Welcome to sust*AI*d, an AI-based, design-driven tool with the aim to assist fashion designers in the process of sustainable material selection, combining artificial intelligence, to provide informed, data-driven recommendations that support conscious material choices, with design-oriented thinking in the design process.

How it started

The tool, initially developed as part of a master's thesis at Politecnico di Milano, has been designed to **make sustainable material selection more accessible, understandable, and actionable to fashion designers.** Through its curated material database and AI assistant, sust*AI*d provide guidance, insights, and recommendations that help designers make informed decisions.

Vision

"Transforming the material selection process for fashion design into an interconnected and responsible ecosystem where design and sustainability coexist."

sustAId envisions a **future** where designers – empowered by AI assistance and data-driven insights – can make conscious material choices that respect environmental and social sustainability, respect policies and regulations, promote material innovation, and where **design decisions become catalysts for advancing the sustainable transition of the fashion industry.**

Mission

sust*AI*d's mission is to **bridge the still present gap between sustainable development goals and fashion design practices**, by supporting fashion designers navigating the complexity of sustainable material selection through accessible, transparent, and grounded insights.

Rooted in a design-driven methodology, the tool translates complex sustainability data into actionable guidance, tailored for fashion designers' creative and functional needs. Through this approach sust*AI*d wants to:

- Democratise access to credible and transparent sustainability data.
- Enhance the integration of sustainability criteria into the early design phases where material choices have the highest impact.
- Fostering dialogue between design, responsible materials, and technology.
- Promote the adoption of next-generation and preferred materials
- Encouraging collaboration and interconnectivity between the different stakeholders of the sector.

Ultimately, is fundamental to know that **sust*AI*d does not aspire to substitute human designers** but aspires to be at the same time a creative partner and a knowledge ecosystem.

Data collection methodology

This section describes the approach and methodology behind sust*AI*d

The **sust*AI*d database** was created to overcome the limitation of users, like students or emerging fashion designers, who may not have a material portfolio to upload on the platform, but wish to explore fibres and materials, gaining a complete overview on the textile landscape.

This directly integrated database, has been developed with the support of the custom trained **sust*AI*d GPT collecting free open data from selected sources**. Using only open data, though, the work of the GPT was not always satisfactory manual intervention by the developer was necessary to standardize discrepancies, correct errors, and clearly define each row = material and column = property, to help the AI in generating a complete, consistent, and readable database. All the retrieved data was source-verified by the developer and not fabricated, missing or incomplete records are signaled with N/A.

The update of the database is a responsibility of the developer who will periodically (approximately every 3 or 6 month) instruct the GPT to repeat the research to update some data, or identify new materials missing in the current list, and will check the results to prevent unwanted errors or discrepancies.

1. Data sources

sust*AI*d GPT combines **three different layers of knowledge** – static knowledge (until June 2024), developer-provided and attached documents, web and real-time data – when working. Because the information contained into these three layers of knowledge come from different sources, sust*AI*d follows a hierarchy of data sources – ranked by reliability and temporal relevance in the table below – when executing its workflow. When sources conflict with each other, the GPT prioritizes the most recent and methodologically robust, explicitly stating the motivation for doing so to the user.

Level	Source Type	Examples	Reliability Criteria
A	User-provided files	LCA_data_v2.csv, Textile Exchange reports, scientific literature	Direct, traceable, quantitative data
B	Institutional reports	Materials Market Report 2024–2025, Ensuring Integrity in the Use of LCA Data (2025), etc.	Peer-reviewed, methodologically documented
C	Pre-2024 general knowledge	ISO 14040–44 standards, GHG Protocol, academic references, valid theoretical background, etc.	Valid theoretical background
D	Real-time web research	Textile Exchange, UNEP, ISO, FAO	Used for updates or verification

2. Textile materials and fibres information

Because data on fibres from individual manufacturers are generally difficult to obtain – particularly for free – and following Textile Exchange's Materials Market Reports approach, the **entries listed refer to the fibre family rather than a specific producer**, except for registered materials such as Circulose® (e.g., The entry SUTAID_017, listed as Cotton, does not refer to a specific cotton fibre from a particular manufacturer produced under specific conditions, but rather to the generic family of cotton fibres sharing similar characteristics due to their common raw material origin).
It is for this same reason that many properties were not assessed with just one number, but the result will be either a range or a qualitative evaluation.

To provide homogeneous consistent naming, the developer defined the **categories in which textile materials and fibres should be clustered.**

- Bio-constructed Material
- Biosynthetic Fibre
- Man-made Cellulosic Fibre
- Man-made Protein Fibre
- Natural Animal Fibre
- Natural Plant Fibre
- Natural Polymer
- Next-gen Recycled Fibre
- Non-fibre Material
- Recycled MMCF
- Recycled Natural Animal Fibre
- Recycled Natural Plant Fibre
- Recycled Synthetic Fibre
- Synthetic Fibre
- Synthetic polymer

Presented below is the list of materials comprised in the database (in alphabetic order) – each of one is preceded by its material ID, for easier classification and readability of the database, and the category in which it belongs.

Material ID	Material name	Material Categories
SUSTAID_001	Acetate	Man-Made Cellulosic Fibre
SUSTAID_002	Acrylic	Synthetic Fibre
SUSTAID_003	Alpaca	Natural Animal Fibre
SUSTAID_004	Angora (Rabbit)	Natural Animal Fibre
SUSTAID_005	Bamboo Viscose	Man-Made Cellulosic Fibre
SUSTAID_006	Banana Fibre	Natural Plant Fibre
SUSTAID_007	Bio-based TPU	Biosynthetic Fibre

SUSTAID_008	Biofabricated Cellulose	Man-Made Cellulosic Fibre
SUSTAID_009	Biofabricated Spider Silk	Man-Made Protein Fibre
SUSTAID_010	Bio-PA	Biosynthetic Fibre
SUSTAID_011	Bio-PET	Biosynthetic Fibre
SUSTAID_012	Bio-PTT	Biosynthetic Fibre
SUSTAID_013	Camel Hair	Natural Animal Fibre
SUSTAID_014	Casein fibre	Man-Made Protein Fibre
SUSTAID_015	Cashmere	Natural Animal Fibre
SUSTAID_016	Circulose®	Man-Made Cellulosic Fibre
SUSTAID_017	Cotton	Natural Plant Fibre
SUSTAID_018	Cupro	Man-Made Cellulosic Fibre
SUSTAID_019	Down (Feathers)	Non-Fibre Material
SUSTAID_020	Elastane/Spandex	Synthetic Fibre
SUSTAID_021	Hemp	Natural Plant Fibre
SUSTAID_022	Jute	Natural Plant Fibre
SUSTAID_023	Kapok	Natural Plant Fibre
SUSTAID_024	Keratin fibre	Man-Made Protein Fibre
SUSTAID_025	Leather	Non-Fibre Material
SUSTAID_026	Linen (Flax)	Natural Plant Fibre
SUSTAID_027	Manila Hemp (Abaca)	Natural Plant Fibre
SUSTAID_028	Merino Wool	Natural Animal Fibre
SUSTAID_029	Modal	Man-Made Cellulosic Fibre
SUSTAID_030	Mohair	Natural Animal Fibre
SUSTAID_031	Mulberry Silk	Natural Animal Fibre
SUSTAID_032	Mycelium	Bio-constructed Material
SUSTAID_033	Natural Rubber	Natural Polymer
SUSTAID_034	Nylon/Polyamide	Synthetic Fibre
SUSTAID_035	Orange Fibre	Man-Made Cellulosic Fibre
SUSTAID_036	Organic Cotton	Natural Plant Fibre
SUSTAID_037	PHA (Polyhydroxyalkanoates)	Biosynthetic Fibre
SUSTAID_038	Piña (Pineapple)	Natural Plant Fibre
SUSTAID_039	Polyester	Synthetic Fibre
SUSTAID_040	Polyester Microfiber	Synthetic Fibre
SUSTAID_041	Ramie	Natural Plant Fibre
SUSTAID_042	Rayon/Viscose	Man-Made Cellulosic Fibre
SUSTAID_043	Recycled Cotton	Recycled Natural Plant Fibre
SUSTAID_044	Recycled Cotton (Chemical	Recycled Natural Plant Fibre
SUSTAID_045	Recycled Cotton (Mechanical)	Recycled Natural Plant Fibre
SUSTAID_046	Recycled Nylon	Recycled Synthetic Fibre
SUSTAID_047	Recycled Polyester	Recycled Synthetic Fibre
SUSTAID_048	Recycled wool	Recycled Natural Animal Fibre
SUSTAID_049	Refibra	Recycled MMCF
SUSTAID_050	Sisal	Natural Plant Fibre
SUSTAID_051	Synthetic rubber	Synthetic Polymer
SUSTAID_052	T2T (Textile-to-textile) recycled MMCF	Next-gen Recycled Fibre
SUSTAID_053	T2T (Textile-to-textile) recycled PA	Next-gen Recycled Fibre

SUSTAID_054	T2T (Textile-to-textile) recycled PET	Next-gen Recycled Fibre
SUSTAID_055	Tencel Lyocell	Man-Made Cellulosic Fibre
SUSTAID_056	Tencel Modal	Man-Made Cellulosic Fibre
SUSTAID_057	TPU	Synthetic Fibre
SUSTAID_058	Vicuña	Natural Animal Fibre
SUSTAID_059	Vinyl	Synthetic Fibre
SUSTAID_060	Viscose	Man-Made Cellulosic Fibre
SUSTAID_061	Wild Silk (Tussah)	Natural Animal Fibre
SUSTAID_062	Wool	Natural Animal Fibre

3. Assessment framework and explanation

To overcome the discrepancy errors in the how the GPT searched for data on each material's properties and information, the developer defined, the **list of required information to be included, along with an explanation**. For some properties that needed to be updated to ensure alignment with a design-oriented thinking and methodology, a "*new*" definition was provided.

Since it is more difficult to access open quantitative data for some families of fibres and because it is an easier language for designers, **qualitative evaluation has been preferred over quantitative in assessing some of the following categories**. Qualitative evaluation, as one can read in the list of characteristics, is assessed with a score from 1 to 6 (corresponding to the scale *low*, *medium-low*, *medium*, *medium-high*, *high*, and *very high).*

Here the complete list of properties and how they were assesses:

Sustainability rating – Qualitative assessment of how sustainable the material is comprehensively across multiple sustainability and performance categories. The qualitative evaluation is, in this case, obtained with the average between the evaluation of environmental sustainability, social sustainability, governance, and durability. Materials should be rated *low*, *medium-low*, *medium*, *medium-high*, *high*, and *very high* based on the results.
Sustainability score – Quantitative assessment corresponding to the *sustainability score.* Materials should be rated from 1 to 6, with *low* corresponding to 1/6, *medium-low* to 2/6, *medium* to 3/6, *medium-high* to 4/6, *high* to 5/6, and *very high* to 6/6.
Environmental sustainability – Qualitative evaluation representing the material's impact on the environment throughout its lifecycle. In this context, the evaluation is obtained with the average between the values of Ghg emissions, water consumption, energy use, chemical use, fossil fuel consumption, and toxicity. Since some of these values are quantitative and expressed with numbers, the AI assistant translates them to qualitative evaluations. Materials should be rated *low* (1/6), *medium-low* (2/6), *medium* (3/6), *medium-high* (4/6), *high* (5/6), and *very high* (6/6).
Ghg emissions – Greenhouse gas emissions produced per kilogram of material. Quantitative data expressed in kg CO2e/Kg.
Water consumption – Liters of water used to produce one kilogram of the material. Quantitative data expressed in L/Kg
Energy use – Megajoules of energy required to produce one kilogram of material. Quantitative data expressed in MJ/Kg

Land use – Amount of land required to produce the material, usually expressed in Kg/ha, but in this context made qualitative in this context for easier data retrieving and understanding. Materials should be rated *low* (1/6), *medium-low* (2/6), *medium* (3/6), *medium-high* (4/6), *high* (5/6), and *very high* (6/6).
Chemical use level – The quantity or intensity of chemicals used in the production of the material. Qualitative evaluation for easier data retrieving and understanding. Materials should be rated *low* (1/6), *medium-low* (2/6), *medium* (3/6), *medium-high* (4/6), *high* (5/6), and *very high* (6/6).
Fossil fuel consumption – Amount of fuel required to produce and/or transport the material. Qualitative evaluation for easier data retrieving and understanding. Materials should be rated *low* (1/6), *medium-low* (2/6), *medium* (3/6), *medium-high* (4/6), *high* (5/6), and *very high* (6/6).
Toxicity – Potential of the material to cause harm to humans or ecosystems. Qualitative evaluation for easier data retrieving and understanding. Materials should be rated *low* (1/6), *medium-low* (2/6), *medium* (3/6), *medium-high* (4/6), *high* (5/6), and *very high* (6/6).
Biodegradability – The materials' ability (full, partial, none) to naturally decompose in the environment. Qualitative evaluation for easier data retrieving and understanding. Materials should be rated *low* (1/6), *medium-low* (2/6), *medium* (3/6), *medium-high* (4/6), *high* (5/6), and *very high* (6/6).
Social sustainability – Qualitative evaluation that refers to practices and policies that support human wellbeing, equity, and social cohesion for both current and future generations. At its core, it's about creating systems and communities where people can thrive together over the long term. Materials should be rated *low* (1/6), *medium-low* (2/6), *medium* (3/6), *medium-high* (4/6), *high* (5/6), and *very high* (6/6).
Governance – Qualitative evaluation that in fashion materials ensures that sustainability commitments (like transparency and traceability or policy and regulations compliance) aren't just aspirational statements but are backed by concrete systems that create accountability and drive real change in how fibres are grown, processed, and used. Materials should be rated *low* (1/6), *medium-low* (2/6), *medium* (3/6), *medium-high* (4/6), *high* (5/6), and *very high* (6/6).
Durability – Qualitative evaluation that refers to the material's resistance to wear, tear, or degradation with time. In the context of sustainable development, durability – that can be also emotional, but that unfortunately is unmeasurable – is fundamental because it reduces over consumption and extends the lifespan of garments. In this case is obtained with the average between the values of the properties that influence the performance of a fibre or material, when used to make a garment: abrasion resistance, chemical resistance, tensile strength, temperature resistance. Since some of these values are quantitative and expressed with numbers, the AI assistant translates them to qualitative evaluations. Materials should be rated *low* (1/6), *medium-low* (2/6), *medium* (3/6), *medium-high* (4/6), *high* (5/6), and *very high* (6/6).
Tensile strength – Maximum stress the material can withstand while being stretched. Quantitative data expressed in MPa.
Abrasion resistance – The material's ability to resist surface wear from friction. Qualitative evaluation for easier data retrieving and understanding. Materials should be rated *low* (1/6), *medium-low* (2/6), *medium* (3/6), *medium-high* (4/6), *high* (5/6), and *very high* (6/6).
Chemical resistance – How well the material withstands exposure to chemicals without degrading. Qualitative evaluation for easier data retrieving and understanding. Materials should be rated *low* (1/6), *medium-low* (2/6), *medium* (3/6), *medium-high* (4/6), *high* (5/6), and *very high* (6/6).
Moisture absorption – The material capacity to absorb and retain moisture. Qualitative evaluation for easier data retrieving and understanding, materials should be rated *low* (1/6), *medium-low* (2/6), *medium* (3/6), *medium-high* (4/6), *high* (5/6), and *very high* (6/6), along with quantitative assessment expressed in percentage.
Temperature resistance – The range of temperatures the material can endure without damage. Quantitative data range expressed in °C.
Elasticity – Ability of the material to return to its original shape after stretching or deformation. Qualitative evaluation for easier data retrieving and understanding, materials should be rated *low* (1/6), *medium-low* (2/6),

medium (3/6), *medium-high* (4/6), *high* (5/6), and *very high* (6/6), along with quantitative assessment expressed in percentage.
Dyeability – Ease with which the material can be dyed or colored. Qualitative evaluation for easier data retrieving and understanding, materials should be rated *low* (1/6), *medium-low* (2/6), *medium* (3/6), *medium-high* (4/6), *high* (5/6), and *very high* (6/6), along with quantitative assessment expressed in percentage.
Comfort level – Qualitative assessment of how comfortable the material feels to wear. Evaluation through little explicative sentences for easier understanding when asking the AI assistant suggestions.
Cost range – Typical range price of the material per unit. Quantitative range data usually expressed in $/Kg.
Cost volatility – How much the material price fluctuates over time. Qualitative evaluation where materials should be rated *low* (1/6), *medium-low* (2/6), *medium* (3/6), *medium-high* (4/6), *high* (5/6), and *very high* (6/6), along with quantitative assessment expressed in percentage.
Primary applications – Primary and more usual applications of a material in the fashion and textile industry. Evaluation through little explicative sentences for easier understanding when asking the AI assistant suggestions.
Main challenges – Main sustainability challenges the materials undergoes. Evaluation through little explicative sentences for easier understanding when asking the AI assistant suggestions.
Key opportunities – Main opportunities the material offers with its use. Evaluation through little explicative sentences for easier understanding when asking the AI assistant suggestions.

Technical Information

Framework: React 19 + Tauri 2
Database: Supabase (cloud)
Charts: Recharts
AI: OpenAI (GPT) / Anthropic Claude

Support

Thank you for using sust*AI*d and contributing to the development on the integration of AI into sustainable material selection for fashion design.

For information about the tool and the data collection methodology, questions, or issues, please contact: alessia.vittori@mail.polimi.it