

Your Submission

From Editor Resources, Conservation & Recycling <em@editorialmanager.com>

To Stewart Charles McDowall <publish@scmcd.ch>

Date Friday, June 28th, 2024 at 14:34

Ms. Ref. No.: **RECYCL-D-24-01859**

Title: T-reX: Quantifying waste and material footprints in current and future Life Cycle Assessment (LCA) databases
Resources, Conservation & Recycling

Dear Mr Stewart Charles McDowall,

Thank you very much for submitting your article for publication in Resources, Conservation & Recycling. Your manuscript "T-reX: Quantifying waste and material footprints in current and future Life Cycle Assessment (LCA) databases" has been reviewed. The reviewer comments are appended below. You will see that they are advising that you extensively revise your manuscript. The revision due date is **Aug 28, 2024**.

Please use the reviewer comments to prepare the next version of your paper. Please accompany your submission with a letter describing the response and changes in reaction to the reviewers comments.

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Yours sincerely,

Yuan Yao, Ph.D.

Editor

Resources, Conservation & Recycling

Reviewers' comments:

Reviewer #1: Dear Authors,

I think that this manuscript needs to be ameliorated.

- 1.The system boundary of the case study should define, and it can be shown more clearly by adding diagrams.
2. No input-output table provided for the case studies. Please provide this inventory data in the manuscript.
- 3.Result and Discussion section; this study was present some part of material footprint. I

recommend further discussions and interpretation the result. In addition, it is necessary to present the overall material footprint of battery.

4. Authors should also perform the sensitivity analysis or uncertainty analysis.

Reviewer #2: The manuscript is well-written and presents a clear argument. I had a few minor suggestions.

1. To clearly communicate the novelty of this work, the author may consider emphasizing explicit Comparison with Existing Methods. Although section 3 has comparisons, it's hard to tell the differences between T-rex with the existing LCIA methods (i.e CO2 emissions/waste). Providing a detailed comparison of T-reX with existing LCA and LCIA methods will be helpful to justify the novelty.

2. there are sections where the language can be simplified for better clarity without losing technical precision. For example, the abstract succinctly summarizes the study. However, consider adding a sentence on the main findings from the case study to give a complete overview. The phrase "frantic pursuit of sustainability objectives" in the introduction could be toned down to "dedicated pursuit of sustainability objectives" for a more neutral tone.

3. A discussion on potential future developments and applications of T-reX will be helpful.

4. the graphical of abstract (low resolution figure) is hard to read.

Reviewer #3: I think that the paper presents an interesting and novel method to assess waste generation and consumption of material in systems, but some aspects need a more extensive explanation.

Major comments:

Lines 105-106: I can understand the difference between the T-reX method and the results that one can derive from the LCI analysis (i.e. the list of elementary flows associated with the system under analysis) in the case of waste, because, as you said, T-reX considers also waste flows that are treated, but what about material flows? Why should T-reX results be different from those that one can obtain by the LCI analysis? This point remains unclear to me even after reading the entire paper.

Line 213: I think that T-reX is a method to perform the interpretation of the LCI results, it does not evaluate impacts; as it is correctly reported in lines 409-410, T-reX method calculates waste and material inventory footprints, so the terminology "pseudo-LCIA" is in my opinion misleading (even if there is the "pseudo") and it should be replaced with e.g. "LCI interpretation" method.

Line 300: please say how the single score is calculated for T-reX evaluation.

Results section: as in a standard LCA, the results should be reported before starting with

their interpretation, so please consider adding here for the analysed systems some of the results in absolute terms. This will really help the reader to understand the type of output that can be achieved with T-reX method.

Minor comments

In general, when you refer to the SM section 6, please indicate also the sub-section.

In general, try to avoid putting words in " and use this only when it is strictly necessary (e.g. line 433: why did you write 'circular economy' and not simply circular economy?)

Line 128: what do you mean with "generic waste processing models"? e.g. models that do not take into consideration the type of waste? Usually, databases include different treatment processes for the different types of waste, so please explain what you mean.

Line 227: "the waste categories include incineration, recycling": do you mean "the waste categories include waste sent to incineration, recycling"?

Lines 230-231: "a characterisation factor of -1 is applied to the waste footprint methods": what do you mean? Usually, a CF is given to a flow.

Line 231: please explain the acronym CCS

Table 4 of the SM: there is sand but not gravel: why?

Line 247: which are the methods are you referring to?

Lines 251-253: T-reX does not calculate impacts, so what do you mean with "including non-direct impacts on the market such as co-production of other materials"?

Lines 255-257: are you referring to the cases where the mining of one material is done together with the extraction of another material? Please say more explicitly the situations are you referring to.

Lines 258-260: where exactly can the reader see this aspect in sub-section 3.2?

Line 260 and line 382: "substitution": substitution of what?

Lines 289 and 290: LT stays for what?

Line 303-305: this sentence is not clear to me. Please consider rephrasing it.

Lines 322 and 332: the title includes both waste and material but then nothing is said about the material inventory footprint in the sub-section.

Figure 2: if I consider arrows that enter the cobalt production box, I have 12% + 20% that is more than 22% (cobalt box): why?

Figure 2 caption: here you say that the diagram shows the total solid waste footprint but at the top of the diagram I see the box "treatment of inert waste, landfill", so I do not understand how to read the diagram.

Line 343: what do you mean with "carbon dioxide waste"? Is it not better to call it "waste from CCS"?

Figure 3b: CCS instead of CSS?

Line 370: I think that "T-reX Coal (black) demand method" should be replaced with "Coal (black) demand of T-reX method". The same consideration is valid for the EDIP method (EDIP is the method, "coal no LT" is one of the results of the method).

Lines 373 and 374: natural gas is given as example of fossil fuel related methods and zinc for metal demand methods, but natural gas and zinc are just elementary flows and not methods. So please use the correct terminology.

Lines 422-423: how can a waste represent a loss of resources or an environmental risk?

Please explain it better, maybe adding some examples.

Lines 436-437: I didn't understand the second part of this sentence. Please consider rephrasing it.

Line 443: it does not seem to me that T-reX "examines their connections so supply chain risks and potential environmental damage": T-reX gives simply an overview of waste generated and materials consumed.

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