Selective citation and its consequences

Valorisation

After finalizing the academic work, it is time to reflect on the potential valorisation of the obtained knowledge presented in this dissertation. When speaking about valorisation, what often comes to mind is how to knowledge can be translated into a competitive product or other commercial activity. For research funders especially, this is important to see that the research investment can be made into use. However, for the presented research this financial valorisation is not directly possible. The academic field studying research integrity, and more specifically studying scientific reporting, is a relatively young research field. In this early stage, the focus of the research is mostly on getting an in-depth understanding the nature and magnitude of the problem. This also makes that the presented work is a rather fundamental type of research. This does not mean it is without societeal value. It is important to get a basic understanding of how scientific knowledge develops in order to assure its value and trustworthiness. Luckily, the public trust in science is still high, especially compared to trust in mainstream media (1). However, with the growing notion of research misconduct and questionable research practices, the scientific community needs to stay active to deserve that public trust and make sure valuable knowledge is created.

This valorisation paragraph will focus on societal impact of research integrity research on various stakeholders and look at opportunities for long-term developments. The relevance of the obtained knowledge in multiple non-academic activities will be discussed, namely for policy making, development of medical treatment and product innovation. Finally, we will look at the opportunities following from this dissertation for research publishers and funders.

Policy making

Policy is created on the basis of both scientific knowledge and political vision. The process of policy making is therefore divided into the scientific process of risk assessment and the political process in the risk management phase (2). Although the ultimate decision is made in the risk management phase, this highly depends on the outcome of the scientific risk assessment. In the European Union, risk assessment and risk management are strickly divided, to enhance the legitimacy of policy decisions and to assure the independence of the scientific risk assessment (2). The latter is an interesting objective in light of this dissertation. Risk assessment is considered independent and objective because it is performed by a panel of academics, who are experts on the topic under discussion. Attention is paid to the composition of the panel, to make sure all relevant disciplines are represented and panel members have sufficient knowledge about the subject. Additionally, panel members are screened for ties with industry and political involvement, on which basis they will be excluded. However, no attention is paid to the limitations of the scientific evidence that is being used. In chapter 7 of this dissertation, the concept of intellectual conflict of interest was discussed. The carreer of individual

scientists might impact the evidence that is being put forward or how this is weighted in the risk assessment. But also in a wider context, the discussion on questionable research practice and research misconduct that is currently taking place in the academic arena, is also applicable to the way science is being evaluated in risk assessments. A wide range of questionable research practice can impact the validity of the risk assessment. This includes problems with regard to the reporting of research, but also the use of inappropriate research designs or errors in the statistical analysis, which often occur in scientific publications (3). When scientists are not aware of the existence and magnitude of these questionable research practices, they will not be taken into account in the weighing of the evidence. Creating awareness for problems relating to scientific reporting, such as publication bias, reporting bias and citation bias is therefore an important first step to assure the validity of evidence-based policy making. Apart from creating awareness with the scientists performing the risk assessment, in the longer-term concrete actions should be implemented to improve the credibility and quality of evidence-based policy. Examples of these concrete actions might be the use of systematic search strategy as the basis for their risk assessment. In this way, the risk of citation bias can be reduced. When evaluating the quality of the presented evidence, a checklist might be used to check for the most common questionable research practices.

Medical treatment

Much scientific research revolves around the development of medical treatments. A strong evidence base needs to be build when developing new medical treatments and to get them accepted as the standard treatment. This includes a wide range of study designs starting with mechanistic studies, animal studies, human observational studies and potentially even randomised controlled trails. In each of these levels, knowledge might get to waste because of selective reporting of results and selective citation.

A very illustrative example of how clinical practice can be impacted by selective citations is the work of Andrade et al (2013) (4). They performed a citation analysis on the literature on treatment options for chronic nonspecific low back pain. This literature base consisted of two types of randomised controlled trials: RCTs that compared surgical treatment with non-surgical treatment and RCTs that compared two surgical treatments with each other. The RCTs comparing two surgical treatments far outnumbered the RCTs involving non-surgical treatment, showing that the research agenda was focused on finding the optimal surgical treatment. However, studying the content of all the RCTs, it appeared that no convincing evidence exists for chosing surgery over non-surgical treatment. This is a clear example of how selective citation, by not citing the RCTs including non-surgical treatments, can drive the research agenda into a certain direction that is not evidence-based. Consequently, much research money and time have been invested in unnecessary RCTs that compared two surgical treatments. Even

more important, patients have unnecessarily undergone surgery where other treatments would have been sufficient and actually better. Therefore, also in the development of medical drugs and devices, it is important to have a complete overview of all available publications. In this way, it can be determined if a research question is still relevant and research waste can be reduced.

Innovation

Next to drug development, scientific research functions as the basis for all kinds of innovations. This could include innovations in light of medical equipment, but also innovations to generate sustainable energy or innovations in the financial market. Although these innovations do not depend necessarily on *scientific* evidence, a lot of research is required before a successfull innovation can go to the market. This involves high financial investments as well as investments in terms of time and effort. Most likely, the process of product innovation is one of trial and error. Similar to academia, also product developers tend selectively focus on the success findings, while not reporting the failures (5). Also similar to academia, much can be learned from these failures and future failures and associated investments could be prevented. Additionally, by selectively reporting only successful innovations the unjustified image might occur that all innovations are successful and all investments in innovations are worthwile. By being more transparant in reporting both successes and failures the process of innovation can be made more efficient.

Research publishing and funding

Also within the academic arena, the obtained results are relevant for research funders and publishers. Publishing books and articles remain the core activity in the scientific enterprise and is the foundation for development of knowledge. Because publications are the main communication form among scientists, a great responsibility lies with the academic publishers, in facilitating this in an integer way. This is even more important, given that a high number of academics are actively competing for limited research grants. This high competition might lead to cutting corners when it comes to doing high quality research and a perverse incentive is created to publish research including questionable research practices. The chance of receiving a grant is still highly depending on traditional metrics, such as the number of publications, publishing in high impact factor journals and getting high numbers of citations. Unintentionally, this promotes salami-slicing of publications and self-citation. In this dissertation, we have empirically shown that publishing significant findings increases the chance of being cited in most fields, which brings a competitive advantage when it comes to obtaining research grants. As

an even bigger problem, research quality is not taken into account when evaluating a researchers performance. Potentially this explains also the finding in chapter 2 of the dissertation, saying that much research is carried out without a study protocol. Writing a protocol is a time consuming activity, without any guarantee that the work will be published or other form of reward. Here, we could see a role for publishers and editors. By requesting authors to upload a study protocol together with the manuschript and taking this into account in the peer-review process, authors will be encouraged to set a priori hypothesis and work according to a protocol. Subsequently, studies that were not performed on the basis of a study protocol might be notified as hypothesis generating studies instead of hypothesis testing studies. This is an important distinction to make in order to correctly interpret the research findings.

On a positive note, there is already a growing protest with regard to the way scientific output is measured and evaluated in the current system. A number of editors and publishers, but also governments, are looking for more quality-related measures of research output. Their motivitation to do so is shown for example by signing the DORA initiative, which was signed by the Dutch NWO and several editors of biomedical journals (6). Also in editorials, editors express their concern with regard to the current research climate and the occurrence of questionable research practice (7-9). Concluding, we could say that the intention of research publishers and funders to exclude research misconduct and questionable research practives seems to be positive. However, more research is needed to show the magnitude of the problems in the current system and to find suitable replacements.

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