

From one-off LCA to decision-ready environmental data

How automation can make life-cycle assessment easier to scale, update and use **without compromising scientific rigour.**



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THE CHALLENGE

The challenge is doing all of this repeatedly and at scale.

What may once have been an LCA for a selected product every few years increasingly needs to become analysis that can be repeated and updated across many more products and decisions.

THE PRINCIPLE

Better data where it changes action.

The relevant question is therefore not whether the data is perfect, but whether it is sufficiently representative and reliable for the purpose at hand.

THE MODEL

Start with what is available. Improve what matters. Keep it updateable.

The common principle is to put greater effort into the information that could materially affect the outcome.

INDEPENDENT EXPERT CONTRIBUTION



"Tools such as Unibloom Automated LCA could help bring Life Cycle Assessment into the hands of a much wider range of users."

— Dr Orla Williams, Assistant Professor, University of Nottingham

Introduction

Companies increasingly need product-level environmental information - not only for reporting and internal decisions, but also to respond to customers asking for specific emission data and meet new regulations in marketing claims and Digital Product Passport (DPP).

The challenge is no longer only producing a Life Cycle Assessment (LCA) for one or two priority products. As customer requests increase and companies need to understand impacts across larger product portfolios, environmental assessment has to become much easier to scale. What may once have been an LCA for a selected product every few years increasingly needs to become analysis that can be repeated and updated across many more products and decisions.

The available environmental data may not sufficiently represent the material, geography or production process being assessed. Finding the right emission factors, filling important gaps and turning product and supply-chain information into a robust LCA can take significant manual work and specialist expertise. Too often, the information comes too late to be able to respond efficiently to a customer request or to influence the sourcing, innovation or product decision itself.

Automation offers an opportunity to change this. Repeatable calculation frameworks and the automation of model creation using product and process information, alongside relevant emission factors, can make LCA faster and easier to repeat across more products.

Context-specific emission-factor prediction could help address important data gaps where sufficiently representative factors are unavailable. And updateable models can make it easier to recalculate results when products, suppliers or underlying information change.

The value goes beyond faster environmental reporting.

If sufficiently reliable information is available earlier, it can help teams respond to customer requests and RFPs and inform sourcing, product and innovation decisions while there is still time to act. The methodology, assumptions and uncertainty behind the results still need to remain transparent.

Why product-level environmental data matters to the business

Environmental data has traditionally been closely associated with sustainability teams, reporting and corporate targets. Increasingly, however, that information is needed across the business.

Many of the decisions that ultimately affect a product's environmental impact are made elsewhere in the business.

PROCUREMENT

Procurement selects suppliers and materials.

R&D AND INNOVATION

R&D and innovation teams make choices about product design, ingredients and production methods.

SALES

Sales teams respond to customer requests for product-level information.

MARKETING

Marketing needs evidence to support environmental claims.

FINANCE AND LEADERSHIP

Finance and leadership assess investments and business priorities.

The value and practical use of environmental information therefore depend partly on when it becomes available. Knowing the impact of a sourcing decision after the contract has been signed may help with reporting. Knowing it while alternatives are being evaluated can help procurement make a different choice.

The same applies in product development. Comparing environmental impacts while materials, ingredients or production methods are still being considered makes the information part of the decision itself.

Environmental data is therefore becoming more than a way of measuring what has happened. It can help the business decide what to do next - and make those decisions with better information.

Why LCA has been difficult to scale

Life Cycle Assessment can sound complex, but its purpose is relatively straightforward. It is a structured way of understanding the environmental impacts associated with delivering a product or service. This means connecting information about materials, energy, production, transport and other activities to their potential environmental impacts.

A broad LCA can assess environmental impacts beyond climate, such as water use, land use and other impacts. Unibloom's automated LCA tool looks at emissions in detail across the processes that make up a product's life cycle, rather than just focusing on the headline overall emissions number. With this information, companies can see where emissions occur, what is driving them and how changes to materials, suppliers, energy sources or production processes could affect the result.

This additional detail makes the analysis more useful. It can help teams understand where action could make the greatest difference, compare alternatives and provide more precise product-level emissions information when customers ask for it.

Going into greater detail also requires more data - and this is often where gaps appear. Suppliers may not hold all the information needed about individual processes or areas such as land use, chemical flows and end-of-life. Where sufficiently representative data is not available, predicted values can help fill important gaps and allow the assessment to continue rather than waiting for every data point to become available.

The challenge is doing all of this repeatedly and at scale.

Building a robust LCA can require significant work. Product and supply-chain information needs to be collected and interpreted, relevant processes and material flows identified, and suitable background data and emission factors found. Units, yields and losses may need to be reconciled, while methodological decisions still need to be made around issues such as system boundaries, allocation, assumptions and missing data.

Traditionally, much of this work has been manual and has required specialist expertise. That makes it difficult to repeat the process quickly across a large product portfolio or whenever products, suppliers or underlying data change.

Automation can reduce that effort. Product and process information can be structured, relevant background data and emission factors matched, repeatable calculations performed, and models updated and recalculated when inputs change. AI could take this further. For example, a user could describe a product and its production process in natural language and use AI to create an initial structured model for review and refinement.

The methodology itself does not change. Decisions about boundaries, allocation, data quality, assumptions and interpretation still need to be made,

and specialist expertise remains important where judgement is required. What changes is the amount of manual work needed to apply those methods repeatedly. This can make it faster to respond to customer requests and more practical to use climate information in procurement, innovation and product decisions while those decisions can still be influenced.

As companies move from assessing a small number of priority products to understanding climate impact across much larger portfolios, this becomes increasingly important. The challenge is no longer simply producing an LCA. It is being able to repeat, update and improve the analysis without starting again each time.

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DATA QUALITY

How good does your environmental data need to be?

Making LCA easier and more scalable depends on the data behind it. Automation can reduce manual work, but the result is only useful if the underlying data is sufficiently representative for the decision being made.

That does not mean every assessment requires perfect data. Not every business question requires the same level of environmental data. For identifying the largest emissions hotspots in a product, industry-average data may provide a reasonable starting point.

A sourcing decision may require more specific information, particularly if the differences between alternatives are small enough that better data could change the choice. Customer requests will vary depending on how the information will be used. And information supporting an external environmental claim will generally require greater scrutiny, transparency and, where necessary, independent verification.

The relevant question is therefore not whether the data is perfect, but whether it is sufficiently representative and reliable for the purpose at hand.

Data quality is also about more than whether information comes from a primary or secondary source.

What counts as sufficiently good data depends on how the result will be used. Industry-average data may be adequate for identifying a hotspot, while a close comparison between suppliers may require more representative data. Information used to support an external claim may require greater scrutiny and validation.



Dr Orla Williams, Assistant Professor, University of Nottingham, points to four dimensions that can determine whether environmental data is truly representative: technology, geography, time period and operating conditions.

1

Technology

2

Geography

3

Time period

4

Operating
conditions

Better data is not simply more data. It is data that better reflects the process, location, period and operating conditions being assessed, and is sufficiently reliable for the decision or communication it needs to support.

A high-quality data point may still be a poor choice if it represents a very different production context.

In manufacturing, detailed data on energy and material use is not always available. Standard assumptions can fill the gaps, but they may not reflect how a product is actually made. That can affect the emissions calculation - and potentially hide opportunities to reduce energy and material costs.

Similarly, supplier-specific information can be extremely valuable, but primary data is not automatically better. A supplier figure based on incomplete information, uncertain allocation or missing upstream inputs should not automatically replace suitable secondary data simply because it comes directly from the supplier.

Uncertainty also needs to be considered.

Environmental calculations can produce precise-looking numbers, but those numbers are based on data, assumptions and modelling choices that may themselves contain uncertainty. That should be understood rather than hidden.

Companies therefore need to know what the data represents, how reliable it is and whether it is appropriate for the decision being made.

A useful principle is:

Better data where it changes action.

4

DATA GAPS

What happens when the right data **doesn't exist?**

Environmental databases are essential to LCA, but no database can cover every combination of material, production method, geography, supplier and operating condition. When the right data is not available, companies often have to use an industry average, a proxy or the closest available emission factor.

Sometimes that is sufficient. In other cases, the context can materially change the result.

AGRICULTURE

Agriculture is a good example. The climate impact of a crop can vary depending on factors such as fertiliser use, farming practices and land use. The same crop grown on established agricultural land can have a very different footprint from one associated with recent land conversion or drained peatland.

ALUMINIUM

Aluminium provides another example: its emissions can vary significantly depending on the electricity used in production and the proportion of recycled material. A generic emission factor may therefore represent a very different production context from the product a company actually buys.

Averages and proxies can be entirely appropriate, provided they are sufficiently representative for the intended use.

Matching and prediction are not the same thing

MATCHING

Matching means finding the most appropriate emission factor that already exists.

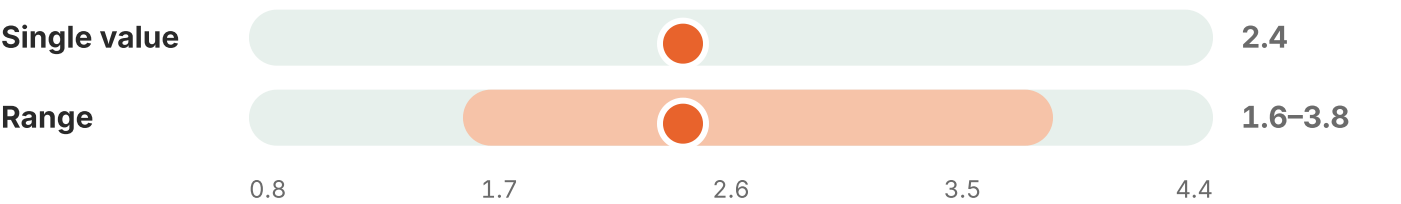
PREDICTION

Prediction means estimating a value for a context that is not adequately represented in the available data.

The Unibloom Emission Predictor helps address these gaps. It complements a company's own data by estimating context-specific emission factors where sufficiently representative primary data is not available. In some cases, this can provide a more representative proxy than a generic database value, allowing the assessment to move forward quickly rather than waiting for every data point to become available.

The prediction can take account of information that is known about the context, such as production route, electricity or heat source, material composition, recycled content, yield, losses, transport or agricultural practices. The aim is to use that information to produce an estimate that is more representative of the actual situation than a poorly matched generic value.

This does not mean treating a predicted value as measured primary data. Its usefulness depends on knowing how the estimate was produced and how much confidence can reasonably be placed in it. The underlying data, assumptions and uncertainty therefore need to remain visible.



For example, presenting an estimate as 2.4 kg CO₂e/kg can imply a level of precision that the available evidence may not support. If the underlying uncertainty is significant, a range such as 1.6–3.8 kg CO₂e/kg may provide a more useful picture for decision-making.

There will also be situations where the available information is simply not sufficient to make a reliable prediction. In those cases, the right response may be to collect better primary data or involve an expert in a more detailed assessment.

The role of prediction is therefore not to replace primary data or established environmental databases. It is to complement them: helping companies fill

important data gaps, make progress more quickly and identify where better data would materially improve the assessment.

This is also the approach behind Unibloom’s solution. Depending on the intended use and available information, an assessment can combine primary data, sufficiently representative secondary data and, where important gaps remain, context-specific estimates from the Unibloom Emission Predictor. Relevant research can also be used to support model inputs such as energy consumption or transportation data where company-specific information is unavailable. The aim is to use the most appropriate information available while keeping its source, assumptions and uncertainty transparent.

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UPDATEABLE

From one-off assessment to updateable LCA

Even a scientifically robust assessment has another limitation: the world it describes does not stand still.

Suppliers change.

Materials and ingredients change.

Sourcing locations change.

Energy sources change.

Production processes improve.

Better primary data becomes available.

An LCA therefore becomes more useful if the underlying model can be updated and recalculated rather than rebuilt from scratch. It can then reflect changes that have already happened and also be used to test possible changes before they are made. Better supplier data can replace an earlier estimate. A new sourcing location can be tested. An alternative material can be compared. A change in energy source can be reflected in the calculation.

It is important to be clear about what “updateable” means. It does not mean that a system automatically knows every time something changes in a company’s supply chain. It means maintaining the underlying model so that new or changed information can be added and the results recalculated.

This is where automation can have an impact beyond simply saving time on one assessment. If data preparation, model construction and calculation become easier to repeat, companies can potentially maintain environmental analysis across a much larger number of products.

Instead of producing a relatively small number of static assessments, they can create analyses that evolve as products, supply chains and the underlying data change. That also allows estimates to be progressively improved. A company may start with secondary data where that is sufficient and replace it with more representative supplier or primary data when it becomes available.

An updateable assessment can therefore do more than describe a product at a particular point in time. It can also support forward-looking scenarios by showing how the result could change with a different material, supplier,

sourcing location or production process. This makes environmental assessment more useful as a business decision tool.

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RIGOUR

Making LCA easier **without lowering the standard**

Making LCA easier, more transparent and more flexible to use should not come at the expense of scientific rigour. As environmental information becomes accessible to more people across the business, transparency around the data, assumptions and methodology becomes even more important.

Users need to understand what sits behind a result: where the data came from, which methodology was used, what assumptions were made, where uncertainty exists and what the limitations are. There needs to be a clear “receipt” behind the calculation: the source data, assumptions, methodology and uncertainty should remain visible.

As Dr Orla Williams, Assistant Professor, University of Nottingham, argues, the objective should not be to hide the complexity of LCA, but to manage it through automation while keeping data provenance, assumptions, limitations and uncertainty visible.

Scientific rigour means that an assessment is methodologically sound, uses information appropriate for its purpose and is sufficiently transparent for the result to be understood and evaluated.

Automation can help maintain this transparency while reducing some of the repetitive work involved.

Applying established rules consistently can reduce repetitive work and some forms of human error. Documentation of sources, assumptions and calculations can also become part of the process rather than something reconstructed afterwards.

INDEPENDENT EXPERT CONTRIBUTION



“Tools such as Unibloom Automated LCA could help bring Life Cycle Assessment into the hands of a much wider range of users. Rather than being something carried out only by specialists, in-depth environmental assessment could become a routine part of engineering and business practice.”

— Dr Orla Williams, Assistant Professor, University of Nottingham

A practical model for decision-ready environmental information

A more scalable approach to product-level environmental information does not mean applying the same data or level of analysis to every question.

It means combining different approaches depending on what the business needs, what information is available and how the result will be used.

WHEN YOU NEED TO...	A PRACTICAL APPROACH	WHAT THIS ENABLES
Start with the best available data	Use the company's own primary or supplier data where available, complemented by suitable established database factors and secondary data.	Start with the best sufficiently representative information available rather than waiting for perfect data everywhere.
Address important data gaps	Where sufficiently representative primary or database data cannot be found, assess whether context-specific prediction can provide a scientifically defensible estimate.	Avoid automatically relying on a poorly matched generic proxy, while making the uncertainty of an estimated value visible.
Build the assessment	Automate repeatable parts of data preparation, life-cycle modelling and calculation	Make LCA practical across more products and reduce repetitive manual work
Understand how reliable the result is	Make data sources, assumptions, methodology, limitations and uncertainty visible	Allow users to judge whether the information is appropriate for the decision
Improve the data where it matters	Replace estimates or secondary data with more representative supplier or primary data when this could materially affect the outcome	Focus time and resources on better data where it changes action
Test alternatives	Change materials, suppliers, sourcing locations or production assumptions and recalculate	Compare options while the business can still influence the decision
Keep the assessment relevant	Update the underlying model as products, suppliers, processes and better information change	Move from a one-off assessment towards environmental information that evolves with the business
Apply deeper expertise where needed	Bring in LCA specialists for complex methodological choices, validation or higher-scrutiny uses	Combine greater accessibility with scientific rigour

These are not separate steps that always need to happen in the same order. The level of data, automation and specialist involvement should depend on the question being answered.

A company might start with its own primary or supplier data where available, use suitable established database factors to fill other needs, and improve or

estimate data where an important gap could affect the decision. Specialist expertise can then be brought in where the complexity or intended use requires it.

This creates a more practical model for environmental assessment:

Start with what is available. Improve what matters. Keep it updateable.

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ACTION

Better data where it changes action

Making environmental information more useful is not simply about collecting more data. It is about giving companies a practical way to work with the best information available, understand its limitations and improve it where greater accuracy matters.

Automation can make LCA easier to create, repeat and update. Context-specific prediction could help address important gaps where sufficiently representative emission factors are unavailable. Together, these capabilities can also change how LCA is used: from an occasional assessment of what has already happened towards an updateable way to compare what could happen next. Transparency, uncertainty and expert judgement help ensure that greater accessibility does not come at the expense of scientific rigour.

Together, these developments could bring product-level environmental information closer to the decisions where it can create most value. The people making those decisions do not need to become LCA experts, but they do need environmental information they can understand, trust and use.

PROCUREMENT

For procurement, that could mean comparing sourcing options before a supplier is selected.

R&D AND INNOVATION

For R&D and innovation, it could mean testing materials or production scenarios while choices are still open.

SUSTAINABILITY

For sustainability teams, it could mean identifying where better evidence is worth pursuing rather than treating every data gap in the same way.

The common principle is to put greater effort into the information that could materially affect the outcome.

Better data where it changes action.

Ultimately, better environmental data creates value when it helps the business make better decisions.

The Unibloom perspective

At Unibloom, we are working to make product-level environmental information easier to access, update and use in everyday business operations, while keeping the underlying data, assumptions and uncertainty transparent.

By combining automated life-cycle modelling with context-specific emission-factor prediction, we want to make LCA faster and more affordable to apply across more products and for more people in the business. It can also help companies respond to customer requests for Product Carbon Footprints (PCFs). The aim is to make better use of the data companies already have, address important gaps and make it easier to update the analysis as better information becomes available.

Ultimately, we believe environmental assessment should help companies look forward, not only explain what has already happened. It should help teams test alternatives, understand the impact of different choices and use that information while there is still time to influence the decision.



Independent expert contribution

This paper includes perspectives from Dr Orla Williams, Assistant Professor, University of Nottingham, whose work includes life cycle assessment and sustainable manufacturing. Her contribution informs the discussion of data representativeness, responsible use of predicted data and maintaining scientific rigour as LCA becomes more accessible.

Unibloom. The data company for sustainable procurement.

Affordable, easy to use and delivers data at speed. With Unibloom Automated LCA, either describe the product in your own words, or upload the files you already have with data about the product. Unibloom builds the value chain, calculates the footprint with the source behind every number, and lets anyone in the business test a change.

1

Describe it or upload your files

2

Unibloom builds the value chain

3

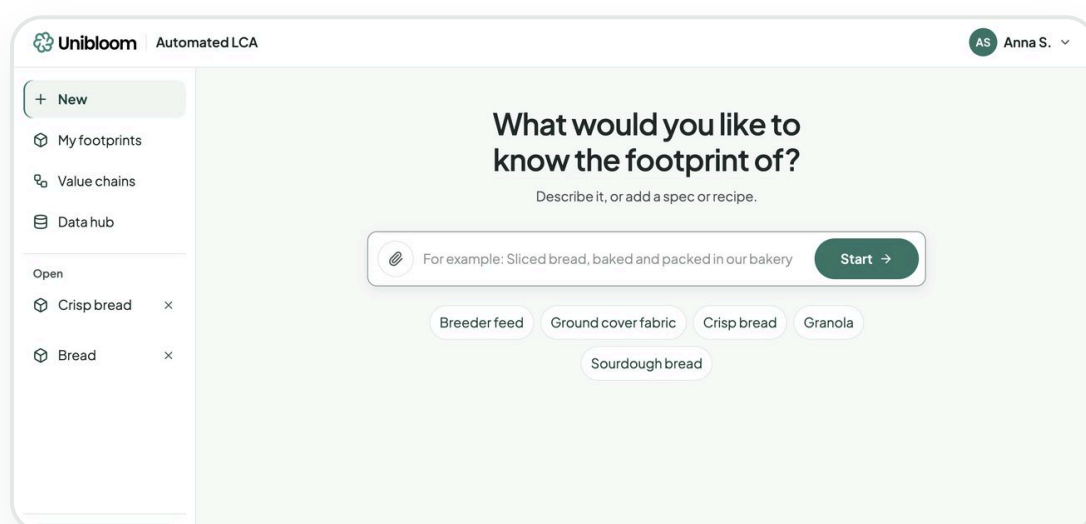
Get an auditable footprint

4

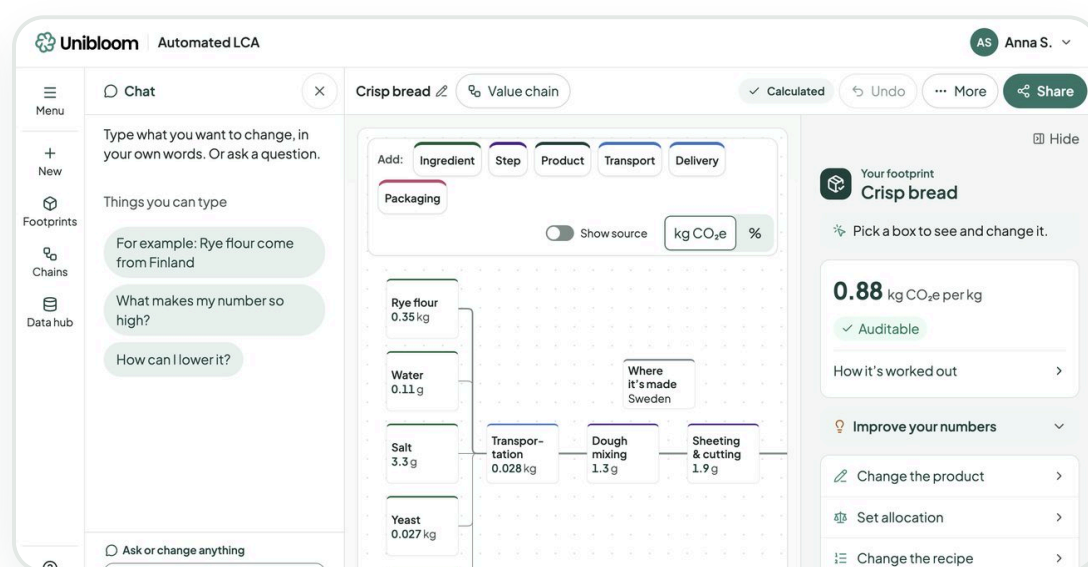
Improve your numbers



Data changed or improved? Update and recalculate, without starting from scratch.



1 • Describe it or upload your files. Natural-language input, or attach the product data you already have.



2-4 • Value chain, footprint, improve. Crisp bread at 0.88 kg CO₂e per kg, auditable, with chat and what-ifs alongside.

Start with what is available. Improve what matters.

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