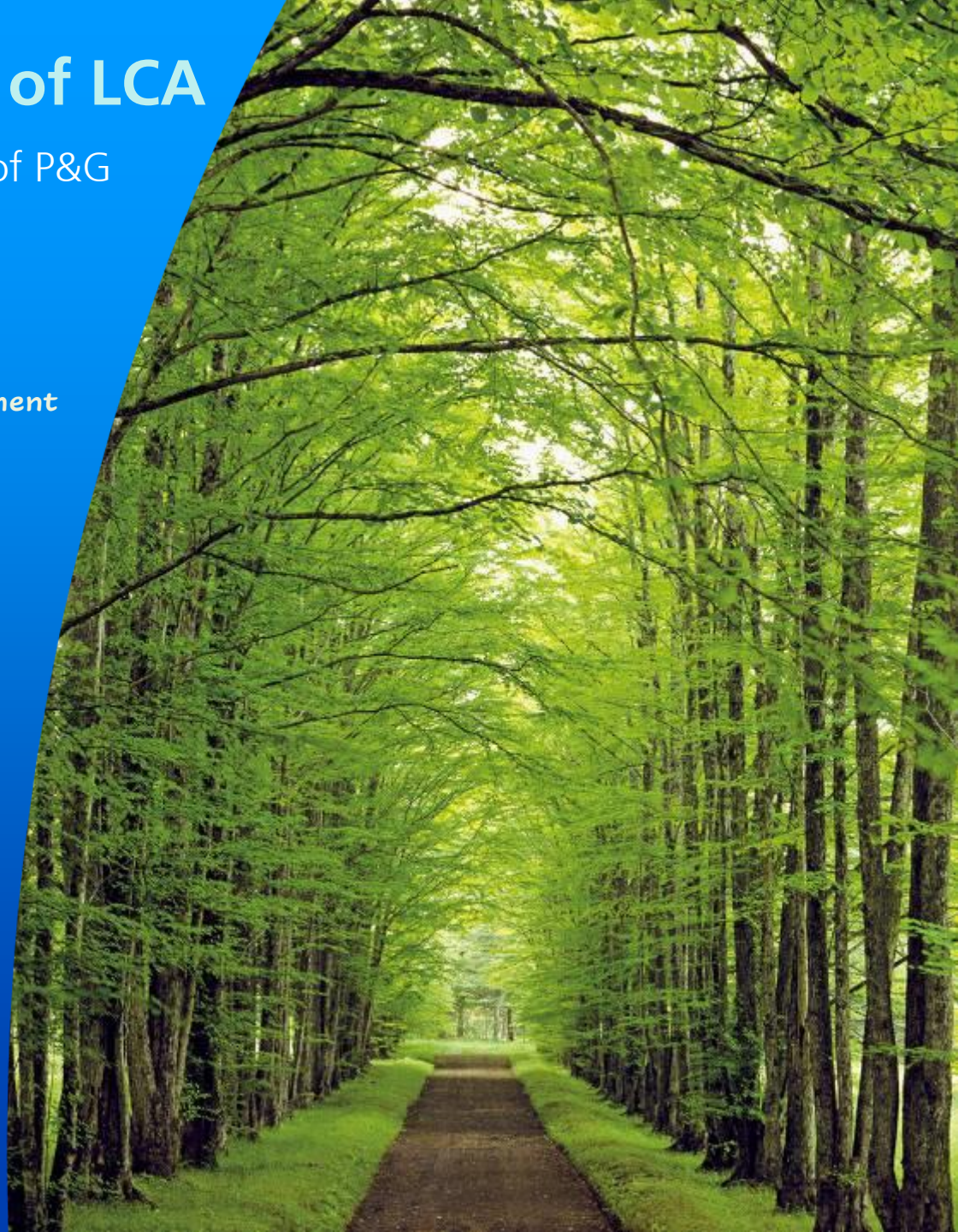
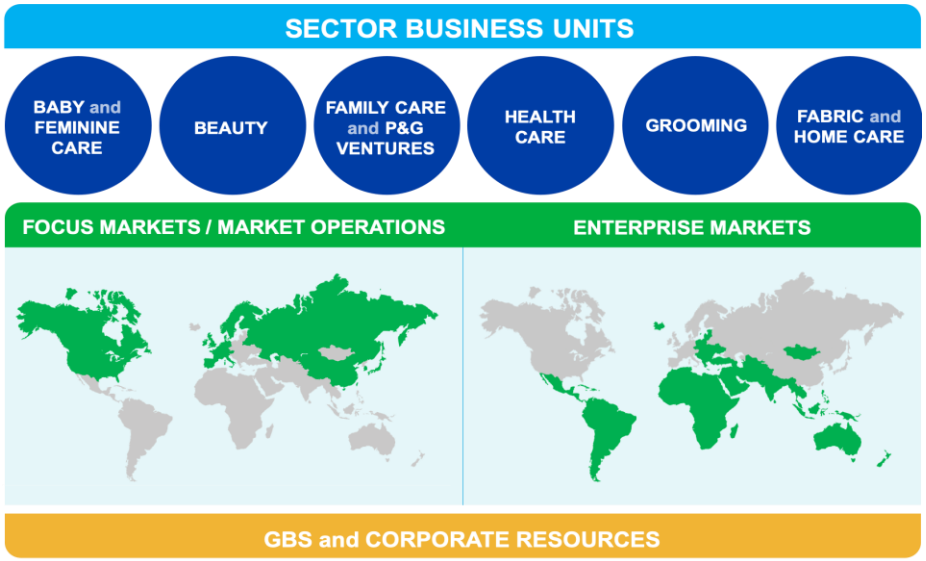
Quality requirements of LCA in business - A perspective of P&G

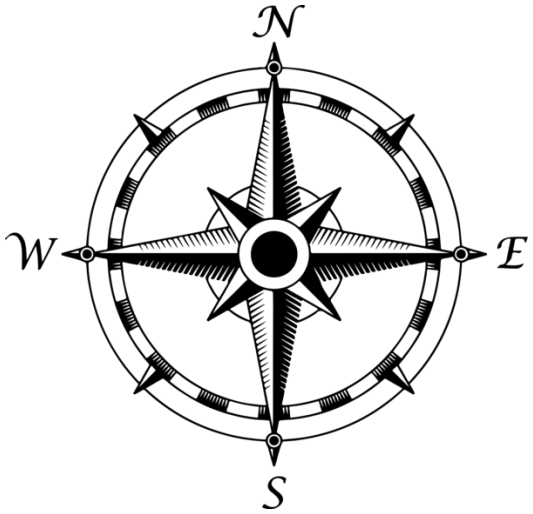
77th Discussion Forum on Life Cycle Assessment
Quality Control in LCA

Joost Dewaele
April 21, 2021



LCA in business support …

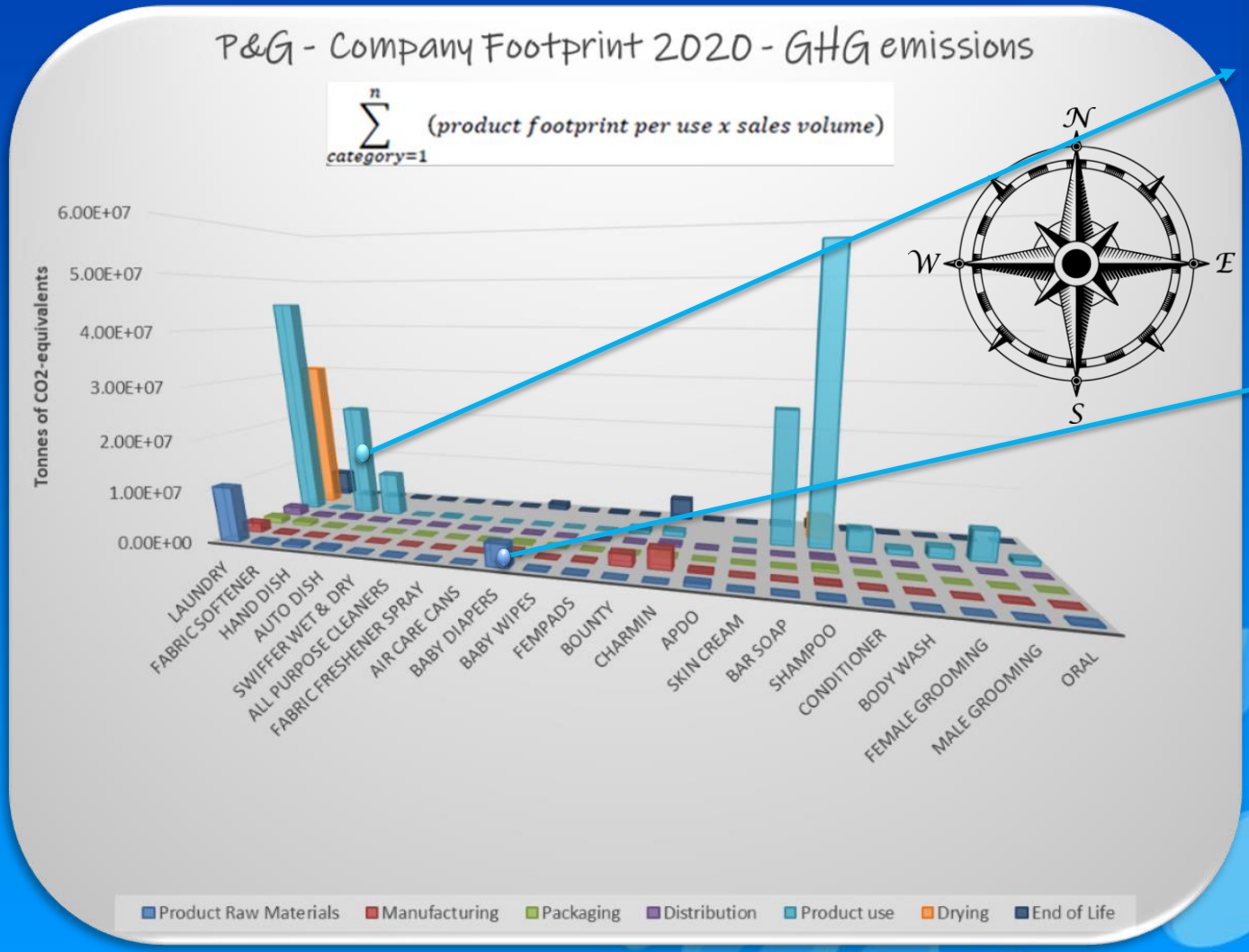




Touching lives, improving life. P&G™

Baby	Feminine Care	Family	Fabric	Home	Hair	Skin & Personal Care	Grooming	Oral	Personal Health Care
Pampers, Pampers pants, Luvs	always, TAMPAX PEARL	Bounty, Charmin	Tide, ARIEL, Gain	DAWN, Swiffer WETJET, FAIRY	PANTENE, Head & Shoulders	OLAY, SK-II	Gillette, Venus, BRAUN	Crest 3D WHITE, Oral-B BLACK 7000	Metamucil, NyQuil

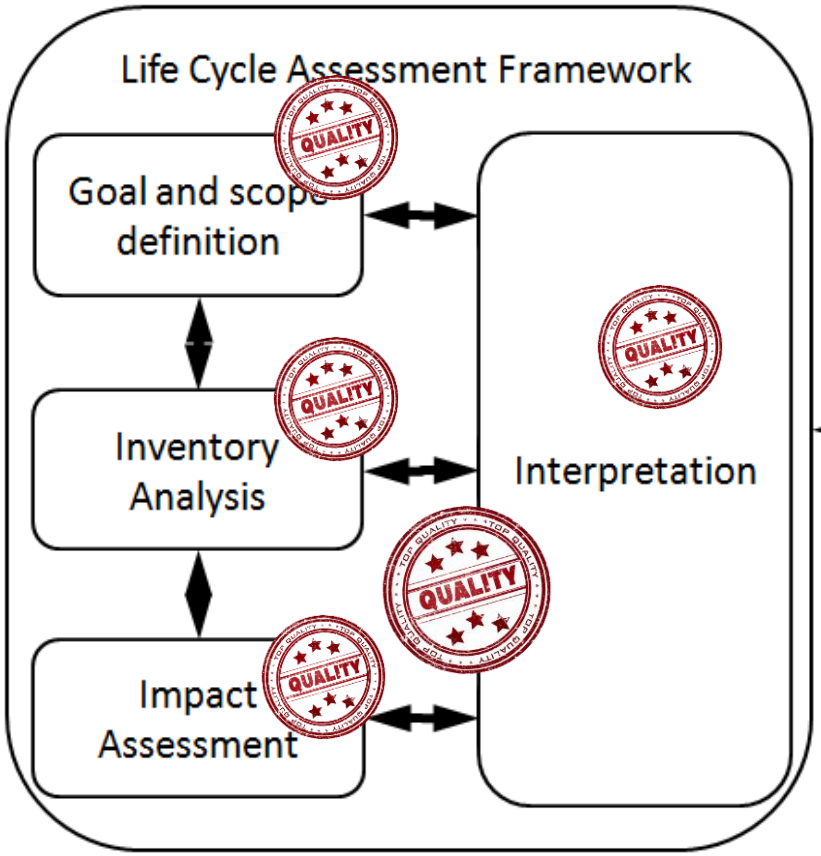
… and Quality Requirements?



"Fit for purpose"

Inspired by:

ISO 14040/14044



Direct applications

- Product development and improvement → Support sustainability understanding and design
- Public policy making
- Strategic planning → Category & Sector strategy & goals; Corporate level strategy & goals
- Marketing
- Other → Communication of choices

Reliability / Validity

Acceptance, level of confidence, trust

Flexibility ⟷ Reproducibility

Internal, B2B, B2C

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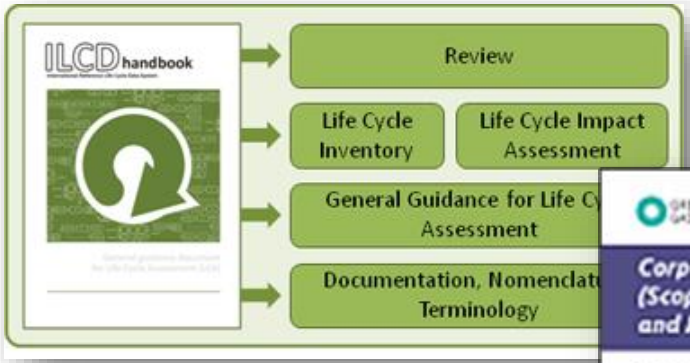
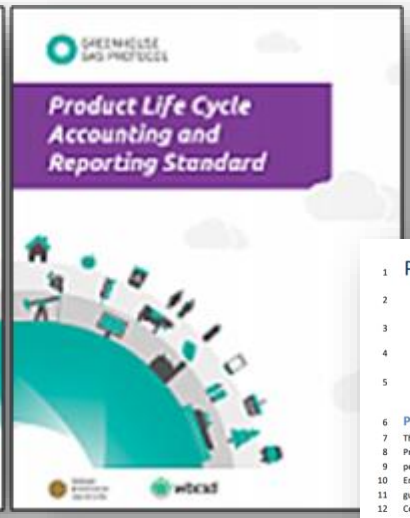
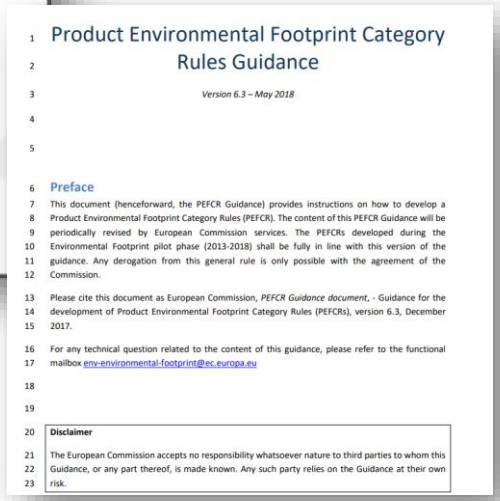
Inspired by :

Other







Product Environmental Footprint Category Rules Guidance

Version 6.3 – May 2018

Preface

This document (henceforward, the PEFCR Guidance) provides instructions on how to develop a Product Environmental Footprint Category Rules (PEFCR). The content of this PEFCR Guidance will be periodically revised by European Commission services. The PEFCRs developed during the Environmental Footprint pilot phase (2013-2018) shall be fully in line with this version of the guidance. Any derogation from this general rule is only possible with the agreement of the Commission.

Please cite this document as European Commission, *PEFCR Guidance document*, - Guidance for the development of Product Environmental Footprint Category Rules (PEFCRs), version 6.3, December 2017.

For any technical question related to the content of this guidance, please refer to the functional mailbox env-environmental-footprint@ec.europa.eu

Disclaimer

The European Commission accepts no responsibility whatsoever nature to third parties to whom this Guidance, or any part thereof, is made known. Any such party relies on the Guidance at their own risk.

Flexibility ⟷ Reproducibility

Internal, B2B, B2C

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‘Framing’ Quality:

Reliability-Validity / Uncertainty-Variability

Survey of factors relevant for quality assessment in LCA

Main quality aspects	DQ indicator	Factors
S Reliability ≈ Spread	Model reliability	• Reproducibility of transformation • Reproducibility of computation
	Input data reliability	• Uncertainty • Completeness • Variability
A Validity ≈ Assessment	Model validity	• Steady state versus real dynamics • Linearity • Goal and scope match • Scope properly elaborated in functional unit, allocation methods and characterisation models • Potential vs. actual effects • Disregarding local circumstances • All relevant empirical mechanisms included? • Models behind equivalency factors
	Input data validity	for 4 types of input data: • System boundaries • Representativeness
P Pedigree	Procedural aspects	• Data verification • Sensitivity analysis • Gravity analysis • Dominance analysis • External plausibility • Parts of model tested • Comparison of outcome with similar models • Status of software provider

Source: Quality assessment for LCA, TNO, CML, IVAM, 1999

Table 1: Point of introduction in the LCA of different types of uncertainty, and examples of possible sources. Based on Huijbregts (1998a)

Type	LCA phase				
	Goal and scope	Inventory	Choice of impact categories	Classification	Characterisation
Data inaccuracy		Inaccurate emission measurements			Uncertainty in life times of substances and relative contribution to impacts
Data gaps		Lack of inventory data			Lack of impact data
Unrepresentative data		Lack of representative inventory data			
Model uncertainty		Static instead of dynamic modelling. Linear instead of non-linear modelling			Static instead of dynamic modelling. Linear instead of non-linear modelling
Uncertainty due to choices	Choice of functional unit, system boundaries	Choice of allocation methods, technology level, marginal/average data	Leaving out known impact categories		Choice of characterisation methods
Spatial variability		Regional differences in emission inventories			Regional differences in environmental sensitivity
Temporal variability		Differences in yearly emission inventories			Choice of time horizon. Changes in environmental characteristics over time
Variability between objects/sources		Differences in performance between equivalent processes			Differences in environmental and human characteristics
Epistemological uncertainty	Ignorance about relevant aspects of studied system	Ignorance about modelled processes	Impact categories are not known	Contribution to impact category is not known	Characterisation factors are not known
Mistakes	Any	Any	Any	Any	Any
Estimation of uncertainty		Estimation of uncertainty of inventory parameters			Estimation of uncertainty of characterisation parameters

Table 3: Overview of tools available to address (reduce and/or illustrate) different types of uncertainty in LCA. Based on Huijbregts (1998a)

	Data inaccuracy	Data gaps	Unrepresentative data	Model uncertainty	Uncertainty due to choices	Spatial variability	Temporal variability	Variability in objects/sources	Epistemological uncertainty	Mistakes	Estimation of uncertainty
Standardisation					x					x	
Data bases		x	x								x
Data quality goals	x		x								
Data quality indicators	x		x								
Validation of data										x	
Parameter estimation		x									
Additional measurements	x	x	x					x			
Higher resolution models				x		x	x				
Critical review		x	x		x				x	x	x
Sensitivity analysis	x		x	x	x	x	x	x			
Uncertainty importance analysis	x		x	x	x	x	x	x			
Classical statistical analysis	x					x	x	x			
Bayesian statistical analysis	x					x	x	x			
Interval arithmetic	x										
Vague error intervals	x										
Probabilistic simulation	x							x			
Scenario modelling			x	x	x	x	x	x			
Rules of thumb	x										

Source: Survey of Approaches to Improve Reliability in LCA, Anna E. Bjorklund, 2002

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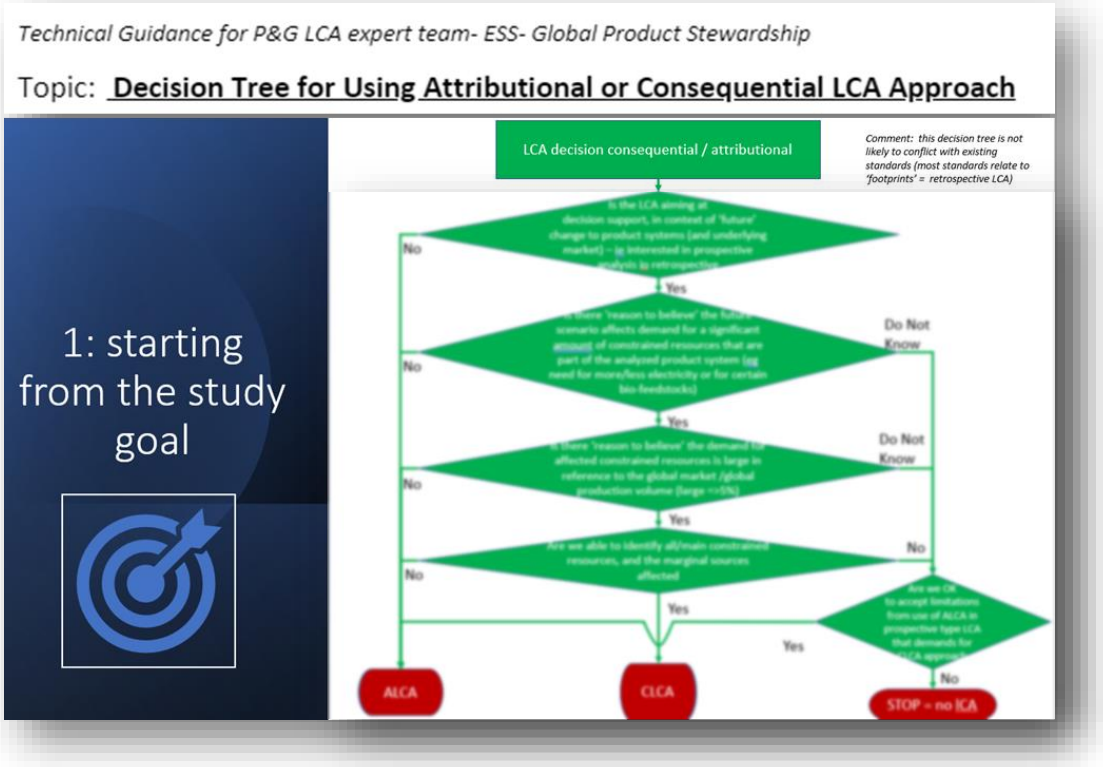
tailored to 'customer' application / need

Procedural (example)



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Data analysis (example)

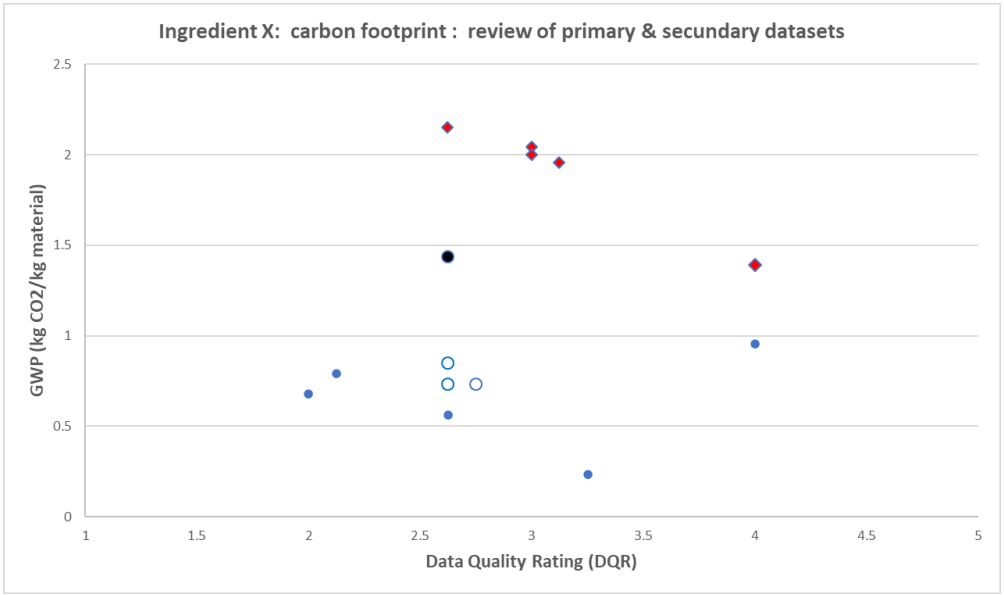

Table 10.4. Pedigree matrix used to assess the quality of data sources, modified from Weidema 1998)

Indicator score	1	2	3	4	5 (default)
Reliability	Verified[5] data based on measurements[6]	Verified data partly based on assumptions *or* non-verified data based on measurements	Non-verified data partly based on qualified estimates	Qualified estimate (e.g. by industrial expert)	Non-qualified estimate
Completeness	Representative data from all sites relevant for the market considered, over an adequate period to even out normal fluctuations	Representative data from >50% of the sites relevant for the market considered, over an adequate period to even out normal fluctuations	Representative data from only some sites (<<50%) relevant for the market considered *or* >50% of sites but from shorter periods	Representative data from only one site relevant for the market considered *or* some sites but from shorter periods	Representativeness unknown or data from a small number of sites *and* from shorter periods
Temporal correlation	Less than 3 years of difference to the time period of the dataset	Less than 6 years of difference to the time period of the dataset	Less than 10 years of difference to the time period of the dataset	Less than 15 years of difference to the time period of the dataset	Age of data unknown or more than 15 years of difference to the time period of the dataset
Geographical correlation	Data from area under study	Average data from larger area in which the area under study is included	Data from area with similar production conditions	Data from area with slightly similar production conditions	Data from unknown *or* distinctly different area (North America instead of Middle East, OECD-Europe instead of Russia)
Further technological correlation	Data from enterprises, processes and materials under study	Data from processes and materials under study (i.e. identical technology) but from different enterprises	Data from processes and materials under study but from different technology	Data on related processes or materials	Data on related processes on laboratory scale *or* from different technology

Secundary data: eg Industry-average
Primary data: eg supplier specific

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Procedural (example)

Technical Guidance for P&G LCA expert team- ESS- Global Product Stewardship

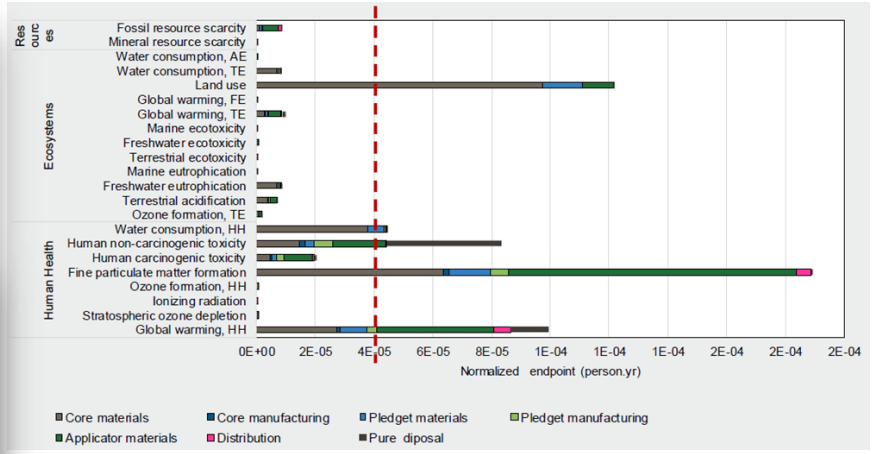
Topic: **Reporting of Environmental Indicators in P&G LCA studies**

A. **Stepwise Procedure:**

LCA studies conducted in P&G (internally conducted or commissioned by P&G to external agencies) are recommended[1] to follow below-described **procedure for reporting of environmental indicators:**

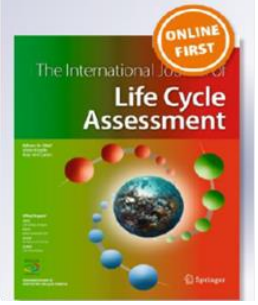
Guidance on reporting of Environmental Indicators in P&G LCA studies (2020)

- **If goal of study requires following external standard, follow standard:**
  PEFCR, EPD, PAS2050, …
- **If goal of study does not require following external standard:**
  - Select relevant indicators from world endpoint normalization
    - Nr indicators (min3-max6): 90+% contribution to total
    - LCIA Method: flexible
    - Exclusion of indicators possible: when justified by scientific argumentation
  - Add GWP (if not already included)
  - 'may' add other LCIA indicators when important in context of study
  - 'may' add measure for total (life cycle) energy demand (CED)
  - 'may' add other indicators (waste, circularity, others)
- **Report on procedure indicator selection, and environmental meaning of indicators** (e.g. as annex)



Indicator selection in life cycle assessment to enable decision making: issues and solutions

Gert Van Hoof, Marisa Vieira, Maria Gausman & Annie Weisbrod



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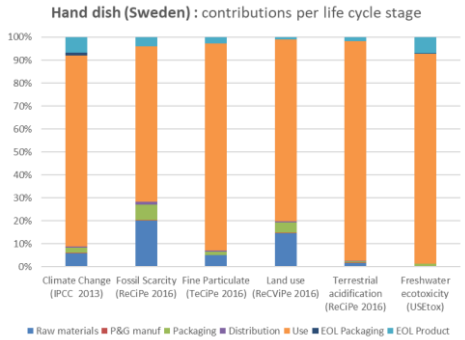
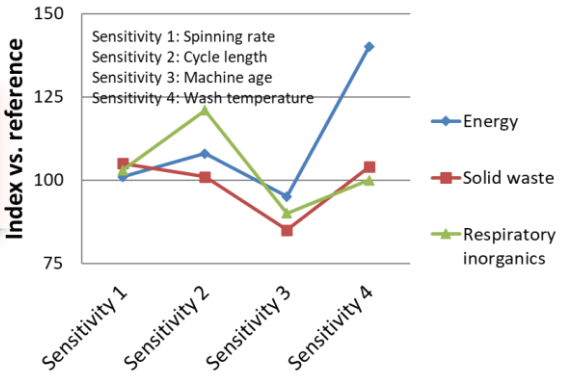
Data analysis (example)

DEFINE GOAL & SCOPE → ANALYSE INVENTORY → ASSESS IMPACT → INTERPRETATION

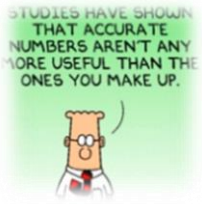
Contribution analysis

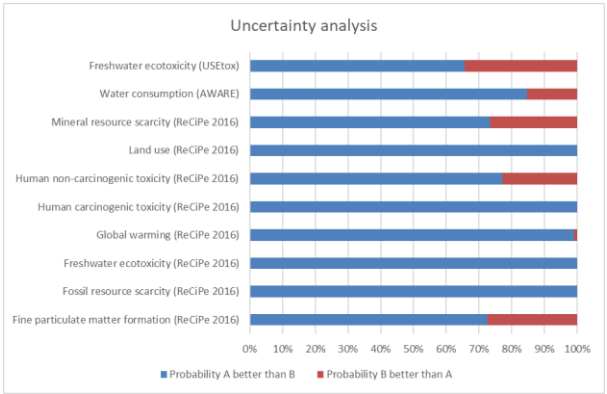


Sensitivity analysis



Uncertainty analysis





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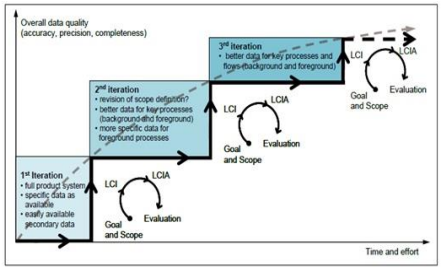

**From ILCD handbook, 2011a*

Reporting and critical review (iterative nature of LCA)

LCA tier	Conceptual LCA	Simplified or Screening LCA			Full or Detailed LCA		
Subcategories	/	Simplified screening LCA	Refined screening LCA	Highly refined screening LCA	Detailed LCA – Inspired by standards	Detailed LCA - Inspired by standards & published in peer reviewed scientific journal	Detailed LCA - Conform to standards (ISO 14000/14044, PEF, ILCD, PAS 2050, ISO 14067,...)
Reporting							
Peer review							
Iterations							
Goal (typical)							
Communication (Use)							
Resources (time/cost)							
Uncertainty							
LCA tools							

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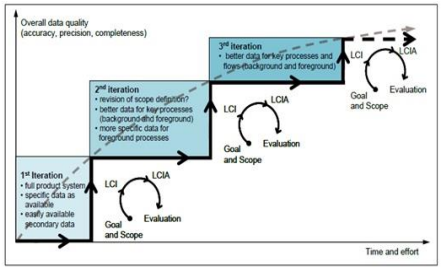

**From ILCD handbook, 2011a*

Reporting and critical review ('claims')

Technical guidance: LCA based claims and relation with LCA tiers and type of critical review

Audience		External Public		External Non-public	Internal
Type		Comparative Assertion	Other		
Technical robustness	Base level				
	Refinement				
	Final Refinement				

Screening LCA / internal review or no review

Full LCA / external review

F = "Full LCA", S= "Screening, or Simplified"

*: no further technical critical review

+: "internal" critical review. This requires at least 1 internal reviewer skilled in LCA (modeling and report writing), and knowledgeable of the system being analyzed.

++: "external" critical review. This requires at least 1 external reviewer skilled in LCA (modeling and report writing) and knowledgeable of the system being analyzed.

+++: external critical review panel. This requires at least 3 external reviewers skilled in LCA (modeling and report writing) and knowledgeable of the system being analyzed. May be supplemented with "interested parties".

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Summary - Some Quality aspects highlighted

	Procedural - standardization (standardization/ harmonization / reproducibility) (taking the best from standards in relation to PG use) (work in progress)	**Data analysis** (model / data input) (output)
Goal and scope	x attributional/ consequential	
Inventory analysis	x allocation recycling	x data quality assessment & rating
Impact assessment	x method - indicator selection x carbon accounting	
Interpretation		x – contribution - sensitivity – scenario -uncertainty
Reporting	x lca tiered approach	
Critical review	x lca tiered approach	

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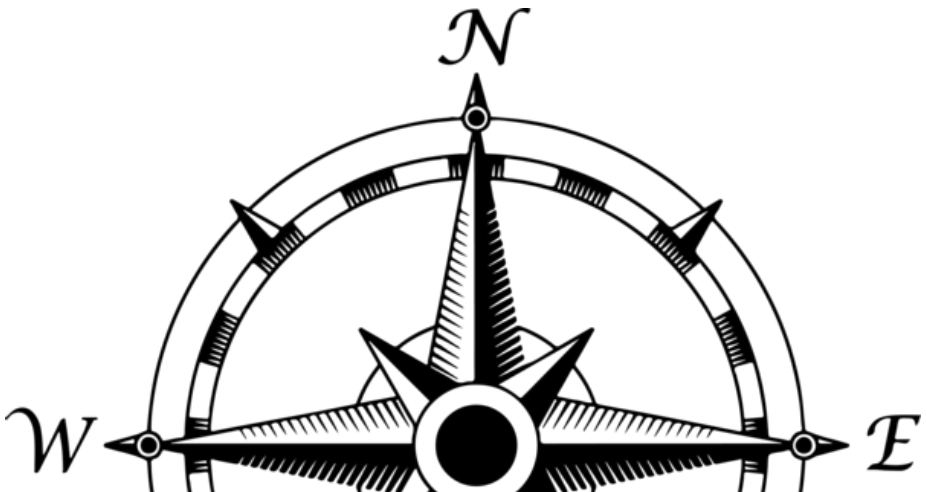

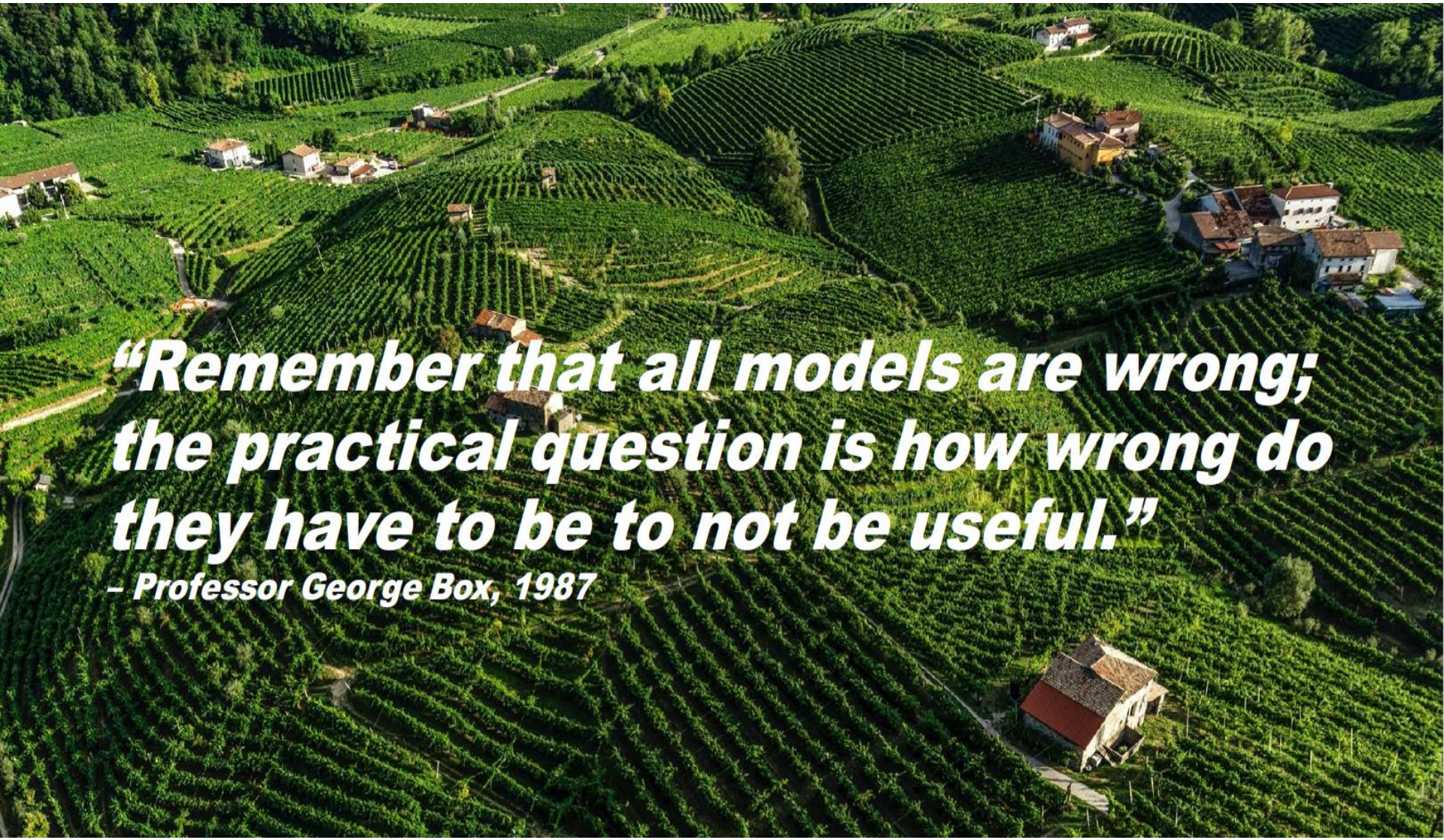
"Remember that all models are wrong; the practical question is how wrong do they have to be to not be useful."
– Professor George Box, 1987