

WELLNESS TEXTILES.

REGENERATION OF LOCAL PRODUCTION SYSTEMS FOR INTEGRATED APPLICATIONS IN THE TEXTILE SECTOR

MARIA ANTONIETTA SBORDONE

Università degli Studi della Campania, Italy
mariaantonietta.sbordone@unicampania.it
Orcid 0000-0002-3780-6142

CARMELA ILENIA AMATO

Università degli Studi della Campania, Italy
carmelailenia.amato@unicampania.it
Orcid 0000-0002-4452-4514

MARCO D'ANTUONO

Università degli Studi della Campania, Italy
marco.dantuono@studenti.unicampania.it
Orcid 0009-0001-3524-0472

SIMONE MARTUCCI

Università degli Studi della Campania, Italy
simone.martucci@unicampania.it
Orcid 0009-0003-3069-1797

Abstract

This paper proposes a design research approach based on the concept of Adaptive Doing, understood as an operational strategy for regenerating production systems and valorizing local resources within the Wellness Textile sector. Adaptive Doing is conceived as a dynamic, situated design paradigm that integrates adaptive processes and experimental practices oriented towards sustainability, well-being, and territorial resilience. In this perspective, the project functions as a mediating device between social, environmental, and technological transformations, translating them into concrete opportunities for innovation and local development. Developed within the RHITA - ResHaping Made in Italy project, the study emphasizes the centrality of place-based knowledge, productive vocations, and tangible and intangible resources as strategic levers for regenerating the fashion system and reinforcing its ties to textiles. Qualitative research, conducted through interviews and direct observation in two representative Campanian production contexts and complemented by evidence-driven experimental laboratory practice, enabled the translation of findings into design solutions and operational models for innovative applications. Adaptive Doing acknowledges the complexity and uncertainty of contemporary contexts and promotes future-oriented design based on the principle of Rethinking Resources. Results highlight how this approach can trigger sustainable regeneration processes, foster second-generation circular value chains, and strengthen local economies through new forms of territorial collaboration.

Keywords: *Adaptive Doing, Wellness Textile, Sustainable and Circular Design, Materials Innovation, Territorial Regeneration*

INNOVATION AND REGENERATION IN LOCAL PRODUCTION CONTEXTS

This contribution is situated within the contemporary debate on the transition toward sustainable, circular, and territorially rooted production models, with a specific focus on the textile sector and its evolution in terms of raw materials, processes, and technologies. In an era marked by the recognition of planetary boundaries (Steffen et al., 2015; Rockström et al., 2009) and the vulnerability of global supply chains, the urgency of a systemic shift to replace fossil-based raw materials with bio-regenerative ones becomes evident. The investigation strategically focuses on Wellness Textiles, identified as a segment of the textile industry that allows the intrinsic properties

of natural resources to be valorized. Through the integration of enabling technologies and low-impact processes, textiles cease to be mere semi-finished products and become functional devices that promote user well-being and the resilience of local production systems. The theoretical and operational framework is based on the adoption of the Adaptive Doing (AD) paradigm, understood as a cultural and design approach capable of integrating action, experimentation, and continuous learning to respond to the complexity and uncertainty of socio-technical and environmental systems. As proposed by Rawluk et al. (2020), AD is a transformative practice aimed at promoting co-design processes with and for people through non-conventional methods,

emphasizing critical reflection and awareness of action within constantly evolving contexts. The AD process unfolds in an iterative cycle of four phases: disruption of the status quo to open the way for change; critical reflection and discussion aimed at acquiring new knowledge; shared re-conceptualization into a concrete action plan; and return to practice with a transformed perspective. AD emphasizes conscious and responsible doing, oriented toward anticipating and managing the unforeseen, integrating rational, empirical, and experiential dimensions of knowledge. Applied to local production contexts, it allows proactive interpretation and response to social, technological, political, and environmental changes, promoting circular and regenerative practices. Within this framework, AD intersects with the principle of Rethinking Resources (Thomsen et al., 2024), which proposes a systemic reinterpretation of territorial resources, moving beyond the traditional view of resources as merely material inputs. Resources encompass primary and secondary materials, waste, immaterial flows, local skills and knowledge, production infrastructure, and human capital, framing the economic, social, and environmental potential of resources and integrating advanced tools and methodologies such as digital modelling, circularity-oriented design, digital material passports, and Life Cycle Assessment (LCA).

Systemic valorization of primary and secondary materials considers qualitative analyses, understanding their evolving uses, and applying Design for Circularity principles, aiming to regenerate ecosystems and create extended mutual benefits. This broadens the concept of sustainability beyond merely reducing environmental and social impacts, emphasizing the capacity of ecosystems to absorb and regenerate, following principles of restoration, repair, reconstruction, and regeneration of natural stocks. Rethinking resources connects to an evolved conception of well-being, understood as an integration of physical, mental, emotional, social, spiritual, and environmental health, as suggested by the One Health approach, which recognizes the close interconnection between human, animal, and environmental health (WHO, 2018; Lirussi & Ziglio, 2021). Contemporary environmental challenges, such as pollution, resource exploitation and degradation, and global warming, require integrated preventive

strategies that promote sustainable resource use and continuous ecosystem monitoring. Reflections on traditional natural therapies and smart therapies, supported by advanced technologies, allow for personalized and remote interventions, contributing to the improvement of individual psychophysical well-being (Cohen, 2004; Bell et al., 2020).

Simultaneously, innovation in bio-functionalized materials, designed to release active ingredients in a controlled manner over time, opens new opportunities for integrating textile design with preventive cosmetics and nutraceuticals, addressing needs related to health, muscle recovery, and skin protection (Thakker et al., 2020; Negi et al., 2024). Additive Manufacturing technologies further expand design possibilities, enabling the development of multifunctional, sustainable solutions combining natural fibers, bioactive extracts, and technological components. In textile-based applications, such as knitting, three-dimensional layers can integrate sensors and conductive materials, creating intelligent and active systems capable of real-time monitoring of physiological parameters and supporting health prevention and individual well-being, paving the way for new Wearable Wellness solutions with enhanced performance (Gurova et al., 2020). These innovations require a systemic design approach capable of managing contextual complexity and promoting integrated solutions through stakeholder engagement and knowledge sharing, encouraging multidisciplinary collaboration among public institutions, research laboratories, and companies. The objective is to build ecosystems of sustainable innovation, in which knowledge, technologies, and territorial resources converge toward common goals while ensuring resilience and adaptability (Bistagnino, 2009; Manzini, 2010; Tamborrini et al., 2018). Engaging with the territory as a complex socio-ecological system requires methodological tools capable of translating this vision into progressive structural changes, broadening the notion of sustainability toward repair, restoration, and regeneration of systems (Sbordone et al., 2022), integrating biological principles into design processes and promoting circular regeneration of resources. In this regard, innovation is recognized as inherently linked to social and environmental contexts, and multidisciplinary cooperation is essential for developing sustainable and long-lasting

solutions. Based on the principle that the outputs of one system become the inputs for another, circular flows of knowledge and resources are promoted, supporting the design of resilient, self-regenerating systems (Gaiardo et al., 2022; Luthe, 2020).

Regarding the perspective of regeneration, design allows ecological and social crises to be approached as opportunities for multidimensional innovation, implementing interventions of repair (immediate actions to halt ecosystem deterioration), restoration (strengthening human-nature connections by combining technological innovation and natural resources), and regeneration (creating resilient socio-ecological systems capable of self-regulation in the long term). AD materializes in the pursuit of environmental, social, economic, and political benefits, conceptually integrating biological principles into design practice and promoting the resilience of socio-ecological systems and the symbiosis between human activities and nature (Antonelli, 2019; Benyus, 2022; Sbordone et al., 2022). The RHITA project aims to revitalize Made in Italy through a process of reshaping the production system and the accumulated knowledge of the fashion system, representing a privileged field of application for principles inspired by *Adaptive Doing and Rethinking Resources*. In the context of *Made in Italy*, this means, on the one hand, sustaining historically consolidated local production realities and guiding them toward sustainability through resource rethinking, whether tangible or intangible. Materials, processes, and products will be reimaged in line with innovation themes, while on the other hand, the intrinsic qualities of Italian production landscapes will be enhanced, valuing history and local knowledge, and generating environmental, social, and economic value at both territorial and individual scales.

METHODOLOGY

The research adopts a mixed-methods approach, implementing Adaptive Doing through a combination of qualitative tools, direct observation, and design experimentation. The methodological aim is to build situated and operational knowledge capable of evolving in response to evidence gathered throughout the research process. The method is articulated in two main components: (i) *Semi-structured qualitative interviews and direct field observation*. The qualitative investigation targeted key actors within the local textile value chain, selected through purposeful sampling,

and focused on two manufacturing realities representative in terms of history, production specialization, and territorial significance. Interviews involved companies with a strong local anchoring, aiming to explore perceptions, operational practices, and structural challenges related to the sustainability and circularity of textile processes. In particular, the analysis addressed topics such as waste and by-product management, the impact of environmental and waste management regulations, value chain governance models, and the relationship between traditional craftsmanship and technological innovation, as well as opportunities for valorizing the local textile landscape.

Direct field observations supported the contextualization of collected information, allowing verification of production processes, daily practices, and organizational dynamics, contributing to a critical and situated understanding of the strategies adopted by firms in their transition toward more sustainable and circular textile models; (ii) *Experimental approach to Textile Design*. The research employs an experimental design approach aimed at constructing application scenarios capable of innovating existing textile productions and exploring new opportunities within the Wellness Textile domain. Materials, processes, and prototypes are developed through iterative cycles of design, experimentation, and evaluation, positioning the project both as an investigative tool and as a final output. The design process begins with the definition of the Textile Concept and functional keywords, which guide the translation of the concept into visual and material choices through moodboards, color palettes, and chromatic combinations. Subsequent material exploration, formalized in a materials folder, allows for evaluation of coherence between sensory qualities, technical performance, and potential applications. The Textile Design Process translates the concept into operational textile configurations through modular and parametric patterns developed in CAD environments, supported by technical datasheets and a prototyping and testing phase aimed at verification, learning, and progressive refinement of design solutions. Although the methodology is structured around two main components, (i) semi-structured qualitative interviews and direct field observation, and (ii) an experimental approach to Textile Design, these

activities are embedded within the four iterative phases of the Adaptive Doing (AD) approach introduced in the Introduction.

The first phase, *Disruption / Exploration*, concerns the conduction of semi-structured interviews and direct on-site observation, through which operational constraints and emerging opportunities within the textile production system are identified. These elements make it possible to challenge consolidated assumptions, opening the need for new approaches to material circularity and textile applications oriented toward well-being. The second phase, *Critical reflection*, involves the discussion and critical examination of the empirical evidence collected during Phase 1 in relation to the main sustainability frameworks and the emerging needs of users and local production contexts. This reflective process enables the definition of intervention priorities. The third phase, *Reconceptualization*, translates the insights that emerged during the reflection phase into design concepts through the identification of functional keywords, mood boards, color palettes, and preliminary material explorations. These activities structured the development of textile scenarios. The fourth phase, *Return to practice / Iterative prototyping*, highlights the iterative dimension of the AD approach. This phase materialized through cycles of prototyping, the use of technologies, pattern refinement, and testing of textile configurations. Each iteration generated new knowledge and adjustments, leading to the consolidated outputs presented in Sections 4.1 and 4.2.

QUALITATIVE ANALYSIS AND EVIDENCE

CASE STUDY: COMPANY A

The interview conducted with a historic textile manufacturing company in Southern Italy provides significant insight into the current dynamics and structural contradictions of the textile sector, particularly in relation to circularity, the valorization of natural vegetable fibers, and the relationship between traditional production and regulatory transformations. One of the most notable aspects that emerges is the company's deep historical roots in the territory, dating back to the early 20th century. Its initial specialization in hemp weaving, a fiber historically cultivated and processed

locally, represents an emblematic example of an integrated supply chain, in which agricultural production, industrial processing, and end uses were closely interconnected. The subsequent transition from hemp to flax, necessitated by the ban on hemp cultivation, is not described as a rupture, but as an opportunity to reconfigure consolidated production knowledge. Flax, a noble fiber and a symbol of high-quality textile tradition, although representing a quantitatively limited niche, allows the company to position itself as a custodian of both tangible and intangible heritage linked to local manufacturing culture. From a technical-production perspective, the company's activity today is primarily focused on orthogonal weaving, based on the interlacing of warp and weft. Production is highly specialized in flax (approximately 95% of volumes), while cotton plays a marginal role. The most significant transformations occur upstream and downstream of the core weaving process: in the selection and preparation of raw materials, spinning, finishing, eco-friendly dyeing, and post-production treatments such as packaging, distribution, commercialization, end use, end-of-life management, or integration into circular supply chains.

A central aspect highlighted in the interview concerns production waste. Historically, waste generated from the processing of natural vegetable fibers was considered a resource: it was reused in artisan crafts, destined for domestic applications, or repurposed in collateral supply chains, such as papermaking through fiber maceration. The introduction of stricter waste management regulations in the late 1990s marked, according to the interviewee, a critical turning point: the reclassification of waste as refuse and the restrictions on its commercialization disrupted established circular practices, transforming a potentially valorized material flow into an environmental and economic cost. This paradox becomes particularly evident when considering that such waste is biodegradable, renewable, and compatible with numerous secondary uses. Only recently, with growing public attention to the environmental impacts of the textile industry and the increasing visibility of textile waste, has this issue re-

entered the institutional debate. However, the interview highlights a systemic delay in the ability of waste management policies to recognize the specificities of supply chains based on natural fibers. Circularity appears as part of the company's cultural DNA, yet its concrete implementation encounters structural obstacles. These include the fragmentation of supply chains, which complicates coordination across integrated processes; the difficulty of establishing stable contractual relationships among different actors; and regulatory uncertainty linked to the introduction of Extended Producer Responsibility (EPR) at the European level, which creates operational and governance challenges. Even highly motivated companies struggle to translate circularity principles into effective operational practices. Another key theme concerns international competitiveness. European regulations, rigorous regarding safety, chemical use, and working conditions, guarantee quality and environmental protection but may represent a disadvantage compared to extra-European contexts, where lower regulatory standards reduce costs at the expense of health, safety, and transparency.

This asymmetry highlights the tension between sustainability and market forces, in which the pursuit of lower prices can prevail over the social and environmental impacts of textile products. The transition toward a sustainable textile system also requires changes in consumption practices. Greater awareness of product origin, working conditions, and environmental impacts is essential. In this perspective, circularity is not only an industrial model but a collective responsibility involving producers, policymakers, and consumers. It integrates tradition, technological innovation, and sustainable management of local resources with conscious consumption practices based on product provenance and impact. The experience described in the interview demonstrates that the transition toward a sustainable textile system requires the integration of tradition, technological innovation, circular resource management, and shared responsibility across the value chain. Circularity thus emerges not merely as an industrial strategy, but as a cultural and operational principle linking local heritage,

environmental sustainability, and industrial competitiveness.

CASE STUDY: COMPANY B

The interview conducted within a high-end textile manufacturing enterprise operating in a historically consolidated regional district provides a clear and structured view of the main challenges and evolutionary trajectories of the sector, particularly in relation to circularity, supply chain governance, and the strategic role of business networks. A key aspect concerns the establishment of a territorially based textile business network as a response to the structural fragility of micro and small manufacturing enterprises. Unlike traditional consortium models, the analyzed business network, structured through formal network contracts, defines measurable common objectives, mutual commitments, and shared operational tools, functioning as a genuine organizational infrastructure that enables companies to address challenges collectively that a single actor could not face alone. Within this model, the creation of a territorial protection brand is included, supported by a stringent disciplinary code that translates historically consolidated ethical and production principles of the local textile district into operational rules. The code serves a dual purpose: it protects the consumer in terms of quality, traceability, and environmental compliance, and it strengthens the territorial identity of the enterprises, serving as a distinguishing element in the market. The theme of circularity emerges as central yet problematic. The main barriers are neither technological nor cultural, but regulatory. Production residues, such as natural fiber yarn remaining on cones at the end of production, are classified as special waste. This classification prevents storage or reuse, turning a potentially valuable by-product into a management cost and an operational constraint, with the risk of penalties from regulatory authorities. Circularity is therefore effectively blocked, not due to a lack of solutions, but because of the absence of sector-specific regulations capable of recognizing the particularities of small textile enterprises. Alongside regulatory constraints, there is an awareness of the economic limits of micro-enterprises: the investments required to transform waste into resources cannot

burden ordinary operations. In this context, the business network becomes central for creating critical mass, accessing dedicated funding, and distributing investment costs. However, access to public funding is described as complex and disincentivizing, particularly due to onerous reporting procedures, which often consume more resources than they return, contributing to explaining why many opportunities related to the circular transition remain largely theoretical [Fig. 01]. Although recognizing that in the high-end furnishing textile segment the volumes of waste are quantitatively limited, a positive view emerges regarding upcycling practices, such as the reuse of fabrics and samples for traditional handcrafted cultural productions. In this case, waste assumes primarily socio-cultural value, contributing to the reinforcement of territorial identity beyond strictly economic considerations. A critical issue concerns the absence of dedicated units for recovering high-quality yarn at the end of production:

despite the intrinsic value of the material and potentially significant volumes at the regional scale, these yarns are sent to landfill because they are classified as waste. The interview thus highlights a systemic contradiction: high-quality materials, safe for end use, are treated as harmful due to regulatory automatism. This represents a potential future opportunity linked to the creation of second-generation supply chains capable of valorizing recovered yarn for alternative applications, thereby reducing landfill disposal.

The discussion on the relationship between craftsmanship and digital technologies highlights a balance between product customization and the integration of digital services. Technology does not replace craftsmanship but supports it, particularly through blockchain tools and NFC systems used to ensure traceability, authenticity, and product storytelling, strengthening the connection between manufacturing, territory,



Fig. 01

and the global market. Artisan knowledge is difficult to transmit quickly and is not always codifiable in line with technological progress. In this context, collaboration with universities and research centers proves strategic both for generational renewal and for innovation management, although it represents an organizational challenge for micro-enterprises. Finally, the business network emerges as a privileged interface for applied research projects, as demonstrated by ongoing experimentation with locally sourced high-quality natural fibers, highlighting the potential of integrated supply chains derived from the reinterpretation of traditional agricultural and production practices.

PROPOSALS AND APPLICATION SCENARIOS IN WELLNESS TEXTILE

TEXTILE PROPOSAL 1: “SMART&SAFE2”
The research project *Smart&Safe2: Design for Smart Inclusive Protection Systems* investigated

issues related to prolonged PPE use, with a specific focus on discomfort and adverse skin effects caused by continuous mask wear. The project applied the Adaptive Doing framework throughout the development process.

The *Exploration phase* identified key problems such as dermatological irritation, limited comfort, and inadequate breathability in traditional PPE. Through *Critical reflection*, these findings were examined in relation to material, ergonomic, and environmental requirements, helping define priorities for intervention. During the *Re-conceptualization phase*, these insights informed the development of functional textile concepts and structural configurations, guiding the selection of natural fibers, bio-based components, and additive structures. The *Iterative prototyping phase* involved cycles of CAD development, material testing, and refinement, progressively shaping the solutions presented below.

The project outcomes respond to limitations



Fig. 02

highlighted during the pandemic, proposing advanced protective systems that integrate multifunctionality, inclusivity, and environmental responsibility. The resulting configurations are: *Type A – Multi-material mask with TPU frame*. Nine masks made from natural yarns combined with a biocompatible TPU inner layer and a tri-layer filtering system, balancing protection, comfort, and recyclability; *Type B – Mono-material mask with 3D-printed frame*. Seven masks developed from a single plant-based yarn. A 3D-printed frame with micro-channels allows functional personalization through bioactive compounds, improving breathability, thermal comfort, and dermatological compatibility; *Type C – Modular multi-patch system with IoT frame*. Mono-material textile patches offering localized protection, integrating controlled-release fillers for targeted skin treatments. An IoT-enabled frame monitors physiological and environmental parameters in real time [Fig. 02].

TEXTILE PROPOSAL 2: “SMART DERMAL WELLNESS SYSTEM FOR PROTECTIVE AND ACTIVE SKIN CARE”

The development of the *Smart dermal Wellness System for protective and active skin care* devices followed the four phases of the Adaptive Doing approach. The *Exploration phase* focused on identifying skin vulnerabilities related to climate-induced stressors, UV exposure, and dehydration. During *Critical reflection*, these findings were compared with emerging opportunities in bio-functionalized textiles and 3D additive structures. The *Re-conceptualization phase* translated these insights into functional concepts integrating plant-based yarns, active delivery mechanisms, and parametric geometries. Through *Iterative prototyping*, the solutions were progressively refined, leading to the consolidated wearable systems described below.

Developed within the Master’s Degree in Design for Innovation (Fashion Ecodesign II and Textile Design laboratories), the projects investigate advanced wearable textile systems addressing the impacts of climate change on skin health and human well-being. The proposed devices operate as active textile interfaces with preventive and supportive dermatological functions. Their innovation lies

in integrating dermo-active delivery systems directly into the textile structure, transforming fabric from a passive support into a bio-functional medium capable of interacting with the skin and offering alternatives to conventional cosmetic practices.

Dermal Wellness: Protection & Bio-active Absorption [Fig. 03]. This device targets the prevention of UV-related skin damage in the upper chest area. Using a Material-Driven Design approach, it combines plant-based yarns with 3D-printed additive structures featuring functional micro-channels for controlled release of bioactive compounds with screening and antioxidant effects. The modular 3D architecture ensures ergonomics, adaptability, and reduced material waste, supporting sustainable production and use; *Filtrails: Adjuvant Care for Safe and Healthy Skin* [Fig. 04]. Designed for the forearm–wrist area, *Filtrails* supports the treatment of xerosis and dehydration-related skin conditions. It integrates plant-based yarns and 3D structures with micro-channels enabling controlled release of moisturizing and soothing compounds, ensuring continuous protection and skin rebalancing.

DISCUSSION

The evidence emerging from qualitative investigations and design experiments outlines a complex yet opportunity-rich framework for the regeneration of the regional textile sector through Adaptive Doing. The companies interviewed show a strong awareness of sustainability and circularity principles, often deeply rooted in their production history, yet face significant obstacles in their practical implementation. The main challenges identified include: regulatory barriers that hinder the valorization of production waste, particularly natural plant-based fibers that could be reintegrated into circular supply chains; fragmentation of the supply chain, which limits cooperation among actors and makes the adoption of systemic models difficult; limited availability of financial resources for innovation investments, a burden especially heavy for micro and small enterprises; competitive asymmetry compared to extra-European productions subject to fewer regulatory constraints. These elements do not merely represent constraints but reveal structural misalignments between cultural readiness for circularity and the



Fig. 03

institutional and market conditions required for its full operationalization. However, these same challenges can be transformed into strengths through the adoption of adaptive strategies. The experience of business networks demonstrates how structured cooperation can generate critical mass, facilitate access to funding, and distribute the costs of innovation.

Moreover, Rethinking Resources enables the valorization not only of material waste but also of local skills, knowledge, and territorial identity, transforming them into strategic assets for market differentiation. In this perspective, circularity emerges not exclusively as a technical objective but as a governance and coordination challenge, requiring alignment between regulatory frameworks, organizational models, and design experimentation. The Textile Design experiments presented highlight how the integration of natural materials, additive technologies, and bioactive compounds can configure new local

textile economies within the wellness segment. These developments require: upgrading existing facilities to integrate 3D printing and material functionalization technologies; diversification of raw materials, favouring local plant-based fibers and valorized by-products; development of multidisciplinary skills through collaboration with universities and research centres; creation of second-generation supply chains capable of transforming by-products into new value opportunities. *Wellness Textiles* emerge as a strategic application area for combining manufacturing tradition, technological innovation, and responses to emerging health and well-being needs. The Adaptive Doing approach allows for the management of market and technological uncertainty through iterative cycles of experimentation, learning, and adaptation, supporting a gradual but structural transition toward regenerative production models. The discussion, therefore, confirms that Adaptive Doing operates not only as a project methodology

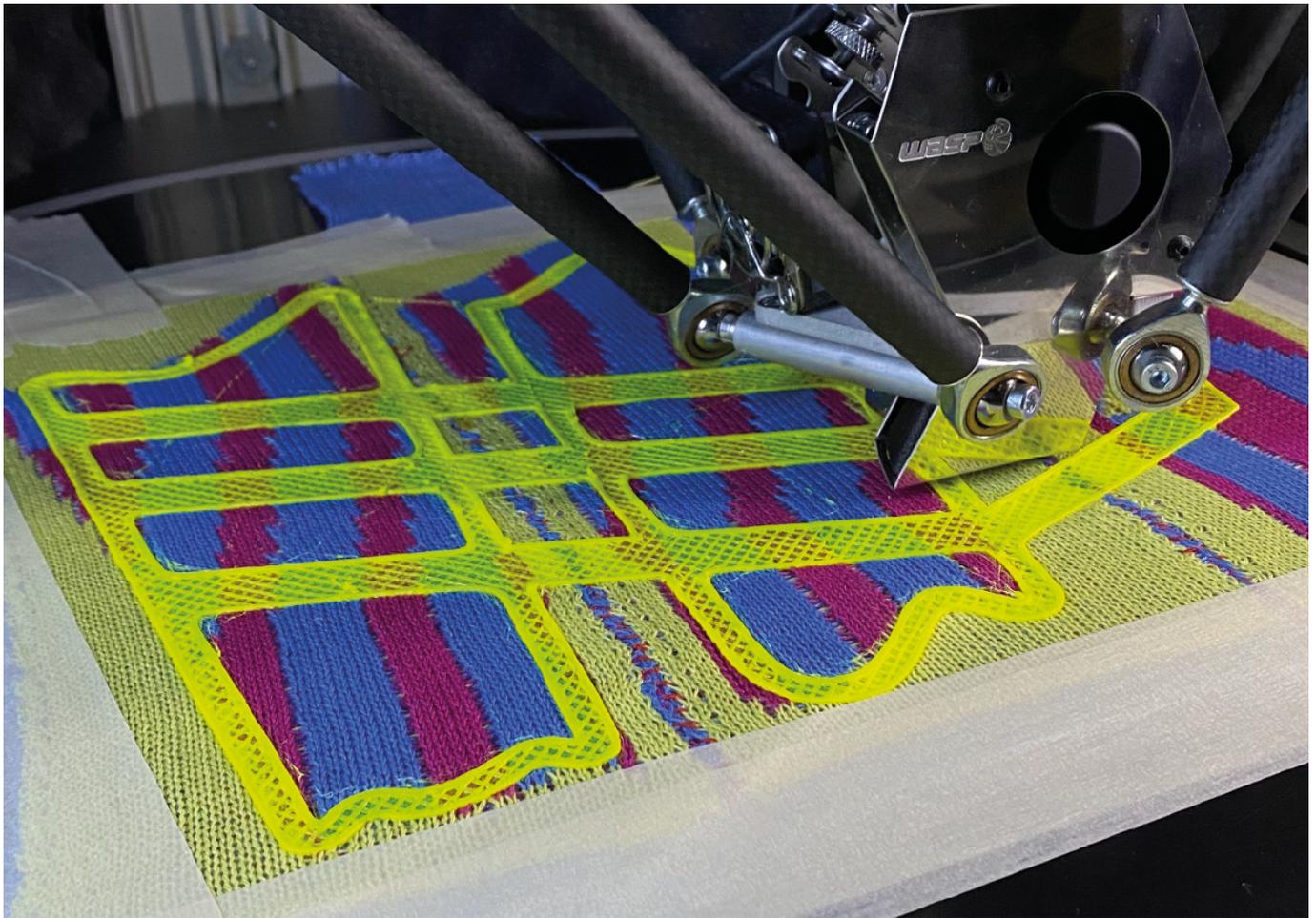


Fig. 04

but as a systemic capability for territorial adaptation, enabling continuous recalibration between empirical evidence, design response, and production feasibility. Collaboration among companies, universities, and public institutions proves essential to building territorial innovation ecosystems capable of generating shared environmental, social, and economic benefits.

CONCLUSIONS

This contribution reflects, from a dual critical and design-practice perspective, on the application of Adaptive Doing as a design paradigm for the regeneration of the local textile sector, with particular reference to the Wellness Textile segment. Through the integration of qualitative investigations and design experiments, the research has demonstrated how the adaptive approach can translate contemporary sustainability and circularity challenges into concrete opportunities for territorial innovation. The analysis of production realities highlighted a wealth of skills,

manufacturing traditions, and environmental awareness, which constitute a solid foundation for transformative processes. However, the full realization of circular and regenerative potential requires overcoming regulatory barriers that hinder the valorization of waste, promoting structured forms of cooperation between companies, and facilitating access to innovation resources. The textile experiments developed demonstrate the technical feasibility and practical relevance of bio-functionalized textile systems for well-being, integrating natural materials, additive technologies, and bioactive compounds into solutions that combine performance, sustainability, and personalization.

These outcomes confirm that design experimentation can function simultaneously as a research method and as a strategic anticipatory tool, capable of visualizing and testing future production scenarios before large-scale industrial implementation. These results outline innovative production scenarios that can strengthen the

competitiveness of local manufacturing through qualitative differentiation and access to high-value-added markets.

Adaptive Doing is confirmed as an effective methodological approach for navigating complexity and addressing uncertainty in contemporary production systems, aspiring to continuous learning, controlled experimentation, and proactive adaptation to ongoing transformations. The principle of Rethinking Resources, integrated into this perspective, allows for the systemic valorization not only of primary and secondary raw materials but also of human capital, local knowledge, and existing infrastructure, transforming them into levers for territorial regeneration. In this sense, the research contributes to repositioning circularity from a compliance-driven obligation to a strategic driver of innovation and resilience within localized manufacturing ecosystems. Future research perspectives include extending the investigation to a larger sample of production realities, experimenting with circular business models supported by digital traceability tools, and quantitatively evaluating the environmental and economic impacts of the proposed solutions through LCA methodologies.

Strengthening ultra-territorial networks of collaboration between research, industry, and institutions also represents a priority for translating research results into strategic industrial policies and tools to support the twin transitions. In conclusion, the RHITA project and the Adaptive Doing approach demonstrate how the valorization of Made in Italy textiles can be based on a conscious synthesis of manufacturing heritage preservation, technological innovation, and environmental and social responsibility, generating resilient, inclusive territorial development models oriented toward shared well-being. Adaptive Doing thus emerges not as a prescriptive framework but as a dynamic and iterative capability, enabling territories to reinterpret resources, manage disruption continuously, and progressively align sustainability ambitions with operational realities.

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DECLARATION ON ORIGINALITY AND USE OF GENERATIVE AI

AI-based tools were employed exclusively to improve grammar, syntax, and linguistic consistency across the manuscript. All conceptual, methodological, analytical, and interpretative content was fully developed by the authors.

CAPTIONS

[Fig. 01]. Silk waste on an industrial loom, reusable textile processing by-products. Silk manufacturing company, sample n°2. Source: authors' elaboration (2024).

[Fig. 02]. Type B shooting referring to mono-material mask with 3D frame and customizable PPE. Smart&Safe2: Design for Smart Inclusive Protection Systems project. Source: authors' elaboration (2024).

[Fig. 03]. Wearable device engineered to prevent UV-induced skin damage, designed to combine protective and bioactive functions for optimized dermal wellness. Source: authors' elaboration (2025).

[Fig. 04]. Prototyping phase of Filtrails: a multi-material device in organic cotton with 3D microchannel structures, engineered for the controlled release of hydrating and soothing bio-actives. Source: authors' elaboration (2025).

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