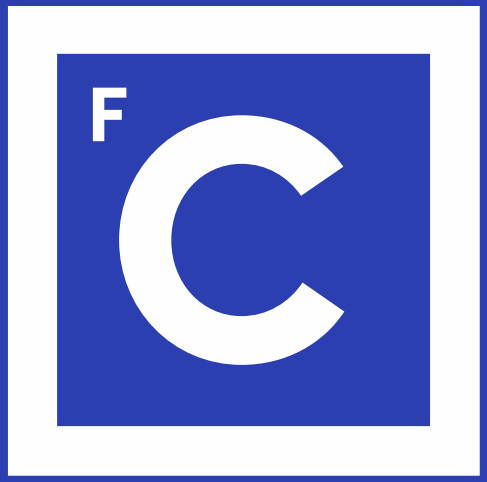

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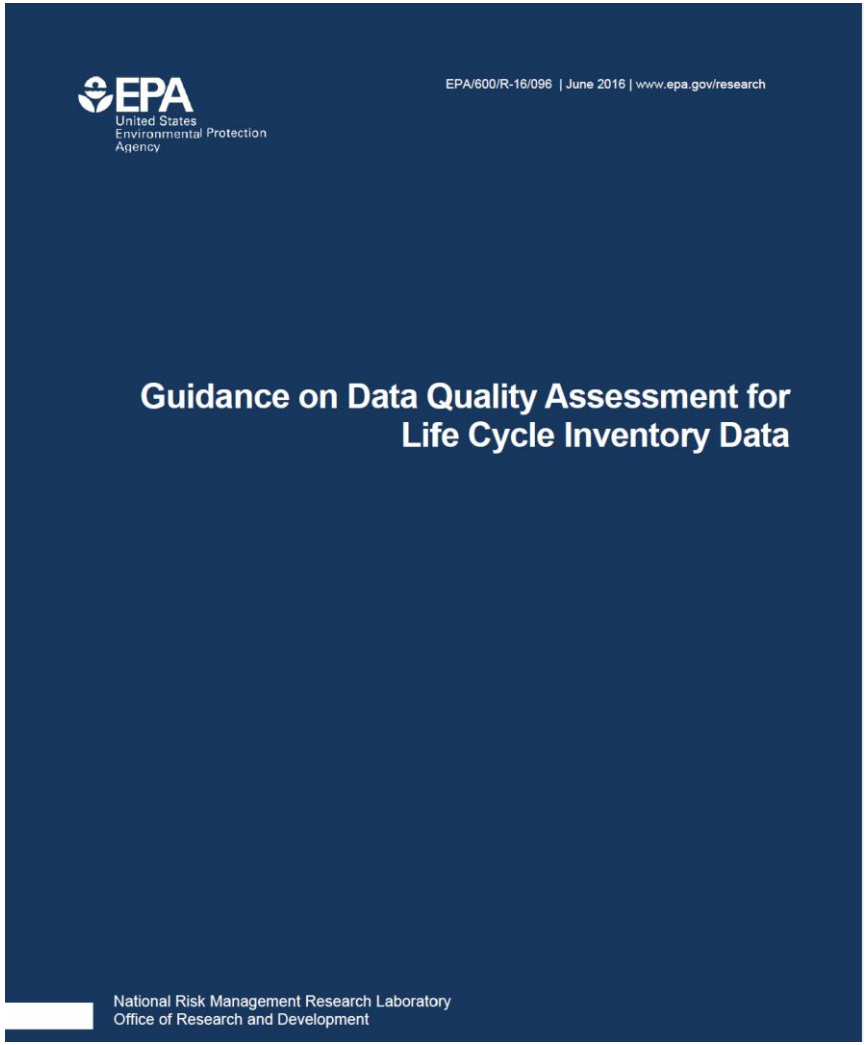
Eng Energy & Environment

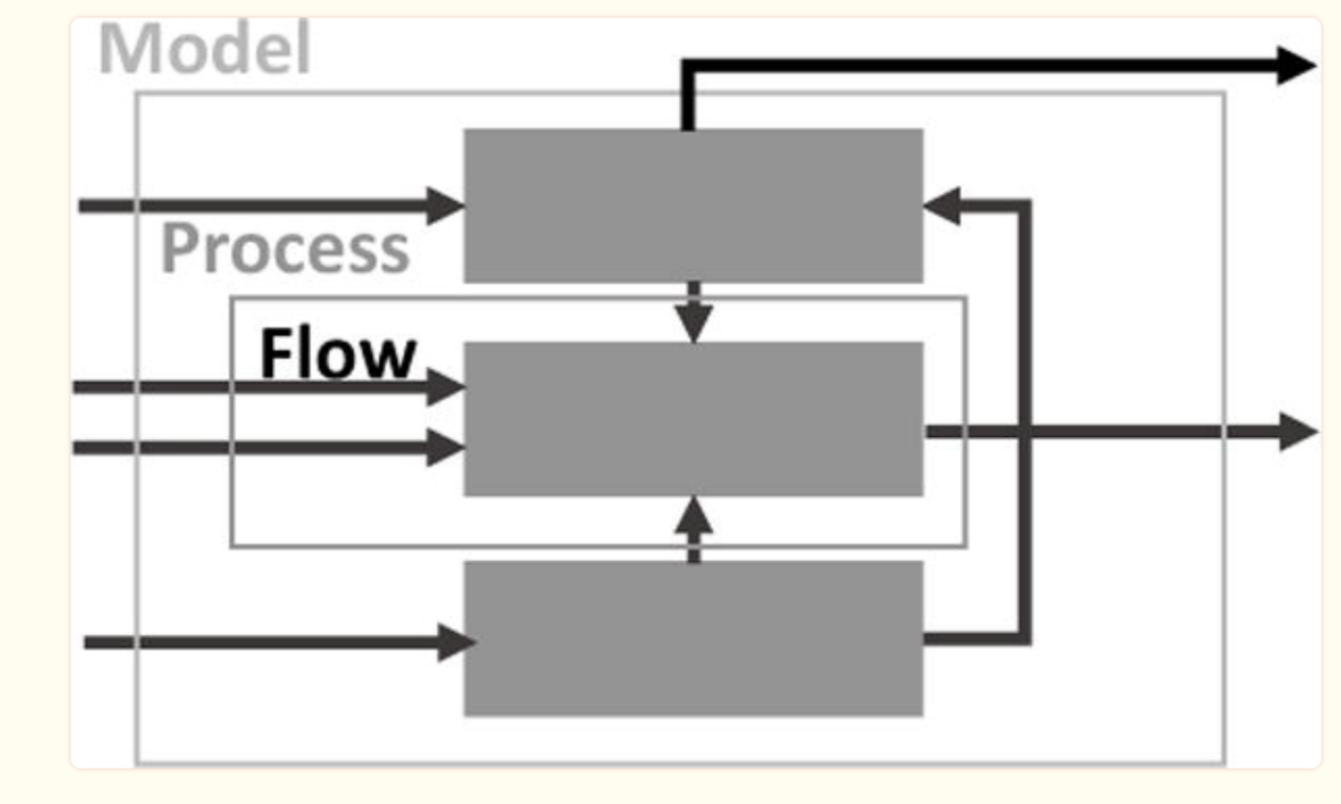
Environmental Impact & LCA

Data Quality Assessment

Based on



Data Quality/sensitivity/uncertainty where??



Model (considered boundary, process and flow); Process (equal or similar); Flow (range)

Data Quality/sensitivity/uncertainty where??

Model (considered boundary, processes and flow ; group of linked processes);

Process (equal or similar);

Depollution

Dismantling

Shredding

ASR sorting

ASR incineration

Flow (range/average value)

Electricity

Fuel/Heat

Mass of parts/materials of ELV

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Data quality/sensitiveness and uncertainty

VERY IMPORTANT: don't mislead the decision-maker with respect to LCA results

Pedigree Matrix – Data quality

Table 3. Updated Data Quality Pedigree Matrix – Flow Indicators

Highest score ← → Lowest score

Indicator		1	2	3	4	5 (default)
Flow reliability		Verified[1] data based on measurements	Verified data based on a calculation **or** non-verified data based on measurements	Non-verified data based on a calculation	Documented estimate	Undocumented estimate
Flow Representativeness	**Temporal correlation**	Less than 3 years of difference[2]	Less than 6 years of difference	Less than 10 years of difference	Less than 15 years of difference	Age of data unknown or more than 15 years
	Geographical correlation	Data from same resolution **and** same area of study	Within one level of resolution **and** a related area of study[3]	Within two levels of resolution **and** a related area of study	Outside of two levels of resolution **but** a related area of study	From a different or unknown area of study
	Technological correlation	All technology categories[4] are equivalent	**Three** of the technology categories are equivalent	**Two** of the technology categories are equivalent	**One** of the technology categories is equivalent	**None** of the technology categories are equivalent
	Data collection methods	Representative data from >80% of the relevant market[5], over an adequate period[6]	Representative data from 60-79% of the relevant market , over an adequate period **or** representative data from >80% of the relevant market, over a shorter period of time	Representative data from 40-59% of the relevant market, over an adequate period **or** representative data from 60-79% of the relevant market, over a shorter period of time	Representative data from <40% of the relevant market, over an adequate period of time **or** representative data from 40-59% of the relevant market, over a shorter period of time	Unknown **or** data from a small number of sites **and** from shorter periods

Pedigree Matrix - Example

Flow reliability -> Documented estimate ->Score 4

Geographical correlation

Resolution[1]	A	B	C	D	E	F	G
Name	Global	Continental	Sub-region	National	(Province/State/ Region)	(County/City)	(Site specific)
Example	World	North America	North America	USA	Ohio	Hamilton	26 W Martin Luther King Dr.

We want a 1000 kg ELV in Portugal so the resolution should be National – D

In our case we didn't get the data from Valorcar so ……"from a different area of study"….. Score 5

Pedigree Matrix

Table 4. Updated Data Quality Pedigree Matrix – Process Indicators

Indicator	1	2	3	4	5 (default)
Process review	Documented reviews by a minimum of two types[1] of third party reviewers	Documented reviews by a minimum of two types of reviewers, with one being a third party	Documented review by a third party reviewer	Documented review by an internal reviewer	No documented review
Process completeness	>80% of determined flows have been evaluated and given a value	60-79% of determined flows have been evaluated and given a value	40-59% of determined flows have been evaluated and given a value	<40% of determined flows have been evaluated and given a value	Process completeness not scored

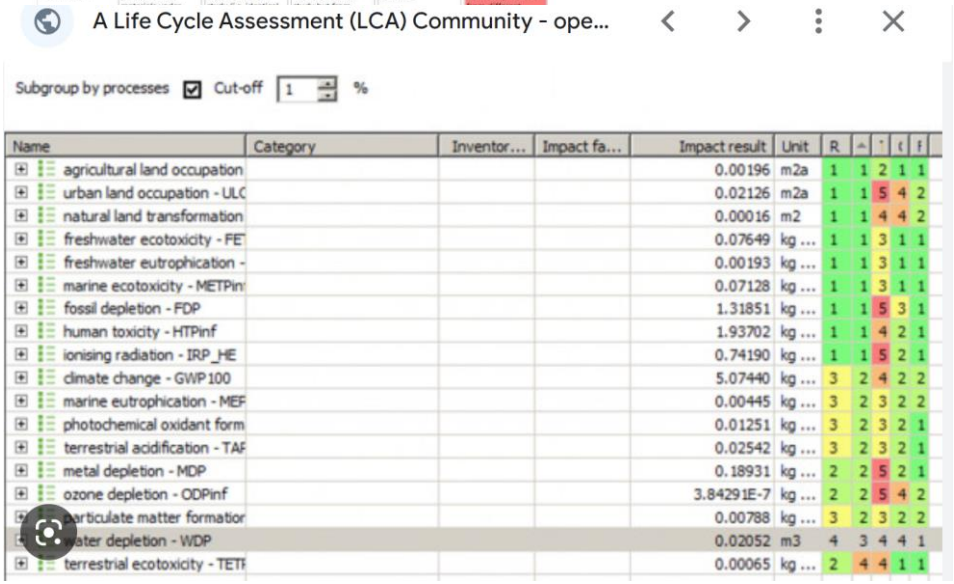
Pedigree Matrix - Example

Process review-> No review by a third party->Score 5

Process completeness-> >80% of the flows were given a value >Score 5

Pedigree Matrix - Example

Colour from green Score 1 to red Score 5



Calculate an average Score

$$\frac{\sum_{i=1}^{n} Score_i}{n}$$

n = number of flows

n = number of processes

Sensitivity & uncertainty

Based on

The International Journal of Life Cycle Assessment
https://doi.org/10.1007/s11367-017-1432-6

UNCERTAINTIES IN LCA

Uncertainty in LCA case study due to allocation approaches and life cycle impact assessment methods

Edivan Cherubini[1,2] · Davide Franco[3] · Guilherme Marcelo Zanghelini[1,2] · Sebastião Roberto Soares[1]

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Abstract

Purpose Uncertainty is present in many forms in life cycle assessment (LCA). However, little attention has been paid to analyze the variability that methodological choices have on LCA outcomes. To address this variability, common practice is to conduct a sensitivity analysis, which is sometimes treated only at a qualitative level. Hence, the purpose of this paper was to evaluate the uncertainty and the sensitivity in the LCA of swine production due to two methodological choices: the allocation approach and the life cycle impact assessment (LCIA) method.

Methods We used a comparative case study of swine production to address uncertainty due to methodological choices. First, scenario variation through a sensitivity analysis of the approaches used to address the multi-functionality problem was conducted for the main processes of the system product, followed by an impact assessment using five LCIA methods at the midpoint level. The results from the sensitivity analysis were used to generate 10,000 independent simulations using the Monte Carlo method and then compared using comparison indicators in histogram graphics.

Results and discussion Regardless of the differences between the absolute values of the LCA obtained due to the allocation approach and LCIA methods used, the overall ranking of scenarios did not change. The use of the substitution method to address the multi-functional processes in swine production showed the highest values for almost all of the impact categories, except for freshwater

Sensitivity – Allocation method

Allocation by outputs or allocation by inputs…..

Does it change the scenario ranking?? It is better to incinerate the ASR to provide energy to the ELV system or not?

Sensitivity – ASR final destination

Does it change the scenario ranking??
Affects the impact category by how much, in percentage?

considering ASR after sorting go to landfill

or incineration without energy recovery.

ASR Landfill

The only emissions associated with landfilling plastics are from transportation to the landfill and moving waste in the landfill,

https://archive.epa.gov/epawaste/conserve/tools/warm/pdfs/Plastics.pdf

0.04 $MTCO_2eq$/Short Ton = 55 gCO_2eq/ kg Plastic

MT – Metric Ton 1000 kg

ST – Short Ton 907.18 kg

ASR Landfill

BUT THERE CAN BE BACTERIA/Microbes….

https://www.smithsonianmag.com/smart-news/polystyrene-eating-superworms-may-provide-clues-for-better-recycling-180980239/

Incineration without energy recovery produces 371 kg CO_2/ (67.5+169.9) kg ASR after sorting

1.6 kgCO_2/kg ASR after sorting

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Uncertainty– Parameter uncertainty

data variability, for example electricity consumption in Shredding min-max found in literature how it reflects in output variability

Min
Average
Max

Min
Average
Max

Challenge #5 Pedigree Matrix-Sensitivity-Uncertainty

1- Apply the Pedigree Matrix of the 1000 kg ELV example;

2- Sensitivity to electricity generation mix ? A variation causes a variation in results?

3- Sensitivity regarding allocation procedure in “ASR incineration”? A variation causes a variation in results?

4-Sensitivity regarding ASR –mostly plastics incineration with energy recovery versus without energy recovery

5- Uncertainty due to electricity data for shredding

Deliver until 13/16 December

Challenge #5 Pedigree Matrix-Sensitivity-Uncertainty

Tip – Pedigree Matrix

Process

Depollution

Dismantling

Shredding

ASR sorting

ASR incineration

Flow (range/average value)

Electricity

Fuel/Heat

Mass of parts/materials of ELV

Challenge #5 Pedigree Matrix-Sensitivity-Uncertainty

Tip – Pedigree Matrix

		Flow reliability	Temporal representativeness	Geographical representativeness	Technological representativeness	Data collection methods	1	
FLOW	electricity -empilhadora						2	
	electricity -dismantling						3	
	electricity shreding						4	
	fuel -diesel - empilhadora						5	
	heat - kerosene -ASR sorting							
		Review	Completeness					
PROCESS	Depollution							
	Dismantling							
	Shredding							
	ASR sorting							
	ASR incineration							
	Average score							

Challenge #5 Pedigree Matrix-Sensitivity-Uncertainty

Tip – consider the base case, year 2020, allocation at incineration by outputs and incineration of ASR with energy recovery

Register deviations from baseline:

- observe the deviation, in %, of the carbon footprint by considering allocation by inputs;

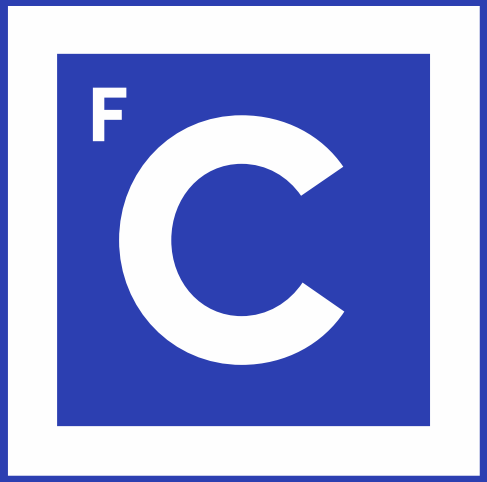
- observe the deviation of the carbon footprint is there is ASR incineration without energy recover;

- Observe the effect in the carbon footprint of considering the range of values in electricity needs in shredding instead of a unique value.

Evaluation dates

Time	13-12-2022 (1.3.20)	16-12-2022 (6.2.50)	11-01-2023 (1.3.20)	30-01-2023 (6.2.44)
13h	x	X Santo		
13h30	x	X Margarida		
14h	x	X Lara		
14h30	x	X Carolina		
15h	x	X Sara		
15h30	x	X João V.		
16h	x	X Leonor		
16h30	x	X Miguel	x	x
17h			x	x
17h30			x	x
18h			x	x
18h30			x	x
19h			x	x
19h30			x	x

Thanks



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