**Author’s response to reviewers**

**Reviewer 1**

**Comment 1:** I think that the section on orthogonal rotation should be clarified. How do you find or choose the orthogonal rotation matrix? Can you elaborate on the varimax rotation and/or any other type of rotation that can be helpful?

**Author response:** I have made substantial adjustments and additions to the manuscript in order to address the reviewer’s concerns regarding the orthogonal rotation matrix. In particular. For starters, I have replaced the word “orthogonal” with “orthonormal”, as this is what I meant to say. Also: 1) In the section “Signals from noise: dimensional reduction of portfolios”, which comes prior to any talk of orthogonal (henceforth orthonormal) rotation matrices, I have added text and equations clarifying the mathematical derivation of the loadings matrix and its close relation to the data correlation matrix, in order to better prepare the reader for the subsequent introduction of the orthonormal rotation matrix. 2) In the section “Applying an orthonormal rotation to clarify loadings” (where the orthonormal rotation matrix is introduced), I have added text and equations to explain why it is important that the rotation matrix must be orthonormal. 3) In the same section, I include a new footnote referring the reader to literature if they want to learn more about varimax rotations. (I decided not elaborate on varimax rotations in the main text as this is of tangential importance to the main aims of the paper, and would add considerable complexity to an already somewhat complex mathematical exposition.) 4) At the end of this section, I also added new text and equations clarifying how the orthonormal rotation, retained eigenvalues, and retained eigenvectors can be recovered from the rotated loadings alone, without any need for the original data. This includes (a better presentation of) the material provided in the section “Recovering the signals correlation matrix and leading eigenvectors from the loadings”, which I have deleted. These changes also required I make some edits in the subsequent section “Approximating the data correlation matrix from the retained loadings”, since some of the material there is now presented earlier in the manuscript. 5) I also rewrote the section “Reverse engineering project and SO correlation matrices from domain knowledge”, splitting it into three sections: “Reverse engineering the project correlation matrix from domain knowledge”, “Reverse engineering the policy covariance matrix from domain knowledge”, and “When is it appropriate to ‘reverse engineer’ correlation/covariance matrices from domain knowledge?” In the first of these three new sections, I explain why it is important to interpret the crowdsourced project-policy correlations as orthonormally rotated loadings (as opposed to unrotated loadings).

**Comment 2:** It will be a good test of the theory to find some example with good data and good domain expertise so that you can verify if the results obtained by applying the method from the domain expertise agree with the data.

**Author response:** This might be a good idea in terms of “model validation”, but also a little redundant considering the financial example already included in the paper. The financial example (especially Fig 5) essentially validates that the crowdsourced correlation matrix will closely match the data derived correlation matrix insofar as 1) institution policies may be interpreted as a set of orthonormally rotated, leading principal components explaining a good portion (>90%) of the variance in the (unobserved) data, and 2) the domain experts accurately estimate the policy-project correlations (i.e., the orthonormally rotated loadings). I have added some text to the Discussion section in order to clarify this point. Also, note the text already in the Discussion section where I discuss the usefulness of the proposed protocol in exploring the hidden implications of expert domain knowledge even if the knowledge is inaccurate.

**Comment 3:** On the other hand, there is a problem with the figure references.

**Author response:** I have brought the figure and table references in line with PLOS ONE submission guidelines. I am grateful to the editors for not desk rejecting my paper on this basis.

**Reviewer 2**

**Comment 1:** In the Abstract and Introduction, the author should clearly explain why this new method is better than the existing methods (if such methods were studied before). Since there is almost no literature review, it is hard for readers to grasp the novelty of the method.

**Author response:** While there is no “literature review” section per se, in the Introduction I do briefly indicate that the proposed protocol is more expedient than the only two other remotely comparable crowdsourcing methods that exist (the Delphi Method and Analytical Hierarchy Process). Later, in the closing paragraphs, I also discuss the relevance of the proposed protocol in the context of AR4D’s long history of good intentions but poor results in priority setting/resource allocation exercises, and the crisis in donor-researcher relations that this poor performance has created. I also point to literature indicating a similar situation across other disciplines, suggesting that the protocol could be useful there as well. I have added a sentence to this discussion calling out the trouble experienced in the CGIAR in particular; and a sentence to the Abstract and Introduction to alert the reader that such a discussion is included in the paper.

**Note:**

In addition to addressing the Reviewers’ concerns above, I have also made the following revisions:

* In the originally submitted manuscript, I mistakenly call the signals or policy covariance matrix a correlation matrix. I have corrected this in the revised manuscript, including new equations to make this clearer in the mathematical exposition. This required changes to the matrices appearing in Figs 8 and 10. (Modified graphics included in my revised submission.)
* I rewrote some of the paragraphs in the “An illustrative example” section to improve the readability and instructiveness of the example, especially as regards the interpretation of the reverse engineered policy covariance matrix.
* I rewrote and renamed the section “Potential application in research portfolio optimization”. The main change is that the return target constraint is removed from the risk minimization problem, leaving only the budget constraint. This is because it is pointless to include expected returns in an optimization problem if they are centered, as the “reverse engineering” method requires. (The expected value of any centered variable is 0.)
* I generally corrected numerous misspellings and typos throughout the manuscript, including in the equations. I have also made several minor edits to the text and equations to improve clarity and readability. For example, I have replaced “SO” (the abbreviation for strategic objective) with “policy”. This required changes to the column titles of Fig 6, and adjustments to the titles of Figs 7, 8, and 10. The revised figures are included in my revised submission package.

Sincerely,

Benjamin Schiek

(Author)