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Detection of inappropriate types of authorship using bibliometric approaches

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Abstract

Among a variety of types of scientists' misconduct, the problem of authorship is of special significance. Detection of such inappropriate types of authorship as guest, gift or ghost authorships implying fictive participation of one researcher or the absence in the byline of another researcher who had taken part in a study is one of the topical issues for the academic community to save and maintain integrity when carrying out research work and publishing its results. This study describes how bibliometric tools can be potentially used when detecting inappropriate types of authorship in research manuscripts. We believe that a certain distribution of publications is inherent at each stage of scientists' career progress. Significant deviations in a number of papers, co-authors, subject areas or set of journals in a certain period of work can be regarded as indicators of possible misconduct including, e.g., guest or honorary authorship. In this study, we used a set of prominent scientists of the Siberian Branch of the Russian Academy of Sciences to reveal a correlation between career progress points and unexpected increase in scholarly output possibly achieved by means of unethical co-authorship.

Introduction

A number of publications are one of the significant formal indices for assessment of the efficiency of scientists' work. Scholarly output influences the probability of grant applications to be accepted, career progress, election as academicians, and authority in scientific society. Publications are counted in case of performance review, scientific reports; a number of papers are a nearly single index when evaluating the work of young scientists (Research Metrics Guidebook, 2018). Therefore, the majority of researchers tends to publish as many as possible papers, especially in journals indexed in international scientometric databases.

Another impetus for publishing can include, for example, thesis defence which requires a fixed number of papers in some countries; work as an editor implying writing specific types of papers (e.g. prefaces, editorials, responses to readers, etc.). Dependence between career progress and indicators of scientists' efficiency lends itself to bibliometric calculation, although sociology approaches are also used for solving this issue. We believe these analyses are important when regarding publication ethics conditions which impose increasingly stricter requirements to authorship and researchers' responsibility for published results (Scott-Lichter, 2012).

This study aims to detect the possible correlation between scholarly output and career progress points including assignment to an executive position, thesis defence, and selection to the academic community (in this case the Russian Academy of Sciences). Then we analyze if publishing activity in each case corresponds to recommendations of committees on publication ethics (Defining the Role of Authors and Contributors, 2018), especially regarding inappropriate types of authorship including guest, gift, and ghost models (Rennie, Yank, & Emanuel, 1997; Yank & Rennie, 1999). To some extent, this paper continues our previous

studies on the use of bibliometrics when detecting misconducts in scholarly publishing including plagiarism detection (Mazov & Gureev, 2017; Mazov, Gureev, & Kosyakov, 2015).

Brief overview

In the course of the process of knowledge production, the number of researchers is also increasing. Change from the model "One study – one researcher – one author" to the model with multiple participants demonstrated that the system of scientific communication is not ready to give an answer concerning actual authorship in research papers and who is worth to be an author.

In the last decades, authorship phenomenon is actively discussed in medicine due to high requirements to integrity and safety of the proposed approaches to treatment. There were medical journals for which the International Committee of Medical Journal Editors (ICMJE) prepared the first Guidelines on authorship (Guidelines on authorship, 1985). These guidelines for the first time formulated criteria of authorship as follows:

- Each author should have participated sufficiently in the work to take public responsibility for the content.
- The contribution includes: (a) conception or design, or analysis and interpretation of data, or both, (b) drafting the article or revising it for critically important intellectual content, and (c) final approval of the version to be published.
- All elements of an article (a, b, and c above) critical to its main conclusions must be attributable to at least one author.
- A paper with corporate (collective) authorship must specify the key persons responsible for the article.

Besides, editors may require authors to justify the assignment of authorship. These conceptual definitions of author contribution constitute the basis for all further recommendations not only in medicine but also in other subject areas (On being a scientist, 2009; Academy of management, 2011).

With time authorship criteria have become more complicated; new practices have emerged which are not standardized according to current guidelines; the gap between the interpretation of valid and unfair authorship has been widened (Marušic et al., 2014). ICMJE criteria have been significantly specified in each subsequent version. One of the new paradigms conceptually divides a scientific article into four basic elements: ideas, work, writing, and stewardship to quantitatively evaluate the contribution of each author into those elements and to elaborate an authorship matrix (Clement, 2014). PLoS journals are a good example of partial implementation of these proposals since all authors are obliged to indicate their roles in the study which comprises 14 different positions (https://journals.plos.org/plosone/s/authorship#loc-author-contributions).

Extent detalization of authorship gave an incentive to the development of the new concept of contributors responsible to the integrity of the whole study (Rennie, Yank, & Emanuel, 1997; Smith, 1997; Rohlfing & Poline, 2012). At the same time, the model of group authorship also attracts criticism since makes equal participants of large research projects and small groups of authors. Researchers noted that addition of group authors into byline devalues author efforts, cripples stable system of evaluation of science, and opens the door for unfair authorship violating the main publishing ethical principles (Gasparyan, Ayvazyan, & Kitas, 2013; Rohlfing & Poline, 2012).

Reasons for unethical behavior are frequently connected with a deficient system of government of science, e.g., the use of formal approaches when evaluating the efficiency of researchers' work, addressing scholarly output and citations when funding, employing and promoting, etc. The topicality of protection from unfair authorship is caused by the necessity to sustain core values of scientific ethics, as well as to strengthen the image of science in society. Generally,

inappropriate authorship can be considered as a threat to the existence of science as a social institution.

To date, participants of scientific communications understand the necessity to use a complex approach to prevent inappropriate types of authorship. Particularly, the following approaches have been elaborated (Gasparyan, Ayvazyan, & Kitas, 2013):

- **Scientific organizations and universities** must implement relevant educational courses, set a policy to discourage inappropriate authorship, and develop and update policy statements and authorship criteria.
- **Publishers** must ensure proper guidance and interpretation of authorship in instructions for authors; adopt field-specific recommendations.
- **Editors** of journals must stick to authorship criteria and journal instructions, obtain author contributions statements, resolve disputes by cooperating with authors or research institutions.
- **Reviewers** must familiarize with available guidelines, report suspected authorship to editors.
- As for **authors**, they must familiarize with available authorship guidelines and journal instructions for authors; agree on the responsibilities, order and place of listing co-authors early at the start of the research, and avoid misconduct and unfair authorship by self-regulation.

Development of various methods for the detection of cases which had not been prevented is another task for the scientific and publishing community. Of note, successful detection of cases of unfair authorship is of random nature, as editors and reviewers often rely on the integrity of scientists and their adherence to author guidelines. Unfortunately, it should be acknowledged that now there are no efficient tools for the detection of violations of authorship criteria. Thus, it is recommended that strong deterrents should be established to end undeserved authorship and related fakeries (Rivera, 2019).

The bibliometric approach seems to be very promising in addressing the problem of detection of inappropriate authorship. One of the bibliometric directions includes the development of "justified" indices to evaluate the efficiency of work of a scientist. Developing of separate indices for each participant of a study reflecting his/her contribution can lead to the eradication of unfair types of authorship (Kovacs, 2013). The other study proposed to analyze the degree of incidence of the same co-authors to detect a threshold, with raising ethical concerns when it is exceeded (Bugaev, 2012). Using bibliometrics, it is possible to define typical publication behavior and typical distribution of papers for certain author connected with his/her stage of career progress and to detect significant deviations from that distribution that can raise suspicions concerning meeting the requirements of publication ethics.

Data and methods

In our study, we used a sample of prominent scientists working in research institutes of Academgorodok (Kupershtokh & Apolonskiy, 2014) belonging to the Siberian Branch of the Russian Academy of Sciences. List of organizations currently includes institutes of former Russian Academy of Medical Sciences as well as Russian Academy of Agricultural Sciences and is presented on SB RAS official website (https://www.sbras.ru/ru/organization/2134). Out of 53 institutes, we selected 39 ones since we omitted subdivisions of Novosibirsk institutes, as well as Novosibirsk subdivisions of institutes located in other Russian cities.

Our sample can be regarded as representative due to the high authority of scientists holding key positions at SB RAS institutes covering almost all scientific subject areas (Table 1). It includes 18 academicians and 6 associates of the Russian Academy of Sciences.

Table 1. Distribution of Novosibirsk research organizations according to subject areas.

Subject area	*Number of institutes*
Medicine	9
Physics	7
Chemistry	6
Life Sciences	6
Humanities and Social Sciences	6
Mathematics and Informatics	4
Earth and Planetary Sciences	3
Agricultural Sciences	2

When collecting bibliometric data, we used the Russian Science Citation Index (www.elibrary.ru) comprising more than 12 million bibliographic records of papers published by Russian authors. We analyzed all types of publications from 1988 to 2017. To reveal the publication coefficient at the moment of working as a head of the organization and before assignment to this position, we considered equal timespans. For instance, if a researcher has managed the organization for 10 years, we also analyzed his/her publications for 10 years before the date of appointment. In the case of thesis defence, we analyzed the 3-year window before and after the defence. Data on thesis defence were extracted from open electronic catalogs of the Russian State Library (http://diss.rsl.ru) and Central Scientific Medical Library (http://www.scsml.rssi.ru). When studying changes in subject areas of scientists' research, we used the State Rubricator of Scientific and Technical Information (http://grnti.ru).
We did not indicate data on specific organizations of scientists since the goal of this papers is to present the general rationale for the dependence of career progress events on publication activity and to reveal a violation of publication ethics requirements in a certain period of work. All organizations are marked with digits.

Results

Figure 1 presents the publication coefficients of the scientists from our sample in case of their assignment to leading positions. We analyzed two periods, i.e. before and after an assignment, respectively. Publication coefficient K_p^1 was calculated as follows:

$$K_p^1 = \frac{P_1}{P_1+P_2} \times 100, \quad (1)$$

where P_1 denotes the number of publications before an appointment to the leading position, P_2 is a number of papers at the time of holding an appointment. Similarly, we detected publication coefficient at the time of holding an appointment:

$$K_p^2 = \frac{P_2}{P_1+P_2} \times 100. \quad (2)$$

Multiplier 100 was included for clearer difference between the coefficients.

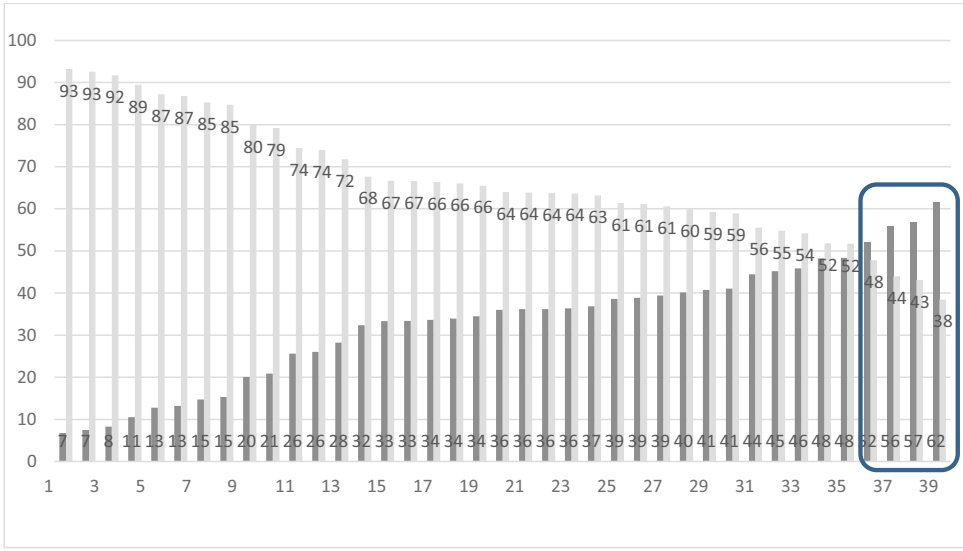

Fig. 1. Publication coefficients of researchers before and after appointment to leading positions. Dark grey denotes publication coefficient before an appointment; light grey – at the time of institute administration. Unusual cases of higher scholarly output before appointment are boxed.

Figure 1 shows that 35 scientists (90 percent) out of 39 significantly increased their scholarly output after their appointment to leading positions.
In figure 2 we revealed an indicative enhancement of a number of subject areas in publications after appointment to the leading position. Subject areas coefficients were calculated as that of publications coefficients (see formulae (1) and (2)).

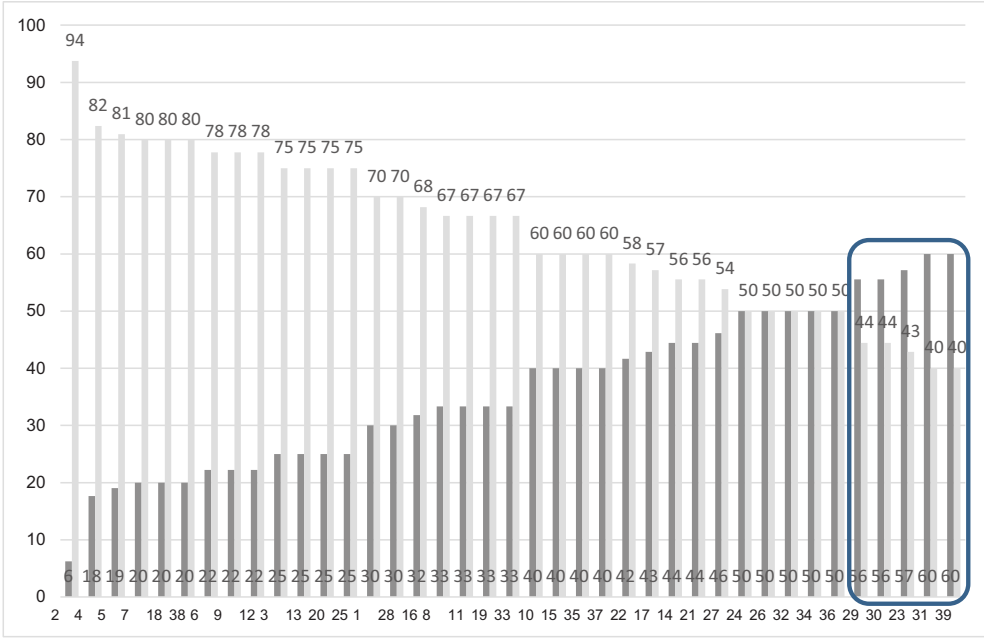

Fig. 2. Dynamics pattern of subject areas in publications by scientists before and after their appointment to leading positions in terms of the number of rubrics of the State Rubricator of Scientific and Technical Information. Dark grey denotes subject areas coefficient before an appointment to leading positions, while light grey coefficient after an appointment. Unusual cases of wider subject distributions before an assignment are boxed.

As Figure 2 indicates, only in 5 cases out of 39 subject varieties in publications decreased after assignment to leading positions, and in another 5 cases remained the same. In publications of remain 29 scientists (74 percent) topic variety in publications significantly increased.

Figure 3 demonstrates how an appointment affects the model of authorship. Co-authorship coefficient was calculated in a similar way as for publication coefficient (see formulae (1) and (2)).

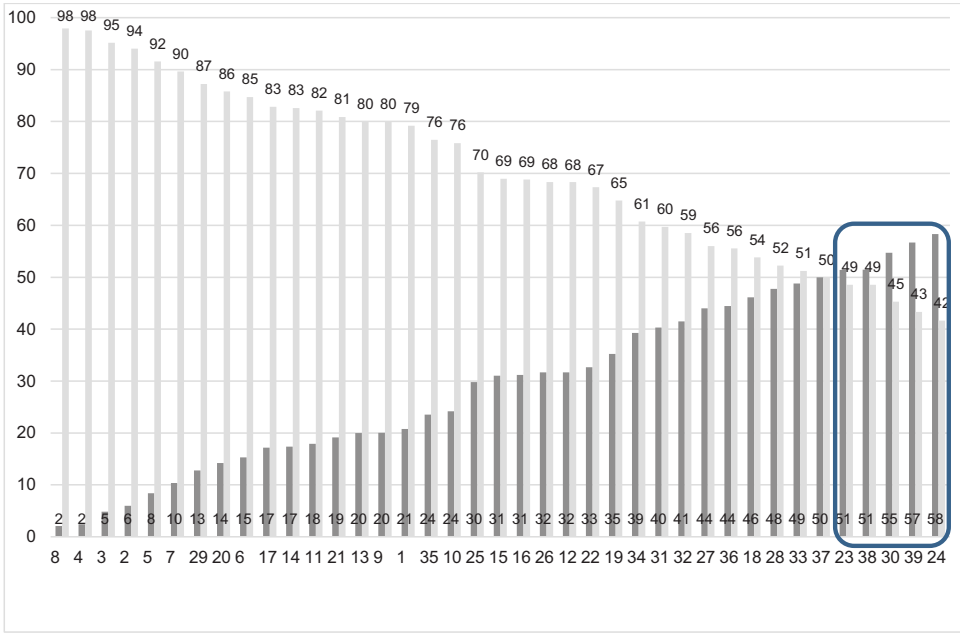

Fig. 3. The share of co-authors in papers by scientists from the sample before their appointment to leading positions and at the time of institute management. Dark grey denotes co-authors coefficient before an appointment; light grey – at the time of institute administration. Unusual cases of a higher number of co-authors before appointment are boxed.

Figure 3 shows that publications of only five researchers from our sample have a lower number of co-authors at the time of appointment, and in one case remained the same, while in most cases number of co-authors significantly increased.

Figure 4 demonstrates the distribution of papers in 3-year windows before and after an election of researchers from our sample as the members of the Russian Academy of Sciences. Coefficients were calculated according to formulae (1) and (2).

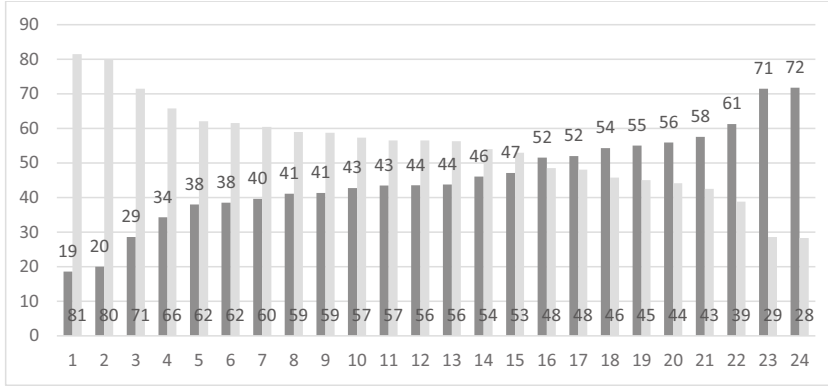

Fig 4. Publication coefficients of scientists in 3-year windows before and after the selection as members of the Russian Academy of Sciences. Dark grey stands for publication coefficient before the selection, while light grey – after the selection.

Out of 24 analyzed scientists being members of the Russian Academy of Sciences 15 researchers (63 percent) demonstrated increased scholarly output after the selection as members, while 9 scientists had decreased number of papers. Generally, except for extreme edge positions of the diagram we observe the equal distribution of papers.
Figure 5 depicts publication coefficients before and after thesis defence. Coefficients were calculated in the same manner as mentioned above.

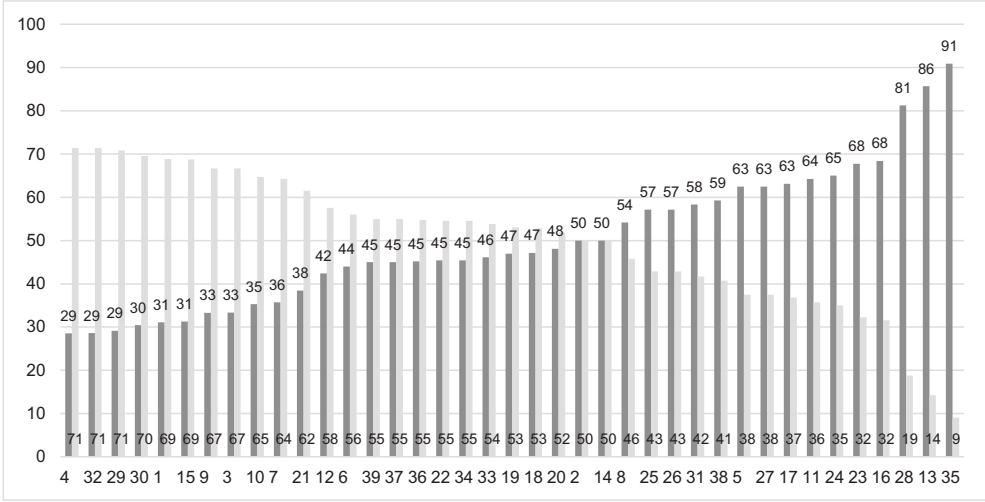

Fig. 5. Publication coefficients in 3-year windows before and after thesis defence. Dark grey stands for publication coefficient before thesis defence; light grey – after thesis defence.

Fifteen scientists decreased their publication activity after thesis defence as compared to the period of preparation of thesis; a scholarly output of 22 researchers increased, while in 2 cases remained the same.

Discussion

Using an example of Russian prominent scientists, we tried to detect dependence between changes of formal bibliometric indices and career progress events. Out of several possible cases we addressed three ones including (1) assignment to a leading position in research institute; (2) selection as a member of the Russian Academy of Sciences; and (3) thesis defence.
In all three cases, we obtained different results. The most indicative are changes in scholarly output after assignment of scientists to leading positions. Only in 4 out of 39 (Fig. 1) cases, we detected a negative trend. Furthermore, the decrease in a number of publications (right side of the diagram) was not as much expressed as rapid growth after the appointment (left side of the diagram). We believe that this growth trend is caused by the assignment to the leading position. Considering the large administrative load of scientists holding leading positions resulting in shortening the free time for research, an increase in a number of papers is achieved exclusively by means of co-authorship. As Fig. 3 depicts, it is associated mainly with the inclusion of executive in the byline as co-author. The reasons can be different including supervision in the grants, the teaching of young scientists, the inclusion of prominent name to speed peer review stages, etc.

At the same time, in the last two decades requirements to authorship have become stricter. The main criteria of authentic authorship that should be regarded together are the following (Kassirer, 1995):

- substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;
- drafting the article or revising it critically for important intellectual content;
- final approval of the version to be published;
- each listed author must be able to take public responsibility for its content.

It is important that authors must fulfil all of these criteria. Authors are also expected to designate their functional role within the group. In addition to being accountable for the parts of the work he or she has done, an author should be able to identify which of their co-authors are responsible for specific other parts of the work. In addition, an author should have confidence in the integrity of the contributions of their co-authors (Scott-Lichter, 2012). In all other cases, researchers should be mentioned in an Acknowledgment section.

A number of publishing societies have tried to prevent violation of authorship criteria, especially in the case of papers black markets selling authorship in ready-to-be-published articles (Hvistendahl, 2013). The most spread violation cases include guest, gift, and ghost types of authorship. Guest authorship has been defined as authorship based solely on an expectation that the inclusion of a particular name will improve the chances that the study will be published or increase the perceived status of the publication. The "guest" author makes no discernible contributions to the study, so this person meets none of the criteria for authorship. Honorary or gift authorship has been defined as authorship based solely on a tenuous affiliation with a study. A salient example would be "authorship" based on one's position as the head of a department in which the study took place. Ghost authors participate in the research, data analysis, and/or writing of a manuscript but are not named or disclosed in the author byline or Acknowledgments (Scott-Lichter, 2012).

Our findings enabled us to assume that assignment of scientists to leading position frequently leads to violation of publication ethics regarding international authorship criteria since the use of guest of gift authorship seems to be rampant among Russia scientists especially in the frequent absence of local standards of authorship at Russian research organizations and universities. It is confirmed by a very intensive increase in a number of papers, accompanied by an increase in a list and number of co-authors and significant enhancement of subject areas (Figs. 2 and 3). Besides, in a number of organizations especially medical ones we detected an unexpectedly high number of papers per year close to 100 items. Considering a high administrative burden, it is highly unlikely that a scientist would have enough time for publishing such a high number of papers and concurrently meet abovementioned modern requirements of authorship.

Analysis of data on the scholarly output before and after the election as the Russian Academy of Sciences members (Fig. 4) failed to detect a significant correlation between the election event and publication activity.

Distribution of papers before and after theses defense revealed that in most cases the scholarly output of analyzed scientists did not decrease after defense as one might expect, but increase. Only in 15 cases (38 percent) of 39 scholarly output decreased.

Conclusion

Authorship is considered to be one of the main sources of academic capital of a researcher. In the context of severe competition for academic positions and funding authorship is regarded to be a key index of scientific capacities and potential of a scientist (Olesen, Amin, & Mahadi, 2018). Stimulation of scientific work can lead both to loss of quality of studies and papers and to increasing a number of co-authors including cases of inappropriate authorship models.

Addressing the issue of author attribution problem should define an actual contribution of scientist to the study and divide areas of responsibilities (Gasparyan, Ayvazyan, & Kitas, 2013). Except for different author guidelines designed to provide comprehension of responsibility of researchers regarding compliance with publication ethical standards, the goal to develop technical models to detect inappropriate authorship is still topical.

In the current study, we have detected that sharp fluctuations in scholarly output can sometimes point to possible misconduct in publishing and fictive participation in the research. Especially we mean a sharp increase in a number of papers, significant fluctuation in a number and compound of co-authors, change in research areas, change in position in the byline, increase in a pool of journals with scientist's papers. Complex bibliometric analysis of a number of above mentioned and some additional changes and their comparison with certain changes in the career path of a scientist can be used for the development of powerful bibliometric tool to reveal common factors of the real and fictive contribution of scientists in publications and to develop a probable bibliometric model for detection of inappropriate types of authorship.

In further research, we plan to collect more data and to carry out more qualitative analyses including detection of thresholds at which the increase in authorships, subject areas, or co-authors would clearly indicate guest or gift authorships making it possible to develop new bibliometric model for detection of violations of publication ethics.

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