

Evaluation practices and effects of indicator use – a literature review

Abstract

This review of the international literature on evaluation systems, evaluation practices and metrics (mis-)uses was written as part of a larger review commissioned by the Higher Education Funding Council for England (HEFCE) to inform their independent assessment of the role of metrics in research evaluation (2014-2015). The literature on evaluation systems, practices and effects of indicator uses is extremely heterogeneous: it comprises hundreds of sources published in different media, spread over disciplines, and with considerable variation in the nature of the evidence. A condensation of the state-of-the-art in relevant research is therefore highly timely. Our review presents the main strands in the literature, with a focus on empirical materials about possible effects of evaluation exercises, 'gaming' of indicators, and strategic responses by scientific communities and others to requirements in research assessments. In order to increase visibility and availability, an adapted and updated review is presented here as a stand-alone - after authorisation by HEFCE.

Introduction: main research strands

The use of metrics in academic evaluation and assessment systems has a range of constitutive effects (Dahler-Larsen 2014) that have only scarcely been documented and analyzed in empirical research. This knowledge gap may be due to the intimate nature of the interactions between evaluation (which is mostly confidential) and knowledge production (often in the realm of daily life of researchers) (Wouters 2014, 50). In addition, the research agenda that is exploring these interactions is relatively new (Gläser et al. 2002; Gläser and Laudel 2001; Gläser 2010). As a result, we know some of the implications of quantitative assessments but the picture is still very incomplete (Gläser et al. 2002; de Rijcke and Rushforth, 2015; Wouters 2014).

The present contribution is an updated version of a literature review that was written as part of a larger review commissioned by the Higher Education Funding Council for England (HEFCE) to inform their independent assessment of the role of metrics in research evaluation (2014-2015) (Wouters et al. 2015).¹ Below, we present the most relevant lines of work in the literature, with a focus on empirical materials about possible effects of evaluation exercises, 'gaming' of indicators, and strategic responses by scientific communities and other actors to requirements in research assessments. Providing a complete overview of the literature is not feasible for a couple of reasons. First of all, the literature is very diverse. Studies on evaluation systems,

¹ See Waltman (2015) for the part of the review that discusses the technical literature on citation impact indicators.

evaluation practices, and effects of indicator uses are published in different media, and the preferred outlets are not necessarily always international journals that are covered well by web-based citation databases. The hundreds of sources are spread out over books, edited volumes, articles, reports and other forms of grey literature that are sometimes relatively inaccessible. Secondly, the relevant literature is scattered over a large number of social science fields, including sociology of science, innovation studies, library and information science, higher education studies, sociology of evaluation, evaluation studies, economics and business studies, medical sociology, science policy studies, research management and innovation, political science, and governance studies. A third hampering factor in presenting a complete overview is the epistemic nature of the evidence presented in the literature. The studies range from surveys and interviews on researchers' perceptions of evaluations and formal policy analysis of principal - agent relationships to cultural critiques of the evaluation society and ethnographic studies of evaluation in action (an emerging body of work). The resulting heterogeneity of the evidence poses particular challenges in integrating the literature in a single review. We have therefore opted for the format of a qualitative literature review that aims at mapping the territory, identifies common elements and themes that lie in or across individual studies, and discusses the findings and conceptual arguments on the same subject. We do not aim for comprehensiveness and critical appraisal; the added value lies mainly in bringing together these sets of literature in a systematic manner.

We begin our review by briefly embedding the studies that focus on effects of evaluation practices and metrics uses in a broader context: the set of literatures that focuses on the governance of science at large. The main aim of this introduction is to delineate the main foci of the most important research strands.

A large body of work from higher education studies, new public management studies, organisation studies, anthropology of science, philosophy of science, economics and political science analyzes effects on academic institutions of shrinking governmental research funding and the emergence of new public management from the 1980s onward. These literatures characterise the rise of performance measurement in academic settings as part of a broader surge of accountability measures that has swept across public institutions over the past three decades (Feller 2009, Keevers et al. 2012, Nedeva, Boden, and Nugroho 2012, Thomas and Davies 2005) – which are in keeping with broader statements about the emergence of an 'audit society' (e.g. Power 1997; Dahler-Larsen 2012; Strathern 2000). The most critical voices portray researchers as becoming disciplined (often willingly) by pre-defined, measurable outcomes that

crystallise an ideological attempt to extend market-like mechanisms into the sphere of higher education (Shore and Wright 2000, Shore 2010, Burrows 2012). As such, indicators are positioned as tools to steer academic institutions and researchers towards becoming more market-oriented, by actively stimulating competition, instrumentality and privatisation strategies (Deem, Hillyard and Reed 2007, Willmott 2011, Leisyte and Dee 2012).

Science policy and higher education studies (e.g. De Boer, Enders, and Leisyte 2007, Rebora and Turri 2013, Reale and Seeber 2013) typically focus on formal characteristics of the assessment mechanisms adopted in national or regional evaluation systems (Fealing 2011, Reale and Seeber 2013). Most research in this area provides the impetus for furthering science policy, and puts much effort into methods of research evaluation. These studies often respond relatively swiftly towards the introduction of new evaluation programmes and methods (cf. Cozzens and Melkers 1997). A typical example is the study by Luukkonen (2012), that examines the peer review processes of the then-recently established European Research Council (ERC). Science policy studies tend to focus mainly on formalised national evaluation systems, in which indicators of funding success play a larger role than citation based indicators. Even in indicator based systems such as the Australian evaluation system citation analysis does not figure prominently (Gläser, Lange, Laudel and Schimank 2010, p. 169). The current Swedish system is an exception as it uses citation counts from the Web of Science.² This does not mean that citation-based indicators are not used at all, but they are not visible in the formal systems of accounting (Wouters 2014, p. 49-50).

Sociology of science literature, on the other hand, focuses on institutional and organisational dynamics of science and innovation, including managerial and control mechanisms (Whitley and Gläser 2007; Whitley 1984, 2000, 2011; Whitley et al. 2010). Organisational approaches to sociology of science have taught us that quality control is not exclusively a cognitive/epistemological phenomenon, but is also deeply social and organisational (cf. Hemlin 2006; Whitley 2000). This work intimates knowledge production is changing in light of transformations to relational systems in which academic researchers are broadly placed (Whitley et al. 2010, Musselin 2013, Paradeise and Thoenig 2013). It has also begun to analyze how researchers handle the demand for accountability in their epistemic decision-making. However, most of these studies do not deal directly with effects of indicator uses. The studies that do engage with indicator effects will be discussed in the next section.

² cf. Hicks (2012) for a few other countries that also use citation scores in their evaluation systems.

Implications of evaluative metrics

This section starts with an overview of studies that consider a number of implications of evaluative metrics for research practices (including strategic behavior and goal displacement, task reduction, and potential biases towards interdisciplinary research). This is followed by a discussion of empirical research on institutional responses to metrics-based assessments. Lastly, we describe emerging research on the complex relation between indicators and knowledge production.

Strategic behavior and goal displacement

In tandem with the development and first applications of performance indicators in the 1970s, discussions surfaced about strategic behavior and ‘gaming the system’ (cf. MacRoberts and MacRoberts 1989). Researchers are not passive recipients of research evaluation but play an active role in assessment contexts (cf. Aksnes and Rip 2009; Van Noorden 2010). Assessment systems that affect money or reputation, whether the systems are peer review or indicator based, will tend to influence researchers’ behavior in two ways (Butler 2007). The first is goal displacement: scoring high on the assessment criteria becomes the goal rather than a means of evaluating if certain objectives (or performance levels) have been met (Colwell et al. 2012, p. 27). The second is a more fundamental transformation of the scientific or scholarly process itself regarding the assessment criteria (for instance by avoiding risk in selecting research topics), a transformation that may be harder to recognise (Butler 2007, p. 572).

Studies that focused on effects of funding and evaluation systems on scientific output have indeed demonstrated goal displacement. Butler (2003; 2005) for instance analysed the introduction of performance metrics in Australian research funding allocation. Her study revealed a sharp rise in ISI-ranked publications in all university fields (but not in other branches of research where this type of funding allocation is not present) when funding becomes linked with publications (Butler 2005). As in the Australian evaluation system there was no differentiation between publications (besides being peer-reviewed or not), the amount of publications especially rose in the third quartile of journals that are more easily accessible. Butler earlier demonstrated how this strategy, while leading to a rise of relative share of Australian publications, has also contributed to a decline of scientific impact (measured in citations) during the same period (Butler 2003). Colwell et al. (2012) state that researchers’ quality considerations may be displaced by incentives to produce higher quantities of publications when funding is explicitly linked to research output (in terms of the number of

publications) (Colwell et al. 2012, p. 26). Similar effects of the use of bibliometrics on the amount of publications have been found in Spain (Jiménez-Contreras, Anegón and López-Cózar 2003; however see Osuna, Cruz-Casto and Sanz-Menéndez, 2011), Denmark (Ingwersen and Larsen 2014), Flanders and Norway (Ossenblok et al. 2012; Schneider 2009; Aagaard, Bloch and Schneider 2015).

Strategic response by the research community was also demonstrated in a longitudinal bibliometric study of UK science covering almost twenty years (Moed 2008). UK publication patterns between 1985 and 2003 suggests that specific publication patterns emerged in years before three RAE's that took place in that period (1992, 1996, 2001), depending on whether the RAE was aimed at quantity or quality of publications. In the UK, findings of 'playing the RAE game' (Harley 2002) in this way are numerous (e.g. Hare 2003; Keenoy 2005; Alldred and Miller 2007; Sousa and Brennan 2014). Another study of the UK RAE impact shows that the cumulative research productivity of individuals increased over time, but the effects differed across departments and individuals. Where researchers in higher-ranked programs increased their output in higher-quality journals, researchers in lower-ranked departments aimed at increasing their publications in other outlets (Moore et al. 2002, abstract). A survey among journal editors conducted at the end of the 1990s (Georghiou et al. 2000) also showed that the RAE influenced where authors published. Indeed, research shows that the status of a journal is crucial for researchers' submission decisions (Harley et al. 2010; Chew et al. 2007). However claims the RAE would lead towards salami publishing of 'least publishable units' (cf. Huth 1986) - were not verified in a later study (Georghiou et al. 2000).

Osuna, Cruz-Casto and Sanz-Menéndez (2011) are particularly critical of attempts to argue for a causal relation between the introduction of evaluation systems and the rise in the number of publications on a national level (see for instance, Butler, 2003; Jiménez-Contreras, Anegón and López-Cózar 2003). Analyzing the Spanish case, they argue that there are a range of other explanations, such as the maturation of Spanish science and the rise of the R&D budget and number of researchers that could explain the rise in the number of publications. Moreover, their attempt to isolate the effect of the introduction of a new evaluation system in Spanish science in 1989 does not find any clear effects.

This suggests that the introduction of evaluation systems might be part of a broader development in national science contexts, and that the causal effect of evaluation systems itself is less clear-cut than is usually assumed. Osuna, Cruz-Casto and Sanz-Menéndez (2011: 588) conclude by arguing that the introduction of the evaluation system might have had an effect in

standardizing publication patterns and making explicit the norms that researchers should follow. As such, understanding the effects of the introduction of evaluation systems would benefit from both more advanced quantitative analysis as well as in depth qualitative research into how these systems ‘trickle down’ into institutions and working practices.

Biases against interdisciplinarity

A related concern is the potential influence of disciplinary assessments like the REF on interdisciplinary research. An early survey of the impact of the 1996 UK RAE reported evidence of negative effects for interdisciplinary work. Almost half of those in management positions felt the RAE ‘had hindered’ interdisciplinarity (Mcnay 1998, p. 20). A worldwide survey among demographers showed contradictory results. It revealed that this community displayed no tendency to focus on monodisciplinary research in terms of reading or publishing activity (van Dalen and Henkens 2012). In economics and many departments in business studies, however, publication productivity has been strongly stimulated by the ubiquitous use of journal rankings as obligatory publication outlets for faculty (Mingers and Willmott 2013). Until recently these lists were not based on citations but on a qualitative consensus in mainstream economics and business studies about the top journals (more recent lists use a version of the JIF). In a first comparative analysis of the effect of these rankings in business and innovation studies, they were found to be biased against interdisciplinary work (Rafols et al. 2012). This study concludes that citation indicators may be more suitable than peer review for interdisciplinary work because criteria of excellence are essentially based on disciplinary standards.

Pontille and Tornay (2010) analysed the production of three journal lists in the humanities and social sciences by the Australian Research Council (ARC), the European Science Foundation (ESF), and the French Agency for Evaluation Research and Higher Education (AERES). They found that the production of journal ratings is a highly cognitive and political task, and not merely a matter of univocal inventory-making. The modalities that were selected produced very different effects in terms of which scientific communities were involved, how boundaries were drawn around disciplines, and the ways in which revision processes adopted criticism from the fields involved. According to the authors, these and other built-in tensions will not only keep feeding critique but also the need for permanent revisions of the ratings (see also Jensen 2011).

As soon as research managers started to set publication targets based on the two top categories on the list, the Australian Research Council decided to drop the established journal rankings in its assessment system (Colwell et al. 2012, p. 56).

Task reduction

An analysis of researchers' responses to funding criteria in Australia has analysed the extent to which researchers are forced to focus their tasks and types of publication (Laudel and Gläser 2006). A tension was observed between the formalized journal ranking procedures and researchers' own valuations of their work. In ten out of the twenty-one disciplines under study, the four publication types used in the Australian evaluation were not the same as the four types of output that researchers themselves found most important. This mismatch may result in the abandonment of particular types of work (Laudel and Gläser 2006, p. 294). Laudel and Gläser go on to conclude that arts and humanities are likely to suffer greatly in situations whereby evaluation systems have been modeled primarily around journal-oriented disciplines.

This conclusion is supported by Whitley's (2007) examination of the possible effects of evaluation in specific disciplines. He suggests that the consequences of indicator uses are dependent on both the design of the evaluation system and the social and intellectual structure of the field in which assessment is applied. Whitley makes a distinction between weak (results rarely published or directly tied to sources) and strong evaluation systems (results advertised and directly used for resource allocation). Not surprisingly he finds that strong evaluation systems are most likely to influence research agendas and practices within any given field. This is especially the case if relatively few competing systems of evaluation and resource allocation exist. He continues to argue that research fields in the social sciences and humanities are especially likely to be directly affected by strong evaluation systems, owing to little agreement on research goals, less collaboration and relatively large freedom for individual researchers to develop their own research agendas. A recent study of departmental responses to the national indicator used in Norway supports these claims. The analysis shows how the Norwegian national indicator is used more frequently at individual levels in the humanities, and the indicator has more importance for judging scholarly status in these fields (Aagaard 2015). One possible consequence of strong evaluation systems, according to Whitley, is that disciplines of low 'centrality and prestige' will imitate research practices and norms of dominant fields; for example by changing publication behavior. Hammarfelt's and De Rijcke's (2015) study of publication patterns at the faculty of Arts at Uppsala university (Sweden) seems to back this

assertion as an increase in the most common type of output in the natural sciences, life sciences, and medicine (i.e. English language journal articles) was observed among scholars in the humanities.

One could feasibly expect that increased drives towards journal publications will devalue other academic activities. A worldwide survey among demographers in developed and developing countries found that ‘traditional’ academic tasks - such as writing referee reports or translating research outcomes for policy - are negatively affected by a move toward rewarding individual productivity (van Dalen and Henkens 2012). A study of the RAE exercise in 1996 found for instance that publication in professional journals was ‘actively discouraged’ by some research managers (McNay, 1998, p. 22). Hoecht (2006) warns that the increased audit-based quality control has replaced a trust-based form of control and as such autonomy has decreased in academic settings in the UK in recent decades. This form of one-way accountability that lacks a fostering of trust might negatively affect innovative teaching and research practices. Similarly, Willmott (2011) argues that audit-based control pushes researchers towards mainstream topics that have the highest chance of being published in the highest ranked journals.

An exploratory study of UK university education departments shows that the use of performance indicators in evaluation is perceived as an increasing recognition of specific forms of academic involvement - academic research and publications - that are often opposed to more public roles, including applied research, writing professional publications, or teaching (Wilson and Holligan 2013). The authors argue that the ways in which this development is perceived depends on the position of the researchers in question and whether or not it fits with their scholarly practices.

Effects on institutions

In addition to possible goal displacement, bias against interdisciplinarity and reduction of task complexity, metrics-informed assessments have also been thought to affect institutional arrangements as well as the relationship between higher education and government (Martin and Whitley 2010). According to Colwell et al. (2012), the RAE has led universities to develop ‘transfer market’ hiring strategies, some focusing on recruiting younger staff with research potential, with others hiring only ‘well-established researchers’ in the run-up to the RAE (Colwell et al. 2012, p. 27-28). This second strategy was also observed in Australian university’s responses towards formula-based funding (Gläser et al. 2002, p. 17). This type of

strategic behavior may therefore have long-lasting effects on the position of universities and research institutes and thereby on the research agenda.

Alignment between demands of various formal evaluation agencies along more-or-less the same standardised criteria is likely to focus the attention of organisations and sub-groups towards satisfying them (Pfeffer and Salancik 2003). In a recent study Laudel and Gläser (2014) find that the chances of ‘exceptional’ projects (in terms of planned innovations and answers to ‘big questions’) being funded appears to reduce across all disciplines in an increasingly standardised grant funding landscape, even in those funding programmes that enable this type of research (Laudel and Gläser 2014, p. 1208).

Seeing that epistemic properties of knowledge and research funding and organisation are strongly connected (Laudel and Gläser 2014), there is reason to assume that the development of formal performance criteria has grown stepwise with local lock-in mechanisms dependent on specific systems of governance, rather than based on a consistent evaluation logic (cf. Van der Meulen 2007). Although the rise of formal evaluation may appear an isomorphic phenomenon, the extent to which it has transformed scientific institutions is far from uniform (Whitley and Gläser 2007). So far little is known of the capacities that governance mechanisms like evaluation programmes have for actually controlling and steering loosely-coupled work systems of academic knowledge (Gläser 2013). The strategic response of organisations to increasing demands of accountability takes many forms, and one of these is the development of evaluation systems on the university level. However, so far there have been few studies on the effects of such initiatives. In a study of Norwegian universities Aagaard (2015) finds several reasons for the local use of indicators: they are convenient and readily available, they reduce the anxiety associated with quality judgments and are used as an instrument in battles for resources and prestige within departments. Hammarfelt and colleagues (n.d.) on the other hand depict tensions between developing local systems and following national formulas among Swedish universities. The indicators used in Swedish academic settings are diverse; all universities have their own model, yet the basic incentives given in these evaluation models are almost identical. Thus, local allocation models are highly influenced by the national system, but the universities under analysis also want to present a unique and independent indicator. Noteworthy in both the Norwegian and the Swedish case is that national systems, despite explicit advice against adoption on lower levels, are used at the university-, departmental- and individual-level. In fact, a handful of Swedish universities use bibliometric measures to reward individual researchers, and a couple of institutions allocate resources directly to authors based

on recent publications. An article which is both listed as ‘level 2’ in the Norwegian list of journals and is indexed in the Web of Science could at one particular university generate as much as 70,000 SEK (approximately 7000 EURO) to be used for research time and expenses (Hammarfelt et al., nd.). Thus, it appears that in these Scandinavian cases bibliometric indicators do trickle down to the point that they actually permeate all organisational levels.

Knowledge about the performativity of numbers suggests that the availability of metrics for generating and ordering hierarchically information about performance creates a demand for such information (Porter 1995, Wouters 2014). Such information-generating functions could carry authority even if some of its first-order epistemic limits are known (Dahler-Larsen 2012). Organisations cannot resist the temptation to collect such information because it is considered as strategically useful in managing researchers and improving on measures of organisational performance. The fact that competitors collect similar information for strategic purposes makes the prospect of opting-out or ignoring such information perilous (see also effects of rankings e.g. Espeland and Sauder 2007). The legitimacy of such indicators does not rest exclusively on their first-order accuracy, but also on the fact that they are assumed to carry authority within the institutional environments with which organisations strategically engage.

Conversely, emerging empirical work on rankings shows how in complex academic settings performance metrics are not tightly coupled with actions across all sections of the organisation (cf. De Rijcke et al. 2015). This goes against recent tendencies to assume that patterns of behaviour towards indicators at one level of a public organisation imply uniformity across the board (e.g. Sauder and Espeland 2009).

More fundamental changes in the character of academic settings as independent and critical institutions (Shore 2008; 2010; Craig et al. 2014) as well as increased levels of stress and anxiety are also reported in personal accounts and interview-based analyses (Chandler et al. 2002; Gill 2009; Sá et al. 2013). Burrows (2012) argues that performance-based control mechanisms have become autonomous entities that are increasingly used outside the original context of evaluations, and get a much more active role in shaping the everyday work of researchers. According to him, the rise of numbers into the fabric of university bureaucracies may even create feelings of powerlessness among researchers. Neoliberal universities provide fertile ground for a “co-construction of statistical metrics and social practices within the academy” (Burrows 2012, p. 361). Among other things, Burrows contends this leads to a reification of individual performance measures such as the H-index (ibid, p. 361). Though hard to assess, such statements of discontent expressed by researchers are empirically important and

are therefore included in this review. The emerging empirical evidence we discuss in the final section below suggests that the use of metrics in decision-making contexts cannot however be explained simply as explicit responses to top-down commands. To some extent metrics also seem to transform more fundamentally ‘what can be talked about’ and how valuations of academic worth are being made (cf. Espeland and Stevens 1998; Lamont 2012).

Practices of indicator use

The evidence discussed above indicates that performance informed research assessment does indeed increase the pressure on researchers and institutions to meet the performance criteria, irrespective of whether the latter are based on peer review or on citations. That the research community and other stakeholders respond strategically towards interventions deliberately designed to align them with current science and innovation policy priorities (Whitley and Gläser 2007) may in turn have unintended effects. Examples include the mechanisms of goal displacement and the more structural changes to research priorities, publication activities, and research capacity-building and organisation. However, the evidence to support these claims is at best partial. Whilst most existing studies focus on systems where funding decisions are based directly on performance, whether this link is necessary for unintended effects to occur is debatable. The effects are not primarily based on the amount of funding that is shifted due to performance differences, but mainly on the consequences for researchers’ reputation (Hicks 2012). Systems where performance is publicly reported but not directly linked to funding may therefore lead to comparable or identical effects. Lastly, the most visible types of strategic behavior may obscure more fundamental shifts in knowledge production (Wouters 2014).

Butler (2003; 2005) notes conservatism of metric users as a long-standing problem, in displaying a preference for user-friendly measurements that trump other inclinations for adopting more state-of-the-art scientometrics. Many scientometric contributions take a normative stance regarding ‘unanticipated effects’ of quantitative performance measures on the science system and debate whether the field itself might play a more active role in promoting ‘good practices’ (Weingart 2005, Van Dalen and Henkens 2012). This concern can be seen in the journal *Scientometrics* which recently published an issue dedicated solely to the Journal Impact Factor (JIF)’s *uses* and *misuses* (Braun 2012). Many studies have highlighted epistemic limitations in the JIF, particularly in the evaluation of individuals (Moed and van Leeuwen 1996, Buela-Casal and Zych 2012), whilst others cite ‘gaming’ by journal editors

and publishers as a perverse effect of its rise to prominence in academic evaluation contexts (Archambault and Larivière 2009, 635).

However, emerging empirical evidence paints a more complex picture of how certain metrics, including the JIF, become reified in research management and decision-making contexts, as both formal and informal standards against which to assess the value and usefulness of research activities (e.g. Aksnes and Rip 2009; Buéla-Casal and Zych 2012; Derrick and Gillespie 2013; Rushforth and De Rijcke ~~2015~~; Sá, Kretz and Sigurdson 2013; Stephan 2012).

At least two potential explanations are provided in these literatures for the reification of evaluative indicators (both ‘amateur’ and ‘advanced’). First of all, the metrics inform deep-seated, firmly established mechanisms to build reputation and to hire, select and promote staff (including publishing in high JIF, peer reviewed journals). Secondly, the responsibility for certain applications of bibliometric indicators is spread over many key stakeholders in the current ‘citation infrastructure’ (Wouters 2014) – including scientometrians, publishers, librarians (cf. Åström and Hansson 2013; Demšar and Južnič 2013; Petersohn 2014), policy makers, evaluators, research managers, consultancies, researchers, and other metrics users (De Rijcke and Rushforth 2015). Changing the current dominant ‘order of worth’ in research assessment (cf. Boltanski and Thevenot 2006; Linkova 2014; Stöckelová 2014) is therefore also a distributed responsibility.

In addition, recently several constructivist studies have emerged which challenge a number of received normative assumptions about ‘proper uses’ of indicators. Dahler-Larsen (2013) argues that commonly heard terms like indicator ‘misuse’ or ‘unintended effects’ perpetuate a fallacy that the ‘right’ use of an indicator can be *known* by some group of experts (and that deviation from such pre-conceived norms therefore constitutes perversion). Dahler-Larsen argues in fact there can be no such external referent, as indicators can only acquire meaning through contexts of use. His encouragement to treat indicator uses as an empirical topic was taken-up by a recent ethnographic study that explored the constitutive effects of the Journal Impact Factor in Dutch biomedical research. Rushforth and De Rijcke (2015) reported that notions like ‘misuses’ or ‘unintended consequences’ did not match-up to the complexities of their empirical findings from the ‘shop floor’. The authors found that prestige – an outcome of knowledge work which gets recycled as an ‘exchange good’ by academic researchers (Stephan 2012) – was tightly coupled with citation counts and indicators like the Journal Impact Factor (JIF) ~~and the H-index~~ (in targeting specific publication outlets, referencing ‘hot’ papers, negotiation of authorship

priority etc.). Quantitative indicators were also observed to feed-into quite routine knowledge producing activities (e.g. discussions over whom to collaborate with and when, how much – additional - time to spend in the laboratory producing data). The JIF in particular functioned on occasions as screening devices for selecting useful information from the overwhelming amounts of literature biomedical researchers could potentially read. These examples suggest that metric-criteria feed-into deliberations over where new scientific knowledge is likely to emerge or can be found. As such, the JIF can both denote a certain standing in a field and a particular type of scientific work (e.g. descriptive versus causal) (Rushforth and De Rijcke [n.d.2015](#)). In addition, some researchers seem willing to wait longer on editorial decisions when the JIF is higher, which shows the clogging effects the JIF can have on scholarly communication (Rousseau and Rousseau 2012). Generally speaking, the promise of bibliometric tools for ‘reducing complexity’ is a feature managers and policymakers find most appealing (Collini 2015, Cronin and Sugimoto 2014, Woelert 2013). In sociological terms journal ranking tools like JIF-lists help make ‘commensurable’ (Espeland and Stevens 1998) the levels of prestige acquired from publishing in one journal rather than another. This ‘shortcut’ is particularly attractive where there is a lack of substantive expertise in a field or of informal knowledge of the reputational standings of journals among peers. Given the extent of the ~~Journal Impact Factor~~ **JIF**’s embeddedness in knowledge making activities, Rushforth and De Rijcke conclude that ‘misuse’ and ‘unintended effects’ are inadequate as analytical concepts for understanding deep-seated effects of indicators on research practices.

Another set of more phenomenologically inspired works has begun to explore researchers’ own perceptions and attitudes around metrics. This has tended to reveal a discrepancy between the importance of indicators in evaluation practices according to researchers and their own judgment of the accuracy of certain measures (Buela-Casal and Zych 2012). Studies show researchers often have ambivalent attitudes about performance and citation indicators (Hargens and Schuman 1990 in Wouters 2014). Citations acquire value as part of the scientific reward system and are often mobilised by researchers in pursuit of scarce resources (Hessels et al. 2009). At the same time researchers also criticise citations for inadequately representing actual scientific contribution and often preserve prior beliefs about the value of their work in interpreting citation scores. (Aksnes and Rip 2009, p. 895). This is explained in the literature by the concept of ‘folk citation theories’, which do not have to be consistent in order to be mobilised by researchers as explanatory devices in their competition for reputation. However, the sophistication and complexity of researchers’ interpretation of citation should not be

underestimated. Aksnes and Rip (2009) observe that their respondents know the complexity and ambiguity in citations. "In other words, researchers have a sophisticated understanding of the citation process and its outcomes, and can explicate such understanding when there are no immediate stakes to be defended." (Aksnes and Rip 2009, p. 904).

Lastly, the use of performance indicators and more advanced forms of bibliometric information may also influence the terms and conditions of the development of research agendas. Derrick and Pavone (2013) have reviewed government policies in three countries (the UK, Australia, and Spain). Each country has committed itself to increasing the societal role of researchers by opening up the setting of research problems by a larger group of stakeholders. The study characterises this as a move towards more participatory approaches. The authors argue that the use of scientometrics for informing this process has so far been largely overlooked. The question is too often formulated as the choice between peer review and metrics (Taylor 2011). Derrick and Pavone (2013, p. 573) conclude that the choice should be on the type of use that scientometric information is put to. "The simple information portrayed by correctly calculated and applied bibliometric indicators has the potential to engage a larger group of stakeholders than previous evaluation systems could." According to this study, future research policies should take advantage of bibliometrics to foster greater democratisation of research to create more socially reflexive evaluation systems.

Despite the sheer volume, breadth and heterogeneity of the studies discussed above we still know relatively little about the actual effects of indicator use. Many studies are of tentative and theoretical nature, prophesising on potential effects rather than documenting actual consequences. Larger empirical studies are often restricted to specific and limited aspects (e.g. publication patterns), and rarely touch on more general changes in academic work and knowledge production practices. Several evaluation mechanisms, such as the use of national indicators for resource allocation, are also of quite recent date. More time is needed to fully assess the impacts of these procedures. It is also quite challenging, if not virtually impossible, to separate the influence of specific evaluation procedures from the effects of other societal factors. Yet these difficulties should stimulate rather than hamper further interdisciplinary, mixed-methods inquiry into effects of research assessment and evaluative metrics.

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