Research Policy 48 (2019) 492–502

Contents lists available at ScienceDirect

Research Policy

journal homepage: www.elsevier.com/locate/respol

The extent and causes of academic text recycling or 'self-plagiarism'

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ARTICLE INFO

Keywords:
Scientific integrity
Scientific misconduct
Text recycling
Self-plagiarism
Causes
Prevalence

ABSTRACT

Among the various forms of academic misconduct, text recycling or 'self-plagiarism' holds a particularly contentious position as a new way to game the reward system of science. A recent case of alleged 'self-plagiarism' by the prominent Dutch economist Peter Nijkamp has attracted much public and regulatory attention in the Netherlands. During the Nijkamp controversy, it became evident that many questions around text recycling have only partly been answered and that much uncertainty still exists. While the conditions of fair text reuse have been specified more clearly in the wake of this case, the extent and causes of problematic text recycling remain unclear. In this study, we investigated the extent of problematic text recycling in order to obtain understanding of its occurrence in four research areas: biochemistry & molecular biology, economics, history and psychology. We also investigated some potential reasons and motives for authors to recycle their text, by testing current hypotheses in scholarly literature regarding the causes of text recycling. To this end, an analysis was performed on 922 journal articles, using the Turnitin plagiarism detection software, followed by close manual interpretation of the results. We observed considerable levels of problematic text recycling, particularly in economics and psychology, while it became clear that the extent of text recycling varies substantially between research fields. In addition, we found evidence that more productive authors are more likely to recycle their papers. In addition, the analysis provides insight into the influence of the number of authors and the existence of editorial policies on the occurrence of problematic text recycling.

1. Introduction

Among the various forms of academic misconduct, text recycling or 'self-plagiarism' holds a particularly contentious position. Scientists and commentators agree on the undermining effects of infringements of core conventions in research, such as falsification, fabrication and plagiarism (FFP), and a series of questionable research practices (QRP). These have been widely studied, leading to a growing body of literature discussing the nature (Steneck, 2006), prevalence (Fanelli, 2009), causes (Fanelli et al., 2015) and consequences (Steen, 2011; Zhang and Grieneisen, 2013) of scientific misconduct.

However, text recycling raises interesting questions about the nature and causes of misconduct. Academic text recycling is the reuse of one's own writing in academic publications, ranging from a sentence to several pages or even entire articles, without reference. Some authors object to the term 'self-plagiarism', as stealing from oneself is a legal oxymoron (Callahan, 2014; Chrousos et al., 2012; Thurman et al., 2016). Therefore novel terms such as '(unacceptable) text recycling' (Moskovitz, 2016) or '(unacceptable) duplication' (Thurman et al., 2016) have been proposed. In this paper we will adhere to the term 'text recycling'.

Text recycling is one of the novel forms of misconduct specifically aimed at gaming the current reward system of science. Journal editors and research leaders have rung the alarm over the spread of misconduct and the emergence of these novel forms (Bohannon, 2013; Martin, 2013). They point out that authors and editors employ various practices specifically aimed at increasing publication or citations records and journal impact factors. These practices include faking peer review reports (Callaway, 2015), the formation of 'journal citation cartels' (Mongeon et al., 2016) and 'coercive citation' strategies (Martin, 2013).

A recent case of alleged 'self-plagiarism' by one of the most prominent Dutch scientists has attracted much attention in the Netherlands. For years, economist Peter Nijkamp published peer reviewed journal articles at an astonishing rate of about one and a half per week. In 2013, it appeared he had been recycling large parts of his previous work, triggering accusations of 'self-plagiarism' (Retraction Watch, 2014). The allegations, and perhaps particularly the conclusions of the integrity committees investigating them, led to a fierce debate about authors' fair use of their previously published texts (Breedveld, 2015). As the case stands, it has become evident that many questions around text recycling have been answered only partly and much uncertainty still exists. While the conditions of fair re-use of text have been

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http://dx.doi.org/10.1016/j.respol.2017.09.004
Received 21 December 2016; Received in revised form 31 August 2017; Accepted 7 September 2017
Available online 19 September 2017

specified more clearly, the extent and causes of improper recycling remain unclear. Some smaller studies have been done, but they provide contradictory results. Estimates of the occurrence of 'self-plagiarism' range as widely as from 3% (Bazdaric et al., 2012) to 60% (Bretag and Carapiet, 2007), feeding intense speculation (Binder, 1990). Other studies indicated that 'self-plagiarism' is more common than plagiarism (Sun, 2013). Along with uncertainty over the extent of improper text recycling, questions about its causes and potential ways to avoid its occurrence have been posed (Honig and Bedi, 2012; Martin, 2013; Scanlon, 2007; Sun, 2013), but so far largely remain without satisfactory answer.

It is precisely this knowledge gap that this study aims to address. As such, this study provides important new insights into the phenomenon of 'self-plagiarism', most prominently regarding its extent in various research areas and potential causes of improper recycling. An analysis was performed on 922 research articles, spread over four scientific disciplines, using the Turnitin plagiarism detection software and manual interpretation of the results.

This paper is divided into two parts. The first provides the necessary background material, including an overview of the scholarly literature addressing a wide spectrum of concerns and questions related to 'self-plagiarism' and scientific misconduct in general. Furthermore, it deals with a description of the Nijkamp-case in the Netherlands. It discusses the nature and consequences of the case, both for individuals as for the research system as a whole, as the debate raised arguments for and against authors' right to reuse texts. Subsequently, we point out several questions that the Nijkamp-case gave rise to and formulate hypotheses regarding the causes of (problematic) text recycling, based on the literature. The second part empirically describes the extent of text recycling in four research domains. It provides an account of the methodological approach (Section 5), the obtained results (Section 6), and a reflection on hypotheses regarding the causes of text recycling (Section 7).

2. The academic debate on text recycling

Although improper text recycling was first mentioned in the academic literature in the early 1990s (Binder, 1990; Samuelson, 1994), major contributions to the discussion have been made only recently (Chrousos et al., 2012; de Vasconcelos and Roig, 2015; Harriman and Patel, 2014; Joob and Wiwanitkit, 2016; Martin, 2013; Moskovitz, 2016; Roig, 2010). Since the discussion about misconduct and plagiarism in science started already in the 1980s (Horbach and Halffman, 2016), text recycling is a relatively new concern among scientists. Within the current debate about text recycling, most researchers focus on the damage to the reader who is 'deceived by false claims of originality' (e.g. de Vasconcelos and Roig, 2015). Only marginal attention is paid to the implications of text recycling to the scientific enterprise as a whole, overlooking consequences for co-authors, fellow scientists and even society, in the form of unfair competition due to skewed rewards or the abuse of publication resources and reviewer's efforts (Tramer et al., 1997).

Within the debate on 'self-plagiarism' most discussion is undoubtedly concerned with its permissibility. In this facet of the debate, no consensus has been reached. The opinions expressed by multiple scholars range from deeming 'self-plagiarism' 'a serious offence' and 'academic misconduct' (Bretag and Mahmud, 2009; Martin, 2013) to stating that 'it does not exist' (Callahan, 2014) and deeming it 'unavoidable' (Chrousos et al., 2012).

There are several arguments to claim text recycling is unacceptable. Re-publication of texts could be considered an abuse of the scientific publication system, arguably overloaded with less than essential publications. This is especially the case for the reliance on reviewers who offer their time to assess work that has already been reviewed. However, these arguments only hold for large sections of texts, as the reuse of smaller text fragments hardly poses a burden on the publication system. The major argument against text recycling is that it is a form of gaming the reward system of science: text recycling scientists claim more 'productivity' than their work actually warrants. In a research system where the number of publications is considered an indicator of 'quality' and is an instrument in career promotion and even grant allocation, text recycling is a way to boost scores, at the expense of other researchers by unfair competition for grants or positions. (Evidently, this raises the bigger question to what extent proxies based on publication productivity are meaningful assessment criteria for job or grant allocation.) Lastly, text recycling also has potentially harmful consequences for society, at least in biomedical research. Tramer et al. (1997) point out that duplicate reporting of the effectiveness of a certain drug will yield erroneous results in *meta*-analyses on these drugs. Estimates of treatment efficacy might be biased, which creates obvious potential harm to patients.

Besides these arguments against text recycling, some authors have argued in favour of it (Callahan, 2014). Apart from the argument that authors cannot steal from themselves, the reuse of particularly well-formulated expressions for standard methods, disclaimers, or even nuance theoretical positions, could arguably be justified, although even then a reference can easily be added. In addition, some authors claim that reusing one's own work is unavoidable, especially in small research fields in which an author builds on his own line of research (Chrousos et al., 2012). Moreover, publishing similar results for different audiences has been presented as a justified reason to reuse previously published material (Nijkamp, 2015; Samuelson, 1994). In the aftermath of the Nijkamp case, another argument was made in favour of text recycling: economists claimed it has become standard practice in their field (Nijkamp, 2015; Westlund et al., 2014). If text recycling has become standard practice, they argue, this can hardly be held against one singled out scholar.

Due to its contentious nature, text recycling holds a remarkable position in the current debate on integrity and misconduct in science. A general tendency in the current integrity debate assumes a universal understanding of integrity, with demarcations within the spectrum ranging from 'Responsible research practices' via 'questionable research practices' to 'scientific misconduct' (Horbach and Halffman, 2016; Steneck, 2006). Based on this assumed collective understanding, extensive effort has been put in measuring the prevalence and causes of breaches with integrity (e.g. Fanelli, 2009; He, 2013; Martinson et al., 2005; Steen, 2011). Despite many hurdles in obtaining accurate results, (e.g. due to the limits of self-reporting), several estimates on the prevalence of questionable research practices (QRP) or misconduct have been given (Fanelli, 2009; John et al., 2012). These results generally indicate that the prevalence of QRP greatly exceeds the prevalence of the core examples of scientific misconduct, FFP. In addition, various scholars suggest potential causes for the occurrence of misconduct in science. These include:

- Scientific age: younger scientists are frequently considered to be at greater risk of committing misconduct, due to their lack of experience with accepted practices; the rise of the internet and the subsequent culture of using this in essays, theses and articles; and due to the fact that young scientists do not yet have established names in the field and thus have 'more to gain' than older researchers (Fanelli et al., 2015; Honig and Bedi, 2012). As a result, measures to prevent misconduct or to foster integrity commonly aim at junior or future scientists (Godecharle et al., 2013; Horner and Minifie, 2011; Kornfeld, 2012; Necker, 2014; OECD, 2010).
- Research culture: it is commonly suggested that the academic culture, most notably the pressure to publish and the focus on quantity rather than quality, increases the chance of scientists engaging in misconduct (Anderson et al., 2007; Fanelli et al., 2017; Van Dalen and Henkens, 2012).
- Number of authors: it is suggested that the increase in the average number of co-authors on a single article increases the incidence of

misconduct. This is explained by the fact that the responsibility of every single author dilutes by adding more co-authors to a paper. As a result, authors might be more likely to cut corners (Bennett and Taylor, 2003; Sun, 2013).
- Clear rules and policies: It is commonly suggested that the existence of codes of conduct and formal regulations on misconduct and protocols for handling suspected cases have a deterrent effect on misconduct (Fanelli et al., 2017; Godecharle et al., 2014). In addition, a lack of such codes and specifically a lack of consensus on definitions of dubious practices are considered a source of occurrence of such practices.
- Lack of social control: It is hypothesised that a (perceived) lack of social control might increase the extent of unjust research practices (Bohannon, 2013; Enders and Hoover, 2004; Fanelli et al., 2017; Stroebe et al., 2012). This social control might exhibit itself in various forms, including peer review, editorial evaluation, mentoring and societal evaluation.

The suggested potential sources of scientific misconduct are commonly based on linking self-reported cases of scientific misconduct with contextual background information. Due to the limitations of this self-reporting, results tend to have high levels of uncertainty. In this respect, text recycling holds a specific position in the spectrum of dubious behaviour in science, since it is relatively easy to measure with the aid of modern plagiarism software. By using plagiarism detectors, we were able to test the literature's claims about misconduct directly, at least for this particular questionable research practice. Our study both provides insight into several open questions regarding text recycling, its perceived permissibility, and its incidence. In addition, it forms a window into the potential sources of text recycling and scientific misconduct in general.

3. Raising concern: the Nijkamp-case

The controversy around the text recycling accusation of Peter Nijkamp is interesting for several reasons. It illustrates the tensions that arise when a questionable, but not formally regulated practice is challenged – in this case through the media. In the Dutch context, the Nijkamp controversy triggered a debate about the acceptability of various degrees of text recycling, resulting in an articulation of standards that we used to define which text recycling is 'problematic'. The controversy also raised several questions about the incidence and causes of text recycling, to which we attempt to provide a contribution.

The case of Peter Nijkamp is extremely rich, with allegations of misconduct involving plagiarism, self-plagiarism, as well as data fraud; media interest; legal procedures; and regulatory action. The many ramifications of this case would warrant a full-length article, but for brevity's sake, we will limit ourselves here to the aspects directly involving 'self-plagiarism'. In this section, we will provide a description of those elements of the case related to text recycling, including the formal allegations, the process of investigation by integrity committees, the committee's final conclusions and the subsequent consequences of the case. This highlights how the different arguments used in favour and against text recycling operate in the context of a concrete case, illustrating the complexities and contradictions that came about as various investigating committees came to differing conclusions.

Peter Nijkamp is Emeritus Professor in Regional Economics and Economic Geography at the Faculty of Economics of the Vrije Universiteit (VU) in Amsterdam. In his career, Nijkamp has become widely known as one of the most productive economists in the world. From 1975 onwards, he published over 2300 research articles and more than 100 edited volumes. In addition, his work is highly cited. Nijkamp's publications obtained a total of nearly 40.000 citations, giving him an h-index of 88 and an i10-index of 752 (obtained from Google Scholar on September 8th 2016). His enormous productivity and influence were rewarded with the Spinoza Award, the most prestigious scientific award in the Netherlands, in 1996. In addition, he was president of the governing board of the Netherlands Research Council (NWO) from 2002 till 2009, chairman of the Dutch Social Science Council (SWR) and vice-president of the Royal Netherlands Academy of Sciences (KNAW). A more stellar career in Dutch academia would hardly have been possible.

3.1. The allegations

The Nijkamp-case began in May 2013, with an anonymous whistleblower's allegation concerning the dissertation of Nijkamp's PhD student Karima Kourtit. This allegation concerned plagiarism, both from the authors' own work as well as that of others. Although the allegation did not target Peter Nijkamp directly, it did concern his work, since he co-authored most chapters in Kourtit's thesis. More accusations would follow, all from the same anonymous source, shifting attention to Nijkamp himself.

During the Nijkamp-case, several integrity committees were responsible for the official handling of the allegations. The committee handling the first allegation found Nijkamp and Kourtit guilty of inappropriate text recycling. Interestingly, the official investigation report referred to it as "plagiarism" (VSNU, 2013), most probably because of a lack of clear and accepted terminology on this topic. According to the committee, reuse of earlier material occurred via a process it also labelled as 'self-citation'. The process – which differs from the usual understanding of 'self-citation' as a reference of authors to their earlier published papers – runs as follows: Author A and B write an article. Together with author C, author A later publishes a novel article in which, without reference, he uses material from the first article. Subsequently, in some later stage, author C writes a thesis using passages from the article authored by A and C, again without reference (VSNU, 2013). This process is, among others, problematic because the credit for the contribution of author B is lost. The fact that the unfortunate term 'self-citation' was used for this process, was later attributed to administrative issues in publishing a summary of the committee's report (Schuyt, 2014)

In November 2013, shortly after the presentation of the findings of the integrity committee handling the first allegation, the anonymous whistle-blower provided a second allegation to the VU ombudsperson concerning plagiarism and self-plagiarism in sixteen publications by Kourtit, largely co-authored by Peter Nijkamp. Later, other allegations concerning data fraud were made, which we will not discuss these in further detail here.

The second allegation was deemed partly founded by the initial committee investigating it (LOWI, 2015), but after appealing his case at the national integrity office (LOWI) Nijkamp was cleared of all charges in this allegation (LOWI, 2015). The LOWI-committee decided that Nijkamp and Kourtit were not guilty of (self)-plagiarism, because in order to classify an act as such, there should be 'a clear intention to deceive' (LOWI, 2015). According to the LOWI, this indication was not present in the case at hand, among others because of the nature of the published articles (a book review, in which 'overlap with the original source can be expected') and the amount of copied material (in the alleged cases not more than several sentences).

Due to the extensive outcry among scientists and the media alike, the directory board of Nijkamp's university decided to launch another investigation into his publication practices. A new committee was installed, charged with the task to investigate not only those publications that were part of a formal allegation, but rather to study publication and citation practices in Nijkamp's entire oeuvre (Zwemmer et al., 2015). For their research, the committee sampled all his publications since 1970 and then scanned a selection of them with plagiarism-detection software (Zwemmer et al., 2015). Due to technical difficulties and time constraints, the committee decided to test 261 out of the more than 2300 articles from Nijkamp's oeuvre. Among the 261 scanned articles, they found 60 to have significant overlap with prior

publications without relevant citations. The committee judged that the amount of overlapping passages gave the impression of 'systematic copy-pasting': 'the copy-pasting serves as a strategy that should lead to a high number of publications, rather than an original oeuvre' (Zwemmer et al., 2015). Nijkamp severely criticized the committee's work, among others because of its strategy to use mechanic plagiarism-detection software with only little human verification and interpretation of the results (Nijkamp, 2015).

Ultimately, Nijkamp was found responsible for committing 'self-plagiarism' but was cleared of all other charges. Most allegations in this case were investigated by multiple committees, which frequently came to diverse conclusions. Some committees required a clearly visible 'intention to deceive' in order to label a practice as scientific misconduct, whereas others did not. In addition, some committees took the specific context of material into account, such as the type of article or the part of the article that contains recycled text, whereas others adhered to more strict definitions of (self) plagiarism in which context is more or less ignored.

3.2. The consequences

The findings of the committees in the Nijkamp-case have had consequences for the actors involved as well as for the Dutch research system. In the end, Peter Nijkamp was not officially sanctioned by his university, but he did suffer major reputational damage: the case drew a lot of attention (judging by the 280 newspaper articles and multiple blogs about the case) and created large public outcry about the scientist (as well as the person) Peter Nijkamp. In addition, two of his papers were retracted by *The Review of Economic Analysis* on grounds of 'self-plagiarism' (Retraction Watch, 2014), demonstrating that text recycling, at least by some, is considered a severe act of misconduct.

Part of the confusion regarding the severity of text recycling might have been the result of lacking formal policy on this issue. In response to the Nijkamp-case, the Royal Netherlands Academy of Arts and Sciences (KNAW) published an advice on correct citation practices (KNAW, 2014). The advice commented on the act of plagiarism and more specifically on the act of 'self-plagiarism'. In response, a specific paragraph on text recycling was incorporated into the Netherlands Code of Conduct for Academic Practice (VSNU, 2014;Schuyt, 2014). Thereby the Dutch were among the first to incorporate regulations on text recycling into their national policy statements (de Vasconcelos and Roig, 2015).

Besides the statement in the Netherlands, the Committee on Publication Ethics (COPE) also published a set of guidelines regarding text-recycling (Harriman and Patel, 2014). Both policy statements agree on the fact that the permissibility of reusing an author's own material is highly dependent on the circumstances in which it is done. They agree that reuse can be permissible "when it concerns brief passages of introductory, theoretical or methodological explanation" (KNAW, 2014). However, reuse of parts of the results, conclusion or discussion sections are, in general, not permissible (Harriman and Patel, 2014). Both policy statements stress the fact that reused passages should never create the suggestion of constituting novel contributions and should always be accompanied by proper references. Other codes of conduct stress the need for being open about recycling material, among others on an author's C.V. or list of publications (ESF/ALLEA, 2011)

Despite controversies around the permissibility of textual recycling, the novel policy statements by VSNU and COPE acknowledge that, in any case, there exist forms of text recycling that are problematic. We have worked with the current Dutch criteria to identify *problematic* text recycling. In the remainder of this article we will address the extent to which these forms of text recycling appear among Dutch authors and suggest reasons for their occurrence.

3.3. Questions raised by the Nijkamp case

Despite the many investigation committees studying the case of Nijkamp and the extended (national) debate among scientists, there are still many questions left unanswered. One of the defences by Peter Nijkamp was that he did not deviate from the common practices and behaviours in his research area. This argument was endorsed by his fellow economists in an open letter to the VU's Rector, in which they claim that any of them would be guilty if they were subjected to the norms applied to Nijkamp (Westlund et al., 2014). This raises the question how common inappropriate text recycling is and whether major differences exist between economics and other research fields. Is it a concern specifically for economists or is it more widespread? Second, the act of text recycling was considered by many as one of the explanations of Nijkamp's enormous productivity (Zwemmer et al., 2015). This raises the question whether recycling is more common among productive scientists, as compared to their less productive colleagues. Third, the occurrence of unacceptable text recycling was argued to result from a lack of clear rules and guidelines regarding this topic. This raises the question whether the existence of guidelines regarding text recycling is an effective means of preventing it.

4. Testable claims about text recycling

Both in the literature and in the context of the Nijkamp controversy, several claims were made about the extent and causes of questionable research practices and problematic text recycling in particular. Given the limited amount of research, some claims were made casually, other with more substantial support, and yet others as defence or accusation. Below are the claims in this debate we could test with our approach, generating our research hypotheses.

4.1. Causes of (problematic) text recycling

Several causes for the occurrence of text recycling have been proposed. We will discuss these causes, categorising them as 'individual causes', referring to aspects related to the individual author(s), and 'systemic causes', referring to aspects of the research system. The discussion of these potential causes leads to several hypothesis on the occurrence of problematic text recycling, which will be further discussed in Section 7.

4.1.1. Individual causes

Several causes of the occurrence of text recycling related to the position and identity of the individual author have been proposed. First, multiple scholars suggest that the number of authors of an article influences its chance of containing plagiarised material. It is suggested that by increasing the number of authors, the responsibility of every single author is diluted and therefore the chance of committing (self-) plagiarism increases (Bennett and Taylor 2003; Sun 2013).

Hypothesis 1: A higher number of authors on an article increases its likelihood to contain problematic text recycling.

Second, it is claimed that scientific age or career stage (i.e. level of maturity of the scientific career and position) influences the likelihood of committing (self-)plagiarism (Fanelli et al., 2015; Honig and Bedi, 2012). Various academics point to the fact that junior researchers have more incentives to (self-)plagiarise than senior researchers, because they have more to gain. In addition, it is believed that " … graduate and post-doctoral students, […] are not aware of the problem or […] have trouble writing with ease and speed and feel that taking some material from here and there is something that won't be noticed" (O'Hair and Neff, 2013). It is therefore hypothesized that (self-)plagiarism occurs more frequently among junior researchers (Honig and Bedi, 2012). This is not to say that scientists in the later phases of their careers are resistant of engaging in practices of text recycling. Several scientists accused of 'self-plagiarism' were in the later phases of their career, such as

Nijkamp, Breslow (Oransky, 2012) and Wansink (Chambers and Etchells, 2017). Based on these cases the contrary might seem plausible as well, but based on the scientific literature we hypothesise:

Hypothesis 2: Authors of younger scientific age are more likely to improperly recycle text.

4.1.2. Systemic causes

We identify two reasons for the occurrence of problematic text recycling related to the research system and policy that have been proposed.

First, some scholars suggest a correlation between the clarity of norms and guidelines set by journals/publishers and the extent of text recycling among the various research areas. It is suggested that clear policy is needed to make authors aware of what behaviour is permissible and what behaviour is not. Therefore, the absence of clear policy might increase the extent of problematic text recycling (Karabag and Berggren, 2012; Martin, 2013). While rules by academies and other science-governing organisations are relatively new, several journals already had editorial policies against text recycling. Similarly, the Nijkamp controversy suggests that a lack of clear guidelines could leave room for text recycling practices.

Hypothesis 3: The absence of clear editorial statements on text recycling increases its likelihood of occurrence.

Second, variations between research fields might be relevant. These variations appear on multiple levels. First, some scholars have suggested that text recycling in the humanities is a more serious offence than in the natural sciences, because in the humanities "the wording is the essence of the novelty" (Chrousos et al., 2012). Based on this reasoning, the humanities could be expected to have more strict conventions about text recycling and hence lower incidence rates compared to other scientific domains. Similarly, the recycling of (highly technical) research protocols in the natural sciences is often considered as less problematic, partly because language in these sections is highly standardised. This suggests that the incidence of recycling in the natural science might be substantial.

In addition, besides having official policy regarding (self-)plagiarism, also the willingness of journal editors to act against (alleged) cases of (self-)plagiarism might be of influence on the frequency of recycled articles making it to publication. In addition, the (perceived) level of social control via editorial evaluation potentially influences the writing strategies of authors (Bennett and Taylor, 2003; Fanelli et al., 2017). The crucial role of editors in fostering integrity in research and to maintain the integrity of the scientific literature is commonly stressed (Council of Science Editors, 2012; Marusic et al., 2007). It is commonly accepted that editors can (and should) not act as 'the policing force of the scientific community' (Marusic et al., 2007), but that they nonetheless should be proactive in fostering research integrity (Council of Science Editors, 2012). Enders and Hoover (2004) show that editors of (top) economic journals do not seem particularly strict with cases of text recycling, as opposed to de Vasconcelos and Roig (2015), who argue that journal editors are generally very keen on fighting unacceptable text recycling. This is confirmed by Wager et al. in a survey amongst journal editors, in which redundant publication and plagiarism are considered the greatest concerns with respect to integrity in science (Wager et al., 2009). It is suggested that if editors do not show willingness to act against improper behaviour, including unacceptable text recycling, then authors might expect only minor consequences of this behaviour. From this 'rational actor' perspective, authors would be tempted to recycle text if they do not expect sanctions.

The combination of these factors leads us to our last hypothesis:

Hypothesis 4: Problematic text recycling is more common in research disciplines in which phrases are more standardized and editors are less willing to act against recycling.

5. Methods

5.1. Data collection and analysis

To measure the extent of problematic text recycling and to study the disciplinary differences between various research domains, we selected four research areas. The selected domains are: biochemistry & molecular biology, economics, history and psychology. These domains cover a wide spectrum of research and can offer a perspective on the diversity in the research community. Since multiple scholars have found that publication cultures, competitive pressures and policy formulations are highly heterogeneous among different countries (Fanelli et al., 2015; Godecharle et al., 2014), we decided to focus our research on a single country. Due to the great uproar around 'self-plagiarism' in the Netherlands after the Nijkamp-case, we decided to focus our study on authors affiliated with Dutch universities.

Research articles from the authors in the specified research areas were collected. To study the influence of the authors' productivity on the occurrence of text recycling, we grouped the sampled articles into the categories of 'productive' and 'less productive' authors. The sample articles were scanned using the Turnitin plagiarism detection software (Turnitin, 2006). The results were subsequently subjected to full-text inspection, to delete all forms of overlap that were considered acceptable. Below we provide detailed descriptions of the data collection and the analysis techniques.

5.2. Collection of research papers per research area

5.2.1. Biochemistry

A list of most productive scientists affiliated with a Dutch university was created via Web of Science (search on research area = -biochemistry & molecular biology, country = Netherlands, and timespan = 2010-present). We then retrieved papers of the authors on top of the list (top 6) via Sciencedirect. For the less productive authors, we searched Sciencedirect by research area (biochemistry and molecular biology) and affiliation with Dutch universities. We then selected papers in which none of the authors were ranked in the top 25 of the Web of Science productivity ranking. Papers were selected from the period 2010 till present and selected on the basis of publication date (newest papers first). Entries in Sciencedirect containing only announcements of papers coming up in subsequent issues, or short abstracts of articles were omitted.

5.2.2. Economics

As with the previous research area, only here we used the list of most productive Dutch economists as listed in the *Economische en Statistische berichten* (ESB) list of top economists ("economentop 40") from 2013 (Phlippen, 2013), because it provides a more accurate overview of Dutch economists' productivity than Web of Science could. We then again searched Sciencedirect for the top 6 authors on this list (for the 'productive' category) and searched Sciencedirect for economists affiliated to Dutch universities and select papers that do not include any author on the top 40 (for the 'less productive' category).

5.2.3. History

Similar to biochemistry, with a slight alteration in the search engine, due to a lack of history articles in Sciencedirect. Research articles were not collected via Sciencedirect, but via Google Scholar and the database of the Dutch Journal *Nederlands Tijdschrift voor Geschiedenis* (all articles from 2010 onwards) and we distributed the articles over productive (top of list) and none-productive (not in top 25) of the list from Web of Science.

5.2.4. Psychology

idem to biochemistry, with the obvious alterations in search terms, both in Web of Science and Sciencedirect, from 'biochemistry &

molecular biology' to 'psychology'.

For all areas, we sampled between 125 and 135 articles, both for the 'productive' category as well as for the 'less productive' category. Because of the lack of a large database and the low number of articles of the research area 'history' in general, we were only able to select 50 articles from productive authors in the time period 2010-present. In all cases in which articles of a specific author were sampled, we used the spelling of author names corresponding to the spelling in the productivity list of the ESB (in case of economics) or Web of Science (in the other cases).

5.3. Collection of policy guidelines

For the analysis of hypothesis 3, we collected editorial policy guidelines of academic journals. We distinguished three categories of journals: journals with the highest impact factor in their research area ('top journal'), journals most frequently present in our sample of articles ('most frequent'), and journals that published one of the articles containing problematic text recycling in our sample ('containing problematic recycling'). A journal was acknowledged to contain statements on plagiarism if it included statements referring to the inclusion of previously published work, or specifically uses the word 'plagiarism'. Specifically pointing out that authors are also not allowed to copy text from their own previously published work, classifies the journal as having statements on 'self-plagiarism'. These guidelines were collected via the journal's and the publisher's webpage, because these are the pages to which authors are directed when submitting their manuscript and that provide instructions for preparing manuscripts.

5.4. Analysis

We uploaded all documents to the plagiarism detection software Turnitin (Turnitin, 2006). This software provides three levels of strictness in scanning the documents: 'compliant', 'standard' and 'strict'. We used the 'standard'-level for all investigations. The collected articles were tested on textual overlap against an internal Turnitin database consisting of over 62 billion webpages and 165 million scientific articles (Turnitin, 2006). Hence, the sampled articles were not only tested against other articles in our sample, but to a wide variety of journal articles and other sources, including books and book chapters.

Then, for every individual paper, we checked all passages flagged as overlapping by Turnitin by inspecting the text of the article itself. With this, we specifically aimed to avoid the critique of mechanical analysis, as was for instance fiercely expressed in the Nijkamp-case (Nijkamp, 2015). In addition, this distinguishes our work from previous research on text recycling (e.g. in Sun, 2013). In agreement with the novel policy statements by COPE and VSNU (Harriman and Patel, 2014; VSNU, 2014), the following were considered acceptable overlap:

- Identical matches to full-texts or abstracts of the exact same article in the original journal or an electronic database
- Author information (name, address, affiliations, etc.)
- List of references
- Overlap correctly cited by reference to the original
- Overlap with the master- or PhD-thesis of one of the authors
- Overlap with unpublished working papers
- Overlap with articles published after the publication date of the studied article (a.o. to make sure no overlap was counted twice)
- Overlap in (technical) descriptions in the methodological sections of the paper that contain a reference to a previous paper.

Clearly, deciding on the appropriateness of textual overlap was not always straightforward. Specifically, the fourth criterion, asserting that overlap is appropriate in case it is correctly referenced, can cause some discussion. In such cases of discussion, it was decided to label overlap as appropriate, thereby rendering all contentious cases 'unproblematic'. Consequently, the resulting analysis yields a conservative estimate of the extent of text recycling.

Table 1
Number of articles scanned per research area and category.

Research area	Category					
	Productive		Less productive		Total	
	Number of articles	Number of 'first authors'	Number of articles	Number of 'first authors'	Number of articles	Number of 'first authors'
Biochemistry	128	104	112	107	240	211
Economics	133	78	125	106	258	184
History	48	25	142	127	190	152
Psychology	125	91	109	103	234	194
Total	434	298	488	443	922	741

Articles were considered problematic if, after deletion of all acceptable overlap, they contained at least 10% identical passages to previously published articles. The threshold of 10% was chosen in accordance to previous research on text recycling (Bretag and Carapiet, 2007; Bretag and Mahmud, 2009). Data collection and analysis are schematically depicted in the graphical abstract.

In some cases, the Turnitin software was not able to scan an uploaded article, e.g. because of trouble with particular text formats. In the end, we therefore retained information on the number of articles as shown in Table 1. For all articles we stored information on: the research area, the category (productive/less productive), the journal in which it was published, the year in which it was published, the number of authors and the extent of text recycling (problematic if above 10% after close study, unproblematic otherwise). In addition, Table 1 provides information on the number of first authors involved in our analysis. A more specific analysis on the number of authors in our sample is presented in Section 6.

6. Results

This section presents the results of the empirical analysis described in section 5. The presentation of results will be based on the discussion of Fig. 1 and Tables 2–4, providing information on the occurrence of text recycling (Table 2), its connection with policy statements (Table 3) and its connection with the number of authors (Table 4). Conclusions from these results, as well as reflection on the hypotheses stated in section 4, will be postponed to the subsequent section.

Table 2 and Fig. 1 present an overview of the extent of problematic text recycling in the various research areas, both among productive authors and their less productive colleagues. In the table, 'articles containing problematic text recycling' refers to the articles that were deemed 'problematic', as defined in Section 5.

Table 2 presents several interesting results. First, it gives an indication of the general extent of problematic text recycling, with an occurrence of a little over 6% in the entire sample. Second, the table's last column demonstrates major differences between the extent of text recycling in the various research areas. Whereas text recycling seems fairly common among economists, it is hardly found among historians. As much as one in seven publications by Dutch economists contains at least 10% text that has been published before. In fact, some economists show rates of over 40% of their articles containing problematic forms of text recycling, when assessed against current standards.

Last, it is apparent from the table that the occurrence of text recycling is different among productive and less productive authors. Productive authors recycle their previous work significantly more often than their less productive colleagues (10.1% vs. 2.5%, $p < 0.0001$). Moreover, this general pattern is visible in all of the individual research areas.

Table 3 demonstrates the frequency of scientific journals having

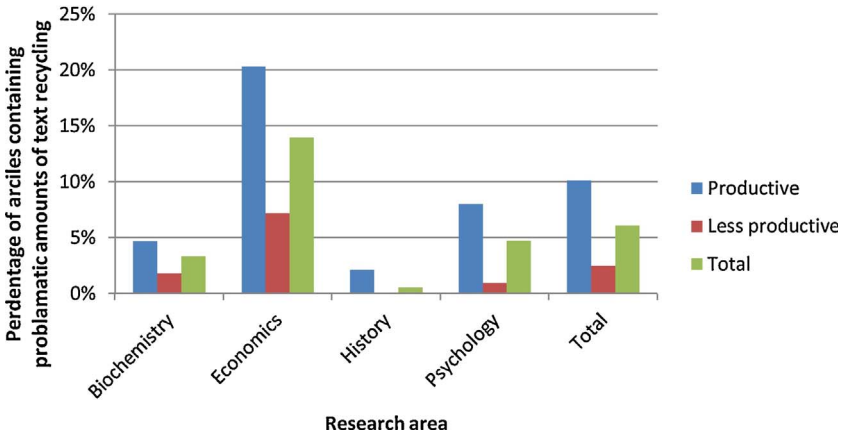

Fig. 1. The extent of recycling: The extent of problematic text recycling in various research areas among productive and less productive authors affiliated to Dutch universities.

specific statements on (self-)plagiarism in their policy guidelines, as identified with the procedure described in Section 5.3. Table 3 demonstrates that statements on text recycling are rather uncommon in journals' policy guidelines, with the vast majority of the journals in our sample not explicitly disapproving text recycling. Statements on text recycling are more common in influential journals (those with high impact factors). The journals most commonly present in our sample, as well as those journals containing recycled articles, almost uniformly lack statements on text recycling. In contrast, nearly all journals mention the prohibition of plagiarism.

Assuming that the most influential journals represent common practices in their research area, we conclude that the fields of biochemistry and psychology demonstrate most attention for (self-)plagiarism.

Table 4 presents an analysis of the average number of authors in various categories of our sample. It provides information on the number of authors on either recycled or non-recycled articles, either in the category of productive or less productive authors. From the analysis, we conclude that articles containing problematic text recycling on average have more authors than articles not containing problematic recycling. This holds for all research areas, except economics in which the values are nearly identical. Analysis over the entire sample demonstrates that self-plagiarised articles have significantly fewer authors than non-self-plagiarised articles (3.64 vs. 4.19, $p < 0.05$). Remarkably, this pattern is most clear among the category of productive authors. In this category, the articles containing problematic recycling have unmistakably fewer authors than articles not containing problematic recycling (3.68 vs. 5.21, $p < 0.005$).

Lastly, we would like to mention that our methodological approach enabled us to not only find cases of text recycling by the authors itself, but also by other scholars. Hence we were not only able to track 'self-plagiarism', but also actual 'plagiarism'. However, whereas we found 56 cases of problematic text recycling by the original author of an article, we only found one case that tended towards plagiarism. In this case it was one of the articles from our sample that was plagiarised by authors not affiliated with Dutch universities and hence outside of our sample.

7. Conclusion

This research set out to study the extent of problematic text recycling among various categories of scientific authors. The results of our analysis indicate an occurrence of problematic text recycling in 6.1% of the articles published by authors affiliated with Dutch universities. However, the results show strong differences between the extent of problematic text recycling among various research areas, with high rates in economics and very low rates in history. In addition, it demonstrates that text recycling is significantly more common among productive authors as compared to their less productive colleagues (10.1% vs. 2.5%, $p < 0.0001$).

In the remainder of this section, we will comment on the hypotheses regarding the occurrence and causes of problematic text recycling as derived from the literature in section 4 of this article.

7.1. Number of authors

The first hypothesis states that a higher number of authors on an article increases the likelihood of text recycling. However, our results show the contrary. On average, the 56 articles in our sample containing problematic recycling have 3.66 authors, whereas the 866 articles not containing problematic recycling have on average 4.18 authors. Also, if we consider the individual research areas, the same pattern appears: the number of authors on recycled articles vs. the number of authors on articles not containing recycled text is 5.63 vs. 7.16 (biochemistry), 3.12 vs. 3.04 (economics), 1.00 vs. 1.20 (history) and 4.25 vs. 4.76 (psychology). In addition, this pattern is most clear among the category of productive authors. In this category, the articles containing problematic recycling have significantly fewer authors than articles not containing problematic recycling (3.68 vs. 5.21, $p < 0.005$). Again this difference appears as well in the individual research areas with problematically recycled articles written by productive authors in biochemistry having on average 4.00 authors compared to 6.18 authors for articles without problematic recycling. In psychology and economics the ratios equal: 4.18 vs. 5.38 and 3.09 vs. 3.26 respectively. Hence, we argue that a higher number of authors reduces the likelihood of

Table 2
The extent of recycling: The extent of problematic text recycling in various research areas among productive and less productive authors affiliated to Dutch universities.

Research area	Number of articles			Number of articles containing problematic text recycling			Percentage of articles containing problematic text recycling		
	Productive	Less productive	Total	Productive	Less productive	Total	Productive	Less productive	Total
Biochemistry	128	112	240	6	2	8	4.7%	1.8%	3.3%
Economics	133	125	258	27	9	36	20.3%	7.2%	14.0%
History	48	142	190	1	0	1	2.1%	0.0%	0.5%
Psychology	125	109	234	10	1	11	8.0%	0.9%	4.7%
Total	434	488	922	44	12	56	10.1%	2.5%	6.1%

Table 3
Policy statements: existence of statements on (self-)plagiarism in policy guidelines of scientific journals. Three categories of journals are distinguished: journals with the highest impact factor in their research area (Top journal), journals most frequently present in our sample of articles (Most frequent), and journals that published one of the articles containing self-plagiarism in our sample (containing self-plagiarism).

Research area	Top journal			Most frequent			Containing problematic recycling		
	Tot	plagiarism	text recycling	Tot	plagiarism	text recycling	Tot	plagiarism	text recycling
Biochemistry	10	9	6	5	5	1	3	3	1
Economics	10	4	4	5	5	0	17	15	0
History	10	3	3	5	2	2	1	0	0
Psychology	10	8	3	5	5	0	8	8	0

committing problematic text recycling. This could possibly be explained by the fact that a higher number of authors amplifies the internal control on the content and the origin of a manuscript.

Concluding from the results we argue that productive authors publishing a manuscript with few co-authors, are a category of authors specifically at risk of recycling their previous work.

7.2. Scientific age

The second hypothesis predicts a higher extent of problematic text recycling among authors of younger scientific age. Our data, however, shows that productive (in all cases senior) researchers show significantly more signs of text recycling than less-productive (often more junior) researchers. The hypothesis is therefore not supported by our data.

We surmise that senior researchers might recycle text more frequently for multiple reasons. First, cynicism regarding the research and peer review system is identified as one of the factors enhancing one's preparedness of committing misconduct (Clair, 2015). Perhaps senior researchers have grown more cynical regarding the system than junior researchers. Therefore, they might be more likely to commit dubious behaviour in general and text recycling in particular.

Second, senior scientists might be more confident or aware about low probabilities of getting caught. In a rational actor perspective on committing misconduct, a researcher will be less likely to participate in dubious behaviour if he perceives the consequences as severe. In theory, the consequences of committing (self-)plagiarism are severe, ranging from job dismissal to irreparable reputational damage. However, in practise these consequences or penalties are hardly ever put into practice (Hoover, 2006). Considering the fact that definitions of 'self-plagiarism' are widely contested, it is extremely difficult for any agency, journal, editor, or whatever institution to make a successful case against a 'self-plagiarist'. In addition, there is no consensus on whose responsibility it is to act against a 'self-plagiarist'. Moreover, even clear-cut cases of (self-)plagiarism usually go unexposed or unpunished (Hoover, 2006).

Senior researchers might be more aware of this situation, where, in practice, the consequences of recycling text are small. This provides a possible explanation for the fact that senior researchers more commonly commit text recycling as they might perceive it as one of the more 'safe' options of shortcutting the pressures of the academic system.

7.3. Editorial policy statements

The third hypothesis concerns the relation between editorial policy and the extent of problematic text recycling, stating that the absence of clear policy statements on text recycling increases its likelihood. Our data presents only limited evidence for this claim. In this we distinguish between (a) policy statements in high impact journals, arguably setting the tone for their research area, and (b) policy statements in the journals in which a specific paper is published.

In the first case, the existence of editorial policy statements does not seem to have a clear correlation with the extent of problematic text recycling: whereas journals in the area of economics are not very active in publishing policy statements regarding (self-)plagiarism, journals in history are even far less active. The latter journals hardly ever include any statement about the acceptability of (self-)plagiarism in submitted articles or how to respond to such cases. Yet articles by historians show very little sign of text recycling, whereas economists demonstrate a significantly higher extent of problematic text recycling. In addition, journals in the field of biochemistry are most likely to include statements on (self-)plagiarism in their editorial policy instructions, but biochemists do not show the lowest extent of problematic text recycling in their articles.

In contrast, we notice that, of all journals in our sample that published an article containing recycled text, (nearly) all had statements about plagiarism in their policy guidelines, while (nearly) none had specific statements concerning text recycling. In addition, of all journals present in our sample, journals in history (the area with the lowest extent of problematic text recycling) most commonly published statements on text recycling in their editorial policy guidelines. This suggests that the existence of statements in the policy report of the journal in which an article is published decreases the likelihood of authors recycling their texts. However, it might also indicate that editors of these journals are keener to detect and reject recycled manuscripts, a topic which will be discussed more in depth below.

7.4. Willingness of editors

Last, the fourth hypothesis asserts that a higher level of standardized language in research areas and poor willingness of editors to act against

Table 4
Number of authors: Average number of authors per article in various categories of our sample.

Research area	All articles		Articles with problematic recycling		Articles without problematic recycling		Total		
	Productive	Less product.	Productive	Less product.	Productive	Less product.	all	Problem. recycling	No prob. recycling
Biochemistry	7.98	6.12	6.17	4	8.07	6.15	7.11	5.63	7.16
Economics	3.22	2.87	3.09	3.22	3.26	2.84	3.05	3.12	3.04
History	1.06	1.24	1	0	1.06	1.24	1.19	1.00	1.20
Psychology	5.52	3.83	4.18	5	5.68	3.82	4.73	4.25	4.76
Total	5.06	3.57	3.68	3.5	5.21	3.35	4.16	3.64	4.19

(alleged) cases of problematic text recycling increases its likelihood of occurrence. Our results partly support this hypothesis. As expected, the extent of problematic recycling among historians, as part of the humanities, is very low. This is in line with the hypothesis, based on the fact that 'wording is the essence of novelty' in this research area. However, this reasoning would predict a high incidence of text recycling in biochemistry, due to the high level of standardization in language used for research protocols and methods sections. Contrary to this hypothesis, the incidence of problematic text recycling in biochemistry is relatively low.

With respect to perceptions of editors, Enders and Hoover (2004) show that editors of (top) economic journals do not seem to act very strictly to cases of plagiarism, whereas de Vasconcelos and Roig (2015) argue that, in general, journal editors are very keen on fighting 'self-plagiarism'. A survey amongst (mainly) editors of medical journals demonstrated that redundant publication and plagiarism are their number one concern regarding publication ethics (Wager et al., 2009). Although no specific data is available for the attitude of journal editors in the other research areas, the high frequency of text recycling and the arguably low willingness of editors in the area of economics to act against it, supports the hypothesis. In addition, we already discussed in paragraph 7.3 that text recycling tends to occur relatively often in journals that do not have policy statements concerning this form of misconduct. Arguably, the editors of these journals are relatively unconcerned about 'self-plagiarism' and less keen to act against it.

Therefore, our data suggests that journal editors' perceptions on the severity of text recycling and their willingness to act against it have major influence on the frequency of text recycling occuring in published journal articles. However, a thorough study on journal editors' perceptions is required to further adress this topic.

8. Discussion

Judging by the results of our study, the inappropriate reuse of textual material in research is definitely a form of misconduct that deserves serious attention and consideration. Whereas in the current debate on textual reuse, the focus lies primarily on the reader who is 'deceived by false claims of originality', we argue that, on top, text recycling is a concern to the research system as a whole. The inappropriate reuse of prior research puts the current reward system of science under stress, potentially disrupting the system by harming various actors such as co-authors, colleagues, reviewers and editors.

Our study suggests that rates of problematic text recycling are substantial. With an occurrence of over 6%, it seems to be significantly more common than other, more serious forms of misconduct, such as plagiarism, falsification and fabrication (Fanelli, 2009). In addition, we identified several causes and risk factors that increase the extent of problematic text recycling, thereby suggesting potential measures to avoid inappropriate text recycling. These include the confirmation and effective implementation of rules, as in journal policies; enhanced social control among authors; and attention for publication practices of prolific authors, in addition to raising research integrity awareness among young researchers. These may all serve to either actively prevent or quickly detect the improper recycling of previously published text.

Besides indicating specific risks factors, the results of our study also identify potential differences in publication cultures among scientific disciplines. This suggests that a one-size-fits-all approach to preventing improper text recycling may well be too disrespectful of the diversity in practices among research fields. Consequently, specific measures for specific disciplines should be sought.

The need for specific measures and the shortcomings of a one-size-fits-all approach are clearly highlighted by the Nijkamp-case. This case in the Netherlands demonstrated the rather contentious nature of text recycling in academic publishing, with even various integrity committees judging differently about similar cases of text recycling. Specifically, the case points out several aspects of the published material that might be subject of debate, such as the type of article being published, the section of the article containing recycled material and the presence of a clear intention to deceive. In addition, the results of our analysis confirm the statements expressed in the Nijkamp-case that text recycling might be a rather common phenomenon in some academic disciplines. This seemingly widespread occurrence of text recycling, the variations between research fields, and the fact that text recycling is openly criticized (and sanctioned) by some, while accepted (or even promoted) by others, may require further discussion and carefully tailored measures.

This study's findings may be somewhat limited by a number of factors. First, different research disciplines may exhibit different publication practices. For example, books and book chapters are more common media for publication in history as compared to the biomedical sciences. In our research, we limited the sampling of text to academic journal publications, thereby potentially leaving out other relevant forms of academic publishing. We stress however, that the majority of these sources (such as books and book chapters) are present in the Turnitin database against which our sample of text was tested. Therefore, potential overlap with these sources was visible in our analysis.

Second, the qualitative step in our analysis in which textual overlap was either classified as appropriate or non-appropriate, leads to conservative estimates of the extent of text recycling. Besides this step leading to conservative estimates, some variation between research areas might have been introduced in this step. This might have occurred, for example, due to the fact that 'grey' cases of text recycling, in which it was not obvious whether the recycling was problematic or not, were all labelled as 'unproblematic'. However, given the large numbers of sampled papers and the fact that no systematic differences appeared between research areas in this respect, we are confident that such variations are kept to a minimum.

Last, our analysis focuses specifically on text recycling by researchers at Dutch academic institutions. While this limitation was necessary to keep parameters of the specific national context stable, this does leave questions regarding the generalisability of our findings. Relevant differences between the Netherlands and other countries might come in the form of different publication practices and different levels of competitive pressures. Regarding publication practices, the Netherlands was one of the first countries to set up national policy statements on the permissibility of text recycling. In light of our results, suggesting that the existence of formal policy reduces the extent of unjust text recycling, it might be expected that the extent of text recycling in other countries is even higher. In addition, various analyses on publication practices and research culture show that researchers in the Netherlands are not at higher risk of engaging in misconduct or questionable research practices (Fanelli, 2016; Fanelli et al., 2015).

Text recycling is particularly pernicious where research funding is allocated between university departments on the basis of productivity indicators, as in some parts of Dutch academia. While extensive text recycling may seem just a quirk of a particular field's publication culture, simple output indicators will over-estimate the productivity of research groups in fields with high levels of text recycling, skewing allocation of resources in their benefit.

As the publication system is gradually turning into one large 'meta-journal' in which articles are increasingly available to all scholars, the act of text recycling is becoming more and more silly. If previously published material is easily accessible, the need to reuse text is quickly diminishing, as a reference to the original material can be easily added. Hence the act of recycling one's own text, arguably serves little other purpose than to boost one's publication record. Hence our results reaffirm that assessing quality by productivity is problematic and may give rise to undesirable gaming. As has previously been shown, any performance measurement has a limited lifespan: it will cease to be effective after some time, because professionals learn to play with it or because the beneficial effects of performance measurement are realized

or worked out (De Bruijn, 2002; Hicks et al., 2015). A substantial extent of text recycling may, among many others, be considered as an indication that the era of the current reward system in science is reaching its limit.

Acknowledgement

This project has received funding from the European Union's Horizon 2020 research and innovation programme, under grant agreement No. 665926 (PRINTEGER) and from ZonMw's 'Bevorderen Verantwoorde Onderzoekspraktijken'-programme under grant agreement No. 445001001 (IMPER). In addition, we thank Ilse Evertse for copy editing the final manuscript, the anonymous reviewers, and editor Martin Kenney.

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