# VAMO

BIENNALE
ARCHITETTURA
2025

VEGETAL
ANIMAL
MINERAL
OTHER

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ARCHITETTURA
2025

# VAMO

## A CIRCULAR VISION FOR ARCHITECTURE

ETH ZURICH
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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# BIENNALE ARCHITETTURA 2025

# VAMO

## Vegetal — Animal — Mineral — Other

The VAMO canopy brings together material and construction research from ETH Zurich and the Massachusetts Institute of Technology (MIT) to propose a circular vision for architecture. Conceived as an ultra-lightweight and transportable structure that expands the architectural potential of reclaimed resources, the installation encapsulates multiple life spans within a diverse material palette of waste materials from vegetal, animal, and mineral forms.

Constructed with timber salvaged from a Swiss demolition site and built by ETH Zurich's Circular Engineering for Architecture (CEA) research group, the upcycled wooden hoops extend the conversation on material reuse beyond the scale of temporary installations toward broader architectural applications.

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The canopy's structural support, developed by MIT's Digital Structures research group, explores new possibilities for these materials through computational form-finding. Inspired by natural forms and efficient structures of history, the design interlaces an anticlastic tensile network of spliced hemp-rope cable net with a tilted compression hoop, spanning 6.5 meters in pure tension and compression.

Most vegetal, animal, mineral, and other cladding elements are circular material innovations supported by MITdesignX, a program dedicated to design innovation and entrepreneurship at the MIT Morningside Academy for Design (MAD). Emerging biodegradable materials and upcycled resources find new life as architectural finishes: individual panels are made from used coffee grounds, pineapple peels, waste wool combined with beeswax, coconut husks, leather scraps, and biopolymers. The stools under the canopy are made from reused wood and waste glass from Murano, Italy.

VAMO also features work by other initiatives focused on sustainable



materials. It partnered with DumoLab at the University of Pennsylvania's Stuart Weitzman School of Design to include panels combining wood biomass composites with novel additive manufacturing techniques. It also collaborated with Manteco, a local Italian company that produced panels made of high-end circular recycled wool.

Fabricated in Zurich, Switzerland from local upcycled timber, and a reused rope network spliced in Cambridge, Massachusetts, United States, VAMO was brought to Venice for the Biennale and is to be relocated to Switzerland where the natural biodegradation will be researched. The visible effects of time serve as an open invitation to rethink permanence in architecture. By embracing disassembly, reuse, and material transformation, VAMO challenges traditional construction practices by envisioning architecture as adaptable, regenerative, biodegradable, and circular.


01

# Computational form-finding


**DIGITAL STRUCTURES RESEARCH GROUP**

**MASSACHUSETTS INSTITUTE OF TECHNOLOGY**

ADAM BURKE

ADRIANA GIORGIS

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CAITLIN MUELLER

JOHN OCHSENDORF


To achieve a lightweight canopy structure that could be made with humble natural materials, a digital design process was used to explore formal possibilities while accounting for gravity and physics. Spatially, the project forms a simple enclosure, marked overhead and gently tilting toward the central axis, inviting visitors to sit and learn about natural, biodegradable materials.

With all materials working purely in tension (hemp rope) or compression (large timber ring), the structure is able to leverage the full capacity of its parts, allowing for delicate, slender elements that can nevertheless support substantial loads over large distances.

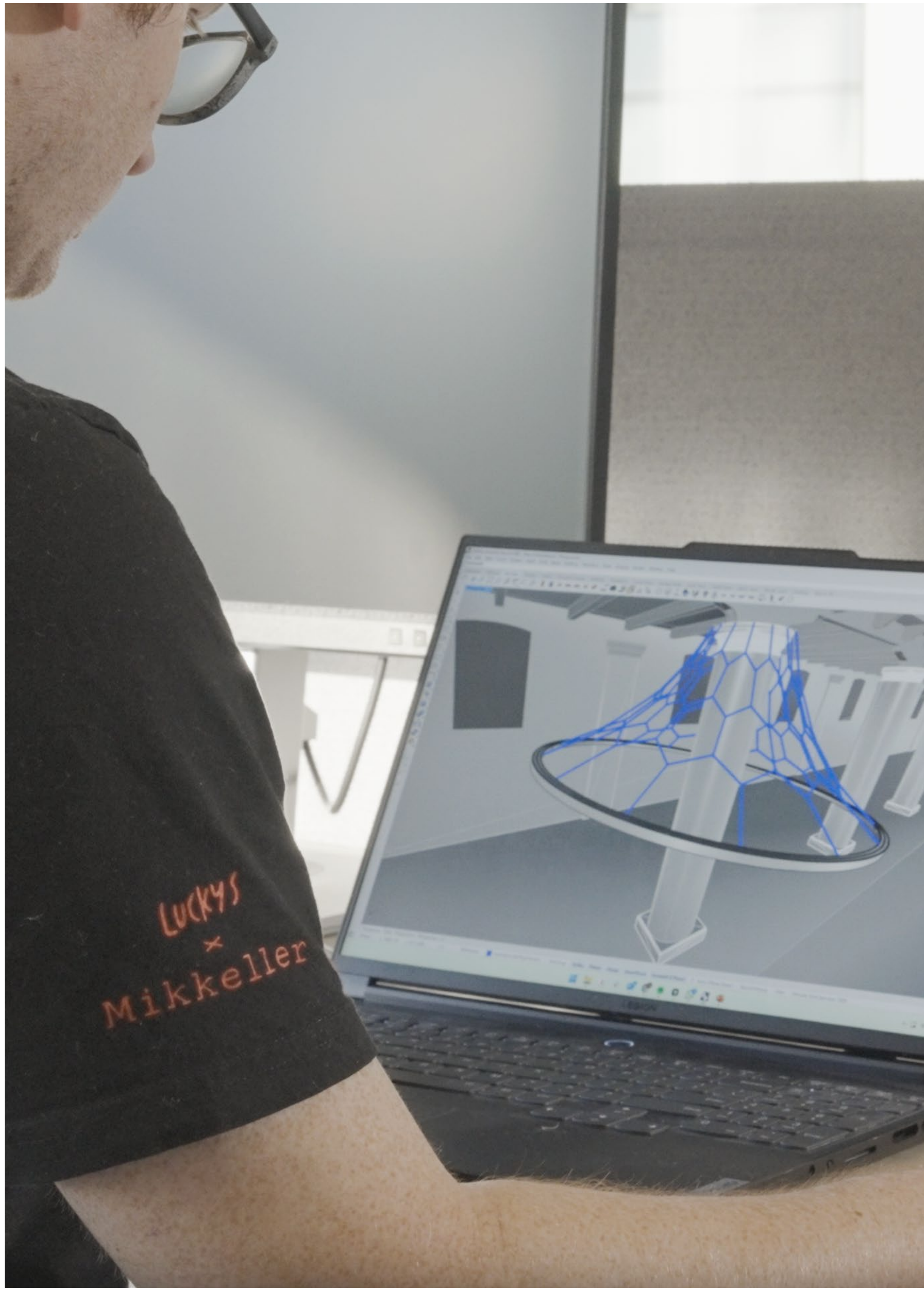
The discovery of structural geometries that exhibit this careful equilibrium was empowered by a digital form finding toolkit called Ariadne and Theseus developed by MIT's Digital Structures research group.

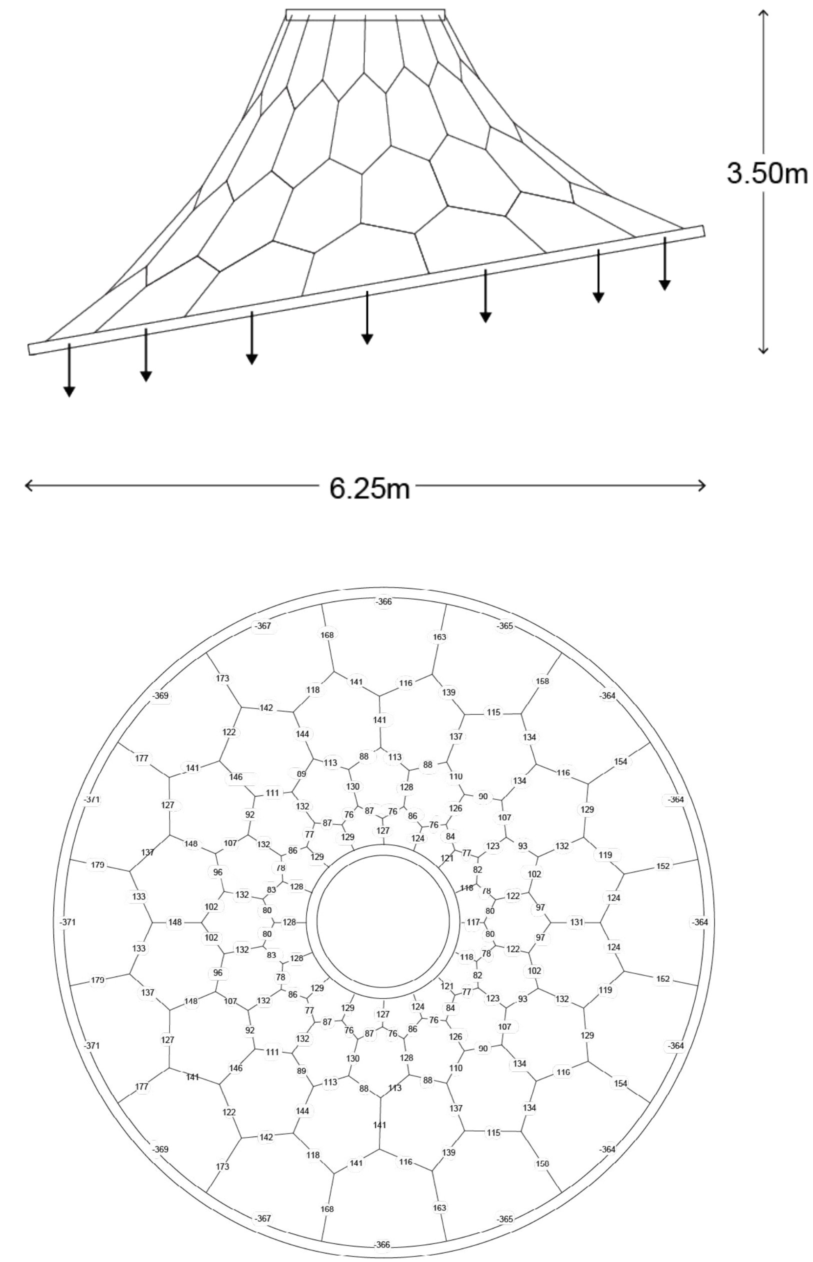
The toolkit allows designers to model 3D design concepts, and offers automatic adjustments to their geometries to ensure that all elements in the structure are in pure tension or compression.  It also allows for the integration of constraints related to fabrication, material strength, available support reactions, and more complex geometric relationships.

To design VAMO, the toolkit allowed the team to rapidly explore many variations of the structure in a spatialized, human-experience driven manner.  The final version features a planar compression ring in timber with an upward tilt, inviting visitors to enter the exhibition, and an anticlastic tensile network whose shape references natural forms.

Covering over 6 meters in diameter, the structure weighs less than 200 kg, highlighting the incredible lightness that equilibrium forms can attain.






3.50m
6.25m

02

# Material Upcycling

**CIRCULAR ENGINEERING FOR ARCHITECTURE RESEARCH GROUP**

**ETH ZURICH**

CLARA BLUM

VANESSA COSTALONGA

TIM COUSIN

CATHERINE DE WOLF

OCÉANE DURAND-MANICLAS

ZAIN KARSAN

The wooden rings of the VAMO canopy are made from timber salvaged from two temporary buildings disassembled in the framework of ETH Zurich's Digital Creativity for Circular Construction course: the Music Pavilion and the Huber Pavilions in Switzerland. The Music Pavilion was a temporary structure designed for disassembly, as part of a clinic in Oetwil am See. The Huber Pavilions, originally designed by Prof. Benedikt Huber and Rudolf Bolli, were built as temporary structures on the ETH Zurich Hönggerberg Campus between 1987 and 1991 and used as studio space for the subsequent four decades.

Both pavilions were deconstructed with the intention of giving the materials new lives in various real-world applications. The remaining materials were in poor condition:

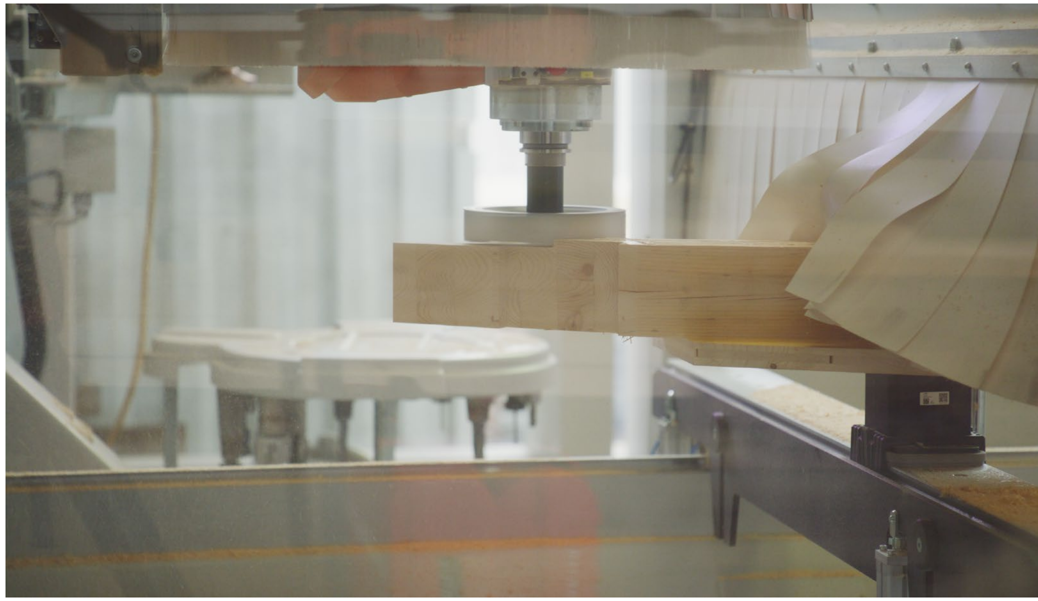
structural beams were delaminating and non-structural boards were weathered. Embracing these imperfections as design opportunities, researchers from ETH Zurich's Circular Engineering for Architecture (CEA) research group, led by Professor Catherine De Wolf, consciously chose to upcycle these materials. The beams and boards were relaminated into curved, structural forms based on form-finding and design explorations detailed in the first chapter. The top ring was crafted from beams of the Huber Pavilions, while the bottom ring was formed from salvaged boards from both the Music and Huber Pavilions. This exemplifies how elements that are no longer or not structural can be transformed into load-bearing components.

The eight identical scarf joints in the lower ring of the VAMO canopy were digitally fabricated using 5-axis CNC milling. This approach aimed to investigate how digital fabrication can support circularity by enabling the reuse of materials, while identifying the challenges of applying high-precision digital tools to these imperfect, non-standard reclaimed components. The project explored the balance between



handcraft and CNC techniques, comparing their precision, flexibility, and practicality.

Circular construction isn't just a technical challenge, it is also about culture, education, and legacy. The reuse of the pavilions' materials connects past and future, while enabling researchers and students to learn about circular creativity through hands-on experimentation. VAMO goes beyond repurposing: it looks ahead to a future where circular design and digital transformation help build climate-resilient architecture.





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03
# Woodcraft

ANKU.CH

VAMO's wooden rings surround the historic brick column of the Corderie, respecting and preserving this significant architectural heritage element of the Arsenale. Traditional, centuries-old woodworking techniques were used to craft these wooden rings. The project highlighted the value of craftsmanship and the adaptability of traditional joinery when working with reclaimed, non-standard materials. With only two joints, the upper ring was ideal for a handmade approach, without the need for scanning, programming, or costly machinery, while digital fabrication, as detailed in the second chapter, was more practical for the lower ring's eight joints.

NICOLAS PETIT-BARREAU

Traditional craftsmanship offers a level of responsiveness to material irregularities and fabrication subtleties that machines often cannot yet replicate. This exploration suggests that combining both traditional and digital methods can lead to more sustainable, context-sensitive solutions.

Cold bent lamination was used to achieve the curved shape of both the lower and upper ring, since they were made from straight degrading boards and beams, respectively. When bent and glued wood is unclamped, it tends to spring back toward its original, flatter shape. This "springback" must be considered during lamination. For the lower ring, which has a larger radius, eight layers of the boards at their original thickness were enough. To minimize springback in the upper ring, which has a smaller radius, 22 thinner layers were used. These layers were cut from the delaminating beams, effectively turning them back into a structural element.

The joints of the upper ring are half-lap connections, where two pieces of wood are cut halfway through and overlapped to fit together flush. Each connection is secured with four dovetail-shaped wooden wedges that lock the joint tightly and two wooden pegs which help align and reinforce it. This creates a strong, stable connection over time.



Inspired by traditional woodworking, the connections of the upper ring are made with modern hand and power tools. Precision is key: the more surface contact in the joint, the stronger it is, and this accuracy is achieved entirely by hand and eye.


04

# (Re)emerging materials

MIT MAD,
MIT DESIGNX &
COLLABORATORS

MASSACHUSETTS
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TECHNOLOGY

VAMO's material innovations are the result of research and experimentation developed through MITdesignX, an academic program within the MIT Morningside Academy for Design (MIT MAD) at the Massachusetts Institute of Technology. Dedicated to design innovation and entrepreneurship, MITdesignX empowers students, researchers, and faculty to develop impactful solutions to the challenges facing cities and the human environment.

MITdesignX supports interdisciplinary teams through a structured academic and design-driven process. Participants analyze real-world needs, prototype materials or systems, and build implementation strategies through applied research and iterative design. The result is not just a product, but an integrated vision

SVAFA GRÖNFELDT
GIULIANO PICCHI
GILAD ROSENZWEIG

that merges creative design, social impact, and technical feasibility.

Several of the materials featured in VAMO were developed by teams that participated in MITdesignX's international initiatives focused on sustainability and circularity. Four of these—COBI, Cortado, Kokus, and Hera Materials (formerly Atacama)—originated from the core MITdesignX program in Cambridge, where they advanced their ventures through prototyping, venture design, and a research-based innovation process.

Two other teams—Vérabuccia® and rehub—were part of MITdesignX Venice, a multi-year initiative bringing the MIT program to Venice in collaboration with local partner SerenDPT. A seventh team—ReLea Core—participated under an ongoing collaboration between MITdesignX and the Department of Design at Politecnico di Milano.

In addition to MITdesignX teams, VAMO includes contributions from other partners advancing sustainable materials. DumoLab Research (DLR), based at the University of Pennsylvania's Stuart Weitzman



School of Design, developed panels that combine wood biomass composites with additive manufacturing techniques. Manteco, a leader in high-end circular textiles, contributed panels made from recycled wool. Both collaborations reflect the broader ecosystem of initiatives informing VAMO's material palette and its commitment to regenerative design.

MITdesignX views design as a method for building sustainable futures—one that centers research, systems thinking, and implementation. The materials in VAMO are not only technical experiments but also cultural propositions. They embody how design innovation can engage deeply with place, ecology, and time.

In this way, VAMO is not just a structure—it is a convergence of ideas, tools, and communities shaped by MITdesignX's vision for a regenerative built environment.

# COBI

IAN ERICKSON
VINCENT JACKOW
NICKY RHODES

COBI—the Collective Organic Building Initiative—was founded by Nicky Rhodes, Vincent Jackow, and Ian Erickson through the MITdesignX incubator. Our mission is to craft locally sensitive, joyful spaces through a collaborative, research-driven process that engages with the cultural, ecological, and material systems unique to each site. We explore assemblies of low-carbon, organic, and reclaimed materials through a synthesis of low-tech self-built methods and high-tech digital tools, challenging conventional building paradigms while grounding our work in place-based values.

One investigation, presented here, is a prototypical sheep wool and beeswax-infused panel. Conceived as a biodegradable alternative to the petrochemical-based facade cladding prevalent in North America, this tactile, translucent material models a new paradigm of environmental responsibility.

We specifically worked with waste wool sourced from American Woolen Company, one of only a few remaining wool textile mills in the USA. In typical wool processing, "low-grade" wool fibers that are coarse, short, greasy, or irregular are considered unsuitable for spinning. Although they are rich in character and insulative quality, almost none of these remnants find use beyond low-value industrial filler or disposal, and are often illegally dumped or burned. By upcycling this offcut wool, we tap into an abundant yet underutilized resource, bringing new value to discarded material and reinforcing a circular design ethos.

The VAMO pavilion stands as a testbed for this research, enabling us to explore how these wool-beeswax panels might form architectural skins that produce new aesthetic and functional relationships with light and atmosphere. Through the mentorship of MITdesignX, we are designing material systems like the one displayed here and establishing frameworks to scale up artisanal methods to prefabricated components—bridging the gap between experimental craft and larger-scale production.

There are countless inherent challenges to creating a scalable, biodegradable product, including regional sourcing, building regulations, and performance characteristics. We believe, however, that design has the power to shift cultural practices, and that a construction ethic where materials enrich local ecologies and economies is in sight.

This research was initially developed in a course at the Harvard Graduate School of Design taught by Assistant Professor of Architecture Jonathan Grinham and conducted in collaboration with Ashutosh Lohana. Further material science research is being carried out within the Grinham Research Group (GRG), expanding on the possibilities of utilizing waste wool as a high-performing building material.

# Cortado

JENNY CANG
AVIGAIL GILAD
BOOKER SCHELHAAS

Cortado is dedicated to giving a second life to spent coffee grounds by transforming them into coffee leather. Six million tons of spent coffee grounds end up in landfills every year, releasing 1.2 million tons of carbon. Instead of being harnessed for their natural properties, they harm our planet. Our mission is to unlock the value of spent coffee grounds and transform them from waste into a resource. By extending the lifetime value of coffee grounds and reintroducing them into the ecosystem, we are moving one step closer to a circular economy.

Cortado was born out of the 2024 MITdesignX cohort. Our group entered the program determined to design a solution around upcycling waste coffee grounds. Despite many roadblocks and sleepless nights, we stayed true to the question that originally brought us together. We considered insulation bricks, pyrolysis for coffee fuel, and even camping soap—but with the help of incredible MITdesignX mentors, we made steady headway. MITdesignX gave us the tools, structure, time, and space to step into the laboratory (our home kitchen) and start experimenting.

Cortado is an ongoing experiment. Its final use case can be incorporated into the luxury fashion market, automotive sector, or interior household finishes. It is 100% biodegradable and compostable, while maintaining the durability of leather. While cow leather emits 110.9 kg of $CO_2$ per square meter, coffee leather has a tenth of the carbon footprint, with 11.8 kg $CO_2$ emissions. Its production costs are only 5% of cow leather, at €2.50 per square meter compared to €45.00. Our product aligns sustainability goals with a viable economic reality for the U.S. market.

While Europe is echelons ahead of the U.S. in its sustainability ecosystem (through tax and monetary incentives, as well as an incredibly value-driven market), the U.S. is following suit. There



is growing consumer demand for more sustainable products such as alternative leather. As the US moves to more local economies, there will be a stronger push toward locally sourced materials, which could propel the development of local ecosystems that are better at upcycling local waste into new products. Cortado offers a solution everyone loves—with the smell of coffee but the aesthetics of leather, it offers a new way of looking at waste.

Throughout history, we have always shaped materials that, in turn, shape us. Leather is a $440 billion global market, with 15% projected growth for bio-based leathers. Cortado will shape the future of design and architecture by inspiring novel ways of creating, building, and harnessing offcut wastes.

# DumoLab Research (DLR)

NAZHLA ALIZADEGAN
EDA BEGUM BIROL
ALEXIA LUO
BEHZAD MODANLOO
LAIA MOGAS-SOLDEVILA
BOWEN QIN

DumoLab at Penn designs biomaterial systems by bridging life sciences and vernacular architecture to derive everyday products and structures that support health during processing, use, and end of life. Recent outputs are bricks, furniture, walls, or canopies able to replace unsustainable material families, re-valorize waste, bio-remediate problematic air and soil, or detect, display, and correct chemical changes in human habitats. Ongoing research in our Ramus series looks at regenerative material blends that can be additively manufactured and able to bind wood biomass particles from agricultural and forestry waste without the use of petrochemical-based binders.

Fuel-free printable wood comes with a challenge of rationalizing biopolymers from abundant natural resources into binders with not only predictable but also robust mechanical properties similar to synthetic counterparts. To evolve our Ramus blends we embarked into a multiyear journey of articulating nature's assembly strategies. We used simple polysaccharides and fibers with medium strength capacity but arranged into tuned geometric conformations at the nanoscale to achieve superior performance at the macro-scale.

When commissioned with Ramus-0 components for VAMO, we arranged bundled and latticed patterns to obtain stiff rim and axis conditions while preserving overall flexibility and lightness. This conferred Ramus-0 panels with capacity to mediate light, ease of transportation and assembly, and ensured maximum material exposure for fast decay later into forest soils. Ramus-0, and the entire upcoming Ramus series, couple benign wood biomass composites research and novel additive manufacturing techniques to enable precise material distribution, designed hierarchy, minimum material use, and zero waste. It contributes to the invention of structural and tunable material systems



able to break down without toxicity.

DumoLab at the University of Pennsylvania's Stuart Weitzman School of Design started operations in 2022 and is run by Assistant Professor of Graduate Architecture Dr. Laia Mogas-Soldevila and projects are led by her team of interdisciplinary researchers. This work is supported by the Johnson&Johnson Foundation Woman in STEM2D Award.

# Hera Materials

JOSÉ TOMÁS DOMÍNGUEZ
PALOMA GONZÁLEZ-ROJAS
JOSÉ ANTONIO GONZÁLEZ

Hera Materials is a Greentown Labs-based MIT spin-out developing electrified, paper-based materials to replace fossil plastics in packaging and construction. Formerly known as Atacama Biomaterials, Hera is venture-backed and has been recognized by MITdesignX and Nucleate for its innovation in circular, low-energy manufacturing. Hera's materials are engineered using a proprietary, AI-enhanced platform that optimizes formulations based on regional biomass and performance needs, enabling scalable production with lower carbon and lower cost.

In the VAMO project, Hera showcases panels made of Woodpack (WPk)—a compostable, paper-recyclable material designed for packaging and architectural use. The installation emphasizes how materials like WPk can merge beauty, sustainability, and performance in the built environment. Unlike conventional plastics and most biopolymers, WPk integrates into the paper-recycling stream, biodegrades naturally, and requires 89% less energy to manufacture. It outperforms competitors by offering high humidity resistance, mechanical strength, and heat sealability—all without fossil inputs or energy-intensive processing. While most alternatives rely on expensive synthesis or narrow feedstocks, WPk is made from diverse, local raw materials, making it adaptable and economically viable.

To meet growing demand, Hera is currently scaling its manufacturing capacity through modular, electrified systems that can be deployed at industrial scale. By mid-2026, Hera aims to reach ton-scale daily production of WPk, enabling cost-competitive delivery to clients in packaging, construction, and consumer goods markets.

Paloma González-Rojas, CEO, is a scientist, designer, and entrepreneur driving Hera's vision of clean, scalable materials innovation. A Research Affiliate at MIT Chemical Engineering, she leads the company's AI and materials development strategy. José Domínguez, CTO, is a mechanical engineer with extensive startup experience, focused on deploying novel technologies into production. Together, they are leading Hera's transition to full-scale manufacturing, targeting ton-scale WPk production by mid-2026 to serve both packaging and building materials markets.

With WPk, Hera is pioneering a new generation of bio-based films that meet industry performance standards while closing the loop on cost, carbon, and circularity.

# Kokus

BERFIN ATAMAN
LEE MAROM

Kokus is a design and material research lab founded by Lee Marom and Berfin Ataman, committed to creating sustainable systems for product and architectural design. We are driven by the need to rethink how materials are sourced, designed, and implemented. Kokus develops high-performance, biodegradable materials while exploring design solutions that function with minimal energy input. Our goal is to integrate renewable resources and low-impact strategies into systems that are efficient, adaptable, and built for long-term use.

Our first project explores the potential of coconut husk byproducts and reclaimed wool. When combined through a tufting process, these two undervalued waste streams form insulation and acoustic



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panels without the use of synthetic binders. The natural structure of each material allows us to build layered compositions that meet performance requirements while remaining compostable and safe to handle. These panels can be adapted for interiors and modular systems, demonstrating how waste can be reimagined as a reliable, regenerative resource.

Through MITdesignX, we translated early material experiments into a venture. The program provided the momentum and mentorship to prototype, evaluate use cases, and refine a long-term roadmap for Kokus as a research and development platform. Our work is not just about a single material, but about creating pathways for scalable innovation rooted in ecological responsibility.

As Kokus grows, we're developing a practice that brings together sustainable materials, physical systems, and performance-focused design. We focus on how low-energy solutions and intentional design can work together to create systems that are responsive, efficient, and adaptable. Whether material,



structural, or spatial, every element plays a role in shaping how things perform, feel, and function—across products, spaces, and everything in between.

At Kokus, we're building a future where sustainable materials and design systems are the default, not the exception. Kokus is here to make that shift possible, meeting today's needs without compromising tomorrow.

# Manteco

LUCA QUERCI
MATTIA TROVATO

Manteco, an Italian textile company based in Prato, Tuscany, set out to elevate recycled wool to a new standard of quality with the development of Pure®, a material made entirely from MWool®, their next-generation recycled wool. Drawing on more than 80 years of experience in wool recycling, the company created Pure® through a mechanical process that requires no added chemicals or dyes.

The raw material—carefully selected post-consumer garment and pre-consumer production scraps—is sorted, processed, and colored using Manteco's Recype® system, which blends fibers rather than dyeing them, preserving both color and fiber quality. This approach reduces water consumption by 99.9%, energy use by 93.3%, and climate impact by 99.2% compared to conventional virgin wool, according to independent life cycle assessments.

Pure® fabrics offer a high-end alternative to virgin wool and synthetic textiles. They retain the natural performance qualities of wool—breathability, insulation, durability—while eliminating the need for new raw material extraction. As a 100% recycled and recyclable fiber that contains no petroleum-based additives, Pure® also avoids the release of microplastics during production and use.

One of the key challenges in developing biodegradable textiles is balancing durability with environmental responsibility. Pure® addresses this by leveraging the intrinsic strength of natural wool fibers, combined with mechanical processing techniques that preserve fiber integrity without chemical reinforcement. As recycling technologies and quality control methods improve, it is becoming increasingly possible to create circular textiles that meet both performance and ecological standards.

Manteco's work reflects a broader shift toward regenerative practices in design



and architecture. Materials like Pure® demonstrate that circularity and quality are not opposing goals, but mutually reinforcing ones. By extending the lifespan of existing resources and eliminating reliance on virgin materials, recycled wool fabrics open pathways for sustainable, responsible design across disciplines.

# rehub

MATTEO SILVERIO

LUCREZIA SOLOFRANO

BAPTISTE TRACA

rehub introduces revéro™, a sustainable material developed from Murano's glassmaking heritage.

Our story began with a concrete problem: Murano glass factories produce nearly 1,000 tons of non-recyclable glass waste annually, creating significant environmental challenges. Deeply rooted in Murano's tradition and craftsmanship, we designed a disruptive process that transforms this waste into revéro™, a versatile glass paste that can be reshaped at room temperature into products for interior design and architectural applications. revéro™'s potential is already evident in practical items such as terrazzo-inspired vases, candle holders, and architectural panels, which showcase its strength, flexibility, and unique aesthetics.



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Unlike conventional ceramics or terrazzo, revéro™ aligns sustainability with real-world functionality. Our production method significantly reduces environmental impact without compromising quality, durability, or practicality, meeting consumer demand for authentic, responsible products.

Our collaboration with MITdesignX reshaped our initial local solution into a globally scalable model. Their structured guidance, rigorous technical validation, and strategic business insights revealed that the waste challenge extends far beyond Murano. MITdesignX provided the essential tools to scale effectively, transitioning revéro™ from a niche artisanal experiment to a robust commercial product with global relevance.

Currently, Rehub is focused on industrializing our proprietary process, actively collaborating with leading industrial partners and multinational companies to integrate this innovative technology into their production chains. Our goal is to create a repeatable, scalable system, deployable worldwide, capable of intercepting and upcycling millions of tons of glass waste annually—waste that would otherwise end up in landfills. Through this strategic expansion, Rehub is turning a pressing environmental challenge into a practical industrial opportunity with tangible global impact.

# ReLea Core

MARCO ARIOLI
BARBARA DEL CURTO
AGAR FIRENZUOLA
MARIAPIA PEDEFERRI
ROMINA SANTI

The fashion industry, particularly the leather goods sector, is among the most polluting in manufacturing. In response, governments and institutions are promoting initiatives to reduce its environmental impact and carbon emissions. Developing new materials from leather scraps and reintegrating them into the production represents a viable approach to extend its life cycle.

Currently, this approach is mainly applied by mechanical recycling methods, obtaining regenerated leather and involving the use of additives and binders, or specialized technological processes. However, scientific literature highlights the potential of chemical recycling for leather as a method to make the most of the potential of leather waste.



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These considerations led to the development of ReLea Core, a composite material entirely retrieved from industrial leather dust and its extracted collagen, and conceived by the MakingMaterials research group at Politecnico di Milano. This process, which employs mild chemistry and non-hazardous substances, resulted in a material almost composed of leather powder. The resulting material, produced in sheets, is flexible and enhances the aesthetic value of the waste used in its production. It is designed for decorative elements of bags, commonly referred to as charms, but its potential extends beyond this initial application.

Thanks to the ReLea Core making process, leather scraps become a valuable resource that can be reintegrated into the production cycle of the fashion industry. Its strengths include the use of recycled by-products, environmentally friendly substances, mild chemistry processes, and simple yet effective manufacturing techniques. Additionally, the extraction of collagen from leather waste has proven to be highly versatile, making it the primary binder of the material and further expanding its range of applications.

The relationship with MITdesignX provided an opportunity to refine production techniques and move from small-scale experimentation to larger-scale applications. Moreover, MITdesignX played a key role in encouraging the exploration of ReLea Core beyond the fashion industry, particularly in architectural contexts. This led to testing the material for use in interior design—such as panels and other decorative elements. These advancements demonstrate the material's potential across multiple industries, highlighting its capacity to reduce industrial by-products while offering circular alternatives for both fashion and architecture.

# Vérabuccia®

MASSIMILIANO BANINI
FABRIZIO MOIANI
FRANCESCA NORI

The idea of creating a new material from the peel of the pineapple fruit (Ananasse™) was born in 2017 from the intuition of Francesca Nori while preparing her degree thesis. Subsequently, together with Fabrizio Moiani, the Vérabuccia® brand was founded with the aim of bringing the natural paradigms of exotic fruit to other sectors—starting with fashion and design—to protect something precious through the very wrapping that nature creates.

This approach reduces the environmental impact of processing in Italy, with zero use of new resources, land, plastic, and without cruelty to animals, while lowering CO2 emissions and water consumption. It does so without compromising aesthetic quality, offering materials that are easier to dispose of and unique in their kind,



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without imitating animal leather.

The obstacles ahead, looking toward 2025, remain significant. There is still a lack of UNI/ISO regulations to support companies in using bio-based materials without requiring them to alter their composition with plastics in order to align with traditional material standards. It is crucial to encourage material innovation and support young entrepreneurs, re-evaluating industry standards—not as an acceptance of lower durability or quality, but as an opportunity to redefine them.

Vérabuccia® was selected and awarded first prize at MITdesignX Venice 2023. Through the program, the team was able to rethink their approach from the ground up, rebuilding and innovating their initial business model to better face the challenges of the future. The program proved to be a valuable tool for international visibility and a driver of connections with other start-ups and professionals, thanks to meaningful moments of co-working, sharing, and face-to-face discussion.

We believe that, beyond the Ananasse™



material itself, it is the set of actions and mindsets that will shape the future of design and architecture—a new way of thinking translated into new business models. In this context, Vérabuccia® moves forward, honoring and inheriting Italian mastery in a contemporary way, aimed at fostering diversity and creativity as essential drivers of resilience and innovation. By adopting the principles of the circular economy, we embrace environmental, economic, and social sustainability. We strive to create tools and models that can have a global impact, while continuously building relationships with those who share our perspective: a Made in Italy approach that supports savoir-faire, challenges fast fashion, and mitigates the negative effects of industrial production on the environment.

# Acknowledgments

The VAMO team would like to thank Oliver Appling Bucklin and the Gramazio Kohler Research for enabling the joints to be cut using the 5-axis CNC milling machine, as well as Anne Roca for her lighting design consultation.

The team would also like to express its gratitude to Targetti for providing the lighting design for the installation. Their thoughtful contribution helped highlight the materiality, structure, and atmosphere of the canopy at the Biennale Architettura 2025.

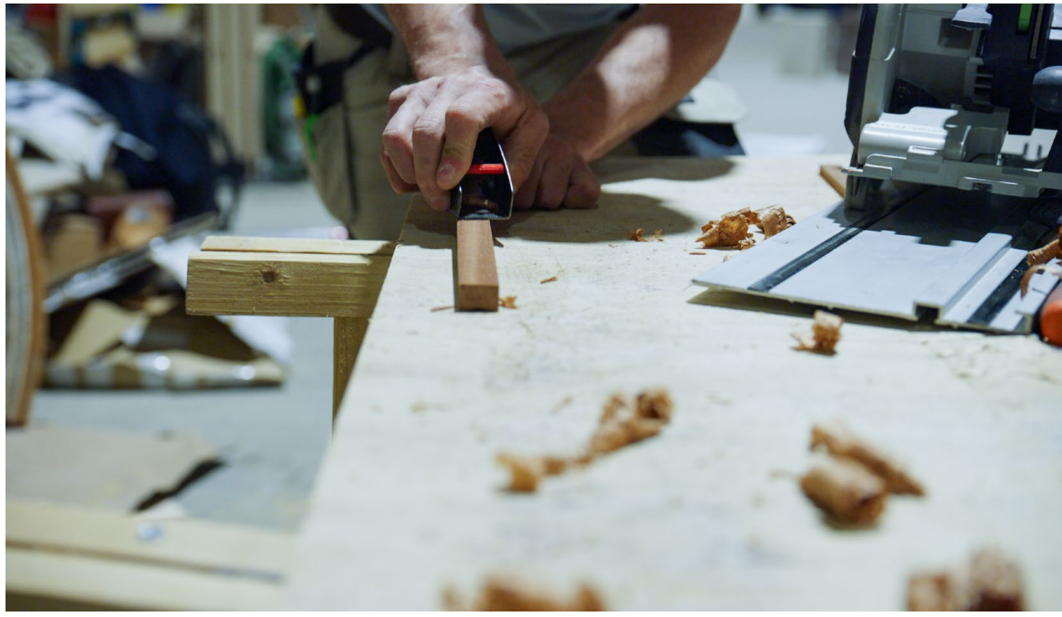
Targetti has been designing and producing indoor and outdoor architectural light fixtures since 1928. For almost a century, their products are synonymous with innovation, research and attention to detail. They are lighting worldwide the most prestigious

architectural and artistic works, creating extraordinary atmospheres. Targetti identity is the result of the experience and know-how gained over time and shared through passion for light.

Over the years the attention towards environmental sustainability brought Targetti to implement new product development and production processes for guaranteeing increasingly sustainable lighting. Their products are designed in every detail to ensure the highest efficiency, maximum reliability and the minor environmental impact over time.

VADER, the product used for VAMO's on-site installation, was designed by Targetti in collaboration with the internationally renowned lighting design firm FMS. VADER is the all-in-one outdoor projector that offers the flexibility of multiple luminaires in a single product. Even after installation on site, VADER offers the ability to choose light distribution, color temperature, and light management system (0-10V, DALI, DMX).





DIGITALSTRUCTURES.MIT.EDU
CEA.IBI.ETHZ.CH
ANKU.CH
DESIGN.MIT.EDU
DESIGNX.MIT.EDU
COBI.BUILD
CORTADO.BIO
DESIGN.UPENN.EDU/DUMOLAB
HERAMATERIALS.COM
KOKUS.LIVE
MANTECO.COM
REHUB.GLASS
MAKINGMATERIALS.CMIC.POLIMI.IT
VERABUCCIA.IT

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