

Sound Science: Selective citation in science based decision-making

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Background

Scientific knowledge plays a key role in today's society. During the last years a negative perception of academic research is emerging. Also elsewhere there is concern regarding science, which includes mainstream press, among policy decision-makers and industry. If integrity in science can no longer be taken for granted, there is an urgent need to investigate its potential impact along the entire chain of knowledge and dissemination.

This also applies to the risk assessment of chemicals and their possible impact on human health. If policy decisions regarding chemical exposure and health can be taken based on sub-optimal science, the consequence for industry and society could be enormous.

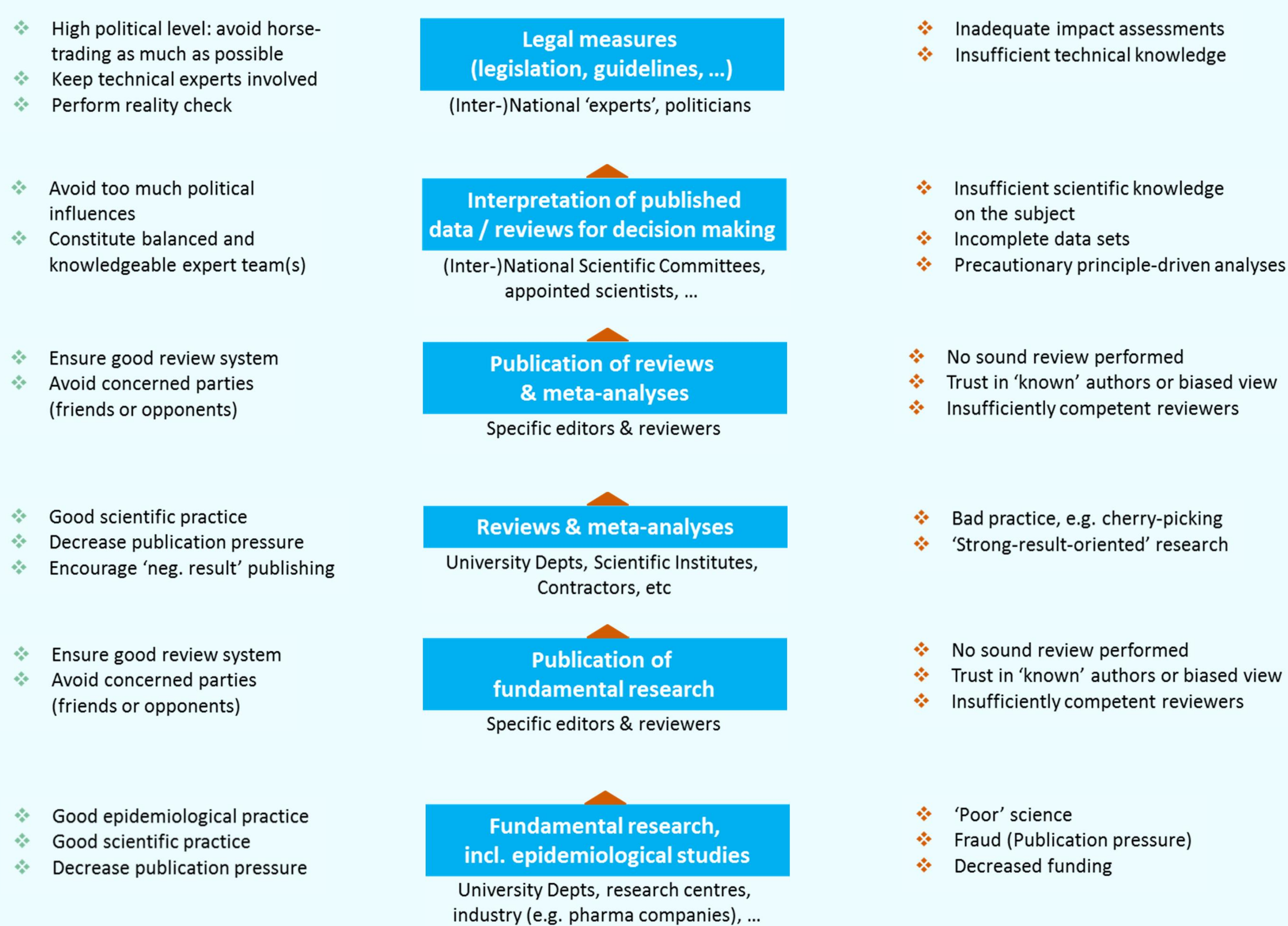
In the cascade of the scientific process and knowledge dissemination eventually leading to regulatory decision making several key moments can be identified where Sound Science is at risk. One of these is selective citation.

Selective citation

It is generally accepted that scientific papers should give a balanced overview of the already existing literature on the topic of interest. A biased representation, for example by citing papers that confirm a certain association and omitting citations to papers that question this association can prime the unaware reader to easily accept the new findings in the paper to be in agreement with the existing literature. Not citing papers that are in disagreement with the beliefs of the authors is known as Citation Bias. Misrepresentation of referenced paper to better fit with the beliefs of the authors is called Citation Distortion.

The chain of knowledge development and dissemination

There are several steps in the process that leads from scientific research to regulatory decision-making in which Citation Bias and Citation Distortion can be investigated in an empirical fashion (see figure below). For example, is biased citation within the scientific literature a phenomenon that regularly occurs, what are its determinants and how can we influence this?



Objective

This project will focus on 'Citation Bias' and 'Citation Distortion', which are suspected to be one of the main drivers of skewed knowledge dissemination. The aim is to systematically collect reproducible data on five selected topics to assess the extent of selective citation bias that occurs in the process of science based decision-making.

Work content

We will perform multiple social network citation analyses, in each step in the 'chain of knowledge development and dissemination' for a variety of topics. We will first focus on:

- Swimming in chlorinated pools in association with childhood asthma
- Butadiene exposure and childhood leukemia
- Mould exposure and childhood asthma

The work includes:

Topic specific analyses

1. Identification of the literature

We will query all English language PubMed indexed articles of toxicological or epidemiological concerning the predefined associations of interest including all published reviews and meta-analyses that potentially contain statement on one of these topics. Relevant reviews for decision-makers and other policy reports will be identified via interaction with content experts.

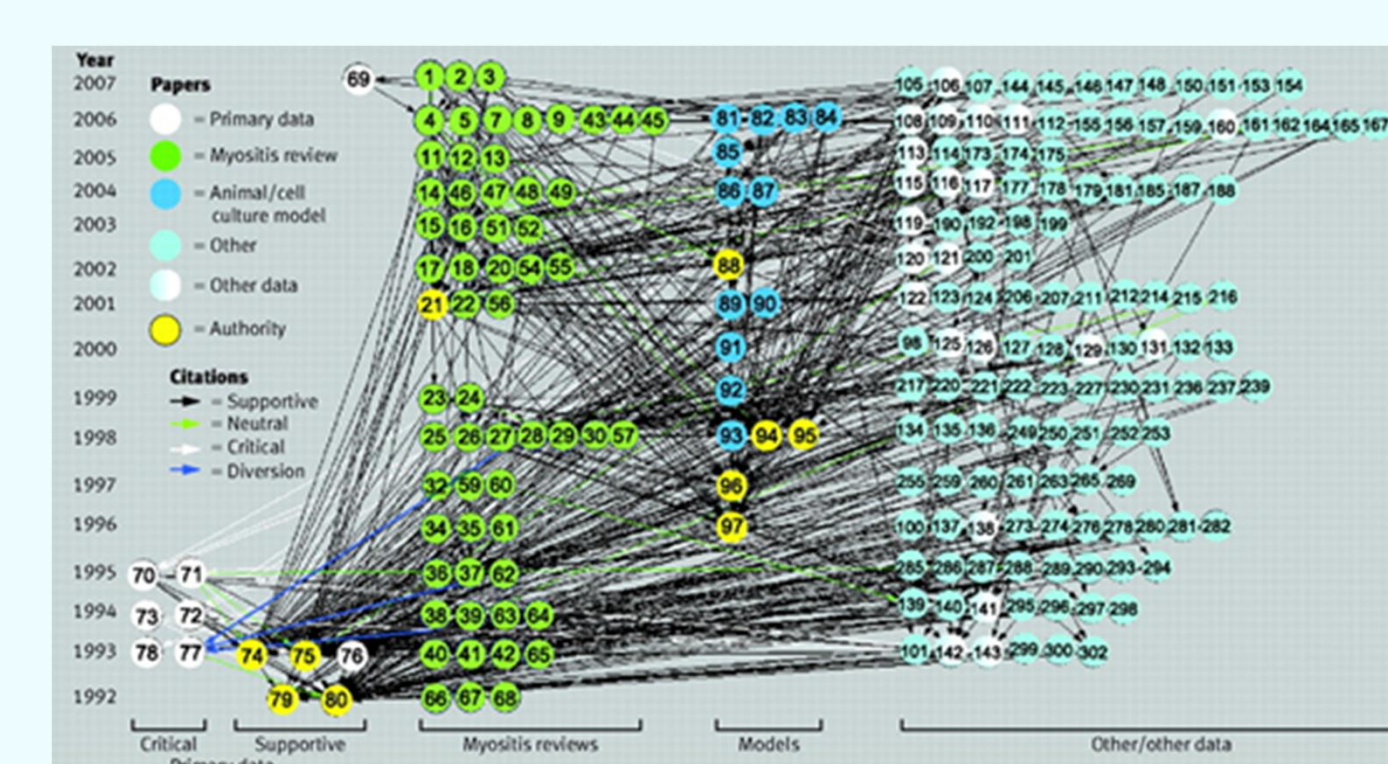
2. Identification of the citations

All citations between the identified literature will be assessed and linked by using Scholar Google, the Science Citation Index and the 'BiomedExperts' networking system.

3. Classification

Each paper will be classified on three levels: (1). Its place in the 'chain of knowledge development and dissemination' be it 'Toxicological', 'Epidemiological', 'Review' or 'Policy Report'. (2) Its belief system ('supportive', 'neutral' or 'critical' according to how its introduction section supports the belief of an association between the chemical of interest and its association to human health). (3) Potential determinants of selective citation, including level of authority (following the method of Kleinberg), affiliation (industry, government, academia) and journal impact.

4. Construction of the citation network



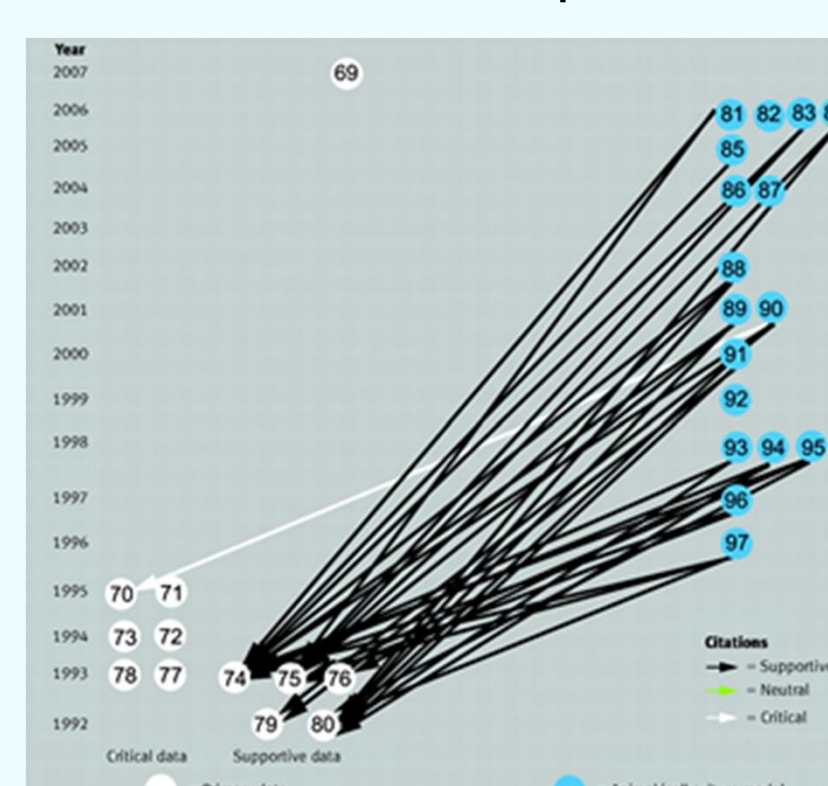
For each topic, we will construct its citation network representing papers as nodes and citations as links from node to each other. Please see the left figure for an example.

5. Identification selective citation

This citation network will be statistically analyzed using graph theory to identify potential (1) Citation Justification Bias. (2) Citation Diversion. (3) Citation amplification in which we will explore the expansion of a belief system without new data from toxicological or epidemiological studies

6. Pairwise selective citation

We will visualize selective citing in more detail by repeating steps 3-5 in each of the nine pairwise steps in the 'chain of knowledge development and dissemination' (please see figures and table below for an example).



	Toxicology	Epidemiology	Reviews	Policy reports
Toxicology	1			
Epidemiology	2	3		
Reviews	4	5	6	
Policy reports	6	7	8	9

Topic over-arching analyses

Once the data from each the five topics is analyzed, aggregate analyses will be performed to identify consistent patterns and the main sources of selective citation which may or may not be based on concepts such as it's positive, neutral or critical belief system, level of authority, affiliation and journal impact.

Development of guidelines

The project will be concluded with the development of a guideline that aims to correct the identified sources of selective citing and the promotion of the adoption of these guidelines.