Practical Steps for Increasing Openness and Reproducibility

Discussion

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April 24, 2015 UC Riverside

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Outline

Reproducibility & Transparency

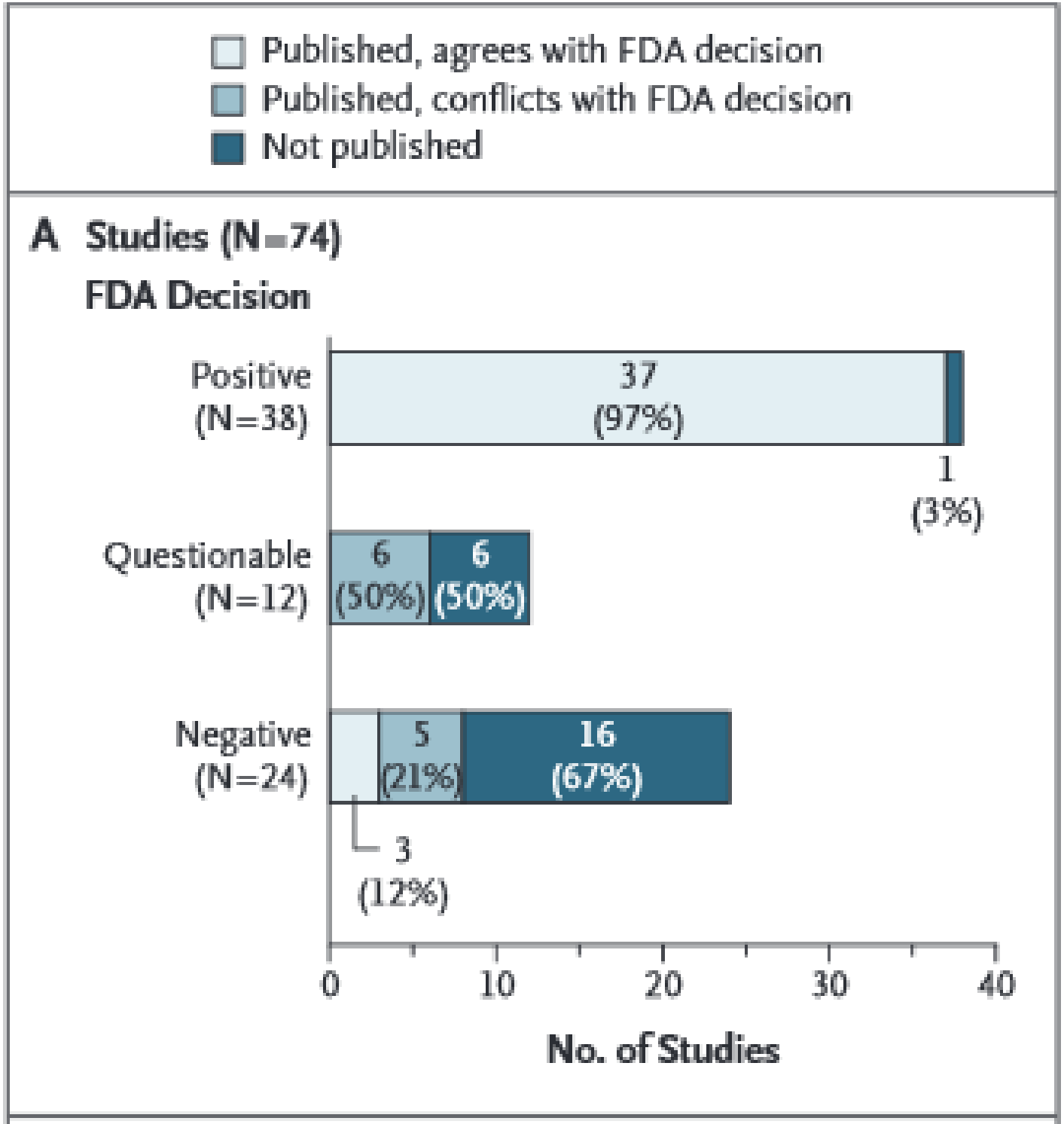
- What are problems associated with reproducibility?
- What are solutions to these problems?
- What are practical tools to implement these solutions?

Problems

- Publication bias
- Specification Searching
- Data not available
- Code not available/unintelligible

Publication Bias

- Only signficant results get published, even though the null result might be the truth, so we can't distinguish the truly significant from the 5% we should expect due to randomness.
- See Turner et al. 2008 for medicine or Franco et al. 2014 for social sciences.


Published, agrees with FDA decision
Published, conflicts with FDA decision
Not published
A Studies (N=74)
FDA Decision
Positive (N=38)
37 (97%)
1 (3%)
Questionable (N=12)
6 (50%)
6 (50%)
Negative (N=24)
5 (21%)
16 (67%)
3 (12%)
0
10
20
30
40
No. of Studies

Specification Searching

- AKA Data mining, data dredging, p-hacking, fishing.
- Flexibility in analytical decisions lets you display practically anything as statistically significant. Simmons, Nelson, Simonsohn (2011) ‘proves’ that listening to the Beatles makes you younger.

Irreproducible Workflow

- Even with the original authors' help, you can't get the data to reproduce the published results. Or you just can't find the data to begin with.
- *Journal of Money, Credit, and Banking* Project. (Dewald et al., AER 1986)
- Martin Feldstein on Social Security and private savings, Reinhart and Rogoff on debt and GDP growth.

Solutions

- Study Registry
- Pre-Analysis Plan
- Reproducible Workflow
  - Literate Programing
  - Data Sharing

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Specific Tools

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  - NIH's Clinical Trial Registry
  - AEA Social Science Registry
  - Experiments in Governance and Politics (EGAP)
  - Registry for International Development Impact Evaluations (RIDIE)
  - Open Science Framework (OSF) Link

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Pre-Analysis Plan

What is a PAP?

- From 3ie: “A pre-analysis plan is a detailed description of the analysis to be conducted that is written in advance of seeing the data on impacts of the program being evaluated. It may specify hypotheses to be tested, variable construction, equations to be estimated, controls to be used, and other aspects of the analysis. A key function of the pre-analysis plan is to increase transparency in the research. By setting out the details in advance of what will be done and before knowing the results, the plan guards against data mining and specification searching. Researchers are encouraged to develop and upload such a plan with their study registration, but it is not required for registration.”

Origin: FDA's Guidance for Industry

"E9 Statistical Principles for Clinical Trials" (1998) ▸ Link

§V Data Analysis Considerations

1. Prespecification of the Analysis
2. Analysis Sets
3. Missing Values and Outliers
4. Data Transformation
5. Estimation, Confidence Intervals, and Hypothesis Testing
6. Adjustment of Significance and Confidence Levels
7. Subgroups, Interactions, and Covariates
8. Integrity of Data and Computer Software Validity

Glennerster, Takavarasha Suggestions

Running Randomized Evaluations

1. the main outcome measures,
2. which outcome measures are primary and which are secondary,
3. the precise composition of any families that will be used for mean effects analysis,
   - Mean effects: FWER, FDR using Anderson (JASA 2008).
4. the subgroups that will be analyzed,
5. the direction of expected impact if we want to use a one-sided test, and
6. the primary specification to be used for the analysis.

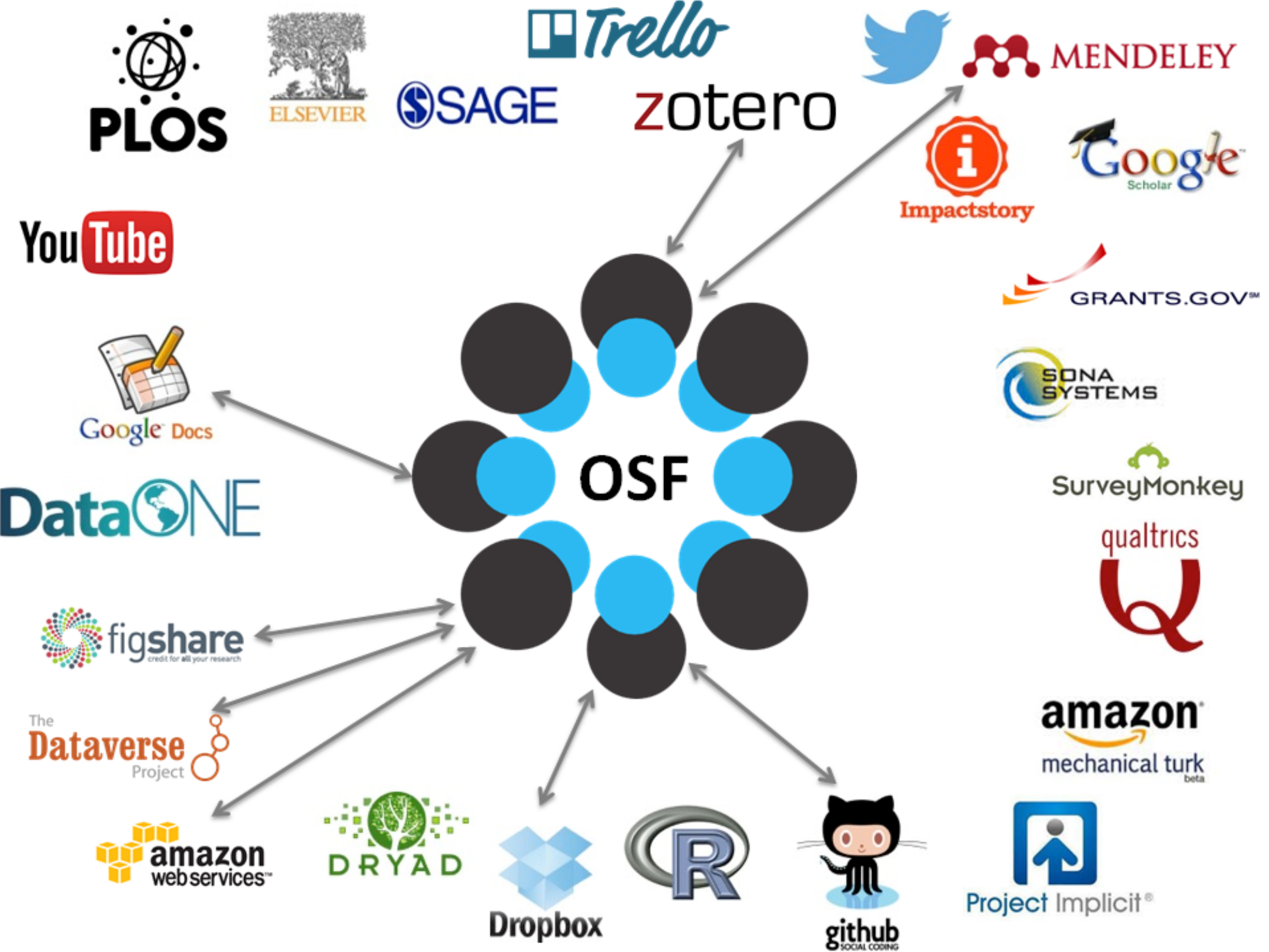
McKenzie Suggestions

World Bank Development Impact Blog

1. Description of the sample to be used in the study
2. Key data sources
3. Hypotheses to be tested throughout the causal chain
4. Specify how variables will be constructed
5. Specify the treatment effect equation to be estimated
6. What is the plan for how to deal with multiple outcomes and multiple hypothesis testing?
7. Procedures to be used for addressing survey attrition
8. How will the study deal with outcomes with limited variation?
9. If you are going to be testing a model, include the model
10. Remember to archive it

Reproducible Workflow

- R Markdown and R Studio to write dynamic documents.
- Version control with Github or OSF.
- Literate Programing
  - Writing code to be read by a human instead of a machine. (Loosely: commenting the hell out of it.)
- Data Sharing
  - Harvard's Dataverse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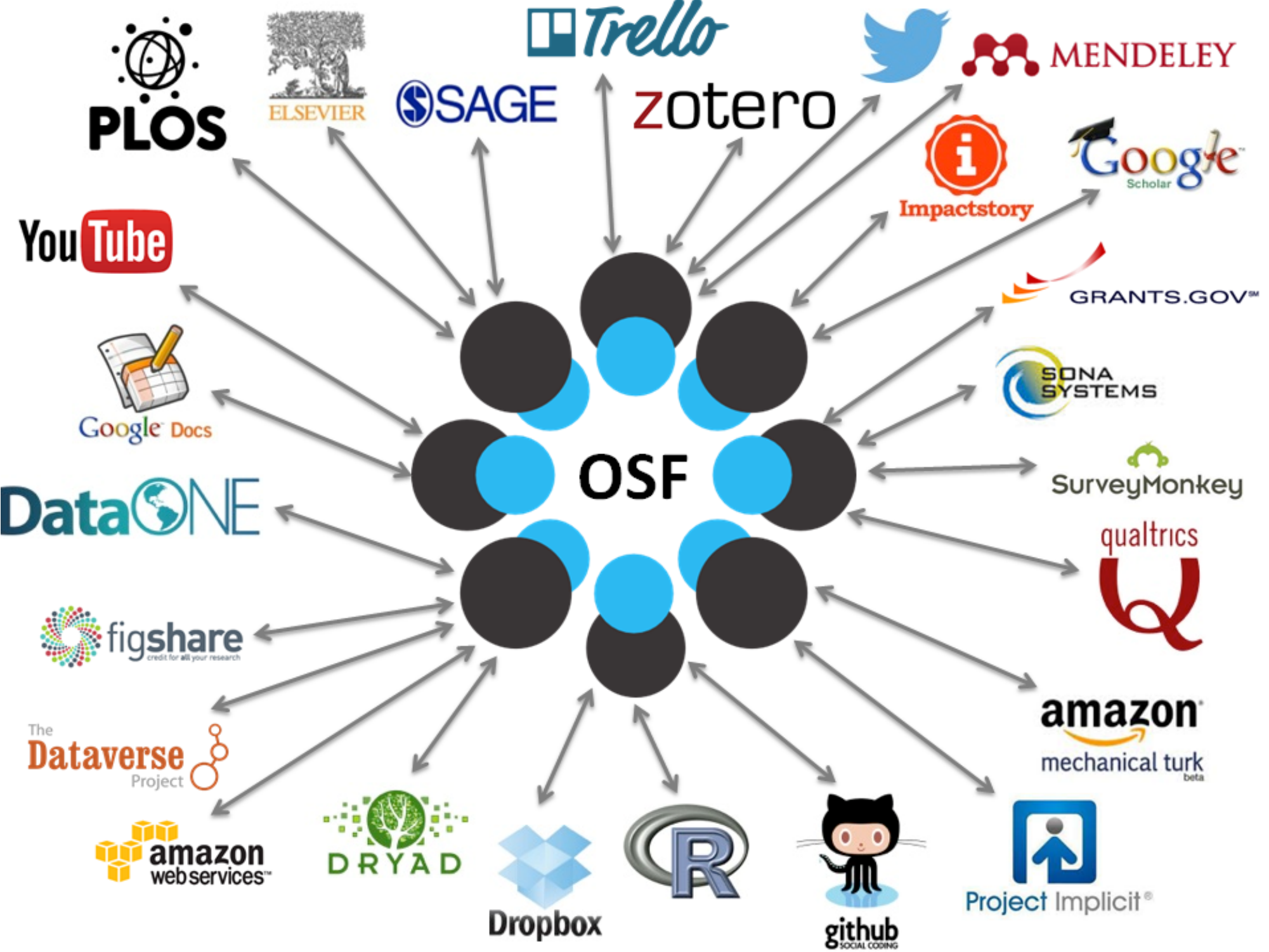
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Conclusion

Simple tools exist to help you transparently and reproducibly take your research from beginning to end.

- Open Science Framework
- Trial Registries
- Version Control
- Dynamic Documents
- Trusted Public Data Archive