

Knowledge Synthesis Methods

4. Meta-analysis¹

Summary of method

A statistical tool to reanalyse existing data from multiple studies. Meta-analysis is not an independent type of review. It relies on data extracted from an existing set of studies resulting from a review.

Key references

Koricheva, J., Gurevitch, J., Mengersen, K. (2013). *Handbook of meta-analysis in ecology and evolution*. Princeton University Press, Princeton and Oxford.

Examples of application

The following examples have been suggested, but details of a link to actual policy decision-making is not clear.

- Crop responses to conservation agriculture
- Environmental and yield effects of organic farming
- Estimation of adoption and productivity trends
- Understanding forest plots

Meta-analysis

Cost	Staff: very variable as it will depend on whether data are already available and what type of review is needed to collate data. Can be conducted in three weeks if data are already available
	Expert statistician
	Affected by: size of the evidence
Time required	Can be conducted in three weeks if data are already available

¹ A guidance note from Dicks LV, Haddaway N, Hernández-Morcillo M, Mattsson B, Randall N, Failler P, Ferretti J, Livoreil B, Saarikoski H, Santamaria L, Rodela R, Velizarova E, and Wittmer H. (2017). *Knowledge synthesis for environmental decisions: an evaluation of existing methods, and guidance for their selection, use and development – a report from the EKLIPSE project*.

Repeatability	High (if conducted, recorded, and archived properly)
Transparency	High (if conducted and recorded well, i.e. endorsing organisations)
Risk of bias	Low (if conducted well and evidence is reliable). Depends on what has led to the meta-analysis. Bias can be quantified and visualised
Scale (or level of detail)	Independent of scale (any)
Capacity for participation	Low
Data demand	High
Types of knowledge	Scientific/technical, explicit
Types of output	Statistical results (usually reported within other type of document)
Specific expertise required	Statistical expert

Strengths

Powerful statistical tool for summarizing multiple, possibly contradictory research studies

Allows for assessment of the presence of heterogeneity (disagreement)

Extension analyses (including sensitivity analysis, subgroup analysis and meta-regression) allow for the analysis of categorical and continuous explanatory variables that may be causing heterogeneity

Publication bias can be assessed statistically

Study validity (i.e. quality) can be assessed by weighting studies, for example using critical appraisal results

Weaknesses

Not a standalone review method, relies upon one of the other synthesis methods to provide data

Reliability of a meta-analysis depends heavily on the reliability of the data included in the analysis

Requires considerable technical skill

Not suitable for broad topic areas: requires very specific question