brands and retailers. Or as one denim manufacturer explained, the payoff could mean becoming a preferred supplier, which then opens doors to more opportunities for industry collaboration and visibility.

An Environmental, Social and Governance (ESG) lead from a supplier explained:

> "If you have good partnerships and you are one of the strategic suppliers for the brands they also connect you with different organizations like Apparel Impact Institute, Fashion for Good, and other innovators that do a lot of good work."

It's important to note that the ability to invest in innovation is a privilege not afforded to all suppliers. The suppliers interviewed for this report represent a tiny fraction of the world's producers, despite being some of the largest. Tens of thousands of smaller suppliers are working to impossibly tight margins, taking on significant debt just to fulfil orders, and have low visibility into the future of their business. As identified in our 2023 report, Rethinking Fashion's Doomed Climate Strategy,[93] this makes the investment into necessary facility-level decarbonization challenging,[94] let alone funding product-level innovation that might never get adopted.

Even at large producers, if a facility isn't producing at high enough volumes to run trials, the cost of participating in innovation is too high, says one manufacturer:

> "You can't do samples if you're not making production... If you're in production, you can slip it in and it's not costing that much to put it in the process. You have to have a vibrant mill that's producing a lot of fabric to be able to get samples through."

It comes back to the question of power. Large suppliers with the profit and resources to engage in innovation, whether in-house or with startup partners, appear to have a more even power balance with brands and retailers, who rely heavily on them. Some research participants for this report believe that this gives these suppliers a higher degree of influence and leverage with their customers.

One consultant told us that this subverts the perceived top-down chain of command:

> "[The industry] still believes that we work in this hierarchy, with the customer on top and the supplier at the bottom. But it has been a peer-to-peer relationship for a long time, because there are lots of brands that can't live without their suppliers. Or if you look at some of the big suppliers in the world today, they are much bigger than their customers."

However, while certain suppliers have the capacity and funding for R&D, it still comes at a high cost with little guarantee of any return on investment. Brands and retailers set the terms, often informally, as well as timelines and commercial decisions. A supplier might work on an innovation concept at the request of a brand, only for the brand to lose interest or shift priorities, especially if the end result is more expensive than the existing option.

A denim manufacturer told us:

> "We have brands walking away from certain process-led improvements thinking it's too high a price to do this in the garment. Even acknowledging that it's going to be useful. Especially at the process level, it is always assumed that it will be cost neutral, but most of the time it cannot be."

Supplier power is conditional and limited due to historical exclusion from decision making opportunities. In our 2024 Deep Dive report, we explored the lack of supplier voice in MSIs.[95] Without systemic shifts to redress the uneven distribution of risk away from suppliers' shoulders by bringing them into strategic decision making from the outset, their innovation efforts will remain undervalued by the industry. We explore this issue further in chapter Barrier #2: Suppliers are not Considered Core Value Creators of Innovation.

A representative for a brand related foundation said:

> "Hopefully the future-proofing of the industry is connected to more equitable partnerships, rather than the transactional nature of what we see today."

* SUPPLIER ROLES AND RISKS AT DIFFERENT STAGES OF INNOVATION STARTUP PARTNERSHIPS

FUNDING STAGES	Pre-Seed	Seed Round	Series A	Series B	Series C +
INNOVATION STAGE	LAB RESEARCH / PROOF OF CONCEPT	R&D & PILOTING	VALIDATE PRODUCT- MARKET FIT	INDUSTRIAL SCALE UP / COMMERCIALIZATION	MARKET GROWTH
SUPPLIER RISK	NIL – LOW	MEDIUM RISK	HIGH RISK	HIGH RISK	MEDIUM RISK
SUPPLIER ENGAGEMENT & RISK TYPES: TECHNICAL & COMMERCIAL	☐ Fostering relationships with academia/ innovation labs ☐ Seeking trial/pilot opportunities with startups ☐ Informal technical support to startups ☐ Initial prototyping support to validate idea / develop MVP for startups	☐ Testing and sampling ☐ Prototyping ☐ Small scale trial/ pilot ☐ Machinery retrofitting ☐ Process changes ☐ Trouble-shooting ☐ Introducing other supply chain actors ☐ Knowledge sharing with innovator and brand partners	☐ Brand partnerships ☐ Continued trial/pilot ☐ Capital investment in machinery modifications ☐ VC investors might call in ROI jeopardizing startup cashflow or project milestones ☐ Validation of sustainability and/or product claims ☐ Traceability collaborations	☐ Trialing commercial scale volumes with innovator ☐ Requirement for startup to generate profit putting pressure on go-to-market strategy ☐ Price premium at top of cost curve ☐ Volume commitments triggered ☐ Performance challenges	☐ Margin pressure from brand customers ☐ Supply chain integration hurdles ☐ Dependency risk
AGREEMENT TYPES SIGNED BY SUPPLIERS	☐ Mutual Non-Disclosure Agreement (MNDA)	☐ Mutual Non-Disclosure Agreement (MNDA) ☐ Equipment hire agreement ☐ Consulting agreement ☐ Pilot testing agreement	☐ Exclusivity agreements for guaranteed capacity from commercial facility ☐ Letter of intent ☐ Offtake agreement ☐ IP licensing agreement	☐ Letter of intent ☐ Offtake agreement ☐ Volume commitment agreement	☐ Strategic collaboration Agreements ☐ Framework agreements
DURATION	3 – 5 years	3–10 years +	2 – 4 years	5 years +	

Figure 3
A table demonstrating the supplier risk junctures at the different funding and innovation stages of startup partnerships
Source: Transformers Foundation.

THE INVESTMENT SCENE

In the 2020 'Financing the Transformation' report, Fashion for Good and Boston Consulting Group (BCG) estimated that the industry would need $20 to $30 billion annually invested in innovation to reach its 2030 climate goals, with 35 percent of this overall financing needed in the upstream processing and cut-make-trim facilities, and around 45% in raw materials and end-of-use solutions.[96]

Avenues for funding novel solutions are varied, from government or philanthropic grants, brands and their investment funds, venture capital, banks and private equity.

For innovators, these financing mechanisms perform different roles at different maturity stages. They also have varying levels of patience to see returns on their investments (ROI). Finding and maintaining the right investment at the right time is critical for innovators to ensure the long-term health of their business, but external investors are often unfamiliar with the fashion industry and its supply chains.[97] Fashion's sourcing and production timelines, multi-layered manufacturing processes, and the fractured, fragile nature of supply chains can be uniquely complex for investors to understand. For innovators and investors alike, aligning expectations on ROI timelines, impact, scalability and performance is a critical element of success.

A denim sector consultant explains:

> "If you're an innovator in this space, you need capital to grow. The question is, where do you get this capital from? You can either get the capital from venture capitalists, who normally are looking for a very short-term return, but can offer a lot of cash fast—very attractive. Or you can go to [impact investors], where you can get more long-term investment, but less return and less money. This balance is really, really difficult."

Existing funding models are misaligned with the realities of innovation in fashion supply chains.

Financing fluctuates—it's abundant at some stages of the innovation lifecycle and scarce at others.[98] Several interviewees explained that there is a wealth of seed funding compared to financing during the post-pilot scale-up phase. The lack of consistent financing proves a major challenge for innovators to navigate as they go from seed to pilot to commercial scale. This process can take years, but unpredictable appetite for financing can kill viable innovations when they need it the most.

A technology innovator interviewed for this report shared that despite their technology being ready to scale, they found most financing options were open to seed-stage innovators trying to get a concept off the ground, and not to fully fledged businesses. The closer to scalability the solution becomes, the more heavily it is scrutinized by potential investors, explained the innovator.

The consequences of not securing timely funding that aligns with the innovation maturity level can be dire, they said:

> "There's only so much runway that a new innovation has. Eventually we run out of money. And often people are running out of money right at the point that it should be taking off... If you want radical results, you need radical innovation, but then you need a new way to fund it."

Brand-related investment funds[99] have a unique advantage over traditional financiers as they operate within the fashion ecosystem, bringing valuable networks and insights to the innovators they support. These funds tend to take minority ownership positions in early stage startups or make Series A investments. They often act collaboratively with competitor brands and retailers to pool funding for larger investment rounds.

The investment mix behind a startup matters. Whilst supply chain partners share the risk of R&D, they obviously do so in the high hopes the innovation will succeed. For this reason, we heard from suppliers with considerable experience trialing new solutions that determining the financial acumen of founders from the outset is key. See the readiness checklists for more information.

* THE STARTUP LIFECYCLE & STAGES OF INNOVATION MATURITY

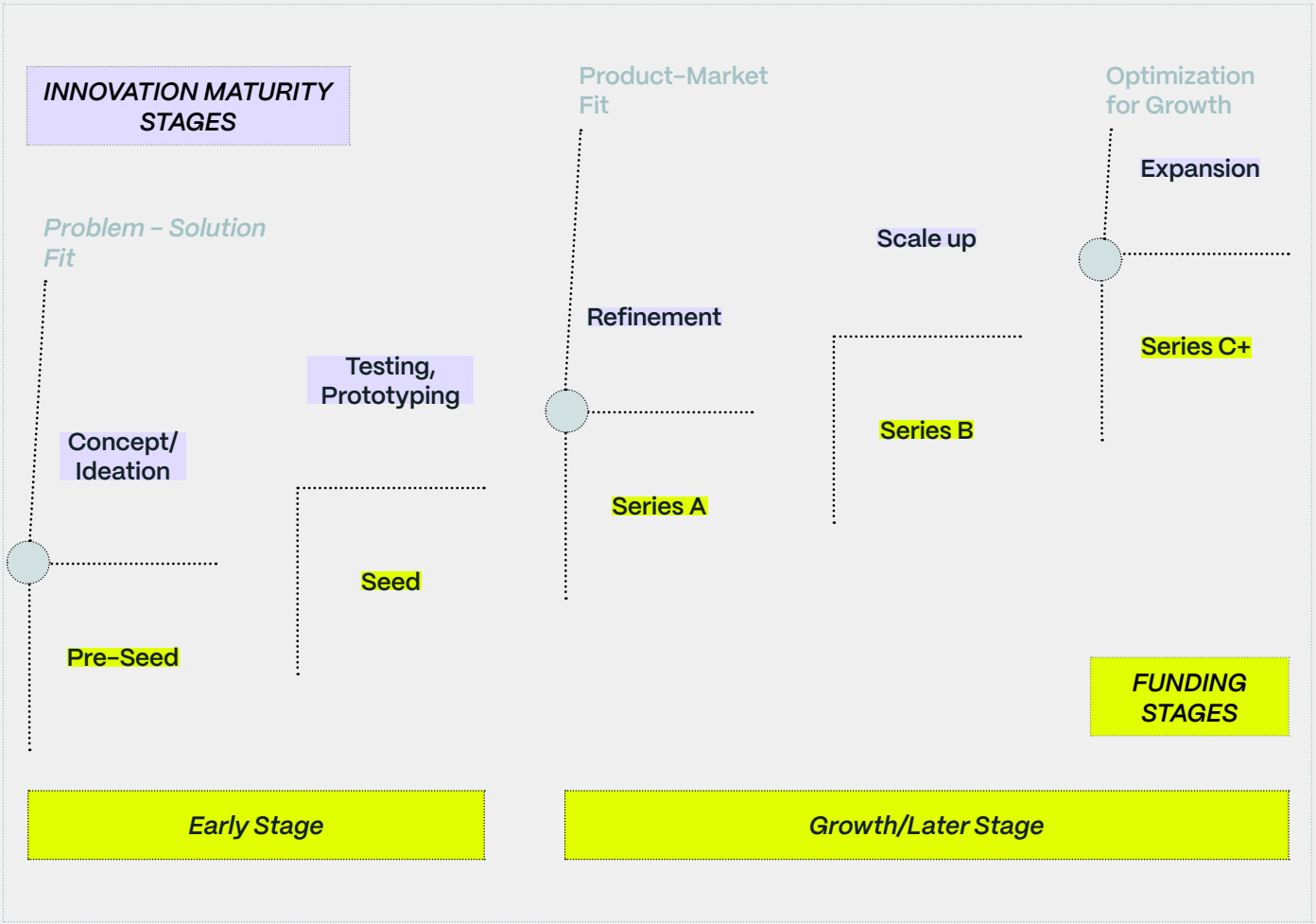


Figure 4
The startup lifecycle and stages of innovation maturity.
This figure illustrates the different stages of funding for startups raising capital and the progression of maturity of their innovations at each funding stage.

* WHAT DO THE DIFFERENT FUNDING STAGES MEAN?

New companies may need to operate at a loss for several years before they make a profit. To help their company grow, business owners hold funding rounds to raise capital from investors. Each investor buys a stake in the company, hoping it will gain value as the business grows.

Pre-Seed Funding

The earliest stage of funding for a new company. It comes so early in the process that it is not generally included in the funding rounds. Known as "pre-seed" funding, this stage typically refers to when a company's founders get their operations off the ground. Common "pre-seed" funders include government or industry grants, and close friends and family or other supporters.

Seed Funding

The first official equity funding stage. It typically represents the first official money a business venture or enterprise raises. Seed funding helps a company finance its first steps, including market research and product development. With seed funding, a company can get assistance in determining what its final products will be and who its target demographic is. Seed funding is generally used to employ a founding team to complete these tasks.

Series A Funding

The first round of significant venture capital investment that a startup raises after seed funding. It typically occurs once a company has a proven business model, some traction, and is looking to scale its operations. The funding is usually used for hiring, product development, and market expansion, and investors receive equity in the company in return.

Series B Funding

Series B rounds are about taking businesses to the next level, past the development stage. Investors help startups get there by expanding market reach. Companies that have gone through seed and Series A funding rounds have already developed substantial user bases and have proven to investors that they are prepared for success on a larger scale. Series B funding is used to grow the company so that it can meet these levels of demand. Series B appears similar to Series A regarding the processes and key players. The difference with Series B is the addition of a new wave of other venture capital firms specializing in later-stage investing.[100]

INDUSTRY ORGANIZATIONS ARE CONNECTING THE DOTS BETWEEN STAKEHOLDERS

Philanthropic foundations, multi-stakeholder initiatives, and non-profit organizations play a key role in convening stakeholders around common goals and catalyzing collaboration. They bridge the gaps that separate suppliers, brands and retailers, investors, and innovators, inviting the right people around tables to broker deals, unlock funding opportunities, find solutions to complex problems, increase transparency, and build standards.

The former textiles research consultant speaks to the need for more alignment between stakeholder groups:

> "There's a lack of mutual understanding of the pressures that everybody is under, and it's an us-versus-them type of mentality... We really need an alignment, maybe at the ownership level, of what the priorities and the values are, and then work our way back down from there. Assuming that everybody is actually on the same side of the table, and there is not a victim or an oppressor."

They also play an increasingly important role in concentrating investment towards a specific solution, or category of solutions, to help achieve scale. For example, Fashion for Good's Future Forward Factories[101] project is creating an open-source portfolio of blueprints for tier two factory decarbonization solutions, working with a consortium of stakeholders to scale low-impact innovations.

One manufacturer suggested that if the 10 biggest brands in a product category could agree on a set percentage of recycled fiber and align on an agreed premium during the scale up phase, this would drive volume demand and accelerate the pathway to cost neutrality, a major sticking point as we will learn about in chapter Barrier #3: Insufficient Brand Commitment. This suggests that the role of industry organizations could be expanded further to set and hold participants accountable to agreed targets.

The program lead at a philanthropic foundation explains its function:

> "The sort of things that philanthropy can play a role in, beyond funding, is enabling these structures, or convening and coalition-building of unlikely alliances with a very specific focus on people...we're enabling this conversation, facilitating in a way, so all parties are heard."

For small to medium enterprise (SME) brands and their suppliers, philanthropic or government programs, can be especially useful by providing pre-competitive opportunities to engage collectively.

Reflecting on their organization's position in the fashion sector to offer accessibility, the program lead told us:

> "Philanthropy can play a very important role in lowering the barrier to entry for some of the smaller brands and in particular, suppliers more broadly. So while the big brands will be part of most of these initiatives, it is, in some ways, harder for mid and smaller brands who are actually willing to also do this, and want to bring some of their smaller suppliers in."

THE ROLE OF REGULATION

What will really move the needle on innovation? Government intervention.

Regulation is arguably a driver of innovation,[102] and has the potential, when designed well, to shift the stubborn business practices of the fashion industry. Policy tools such as subsidies, grants and tax breaks support broader measures, including legislation. Minimum standards and stable policies provide the certainty and level playing field for investors, which the private sector also needs, to move forward with confidence.[103]

In recent years, the wave of legislative initiatives (as many as 60 could have implications for fashion suppliers[104]) has swelled, particularly in Europe, where the EU and individual member states have been ambitious in their plans to tackle high-impact industries.[105]

The renewables sector is a powerful example where policy instruments have successfully driven ubiquity. Germany's Renewable Energy Act (EEG),[106] enacted in 2001 and replicated worldwide,[107] was designed to accelerate the uptake of renewable energy and offset conventional power production through guarantees of grid access for producers and 20 year feed-in tariffs.[108] Now utilising an auction system with market premiums,[109] it is credited with expanding wind and photovoltaic energy sources[110] and influencing similar schemes globally.

This type of policy model has not gone unnoticed in the fashion arena. In 2021, Textile Exchange, backed by over 50 brands and retailers, suppliers and organizations, put on the COP 26 Agenda a 'Trade Policy Request', building on a prior effort in 2018 entitled the 'Preferential Tariff Project'.[111] The proposal argues that preferential tariffs to incentivize sourcing of better materials—with traceable and verified impact data—would address one of the biggest barriers to adoption, one we will learn about further in this report: price premiums. It stresses that reliance on voluntary efforts to move the dial on the industry's numerous climate commitments have largely failed, and it posits the potential this lever has to level the playing field for everyone from farmers to retailers.

Whilst we are yet to see this type of trade policy eventuate, noting that parameters around fiber impacts continue to be debated, developments such as the EU Ecodesign for Sustainable Products Regulation (ESPR),[112] may prove to be the needed driver. Particularly if its proposed minimum recycled content requirement proceeds along with Extended Producer Responsibility (EPR) mandates.

Recently, lobbyists in Europe have pushed back against regulation, forcing legislators to water-down and delay compliance deadlines.[113] Despite this, several experts interviewed for this report still believe that regulation will be the key to unlocking scale, helping sustainability leaders justify action internally, and driving investment into specific types of innovation. They shared examples of instances when regulation catalyzed market adoption, demonstrating the powerful influence that legislation can have on the private sector.

A leader at a chemical supplier told us:

> "[We] were the first company that managed to develop an alternative to fluorine... For 10 years, nobody wanted it. Zero. And then the regulation started to look at this class of products, and you could see sales ramping up to the point that [this] technology is our best seller by far. But it was regulation that determined that."

While progress may have stalled in Europe, the world's leading manufacturing region, China,[114] is pushing ahead with its prioritization of circularity.[115] This has spurred three leading viscose suppliers to launch pilot lines for regenerated cellulose fibers in 2025 alone.[116, 117,118]

A representative from an industry non-profit working in this space explains:

> "Chinese Manmade Cellulosic Fiber producers are recognizing the market opportunity and the need for them to be building more resilient supplies."

03

BARRIERS & OPPORTUNITIES

In the previous section, we explored how the stakeholder groups intersect. In this section, we'll explore what barriers to success look like in the dynamics between stakeholders, how they stymie progress, and what opportunities can be embraced to strengthen alignment. During our research, three predominant hurdles kept recurring, which are underpinned by causes that the industry can address with greater intent and collective commitment.

BARRIER #1

MISALIGNED EXPECTATIONS

A fundamental barrier to scaling innovation is the inherent misalignment of priorities, expectations, and knowledge between all stakeholder groups.

Through our interviews with experts across the supply chain, misalignment has been a consistent thread causing the roadblocks for innovators, brands and retailers, investors, and suppliers alike.

B1.A

Innovators are often industry outsiders—without the right support structures, their progress will be stifled.

Fashion needs outsiders with bold ideas, unburdened by its entrenched business norms, to bring fresh solutions and insights from other sectors. Many innovators bring scientific expertise in biochemistry or engineering to the industry, with distinct skillsets that are lacking inside brands and retailers. Universities, accelerator platforms, and research institutes are breeding grounds for innovation,[119] but academics and scientists are operating under different timelines and conditions to those typical of fashion supply chains.

A lack of industry experience and connections can present significant roadblocks for these innovators. The fashion industry is inherently opaque,[120] making it difficult for outsiders to understand its makeup or identify the right brands and retailers and supply chain actors to connect with. This can create a disconnect between how an innovation evolves and what the industry actually needs. Given resource, time and funding limitations, it's important to avoid innovation for innovation's sake. The industry needs solutions with strong potential to scale, supported by the right stakeholders and an ecosystem to enable this.

We interviewed separate bio-based dye innovators that originated in university research labs. They spoke of the difficulty in accessing the right information and contacts to build their solution in line with industry standards and requirements.

At the time of interviewing, one innovator hadn't yet visited a mill that would, in theory, be the direct customer for their solution. Without first-hand familiarity with how their innovation would be applied to the setting it is being designed for, invaluable insights that would otherwise inform the development of their solution are missed. It speaks to a skills gap within certain startups that should be filled with business development managers or supply chain experts in order to prioritize industry connections. Co-creation with the supply chain is fundamental to the technical development and validation process.

A startup team member shared with us their concern that the academic world was too disconnected from the industry:

> "Sometimes we don't even know what to ask, because we're so new to the textile and denim industry, and so maybe some of the knowledge stuff is about not being on the ground. We're floating up in an academic sphere...if we're not invited to the same arenas as these mills and brands, we'll probably never be able to talk to the right people."

Without structured opportunities for early stage startups to forge connections with brands and retailers and key supply chain actors, the risk of creating a solution without a business case is high. It follows that without a viable product or established brand to pitch, the likelihood of standing out among the crowd is low.

One of the dye startups explained:

> "It is quite difficult to access precise data in the supply chain, especially for innovators without previous experience or networks. Relevant people may be located in Turkey, Pakistan or Mexico and you are in Europe. Especially in the beginning, when you have nothing to sell or to ship, very few people have time or precise information (yields, costs, volumes...) to offer. And your resources are limited to reach them."

Despite the industry's overall opacity, one supplier representative expressed little sympathy for the lack of early engagement. They believe the supply chain is open to new introductions, having fielded many themselves, and highlighted that various trade shows and industry events exist for this purpose, suggesting this argument came from a position of privilege.

B1.B

Outsourcing has stripped brands and retailers of their familiarity with the supply chain. In a bid to streamline resources and teams, brands and retailers have leaned further into their strengths of design and retail, while delegating more technical production roles to trusted suppliers and agents that offer full service programs.[121] As a result, suppliers have become stronger strategic and technical partners, managing more of the deep supply chain relationships that previously would have been formed internally at the brand level.

The result, interviewees shared, is that as these cost cutting exercises have continued, each year there are fewer technical experts inside brands and retailers that understand the reality of their work, including timelines and costs associated with R&D. This has rendered many ill-equipped for handling supply chain innovation.

An interviewee from a denim mill says the skills needed to collaborate on product development are diminishing:

> "Probably 10% of the people that I work with [in brands] actually know what's going on, and you cling to those people... Designers can be good at designing or designers can be good at product development. It's very rare that those two are put together... there's a huge knowledge gap, and it's getting worse."

Similarly, a chemical innovator who has worked in the industry for over 30 years told us:

> "A lot of brands and retailers have downsized remarkably their internal technical function. So there are not many opportunities for a company like ours to have a meaningful discussion with a counterpart."

Highlighting this lack of familiarity with production processes, several suppliers and innovators explained that brands and retailers don't typically fund R&D. Moreover, they can often expect free samples from cash-poor startups that have no guarantee of a contract at the end of the day. A technology startup founder told us that one trial of yarns in their solution costs between $3,000 to $10,000 to conduct. With the exception of one brand, this was expected to be done at their own expense, along with covering the cost to ship samples from their trial facility to brands and retailers around the world.

The founder told us:

"There are definitely brands who are willing to pay for R&D, but a lot of them aren't. The payoff could be that they might buy something...they expect us to jump through the hoops, to give them all of this because we're new and we're having to prove ourselves."

A consultant echoed this sentiment, explaining that larger brands and retailers were more likely to expect free samples from innovators:

"The higher the profile of the brand, the less they want to pay for anything."

A greater emphasis on transparency and partnership between innovators, brands and retailers from the outset could pave the way to more equitable division of unavoidable costs, like sampling and shipping, which add up over time and can strain a startup's already limited resources.

B1.C

Innovation life cycles don't align with fashion timelines. As we've established, innovation takes time and the road to scaling a solution is fraught with delays, unexpected challenges, and funding issues. Piloting a solution presents its own set of challenges: finding the right partners, proving impact, and testing performance. But a successful pilot phase rarely results in a solution going straight into commercial production, and scaling up to full-scale volumes can present a whole host of issues that might not be apparent from the trial phase. For example, a T-2-T recycler might struggle with fragmented collection and sorting infrastructure affecting feedstock consistency as it scales, or a dye innovator might discover quality inconsistencies at higher volumes that weren't identified in the testing phase.

The time between pilot and commercialization can take up to five years, experts told us, and innovators need enough financial runway and engagement from investors and brands and retailers to survive what's often called the 'Death Valley Curve' before their business can finance production from revenue.

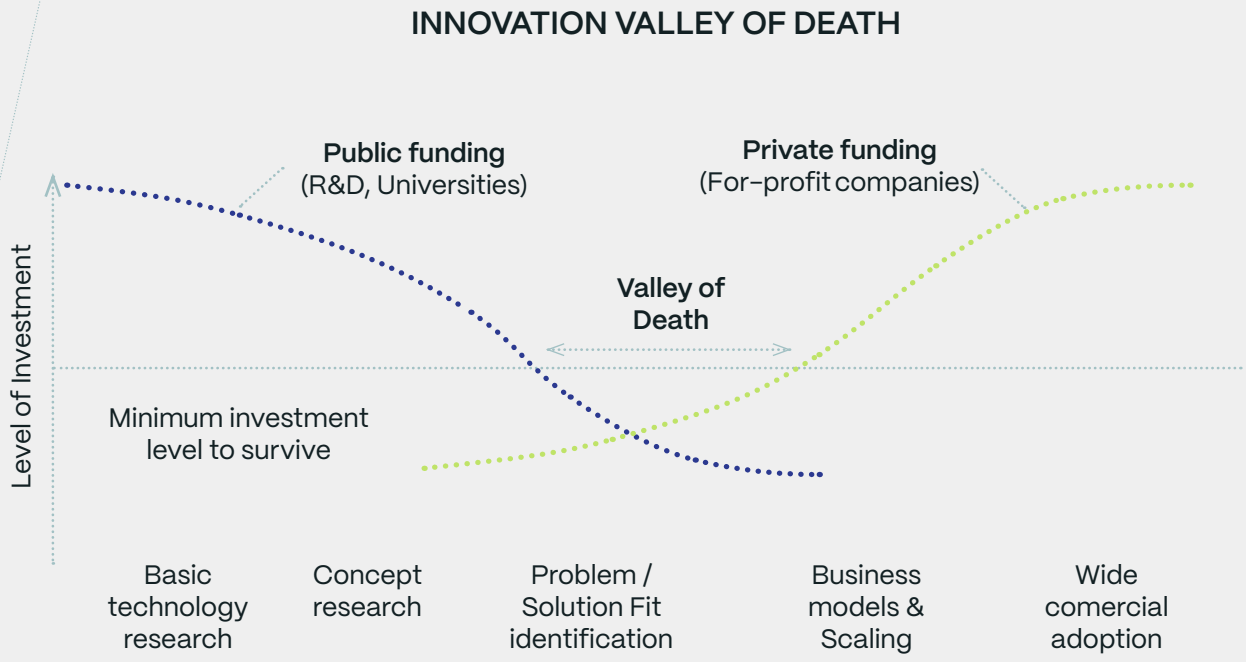


Figure 5
Innovation Valley of Death.
This figure, created by Skillcorn, was published in "The Innovation Valley of Death" blog page on the "Idea to Value" website by Skillcorn in 2021.[122]

As the representative from an industry non-profit put it simply:

"There are always going to have to be refinements. If you go from baking one loaf of bread to automatically baking 10 loaves of bread, you don't just put in 10 times of every ingredient. It doesn't work that way."

The material manager for a brand that works with a number of textile innovators told us:

"Depending on the innovation, until you really get working with the right supply chain, you really have to test it from a commercial point of view to understand how viable it is. There's often so many different pitfalls along the way that just aren't recognized until you actually get going."

Naturally, the fashion industry operates on shorter lead times than innovation, driven by seasons and trends that are quick to change and difficult to predict.[123] Brands and retailers require the flexibility to be more reactive in their planning, adapting to external factors like raw material, transport and energy costs, supply chain and geopolitical issues, tariffs, unpredictable weather and consumer preferences as well as shareholder expectations. This widens the gap between the pace of fashion and the pace of innovation, emphasizing the unnatural fit of the two worlds and the need for 'patient capital' that is often provided by impact investors and family offices.[124]

An innovator details instances when they have been approached by a brand to work on an idea, and by the time they had created a solution, it no longer aligned with the brand's strategy:

"[In a brand] you work by seasons, in the best case scenario, whereas the cycle of innovation of a company like ours, it's years from the moment you start researching something to when you are then ready to go to market... So sometimes it happens that you have a request from a brand, something that you would really want to develop together, but by the time that you're ready, the brand has already moved on. The interest is somewhere else, and sometimes even management has changed."

On the flip side, the brand-side material manager explained the time pressure brands and retailers are under which makes adopting innovation difficult:

"Often when you're working with early stage innovations, they don't come through on the original timeline. And I think that's where it's really challenging. I'm coming from a very commercial background where you have to work to very strict timelines. What I often find with innovators is that they're not necessarily as clued into the tight commercial timeline of the fashion business."

An innovator faced with certain brand customers only wanting to commit to a campaign or annual basis shared that, beyond a handful of leading brands and retailers who understand the role they play, a greater number have a poor appreciation of the fundamental shifts required in their sourcing behavior:

"You've got a real mixed bag [of brands] – some of them just can't get their heads around how they go that far down their supply chain. How do I start? I've only ever talked to tier ones and tier twos, and you want me to talk to tier four– how does that work? And there's a mixed appetite on how we do that."

B1.D

Price parity with incumbents is expected from the outset.

Brand appetite to absorb the increased premiums associated with innovation is low, but this is a typical feature to be expected. By attempting to compare a new product to a conventional one, brands and retailers discount the fact that innovators are creating entirely new solutions and processes. Expectations of a cost-neutral, like-for-like switch are unrealistic and are a fundamental barrier to adoption. In the absence of policy settings such as innovation subsidies, in order to bring the cost down, production volumes have to increase.

While the tide is starting to turn, brands and retailers are hesitant to be part of bringing down the cost curve by committing to buy a solution at a premium for a mutually agreed time. Many prefer to wait until it's cost neutral with the conventional option before making the switch. This hesitancy has led to the creation of transition finance initiatives to decouple the premium or to pool demand from multiple brands and retailers—concepts we'll explore further in chapter Opportunity #3: Accept and Embrace Systems Change.

A chemical innovator tells us:

> "When there is something genuinely new, different, progressive and innovative, that comes with a little bit of a price tag, [but] there is no acceptance and no respect for that."

A manufacturer explained to us that the expectation of cost neutrality is unrealistic for the first few years, during which the premium will gradually reduce as the solution refines, scales, and matures:

> "I don't think the right quality yarns with the right environment credentials are going to be available within the next three years, cost-neutral."

Some brands and retailers are willing to absorb this margin for a short period of time, but as a representative from an investment platform says, this can't be relied on:

> "There's no market for green premium. I mean, it can be kind of symbolic for a transitional phase, but that phase is a lot shorter than we were hoping for, and the premium is a lot smaller than we thought."

A representative for a brand related foundation says that innovators have a responsibility to gather data and model when price parity can be expected:

> "I think everyone buys into the economics of scale logic, but there's a lot of talk around price parity, which is unfair towards the innovators, because you will never reach price parity in the early stages. But there is also the expectation of that happening in the future. That's on the innovators to dig into what scenarios they can present to show that within X amount of time, the economics of scale will kick in."

OPPORTUNITY #1

ACCEPT AND EMBRACE SYSTEMS CHANGE

The onus doesn't fall on just one stakeholder group to close the wide knowledge gaps—it's everyone's responsibility.

Below, find three opportunities to close the gaps, followed by a case study of different avenues being trialled by the industry.

O1.A

Bring top decision makers to the table. Brands and retailers that are family-owned and managed tend to lean into legacy-building, and have longer-term relationships with their suppliers, many of which can also be family-run. This means that support for future-focused investments in sustainability and innovation comes from the top down, weaving into the values of the brand and remaining stable regardless of industry or personnel changes. Owners and board members of brands can learn from this approach, by incorporating innovation and sustainability as core business values, and ensuring ownership of innovation mandates aren't lost with C-suite and internal management turnover.

A research consultant believes going straight to the ownership level would move the needle on innovation buy-in:

> "If you get the six biggest brand owners, and the six biggest suppliers in the world, and they sit at the table, and you begin to have a conversation as a peer group, [you could] align about what you want to do, and how you want to make the business healthier, make it more sustainable for everybody, and how we share risks and responsibility across these supply chains."

O1.B

Get on a plane and meet your supply chain.

Face-to-face engagement is undervalued as a tool for aligning stakeholders. The knowledge-building opportunities can't be overstated—innovators have the chance to teach potential or existing suppliers about their solution, while suppliers can demonstrate the realities of their operations to help them learn and develop accordingly. Brands and retailers stand to benefit from absorbing the complexities of implementation and a deeper appreciation of the practical implications of their strategic ambitions.

Understanding the context and assumptions that each stakeholder brings to the table serves to create deeper collaborations, transparency, and understanding on a personal level. An innovation expert explains that brands and retailers as well as startups often underestimate the value, for all stakeholders involved, of visiting suppliers at their facilities:

> "I think there's an assumption, especially since COVID, that we can do everything via Zoom and we don't have to meet in person... It was so clear that you need to go there, you need to understand their business, and you need to talk to them. They need to know whether they understand what it's going to take..,and they want to know if they like you as people, in addition to liking your solution. And this is very, very underestimated, both on the brand side and the startup side."

Brands and retailers can play an important role here by connecting innovation partners with their strategic suppliers. By facilitating factory visits or making introductions, they can support innovator education and ensure the realities suppliers face on-site are considered. While suppliers have to protect sensitive production information in their facility, some are increasingly open to welcoming innovators to trial and develop a solution collaboratively.

The innovation manager at a vertical manufacturer tells us:

> "We've been very open to innovators sending their technical person to our factory. This is something we're doing much more actively at the company now. While suppliers naturally maintain some boundaries, we've noticed a growing openness to innovators working together to finalize recipes or tweak their systems."

O1.C

Provide open source information to galvanize industry alignment, build transparency and enable standardization across the innovation ecosystem. Whether it's impact data, case studies, offtake agreement and letter of intent frameworks, or ROI modelling, access to information needs to be more democratic for industry-wide alignment. These resources exist, but they're often held behind third-party membership paywalls or are exclusive to partnerships.[125]

Several vertical apparel and denim manufacturers interviewed for this report detailed the bespoke assessment frameworks they have developed to evaluate and validate innovations. Whilst some suppliers and investors use technology assessment frameworks such as a Technology Readiness Level (TRL),[126] a measurement system used to assess the maturity level of a particular technology as part of this evaluation, they also require LCAs or impact data to deduce a solution's capacity for environmental savings. This is critical information, not only to secure internal buy-in, but to provide their brand customers support for their own impact reporting requirements. Without access to high quality data, stakeholders are wary of progressing innovation relationships.

A representative for the innovation platform conceded that they would like to open-source more of their insights and resources:

> "I think the number one knowledge gap is in understanding the impact data, the ROI and impact for all the technologies. Unfortunately, even though we do this exercise, we're not open source. Ideally, we would have open source options to share with brands, because then they're able to make a business case, especially now that the brands have all these climate action plans."

A brand related foundation that works with innovators sees value in strategically partnering new innovators with brands and retailers so they can hear directly from potential customers to understand what they are looking for:

> "Instead of putting really early stage innovators in front of the brands in a pitch situation, we'd rather put them in front of the brands, asking the brands to share whatever they can that might help these people scale without the 'come back to us once you have something ready' [situation]."

Standardized open-source assessment frameworks with aligned impact metrics would enable suppliers, and brands and retailers to determine which partnerships are feasible to move forward with. Additionally, they would provide innovators with a clear understanding of expectations whilst they are developing. Brand readiness, supplier capability, and innovation maturity vary, and misalignment of these relationships can lead to wasted time and resources. While each situation is unique, there are universal base-line requirements that each stakeholder should meet for a successful partnership. Learn more from our readiness checklists accompanying this report, designed to support this process.

* STAGES OF INNOVATION

PHASE	TRL	CHALLENGES	TYPE OF FINANCING
1 Research & Development	*0 Idea*	Characterised by high technological and execution risks – often lack of evidence of product–market fit	Equity (seed, VC), Grants (philanthropic, government, universities)
	1 Basic Research		
	2 Technology Formulation		
	3 Needs		
2 Piloting and small scale production	*4 Small scale prototype*	High risk including technology risk	Equity (seed, VC), Grants (philanthropic, government)
	5 Large scale prototype		
3 (First) Commercial production	*6 Prototype system*	Engineering, operating and market risks may exist. Attractive unit economics may not have been reached (may require further optimisation or economies of scale)	Equity (VC, Growth), Debt (Corporate lending project financing)
	7 Demonstration system		
	8 First of a kind commercial system ("flagship")		
4 Replication/ adoption phase	*9 Replicability and standardisation achieved enabling expansion possibilities*	Quality and commercial (unit economics) targets met; standards set	Equity (Growth, PE), Debt (Corporate lending, project financing)

Figure 6
Stages of Innovation
This figure, created by Aii (Apparel Impact Institute) and Fashion For Good, which shows the characteristics of the different stages of innovation, was published in a report titled "The Great Unlock. Closing the Innovation Commercialisation Gap through Project Finance Solutions" by Jooste, Ley, Kasarjian & Lowbeer–Lewis, published by Fashion For Good in 2023.[127]

*CASE STUDY FOR CLOSING THE KNOWLEDGE GAPS:

CAPACITY BUILDING

Tripartite initiatives that bring stakeholders together for shared learning are vital to overcome the knowledge gaps which lead to delayed time to market, misaligned expectations and in some cases, wasted efforts.

Participants in our report repeatedly cited that one of the systemic factors which stymie progress is innovators' lack of access to, and knowledge of, the fashion supply chain, including the seasonality of buying cycles and nuance of brand sourcing strategies. Likewise, brand understanding of the innovation pipeline and the processes involved during R&D is immature, contributing to misaligned expectations when entering into these partnerships.

Despite this being understood, there remain few open access opportunities, particularly in manufacturing regions, to bring together participants from the length of the value chain, the climate innovation sector, and brands and retailers to forge a stronger understanding of each others roles and requirements.

A number of industry organizations, innovators, and research institutes have focused their efforts into convening key stakeholders for the specific purpose of building knowledge and finding common ground. Discover examples of capacity building, some facilitated through permanent physical locations and others as one-off events that are tackling the issue.

CHALLENGES THESE FRAMEWORKS AIM TO OVERCOME:

- Lack of open-access industry wide networking opportunities for stakeholders to forget connections and learn from one another
- Inability to foster relationship building essential to adoption & implementation
- Inability to incorporate learnings from the supply chain into concept development
- Assumptions that perpetuate misalignment

EFFORTS TO ADDRESS THESE CHALLENGES:

- Demonstration labs to ideate and 'touch and feel' so concepts come to life
- Tripartite framework for shared learning from technical to legal frameworks
- Equal seat at the table to educate each other, ensure risks are understood
- Education on business models, negotiation and partnership structures
- Communication of expectations for impact modelling, pricing and performance
- Acceleration of opportunities to partner

STILL TO SOLVE:

- Dedicated brand R&D budgets to build brand knowledge around
  a. The innovation process from launching pilots to implementing at scale
  b. The contribution of the supply chain to the innovation transformation process
- Pathways for connection between startups and the supply chain independent of brand involvement

INDUSTRY EXAMPLES:

- Accelerating Circularity – US recycled cotton trials, regional supply chain tours and toolkits[128]
- Fashion For Good – Strategic Supplier Initiative[129]
- Future Fabrics Expo – 'Sustainable Fashion Next-Gen Innovation Bootcamp' by Sustainabelle[130]
- HK RITA – Open Lab[131] & Garment 2 Garment recycling system[132]
- The Mills Fabrica – Fabrica X, London[133]

BARRIER #2

SUPPLIERS ARE NOT CONSIDERED CORE VALUE CREATORS OF INNOVATION

B2.A

Suppliers don't have an equal seat at the table when it comes to decision-making, collaboration, or risk distribution. Fashion's climate innovation sector follows the broader industry norms and power dynamics. By failing to see suppliers as key value creators in innovation, the industry is missing out on the opportunity for truly collaborative tripartite partnerships between innovators, suppliers, and brands and retailers.

The sustainability lead at a vertical manufacturer told us:

> "If you really want to make real progress, you have to go back to the people who are going to make the difference... But they often forget that, regardless of anything, be it sustainability or product innovation, the person who is doing it in the supply chain is the only one who can make the difference."

Whilst another stated:

> "Innovations or trials can't happen in silos. It has to happen in a shared responsibility environment. When the supplier and brand is on board and everyone is an equal contributor or shareholder, I've noticed it has been more successful."

It goes without saying that innovators themselves bear the ultimate risk and financial loss if their invention fails to materialize. We've spoken with teams that have been building and testing for over a decade and are only now starting to obtain industry commitments to support their efforts to scale. Their pursuit is the ultimate test of endurance but ultimately half the battle. Taking a lab concept into the supply chain and proving utility requires a considerable leap of faith and dollars. Just how this risk should be shared is something the industry needs to reckon with.

A brand investment arm representative sums up:

> "It's actually the risk mitigation of working with innovation, where we need to agree on who it is that will take that risk and who can afford it."

While suppliers are being increasingly sought out for their expertise to bring innovation to life, it's clear that adequate recognition for their efforts is less forthcoming. Not only do they leverage their deep technical knowledge to proactively co-develop solutions and educate brands and retailers and innovators, but they take on an uneven portion of risk, invest more time and energy into R&D than others realize, and absorb large losses when solutions fail to succeed.

Despite the progress many suppliers have made in innovation and sustainability, one expert believes that entrenched, false assumptions about certain manufacturing regions creates a lack of appreciation for the capabilities of suppliers:

> "A lot of [manufacturers] are five years ahead of brands when it comes to sustainability. But the problem you have today is the disconnect, because the brands have maintained a culture, mindset and belief that this part of the world is underdeveloped, which is completely wrong. What suppliers in this part of the world have been able to transform, adapt and innovate is absolutely mind-blowing."

B2.B

Both innovators and brands and retailers have a lot to learn from the supply chain. For the best chance of success, partnerships should start with suppliers. As we've identified, brand buy-in is critical and supply chains can be hard to connect with. Naturally, this can lead innovators to prioritize brands and retailers over suppliers as they build partnerships to develop their solution. But experts believe this strategy is flawed, making it difficult for suppliers to contribute to a solution early and inform its development from the ground up.

A representative from an investment platform explained:

> "[Innovators] have been somewhat blindfolded by the fact that they had somewhat easy access to the brands. Because for a while, the brand stated clearly that they wanted to do something about it. So there was a lot of interaction and engagement there from both sides, whereas they should have been out there finding the dye houses, the garment factories, the spinners or the mills."

By bringing in the right supplier from the start, innovators imbue their solution with a deeper understanding of the realities of the supply chain. Suppliers bring a wealth of knowledge, experience, and a broader perspective to the table because they are often connected to several stakeholder groups, including MSIs, universities and research institutes, nonprofits, and other direct suppliers.

The brand materials manager told us:

> "Innovators are often very much in this lab world and do not necessarily have the expertise of the commercial challenges that suppliers know from their decades of experience. There's so much that they can learn from the supply chain, as much as they learn from a brand on the commercial side."

When suppliers transform a chip or polymer into an input such as a yarn or fabric, and then into a fully developed end product, innovators can speak to brands and retailers in a language they understand. Existing innovator–supplier partnerships can also help brands and retailers extend recommendations to the other suppliers in their value chain, confident in the backing of a reputable manufacturer.

A representative from a next-gen fiber company told us:

> "We have found that by developing the supply chain base independent of the brand, that's also catalyzed the brand to get comfortable with the product."

By collaborating with suppliers as the vital innovation partners they are, brands and retailers and innovators don't just stand to benefit from their knowledge and technical expertise. They can embrace the opportunity to build equity into the process so that all partners distribute the costs and risks evenly. By collaborating as a collective of trusted partners, each stakeholder can have greater transparency of costs, ensuring fair pricing structures are part of agreements. This is important to ensure that the next generation of fashion solutions don't fall into historical power dynamics that have favored brands and retailers at the expense of the supply chain.

B2.C

It's not just brands and retailers failing to share in the financing—innovation startups can often expect suppliers to test solutions without financial support to reflect their efforts.

Our research reveals a notable gap in how some innovation startups collaborate with suppliers. Specifically, they rarely compensate suppliers for their contributions to the R&D process or share funding with upstream partners who assume the risk and effort of testing new solutions.

When startups perceive a solution—like new dyes—as a simple, cost-free swap, they often conclude there is no need to compensate their suppliers for its integration.

As one startup executive told us:

> "That's something we were hugely conscious of, making sure that whatever our output product was, it could fit into existing supply chains, so that you don't have that need to invest up the supply chain. And so that really allows us to concentrate the funds we have available on scaling our solution."

But this mindset doesn't take into consideration the supplier's time and resources used to test and create samples or adjust processes, nor the risk that a new solution might not work efficiently once implemented. This can cause delays to a production line and cost the suppliers more in the long-run. A major supplier described this as their 'transition risk'. They explained that conducting internal performance trials and assessments can help them mitigate and understand whether that risk is worth taking on.

Highlighting the need for greater transparency around what it really takes to transform, validate and implement new concepts, innovators and brands and retailers underestimate the effort suppliers put in behind the scenes, a representative from the supplier said:

> "Even if a brand is providing funding, there are so many processes involved that it ends up becoming resource heavy for the supplier no matter who's funding what. We have to do five to six kinds of testing, and sometimes brands require third party lab testing even though we have our own internal certified labs. Sometimes we have to pause our orders and dedicate some time to the trial. There are a lot of these investments which a supplier is completely happy to make, but they get lost in the conversations."

OPPORTUNITY #2

CELEBRATE AND INCENTIVIZE SUPPLIERS

Showcasing suppliers can have powerful positive effects. Brands and retailers and innovators can do more to highlight their role. Internally recognizing the work of suppliers is one thing, but publicly promoting their work, co-creating alongside them, and compensating their contributions fairly are tangible ways to strengthen the tripartite relationship between suppliers, brands and retailers, and innovators. To do this, all stakeholders need to take the initiative to learn from each other, develop a shared understanding of other perspectives, and use empathy as a tool to build stronger partnerships.

O2.A

Invite suppliers to discuss the true cost in pricing discussions. To consider suppliers as key innovation partners is to recognize their expertise, center their experience, and incorporate their insights accordingly. Brands and retailers and innovators should engage with their supply chain more deeply and understand how risks can be shared, burdens alleviated, and equity embedded. Whether that includes funding LCAs or impact modelling, contributing to test costs or paying for third party validation, brands and retailers should be seeking a full understanding of pricing to ensure new solutions are budgeted for accordingly.

A representative from an industry non-profit involved in textile innovation says:

> "[Suppliers] are often left out of the conversation because there's so much emphasis on the innovator or the brand, forgetting that without those interventions across the entire supply chain, prices just are not competitive and it doesn't make a great case. It doesn't allow for these innovations to have longevity if we're not disrupting many different parts of that supply chain."

"So many of these [suppliers] no one has ever heard of yet, but they are the heart and lungs of this industry...they are champions of innovation, and they deserve the recognition."

– Industry expert

This is particularly pertinent when it comes to price modelling, as implementation costs can mount at each stage in the value chain resulting in a solution that costs far more than the conventional option. Commonly, this premium is the reason why a brand won't accept the end price of the innovation—it's a major blocker for price-sensitive businesses. In order for innovators to accurately model when an innovation might hit price parity and commercial viability, suppliers at all stages of the supply chain should be co-designers of this process with the often hidden costs of implementation made transparent to all stakeholders. The denim sector, characterized by vertically integrated suppliers, is particularly well set up for this, as development and communication between the supply chain phases is streamlined.

A representative from a brand investment arm says:

> "We look at how we make sure that the premium cost associated with implementing [innovations] into the supply chain doesn't amplify through the different value chain players so we get an artificial price in the end that has nothing to do with the actual innovation, but everything to do with an opportunity cost. We believe that kills innovation, when we start paying for something that is not actually in the product."

To help brands and retailers model pricing more accurately, CIRCULOSE® released a Forward Price Calculator tool in June 2025 that estimates the material and end garment costs associated with the adoption of CIRCULOSE® fibers, as well as the CIRCULOSE® Forward Priced Materials to generate a stronger sense of pricing transparency.[134]

O2.B

Celebrate your suppliers. Typically, brands and retailers have greater name recognition than suppliers among the wider industry. This presents an opportunity to highlight strategic supply chain partners through announcements about offtakes, pilot projects, capsule collections, and investments. One expert explained that increasingly, brands and retailers are holding off announcements until a product is on the shelves, focusing on the behind-the-scenes work over PR—likely looking to avoid accusations of greenwashing. But several suppliers and innovators told us that announcements are invaluable for catalyzing new business as well as building their reputation and credibility with brands and retailers and other industry stakeholders.

As one next gen fiber startup executive explained to us:

> "Earlier this year, we did an announcement with a company in China, and there was no brand attached to our partnership with them. After we made that announcement, a bunch of brands that we have previously been talking to have said: 'Wow, you're working with this company. If they're using your product, we can integrate this much better.'"

For early stage innovators that might not have funding to offer to their supply chain partners, publicly promoting them is one way to reward their work that comes at little to no cost. Arguably, this should be a given, considering the investment being provided. A representative of a T-2-T recycling startup says:

> "We are very happy to publicly talk about and highlight partners who are very much committing time, energy, effort, money, you know, scarce resources that they have towards innovating. There are only so many things that an innovator like us can offer them in the beginning, because we don't have the volume. In the interim, one of the things we can do is recognize champions who are actually pushing this industry forward. They are champions of innovation, and they deserve the recognition."

Incentivize suppliers to partner with startups.

Several experts discussed ways in which suppliers can be rewarded for their role in innovation. While some suppliers innovate speculatively, others negotiate exclusivity deals and first access to volume output in return for their contributions.

As a representative from a vertical denim manufacturer told us:

O2.C

> "If we are the only one who is investing in them, then [we have] first clauses, confidentiality and exclusivity so that we get some time to benefit from the innovation before it can be commercially available for everyone else. Because it's a very thin margin industry, and we are not a philanthropic organization."

To ensure their cooperation, a strong commercial case has to be evident to suppliers, be it through co-patenting, pricing incentives, access to future innovation projects or shared licensing revenue.

As we've covered in chapter Opportunity #1: Close the Knowledge Gaps, open-sourcing is a powerful tool to galvanize traction. Transparency of the details of commitments and agreements, results of trials and costs of R&D can be the difference between a few key players at the table or the long tail of brands and retailers and suppliers jumping aboard. The climate crisis requires everyone to be incentivized to act, and ensuring that SMEs with less financial might are not left behind in the process is a crucial consideration.

But stakeholders should be careful to ensure these incentives are maintained—a brand investment arm representative told us that if the business case for suppliers begins to falter, the success of the innovation is threatened:

> "We can motivate and engage and make sure that everybody gains from this business case, that there is an incentive to work with it. What we have seen is that the minute it begins to be false, or the minute that we interfere so much with the supply chain that we remove their business case, we are only met with hostility and a reluctance to work with a specific innovation because of a fear of that we are removing some of their margin potential that they have."

*CASE STUDY FOR SECURING VOLUME:

OFFTAKE AGREEMENTS

An offtake agreement[135] is a mutually-beneficial commitment to purchase specific volumes of a producer's output, over a specific period of time, signed ahead of availability in order to unlock necessary financing for production. They can be signed between different parties such as innovators and manufacturers, innovators and brands and retailers, as well as innovators and fiber producers.

There is much talk about offtake agreements being one of the main tools to drive adoption and scalability.[136] Less so, dialogue about their what, why and how. They aren't a one-size-fits-all solution. Almost universally agreed is their utility in unlocking finance by demonstrating backing and demand from key industry players between pilot and commercialization stages, namely brands and suppliers, but there are limits to their suitability once solutions are scaled. They are particularly important in obtaining project finance for capital expenditure, such as the build of a commercial facility, as investors view them with high regard.[137]

Clauses can relate to pricing, performance, and volume with project milestones built in to incentivize progress and trigger orders or additional finance, but also to mitigate financial and operational risk. Terms can be negotiated to make these agreements low risk yet high impact for those who rely on them. Offtakes can also accompany feedstock agreements, particularly in the T-2-T field, which demonstrates the supply chain interdependency of a solution's success.

Whilst common in the energy and agriculture sectors, they are largely unknown to the fashion industry and to date have only been signed by some of the world's largest global brands and retailers and suppliers. Brands and retailers have signed offtakes directly with fiber and dye innovators, as listed below, an unusual arrangement given the extensive supply chain in between. Suppliers have also signed agreements with innovators based on perceived brand demand as well as to boost an innovator's ability to reach the next stage of commercialization.

Given they are confidential, it is difficult to determine their variability, binding nature, and governing terms. If they do become a norm in purchasing practices as solutions undoubtedly grow, crafting transparent, standardized formats for suppliers and brands and retailers of all sizes to use as a template from which to build agreements upon should support further uptake. They should be more easily understood, accessible, and equitable.

CHALLENGES THESE FRAMEWORKS AIM TO OVERCOME:

- Investor confidence requires assurance that a market exists for a solution
- Solutions need volume orders to scale. A lack of brand commitments stymies adoption
- Innovators lack industry backing, essential to obtain CAPEX finance
- Lack of unification and standardization in testing at pilot stage between brands and retailers and factories
- Suppliers can be hesitant to make their own investments or commitments to novel solutions without demand signals from brands and retailers
- SME brands and retailers and suppliers aren't able to place volume orders, the largest players are required to kickstart scalability and mainstream innovation

EFFORTS TO ADDRESS THESE CHALLENGES:

- Fiber Clubs encourage offtake agreements through their membership (See Fiber Club Case Study)
- Public announcements amplify supply chain actors taking the lead
- Supplier capability is highly differentiated. Through the trial process and agreement negotiations, technical capabilities are able to be determined, leading to a greater understanding of the baseline attributes required of the supply chain

STILL TO SOLVE:

- Supply chain visibility. Signing agreements with Tiers 3 and 4 of the supply chain requires a fully traced supply chain
- Long term commitments can only be made with strategic partners. Transactional sourcing strategies are inconsistent with the duration needed from these commitments
- Transparency of clauses to promote understanding of the risks and benefits
- Standardization of specifications and agreed parameters to de-risk and encourage greater uptake
- Premium creep. As a solution moves through the supply chain, determining when compounding premiums are justified is complex, particularly if intermediaries between signatories are not involved in the process and pricing discussions
- Supply chain integration is essential for agreements to materialize into output
- Feedstock reliability. T-2-T solutions are particularly dependent on a highly variable source of inputs requiring feedstock agreements to mitigate risks
- The scaling process faces multiple hurdles. Agreement milestones need flex and opportunities for review so challenges which preclude a milestone being met don't lead to a commitment collapsing in its entirety
- SME participation

INDUSTRY EXAMPLES:

- Ambercycle – Inditex[138] and MAS[139], Ganni[140]
- Circulose – Mango[141] and H&M Group[142]
- Infinited Fiber Company – Bestseller[143], Patagonia[144] and PVH Corp[145]
- Samsara Eco – Lululemon[146]
- Spinnova – PUMA[147]
- SYRE – Gap Inc, Target and Houdini[148]

BARRIER #3

INSUFFICIENT BRAND COMMITMENT

B3.A

Stronger early-stage, multi-year brand commitments are needed to give confidence to suppliers and investors. The innovation ecosystem relies on the participation of all stakeholders, but brands and retailers have outsized influence—and some believe responsibility—to lean further in and use their purchasing power to drive progress. Brand buy-in is a critical signal to financiers and suppliers that a market exists for a solution, being a fundamental metric of potential.

Brands and retailers play a larger role than perhaps even they recognize. Without them, there is no success for innovators. Brand demand pulls the rest of the supply chain into alignment — all stakeholders are looking to brands and retailers for their commitment signals.

A representative from a T-2-T recycling company told us:

> "We're working a lot with the brands, because we feel that in order to ensure the demand is pulled through the supply chain, you need the brand. We talk to spinners, fabric manufacturers and mills, and they all express interest, but ultimately they need to know there's a demand from the brand."

This sentiment is echoed by suppliers, who see the catalytic effect a major brand can have to drive sustained, long-term interest in a solution.

A representative from an innovation-focused denim mill says:

> "It takes a long time, so you've got to have certain wins. You've got to get it into a big brand or someone who's a leader in the business—that creates a buzz. And then everyone says 'I want it.' If you get it into [a brand] on a higher level, everyone else will be pulled into it."

Why does it seem so difficult for brands and retailers to commit? As we've established, innovation timelines are an unnatural fit for brands and retailers, the majority of whom aren't familiar or comfortable with the long-term commitments innovation requires. But they're curious about innovation and can be willing to try it. For some, this is where their participation ends. The result is 'innovation tourism'[149] and a glut of pilot projects or capsule collections that rarely convert into a core part of production.

As a representative for an innovation startup puts it:

> "It's very easy to allocate some money from a marketing, innovation, or sustainability budget for a short project. It's a different thing if I'm asking for a multi year commitment that requires various parts of the organization to say yes. It is unnatural for them to commit, because they are spot buyers. They buy whenever they need it. They're not long term."

The reluctance to dive head-first into the world of innovation doesn't come from nowhere—there's a real possibility of betting on the wrong horse.

The first-mover disadvantage[150] is well-documented — risk-takers face greater attention, pressure, and scrutiny from the rest of the market. Brands and retailers that have partnered on small scale projects over the last 10 years have undoubtedly watched several of those startups fail to gain traction. When considering saturated categories like leather alternatives, brands and retailers don't always have the tools to identify which innovator is the right match for them. The safe bet is to spread the risk by piloting several solutions, but distributing support too thin doesn't lead to scale for anyone, or effectively move the needle on collective climate ambitions.

A denim sector consultant says that a lack of trust is at the core of brand hesitance over innovation, but this can be overcome by bringing the right partners to the table:

> "It's very difficult to know whether they're going to make it or not. You're asking me as a brand to trust this thing, but I don't really know what it is, or if it's ever going to scale, or what's going to go wrong. I can't really risk that. But if you come with a strong supply chain and with a range of expertise, when I can start to imagine in my head that there is a very logical business case, then I'm more willing to invest."

A lack of commitment from brands and retailers creates an uneven distribution of risk that naturally falls onto innovators themselves but also largely onto suppliers, who can't guarantee their sweat equity will convert into orders for the resulting product. As a result, suppliers can become understandably risk-averse to protect their business.

A vertical mill and manufacturer explains the benefits of being a member of an industry organization which enables and de-risks innovation partnerships:

> "When multiple stakeholders are involved, it provides everyone a safety net. Because we know that someone is backing it. Sometimes it's financial backing, sometimes reputational backing. That's the first thing which is important. And the second thing is when it comes to multiple stakeholders, we know that someone is going to buy [the product]."

A representative from a brand investment arm speaks to the importance of collective participation to spread risk and build trust between stakeholders as well as screening for viability:

> "How do we bear the risk of innovations more collectively? It's about trust between the different value chain players, but also trust between innovators and the industry. So we begin to work with actual data and actual facts, and we start looking at those many questions around what the best solutions are, and start working with them in a new, more neutral way."

A Letter of Intent (LOI) is a document that outlines the proposed intentions and expectations of participating stakeholders before entering into a legally binding commitment.[151]

An Offtake Agreement is a mutually-beneficial commitment to purchase specific volumes of the producer's output, over a specific period of time, signed ahead of availability in order to unlock necessary financing for production.[152]

B3.B

To support innovators through commercialization, stronger commitment means capital. Letters of intent and offtake agreements can help bridge the gap, but despite increasing awareness, adoption and transparency remains low.

LOIs from brands and retailers, though not binding contractual commitments like offtake agreements, are still hard-won. Like offtakes, they can be taken to banks and third-party funds to raise investment, but they hold less weight, seen more as demonstration of 'warm conversations' as they lack specificity and aren't legally enforceable. In this way, LOIs can act as a gateway to offtake agreements. In 2024 PUMA announced a partnership with Finnish company Spinnova, the producer of SPINNOVA®.[153] In 2025, T-2-T recycler Syre announced undisclosed 'commercial partnerships' with Houdini, GAP Inc. and Target, with offtake agreements in the pipeline.[154]

A representative from a bio-based dye innovator describes the difficulty of securing LOIs from brands and retailers:

> "It's not 'compulsory', but if you have no tangible market traction to show you will never get funded. So it's completely necessary. It's very frustrating for innovators to see that even non-binding LOIs are hard, and sometimes impossible to obtain. A large corporation can tell the whole world about its sustainability commitment for the future and at the same time refuse to sign a non-binding LOI — you don't even indicate price or volume in it. And years of relations do not change the situation."

Offtake agreements have proved to be powerful signals of commitment, showing value in specific stages of an innovation's lifecycle. High-profile commitments of recent years have come from a small number of leading fashion brands and retailers signing offtake agreements.

- BESTSELLER,[155] Patagonia,[156] and PVH Corp[157] signed offtakes with Infinited Fiber Company between 2021 and 2022.
- In 2023, Inditex signed an offtake agreement with T-2-T recycler Ambercycle for over €70 million.[158]
- In 2024, the H&M Group inked an offtake agreement with T-2-T recycler Syre[159] (which it co-founded[160]) worth $600 million over seven years.
- In 2025, sportswear giant Lululemon signed a 10 year offtake agreement with T-2-T recycling innovator Samsara Eco, one of the longest deals of its kind the industry has seen to date.[161] Indeed, compared to the others that appear to be between 5 and 7 years.

Offtake agreements are sometimes seen as the north star for innovators needing to raise capital, but they are still an unnatural fit for brands and retailers that rarely sign long-term agreements with raw material or dye suppliers. A brand's agreement to buy specific volumes or a dollar value from an innovator signals to suppliers that a customer will buy the innovation. Securing an offtake is often a prerequisite for financing, giving an innovator a clear financial runway and specific milestones to work towards.[162]

These agreements can be viewed as part of a brand's risk-mitigation strategy. Typically, agreements of this nature would be negotiated at a C-suite level. While the departments responsible for innovation might have a deep understanding of the solution, this doesn't mean they have the right knowledge and business context to negotiate unfamiliar offtakes. If more C-suite leaders were involved in their signing, negotiating favorable terms that derisk their commitment is likely.

Offtakes also allow brands and retailers to negotiate favourable terms and prices for materials they know they'll need in the future, contributing to more resilient supply chains. An innovation business leader we spoke to thinks it's a low-risk, high reward path for brands and retailers to take, which can also support compliance with incoming regulations. They believe that the alternative would mean more volatile, competitive and expensive sourcing processes in the future.

Without offtakes to bolster the innovation landscape, progress will stall completely, they say:

> "Offtakes are an enabler to scale, but they are going to be more expensive in the short to medium term. If you don't sign offtakes you strangle the industry."

One innovation accelerator expert tells us that how a brand engages with these mechanisms says a lot about their true long-term commitment to transforming their business. They say:

> "Of course brands know they're critical! What's the role of innovation in their business? Is it as a way to mitigate risk, is it for growth, or is it for a marketing gimmick? ...When we see that a business is serious, it's very different in terms of how they handle these conversations—top management is very involved."

For suppliers, there is value in offtake agreements: they support innovators in scaling co-developed solutions, and secure critical feedstock for long-term competitive resilience. Being at the forefront of innovation is seen as an investment in future-proofing their business and signing offtakes is a measured risk in achieving this. When an innovator secures backing from both a brand and supplier in this way, financiers take note.

It's clear that offtakes present another knowledge gap for the industry—they're underused and misunderstood by most as their terms are confidential—contributing to reticence among brands and retailers to adopt. But experts that back the use of offtakes say it's not about getting all brands and retailers on board with these types of agreements or making them the new standard for all innovations to succeed. In theory, a few key leaders signing offtakes should catalyze other brands and retailers to agree to volume commitments, and in turn other suppliers, setting the commercial scaling in motion. The industry could benefit from their greater transparency and visibility to increase familiarity with the typical terms of these types of arrangements.

A representative from a global manufacturer that has participated in offtake agreements explains the positive signal an agreement can have on the market:

> "Offtakes are critical [to get solutions off the ground], I know [some major brands] have figured it out. But we don't want the rest of the brands trying to figure out how to do offtakes... We want them to instead spend their money on paying for the product (supporting the initial upcharge until solutions are fully scaled)...and show that signal. Then, there'll be other suppliers who think, wow, you know what? I have to be in this space."

B3.C

When would strategic brand partnerships make the biggest impact? When they fill the commercialization gap beyond the exciting early stages of innovation. Seed funding and piloting a new innovation can be exciting, but it's the phase between pilots and commercial scale where brand commitments really make the difference for innovators. Volume commitments are needed to drive momentum and confidence when innovators face the true test of scaling up their solution. But as the risks, costs, and commitments increase, this is where brands and retailers can often take a backseat (view Figure 7).[163]

One technology startup founder told us that after a pilot, it typically takes between 24 and 36 months to secure capital expenditure for their solution, and that's if everything goes smoothly, they say:

> "We have this expectation that innovation should be implemented in 12 to 18 months. It's just not realistic. From an investment standpoint, to get investors and brands to look at the longer runway, to start earlier and, you know, be true partners—that would be amazing."

The perception that innovators fail to scale after a pilot often overlooks the reality: they are actively working through the commercialization gap—securing funding, solving scaling challenges, and meeting mounting partner demands. The technology startup founder says that it is in this phase that potential customers scrutinize their solution more intensely, holding it to higher standards than they would a seed venture or pilot project because the innovation is tangible, the outcomes are clear, and the commitments needed are no longer hypothetical:

> "People are very excited about [the initial] stage in the process... When you get to our stage— and we're truly at scale—I find that people want to find everything that's wrong."

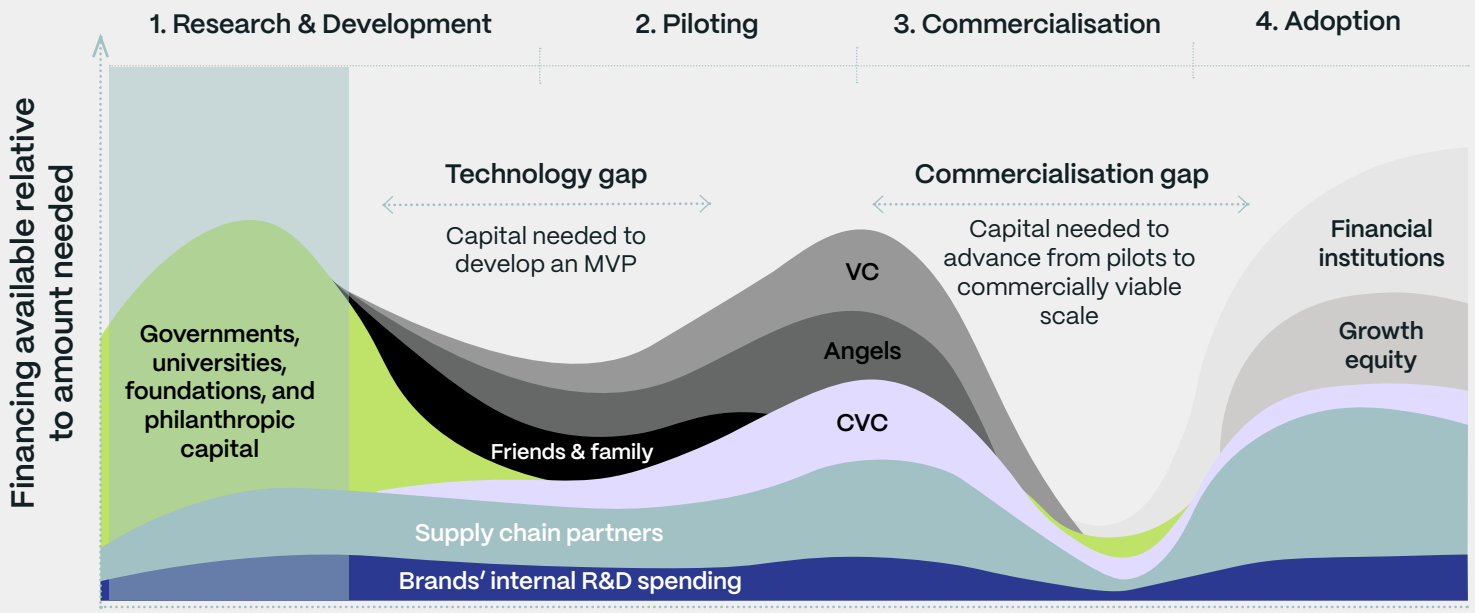
To be clear:

Filling funding gaps is not solely the responsibility of brands and retailers[165]—they provide comparatively less funding than VCs, banks, third-party and government funds.[166] But their intervention is needed more directly throughout every stage of the innovation pipeline—from concept to commercialization.

A brand's long-term support (financial or otherwise) creates a powerful knock-on effect for other stakeholders, especially suppliers, that is necessary to accelerate and scale innovation.

* TYPICAL FINANCING DEMAND AND SUPPLY LANDSCAPE FOR HARD-TECH INNOVATORS

For hard-tech innovators, two financing gaps during the development stages are especially challenging to bridge.



Example of a hard-tech innovator's financing needs, by development

<$500,000	~$5 million	~$25 million	~$50 million

Note: All dollar amounts are in US dollars; actual financing needs may vary.
CVC = corporate venture capital; MVP = minimum viable product; VC = venture capital.
Refers to both external investments and internal R&D spending by suppliers.

Figure 7
Typical Financing Demand and Supply Landscape for Hard-Tech Innovators.
This figure, created by Fashion for Good & BCG Analysis, was published in a report titled "The Great Unlock. Closing the Innovation Commercialisation Gap through Project Finance Solutions" by Jooste, Ley, Kasarjian & Lowbeer-Lewis, published by Fashion for Good in 2023.[164]

OPPORTUNITY #3

ACCEPT AND EMBRACE SYSTEMS CHANGE

Brands and retailers tend to lean out when it's time to lean in. All stakeholders have a role to play in changing this behavior. The fashion system is not structured in a way that enables innovation to succeed. It needs more shared risk, infrastructure building, strong incentives for realignment and critically, a willingness to share the burden of funding the gap to widespread adoption. Below, explore three opportunities for systems change, followed by a case study on fiber clubs that, if successful, will demonstrate the power of pre-competitive collaboration.

O3.A

Sustainability credentials are not enough to move the needle on adoption—innovators need to demonstrate a strong business case for brands and retailers and suppliers.

The urgency of the climate crisis has not been enough to motivate the industry into action. It's evident that innovation adoption has to tick multiple boxes to be considered a strategic business decision. Innovators bear the responsibility of building a holistic business case that taps into the various priorities of a brand or supplier, including cost neutrality, regulatory compliance, reputational risk, customer engagement and environmental impact.

As we've highlighted, some suppliers and investors use technology assessment frameworks such as a Technology Readiness Level (TRL).[167] There is an opportunity to utilize a broader industry framework for all stakeholders to support the decision making process. The Balanced Readiness Level Assessment (BRLa),[168] developed by researchers in Norway, addresses levels of readiness to adopt new and emerging technologies through five dimensions. By measuring their technological, organizational, market, regulatory, and acceptance readiness through a holistic methodology, stakeholders can reflect on the variety of external factors that influence industry adoption.

* BALANCED READINESS LEVEL ASSESSMENTS

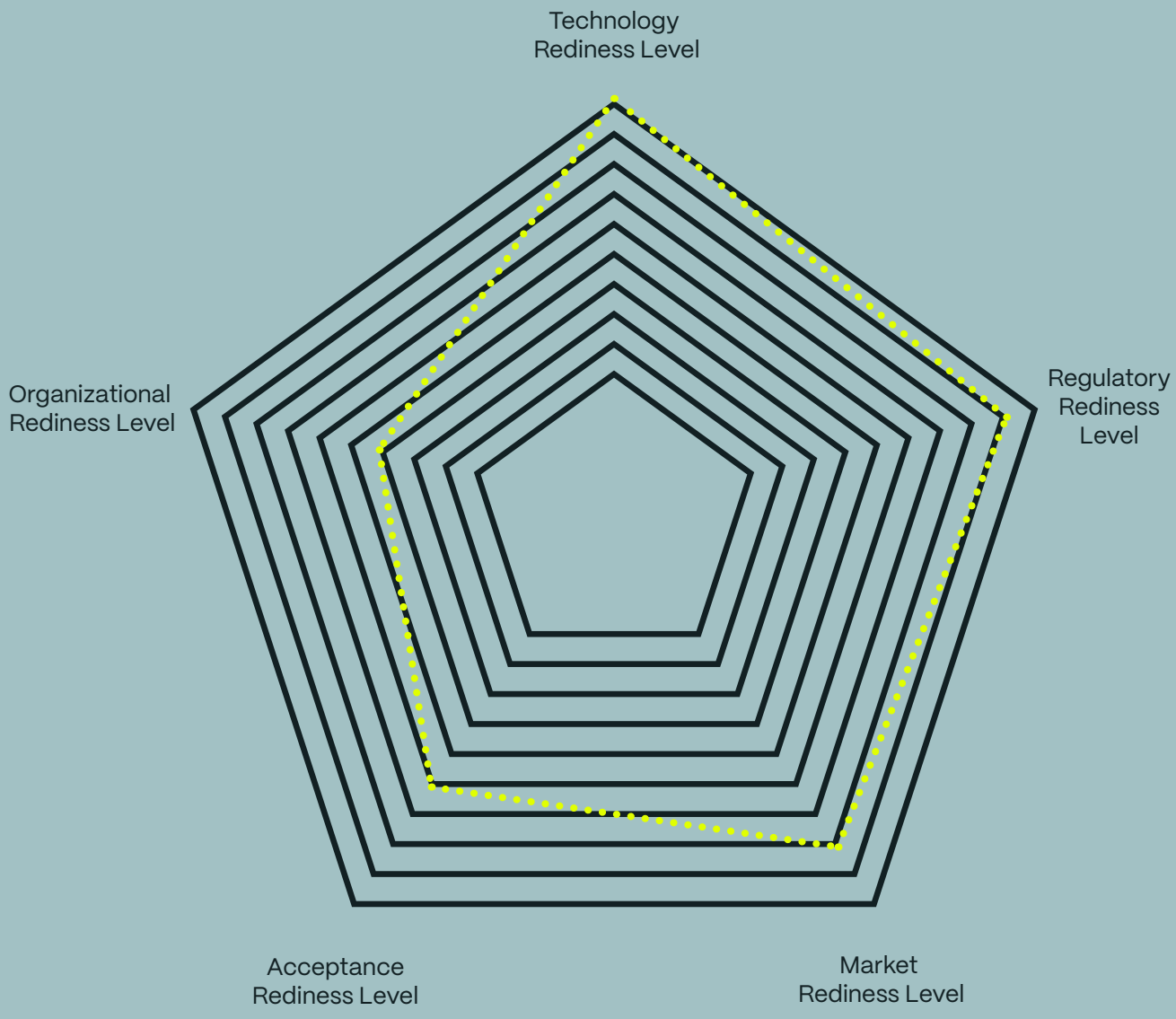


Figure 8
Balanced Readiness Level Assessment (Vik, Melås, Stræte, & Søraa, 2021).
This figure was published in "Balanced readiness level assessment (BRLa): A tool for exploring new and emerging technologies" by Vik et al, which was published in 2021 in "Technological Forecasting and Social Change", which is an Elsevier journal.[169]

This assessment focuses on the technology, but a complete business case must extend beyond functionality to address strategic value and commercial viability. Regulatory dependencies, system interoperability, performance validity, and particularly runway to scalability and price parity, are all factors, as suppliers shared, they inherently consider when sizing up new startup partnerships. Achieving scale is essential to drive production efficiency, demonstrated by annual outputs in the millions of tonnes for some suppliers, and the price reductions necessary for mass-market adoption.

Whilst decarbonization of the supply chain must be prioritized, the energy transition is not without its own dependency hurdles, even when payback periods can be demonstrated. In order to address the breadth of sustainability issues the industry faces, we need a variety of solutions concurrently working on the many levers for change.

Pioneering and validating new solutions doesn't take place in a linear fashion. Climate innovation startups are under pressure to demonstrate the financial case to the industry whilst navigating a lack of ecosystem infrastructure and legacy processes, which carry long-term consequences if not disrupted.

Brand demand is critical to making the economics work. When that demand is predicated too heavily on price parity in the short term, it undermines the fundamental role that innovators play in shaping the future the industry purports to want. What is needed are more first-movers who are willing to co-invest, demand effective regulation and support the initial premiums incurred in market infancy to unlock the capital required to get there.

The opportunity to make the business case is a shared one.

O3.B

Brands and retailers should look at the financial levers that can be pulled to absorb and offset unavoidable premiums. Solutions need time to climb down the cost curve, and brands and retailers should expect that this will take a few years. Those that are serious about big-picture, long-term supply chain resilience can reframe these premiums as investments and will find ways to distribute these costs through their business by tapping into different funding strategies for innovation.

This could include decoupling the innovation premium from the sourcing budget and spreading it into marketing or decarbonization budgets, or working with government development banks and subsidies that can offset part of the cost.[170] Resources like Fashion for Good's Price Parity Toolkit[171] can help brands explore how to decouple material premiums. No matter what this looks like, the duration of these initiatives to absorb premiums are short-term and budget dependent. So what happens when the budget runs out? A representative from an innovation startup tells us their theory:

> "As the technologist, you then need to provide better pricing after that budget has run out. And that's a decision from [the brand] side—their CFO or finance division needs to agree to what they think is tenable for them—where they have additional cash, or where they think they could get this money from. Maybe they believe that they can price up the products on the consumer side, and so the budget could come directly out of sales."

Ultimately, premiums need to be covered by brands and retailers over the long-term, say suppliers, who believe this is where brand funding should be prioritized over more new ventures.

A CEO who has led several brands says adjusting sourcing to economic shifts is nothing new for brands and retailers:

> "Think about the levers that you have inside of every supply chain—there are numerous—and we have to play with them all the time. Sometimes we're privy to shipping fees going up. Sometimes it's cotton going up.... We are always able to think about how things are designed, how materials are used, and also how things are sold... If there's true intent from the industry side to transform, there are plenty of levers to make the economics work."

Governments can play a bigger role in de-risking investment for brands and retailers.[172] Innovators have already demonstrated the power of aligning with governments to accelerate their solution. In 2025, T-2-T recycling company Circ received backing from the French government and the European Union to build its first commercial scale plant in Saint-Avold, France.[173] Bio-based dye innovator Pili has received support and funding from the French government and the EU.[174] While early-stage funding from government grant programs is more common,[175] some experts believe that there are opportunities for stronger co-investment between brands and governments to fill funding gaps in the scaling phase of an innovation.

A non-profit representative that works at the intersection of all stakeholder groups says:

> "There's a lot of financial levers that are available to governments to help brands and manufacturers through the value chain offset [the premiums]. But at the moment, just as there was in the early stages with solar and wind, for that load to be completely carried by the private sector—it's a heavy load to be expecting. Especially given that there are these broader societal benefits: pollution prevention, waste management, the potential of economic development and sort of social advancement and livelihoods with dignity at different kinds of parts of the value chain."

O3.C

Suppliers as well as brands and retailers need to embrace pre-competitive collaboration to drive alignment and adoption at scale.

Individual commitments between brands and retailers and innovators are important, but are limited in their capacity to secure meaningful volumes required for innovation to scale. By creating a consortium of brands to aggregate demand, innovators and suppliers can benefit from higher volume commitments and optimized production, while brands and retailers secure access to the output at a competitive cost.

As we'll explore in the case study below, fiber clubs have emerged as a mechanism for pre-competitive alignment between key stakeholders. Facilitated by Fashion for Good and Circ,[176] then replicated by Altmat,[177] these clubs spread the scaling risk between brands and retailers, suppliers and innovators for their mutual benefit. One expert tells us more clubs are being formed using this framework to bring collaborators together across a variety of materials and solutions. Clubs can be particularly useful for smaller brands and retailers that want to trial novel innovations but aren't able to secure favourable pricing or meet order quantities on their own.

As a representative from the innovation platform explains:

> "If you're able to pool the smaller volumes together and remove the barriers of minimum order quantities [MOQs], we are able to pull enough volume that an innovator can give the same price points they could at higher volumes. This means that all brands and retailers can access these materials with reduced premiums and bring them into their supply chain faster."

Whilst demand pooling can be used to address Minimum Order Quantities (MOQs) and high trial pricing, it doesn't automatically convert into commercial scale volume commitment, which is what suppliers need to see.

One manufacturer suggests that a combination of demand pooling through clubs and more formal offtake agreements could resolve this:

> "Commercial commitment is important. A mix might be good, like you have 60% [of brands] properly committed, and the balance keeps open. But unless it's a firm formal commitment, there's always the risk that people won't see it through."

This collaborative approach to demand pooling could also be replicated for the benefit of suppliers more broadly, who, like innovators, struggle with a lack of coordination from brands and retailers. Competing demands for different technologies, data requirements for reporting, and sustainability initiatives can create inefficiencies and frustration for suppliers.

An ex-sustainability representative for a global brand emphasizes the need for collaborative efforts from brands and retailers on common issues:

> "There is just one planet, so the collaboration piece is absolutely critical. It's not a competitive advantage at all, it's something that people need to embrace together... A material supplier will supply tens of brands. So one brand comes with one agenda, the other one comes with another agenda...if there is not a bit of a harmonization between the brands, that's going to kill [suppliers.]"

*CASE STUDY FOR AGGREGATING DEMAND:

FIBER CLUBS

Fiber clubs are a facilitated, collaborative consortium bringing together brands and retailers and suppliers to drive adoption of tech innovations in the fiber space.[178] They are an umbrella initiative by Fashion for Good & selected innovators, originally developed and launched with textile-to-textile recycler Circ in 2024.[179] A funnel process of sorts, they attempt to address known operational barriers to adoption and integration in order to aggregate demand. First, at the fiber and yarn stages, then ultimately into fabrications at scale. Whether participation in these clubs translates to volume commitments or offtake agreements beyond trials and capsules remains to be seen.

Commercial scale orders are vital to mainstreaming innovation and bending the cost curve, and this overwhelmingly relies on brands and retailers overcoming the resistance to paying a premium in the initial phase of adoption as well as supply chain integration at all tiers. Market traction remains at risk if suppliers lack partnership and support with funding premiums, seen as a short term hurdle until economies of scale kick in or new pricing models are developed.

Stakeholders include suppliers, brands and retailers, innovators and industry organizations. Clubs are established with the short term goal of conducting trials and the long term goal of achieving volume commitments or offtake agreements.

INDUSTRY EXAMPLES:

- Circ Fiber Club for CIRC Fiber[180]
- Altag Fibre Club for Almat Fiber[181]

CHALLENGES THESE FRAMEWORKS AIM TO OVERCOME:

- High Minimum Order Quantities (MOQs) from suppliers due to a lack of high volume orders
- Lack of unification and standardization in testing at pilot scale between brands and factories
- Prohibitive pricing – trial prices carry high premiums
- Low visibility of future pricing and available volumes
- Fragmented supply chain with varying levels of capability and capacity
- Suppliers lack of technical experience with a new product if not part of trials

EFFORTS TO ADDRESS THESE CHALLENGES:

- Leverage existing brand-supplier relationships interested in and have the capacity to implement novel fibers
- Simplifying supplier engagement by standardizing yarn counts for pilots
- Pooling volume through the consolidation of orders from brand club members to remove or lower MOQs and lower prices
- Offering brands a unified platform for simultaneous testing and adoption, helping to overcome financial and logistical barriers
- Providing knowledge sharing opportunities to unlock progress
- Giving visibility into commercial pricing and long term commercial volumes. Member brands have the option to reserve fiber capacity at volume from commercial plants

STILL TO SOLVE:

- Commercial orders for core collections are up to each brand to make. Whilst these clubs seek to encourage volume commitments by addressing operational barriers to adoption at the pilot stage, they cannot enforce volume commitments from brands once commercial facilities are built
- Pricing of yarn and fabrication is between suppliers and brands and can be variable so premium creep still a challenge

04

CONCLUSION

For innovation to become a genuine climate solution, this report argues the fashion industry must make two pivotal shifts: first, to fully collaborate and create equal participation conditions for new solutions to scale; and second, to focus its investments strategically, avoiding the futility of innovation for innovation's sake. Spreading resources too thinly between competing solution providers serves no one. A representative from a brand investment arm puts its succinctly:

> "There are some hard talks that we need to have. Hard talks around what works and what doesn't work when we talk about implementing innovation into the supply chain and into the industry."

The startup scene could be on a trajectory to repeat long-established top-down dynamics that have shaped the wider fashion industry for decades. It's critical that all stakeholders are at the table with intent and a willingness to counter historical power structures which maintain an uneven spread of risk and responsibility holding the climate innovation sector back.

Innovators face the weight of the industry's expectations to scale faster than is realistic to meet urgent demand for climate-related solutions.

Suppliers are typically allocated a greater burden of contribution than other stakeholders are even aware of because their voices are not always represented in decision making.

Brands and retailers and **investors** are hugely influential, but can be short-sighted and fickle in their appetite for risk and appreciation of their role.

Industry organizations are finding new and interesting ways to convene these players, but tangible commitments remain elusive.

"We need to agree on who it is that will take that risk and who can afford it.. Risk is difficult to put on any one player singularly, it has to be put on the industry collectively instead."

– Brand investment arm representative

"I don't think we get to solve easy problems anymore at this stage in the game, the low hanging fruits are gone. From here on out, everything's going to hurt and everything is a little bit more complicated. Just acknowledging that it is going to take effort and time. It's not business as usual."

– Industry research consultant

By attempting to foster innovation within this often fractured and inequitable fashion system, stakeholders have hit seemingly insurmountable barriers and discovered how deeply misaligned these two worlds are. Innovation is slow-moving, while fashion in comparison, is fast-paced. Innovation is expensive, while fashion is price-sensitive. The strength of innovators is that they're often outsiders, identifying opportunities for change with a fresh perspective, but fostering the right relationships and determining how to share the risk, whilst difficult, is necessary.

This requires honest conversations about the systemic changes needed, prioritizing a just transition by acknowledging that a universal win-win is impossible. We must accept that transformation at this scale will inevitably involve resistance and losses for some brands and manufacturers. A representative for a brand related foundation saw the task at hand as a shepherding of two distinct phases:

> "You need to be both a hospice worker and a midwife. So you need to let go of things with dignity, and you need to be empathetic and understand that letting go of the old might need some hospice work. Yet, at the same time, you're midwifing the new into existence."

This report presents an opportunity for developing consensus on what a fair distribution of risk looks like across the value chain. It offers a chance to consider what the minimum viable elements need to be for a balanced approach to innovation within fashion's supply chains.

While barriers are significant, there are equal numbers of opportunities for change available to the industry. Our findings reveal both ambitious, visionary opportunities and practical, incremental steps. This dual approach provides a path forward for all stakeholders, regardless of their current stage in the sustainability innovation journey.

*Key opportunities for all stakeholders identified in the report to consider include:

- Bringing top decision makers to the table to align priorities and buy-in from the C-suite down;
- Co-creating solutions with the supply chain to build equitable partnerships and incentivize participation;
- Providing open source information, frameworks and data to build transparency and standardization of expectations across the industry and innovation sector;
- Treating innovation like any other strategic business consideration by pulling financial levers to support new products and processes;
- Embracing pre-competitive collaboration to drive alignment and adoption at scale;
- Understanding the investment of time, resources, personnel and equipment involved in the R&D and implementation phases and reward this fairly.

While innovation can be somewhat of an unnatural force within the fashion industry, achieving its full potential demands radical systems change. This conclusion is underscored by the 32 industry thought-leaders, across all stakeholder groups, who contributed to this report. Despite diverse viewpoints, their message was unanimous: meeting the industry's climate targets requires a comprehensive reimagining of its core dynamics. Long-term resilience, equity, and trust must become the hallmarks of how fashion defines and creates value for the future.

As one industry veteran succinctly puts it:

"This whole industry has to realize that this is an opportunity for a new economic model."

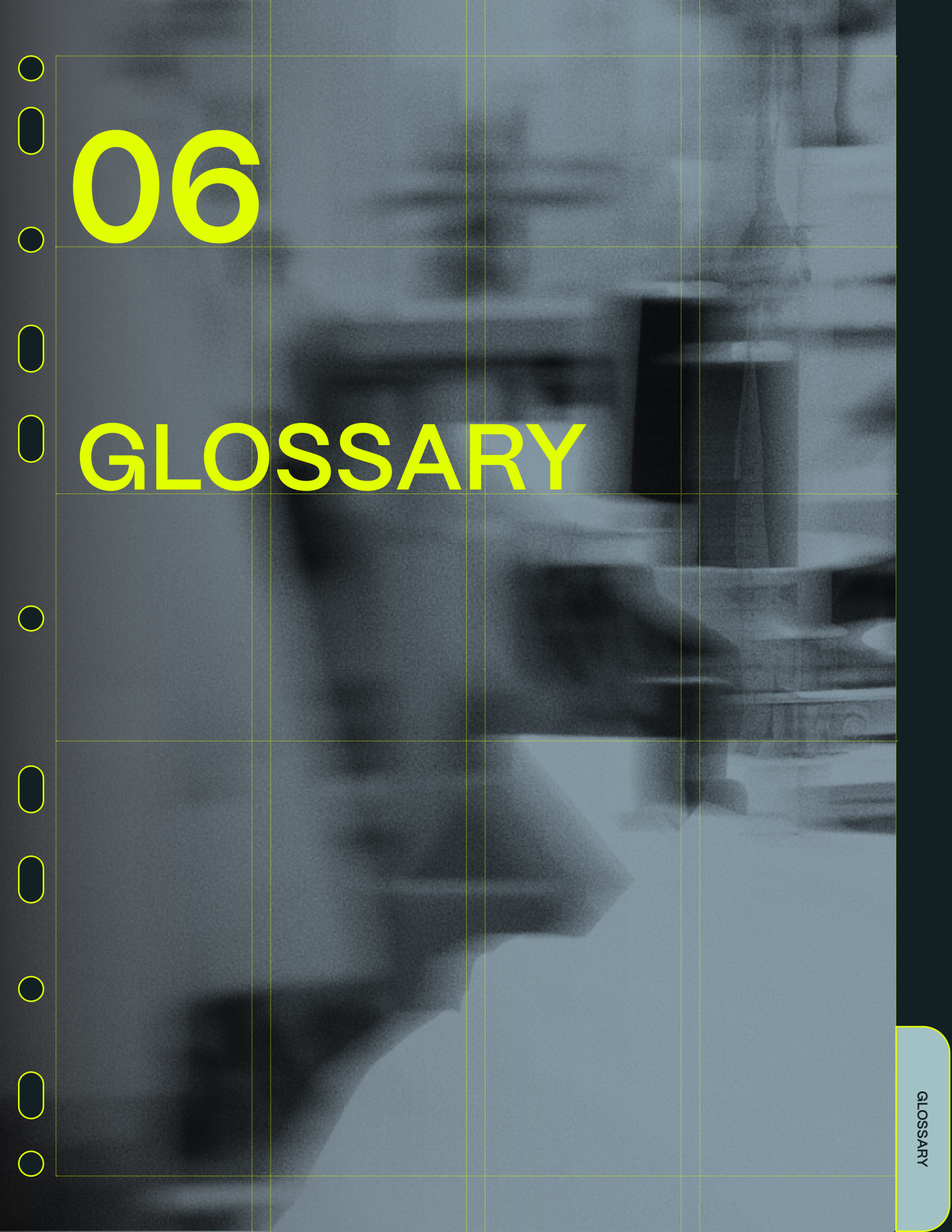
05 INNOVATION READINESS CHECKLISTS

The potential risks suppliers face when testing and implementing innovations can be substantial and often hidden. Conducting a readiness assessment can support partnership discussions between stakeholders to build equitable relationships.

These checklists provide an opportunity to understand the functions each partner fulfils, consider their associated costs, reflect on ways to balance risks and identify opportunities for a meaningful process of consultation and collaboration.

Scan the QR code to download **three checklists** designed for **Suppliers**, **Brands and Retailers** and **Innovation Startups**.

www.transformersfoundation.org/unlocking-equity-in-innovation#checklists



06

GLOSSARY

(1)
Bio-based/ derived Dye

Bio-based pigments, dyes, and inks are natural colorants derived from renewable sources, such as plants, minerals, animals, or microorganisms. While synthetic dyes are derived from non-renewable sources like petroleum, biobased pigments come from renewable sources or agro-industrial waste.[182]

(2)
Cost Curve

A cost curve is a graph that shows how a business's costs change as the level of production changes. It helps visualize the relationship between output and cost, including fixed, variable, average, and marginal costs. A new technology must demonstrate a declining cost curve to show that it can outperform existing solutions on cost and scale, making it a viable and competitive long-term replacement.[183]

(3)
Death Valley Curve

The Valley of Death is the gap between a new technology's development and its successful commercialization, where many innovations fail due to lack of funding, support, or market readiness. In green tech, the Valley of Death is often deeper because solutions are capital-intensive, take longer to scale, face regulatory and market uncertainty, and offer delayed returns – making investors more cautious and progress harder to sustain.[184,185]

(4)
Decoupling of Premiums

The premium decoupling mechanism is a financial strategy that separates the added cost of next-generation materials early in the supply chain – typically at Tier 4 (e.g., raw material level) – to prevent that cost from compounding as the material moves through downstream tiers. Instead of allowing the premium to be marked up at each stage, brands assume and fund this cost directly, often through dedicated internal budgets such as innovation or sustainability funds. This approach maintains stable product and sourcing margins, reduces total system-wide costs, and facilitates the wider adoption of sustainable materials by mitigating price amplification.[186,187]

(5)
Demand Pooling

Demand pooling refers to the pooling of demand across multiple brands to achieve critical volumes at optimized costs. In the fragmented fashion industry, demand signals generated by individual brands are powerful but their impact is often insufficient to drive the critical volumes required for economies of scale, particularly during scaling phases. Aggregating demand across multiple brands becomes essential to eliminate minimum order quantities, optimize production, reduce unit costs, and improve pricing. Coordinating efforts to nominate common suppliers further enhances efficiency, directing consolidated volumes to specific partners and enabling larger, more streamlined production runs across the value chain.[188]

(6)
Financial Runway

Financial runway refers to the amount of time a startup can continue operating before running out of cash, based on its current expenses and available funding. It represents the period during which the business must reach break-even or secure additional financing. Runway is influenced by factors such as burn rate, revenue, funding, market competition, and broader economic conditions.[189]

(7)
Green Premium

While next-gen materials hold environmental promise, most are still on their journey to scale and as such, have attached price premiums – which can be seen as transition costs – that make them more expensive than their conventional counterparts. In order to achieve commercial scale, these materials require investment, volume adoption and time.[190]

(8)
Hard Tech
(also known as Deep Tech)

Hardware technologies require the development of physical, capital-intensive assets like dyeing machinery, new fiber production lines, or recycling infrastructure. Both Next Generation Materials as well as Processing Innovations fall into this category. The degree of asset intensity is an important factor that influences the pace and path of technology development and scale. Hard-tech innovations often bring complex R&D cycles, require specialised skill sets and customised tools, and involve orchestration of a wide set of stakeholders across the supply chain. Hard-tech often have substantially larger capital needs, face unique challenges such as development and construction risk, have higher marginal costs of production, and ultimately scale more slowly.[191,192]

(9)
Innovation Pipeline

A system for managing the flow of ideas through the stages of idea generation, evaluation, development, and implementation. An innovation pipeline includes activities such as idea generation, research & development, prototyping, testing, design and engineering, production & delivery, marketing and sales, as well as customer feedback loops.[193]

(10)
Innovation Tourism

Innovation tourism is the phenomenon where fashion brands eagerly experiment with new materials, technologies, or sustainable practices – often driven by novelty, trend alignment, or marketing buzz – but fail to invest in the systems, supplier collaboration, and long-term strategies required for meaningful adoption. As a result, these innovations remain short-lived, fail to scale, and never become truly integrated into the core business.[194]

(11)
Just Transition

Just transition is the term used to describe the transition to a climate-neutral economy while securing the future and livelihoods of workers and their communities.[195]

(12)
Letter of Intent (LOI)

A letter of intent (LOI) establishes the preliminary intention between parties to do business with one another and the starting terms that have been agreed on, including the basics of a deal, including cost, time frame, and contingencies. While not typically legally binding, a letter of intent can later be used as the foundation of a formal contract such as an offtake agreement, which is legally binding.[196]

(13)
Next-Gen Materials

Fashion For Good defines Next-Gen Materials as "novel and innovative fibers and materials with desired improved environmental and/or social outcomes when compared with conventional options, that are currently in early stages of commercialization or development, and require further technological advancement and cost optimization for widespread adoption.[197]

(14)
Offtake agreement

An offtake agreement is a mutually-beneficial commitment to purchase specific volumes of the producer's output, over a specific period of time, signed ahead of availability in order to unlock necessary financing for production. Offtake Contracts play a pivotal role in project finance, particularly for capital-intensive projects. They provide a secure, long-term income stream, making them integral to project viability.[198,199]

(15)
Patient Capital

Patient capital represents a distinct form of investment that prioritizes long-term impact and sustainability over the pursuit of immediate financial gains. This approach to funding is designed to support ventures that may require extended periods to mature and realize their full potential. It seeks to foster growth that is not solely driven by short-term profit motives.[200]

(16)
Premium Creep

Premium creep refers to the compounding effect of markups across the value chain that causes a modest increase in sustainable production costs to snowball into significantly higher retail prices. This occurs when each stage of the supply chain – manufacturing, distribution, retail – applies standard percentage markups to already elevated costs, effectively adding a premium on top of a premium. The result is inflated consumer prices that create a distorted "green premium".[201]

(17)
Price Parity

Also known as cost parity, price parity refers to the point at which the price of a green technology product becomes equal to or lower than that of its more carbon-intensive, conventional alternatives. Achieving cost parity eliminates the "green premium" and makes sustainable solutions more accessible and competitive in the market. Reaching price parity is seen as crucial for scaling green innovation by removing financial barriers that often prevent widespread adoption.[202,203]

(18)
Return on Investment (ROI)

Expressed as a percentage, return on investment (ROI) is a financial ratio that measures the profit generated by an investment relative to its cost. Key factors influencing ROI include the initial investment amount, ongoing maintenance costs, and the cash flow generated by the investment.[204]

(19)
Seed funding

– Pre-Seed, Seed, Series A, Series B, Series C+
See page 39.[205]

(20)
Suspensive Conditions

A condition which prevents an obligation arising unless and until a specific future event, certain or uncertain, occurs.[206]

(21)
Sweat Equity

Sweat Equity refers to work done to build up value without compensation or immediate financial returns. In the context of supply chain innovation, it describes the non-monetary investment – primarily time, effort, expertise, equipment and problem-solving – that manufacturers and supply chain partners contribute when piloting novel solutions, often without any guarantee of adoption or commercial benefit. In some instances, exclusive or first access for a capped period or preferential pricing is negotiated in exchange.

(22)
Textile-to-Textile (T2T) Recycling

Textile-to-textile recycling transforms textile waste into new fibers or materials of comparable quality to virgin materials. Recycling can be through mechanical or chemical processes. The majority of start-ups in this space are using chemical recycling technology. This method employs chemical processes to break down polymers into their original molecular components. This allows for the creation of new materials that can be.[207]

(23)
Technology Readiness Level (TRL)

Technology Readiness Levels (TRL) are a type of measurement system used to assess the maturity level of a particular technology. Each technology project is evaluated against the parameters for each technology level and is then assigned a TRL rating based on the project's progress. There are nine technology readiness levels. TRL 1 is the lowest and TRL 9 is the highest.[208]

(24)
Transition Finance

Transition finance is finance deployed to temporarily offset the higher cost of sustainable innovations during the transition phase to commercialisation to reduce margin pressure. Sources of transition finance include brand funds allocated from R&D or sustainability budgets to cover the costs of the green premium (premium de-coupling), as well as industry and philanthropic funds. Collective mechanisms are another example where funds are pooled from a variety of actors to reduce price pressure on early adopters.[209]

(25)
Transition Risk

Transition risk describes the risk incurred by the supply chain during the testing, validation, and implementation of new innovations. These risks can arise from uncertain material performance, potential costs of retrofitting infrastructure, equipment compatibility testing and training labor to impacts from disruptions in supply continuity, lack of production scalability, regulatory changes and committing to unproven technologies that may not deliver expected outcomes or ROI.

(27)
Volume Commitment

A volume commitment refers to an agreement or assurance by a brand or manufacturer to purchase a specified quantity of a new or innovative material or product over a defined period of time, helping to de-risk production scale-up by providing predictable demand and encouraging investment in early-stage innovation.

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