

Building the foundations for LCA in SA: Guidelines and Product Category Rules to enable and expedite the application of LCA under the EPR Regulations in South Africa – Key Highlights

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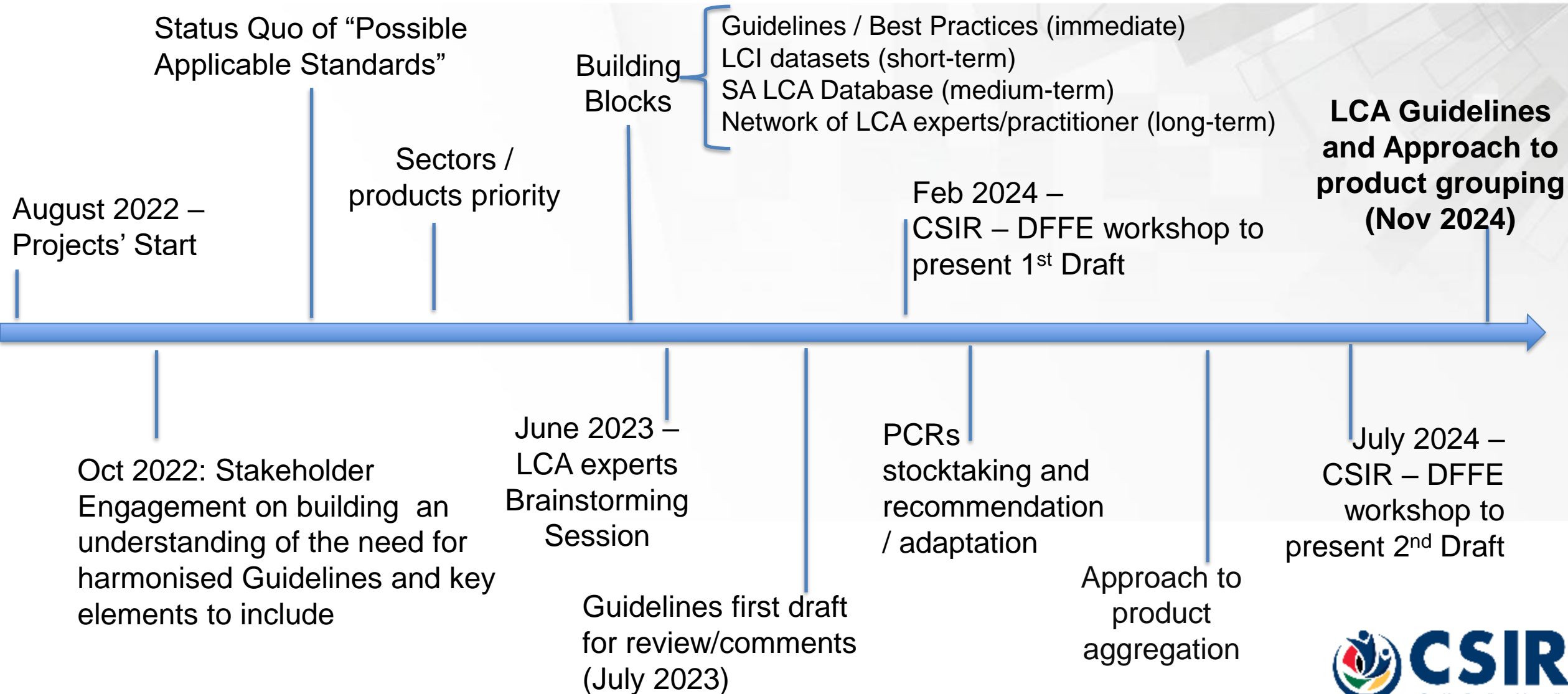
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Context and Motivation for the LCA Guidelines project

- Extended Producer Responsibility (EPR) is an environmental policy based on the 'polluter-pays' principle; obliging producers to assume full responsibility (including EoL) for their products.
- EPR regulations cover some of SA's 'problematic products' - packaging, electronics and lighting, batteries, lubricant oil and pesticides - mandatory EPR as per Section 18 of the Waste Act
- EPR Regulations were gazetted in 2020, with the final Regulations published in 2021. Among other things, the Regs require producers, brand owners and importers of identified products to undertake Life Cycle Assessment (LCA) studies; focussing on
 - material minimisation
 - product design to facilitate reuse, recycling or recovery; and
 - reduction of the environmental toxicity of their waste streams.

Building the foundations for LCA in SA: Development of guidelines and product category rules to meet regulatory and EU market requirements



Challenges to Conduct LCA studies in South Africa

- Limited LCA expertise and capability locally; lack of guidance on how LCAs should be conducted in order to meet various requirements (EPR, EU markets...)
- 2 Main standards (ISO 14040 and 14044), and a range of additional possible applicable standards for different purposes (e.g. PEF), can make it difficult to navigate the LCA landscape
- LCA is a standardized methodology, regulated by the ISO Standards which, however, provide only a general framework:
 - Leave room for interpretation on numerous methodological issues
 - Variations in the implementation of LCA
 - Lack of consistency and validity in the resulting environmental claims

Aim of the LCA Guidelines project was to provide guidance on how to conduct LCA studies in accordance with both the EPR Regs and export market requirements, providing a standardised set of recommendations regarding the various methodological choices that need to be made when conducting an LCA study

CSIR proactive role

- Proactively drafting a series of Guideline documents
- Engaging with Stakeholders:
 - Providing insights on how to take LCA forward both as industry and PRO's
 - Importers unsure what kind of LCA certification is needed for their products to comply with the EPR regulations
 - Engaging with DFFE –
 - Presented the LCA guideline project (5th Feb), review process in progress
 - Presented stakeholders' main concerns about how to operationalize the LCA requirement in the EPR Regs (how many products? Is there a way to group them in a meaningful way?...)
- Drafted a Proposed approach to product grouping



Building the foundations for LCA in SA: Development of guidelines and product category rules to meet regulatory and EU market requirements

Objectives/ Aim

- To develop harmonized LCA guidelines and (PCRs) to enable consistent and rigorous LCA studies to be conducted in SA, in line with the EPR Regulations and EU export market requirements

Why it is important and what impact has it achieved

- EPR Regulations require LCA studies to be conducted on a broad range of products in SA
- EU promulgating strict requirements for all products entering the EU market to have PEF certification
- Lack of capacity to conduct LCA studies in SA and a lack of guidance for producers on how to meet these requirements

CSIR's role and capabilities

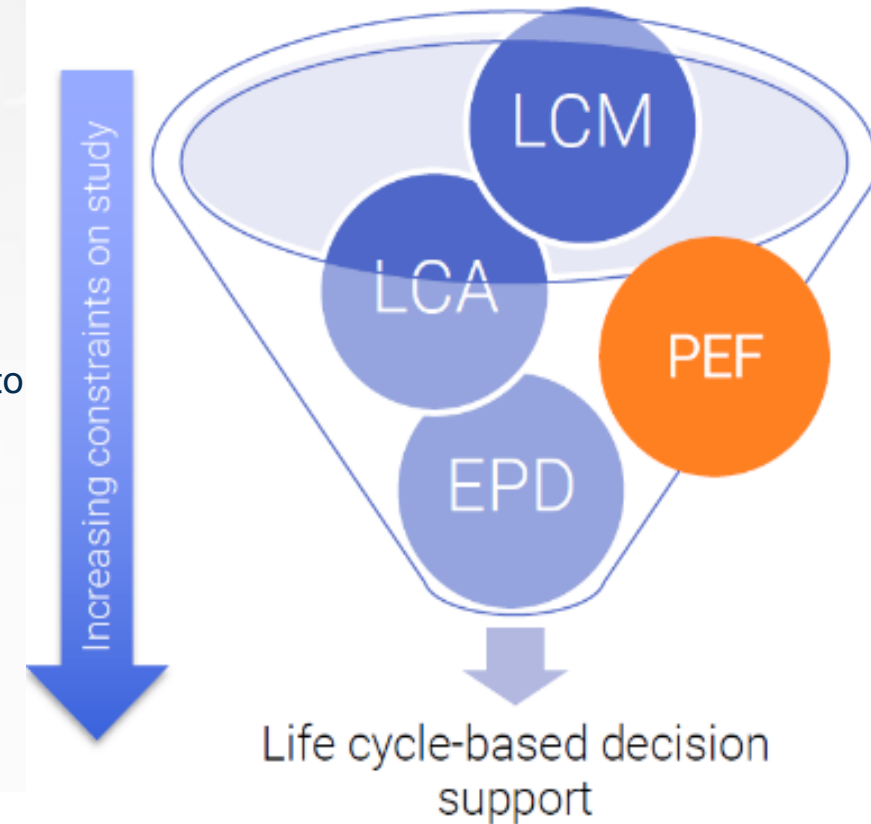
- Engagement with stakeholders and LCA experts and drafting of the Guidelines
- Understanding sector priorities as well as LCA data / capability gaps for South Africa

The deliverables

- LCA Guideline series, including "Best Practice Guideline for conducting LCA studies in SA"
- Reports on status quo of priority sectors/products for LCA studies, & on LCI data availability
- Recommendations on Product Category Rules for identified product category(ies)

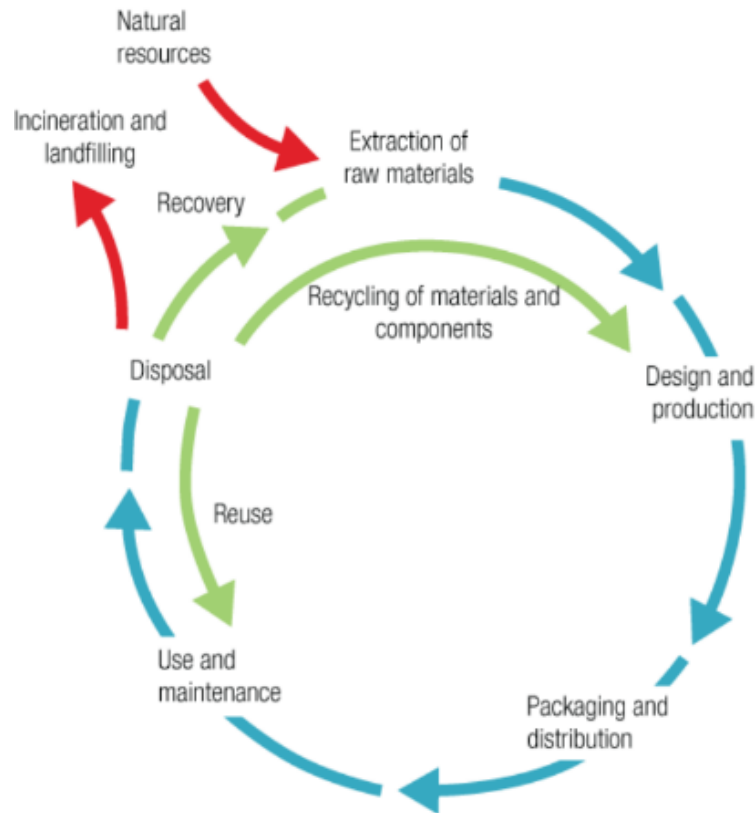
Status of the Project

- LCA Guideline – Completed
- PCR's – draft for discussion



What is Life Cycle Assessment?

Life Cycle Assessment (LCA) provides a framework and a standardized methodology aimed at quantifying impacts and resource use along a product (good or service) value chain.



Typical Product Life Cycle diagram
(source: UNEP/SETAC Life Cycle Initiative)

1. **Life Cycle Focus:** all stages of products are considered
2. **Multi Criteria Analysis:** multiple environmental categories are included in the analysis
3. **Quantitative methodology:** indicators are quantitative and based on mathematical models describing the cause-effect relationships deriving from different stressors (e.g. emissions, use of natural resources..)
4. **Comparative approach:** LCA is primarily designed to allow the choice of the best option among two or more scenarios/alternatives, given its quantitative nature
5. **Global extension:** the analysis can adapt to systems extended from the local to the global scale

The aim is to improve the entire system and not just a single part, and to avoid decisions that fix one problem but can cause another unexpected environmental problem (shifting of burdens)

Benefits and direct application of conducting LCA

- Ensure consideration of **all environmental issues** across the entire product life-cycle
- **Identify unintentional impacts** of actions (e.g. upstream GHG emissions that may offset perceived benefits of a new technology)
- **Avoid shifting problems** from one stage in the life-cycle stage to another (one geographic area to another and from one environmental impact to another)
- **Identify opportunities to improve product performance** with the identification of environmental “hotspots” in the product life cycle.
- Support claims of environmental performance and communicate benefits of a product (**eco-labelling**)
- **Improve decisions** regarding **system design and product choices** to reduce the overall environmental impacts.

- To comply with EPR Regs requirements:
 - (i) Minimisation of material used in the identified product;
 - (ii) Design of the product to facilitate reuse; recycling or recovery, without compromising the functionality of the product; and
 - (iii) Reduction of environmental toxicity of the resulting post-consumer waste stream
- To comply with exports market requirements (e.g. EU Carbon Border Adjustment Mechanism)

Building Blocks to conduct LCA

Standards / Guidelines
/ Reference
documents / Software
tools

South African data /
datasets

Capacity building /
training / LCA
expertise

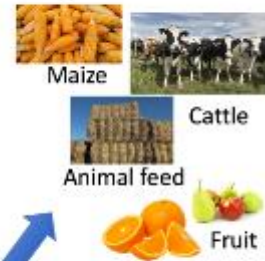


Liquid fuels (conventional
& synthetic)

Mining & manufacturing



Agriculture



Waste disposal



Water supply &
infrastructure



Academia / Research
Institutes
Consultancy / Private
practitioners



The CSIR's LCA Guideline Series



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The LCA Guideline Series



- Guideline 1: Best practice guideline for conducting LCA in SA (*Main guideline*).
- Guideline 2: Relevant standards for conducting LCA studies
- Guideline 3: Summary of available PCR's and PEFCRs
- Guideline 4: Templates for Reporting & Critical Reviews

Key Elements – Summary

Recommendation on harmonised LCA modelling aspects:

- How to set the function, functional unit and reference flow of the system under study – with examples relevant to the product identified in the Notices to the EPR Regs
- System Boundaries – Cradle to Grave
- LCA approaches, allocation procedure and system models – System Expansion, closed-loop approximation and “cut-off, by allocation”
- High level guided approach on how to:
 - Model system expansion in practice and
 - Build Life Cycle Inventories from data collection, to select / adapt appropriate datasets for building product system (step by step procedure)
- Life Cycle Impact Assessment methods available and recommended (ReCiPe and PEF – where applicable; GLAM as soon as available)
- Modelling end of life and the waste management system in South Africa
- Critical review – recommendations and template for reporting

Up-to-date sources of information for:

- LCA Database (with a focus on SA data, where available) and LCA tools
- PCR related to the waste streams identified by the Notices
- Other Standards/Methodology/Regulation to follow (mainly for exported products)

Key Elements – Modelling aspects (1) – Functional Unit and Reference Flows

The Guidelines provide **recommendations** on:

- Function Unit (FU) and Reference flow (RF) definition to enable product comparability

The Guidelines provide **examples** of FU and RF applicable to products in the Notices to the EPR Regs:

Sector – Lighting

Example product: lightbulbs

Function: Provision of brightness

Functional Unit: Lighting 10 m² with 3000 lux with a spectrum of 3000K for 50 000 hours

Reference Flow: ~19 x 5 CFL warm white (3000K) bulbs of 30 000 lumen with a lifetime of 10 000 hours

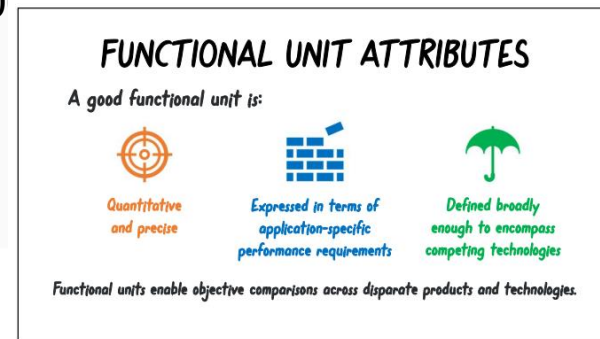
Sector – Packaging

Example product: beverage bottle

Function: To contain, protect and extend the lifetime of a beverage

Functional Unit: A bottle capable of holding and containing 500 ml of a beverage for 1 year

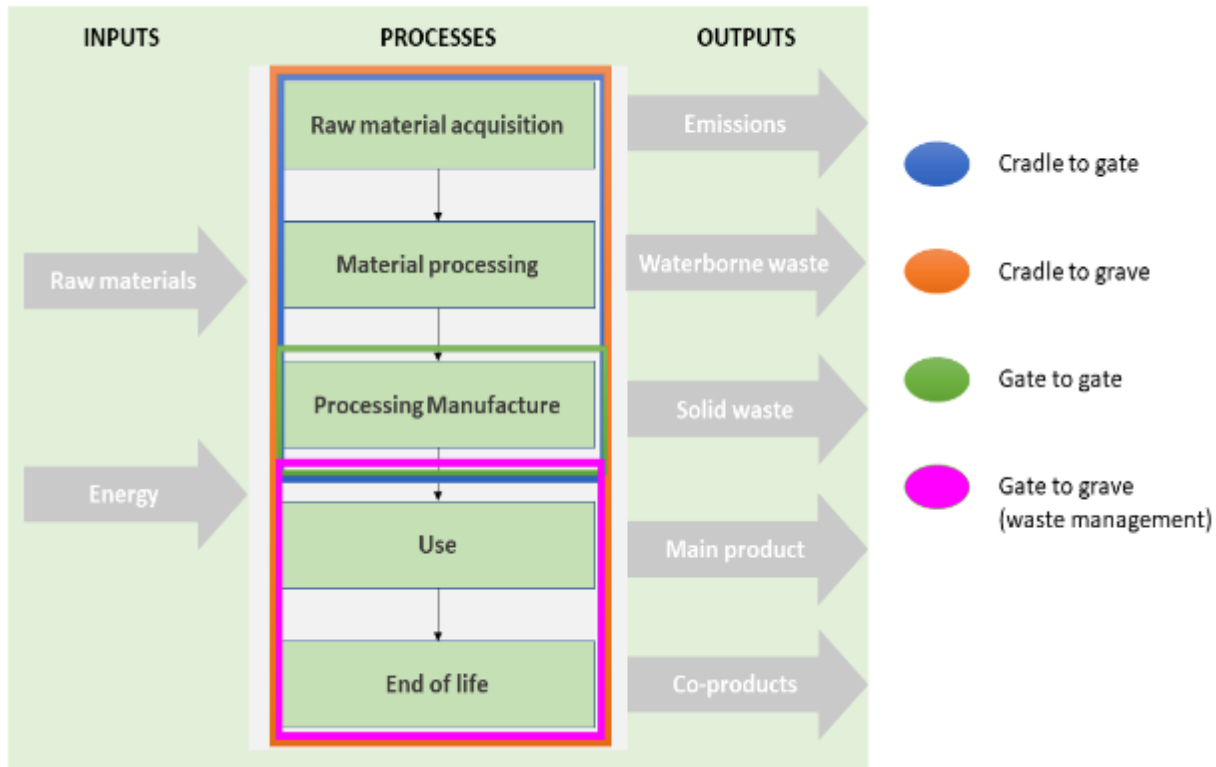
Reference Flow: xx g of packaging material



Key Elements – Modelling aspects (2) – System Boundaries

The Guidelines provide **recommendations** on:

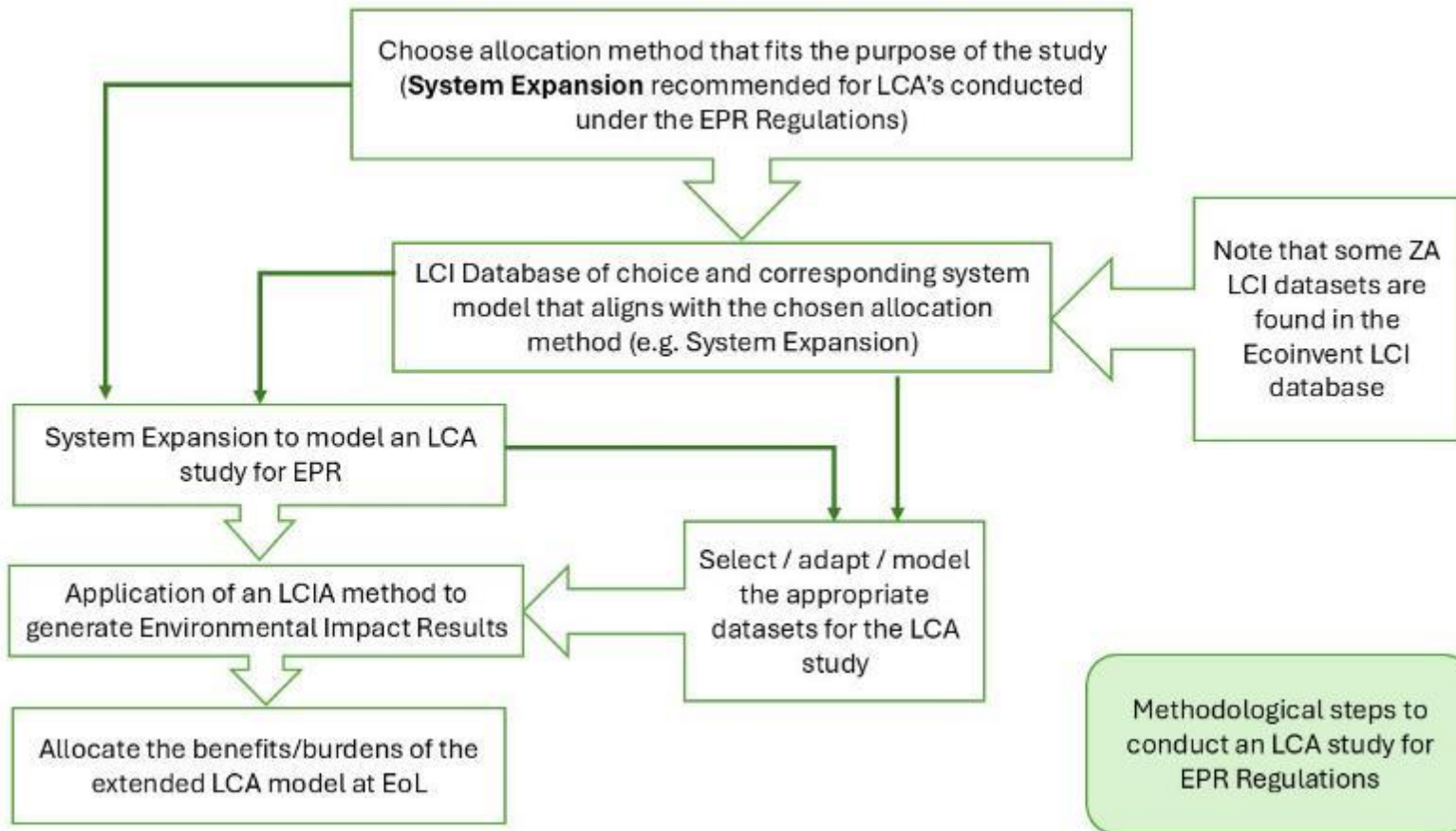
- Boundary of cradle to grave (so same scope that does of course include raw materials and end of life)



Best practice to follow:

- For the purposes of compliance with the EPR Regulations, evaluate product systems with a **cradle-to-grave** boundary to account for all stages of the product life cycle.
- Use a Process Flow Diagram (PFD) to graphically depict the system boundary and to illustrate processes, life cycle stages and flows that are included and excluded.

Key Elements – Modelling aspects (3) – Allocation Procedures



Best practice to follow: *The choice of LCA approach, allocation methods and system models should be consistent.*

- *In most cases, the attributional LCA approach should be used, as this is the simpler of the two approaches, and is consistent with the other modelling choices recommended in this guideline.*
- *For multi-product activities, the recommendation is to avoid allocation through system expansion.*
- *For recycling at end of life, multifunctionality should be dealt with using closed-loop approximation in conjunction with system expansion.*
- *The corresponding system model for the LCI datasets selected for the study should be consistent with the choice of LCA approach and allocation methods.*

Key Elements – Modelling aspects (4) – Inventory Analysis

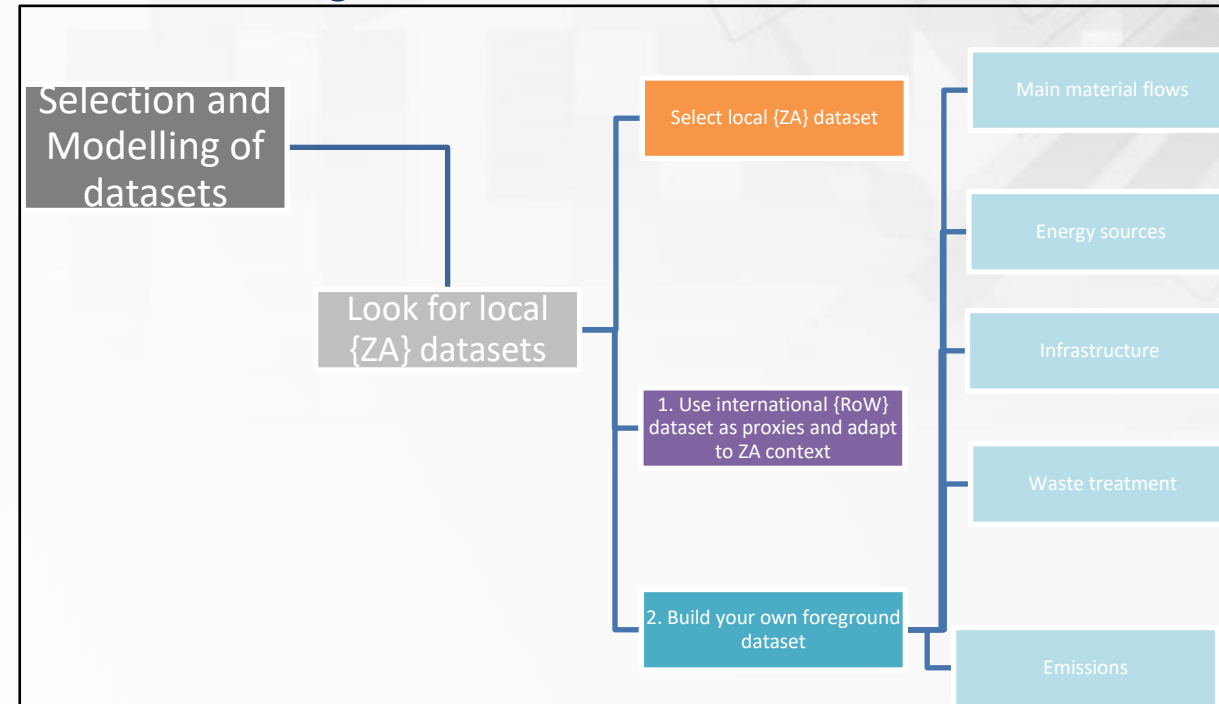
The Guidelines provide **background** on Data collection:

- Background vs Foreground Systems
- Primary vs Secondary data
- LCA Database vs LCI datasets
- Example of LCA Databases and source of LCA/LCI data (e.g. GLAD)

Best practice to follow (geography):

- *As far as possible, it is recommended to make use of databases that provide datasets for production processes in the South African context.*
- *For each process, first check if a suitable background dataset exists for the local context (ZA geography). If not:*
 - *Adapt an existing dataset (from a different geography), or*
 - *Build a foreground dataset by using a combination of primary data (preferable) and secondary data.*

The Guidelines provide **recommendations** on Data modelling:



Best practice to follow (activity type):

- *When data from a specific supplier is not available, or when there is a mix of technologies (usually for supporting datasets), it is recommended to use a market process.*

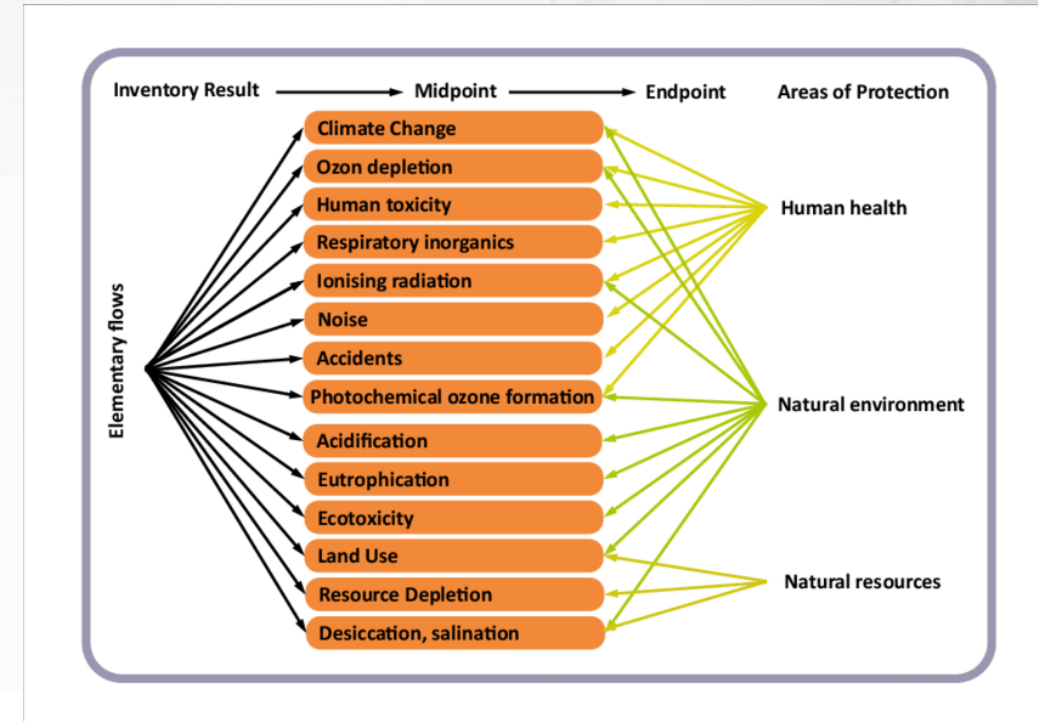
Key Elements – Modelling aspects (5) – Life Cycle Impact Assessment and Interpretation

The Guidelines provide **background** on:

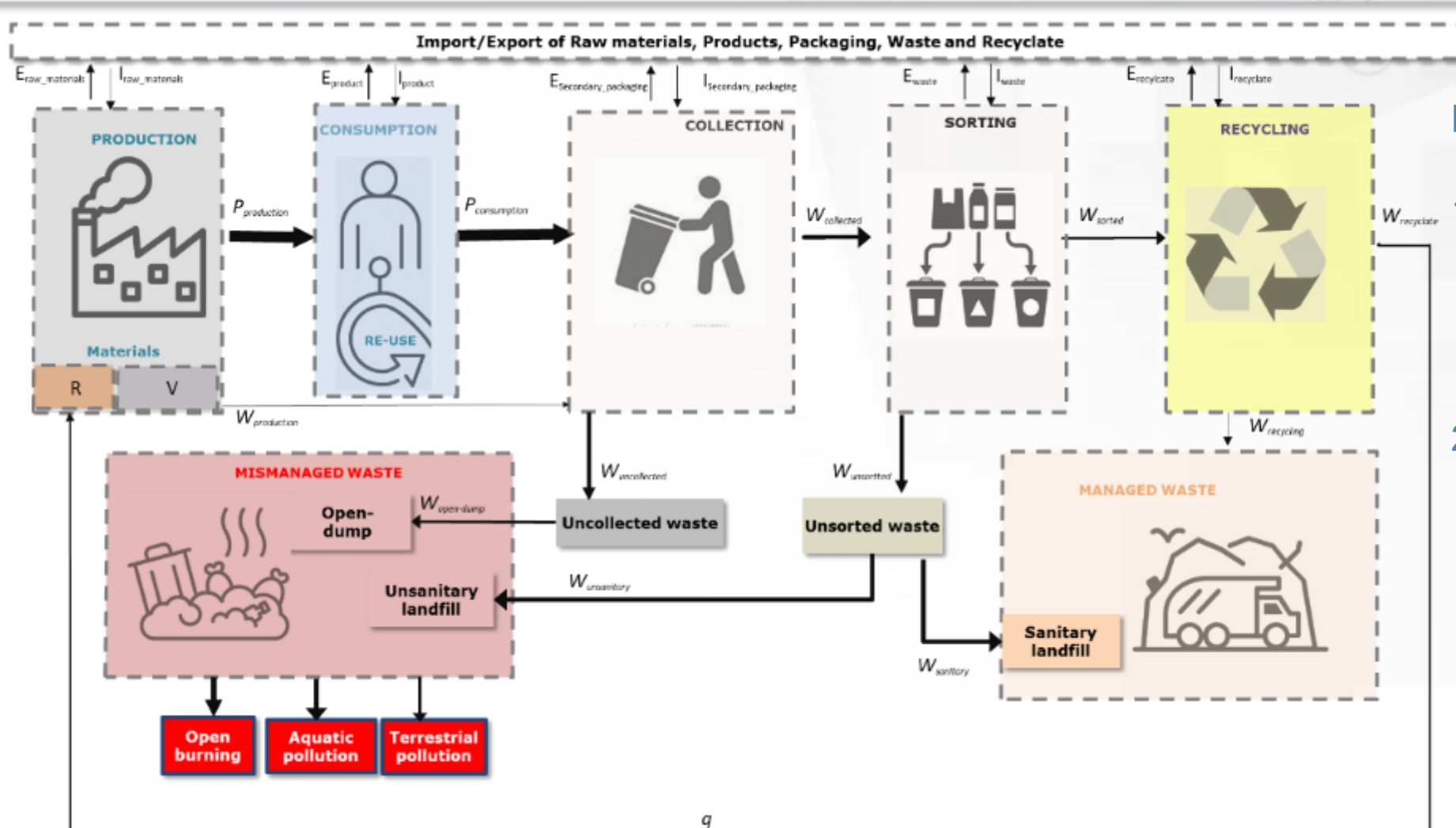
- Life Cycle Impact Assessment mechanism and steps (mandatory and optional) involved in a LCIA
- Mid-point vs End-point impact categories for interpretation and reporting
- List of available LCIA methods

The Guidelines provide **recommendations** on:

- Impact assessment methods standardised (ReCiPe or EF according to the Goal of the study: e.g. for EPR requirement or export to EU markets)
- Reporting, including aggregating to end point or single score according to the method chosen
- A harmonised Template for reporting the results of the LCA study



Key Elements – Modelling aspects (6) – EoL waste management system in South Africa



Best practice to follow:

1. Wherever possible it is recommended to source/use **waste-stream specific** splits for the flows in the graphic
2. if not possible, use the **default values** provided in the Guidelines for:
 - Collected vs Uncollected waste
 - Sanitary vs Unsanitary landfills
 - Open burning of waste

Schematic of main End of Life stages, so to have a common understanding and modelling of EoL waste streams

Key Elements – Reporting aspects – Templates for Reporting and for a Critical Review

The Guidelines provide **background** on:

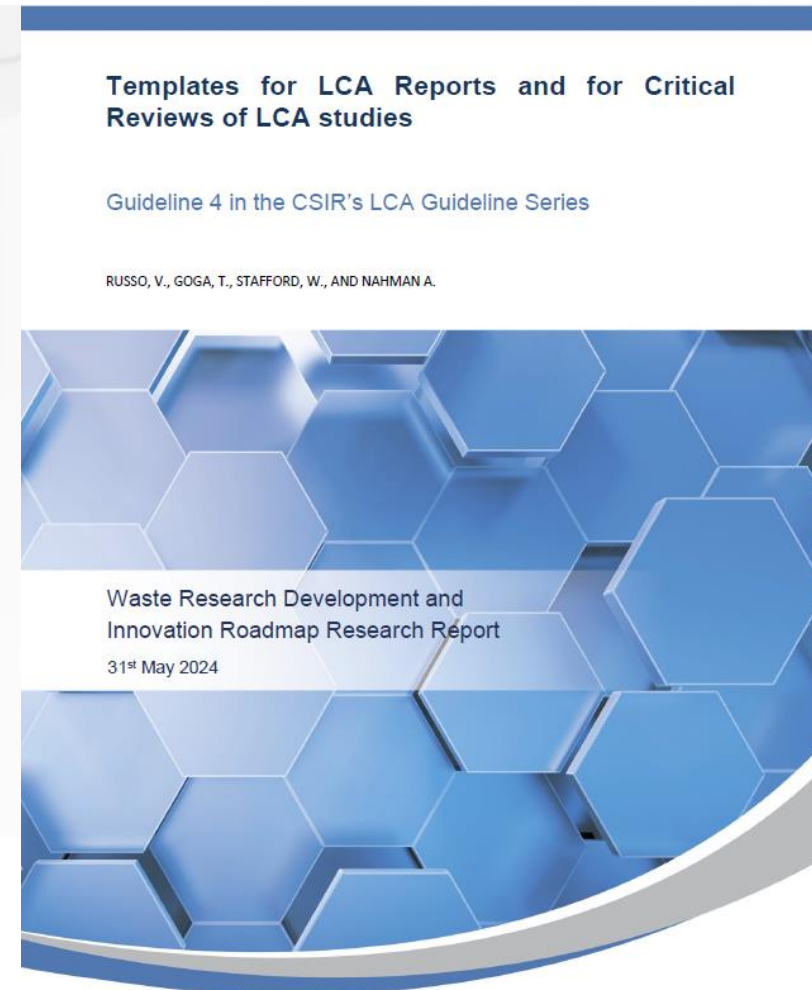
- Suggested template for reporting the results of the LCA study undertaken. The template follows the structure of the four stages of an LCA study as per ISO 14044 (2006).
- What is and when a critical review of LCA study is needed

The Guidelines provide **recommendations** on:

- A harmonised template to follow for conducting a peer review of an LCA study is provided in Guideline 4 – Template for Critical Review
- Best practice to follow in relation to the EPR regulations

Best Practice to follow:

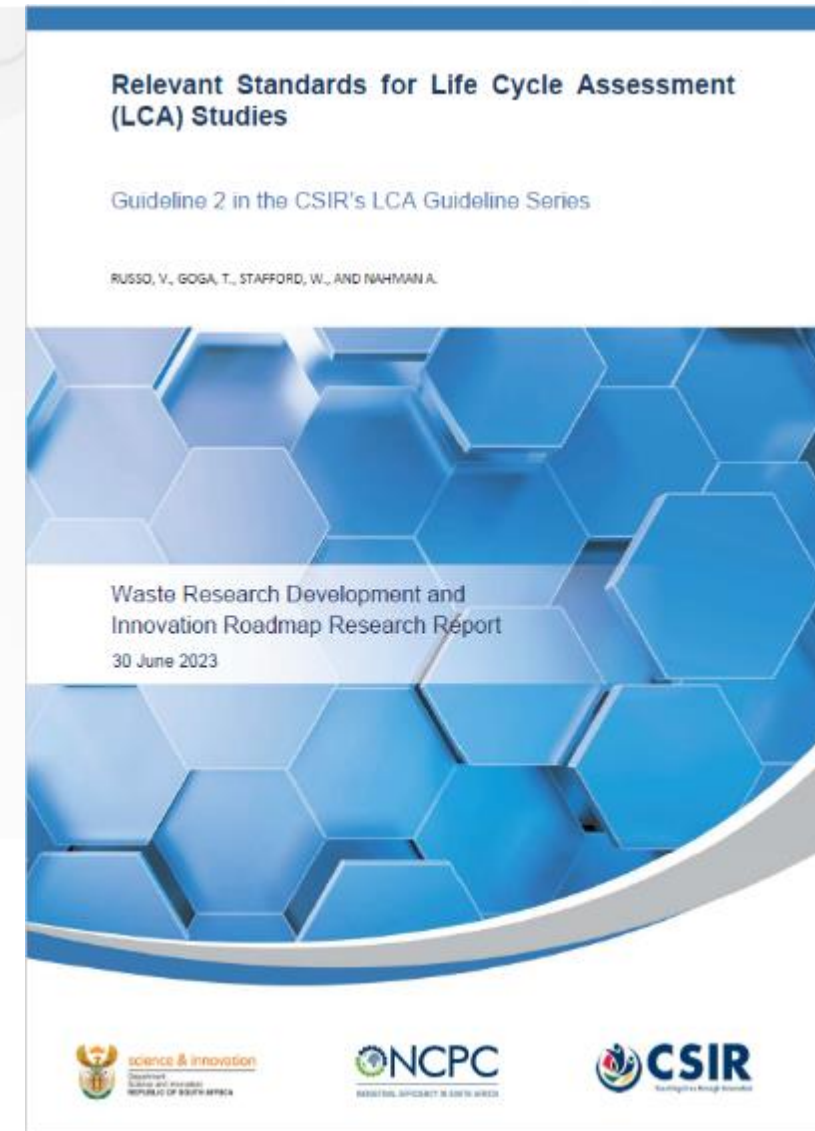
A review of the LCA study is recommended, and shall include verification to check that the study has been carried out in compliance with this guide, and may include validation. Validation requires **third party expert review** to ensure the study is reliable, credible and correct, and shall be carried out whenever the study findings are to be made available to the public.



Supporting documentation – Relevant LCA standards

The Guidelines provide **background** on:

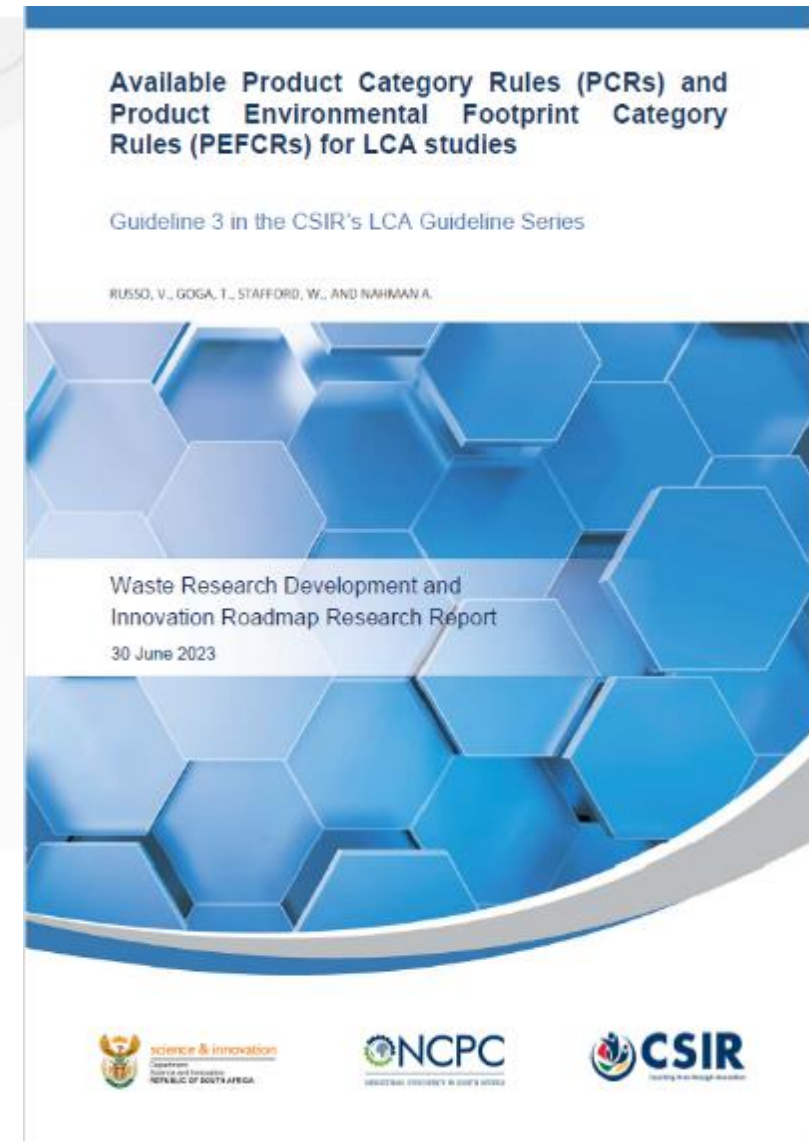
- A full list of possible applicable standards to be used to conduct LCA studies. The relevant standard to be followed will depend on the goal and scope of the study in each case.
- The Guidelines provide **recommendations** on which standard to apply according to the Goal and Scope of the study.



Supporting documentation – Summary of available PCRs and PEFCRs'

The Guidelines provide **background** on:

- A (non-exhaustive) list of Product Category Rules (PCRs) and Product Environmental Footprint Category Rules (PEFCRs) which may be relevant to the products identified under the EPR Notices
- The Guidelines provide **recommendations** on which PCRs and/or PEFCRs to follow for more guidance according to the Goal and Scope of the study.



Suggested Approach for operationalizing the LCA requirements



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Why the need for an Approach to product grouping?

- *Limited LCA expertise and capability locally* and a lack of guidance on how LCAs should be conducted in order to meet various requirements (EPR, EU markets...)
- Large number of products falling under each of the identified product classes (especially when considering all possible variations in size and format) in the Notices; not possible to conduct LCA's for all of them within a reasonable timeframe
- The approach is a **bridging** between the product categories as per the EPR notices that matter for the EPR targets, and product categories for enabling LCA application (streamlined approaches) and LCA requirements to be met

Operationalising the requirements: Can products be grouped?

- Regs say “[...] conduct a life cycle assessment, in relation to the identified product [...]”
 - Which leads to thousands of products

Starting point are the product categories as provided in the EPR regulations

Proposed Approach to Product Grouping

Plastic PET Beverage bottles
Plastic PET Oil Bottles

The CSIR proposed approach is based on three principles:

- 1. Scaling** – to enable variations in size / mass of a product to be assessed in a single LCA study.
- 2. Scenario analysis** – to enable variations in product design (e.g. different colours, materials or additives) to be assessed in a single LCA study.
- 3. Collective approach** – to enable different producers of a similar product to collectively commission a single LCA study, provided that variations in size and design are accounted for through scaling and scenario analysis.

Principle 1: Scaling

- **Underlying principle** : Material type and weight of a product are important characteristics for determining its environmental impacts. A product with *the same material but double the weight has double the impact, unless it is reused more times to perform its specific function (UNEP, 2020)*.
- The above concept can be applied to mono- and multi-material products, such as those identified within the EPR Notice for “*Paper, packaging and some single use products*”, as well as those products whose formulation can be dealt with on a mass basis, such as *pesticides and lubricant oils*.
- Secondary packaging must also be taken into account when relevant; as this could potentially outweigh the primary packaging (in terms of mass and environmental impact)

Principle 1: Scaling – examples

This could be done in one of two ways (examples of a PET bottle):

1. Conduct LCA on a defined quantity of the product (e.g. 1 kg or 1 tonne of PET material); with the results scaled up/down to the actual material weight of the different variations.



2. Conduct LCA on a representative product (e.g. a 1 litre PET beverage bottle), with the results scaled up/down to the different variations



Principle 2 : Scenario Analysis – explore alternatives

Product characteristics that can affect how easily and (cost-) effectively a product can be recovered and recycled at end of life, or the available options for use of the secondary material in new products, could be explored in detail in an LCA study; to inform redesign of products in such a way as to enable the EPR targets to be met.

Within the LCA study itself, through scenario analysis; so as to inform product design in such a way as to enable the EPR targets to be met

Using pre-screening tools on actual recyclability/recovery and targets; to inform the LCA study (optional)

Principle 2 : Scenario Analysis - example

Key products / scenario modelling parameters that could be explored in detail within an LCA study:

- Impact of colours, dyes, binders, adhesives, etc. that can hinder recyclability of the materials;
- Differences in terms of transport (both mode and distances) of the materials/product;
- Different delivery/collection modes, etc.
- Assessing actual recyclability/recovery of products in the SA context by using pre-screening tools to inform the LCA modelling, especially when modelling scenarios that aim to assess environmental impacts and achieve EPR targets.



Principle 3: Collective approach

Single producer/brand owners/ importers:

As it stands currently in the EPR Regulations, the individual producer is responsible for conducting an LCA study on their product(s). By applying the Scaling and Scenario Analysis principles outlined above, the producer could conduct a single LCA study covering all variations of the product (e.g. the PET beverage bottles) that they produce.

The Collective Approach: Multiple producers of a similar product (e.g. PET beverage bottles) could combine their resources to commission a single LCA study (perhaps coordinated through the relevant PRO). It has to be ensured that:

- Minimum requirements should be established for participation in a collective LCA
- Providing data and participating in key decisions regarding the approach; to ensure that the representative product and its variations are indeed representative.
- The representative product could potentially be used for benchmarking. Participants in the Collective LCA could have the performance of their specific product assessed against the benchmark (this information need not be disclosed publicly)
- Furthermore, Sensitivity Analysis (see section 7.4) is recommended to test robustness of the results to variations in key input data.

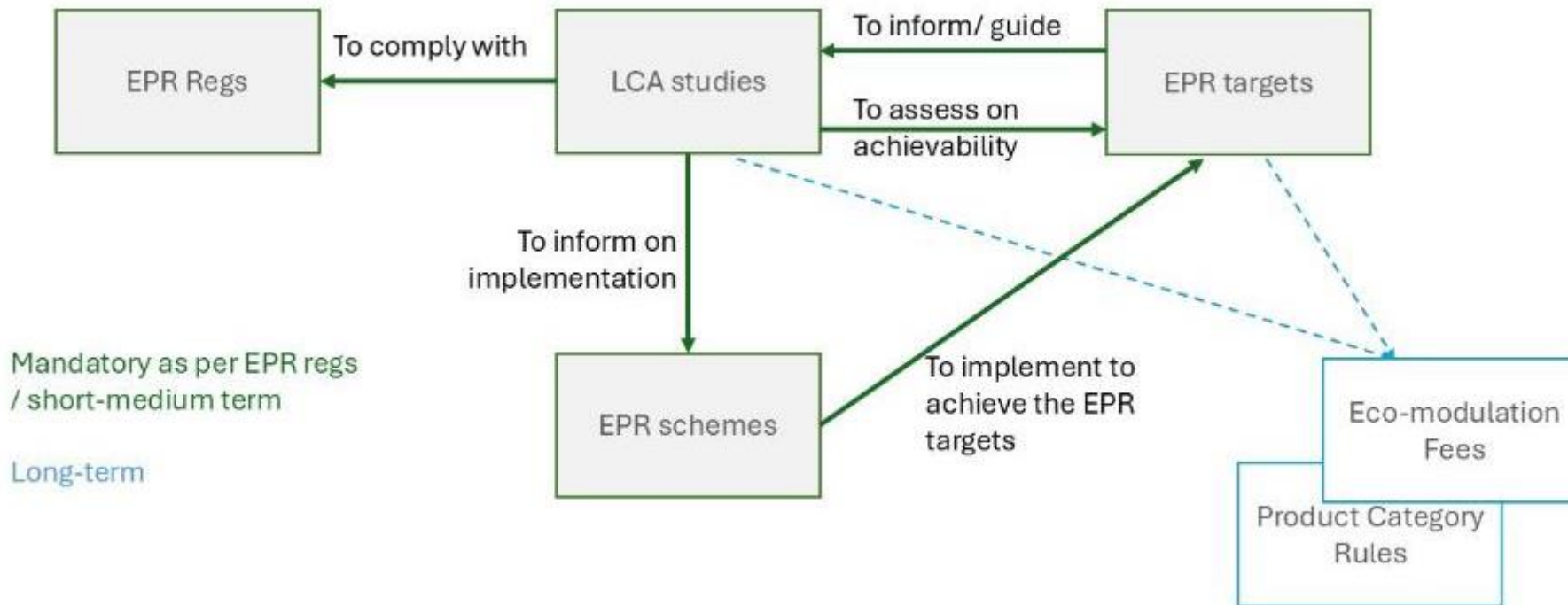
Benefits of the proposed Approach

- *Least onerous and at least cost for the stakeholders* - reduces the number of LCA studies required to fulfill the LCA requirements under the EPR Regulations
- Enables fulfilment of the LCA requirement in the EPR regulations by *providing a step-by-step approach to product grouping* (where required)
- *Harmonised way of dealing with product grouping from a broader perspective* - scalable and adaptable to different products
- It will provide an easier way to monitor *compliance*, and would ensure much more meaningful LCA results and greater comparability between different products and designs
- The approach is a *bridging* between the product categories as per EPR notices that matter for the EPR targets, and product categories for enabling LCA application (streamlined approaches) and LCA requirements to be met.

General recommendations

- A single LCA study should be conducted (collectively, if possible) for each class of products identified in the EPR Regulations.
- The LCA should be conducted for a specified quantity (mass), or for a representative product that best represents the class of products; and results scaled up/down for different variations.
- Include secondary packaging when this is part of the product sold/delivered.
- A Scenario Analysis should be conducted on at least the following aspects:
 - The impact of different design characteristics (e.g. the use of mixed materials, colours, binders, fillers and other additives) on production, recovery and recycling of the material.
 - How variations in the type and quantities of raw material used can influence the environment impacts.
 - How differences in other key parameters, such as electricity supply and transport of the materials/products, affects the results.
- However, these general recommendations would need to be unpacked and confirmed on a case-by-case basis for each product class; through discussions between the relevant PROs, producers, LCA experts, and technical experts on the products/materials in question.

Short- and Long-term vision



LCA can play a broader role within the context of EPR and the circular economy; e.g. in helping to inform the setting of eco-modulated EPR fees.

Product Category Rules (PCRs) would help to provide further guidance; while there a need for SA relevant data in certain sectors.

Summary

- The proposed approach aims at tackling not just a set of 'PCRs for the identified product category', but rather **providing a broader approach to product grouping that can be applied to different product categories** (to be further refined with the PROs)
- The proposed **Approach for operationalizing the LCA requirements** will be integrated in the Guidelines as a recommended way to deal with product grouping
- Producers and PRO's should work together to determine appropriate level at which LCA studies should be conducted for their products, based on the 3 principles (scaling, scenario analysis, collective approach)
- The CSIR's LCA team could assist in these discussions where needed and provide a series of **training workshops on the Guidelines and the associated Approach**

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