

# MATERIALS SELECTION FOR FASHION DESIGNERS: A PRELIMINARY MOCK-UP TOOL

## INTRODUCTION & RESEARCH GAP

The textile and fashion industry is widely recognized as one of the most resource-intensive and environmentally impactful sectors, contributing significantly to global greenhouse gas emissions, water consumption, and chemical pollution. Recent literature highlights how these impacts are largely determined during the design phase, particularly through material selection and product development decisions (Niinimäki et al., 2020; Ellen MacArthur Foundation, 2017). Within this context, ecodesign has emerged as a key strategy to reduce environmental burdens by integrating life-cycle thinking into design processes. However, the complexity of textile materials and supply chains continues to challenge the practical implementation of sustainable design approaches.

### Research Gap

Despite the growing emphasis on circular economy principles, durability remains an underexplored and inconsistently applied concept in fashion design practice. While technical durability (e.g., resistance, longevity) is often considered, emotional durability—related to user attachment and long-term use—is less systematically integrated (Chapman, 2005; Cooper, 2010). This gap reveals a disconnect between material performance, user perception, and sustainability goals, limiting the effectiveness of current ecodesign strategies. Furthermore, designers often lack accessible tools to translate sustainability requirements into actionable material choices.

### Aim of the Study

This study aims to investigate how material selection can better support ecodesign practices in the fashion industry by integrating both technical and sensory attributes of textiles. The research seeks to develop a structured approach that enables designers to evaluate materials not only in terms of environmental impact but also in relation to durability and user experience. By bridging engineering-based material assessment with design-oriented criteria, the study contributes to advancing more holistic and applicable ecodesign methodologies (Ashby, 2013; Fletcher & Grose, 2012).

### Methodology

The research adopts a multi-step approach combining literature review, regulatory analysis, and methodological development. First, existing frameworks related to textile sustainability, including certification schemes and policy guidelines, are analyzed to identify key criteria for ecodesign (European Commission, 2020). These insights are then integrated with material selection methodologies to develop a structured decision-support tool. The proposed tool is tested through a mock-up application, demonstrating its potential to guide designers in evaluating materials across environmental, technical, and experiential dimensions. The research analyzes regulatory frameworks and certification schemes related to textile ecodesign, combining them with material selection methodologies. Based on this analysis, a structured approach and a mock-up tool are proposed to guide material choices in industrial practice.

## OPERATIONAL PATHWAY

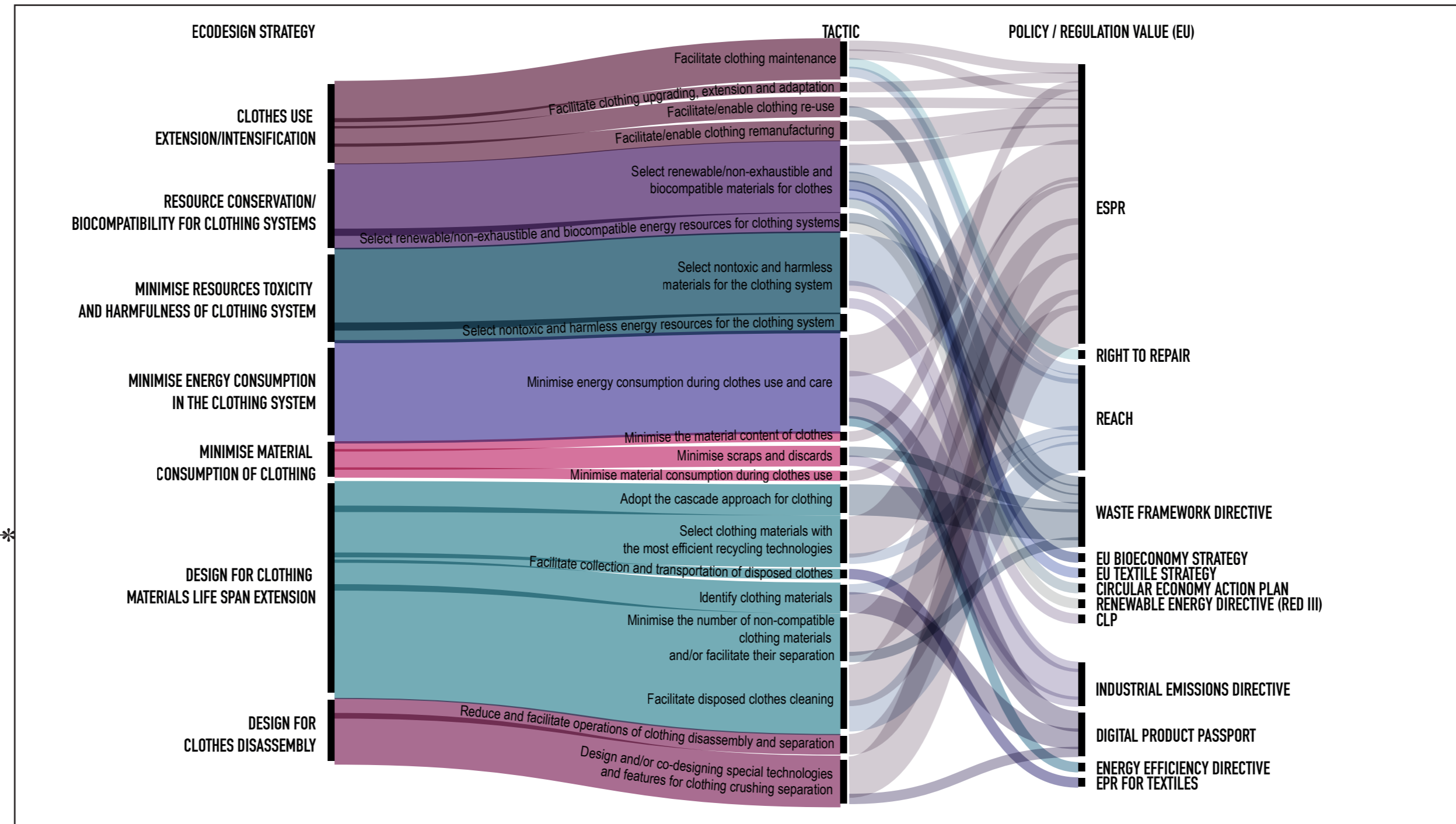
### COMMON FABRIC SELECTION STEPS IN FASHION DESIGN PRACTICE

<b>PROJECT DEFINITION</b> Scope, target user, context
<b>END-USE REQUIREMENTS</b> Comfort · Aesthetics · Function
<b>PERFORMANCE CRITERIA</b> Durability · Breathability · Elasticity
<b>FABRIC ANALYSIS</b> Fiber · Structure · Weight · Finishes
<b>MATERIAL SCREENING</b> Alternatives · Supplier availability
<b>SAMPLING &amp; TESTING</b> Lab tests · Prototypes · Hand feel
<b>COST &amp; SUSTAINABILITY</b> Price · Environmental impact
<b>FINAL SELECTION</b> Technical + aesthetic validation
<b>PRODUCTION APPROVAL</b> Final check · Manufacturing start

### VARIABLES AFFECTING THE SELECTION

FIBERS
YARNS
WEAVES
KNITS
LACES/NETTINGS
NON-WOVEN/FELTINGS
FINISHES

## INTERPOLATING VARIABLES WITH ECODESIGN GUIDELINES AND POLICY/REGULATORY SYSTEM



## EXTRACTION OF ECODESIGN-DRIVEN MATERIAL SELECTION AND DESIGN GUIDELINES

Material selection focus	Guideline / Description	Related material properties	Design focus	Guideline / Description	Related material property
Selection of efficiently recyclable materials	Select materials whose recycling technology results in the highest material recovery. Given the difficulties of fiber-to-fiber recycling, it is necessary to establish agreements with specialized recycling companies to ensure product recovery at end-of-life.	Disposable end-of-life treatment	Design to increase crease resistance	Prefer twisted yarns for better fabric recovery and woven structures such as basket and twill, where yarns move more freely, thus absorbing stress more easily.	Medium-low crease resistance
Selection of certified materials and suppliers	Prefer materials and suppliers certified by third parties regarding environmental impact and ethical standards.	No, few certifications available	Design to increase stain resistance	Prefer natural fibers and/or circular cross-sections and fabrics with low surface hairiness. Fabrics with tight weaves or closed knits tend to get dirt less easily but are more difficult to clean.	Medium-low stain resistance
Selection of renewable materials	Prefer renewable raw materials (and rapidly renewable ones) to avoid the depletion of fossil resources.	Non-renewable material origin	Low-impact textile structures	Prefer knitted textile structures to reduce energy consumption during production and pre-consumer waste.	High textile production impact
Selection of recycled materials	Prefer recycled raw materials to avoid virgin material extraction and to encourage circularity.	High percentage virgin material origin	Functional textile structures	Raveling: prefer plain weaves and interlock knits; avoid satin weaves and french-terry knits. Elasticity: prefer rib knits to avoid elastane. Cover and warmth: prefer lighter weaves and closed knits. Drape: structures with free-moving, low-twist yarns provide a softer drape.	Medium-low abrasion resistance
Selection of materials efficient in water consumption	Prefer raw materials that minimize water consumption during fiber cultivation or production.	High textile production impact	Design to increase abrasion and pilling resistance	Avoid textile structures in which yarns and fibers have high mobility and avoid fancy or bulky yarns, as they are more prone to abrasion.	Medium-low pilling resistance
Selection of less energy-intensive materials	Prefer raw materials that minimize energy use during the production phase.	High textile production impact	Design to extend product lifespan	Apply functional surface treatments to improve durability without compromising end-of-life processing.	Low stain resistance, low color fastness, low UV resistance
Selection of materials that do not release microplastics	Prefer raw materials that do not cause microplastic pollution during production and use phases.	Microplastics release phases	Functional variation of thicknesses	To avoid excessive material use or premature wrinkling, reinforce only the areas most subject to wear by layering materials.	High textile production impact
Selection of alternative materials to the most commonly used ones	Prefer alternative fibers to reduce global environmental stress caused by high market demand.	Virgin material origin	Design for connection strength	Use strong connections between different parts of the garment and accessories to ensure durability.	Critical end-of-life management
Select materials with high dirt resistance	Prefer fabrics that naturally show high dirt resistance to avoid frequent washing. For materials that easily accumulate pollutants, choose easily washable textile structures.	Dirt resistance medium-low	Multifunctional design	Transformable and versatile garments suitable for various contexts reduce the number of purchases and promote emotional durability.	Strong durability properties
Selection of materials with high color fastness	Prefer fabrics with good color fastness to avoid premature disposal of garments.	Poor color fastness	Monomaterial product	Use a single material for the entire product.	Critical end-of-life management
Selection of materials with high durability	Prefer materials with high abrasion and pilling resistance. When pilling occurs, prefer natural materials where pilling is easier to remove and more resistant textile structures.	Pilling resistance medium-low	Design with end-of-life in mind	Anticipate the possible end-of-life of the product during its design phase and facilitate this process.	Critical end-of-life management
Select materials with high crease resistance	Prefer fabrics that naturally have high crease resistance to avoid frequent ironing at high temperatures. In the case of materials that wrinkle easily, choose textile structures capable of absorbing stress more effectively.	Medium-low crease resistance	Design for easily disassemblable components	Use reversible connections between parts (e.g., avoid high-tension stitching, rivets, etc.).	Critical end-of-life management
Selection of materials with high odor resistance	Prefer fabrics that naturally resist odors, avoiding frequent high-temperature washing that contributes to the garment's environmental impact and reduces physical lifespan.	Medium-low odor resistance	Modular design	Use materials with different end-of-life options in separate and easily disassemblable modules.	Critical end-of-life management
Selection of fast-drying materials	Prefer fabrics that naturally dry quickly to avoid the use of tumble dryers, which are energy-intensive and increase the environmental impact during the use phase.	Low drying velocity	Minimization of parts	Simplify the product structure by reducing the number of parts and accessories to avoid excessive material use.	Critical end-of-life management, high textile production impact
Selection of easy-to-maintain materials	Prefer materials that do not require specific maintenance skills and can be easily cared for by users. Handwashing or complex maintenance could discourage proper care and reduce material durability.	Check washing options	Laser cutting of synthetic fabric patterns	Laser cutting thermally seals the edges of patterns, reducing microfiber release and fraying.	Fraying tendency, microplastic release
Selection of materials with minimal human toxicity	Prefer raw materials whose production minimizes risks of human toxicity.	High textile production impact	Textile and yarn structures to reduce microfiber release	Prefer twisted yarns and woven structures (instead of knitted ones) since higher abrasion resistance leads to fewer broken microfibers on the fabric surface.	Medium-low pilling resistance
Selection of materials with minimal climate impact	Prefer raw materials whose production minimizes contributions to climate change.	High textile production impact	3D printing technology	Use 3D printing for accessories to enhance personalization and emotional durability.	Low stain resistance, low color fastness, low UV resistance
Material selection focus	Guideline / Description	Related material properties	Aesthetic-functional patterned design	Prefer decorative patterns that can "mask" small stains, postponing washing or disposal.	Low stain resistance, low color fastness, low UV resistance
Selection of efficiently recyclable materials	Select materials whose recycling technology results in the highest material recovery. Given the difficulties of fiber-to-fiber recycling, it is necessary to establish agreements with specialized recycling companies to ensure product recovery at end-of-life.	Disposable end-of-life treatment	Elimination of unnecessary treatments	Prefer natural fiber coloration and replace polluting functional treatments with fiber blends.	Critical end-of-life management
Selection of certified materials and suppliers	Prefer materials and suppliers certified by third parties regarding environmental impact and ethical standards.	No, few certifications available	Use of functional textile structures	Employ knitted or woven structures to enhance material performance and/or avoid blends.	Critical end-of-life management

### Key Findings

The results highlight that material selection plays a pivotal role in determining both the environmental performance and the perceived value of fashion products. Integrating life-cycle assessment with qualitative attributes such as touch, aesthetics, and comfort can significantly enhance product longevity by fostering stronger user attachment (Niinimäki & Koskinen, 2011). Moreover, the study emphasizes that combining quantitative and qualitative criteria allows for a more comprehensive understanding of sustainability, supporting the transition toward circular design practices.

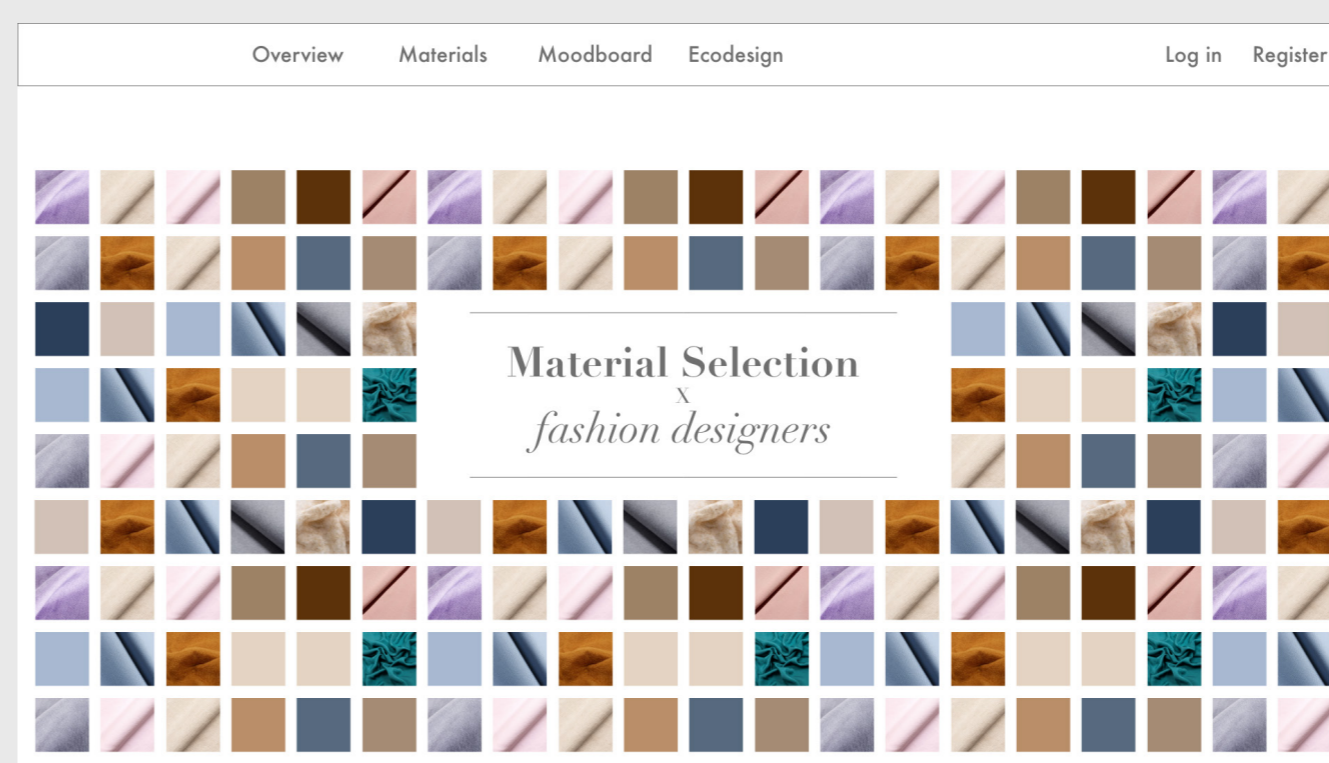
### Implications for Design Practice

The proposed approach provides designers with a practical framework to incorporate sustainability into early-stage decision-making processes. By facilitating informed material choices, the methodology supports the development of garments that are not only environmentally optimized but also more likely to be used and valued over time. This contributes to reducing consumption rates and extending product lifespans, which are critical objectives in circular economy strategies. However, challenges remain in terms of data availability, industry adoption, and the need for interdisciplinary collaboration.

### Conclusion

This research contributes to the ongoing discourse on sustainable fashion by demonstrating the importance of integrating material science, design thinking, and user-centered approaches. It underscores the need for tools that translate sustainability principles into actionable design strategies, particularly in the context of material selection. Future research should further validate and refine the proposed methodology through real-world applications and industry engagement.

## MATERIALS SELECTION FOR FASHION DESIGNERS MOCK-UP TOOL



### SCREENING CRITERIA & MATERIAL FICHE SAMPLE CAN BE IMPORTED IN MOODBOARDING SPACE

### MOCKUP WORKFLOW

