Climate Action Accelerator

Avec la participation de MINISTÈRE DE L'EUROPE ET DES AFFAIRES ÉTRANGÈRES

hulo

APPENDIX 1

PRICE COMPARISON AND ENVIRONMENTAL ANALYSIS METHODOLOGIES

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1. INTRODUCTION

This document explains **how the Accelerator and hulo conducted comparative price, Total Cost of Ownership (TCO) and simplified Life Cycle Assessments (LCAs) analyses and studies to inform procurement decisions for humanitarian operations.**

This document describes the actual approach across three complementary methodologies, the tools used, the specific environmental indicators measured, and the key decisions made to balance analytical rigour with practical constraints.

The three analyses work together to provide a comprehensive picture: comparative price analysis examines market price differences between conventional and alternative products at a given point in time across Lebanese suppliers; TCO calculates the full financial cost of ownership over time; and LCA quantifies environmental impacts across the product lifecycle.

This document serves as a transparent account of the work completed, allowing readers to understand how the figures presented in the procurement factsheets were derived and where the limitations lie. It is intended for both procurement specialists who may replicate this approach and general readers who want to understand what price analysis, TCO, and LCA tell us about sustainability, cost, and market reality.

What is comparative price analysis?

Comparative price analysis examines the gross prices of conventional products against alternative products with sustainable technical specifications at a specific point in time. The purpose is to answer a straightforward question: *are alternative products necessarily more expensive than conventional options?* By comparing prices across Lebanese suppliers and markets, pricing trends can be identified and then it can be determined whether sustainability and environmental performance come at a cost premium or whether viable lower-cost alternatives exist.

This price comparison is fundamentally a snapshot: it captures price differences at one moment in time and reflects the particular context, order volumes, supplier availability, and market dynamics of that period. Price differences may shift considerably over time as market conditions change, production scales increase, or supplier networks expand. The analysis does not predict future prices but rather describes the current landscape and identifies whether price barriers exist for sustainable alternatives.

What is total cost of ownership?

Total Cost of Ownership (TCO) is a financial accounting method that calculates the complete cost of owning and operating an asset across its entire useful life, rather than

just its purchase price. TCO demands to think beyond initial purchase price, it extends further to capture all costs throughout the product's lifecycle.
A humanitarian organisation purchasing printers, vehicles, or even simple items like blankets often makes procurement decisions based on the purchase price only. However, TCO might reveal that the cheapest option is often the most expensive when all costs are summed over time.

What is a life cycle assessment?

A Life Cycle Assessment (LCA) is a systematic method for evaluating the environmental impacts of a product or service across its entire lifespan. Crucially, LCA looks beyond manufacturing and purchase price. It traces the environmental consequences from the moment raw materials are extracted from the earth, through production and transportation, across the product's use phase, and finally through end-of-life disposal. By considering this complete picture, LCA reveals impacts that might be hidden if only the purchase price or use phase alone is considered.

LCA measures impact across multiple environmental categories, these typically include climate change (measured in CO2 equivalents), water consumption, eutrophication (excess nutrient pollution), resource depletion, acidification, and impacts on human health.

Different products affect the environment in fundamentally different ways, and a comprehensive assessment must capture this diversity rather than reducing all impacts to a single metric.

Why use all three approaches?

Price analysis, TCO, and LCA answer distinct but complementary questions. Price analysis is market-focused and temporal: what are current prices, and does sustainability cost more in Lebanon at a specific time? TCO is financial and lifecycle-focused: what is the true cost of ownership over the product's useful life? LCA is environmental: which option places the least burden on the planet and human health?

These three questions matter for different reasons. Price analysis reveals immediate market reality and barriers to adoption. TCO reveals financial reality beyond purchase price; an expensive upfront investment may save money over time. LCA reveals genuine environmental impacts that price cannot capture, a cheap option might pollute water supplies or expose workers to toxic chemicals.

By using all three tools together, procurement decisions that promote price competitiveness, financial sustainability and the achievement of environmental objectives can be identified. This also highlights where trade-offs are necessary, where

environmental benefits come at financial cost, or where current market prices favour conventional options, enabling informed procurement decisions.

2. PRICE COMPARISON

The approach

The methodology for identifying the reference prices used for conventional and sustainable products is presented by product type in the table below.

10 priority items:

#	Item/ service	Price used for conventional items / services	Price used for alternative items / services
1	**Tee-Shirt**	To ensure a more representative picture of the prices charged by suppliers to humanitarian organizations participating in hulo initiatives, the prices used for "conventional" items are the average of the prices offered by the suppliers selected through the July 2024 joint NFI tender (Joint Procurement Initiatives: JPI). For each item, the price is therefore the average of the prices offered by suppliers for that same item. Prices are in USD VAT excluded in Lebanon.	Prices excluding VAT in USD, July 2026 in Lebanon – a sustainable product price from a specific company identified as an alternative and sustainable option.
2	**Soap**		
3	**Bucket**		
4	**Blanket**		
5	**Printer**	The reference prices for these items are the prices charged by the suppliers of the NGO Solidarités International in Lebanon in July 2026, in USD, excluding VAT. For the efficiency of the process, the NGO Solidarités International was chosen to provide the reference prices, as it is the NGO that supports the Hulo cooperative in Lebanon.	
6	**Laptop**		
7	**Food parcel**		
8	**Emergency latrines**		
9	**Car rental**	Price of one specific car rental company for both conventional and alternative solutions. Price in USD, VAT excluded, July 2026.	
10	**Trainings**	Price of a regular venue (hotel that is the most used by HO) in central Beirut for their workshop and trainings in USD, VAT excluded, July 2026.	Prices excluding VAT in USD, July 2026 in Lebanon – a sustainable product price from a specific company identified as an alternative and sustainable option.

15 additional items analysed:

#	Item/ service	Price used for conventional items / services	Price used for alternative items / services

11	**Clothes bags**	The reference prices for these items are the prices charged by the suppliers of the NGO Solidarités International in Lebanon in July 2026, in USD, excluding VAT. For the efficiency of the process, the NGO Solidarités International was chosen to provide the reference prices, as it is the NGO that supports the Hulo cooperative in Lebanon.	Prices excluding VAT in USD, July 2026 in Lebanon – a sustainable product price from a specific company identified as an alternative and sustainable option.
12	**Winter jacket / coats and raincoats**		
13	**Foam mattress**	To ensure a more representative picture of the prices charged by suppliers to humanitarian organizations participating in hulo initiatives, the prices used for "conventional" items are the average of the prices offered by the suppliers selected through the July 2024 joint NFI tender (JPI). For each item, the price is therefore the average of the prices offered by suppliers for that same item. Prices are in USD VAT excluded in Lebanon.	
14	**Shampoo**		
15	**Laundry washing powder**		
16	**Adult and children's toothpaste**		
17	**Toothbrush**		
18	**Sanitary pads**		
19	**Baby/child diapers**		
20	**Tarpaulin**		
21	**Jerrycan (semi-collapsible)**		
22	**Family tent**		
23	**Recycled sleeping mat**		
24	**Thermal carpet**		
25	**Kitchen set**		

Key limitations

The purpose of this price comparison is to highlight trends in price differences. This price selection methodology has limitations, particularly regarding the prices of NFI items resulting from the 2024 joint tender. These prices do not consider inflation or contextual changes in 2026. Therefore, prices of standard imported items might be more expensive in 2026.

Due to these limitations, the gross prices and the names of the suppliers selected through the joint procurement process are not disclosed. Price differences are expressed as percentages only. Similarly, alternative, local, and/or sustainable companies are not prequalified in this manner; therefore, their names and information are not disclosed in this report. Consequently, their gross prices will also not be disclosed.

3. TOTAL COST OF OWNERSHIP

When to use TCO

TCO analysis can be used selectively to products where operational, maintenance, and replacement costs represent a significant proportion of total lifetime expenditure. TCO is most valuable for durable goods with extended lifespans and substantial use-phase costs. Printers, laptops, and vehicles are excellent candidates because their consumables (ink, toner, energy), maintenance (repairs, cleaning), and eventual replacement accumulate rapidly and often exceed initial purchase cost.

Elements of TCO analysis

TCO is calculated across the product's assumed useful lifespan, typically 3 to 10 years depending on the product. TCO may include the following cost elements:

- **Initial acquisition cost:** the purchase price, including shipping and any installation charges.
- **Expected lifespan and replacement frequency:** how long the product functions before it must be replaced.
- **Energy or fuel consumption:** for devices that consume electricity (printers, laptops) or vehicles that consume fuel, annual consumption and multiplied by current Lebanese energy prices were estimated. The assumption of constant energy prices over the lifespan was made.
- **Consumables and spare parts:** ink cartridges, toner, batteries, replacement components. Consumption based on typical usage patterns was estimated.
- **Maintenance and repair:** labour costs for repairs, cleaning, servicing. For complex equipment, these accumulate over time, especially as products age.

Where supplier data was unavailable conservative assumptions were made. For instance, if a supplier did not specify expected lifespan, a shorter, more conservative estimate was assumed. If maintenance costs were unknown, industry averages or worst-case assumptions were used.

Modelling tool used

In the context of this project, a comparative analysis of a variety of available TCO tools, mostly available free of charge and in the form of Excel-based calculation sheets, was thoroughly undertaken and presented. Twelve tools were identified and compared.

Eventually, the **German Berliner Energieagentur (BEA) tool** "Berechnungshilfen Lebenszykluskosten" (which translates to "Calculation aid for life cycle costs") was selected for the analysis. Another tool considered was the general Excel-based tool of the German Federal Environment Agency (Umweltbundesamt). The BEA tool was chosen for its simplicity, straightforward use, open source, adaptability since it can be easily customized, and ability to deliver the needed results and cover the required parameters. It was also the tool most suitable for the first three electronic equipment & machinery items, while the soaps and blankets were considered as additional examples to assess the challenges of applying TCO to consumables or products for which the usage pattern is highly dependent on the consumer.

Since not every cost category is applicable to every product (for example, fuel consumption is relevant to vehicle rental, while printer consumables are relevant to printers, and energy consumption is relevant to laptops & printers, etc.), the selected tool had to be flexible enough or offer options that cover all these aspects.

Key limitations of TCO

- **Product quality variability remains the largest source of uncertainty**. Two printers with identical model numbers and specifications may have vastly different lifespans depending on manufacturing quality, component sourcing, and build robustness. A well-made printer might function reliably for a decade with minimal repairs; a budget model might fail within three years. The analysis was undertaken based on supplier data, but without independent laboratory testing or long-term field observation, actual lifespan remains uncertain. This uncertainty directly translates to TCO uncertainty: if the product lifespan is underestimated, TCO appears lower than it actually is.
- **Refurbished products present a specific difficulty.** A refurbished laptop is a used product whose remaining lifespan is not deterministic but depends on the condition of internal components, battery health, and how it was treated previously.
- **Consumables are unpredictable for many products.** How much soap does a person use per wash? It depends on water hardness, skin type, personal habits, and training in proper use. How many pages will a printer produce before its cartridge is empty? It depends on print density, ink coverage settings, and maintenance. The analysis estimates typical consumption but acknowledge this variability.

Next steps

The analysis shows that TCO can be a **valuable tool for supporting sustainable procurement**, but its application should be adapted to the particularities of each procurement category.

- **Standardise procurement data requirements.**

To make future TCO assessments easier, suppliers could be requested to provide consistent and clear information, to reduce the number of assumptions required in future analyses. Data requirements can include:

- Purchase/rental price;
- Expected useful lifetime;
- Energy/fuel consumption;
- Maintenance or washing requirements;
- Warranty;
- Replacement components;
- Consumable requirements; and
- Relevant transport or delivery information.

- **Develop a simplified TCO template**

While the tool was enough for this analysis, it also shows the potential to develop own standard organisational TCO template containing the necessary elements that need to be taken into consideration, while allowing irrelevant cost categories to be excluded depending on the product.

4. SIMPLIFIED LIFE CYCLE ASSESSMENT

The questionnaire-based assessment

Traditional LCA is conducted by identifying a single production process and modelling it in detail. Analysts visit factories, interview production managers, measure actual material flows and energy use, and build a precise model of how that specific product is manufactured. This approach produces highly accurate results but is time-intensive and expensive. It is often impractical when working across multiple suppliers, particularly in diverse local and regional markets.

Therefore, a different approach was adopted: rather than deep investigation of one or two suppliers, a tailored questionnaires were sent to a broad range of suppliers for each product category. This breadth-over-depth strategy served several purposes. First, it allowed a better understanding of the local market landscape; which production methods are available, where they are concentrated, and what barriers prevent local producers from scaling up. Second, it avoided the bias of focusing on a single "best practice" supplier, which may not represent actual procurement options. Third, it revealed market variability with its range of environmental and cost profiles across real-world suppliers, not just the theoretical optimum.

Each questionnaire was customised to the product's characteristics but consistently addressed all major lifecycle phases:

- **Raw material sourcing** (which materials are used, where they come from, extraction methods)

- **Production** (energy sources powering the facility, waste generation, treatment processes)
- **Packaging** (materials used, weight, end-of-life)
- **Transportation** (shipping methods, typical distances)
- **Use phase** (water contamination risk, chemical leaching, product degradation)
- **End-of-life** (reuse potential, repair possibilities, recycling pathways, landfill)

Follow-up site visits or detailed production audits were not conducted. This pragmatic compromise allowed the Accelerator to survey many suppliers without the time and cost of verification.

Understanding the environmental footprint method 3.1 (EF3.1)

The Environmental Footprint 3.1 (EF3.1) method to assess the environmental impacts of humanitarian products was used. EF3.1 is a harmonised, internationally recognised method developed by the European Commission and adopted across Europe and beyond. It was chosen because it is comprehensive (covering multiple environmental impacts, not just carbon), well-documented, suitable for comparative analyses between products, and widely used.

EF3.1 divides environmental impacts into distinct categories, each representing a different type of harm to the planet or human health. The Accelerator focused on specific indicators considered as the most relevant to humanitarian procurement:

- **Climate change:** This captures greenhouse gas emissions; carbon dioxide, methane, nitrous oxide; from energy use, material production, and transport. It represents the product's contribution to global warming and is relevant because climate impacts affect food and water security across humanitarian contexts.
- **Human toxicity - carcinogenic:** This measures the risk that chemical releases during production, use, or disposal could cause cancer in exposed humans. It includes toxic chemicals in production processes, pesticides in agriculture-based materials, and harmful substances that may leach from products during use. This is critical because workers in manufacturing regions and communities near disposal sites face real health risks.
- **Human toxicity - non-carcinogenic:** This measures other health impacts from toxic chemical exposure, including neurological damage, reproductive harm, and organ damage. These toxins enter the environment through production waste, agricultural runoff, or leaching from disposed products. Children and pregnant women are particularly vulnerable to these exposures.
- **Ionising radiation:** This measures exposure to radioactive emissions, relevant primarily when electricity comes from nuclear power plants. It is not significant in Lebanon's energy mix, but the metric was retained for methodological completeness.
- **Particulate matter formation:** This measures air pollution from fine particles (dust, soot, fine particles) that damage the lungs and heart. Particulate matter results from energy production, transport, and industrial processes. Air pollution from particulate matter contributes to respiratory and cardiovascular disease, which is already a leading cause of death in many humanitarian contexts.

- **Photochemical oxidant formation:** This measures air pollution from secondary pollutants, primarily ozone, formed when combustion gases react with sunlight. Photochemical oxidants cause respiratory disease and reduce lung function. Like particulate matter, photochemical oxidants result from energy production, transport, and industrial processes and contribute significantly to the health burden in communities affected by air pollution.

Those five last indicators (both human toxicity, ionising radiation, particulate matter formation and photochemical oxidant formation) were used to calculate a **combined indicator that provides a measure of human health impact** by weighting each indicator according to its relative contribution.

OpenLCA: the modelling tool

OpenLCA, an open-source software platform, was used to construct and run the LCA models. OpenLCA allows users to define product systems as networks of processes, each representing a step in the supply chain (e.g. raw material extraction, transportation, manufacturing, packaging). Each process is defined by inputs (materials and energy) and outputs (products and waste). OpenLCA then calculates environmental impacts by applying characterisation factors from impact assessment methods (in this case EF3.1) to these flows.

A key feature of OpenLCA is its ability to link to background databases of environmental data. For most processes, primary data are not available. The exact energy mix used by every electricity supplier is unknown, nor the precise environmental burden of mining the metals in the targeted products. Instead, the Accelerator relied on Ecoinvent. Ecoinvent contains modelled data for thousands of standard processes: electricity generation from various sources, transport modes, material production, and end-of-life treatment.

This way when a supplier answered to the questionnaire, "We use electricity to power our production," OpenLCA linked to Ecoinvent data on Lebanese electricity (or regional averages where Lebanese-specific data was unavailable) to estimate the emissions and impacts of that electricity.

Building process models and creating scenarios

In OpenLCA, the Accelerator constructed a process model for each product based on questionnaire responses. For example, for a locally produced plastic bucket, the model might include:

- Raw material: virgin plastic pellets sourced from a polymer supplier
- Production: injection moulding at a facility powered by diesel generators
- Transportation: buckets are trucked 100 kilometres to a distribution warehouse
- Use: washing of the bucket
- End-of-life: landfill disposal

Each component of this process is quantified.

Scenarios emerge when the Accelerator model multiple suppliers or procurement alternatives in parallel. Instead of building a single bucket model, the Accelerator have

built several: locally produced plastic (virgin), locally produced plastic (recycled material), imported plastic and imported metal. Each scenario retains the same lifecycle structure but varies the material, energy source, transportation distance, or end-of-life assumption.

This scenario approach is powerful because it separates the "good ideas" from the "actually good ideas." A local producer might seem preferable because it reduces transportation. But if that producer uses significantly more energy-intensive production methods than an established import, the transport savings may be offset. A recycled-material option sounds sustainable, but if the recycling process is energy-intensive and the collected material is of poor quality (reducing product lifespan), the net environmental benefit disappears. By modelling these scenarios quantitatively, it is possible to test assumptions and reveal which procurement decisions genuinely reduce impact.

Key limitations and compromises in LCA

Data availability remains the primary constraint. When suppliers did not provide complete information, reasonable assumptions based on industry averages or secondary research were made. For instance, if a supplier did not specify energy consumption, typical consumption rates for similar production facilities were used. Analyses should be treated as indicative rather than absolute.

Process detail is limited as factory audits or measure actual flows were not conducted. Those models are based on questionnaire responses and secondary data, which means important details of actual production might be missed. A supplier may use a more efficient production process than Ecoinvent's average model assumes, reducing the model's predicted impacts. Conversely, a supplier may have outdated equipment, increasing impacts beyond the estimate. Without on-site verification, these discrepancies remain hidden.

Multiple scenarios introduce variability rather than reducing it. Because multiple suppliers were surveyed, multiple scenarios with differing results were generated. Some readers may expect a single, definitive answer: "Use product X." Instead, ranges and scenario comparisons were presented. This is valuable; it shows the market as it truly exists; but it may feel uncertain. This variability reflects genuine choice, not analytical failure.

Ecoinvent represents a global average, not Lebanese reality. Where local production data is unavailable, the Accelerator relied on Ecoinvent's modelled data for energy systems, transportation, and material production. Lebanese electricity has a different carbon intensity than the world average. Transport efficiency, labour practices, and waste management differ. Ecoinvent data were adapted where possible, but gaps remain. Studies conducted in different contexts (Europe, Asia) may be more or less conservative than Lebanese conditions.

5. HOW TO INTERPRET THE RESULTS

The role of analyses in decision-making

Price analysis, TCO, and LCA are **tools to support procurement decisions**, not to replace judgement. The results provide quantitative comparisons between alternatives,

revealing which options are currently cheaper, have lower lifetime cost, or have lower environmental impact. However, many factors beyond price, cost, and environmental impact may influence procurement decisions. Product quality and durability, supplier reliability, technical compatibility with existing systems, availability of local maintenance and repair services, social and labour standards in production, and alignment with organisational values all matter. A product with the lowest current price may become expensive over its lifetime due to poor durability. An option with the lowest TCO may be unreliable or produced under conditions the organisation finds unacceptable. An environmentally superior option may be unavailable at scale or incompatible with existing infrastructure.

The analyses should inform discussion and negotiation with procurement teams and leadership. They reveal what is at stake when choosing between options. They expose assumptions (often hidden) that drive decisions. They sometimes challenge conventional ideas, revealing that an expensive option is cheaper over its lifetime, that a currently expensive alternative is competitive on price in the market, or that a supposedly sustainable alternative increases environmental impact. But they do not replace professional judgement and organisational strategy.

Invalid comparisons and limitations

- **Extrapolating findings to very different contexts**. This analysis is rooted in Lebanese conditions: local energy mix, transport infrastructure, labour practices, waste management systems, and market structure. Applying the findings to Sub-Saharan Africa or Southeast Asia introduces significant error. Those findings can help to identify some broad trends, but they are closely linked to the Lebanese context and market. Price analysis is temporally and geographically specific; prices in 2024 Lebanon do not predict prices in 2026 or prices in other regions.
- Using price analysis as a forecast. **Price comparisons capture a snapshot at one moment in time. They do not predict how prices will change as markets evolve**, production scales increase, or supply chains shift. An alternative that is currently expensive may become cheaper in the future, or vice versa.
- **Using those analyses as definitive proof of product quality or superiority**. Price analysis measures cost at purchase; TCO measures financial cost over time; LCA measures environmental impact. None of these measure durability, safety, reliability, performance, or actual users satisfaction. A low-cost product may be poor quality; a high environmental impact product may be highly durable.

Uncertainty and sensitivity

All of those analyses contain assumptions, particularly in areas where supplier data was incomplete or where we relied on secondary sources. A product's actual price may fluctuate; its actual cost of ownership may differ from the estimate; its actual environmental impact may differ from our model. The question is: How much can the results be trusted?

For price analysis, price differences of less than *5 to 10 %* are within the margin of variation across different suppliers and markets and should not be treated as meaningful distinctions. Larger differences (*30 % or more*) **suggest genuine price variation and real market opportunity.**

For TCO and LCA, small differences in results (*5 to 10 %* between alternatives) are not meaningful given the uncertainty in the assumptions. An alternative that appears 5 per cent cheaper in TCO may actually cost more once price volatility is accounted, unexpected repairs, and usage variability. Larger differences (*30 % or more*) **are more robust and suggest a genuine cost or impact difference between alternatives.**