Review of: "Quantifying the Environmental Impact: A Comparative Analysis of Consensus Algorithms in Blockchain for Carbon Footprint Reduction and Mitigating Climate Change"

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Potential competing interests: No potential competing interests to declare.

The paper deals with an important topic: the environmental footprint of blockchain technology.

Unfortunately, the paper is incomplete. Right after a methodology is proposed to tackle the research question, the authors conclude. The reader expects to see an application of the methodology, a description of the results, and an interpretation of the results. Hence, the core of the paper is missing. The authors are likely aware of this when they call their paper in the abstract a “detective story”. In the abstract, they also claim to “(dive) deep into the inner workings of consensus algorithms in blockchain systems”, which is simply not true and misleading.

The main contribution of the paper seems to be to propose a methodology to compare the environmental impact of different consensus algorithms. This model is very basic, but that is actually a positive, as it can be easily applied – in theory. In practice, the crucial aspect of the model is the “carbon intensity factor”. It could even be that this factor is negative for some PoW mining sites, but it will be extremely hard to impossible to collect reliable data.

There are two important oversights by the authors in regards to the model:

1) The model relies on the number of transactions instead of the value of the transactions. Securing a $1 billion transaction is arguably more valuable than securing a transaction of $0.1. It is highly suggested to change the number of transactions to the total transaction value in $.

2) A consensus algorithm secures transactions on the first layer – but also on all layers on top. Layer 2 transactions are very common by now for smaller-scale transactions, and even layer 3 transactions are already seeing the light. These transactions would need to be incorporated as well. In general, the reader might find it too obvious that any consensus mechanism that relies on energy (PoW) is more detrimental to the climate than a mechanism that does not (PoS), which renders the whole analysis a bit useless. Hence, the authors should carve out an important point why a comparison still makes sense: Consensus algorithms are not interchangeable. They differ in the security they provide and the possible attack vectors. For example, it is well-argued that PoW systems are safer than PoS systems, which, in turn, are supposedly safer than dPoS systems. Hence, they do not deliver the same “service”, which might warrant a difference in the energy intensity.

In regards to the literature review, the authors mainly describe the topic and analyses carved out in papers, but often miss

to mention the main argument and conclusion. These should be added.