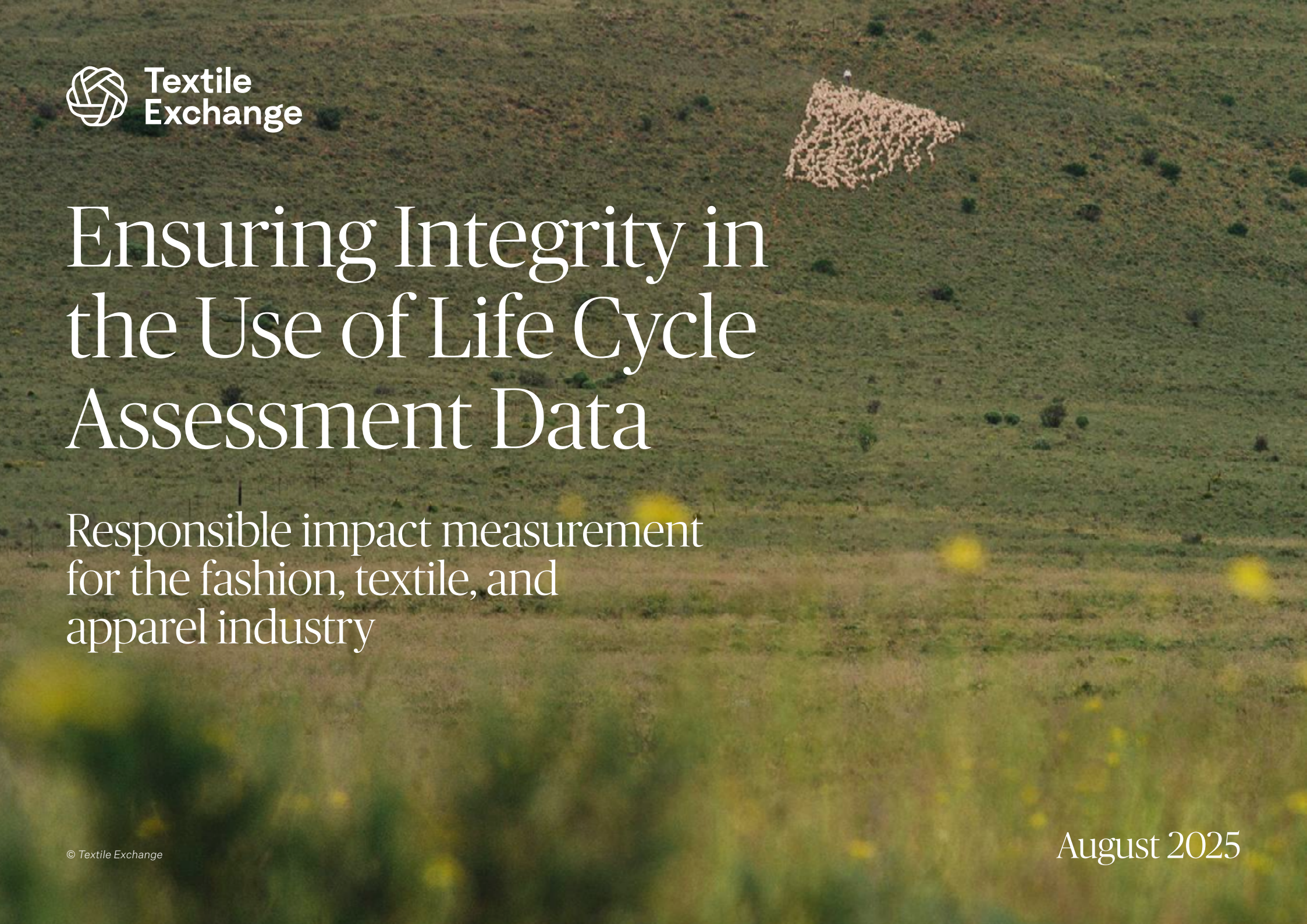

Textile Exchange

Ensuring Integrity in the Use of Life Cycle Assessment Data

Responsible impact measurement for the fashion, textile, and apparel industry

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Contents

Cover photo: Carl van der Linde

Overview

A call for industry-wide integrity in LCA data use

The fashion, textile, and apparel industry has a vast and complex environmental impact, requiring robust and nuanced measurement approaches. Life Cycle Assessment (LCA) is the most widely used method for evaluating these impacts, offering adaptability across supply chain stages, geographies, and environmental scopes. However, LCA has limitations. Establishing a shared understanding of its appropriate uses is crucial, along with recognizing the need to move beyond current LCA metrics to capture a more holistic view of environmental, social, and animal welfare impacts.

The following organizations have pledged their support for the recommendations in this document:

apparel impact institute

FASHION FOR GOOD

Recommended ways of using LCA data

1. Textile Exchange recommends that LCA data is only applied when there is a full understanding of the key assumptions, methods, and use cases. End users of LCA data, such as brands, may need to work with consultants or other third parties to support with the application of LCA data.
2. Comparisons between separate LCA studies should not be made and neither should comparisons within a study, unless the study is a comparative LCA.
3. Textile Exchange discourages the comparison of LCA data between fiber or material categories or geographies. For example, comparisons between natural and synthetic fibers should not be made as the systems are fundamentally different and therefore not comparable. Textile Exchange also discourages shifting sourcing geographies as a method to reduce or avoid impact. Instead, we encourage implementing reduction measures within existing sourcing regions.[1]
4. The usefulness of LCA data depends heavily on its quality. Robust, high-quality data supports a much broader range of applications. Generally, LCA data quality for the industry must be improved to enable the desired use cases.
5. Textile Exchange encourages LCA studies to fully document the assumptions, methodological decisions, limitations, and underlying datasets (primary and secondary) applied within an LCA. LCA data can only be improved if there is a good understanding of existing studies and how they have been developed.
6. Brands may choose to subscribe to an industry database such as the Higg Material Sustainability Index (MSI) or Quantis World Apparel and Footwear Life Cycle Assessment Database (WALDB) which house supporting information from Textile Exchange's Life Cycle Inventory (LCI) Library. LCA data from industry databases should not be compared. These are not like-for-like comparisons, as each database will apply differing methodologies and assumptions.
7. There is a critical need to move beyond current LCA methodology and adopt an "LCA+" approach. This considers context-specific impact areas and includes beneficial outcomes not captured within current LCA methodology, such as biodiversity, soil health, water, animal welfare, and livelihoods.
8. For Scope 3 footprinting,[2] Textile Exchange encourages the use of supplier-specific data and LCA data from well-documented LCA studies, with careful consideration of data quality in relation to the materiality of a fiber or material within the overall footprint.
9. To help close remaining impact data gaps, frameworks such as Textile Exchange's Regenerative Agriculture Outcome Framework should be used. This tool can help track progress across a holistic set of impact areas tailored to specific systems and contexts over time. Crucially, it supports measuring beneficial impacts ("doing more good"), not just negative impacts ("doing less bad").

An aspirational goal for impact measurement is to track outcomes on a continuous basis, either through annual LCA studies (or a cadence that makes sense for a particular system) or frameworks such as the Regenerative Agriculture Outcome Framework. It should be noted that for some indicators, tracking year-on-year changes may not be appropriate.

Introduction

Seeing the complete picture

The fashion, textile, and apparel industry relies heavily on ecosystems and natural resources to produce raw materials. However, the continual increase in extraction of new raw materials to make new products, particularly in recent years, has led to increased negative impacts within these ecosystems, including greenhouse gas (GHG) emissions, natural resource depletion, and biodiversity loss. According to the Apparel Impact Institute, the apparel sector alone is responsible for 878.7 million tonnes of carbon dioxide equivalent (Mt CO_2e). Of this, 21% occurs at Tier 4 of the supply chain[3] (raw material production and primary processing).[4]

Accurately assessing the industry's environmental impact presents a complex challenge, given the multiple approaches available to define, measure, and track impact. Each approach comes with strengths and limitations. Currently, the most widely used and accepted method for measuring environmental impact in the textile industry is the Life Cycle Assessment. LCA methodology covers numerous environmental impact categories and can be adapted to account for different supply chain stages, geographies, and environmental scopes.

Because raw material production represents a significant portion of the industry's overall environmental impact, having up-to-date and robust LCA data on materials is critical. Textile Exchange supports the need for strong LCA data for the industry but also recognizes that LCA alone does not provide a complete picture. This is where Textile Exchange's concept of "LCA+" comes in—an approach to impact measurement that takes into account impact areas such as biodiversity, soil health, water, animal welfare, and livelihoods, while acknowledging that these impacts are typically context-specific. Current LCA methodology does not cover many of these impact areas, so it is not always possible to quantitatively assess all relevant impacts within the confines of an LCA study. However, Textile Exchange believes it is important to attempt to provide additional qualitative information where possible, enabling a holistic understanding of the interdependent impacts associated with a fiber, material, or product. Understanding this context is necessary to appropriately interpret and apply LCA data.

Photo: Carl van der Linde

Understanding Life Cycle Assessment

What is LCA?

Life Cycle Assessment is a recognized framework for measuring the environmental impacts of materials and products across their life cycle.[5] LCA studies provide an adaptable framework for assessing impact that is governed by recognized standards, to ensure studies are built in a robust and credible way.[6]

LCA allows you to define the system, including a set of interrelated processes that together constitute a material or product you are interested in. The LCA then measures the required inputs and resulting outputs of a system and transforms these into environmental impacts.

LCA is used across various industries and sectors. There is an entire global community of technical LCA experts, also known as LCA practitioners, who are skilled in using and applying this methodology and interpreting the results.[7]

Why conduct an LCA?

In the fashion, textile, and apparel industry, LCA is the most thorough and widely used method for evaluating environmental impacts, including greenhouse gas emissions. As the name suggests, LCA methodology can assess the impacts associated with products across the whole life cycle. However, it can also be applied specifically to the materials used in products, which is how Textile Exchange generally utilizes LCA data.

LCA studies are increasingly used by key decision-makers, including governments, to inform important policies and standards. For this reason, we believe it is critical to address the limitations and inconsistencies in the data quality of currently available LCA studies, ensuring that such influential tools are based on robust, accurate, and context-appropriate information.

Photo: Sofia Tercarolli

What are the steps to conduct an LCA?

LCA studies are typically broken down into the following steps: [8]

1. Scope and planning phase

During this stage, the goal and scope of the study are defined and include the intended use, the rationale for conducting the study, and the intended audience. Technical aspects of the study are also established, such as the functional unit, the system boundaries, the approach to allocation, data quality requirements, impact categories to be considered, and specific methodologies to be applied.

2. Life cycle inventory phase or data collection

During this stage, the LCA practitioner collects data relevant to the goal and scope of the study. Data collection typically falls into two categories—inputs and outputs. Example inputs might include energy consumption or raw material consumption, while example outputs would be pollutants and waste generated.

3. Life cycle impact assessment phase

During this stage, the LCA results are calculated using the specific methodologies identified in the first stage. Additionally, data collected is "transformed" into impact categories. An example would be calculating climate change impacts (or GHG emissions), from the use of fossil fuels (note that climate change impacts do not just result from fossil fuel use; this is just one example).

4. Life cycle interpretation phase

During this stage, results are interpreted in relation to the study's defined goal and scope. Practitioners will complete various "checks" to assess the completeness and consistency of the results. This step is important to ensure any limitations and uncertainties in the results are clearly outlined.

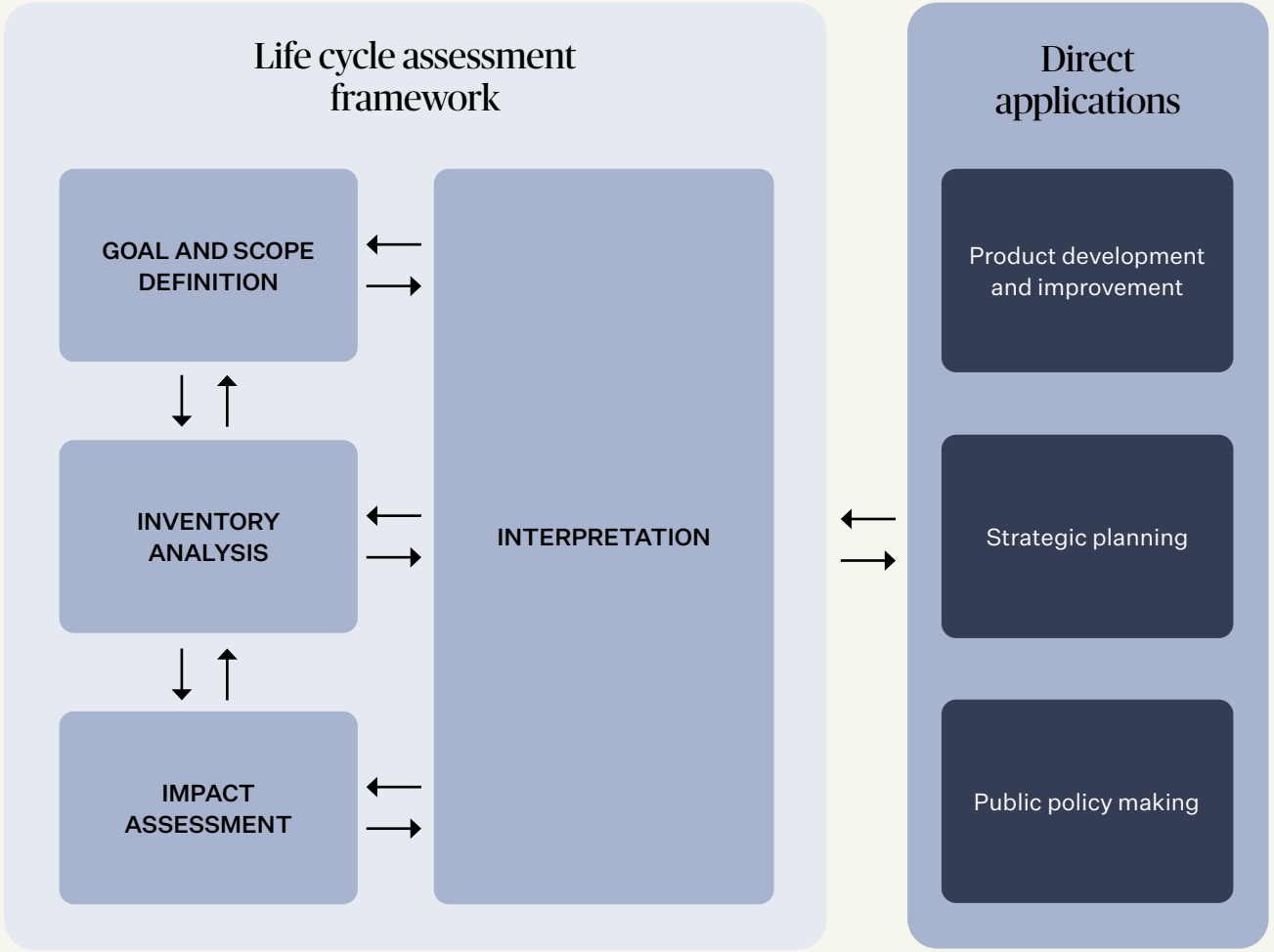


Figure 1: Steps included within a Life Cycle Assessment study with example applications

What is the scope of an LCA study?

LCAs can have different scopes, including covering different production systems, processes, geographies, and materials. The scope of an LCA study is determined by the overall goal and aim of the work being conducted. This includes the intended use of the results—a key component of the scope—as it determines and influences the data quality requirements, assumptions applied, and the interpretation of the results.

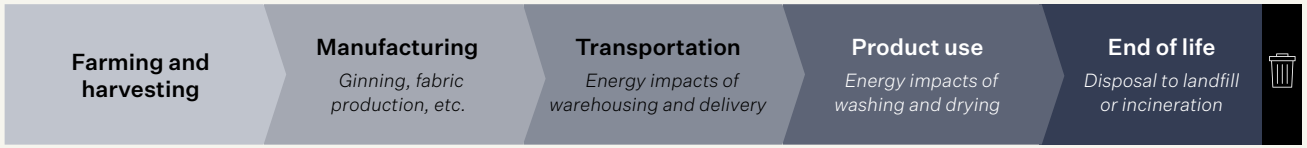
A full LCA study would consider the entire life cycle of a product from raw material extraction through to use and end of life. The technical term for this is a **cradle-to-grave** LCA. Partial LCA studies can also be developed and include cradle-to-gate and gate-to-gate studies. **Cradle-to-gate** studies consider a subset of production processes including raw material extraction. **Gate-to-gate** considers production and/or operational processes, typically one supply chain step.

Consider cotton production for a t-shirt:

A cradle-to-grave study would include impacts from cotton farming, manufacturing, transportation, use, and end-of-life (disposal). In contrast, a cradle-to-gate study would consider impacts from raw cotton production through to its arrival at a manufacturing facility.

Here is how the different boundary options relate to cotton:

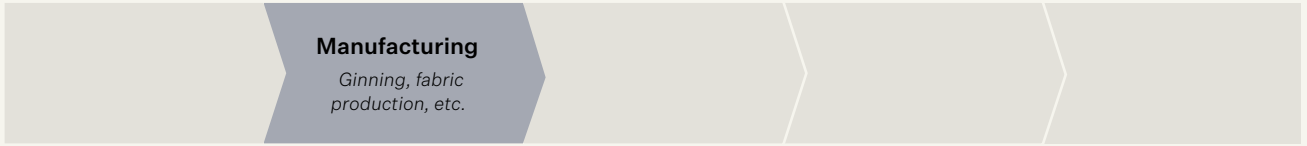
Cradle-to-grave (Complete LCA)



Cradle-to-cradle (Partial LCA, used with recycled products)

Cradle-to-gate (Partial LCA, covering a subset of life cycle stages)

Gate-to-gate (Partial LCA, limited to production and operational processes)



What is the scope of an LCA study?

Textile Exchange's focus on Tier 4 impacts

There are multiple impact data gaps for the fashion, textile, and apparel industry, including at Tier 4 of the supply chain—the raw material extraction and initial processing phase. This is Textile Exchange's organizational focus.

In 2022, Textile Exchange launched a series of LCA studies to help the industry address impact data gaps related to raw materials and fibers.

The first priorities were identified using the following criteria:

- The total volume of a fiber or material used by the industry.
- The availability of impact data.
- The quality of the available impact data.

Through this process, seven priority LCA studies were identified:

- Cotton
- Polyester
- Leather (hide production)
- Responsible Wool Standard (RWS) wool
- Responsible Mohair Standard (RMS) mohair
- Nylon
- Cashmere

Each of these LCAs focuses on the pre-spin, or equivalent, impacts of the fiber or material. Textile Exchange is uniquely positioned to engage with producers across fiber and material types to gather the needed primary data, and to ensure that the studies are conducted in a robust and impartial manner. Textile Exchange's LCAs are **cradle-to-gate** studies.

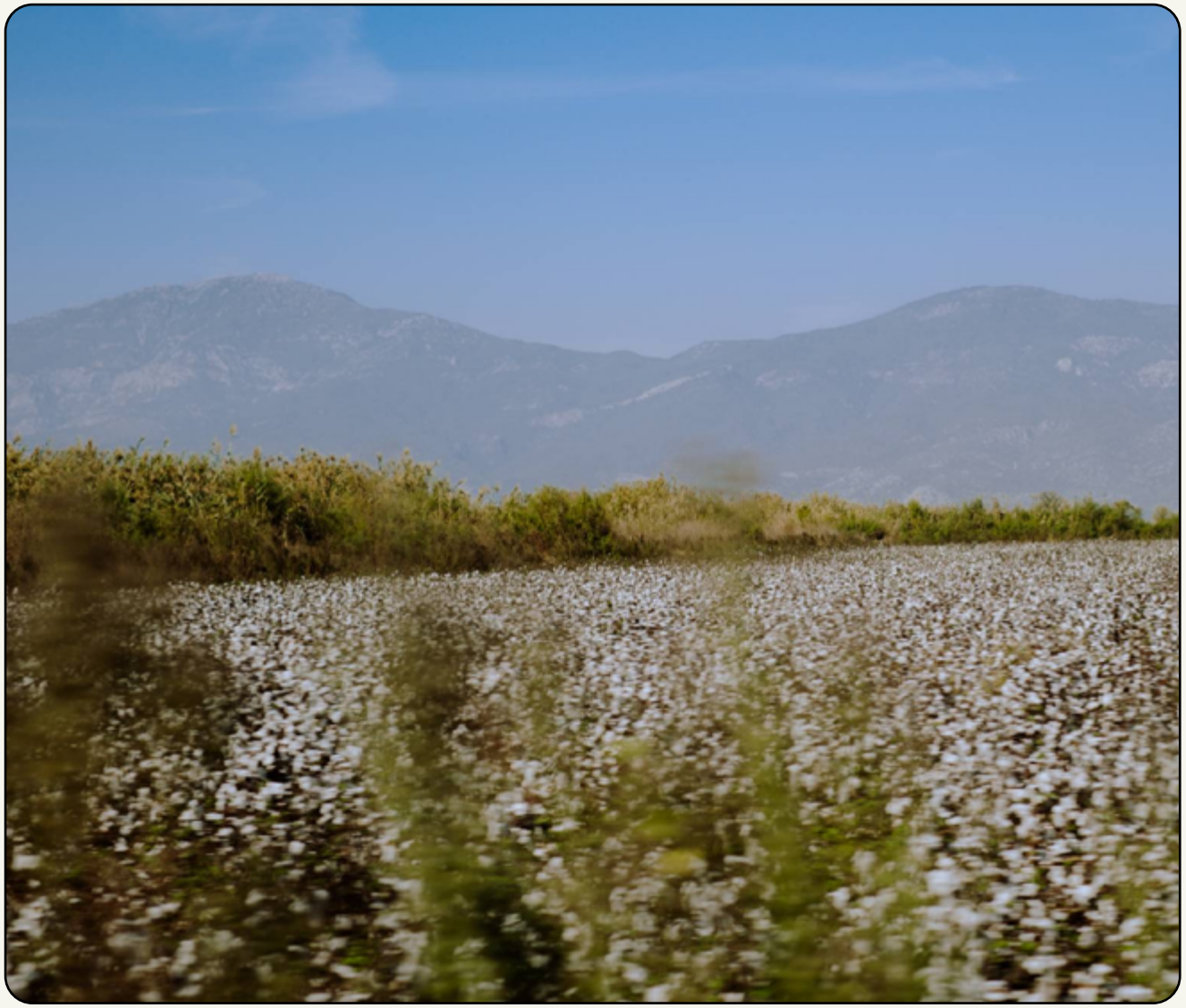


Photo: Anass Ouaziz

What do LCAs measure?

LCA studies can measure one or several environmental impacts over a product's life cycle, the scope of which is determined in the first stage of developing an LCA study.[9] LCAs for the fashion, textile, and apparel industry can be developed for full products or for a single phase in a product's life cycle; for example, for fiber or raw material production. Current LCAs typically consider several environmental indicators that ladder up to understanding differing environmental impacts such as global warming (GHGs), water pollution (e.g., acidification and eutrophication), water consumption, and many more.[10] The methods applied for different environmental impacts differ in robustness because of the specific modeling approaches and data availability for the specific study.

What kind of data is used in an LCA?

The two types of data used within an LCA study are primary and secondary.[11]

- **Primary data** is data that has been directly measured or collected in relation to the LCA study and/or is specific and representative of a particular process being considered within the LCA.
- **Secondary data** is data that already exists and has not been directly collected, measured, or estimated as part of the study. Secondary data for LCA studies is often housed in third-party databases, such as Ecoinvent.[12] This type of data is used to fill any data gaps, for example, where primary data couldn't be collected or where it was not resource- or time-efficient to gather primary data for a particular process. LCA practitioners will refer to secondary datasets as background data.

The robustness of primary and secondary data can vary. For example, primary data could be third-party verified or validated, which would be considered robust, or it could be from a small, unrepresentative sample. Secondary data can be updated frequently (for example, annually) or it could be sourced online. To fully understand how robust data is, a data quality assessment should be completed and communicated when interpreting LCA studies. LCA data quality determines how data should be used and whether it is good enough for the desired use cases.

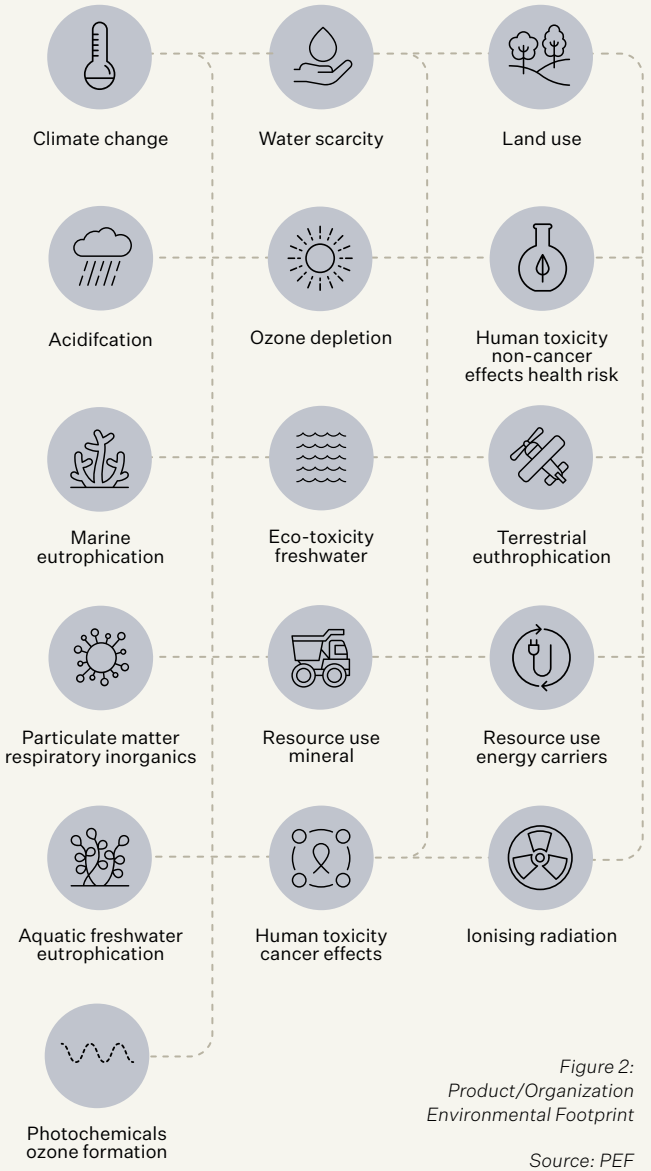


Figure 2: Product/Organization Environmental Footprint

Source: PEF

The critical role of LCA data in the textile industry

How LCAs are currently used by the industry

Currently, LCA is the industry's primary way of measuring the environmental impact of the raw materials and fibers they use. LCA data provides a consistent and robust framework for measuring impact when developed in accordance with ISO standards and validated through a third-party review process.[13] As a result, reviewed LCA data is used by brands, manufacturers, and policymakers to set targets for environmental impact areas, such as setting science-based targets for climate and nature.

LCAs are often used by companies to measure the environmental impact of greenhouse gas emissions. To do this, emission factors calculated using LCA are combined with production/consumption data for fibers and materials. LCAs are also developed and used to understand product-level impacts from raw material extraction through to use, end-of-life, or recycling.

For a company's GHG emissions, the calculated impact of fibers and materials can be integrated with the rest of a company's direct and indirect emissions. This can then be used to calculate their overall corporate GHG impact, supporting reporting and target-setting, such as those required by the Science Based Targets initiative.

LCA data can be accessed through third-party databases such as Quantis WALDB, Higg MSI, and Ecoinvent, among others. LCA databases can enable tracking of impacts over time as underlying datasets are updated and refreshed at a set cadence. Companies can work with LCA specialists (internally) or external consultants, along with supply chain partners, to produce LCAs that are specific for processes in their own value chains.

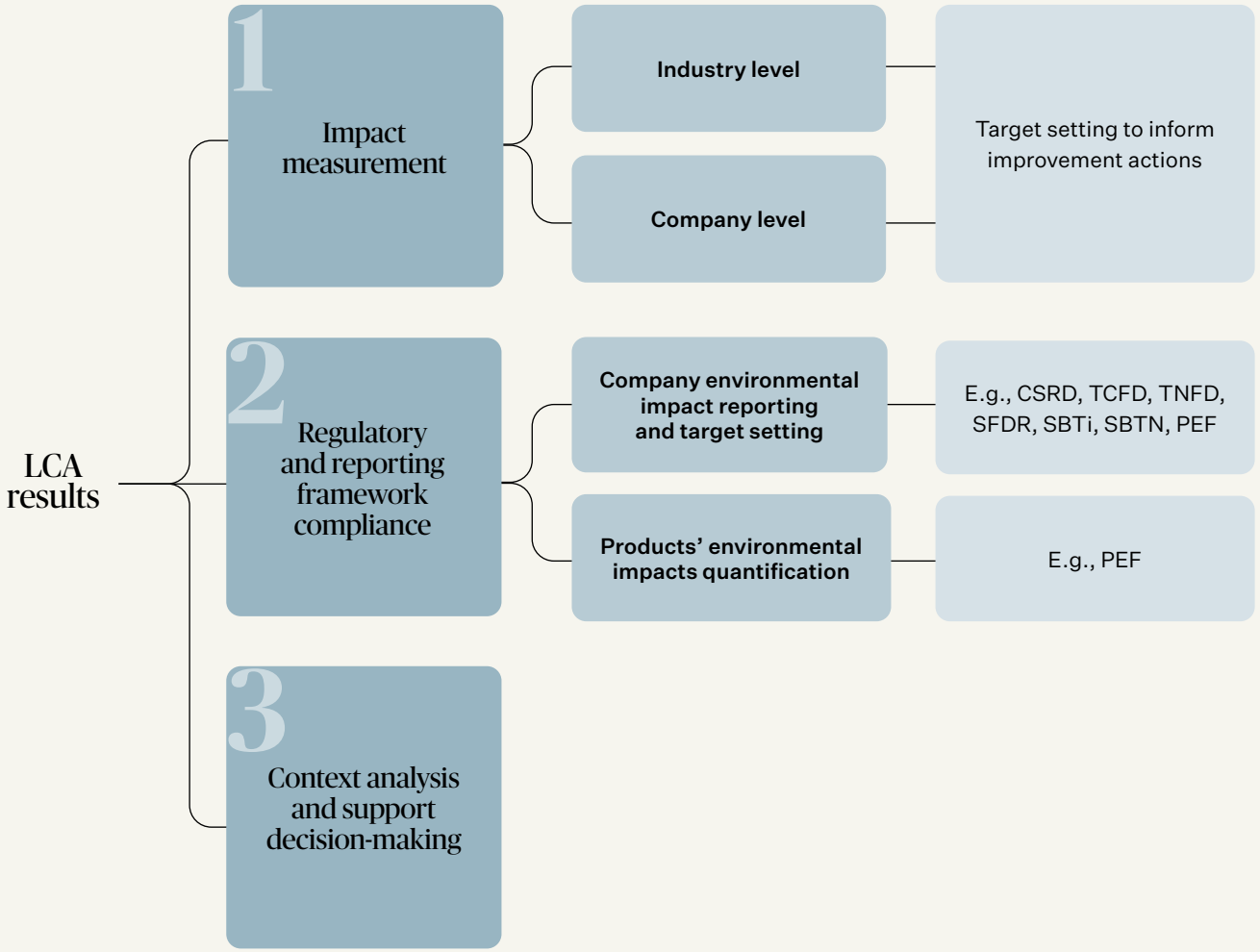


Figure 3: Overview of LCA data use cases across the industry

Textile Exchange's view on industry LCA use

Textile Exchange supports the use of LCA data for the following purposes:

- For GHGs, specifically Scope 3 reporting and target setting.
- As a source of default inventory data for internal use by an organization or supply chain-specific assessments.
- As a source of validation and benchmarking data for internal or supply chain-specific assessments.
- Scenario analysis and the assessment of potential environmental impact reductions, where feasible, based on available LCA data.

Textile Exchange uses LCA data to track progress against its industry target of a 45% reduction in GHG emissions related to raw materials and fibers by 2030, and to model potential interventions for achieving this target. More information on this can be found in the Climate+ Dashboard.

The use of LCA data in the industry has recently come under increased focus because of emerging regulatory pressures, ongoing methodology development, and the need to improve transparency for corporate reporting, impact measurement, and target tracking.

For example, the following regulatory and voluntary reporting frameworks require disclosure of environmental impacts (the list is not exhaustive):

- EU Corporate Sustainability Reporting Directive
- Green Claims Directive
- GHG Protocol and the GHG Protocol Land Sector and Removals Guidance
- Ecodesign for Sustainable Products Regulation (ESPR)
- Task Force for Climate Related Financial Disclosures
- Task Force for Nature Related Financial Disclosures
- EU Sustainable Finance Disclosure Regulation
- Science Based Targets initiative
- Science Based Targets for Nature
- EU Product Environmental Footprint (PEF) method, which is proposing a harmonized LCA framework to quantify and communicate the impacts of products

Photo: Madeleine Brunnmeier

Challenges and limitations of LCAs in the textile industry

Limitations to LCA methodology

Although LCA can provide valuable insights, its current methodology has numerous limitations that should be carefully considered when interpreting the data. It is important to note that these limitations are consistent across any application of LCA, in any industry; these challenges are not unique to the fashion, textile, and apparel industry.

LCA studies are static, meaning they only measure impacts at a single point in time. This can make it challenging to use them for tracking progress, however this can be done if LCAs are performed at regular intervals, for example, annually or biannually. Even so, this approach can still present challenges, particularly for natural systems which can be influenced by external factors like extreme weather events that can materially affect results. Seasonality-related variability can be mitigated by collecting and averaging data over multiple years.

LCAs often average impacts across a variety of locations and geographies. These can be at a regional, country, or global level, so they may not represent location-specific differences. In some cases, average country-level impacts are assumed to be representative of global impacts, especially in the absence of more representative LCA data. Global averages may be derived from data covering multiple geographies or just a subset of production geographies. This can make it challenging to determine how averages were calculated and whether they are suitable for a specific use case.

When there are data gaps within the underlying LCA data, **secondary data** may need to be used to proxy some data points. It is sometimes not clear where secondary data has been applied in LCA studies, which may result in inappropriate use of the results.

LCA studies typically only measure a **specific set of impact areas**, such as greenhouse gas emissions, water consumption, water pollution, or waste. For example, as of the first quarter of 2025, the EU PEF[14] methodology includes 16 impact categories.[15] But these categories do not consider nature-related impact areas such as biodiversity, livelihoods,[16] or animal welfare. Although LCAs are designed to include all relevant environmental impacts, further development is needed to ensure they offer a truly **holistic approach** to measuring impact.

During the LCA development process, LCA practitioners need to make several assumptions. These assumptions can range from where and how to fill data gaps, which LCA methodologies to apply, and how to allocate impacts where a system has a number of products. These **assumptions are made at the discretion of the LCA practitioner**. This means that LCA studies can't be compared—they aren't like-for-like even for a very specific material or process.

LCA scopes cover life cycle steps that are considered anthropogenic.[17] For natural fibers and synthetic fibers, the **system boundaries are different because the types of inputs vary between these production systems**. This is one of the key reasons why Textile Exchange discourages the comparison between fiber and material categories.

A key decision often made within LCA studies is around allocation. This is how products from the same system are "assigned" a portion of the impact. The approach to allocation is **one of the most contentious topics for LCA methodology**, and there are guidelines on how to allocate impacts and preferred approaches to take included in the LCA ISO standards. However, it is ultimately the choice of the LCA practitioner to decide on the most appropriate approach to take. Allocating impacts and applying different methods can have a material impact on the overall results. LCA studies should include a sensitivity assessment of different allocation methods to help explain the final results calculated.

Regardless of how impacts are apportioned to different products within the system, the overall impact of the system remains the same, as do the actions that need to be taken to mitigate impacts. **Debates on allocating impact shouldn't be a distraction from taking action.** For natural and synthetic materials, cross-industry collaborations are required regardless of the "portion" of impact allocated to a particular product (or sector).

Photo: Madeleine Brunnmeier

Lack of holistic impact measurement

Impact areas considered within current LCAs are limited, focusing only on a subset of environmental impacts. To address this, Textile Exchange has developed its LCA+ approach, designed to complement LCA data by including impact areas typically not considered. This more holistic approach expands the scope of impact measurement and incorporates critical factors such as biodiversity, soil health, animal welfare, and livelihoods, where relevant.

In current LCAs, there are methods to account for **biodiversity** as an impact area; however, these methods are typically high-level and not context-specific. Therefore, LCA biodiversity methodologies should be considered as a screening approach, not a full biodiversity assessment.[18] Current LCA studies also partially consider **soil health** through GHG impact calculations associated with land-based raw materials. But similarly to biodiversity, this is a relatively high-level assessment considering soil carbon sequestration potentials and soil carbon content only.

To be effective, detailed biodiversity and soil health assessments need to be place-based and tracked over a number of years. This type of analysis is not feasible within current LCA methodology. As **animal welfare and livelihood** impacts are not environmental impacts, they are also not considered in current methodology.

Due to the complex nature of these "LCA+" impact areas, and because it is not always possible to quantitively measure impacts, we believe it is important to include qualitative assessments where possible. This will enable a greater contextual understanding of the interdependent impacts associated with a fiber, material, or product. This approach to holistic impact assessment is used in Textile Exchange's resources and impact tools, including the Regenerative Agriculture Outcome Framework, the Fiber and Material Matrix, and the Materials Impact Explorer.

Data limitations and variability

LCA studies are time and resource-intensive to complete, mainly because of complex primary data collection which requires hundreds of data points for each farm or facility included within the scope. Often new or additional information for farms or facilities to collect requires training for those collecting the data. Data quality and correctness checks also need to be performed throughout the process to capture potential issues in the data and misunderstanding of the data requests.

Textile Exchange's LCA studies, with the support of expert LCA consultants, work with farm groups, programs, and facilities to collect primary data. In some cases, it is the first time these groups have contributed to LCA data collection. This has meant that these groups have been able to set up their own data collection processes. This will help ease the intensity of future data collection requirements as LCA studies are updated on a more frequent basis and as on-the-ground data is collected for frameworks, such as science-based targets for nature.

Another factor contributing to data variability and comparability is the way LCA results are presented and aggregated in multiple ways—for example, as global averages or regional impacts. While global average results can provide a general indication of impact, they cannot fully replace region-specific risk assessments. The global averages must be interpreted with care, as they may not consider all sourcing locations, and important contextual differences can be lost in aggregation. LCA results should be used as an indication of impacts and further in-depth analysis needs to be performed to represent specific realities.

Photo: Carl van der Linde

Can LCA studies be compared?

LCA studies can be specifically designed to be comparative and allow for comparative assertions. For this to be the case, the specific LCAs need to meet the ISO standards relevant for comparative LCAs. There are various requirements for this, such as:

- Ensuring consistent scope boundaries
- Equivalent functional units (the products should be substitutable)
- Aligned assumptions and methodological approaches

From an ISO perspective, there is no restriction on the products that can be compared if the standard requirements are met.

Individual LCA studies that have not been built in accordance with the relevant ISO comparative LCA standards should not be compared qualitatively or quantitively, and comparative assertions should not be made between the studies. Even if two separate studies are ISO compliant, consistency in methodology and approach cannot be guaranteed. As a result, making comparisons is not based on like-for-like studies which can lead to confusion, uncertainty, and unfair, unreliable, and unjustified conclusions.

Within LCA studies, background data is used to estimate the environmental impacts occurring beyond the product system being considered, for example, to estimate the impacts of electricity generation. Background data can vary in databases, meaning the environmental impacts for the same product will be different between databases. This is another important reason to not compare LCA data outside of a comparative LCA.

Textile Exchange's position on the use of LCA data and LCA comparisons

As an organization, Textile Exchange discourages comparisons between fiber and material categories or between geographies, given the differences in production systems and geographic contexts. In particular, LCA data from synthetic and natural fibers should not be compared, given the fundamental differences in these production systems and how they are considered within LCA methodology.

While the LCA studies Textile Exchange is working on consider different production systems and/or technologies for a given fiber or material, these LCAs are not comparative, so there should be no comparative claims made using data captured within or across the studies.

Textile Exchange is aware that industry LCA databases include data covering a range of fiber and material categories. We also acknowledge that comparisons are often made—both within LCA databases and when data is extracted from them. Sometimes these comparisons use data taken directly from multiple LCA studies. This is not an appropriate use of LCA data, and no meaningful conclusions can be drawn from these comparisons.

Use of LCA data for product-level claims

Textile Exchange discourages the use of generic, averaged LCA data for making on-product claims associated with environmental impact or performance. Such data cannot account for the specific nuances between supply chains. LCA data used to support particular product claims should be based directly on a product's specific supply chain, incorporating a combination of primary data and, where appropriate, representative secondary data.

Photo: Madeleine Brunnmeier

Textile Exchange's LCA studies

A closer look at our seven LCAs currently underway

At the time of writing this document (2025), Textile Exchange is facilitating seven LCA studies for various fibers and materials; cotton, polyester, leather, cashmere, Responsible Wool Standard (RWS) wool, Responsible Mohair Standard (RMS) mohair, and nylon, focusing on raw material extraction, and in some cases, primary processing impacts.

In addition to these, Textile Exchange has developed its Life Cycle Inventory Library which houses the underlying input/output data from LCA studies. This has been created to help LCA practitioners "unlock" the data from existing LCA studies, which can be used to more efficiently develop additional or updated LCA studies, particularly for companies' specific supply chains. Textile Exchange's LCI Library is open source and available publicly—data can be submitted to and extracted from the library.

Textile Exchange intends to submit the data from its seven LCA studies to industry databases, including Higg MSI and Quantis WALDB. Because the LCA studies use the PEF methods, Textile Exchange is also submitting its LCA data to the PEF database.

Why is Textile Exchange submitting data to the EU PEF if we do not agree with the use of LCA data for product claims?

Textile Exchange plans on submitting data to the PEF database to ensure that the most up-to-date and representative data is being used for the materials covered in the seven LCA studies it is facilitating. While Textile Exchange does not endorse the use of non-supply-chain-specific LCA data for product labeling, the PEF database will be widely used. Textile Exchange believes it is important that the data included in various LCA databases used by the industry is consistent, and as up-to-date and relevant as possible.

	Steps in scope	Material in scope	Data sources	Geographic scope	LCA+
Cashmere	Farming, shearing, scouring, cleaning	1 kg fine dehaired cashmere	Primary data collection at farm level/herder level, in collaboration with in-country associations and organizations	Mongolia and China	Where relevant, studies will include the modeling of different production systems and land use change impacts. They will also include the qualitative investigation of LCA+ impact areas such as biodiversity, soil health, and deforestation, as well as a social aspect
RWS Wool		1 kg of wool tops at the primary processing gate		South Africa, Australia, New Zealand, Argentina, and Uruguay	
RMS Mohair		1 kg of greasy mohair at the farm level		South Africa	
Leather hide	Farming, slaughtering	Raw hide production	Existing data from previous LCA studies	USA, Canada, Brazil, Europe, and Australia	
Cotton	Farming, harvesting, ginning	1 kg of lint cotton at the gin gate (organic, conventional, regenerative) / recycled cotton fiber	Primary data collection at farm level, in collaboration with in-country organizations. Secondary data will also be used	Bangladesh, Brazil, China, India, Pakistan, Peru, Tanzania, Türkiye, and USA	Studies will include a social aspect, with qualitative feedback collected from data providers and social experts
Polyester	Extracting from earth (e.g., oil, gas), farming and refining, capturing from air/emissions pre-treatment, extrusion	1 kg of PET chip that can be used in textile production	Primary data collection in collaboration with organizations that cover different recycling technologies with different types of feedstocks, as well as virgin and bio-attributed materials (nylon only)	Europe, Asia, Pacific Islands, and USA	
Nylon		1 kg of nylon chip that can be used in textile production		TBC: Asia and Europe	

Textile Exchange's role in developing LCAs

Textile Exchange has a unique role to play in the facilitation of LCA study development. By engaging with stakeholder groups within and beyond our membership base, we can ensure different supply chain actors are involved and considered as part of the LCA development process.

LCA studies facilitated by Textile Exchange include the following stakeholder groups:

- **Data collection partners**—Organizations, schemes, programs, etc. who support with the collection and delivery of primary data.
- **A Project Advisory Group**—Consisting of project sponsors, such as brands and suppliers, who financially support the improvement of LCA data and provide an industry perspective on the LCA needs for a given fiber or material.
- **A Technical Advisory Group**—Consisting of material and technical experts who review initial project outputs ahead of the formal critical review process. This helps to ensure a robust, transparent, and inclusive review process.
- **Critical reviewers**—Independent third-party reviewers who assess whether the study is consistent with the principles and requirements of the relevant ISO standards.
- **Peer reviewers**—For the animal fiber and material LCA studies, journal articles are prepared and submitted for peer review. This additional level of third-party review adds to the robust and transparent review process.

Each of these stakeholder groups has a critical role to play in supporting the LCA development process, ensuring results are representative, robust, and meeting the needs of the industry.

Textile Exchange LCA resources

Each of Textile Exchange's LCA studies include the following deliverables:

- **Technical LCA reports** that have been through a third-party critical review process in accordance with the relevant ISO standards.
- **Summary reports** highlighting the key points to consider and takeaways for each LCA study.
- **FAQs** covering the key questions that have come up through the LCA development process.
- **Deep dive webinars**, designed for a technical audience, for each LCA to learn more about the methods, assumptions applied, and the results. These will be delivered by the supporting consultants for each LCA.
- For animal fiber LCAs, Textile Exchange will also release an **Animal Fiber Social Livelihoods paper** based on primary socio-economic data from the LCA data collection phase.
- Submission of LCA data to industry databases and inclusion in Textile Exchange's **LCI Library**.

Other guidance documents may include study-specific recommendations on appropriate use cases for the results and key points for applying the data. They can also include summaries of learnings gained during the LCA development process—for example, best practices for data collection methods or approaches to consultation during the review of draft and final results.

Photo: Tristan McKenzie

Conclusion

Closing thoughts

Despite its limitations, LCA is still the most widely used methodology available for calculating the impacts of materials and products in the fashion, textile, and apparel industry. Currently, there is no other way for the industry to measure brand or industry greenhouse gas footprints or to conduct intervention modeling at scale.

An LCA study is much more than the data and results included. A robust, transparent, and critically reviewed study provides important framing that must be carefully considered before data is taken and used. However, current LCA reports are not all-encompassing when it comes to capturing the full range of impacts associated with a given product—or in the case of Textile Exchange's LCAs, a fiber or material. There remain significant gaps such as nature-related impacts, animal welfare, and livelihood considerations. While understanding environmental impacts is crucial, we must give equal attention to the people involved across the supply chains and the communities, groups, and in some cases, entire nations, that depend economically on the production of certain fibers and materials.

Improving the LCA data available for the industry to use is an ongoing effort that requires support and collaboration from the industry. We also support the development and use of other methods of impact measurement that take an "LCA+" approach. Textile Exchange will continue to support industry education on the responsible use of LCA data, so that together we can fill critical impact data gaps to better inform industry-wide modeling and decision-making.

Photo: Carl van der Linde

Appendix

Definitions

Acidification

Impact category that addresses impacts due to acidifying substances in the environment. Emissions of NO_x, NH_3, and SO_x lead to releases of hydrogen ions (H+) when the gases are mineralized. The protons contribute to the acidification of soils and water when they are released in areas where the buffering capacity is low, resulting in forest decline and lake acidification.

Allocation

Partitioning the input or output flows of a process or a product system between the product system under study and one or more other product systems.

Background data

Generic data from databases that provide impact information based on industry averages or scientific studies. Background data fills data gaps for processes not directly measured in the foreground system.

Source: Background data | Ecochain

Comparative assertion

Environmental claim regarding the superiority or equivalence of one product versus a competing product that performs the same function.

Source: Comparative Assertion | Knowledge for policy

Co-products

Any of two or more products coming from the same unit process or product system.

Cradle-to-cradle

Cradle-to-cradle conforms more to the model of the circular economy. In a cradle-to-cradle model, products would be designed in a way so that at the end of their initial life they can be readily reused, or recycled, and therefore avoid landfill altogether.

Cradle-to-gate

A partial product supply chain, from the extraction of raw materials (cradle) up to the manufacturer's "gate." The distribution, storage, use stage, and end-of-life stages of the supply chain are omitted.

Cradle-to-grave

A product's life cycle that includes raw material extraction, processing, distribution, storage, use, and disposal or recycling stages. All relevant inputs and outputs are considered for all the stages of the life cycle.

Critical review

Process intended to ensure consistency between a LCA and the principles and requirements of the international standards on LCAs.

Source: Critical Review | ISO14044

Data quality

Characteristics of data that relate to their ability to satisfy stated requirements (e.g., technological representativeness, geographical representativeness, time-related representativeness, completeness, precision/uncertainty, methodological appropriateness, and consistency). In the context of LCA studies, especially including comparisons, this information can then be used to judge how far the data quality supports conclusions and recommendations from the study.

Eutrophication

The enrichment of water by nitrogen compounds, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned.

Foreground data

Foreground product data relates directly to the product being assessed, including the inputs and outputs across its life cycle. It is referred to as foreground data because it encompasses everything in the immediate product system, such as the energy (e.g., MJ, kWh) consumed or the materials (e.g., kg, m^2) used during production.

Source: Foreground data | Ecochain

Functional unit

Quantified performance of a product system for use as a reference unit.

Gate-to-gate

Gate-to-gate analysis is from factory entry gate to exit gate, and the product use/disposal phase is not included in the system boundary.

Impact category

Class representing environmental issues of concern to which life cycle inventory analysis results may be assigned.

Inputs

Product, material, or energy flow that enters a unit process.

Definitions

Inventory data

It is an inventory of input/output data with regard to the system being studied.

Source: Inventory data | ISO14044

Life cycle

Consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal.

Life Cycle Assessment

LCA is defined by the ISO 14040 as the compilation and evaluation of the inputs, outputs, and the potential environmental impacts of a product system throughout its life cycle. In this document we refer to it as the "current" LCA methodology.

LCA+

LCA+ considers context-specific impact areas and includes beneficial outcomes not captured within current LCA methodology, such as biodiversity, soil health, water, animal welfare, and livelihoods.

Life Cycle Assessment dataset

Dataset with the inventory of a process or system. Can be both unit process and LCI results and variants of these.

Source: Life Cycle Assessment Data Set | ILCD Handbook

Live Cycle Assessment study

Life cycle study that provides the life cycle inventory data of a process or system.

Source: Life Cycle Assessment Study | ILCD Handbook

Outputs

Product, material, or energy flow that leaves a unit process.

Sensitivity assessment

Systematic procedures for estimating the effects of the choices made regarding methods and data on the outcome of a study.

System boundaries

A set of criteria specifying which unit processes are part of a specific product system under study.

System boundary

Definition of aspects included or excluded from the study. For example, for a cradle-to-grave analysis, the system boundary should include all activities from the extraction of raw materials through the processing, distribution, storage, use, and disposal or recycling stages.

Photo: Madeleine Brunnmeier

Endnotes

1 Shifting sourcing to low-carbon geographies is discouraged by SBTi FLAG guidance (p. 48), which emphasizes engagement and improvement in existing supply regions to promote long-term sustainability outcomes (Anderson et al., 2022).

2 Scope 3 emissions are all indirect emissions that occur in a company's value chain including both upstream and downstream emissions (excluding scope 2 emissions). GHG Protocol. 2022. Scope 3 Frequently Asked Questions. https://ghgprotocol.org/sites/default/files/standards_supporting/Scope 3 Detailed FAQ.pdf

3 Apparel Impact Institute. (2024). Taking Stock of Progress Against the Roadmap to Net Zero. https://apparelimpact.org/wp-content/uploads/2024/05/Taking-Stock-of-Progress-Against-the-Roadmap-to-Net-Zero-2024-5.15.pdf

4 Textile Exchange and the Apparel Alliance. (2024). Supply Chain Taxonomy – For the textile, apparel and fashion industry. https://textileexchange.org/app/uploads/2024/12/Supply-Chain-Taxonomy.pdf

5 ISO 14040:2006 Environmental management — Life cycle assessment — Principles and framework. https://www.iso.org/standard/37456.html

6 There are two International Organization for Standardization (ISO) standards relating to LCA study development. ISO 14040: This standard provides the foundational principles and framework for LCAs. ISO 14044: This standard deep dives into how to conduct an LCA, with detailed guidance for implementing each step of an LCA.

7 There are two types of LCA study: attributional and consequential. LCAs used by the fashion, textile, and apparel industry are attributional LCAs. More information on these approaches can be found here: https://consequential-lca.org/clca/why-and-when

8 The information included here is a snapshot of the specific requirements for each LCA step. To learn more or have further details, it is suggested to look into ISO 14040 and ISO 14044.

9 An important note is that a LCA is based on a product's life cycle and multiple environmental impacts. If only part of the product's life cycle is included, then this is a partial LCA as explained in the section 'What is the scope of an LCA?'. In addition, if just one environmental impact is included in the scope, for example GHGs, this would be a partial carbon footprint.

10 The European Union Product Environmental Footprint (PEF) considers 16 environmental impact categories. Textile Exchange's LCA studies cover all 16 PEF impact categories. The PEF impact methods will expand to include a biodiversity risk score and a microplastics assessment. These methods will only be included once they are considered to be robust enough to use.

11 PEF Apparel Footwear. (2025). What's behind the methodology? https://pefapparelandfootwear.eu/whats-behind-the-methodology/#datarequirements

12 Ecoinvent is a database of environmental impact data for various sectors and processes. Learn more https://ecoinvent.org

13 There are two ISO standards for LCA study development – ISO 14040 and ISO 14044.

14 As of May 2025, the Product Environmental Footprint Category Rules (PEFCR) have been approved by the European Commission.

15 PEF Apparel Footwear. (2025). What is the value of the PEF and PEFCR? https://pefapparelandfootwear.eu

16 In addition to environmental LCAs there are methodologies available for social life cycle assessments (S-LCA). These methodologies can be used to assess the social and sociological aspects of products. More information on social LCAs can be found here: https://www.lifecycleinitiative.org/starting-life-cycle-thinking/life-cycle-approaches/social-lca

17 LCAs consider processes that are as a result of human activity only.

18 Damiani, M., Sinkko, T., Caldeira, C., Tosches, D., Robuchon, M., & Sala, S. (2023). Critical review of methods and models for biodiversity impact assessment and their applicability in the LCA context. Environmental Impact Assessment Review. https://doi.org/10.1016/j.eiar.2023.107134