A standardised tool designed to inform and guide sustainability strategies in manufacturing, life cycle assessment has an ever-evolving science behind it.

For good measure

You can't manage what you don't measure. As headlines remind us daily of the impact that manufacturing and using products have on the environment, the need to measure this impact is essential, if not critical. This is the reasoning behind life cycle assessment (LCA) and thinking. For a given product, process or service, it quantifies inputs and outputs, calculating their impact on the environment and various resources such as water, carbon, fossil fuels, land use, and other aspects. It is the basis of the scoring system of the Materials Sustainability Index (MSI), originally set up by Nike and then gifted to the Sustainable Apparel Coalition (SAC) that integrated it as a module of the Higg Index in 2010. It is also the basis chosen for the European Union's Product Environmental Footprint (PEF) project. The tool is used to evaluate all types of products and its influence is growing. But it is also in constant flux and, as a result, LCAs can become inoperative after only a few years if new processes are implemented or legislation and standards change.

The SAC updates the MSI database twice yearly, an indication of how fast new information is generated and integrated into the platform. Its applications can also be varied. The SAC's 250 members use the module for different reasons, says Julie Brown, Higg Index Director. "Some brands create their own preferred fibre lists, others use it to train their staff on environmental sourcing, and still others to calculate the impacts of their own supply chain." The US-based organisation is currently in talks with the European Union to merge the MSI with the PEF programme.

Quantis, a sustainability consultancy, has developed another such programme, the World Apparel & Footwear Life Cycle Assessment Database (WALDB) with industry partners.

It is said to contain more than 550 datasets on raw materials including natural, synthetic and recycled fibres, apparel and footwear production processes as well as use-phase and end-of-life



Turkish denim specialist Isko has conducted life cycle assessments on all of its denim fabrics and has recently joined the Textile Exchange as part of its commitment to responsible manufacturing. The recently launched Arquas and Vital ranges target activewear end-uses.

Isko

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Italian warp knitter Eurojersey has been measuring its impact on the environment for years and obtained Product Environmental Footprint (PEF) certification for its patented Sensitive Fabrics.

Eurojersey

treatment steps. According to the company, it was set up, to address "an immediate need for robust and harmonised data in the apparel and footwear industries to set a clear path to make changes that count."

Standardised and widely recognised, LCA has become the go-to technique to identify high impact areas, known as hotspots, benchmark different sourcing options and material choices, and communicate the sustainability characteristics of a product. It is not, however, without shortcomings.

LCA is a metric system designed to measure quantifiable parameters. It is one of the flagship tools of industrial ecology and has been since the early 1990s, states Roland Geyer, professor of industrial ecology at the Bren School of Environmental Science and Management of the University of California at Santa Barbara. Traditional applications for LCAs are twofold: it can be used to identify hotspots or to compare alternatives, between two different materials or two dyeing processes, for example. "Some queries are fairly straightforward, such as comparing standard polyester with recycled polyester. As these materials are relatively similar, the metrics will also be similar, and the result can be used to make decisions," he says. Comparing natural and synthetic fibres can be more problematical. "Things get complicated because the impacts related to agriculture can be very different from those pertaining to industrial process and more challenging to compare."

Number crunchers

LCA experts often point out that an LCA should be used to compare comparable inputs, not to shift the burden elsewhere. "The risk of swapping a known bad for something that is not known can lead to regrettable substitutions," warns Michael Brown, managing partner at sustainability consulting firm Brown and Wilmanns Environmental, also based in Santa Barbara. A proponent of life cycle thinking, more than life cycle assessment, he believes this "fancy name for an accounting system" works best for industrial processes that do not change much over time. "Some manufacturing supply chains are not as stable as, say, mining," he points out. Irrigation and pest management for cotton growers in the United States will depend on weather and local conditions that are not the same in other regions of the world.

Compiling data for wool or cotton fibre production from countries as different as India, the United States and New Zealand to calculate a global average can lead to errors that can have a negative effect on a material's sustainability score. Allocation methods for supply chains that generate multiple end-products are regularly cited as a source of contention in LCA thinking. Economic weighting is the preferred metric



Looking to expand its understanding of the environmental and social impact of its activities, Swedish brand Houdini has undertaken a Planetary Boundaries Assessment. This system takes a broader view which includes understanding how sheep farming and grazing affect the impact that wool garments have on biological diversity in local ecosystems, the company says.

Houdini Sportswear

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Consultancy Quantis conducted a life cycle analysis on Naia, an acetate fibre manufactured by US fibre producer Eastman. The company's new sourcing policy from sustainably managed pine and eucalyptus woods will have had an impact on its score in LCA databases.

Eastman

for many organisations. Cotton Inc. applies it to cotton farming, allotting 83% of the value to cotton fibre and 17% to seeds.

Other methods will yield very different results. Depending on the farm, some point out, seeds may be trashed, used for oil, turned into cow feed or even mulch. Those end-uses will not have the same economic value. This is where what appears to be a simple accounting system gets complicated. Some allocation methods prefer to use mass or caloric value, specifically with regards to animal farming. These, argues Mr Brown, are social values and this is where his vision of LCA thinking differs from mainstream approaches. "Some will look for an allocation method that makes wool look good," he says. And this also applies to synthetic fibres, as their LCAs must decide on an allocation of the portion of gas, crack oil or coal mining used for plastics production.

Among the major impact areas covered by an LCA, Mr Geyer says greenhouse gas emissions, often used as a synonym for carbon footprint, are the least controversial. But the impact of agriculture on soil or biodiversity is less well known. "We are still trying to figure that out," he says. LCA is therefore a "wonderful tool", but it can be risky as "some numbers are more meaningful than others. That is when LCA turns from being a science into something closer to an art."

Data quality

LCA is ultimately based on information, and this has put a considerable burden on fibre and fabric suppliers. "My mantra is that all information has a cost," says Mr Brown. It can be financial, administrative and time-consuming. "Fabric manufacturers are the focal point for many requests for information as this is where the data needed for a life cycle assessment is best obtained." Whether a company is vertically integrated or not, it nonetheless inevitably buys some raw materials and chemicals from other suppliers. "Fabric manufacturers can legitimately state that all they do is convert materials; they don't grow cotton nor do they extract petrol," he says.

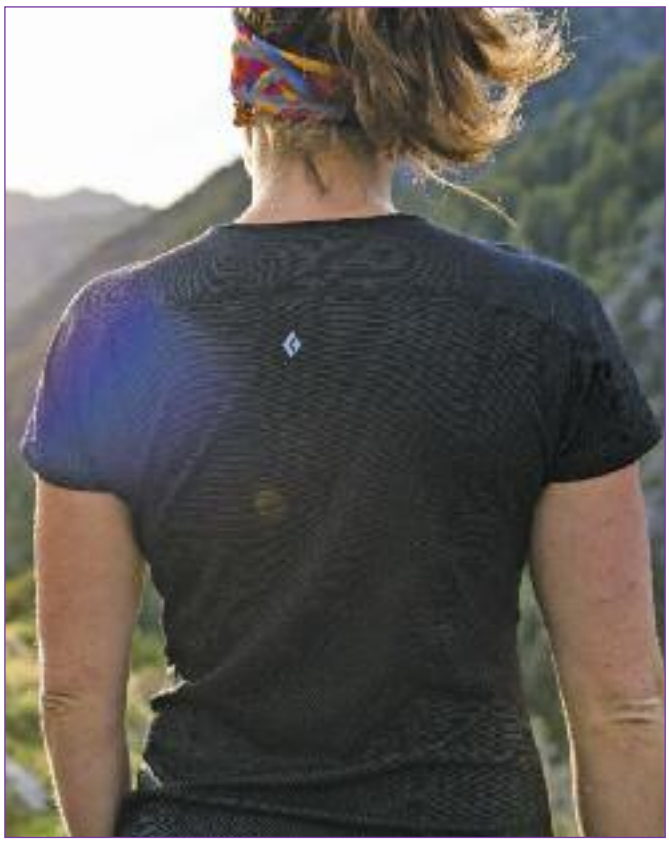
Synthetic fibre manufacturing processes supply data that is easier to measure and impacts that are easier to model, admits Ms Brown at the SAC. But she says that Cotton Inc and the International Wool Textile Organisation (IWTO) have collected "huge amounts of data" and shared it with the SAC to add to the natural fibre knowledge base. This is what makes LCA thinking a work in progress, "and the Higg Index an ever-evolving tool".

The SAC is currently working on expanding its database to include a module dedicated to finished products (apparel, footwear and home textiles). The Higg Index focuses exclusively on raw materials, and the upcoming Product Module will leverage available data from it and add Tier 1 processes (manufacturing, assembly) and logistics (transportation, stock, retail), Ms Brown tells *WSA*. This new addition "will bridge the existing design and development module and the Higg Index," and should be rolled out early next year.

A broader vision

Most LCAs used by manufacturers and brands cover a product's impact from cradle-to-gate (factory door) and rarely take into account either the user-phase or end of life. For both of these, the Higg Index makes assumptions drawn from existing datasets.

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The Woolmark Company believes microplastic pollution should be added to the main impact categories covered by most LCAs. Shown here, a new development for Black Diamond based on Nuyarn technology in which a superfine Merino wool yarn is wound around a nylon core for added performance.

The Woolmark Company

With regards to the user-phase, thought to have a high impact on resources, data has yet to be scientifically analysed. It is relatively easy to determine how much energy and water modern washing machines require, but it is much trickier to measure precisely how many times consumers launder their clothes, remarks Angela Adams, senior sustainability consultant for apparel at Quantis. This is a point often raised by the wool industry that believes wool garments are washed less often than others.

Another grey area is the issue of microfibre pollution, which is under consideration as a possible new key impact area. Research has begun with the Plastic Leak Project, a programme in which Quantis is involved. "Microfibre emissions and synthetics made from coal are perfect examples of changes in an industry that will have a significant impact on LCA data," says Mr Brown. He even believes they are being "turned upside down".

Despite its shortcomings, using LCA is always educational and always useful, Mr Geyer stresses. It is very rare that a company will not learn something from it. But, he says "users should not expect the numbers to be straightforward and directly actionable. This is not because the tool is bad, it is because environmental questions are complex."

It may not be a perfect tool, admits Ms Adams, but she also says we do not have time to wait for a better one. Despite its limitations, as not all impacts are easily quantifiable nor are they always comparable, LCA is widely regarded as a helpful resource in an ever-changing sustainability landscape.

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