# Materials as Agents of Change Innovation Trajectories Toward Sustainable and Circular Transition

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**Abstract**
This article examines the central role of materials in shaping circular design practices and guiding sustainable transitions. Framed within the intersections of Transition Design, Advanced Design, and Circular Design, materials are considered not as passive inputs but as co-evolving actors that influence processes, supply chains, and cultural imaginaries. Through theoretical analysis and case studies, the article highlights how innovative approaches to material design can regenerate resources, enhance transparency through digital and AI-based technologies, enable collaborative supply chains, and foster new aesthetic and ethical values. By addressing materials as agents of change, design is positioned as a catalyst for systemic and cultural transformation in the face of current environmental and social crises. From this perspective, four operational implications emerge for design, outlining an integrated framework for action. As an introductory contribution to the Open Debate section of *diid* on design and materials, the article sets the stage for further reflections and discussions on the experimental trajectories shaping contemporary design cultures.

**Keywords**
Circular design
Transition design
Advanced Design
Material innovation
Digital technologies for circularity

## The Central Role of Matter in Circular Design Practices

The ongoing environmental, social, and economic crisis cuts across all industrial sectors, confronting design cultures with global challenges such as climate change, biodiversity loss, and resource depletion (Irwin, 2015). The design phase has a substantial influence on environmental impacts (Thackara, 2006); therefore, increasing attention must be devoted to the entire product life cycle. Within a context in which Western technological progress has contributed to the illusion of unlimited availability of goods and resources (Stahel, 2019), the role of materials becomes central. The impacts of irresponsible design decisions — both past and present — are now evident in our ecosystems, with plastics (Rosato, 2025) systematically and pervasively reshaping industrial systems.

Superficial material choices generate consequences that reverberate throughout the supply chain (Vezzoli et al., 2022). The origin of raw materials affects artefact recyclability, logistics, and transportation, while transformation technologies directly shape the social and economic dimensions of the territories involved. Adopting responsible material-centred practices thus represents a preventive and concrete means of reducing impacts across the entire production chain, requiring a holistic and systemic vision (Pellizzari & Genovesi, 2021). From the outset of the design process, materials must be regarded as central to innovation, not only formally but also functionally (Manzini, 1986). In this perspective, matter ceases to be a mere pre-existing datum and instead becomes an active agent that orients and guides design processes (Karana et al., 2014; Levi & Rognoli, 2013).

Rethinking materials and their flows constitutes a cornerstone of the regenerative model advanced by the circular economy (European Commission, 2020). This system seeks to keep materials in circulation for as long as possible, thereby avoiding waste and reducing environmental, economic, and social impacts (Ellen MacArthur Foundation, 2013). Key practices include recycling, reuse, reprocessing, maintenance, and recovery, all aimed at extending the life cycles of products and their constituent materials (Potting et al., 2017). In Europe, governance bodies are producing reports and guidelines that increasingly emphasize the role of materials in design (e.g., ESPR) (European Union, 2024). These directives aim to translate research outcomes and ongoing developments into operational practices, fostering continuous evolution while requiring concrete application.

Against this backdrop, it is essential that the regenerative potential of materials be more explicitly recognized within the design community, extending beyond their morphological, aesthetic, and functional qualities. Designers must develop awareness of the actions necessary to ensure products align with the principles of circular and sustainable economies, thus enabling transitions toward new models of consumption.

Design cultures have already elaborated responsible production and consumption strategies to address environmental concerns, in which materials play a decisive role. Circular Design (De los Rios & Charnley, 2017; Moreno et al., 2016), emerging from Design for Sustainability, is grounded in the principles of the circular economy and integrates closed-loop systems with systems thinking. This approach enables designers to shift continuously between user needs and the systemic implications of production processes, through a dynamic of 'zooming in and zooming out'. Within this vision, design is tasked with anticipating multiple product life cycles, incorporating recovery, repair, and sharing practices prior to recycling; shifting the focus from product to service design; extending artefact lifespans; selecting safe and circular materials; pursuing dematerialization through reduced resource use; and, ultimately, fostering modularity as a principle of adaptability and regeneration.

Alongside established practices and consolidated approaches, the design profession itself is evolving and being redefined. Designers working with materials are increasingly called upon to integrate hybrid knowledge and competencies (De Giorgi et al., 2020), progressively combining principles of sustainability and circularity with the concept of transition (Duarte Poblete & Rognoli, 2025). A designer profile centred on circularity, anticipation, and transition is now emerging across multiple design contexts and disciplines (Bisson et al., 2022; Giardina, 2023; Zannoni et al., 2024). A particularly significant example of material-centred design is the Transition Matter Designer, a figure capable of identifying product-system configurations critical for material use and guiding supply chain stakeholders through matter-driven metamorphic processes aimed at gradually building a sustainable and circular transition, operating across different scales of design (Rosato, 2023).

This article introduces a special focus of *diid* dedicated to research at the intersection of design and materials, with the aim of mapping the innovation trajectories currently shaping design cultures in this field. Particular attention is devoted to the dimension of sustainability and circularity, in connection to the theme of transition, in order to reflect on how to strengthen design experimentation and effectively respond to ongoing transformations.

## Theoretical Framework and Research Methodology

The methodological framework lies at the intersection of Transition Design and Advanced Design, serving as a lens through which to observe the capacity for change. On the one hand, Transition Design assumes that environmental and social challenges cannot be addressed through individual approaches but require long-term visions and iterative modes capable of accompanying processes of profound transformation (Irwin, 2018). The design framework of Transition Design unfolds across four interconnected areas of action (Irwin et al., 2020): the construction of sustainable future visions, conceived as open and evolving spaces; the elaboration of theories of change, which position designers as agents capable of understanding and acting within complex systems; the development of collaborative and responsible mindsets, oriented toward revisiting the values and roles of design; and finally, the adoption of design modes characterized by long temporal horizons. The contribution of Transition Design to sustainability thus lies in its ability to integrate systems thinking, collaborative design, and the imagination of desirable futures, situating each project as a step within a broader pathway of transition toward circular societies.

Advanced Design, on the other hand, provides project actors with the ability to think anticipatorily and to respond to the rapid transformations of context, fostering forms of continuous innovation (Celi, 2010). The designer assumes the role of mediator among bodies of knowledge (Celaschi, 2008), acting systemically and prospectively in the design of products and processes. The main areas of action of Advanced Design are fourfold: anticipation, which employs tools of futurology, trend analysis, and latent needs to imagine preferable scenarios and render them accessible through processes and prototypes (Celi & Morrison, 2019); the search for stimuli for innovation within cultural, geographical, or historical contexts that are distant, promoting the transfer of knowledge from extreme conditions to more ordinary design scenarios; the creation of repertoires of solutions transferable across diverse projects (Celaschi et al., 2018, 2019); and finally, design emancipated from its market of reference, grounded instead in needs directly observed by the designer.

The integration between Advanced Design and Transition Design makes it possible to address ecological transition at different scales: from the micro level, related to material, chemical, and aesthetic aspects, to the macro level, concerning systems, relationships, and processes of symbiosis (Zannoni et al., 2024). When combined with Circular Design, anticipation takes on a central role in designing the future life cycles of matter, in foreseeing the evolution of technologies, and in responding to the transitional needs of users (Rau & Oberhuber, 2019).

Within this methodological framework, the article aims to analyze how materials can be interpreted as agents of change, representing a privileged standpoint for understanding and guiding the transition toward circular and sustainable models. The Circular Design Process constitutes the conceptual frame of reference, as it enables the positioning of materials within broader systems, fostering a shift in perspective from the macro-to the micro-scale. The adopted methodology is grounded in the integration of theoretical analysis and the observation of design practices, with particular attention to the convergence of the three aforementioned disciplines. Through the presentation of sources, bibliographic references, and exemplary case studies, four levels of action are outlined to consider materials as agents of change. The first level, Regenerative Material Ecologies, encompasses experiments based on materials derived from renewable sources or waste, as well as local production processes capable of regenerating resources and ecosystems. The second level, Augmented Circular Materialities, highlights how digital technologies, artificial intelligence, and data enable high performance and reduce environmental impacts, thereby opening new design possibilities. The third cluster, Material-Driven System Futures, emphasizes the role of materials as levers for constructing supply chains and future scenarios of co-creation with communities. Finally, the fourth level, Sensory & Cultural Reframing of Materials, underscores the symbolic and communicative value of matter, understood as a bearer of identity, proximity, and sustainability over time.

## Regenerative Material Ecologies

The capacity of a material to act as an agent of transition and change begins with its origin and composition. Bio-based materials — namely those of plant or biological origin, composed of renewable organic components reproducible through natural cycles — are circular materials (Pellizzari & Genovesi, 2021). Research and design-oriented practices dedicated to the design and application of materials derived from waste, renewable sources, and biofabrication processes represent a solution for the circularity and sustainability of supply chains. In recent studies (Duarte Poblete et al., 2024) these experiences have been systematized into three broad categories that delineate the current transition toward more sustainable practices: waste-based materials, renewable materials, and biofabricated materials. Waste-based materials rely on the use of residues and by-products, particularly from the agri-food and textile sectors, with the aim of valorising abundant resources and reducing the use of virgin matter. Renewable materials derive from fast-growing and widely available resources, such as cellulose, chitin, starch, and animal proteins, and are often characterized by properties of biodegradability or compostability that make their cycles compatible with natural regenerative processes. Finally, biofabricated materials result from the use of living organisms in production processes and belong to the field of Biodesign. Significant examples include bacterial cellulose and algae, which highlight the potential of easy-to-cultivate organisms as renewable resources capable of sustaining new design paradigms.

The selection of bio-based and circular materials constitutes a complex process that requires the ability to consider and manage multiple variables. Beyond origin and disposal methods, it is necessary to consider production at the molecular level, transformation processes, and interactions with production systems. The role of the designer is expressed in the capacity to operate at both systemic and process scales, identifying unexpressed properties in the waste of one sector and valorising them as inputs in another, thereby activating relationships of industrial symbiosis (De Giorgi et al., 2020). From this perspective, the designer can even generate new materials from the recovery of existing waste: Circular Materials Designers (Clèries et al., 2021) work on the development of new materials derived from food- or animal-based waste, progressively expanding the repertoire of possibilities within the circular domain. This also aligns with the need to employ local materials, abundant within the territory of reference, making the most of available resources while reducing the environmental impact associated with logistics and transportation (Llorach, 2021).

The integration of circular materials into anticipatory and transitional practices can offer new design directions, wherein matter is no longer merely an input but a co-evolving actor within the project. In this perspective, material possesses an intrinsic capacity for transformation: it is not bound to a predefined form or function but can evolve over time in response to emerging user needs. Design actions involving material are not rigidly pre-planned but open, adaptive, and potentially renegotiable over the course of the product's life cycle.

An exemplary case study illustrates this approach. *Persistence* by Lou Ramage explores the theme of perceptual aging in textiles and the possibility of considering wear not as a sign of degradation but as an evolutionary stage of the material (Ramage & Bassereau, 2025). The project proposes a reconceptualization of the relationship between time, matter, and perception, making the material itself a temporal and relational marker capable of strengthening the bond between user and artefact. It is an example in which the regenerative dimension is entrusted to bio-based, natural-origin materials whose evolution over time becomes an integral part of the design.

## Augmented Circular Materialities

The integration of digital technologies in support of design is transforming the relationship with materials, making them traceable, monitorable, and enhancing their circularity. This integration should not complicate the material dimension but rather amplify the circularity of goods.

In recent years, material traceability has become a fundamental aspect of design oriented toward sustainability and circularity. The goal is to reconstruct and bring transparency to the entire life cycle of matter: what composes a product, its origin, its transformation, and the possibilities for recycling and reuse. Various technologies are enabling this process today and opening new perspectives for designers. RFID and NFC tags, for example, make it possible to associate digital information with each product describing the materials it is composed of, recycling methods, and the logistics pathway that was followed (Hakola et al., 2025). Blockchain platforms ensure transparency in supply chain steps, guaranteeing authenticity and reducing the risk of greenwashing through distributed and immutable ledgers (Neri et al., 2025). The Digital Product Passport (DPPs), promoted at the European level and soon to be implemented (European Parliament, 2024), promises to become a standard for tracing materials and components, making data on composition, repairability, and recycling pathways accessible. This information is provided both to designers and end users, thereby expanding awareness of design and consumption choices.

These examples show that traceability is not merely a technical issue but a genuine design resource: by providing reliable and accessible data, digital technologies enable designers to transform materials into active agents in the transition toward more transparent, circular, and sustainable systems. However, when implementing these technologies, which strongly influence product sustainability, it is important to pay attention to their impacts.

*PulpaTronics* is a London-based startup that has developed fully recyclable RFID tags by employing a carbon-based conductive circuit printed on paper by means of laser technology. The microchip is no longer present, with data encoded in the geometry of the circuit itself. This not only allows an up to 70% reduction in $CO_2$ emissions compared to conventional RFID tags, it also halves production costs. The paper tags can be recycled multiple times before composting, integrating seamlessly into ordinary paper recycling processes.

This is a current and evolving discourse, much like how AI is reshaping the work of design cultures: from extending the capacity to collect and process information, enabling the management of vast amounts of data and their visualization in new ways, to supporting the creation of new meanings through processes that transform raw data into interpretive structures useful for design, to synthesizing chaotic information into coherent representations (Calleo & Rosato, 2023). AI- and data analytics-based technologies make it possible to process vast amounts of data related to material availability and impact, supporting designers in the selection of more sustainable alternatives. Tools of materials informatics or predictive life cycle assessment platforms, for instance, allow the evaluation in advance of the environmental consequences of a material, thereby guiding more informed design decisions.

The *Circularity on the Edge* project, presented at the 2025 Venice Architecture Biennale, explores the potential of artificial intelligence as a tool for addressing the challenges of post-war reconstruction in Ukraine. Using drones, aerial images of destroyed buildings are collected and subsequently processed by computer vision models capable of segmenting and classifying materials such as bricks, cement, wood, metals, or asbestos. The algorithm, trained on large datasets, can recognize over twenty types of materials, thus providing a picture of recoverable resources within the rubble. At the same time, it highlights cases requiring special disposal procedures, such as asbestos. The result is a system that not only accelerates and improves the efficiency of reconstruction processes but also provides a shared and accessible database for designers, local communities, and institutions. Artificial intelligence thereby enables sustainable and resilient reconstruction narratives rooted in the ability to valorize what already exists.

*Orbital Materials* explores the potential of artificial intelligence in generating new materials: through predictive models and simulations, the project aims to identify high-performance, low-impact solutions, anticipating development scenarios that would be difficult to achieve with traditional research methods.

The use of smart manufacturing technologies makes it possible to optimize production, making prototyping and realization phases faster, more economical, and more sustainable. The digitalization of the design phase, and in particular the use of modeling software to visualize the relationship between form, pattern, and waste generation, represents significant support toward zero-waste processes (Mcquillan, 2020). For example, the knitting machine manufacturer Shima Seiki develops technologies capable of producing an entire garment from a single yarn with a single machine, assembling it in 3D (Moore & Smith, 2020). Such technologies, which operate by addition rather than subtraction (Conti & Motta, 2019), make it possible to use only the resources necessary for garment production, thus limiting industrial and pre-consumer textile waste.

It is also important to acquire knowledge of recycling technologies within the specific family of materials under examination: chemical composition, colors, and the presence of rigid parts are only some of the factors that influence, for instance, the recyclability of garments (Eppinger, 2022; Karell, 2021). These characteristics represent variables that designers must consider and responsibly manage to facilitate recycling within a design-for-end-of-life perspective (McKinsey & Company, 2022).

## Material-Driven System Futures

Materials can serve as strategic levers for rethinking supply chains and production models from a circular perspective. In this view, materials are considered infrastructures that activate collaborative processes along the entire supply chain, fostering co-creation practices among diverse actors, from companies to research centers, from institutions to local communities (Battistoni & Barbero, 2020). Attention to the future underscores how design must envision long-term scenarios in which materials contribute to building the transition. In this sense, design becomes an anticipatory device capable of orienting circular models and generating new forms of shared value for communities and territories.

In recent years, design innovation has proposed the configuration of collaborative supply chains, co-creation among actors, and circular business models, with a forward-looking vision centered on communities and supply chains. The design of circular supply chains is a matter of building material infrastructures with a shared future perspective, in which the logistics network, technologies, and social relations become integral parts of innovation. For years, systems and platforms have been developed to enable the exchange of waste materials, providing companies with the data needed to transform these into raw material for design. Industrial symbiosis platforms represent increasingly widespread digital tools for facilitating exchanges between companies in the management of material and energy flows. They take shape as spaces of mediation where data on waste and secondary raw materials are collected, standardized, and made available to potential users, fostering continuous matching processes and virtuous exchanges. These platforms play a crucial role in identifying synergies, gathering information on waste type and quantity, quality, geographic location, temporal availability, and economic value. Such parameters are essential to ensure that recovery and reuse processes generate value both environmentally and economically.

The integration of material databases and design support tools (for example, Ashby diagrams or other libraries of physico-mechanical properties) can guide the identification of concrete applications for secondary materials (Dwek & Fredriksson, 2024). The combination of technical information on materials with exchange platforms thus opens the possibility of expanding markets for secondary raw materials, connecting material research more directly with business needs and opportunities for circular innovation from a systemic perspective.

An exemplary case study demonstrates how these principles can be translated into operational applications. Pestana et al. (2025) developed the Waste Resource Platform for the ceramic and glass sector, conceived as a digital marketplace that could track and connect secondary material flows. The platform, based on Industry 4.0 paradigms and a modular architecture, makes it possible to verify the quality, origin, and costs of waste, facilitating exchanges among supply chain stakeholders and promoting the replacement of virgin resources with recovered materials.

## Sensory & Cultural Reframing of Materials

Matter can become a bearer of renewed identity, capable of expressing demands for sustainability and bringing products closer to ethical and cultural values. The choice of a material thus acquires the significance of a design and value-based statement that must be able to represent transition and integrate it into its sensorial dimension. The use of a local raw material or one rooted in cultural contexts of memory and knowledge legacy is a significant example of this perspective. In such cases, the material becomes a vehicle of proximity and belonging, strengthening local economies and community narratives. As Llorach (2021) emphasizes, the use of local resources also produces positive social outcomes, reducing dependence on imports and increasing the self-sufficiency of communities, which can autonomously decide how to use and valorize their own materials.

Alongside these approaches, the use of biofabricated or experimental materials, when accompanied by transparency in sourcing and transformation processes, acquires a clear ethical dimension, communicating social responsibility and respect for natural resources. The sensory dimension is inevitably intertwined with the cultural one: touch, smell, and color are not merely physical qualities but true mediators of experience.

This perspective entrusts the designer with the responsibility of constructing imaginaries: a material is a language that conveys values of equity, ethics, and belonging. The design challenge lies in translating these values into coherent choices capable of bringing the technical and symbolic dimensions into dialogue. Materials thus become instruments for narrating change, devices that communicate proximity to places and people, making tangible the urgency of transitioning toward more equitable and responsible systems.

While traditional materials have consolidated a recognizable aesthetic, documented in manuals and reference catalogues, circular materials are often presented more for their waste-derived origin than for their aesthetic and performance qualities (Pellizzari & Genovesi, 2021). This contributes to making their applicative identity less clear and limiting their industrial diffusion. Revisiting concepts such as “transitive aesthetics” (Castelli, 1999) may represent a strategy for enhancing the identity of circular and sustainable materials, combining the memory of the past with the expectations of the future (Rosato, 2023). From this perspective, the attachment formed through sedimented experiences intertwines with curiosity toward what is new, offering materials the possibility of communicating continuity and innovation at the same time. The user’s perception and awareness are in fact formed primarily through the images and aesthetic qualities of an object, filtered by memory (Ashby & Johnson, 2010). It is no coincidence that recent studies have analyzed the aesthetics of recycling, noting how the visual identity of regenerated materials remains an open research issue (Polyportis et al., 2022). One example is the *Neolite* project, developed at Domus Academy, which through a heterogeneous plastic material proposes a new imaginary for the aesthetics of recycling (Lotti et al., 2021).

Within this framework, the identity of sustainable materials is not merely a matter of performance but becomes a narrative and symbolic device that can contribute to reinforcing the cultural transition toward more conscious models of consumption and production.

## Materials as Agents of Change

The analysis of the four levels of innovation has highlighted how circular materials can be designed to adapt over time, responding to changing user needs and contexts of use. The projects examined demonstrate that materials can be conceived as dynamic and transformative entities, capable of moving through different cycles while maintaining functional coherence, cultural value, and a reduced environmental impact. The original contribution of this research study lies in showing how the interplay between circular materials and anticipatory and transitional practices, embedded within the domains of contemporary design contexts, opens new design trajectories in which matter becomes a co-evolving actor of the design process. The proposed subdivision should therefore not be understood as a set of parallel and independent lines, but rather as interconnected domains generating a complex network of relationships. It responds primarily to the need for narrative clarity, enabling a more precise description of the design components at each level.

In this overview, materials are not limited to their intrinsic dimension but encompass the production systems in which they are embedded, the technologies that enable their development, the practices through which they are used, and the cultural and symbolic perceptions that surround them. These are overlapping and mutually influential domains, demonstrating that working with materials cannot be reduced to a sectoral approach. Representing this complexity requires a holistic and systemic perspective, capable of connecting the different dimensions at play and capturing their implications for design.

The analysis of the case studies has highlighted how circular materials can be designed to adapt over time, responding to changing user needs and contexts of use. The projects examined demonstrate that materials can be conceived as dynamic and transformative entities, capable of moving through different cycles while maintaining functional coherence, cultural value, and a reduced environmental impact.

The original contribution of this research lies in showing how the interplay between circular materials and anticipatory and transitional practices opens new design trajectories, in which matter is no longer understood as a simple input but as a co-evolving actor of the design process.

The analysis of the four clusters clearly highlights how materials can be interpreted as true agents of change, capable of orienting the transition toward more circular and sustainable models.

Bio-based, waste-derived, or biofabricated materials demonstrate the potential to regenerate resources and processes, assuming a dynamic dimension that evolves over time alongside uses and contexts. The integration of digital technologies, traceability systems, and artificial intelligence transforms materials into carriers of data, ensuring transparency and enabling new possibilities for informed design and extended life cycles. Materials become infrastructures for the construction of collaborative supply chains and industrial symbioses, facilitating virtuous exchanges, new business models, and scenarios of co-creation with communities.

The symbolic and narrative dimension of matter becomes a language of ethical, cultural, and aesthetic values, contributing to the redefinition of the imaginaries and identities of circular materials.

Taken together, these four levels demonstrate that matter is not merely a passive input of design but a co-evolving actor capable of influencing processes, generating new relationships, and fostering the transition toward more equitable, resilient, and sustainable systems.

The article has shown that designing with materials, in a historical phase marked by environmental and social crises, means operating on multiple levels — technical, organizational, and cultural. Designing with these four levels in mind makes it possible to address the current gaps identified in the introduction. Matter is not a simple input of production but a critical node where resource availability, technologies, supply chains, policies, and imaginaries intersect. From this perspective, transition coincides with a transformation that involves systems, practices, and meanings.

Three results emerge as central. First, the regenerative dimension requires addressing material selection as a holistic decision that encompasses origin, transformations, logistics, reparability, disassembly, and end-of-life. In this process, the designer is called upon to mediate among different bodies of knowledge, making explicit the variables at stake and constructing pathways of industrial symbiosis and territorial proximity. Second, enabling technologies do not represent mere technical tools but genuine design devices that render invisible relations visible: composition, provenance, impacts, return pathways. When critically integrated, they enhance circularity, support informed decision-making, and enable new post-sale services. Third, transition has both a systemic and cultural nature: materials structure collaborative supply chains, circular business models, and practices of co-creation, while also operating as a language, communicating identity, ethics, and proximity, and through their sensory qualities building affective bonds that prolong use and foster user responsibility.

From this perspective, four operational implications for design emerge to outline an integrated framework for action. First, it becomes necessary to enable specific competencies in literacy regarding processes and technologies, so that designers can navigate consciously among the variables connected to matter and its life cycle. With this comes the ability to employ targeted tools, such as material libraries, Digital Product Passports, and matching platforms, which expand the range of possibilities and facilitate the meeting between the supply and demand of secondary resources. A further level concerns the facilitation of collaborations: supply chain agreements on traceability and quality, partnerships with local institutions to valorize proximity resources, and a constant dialogue with policies and international standards are fundamental elements for ensuring data interoperability and transparency.

By embracing this complexity, design can guide concrete choices while at the same time cultivating shared visions, transforming materials into true agents of change.

## In This Section

This Open Debate section brings together four contributions that, while adopting different approaches and perspectives, offer a complementary reading of material innovation processes within the framework of the circular and sustainable transition. The essays are situated within the identified thematic clusters and highlight how material research extends into the social, cultural, and systemic dimensions.

The contribution by Valentýna Landa Filípková, *Resolving Functioning of Environmentally Conscious Design and Material Innovation as an Interdisciplinary Practice*, focuses on the role of interdisciplinary collaboration as a necessary condition for developing innovative and environmentally responsible materials. Through interviews with designers, scientists, bio-artists, and engineers involved in international teams, the author explores the ways in which these collaborative practices generate innovation, emphasizing in particular the designer's capacity to act as a mediator between different languages and disciplines.

The text by Marco Manfra, *Design and Materials for Social Change. Rediscovering and Preserving Correspondence with Matter for the Survival of Community Relations*, shifts the focus toward the social and cultural dimension of materials. By analyzing the cases of the cork supply chain in Alentejo and rustic wool in Abruzzo, Marco Manfra shows how material becomes an agent of community cohesion, capable of activating relationships of proximity, local economies, and practices of territorial care.

The article by Silvestro di Sarno and Roberto Liberti, *Fashion AI: Cross-Digital Innovation in the Leather Field. Advanced Methodologies Using GenAI*, addresses the introduction of generative Artificial Intelligence into creative and production processes in fashion, with particular attention to the leather sector. The experience of the Conscious Leather Design Academy highlights how the use of AI can accelerate prototyping, optimize processes, and open new creative possibilities while maintaining attention to sustainability and waste reduction.

Finally, the paper by Margherita Tufarelli, Anna Maria Azzini, and Elisabetta Cianfanelli *Prototyping a Circular Supply Chain for Pre-consumer Textile Waste. The SCAR.TO Project*, tackles the complexities of the Italian fashion system, marked by strong production fragmentation and criticalities in managing pre-consumer textile waste. Through the case of the SCAR.TO project, funded by the Regione Toscana, the authors show how building a circular supply chain requires not only technological innovation but also new models of governance and collaboration among companies, institutions, and local communities.

*The Stories* by Veronica Pasini highlight three experiences of the possible relationships activated by materials.

Together, the contributions provide a rich and multifaceted picture of the research and experimentation trajectories currently active in the field of material design. While Filípková highlights the value of interdisciplinary collaboration as a driver of regenerative innovation, Manfra demonstrates how materials can reinforce cultural and social ties, Liberti and di Sarno illustrate the potential of digital technologies in opening scenarios of circular innovation, and Tufarelli, Azzini, and Cianfanelli address the need for production systems capable of integrating principles of circularity throughout the entire supply chain. Their juxtaposition allows materials to be understood as agents of change not only in technical terms but also in social, cultural, and political dimensions, reaffirming the crucial role of design in the transition toward sustainable futures.

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