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Scientific Library, Belarusian National Technical University (Minsk, Republic of Belarus),
e-mail vslazarev@bntu.by, ORCID 0000-0003-0387-4515**ON THE POSSIBILITIES OF EVALUATING PROPERTIES OF
SCIENTIFIC DOCUMENTS ON THE BASIS OF THEIR CITATIONS
COUNT (OR AGAIN: WHAT PROPERTY IS REFLECTED BY
CITATIONS COUNT *PAR EXCELLENCE*, AFTER ALL?).
PART 1: VALUE**

The **objective** is consideration of the most recent works on the problem of the phenomenon reflected by citations count of scientific documents. The **method** is interpretation of recent research publications made by bibliometricians. The **results** are presenting evidence that the property of scientific documents reflected *par excellence* by their citation is their value. It is also **concluded** that the attempts of identification of the “specific contribution” of cited documents based on the conditional and disputable classification schemes of citations that have been undertaken in the years 2006-2018 are not fruitful.

Keywords: citations count; citation reasons, motivation and functions; classification schemes; value

Introduction

When considering the properties of documents that can be quantified through the use of bibliometric indicators, terminological problems arise (Lazarev, 1996). The key question “What do citation counts measure?” which is, in fact, the title of two reviewing papers (Bornmann & Daniel, 2008; Tahamtan & Bornmann 2019) itself leads to plentiful confusions of concepts that prevent experts from understanding each other. To me, it is natural to expect that exactly the *properties* of the cited documents reflected by the citations counts are going to be the subject matter of a paper with such a title. Especially, since the author of the earlier paper with a similar title meant precisely cited documents properties when asked whether “they <citations – V.S.L.> measure quality, importance, impact, influence, utility, visibility, all of the above, or something else?” (Cozzens, 1989, p. 437)¹.

However, the recent reviewing papers (Bornmann & Daniel, 2008; Tahamtan & Bornmann, 2019) focused not on the properties of cited documents, but on “motivations, functions, and causes of references in scientific communication” (Tahamtan & Bornmann, 2019). These issues relate to different objects other than documents, viz., correspondingly, to the authors (who are motivated), references (which have their functions) and the citer’s comprehension of the document being cited (when a citer takes into account both his own goals and a content of a document or its fragment he is caused either to cite or not to cite). There are a number of other terminological problems, too, associated with the recent works devoted to the problem of the phenomenon reflected by citations count. With this regard, the

¹ “By **properties** we understand the general attributes or characteristics of research that we aim to capture (‘academic quality’, ‘intensity of collaboration’, ‘diversity of knowledge’, ‘brokering role’, et cetera). By **indicators** we understand the observables that can be empirically and directly recorded (citations, number of authors, number of disciplines, number of bridging positions, etcetera), and that can be related to a property through a theoretical model”, stated J. Molas-Gallart & I. Rafols (2018, p. 2). These definitions are possibly not ideal, but intuitively understandable and logically consistent. (The need to define the concept of “property” – which is intuitively understandable by itself – is caused by the fact that, as it will be seen in a couple of lines, absolutely different issues may be considered as a subject of assessment by citations counts – issues that even do not relate to the cited documents.)

objective of the present paper is consideration of the most recent works on the problem of the phenomenon reflected by scientific documents citations count and the revelation of the property of cited scientific documents reflected by their citedness *par excellence*.

Methods

The information base of the research was made of recent publications made by bibliometricians and dealing with the problem “What do citation counts measure?”. Particular attention has been paid to the article by I. Tahamtan & L. Bornmann (2019), as this is the most recent publication on this topic, representing a solid 50-page review. The method is interpretation of above-mentioned recent publications; herewith the special attention is paid to the terminology.

Again, it should be reiterated and emphasized that in the focus of the interpretation are *not* all the possible items that could be associated with citations count of the cited documents, but, first, the ones that are attributed *exactly to the cited documents*. Second, special consideration is paid to the issues (hereinafter referred to as properties according to J. Molas-Gallart & I. Rafols (2018, p. 2) that are reflected by the documents citedness *in the least indirect way possible*. Such an approach is believed to be most relevant to the essence of the question “What do citation counts measure?”

Results and Discussion

The verb “to measure” that is widely used as applied to citations count (Bornmann & Daniel, 2008; Tahamtan & Bornmann, 2019) might be a source of confusions in itself. The fact is that, generally, “measure” relates to *direct* measurement, while in case of using bibliometric indicators we deal with indirect, mediated evaluation (Motylev, 1983). So, I believe that we are to use in bibliometric research the term “quantitative assessment” or “quantification” instead of “measure” (Motylev, 1983). I believe this is really important because, when paying due attention to the *indirect* character of assessment, a metrician would have to focus primarily on a property that is reflected by citations count *to a lesser extent indirectly* and, therefore, predominantly, *par excellence*. Citers’ motives, for instance (considered by I. Tahamtan & L. Bornmann (2019) are hardly such a characteristic!

Another possible source of confusions with the basic terms related to the quantitative assessment of characteristics reflected by citations count is the choice of an unsuitable term out of the synonyms that point to the phenomenon under assessment. I used the word “property” above, but the use of the word “*quality*” instead of “*property*” as, e.g., O. Mryglod & S. Nazarovetz (2019, p. 83) did – although it *is* a use of a synonym – is fraught with confusion between the meanings of the word “quality” since “quality” means both ‘property’ (‘characteristic’, ‘attribute’) and ‘relative excellence’. Such a misuse of a synonym might become a cause, e.g., of such a ridiculous phrase as “Does citations count measure such quality of cited documents as their quality?”

The newest review under analysis (Tahamtan & Bornmann, 2019) does not seem not to deal with the properties of cited documents; it claims to “explore the citation motivation of scholars” with the use of various classification of citations. Many bibliometricians believe that such an approach makes it possible to get more detailed understanding of the nature of citing. Therefore, being interested in the problem of properties of cited documents reflected by citations to them (Lazarev, 1997, 2017, 2018a, 2018b, 2019), I nevertheless attempted to analyze some of this review in search of any findings that could enrich my vision of the answer to the question “What do citation counts measure?”. Especially since the properties of the cited documents, although not being in the focus of its consideration, are still mentioned in the review by

I. Tahamtan & L. Bornmann (2019). Thus, the Introduction to it mentions the assessment of such properties as “impact” and “performance” in relation not only to departments, research institutes, universities (but not to individual authors), but also to such sets of documents as books (evidently, of collected papers) and journals. The Introduction goes on to mention the possibility of studying such properties of cited works as “creative potential” and “overall quality” with citation counts. It is also mentioned there that citations count reflects the *use* of cited documents: “R. Jha, A.-A. Jbara, V. Qazvinian, & D. Radev (2017) noted that a more robust measure of citations is to use the citation context to provide additional information about how *a cited paper has been used in the citing paper*² (Hernández-Alvarez, Gomez Soriano, Martínez-Barco, 2017)” (Tahamtan & Bornmann, 2019).

After reading these statements it was natural to expect the continuation of consideration of cited document properties. Nonetheless, already at the top of its first page, the review makes a sharp turn to identification “of the specific contribution of a given work to the citing work” and application of “citation content/context analyses” (Tahamtan & Bornmann, 2019) with the purpose of such identifying. The formulation of the aim of this work given in its Introduction – viz. “to update the review of L. Bornmann and H. D. Daniel (2008) with an additional focus on the technical developments in the last decade, which have facilitated studies of citations” – should be considered as not specific enough, while the clarification of this formulation given in the Conclusions (“presenting a narrative review of studies on the citing behavior of scientists”) seems still to be too broad and devoid of necessary specificity. The only way to know the authors’ aim is to address the wording of the previous paper with the same title (Bornmann & Daniel, 2008) cited by I. Tahamtan & L. Bornmann (2019). In that paper, the aim was formulated as identification “the extent to which scientists are motivated to cite a publication not only to acknowledge intellectual and cognitive influences of scientific peers, but also for other, possibly non-scientific, reasons” (Bornmann & Daniel, 2008, p. 45). One can argue about the success of this formulation, too, but, in any case, it becomes clear from it that a recent review (Tahamtan & Bornmann, 2019) focuses mainly on the motivation of citing. Further acquaintance with this work allows us to clarify that considered are *not objectively existing reasons for the preference in choice of a particular work for citing*, but retrospectively defined *subjective ideas* about these reasons – the ideas defined either by scientometricians or by the citing authors themselves. These reasons have nothing to do with the properties of the cited documents, therefore, in my opinion, they hardly be called the root causes! As the text of the review shows, they are associated with the ideas about the functions that the cited documents performed in the work of the citing authors, with the ideas about the purposes of citing and about its motivation. However, in relation not to the assessment of documents by the scientometricians (“experts”), but to the questioning and interviewing of the citing authors (“citers”) themselves, it is no longer a question of ideas about the *reasons* for citing, but only about *motivation*. Also, one of the authors cited in the review (Tahamtan & Bornmann, 2019) “showed that “different readers understand the contexts of the same citations in very different ways” and noted that readers (experts) “are unlikely to correctly perceive authors’ reasons for citing” (Tahamtan & Bornmann, 2019). Isn’t this a kind of an indication to uncertainty of identification of the reasons for citing?

I. Tahamtan & L. Bornmann (2019) also mentioned the work by N. Harwood (2009) that “conducted semi-structured interviews with six computer scientists and six sociologists to identify the functions of citations in their papers or book chapters published recently”. As a result, 11 functions (not reasons, not motives!) of citations were allocated; the study by N. Harwood (2009) also showed that a citation may have *more than one function*: “over half of the citations in both fields were said to have more than one function” (Harwood, 2009, p. 495). I believe that this is another example of the uncertainty of the results considered by I. Tahamtan &

²Italicized by me – V.S.L.; mind this thought as we shall come back to it later.

L. Bornmann (2019). Possibly I am prejudiced, but I wish to ask: is the approach to the study of citations based on the recognition of various citation functions really promising?

Also, there are other identified citation motivations still not mentioned above and also presented in the review by I. Tahamtan & L. Bornmann (2019), as well as there are various classifications of references. Extra-academic associations between citing and cited works (such as social relations between cited authors) are also considered... But does all this bring us closer to the answer to the straightforward question formulated in the title of the article “What citation counts measure?”? In my opinion, it rather leads away from it all further: each of the articles analyzed in the review by I. Tahamtan & L. Bornmann (2019) has its own approach, and the authors of the review themselves point out that “every study introduces a new classification system”, that “some citation functions used in previous studies had (to some extent) the same meanings and definitions; however, different researchers had used different names for them” (Tahamtan & Bornmann, 2019). And yet the whole review is built in such a way that the only answer to the title question that can be implicitly seen from it is: “it is impossible to know what does citations count measure, as long as we do not apply citation content/context analyses”.

If only! In fact, the answer options when applying this citation content/context analyses are multiplied from an article to an article... and the authors of the review (Tahamtan & Bornmann, 2019) themselves also seem to recognize this uncertainty: “Possibly, rather than classifying citations into many functional categories <...>, using some general but exclusive functions would lead to comparable and (perhaps) more reliable results”. In this phrase I see some (unconscious?) capitulation: starting with enthusiasm for the possibility of complicating the study of citation motivations and functions, I. Tahamtan & L. Bornmann (2019) then come to think of the desirability of simplifying classification schemes...

Nevertheless, the analysis of citation functions undertaken by I. Tahamtan & L. Bornmann (2019) leads us to the concept of *use* (see footnote 2) which, in my opinion, is the key concept associated with the concept of citation (Lazarev, 1996, 1997, 2017, 2018a, 2018b, 2019). As it is stated by I. Tahamtan & L. Bornmann (2019), “use” was a frequently used and popular function in the classification scheme of several studies. For example, R. Jha et al. (2017) indicated that “the most frequent citation purpose was “use” (17.7%)”, and that the accuracy of their proposed classifier in recognizing “use” was higher <...> than that of other categories”.

However, in what series of notions (Jha et al., 2017 call them “purpose labels”) is, acceding to R. Jha et al. (2017), the notion of *use*?

R. Jha et al. (2017, p. 97) profess the following classification scheme for citation purpose: “criticizing”, “comparison”, “use”, “substantiating”, “basis”, “neutral”. In this series of concepts, “use” does not look as just “another one”, but it looks generic. Indeed, it is easy to imagine “use (of a document or of information that it contains) *for comparison or substantiating*” and, on the contrary, it is difficult to imagine “pure” information use without any further specification of *the nature of the use* that took place. As for me, I believe that by (“pure”) “use” R. Jha et al. (2017) could mean the only mode of use: when the authors of a citing paper directly replicate a method described in a cited paper. R. Jha et al. (2017) themselves stated: “A citing sentence is classified as “use” when the citing paper uses the method, idea or tool of the cited paper” (p. 97). I cannot but ask: “use of them – but how?” If we use method, we can replicate it – or not to use it at all. But how can we “purely” use an idea? By stealing? – so there would be no citation. By quoting? – so there will be not use in the terminology of R. Jha et al. (2017), but either “comparison”, “substantiating” or “basis”. And by the way, in the below wording by R. Jha et al. (2017) let slip that “basis” is a kind of the “use”:

“A citing sentence is classified as “basis” when the author uses the cited work as starting point or motivation and extends on the cited work” (Jha et al., 2017, p. 97) (italicized by me – V.S.L.).

Suspiciously looks also the following wording:

“A citing sentence is classified as “substantiating” when the results, claims of the citing work substantiate, verify the cited paper and support each other” (Jha et al., 2017, p. 97).

Why do the results in the above wording “substantiate, verify” etc. themselves – breaking all the language rules?! In my opinion, such a queer wording was chosen subconsciously to avoid admitting that the citer uses “the results, claims of the citing work” to *substantiate* his/her point through their interpretation or consideration. Without active mental processing of the results and claims (i.e. without their use) substantiating is just impossible!³

Does such understanding of the word (a noun) “use” contradict to its recognized meaning? I have consulted Cambridge Dictionary online (<https://dictionary.cambridge.org/dictionary/english/use>) and read there some interpretations of the *verb* “use” including:

- “to put something such as a tool <...> to a particular purpose”,
- “to take advantage of a person or situation; to exploit”.

I do believe that a research paper may be treated as a tool. It is certainly *not* “a person or situation”, but it *is* very much possible for a citer to take advantage of it, e.g. by placing his own study in a favorable cognitive context, by interpreting the ambiguous findings as supporting his/her standpoint, by convincing the research domain in his own rightness via citing similar results obtained by more authoritative authors... Some of the above actions of the citers with the cited works could be called “exploitation”.

And what about the noun “use”? It is simple – according to the one of the wordings of the same dictionary, the noun “use” means “the act of using something” (<https://dictionary.cambridge.org/dictionary/english/use>). So, if we call such citers’ actions “use”, then there will be a correct usage of this noun.

Another paper cited in the review by I. Tahamtan & L. Bornmann (2019) that contains the similar classification scheme of citation functions is the paper by M. Hernández-Alvarez et al. (2017). According to it, the “primary functions” of citations are “use”, “comparison”, “critique” and “background”. On account of this paper, my position is the same: “comparison”, “critique” and “background” are just various kinds of *use*. Apparently, there is no need to repeat the argumentation.

The above were just a couple of examples. However, in relation to the rest of works analyzed by I. Tahamtan & L. Bornmann (2019), my impressions seem to be quite similar. On one hand, I. Tahamtan & L. Bornmann (2019) themselves stated, that “use” can be seen in several studies <...> *which happens to have a high frequency compared to other functions*. “Use” has also been found to be among the most frequent verbs in different articles sections types” (italicized by me – V.S.L.). Again, “use” was a popular function in the classification scheme of several studies. For example, R. Jha et al. (2017) indicated that the most frequent citation function was “use” (17.7%), and that the accuracy of their proposed classifier in recognizing “use” (60%) was higher than that of other functions. “Use” was found to be mentioned quite frequently in most sections, specifically methods and introduction sections”... But on the other hand, I. Tahamtan & L. Bornmann (2019) stated that “low precision of the classification scheme in detecting citation functions” was mentioned in one of the works under analysis; while, according to another cited paper, “the issue with the studies that use automated data processing is that *the classification schemes they propose for identifying citation functions do not yield reliable results* (Hernández-Alvarez et al., 2017; Tahamtan & Bornmann, 2019).

³ As for the “neutral” “citing sentences” (“A citing sentence is classified as “neutral” when it is a neutral description of the cited work or if it doesn't come under any of the above categories” (Jha et al., 2017, p. 97), I think that there are some kinds of the use that were just not identified by R. Jha et al. (2017): in fact, I cannot imagine useless citing! Why mere reading and even the information retrieval activity is called “document usage” (Kurtz & Bollen, 2010, p. 6), but the next stage of consumption of a document, viz. citation, could not be called use?! (Lazarev, 2017, p. 8-9).

Also, the review (Tahamtan & Bornmann, 2019) states that “the appearance of multiple cue phrases in the same sentence may result in *the low precision of the classification scheme in detecting citation functions*” (italicized by me in both quotations – V.S.L.). Reading all these fragments I cannot help but think that it is odd to hope for a successful increase in precision of citation functions by a bibliometrician – which is an *intermediary*, – while *the citers themselves* very often cannot recognize their own reasons for citing a particular source and not citing another one: questioning the authors about motives for citing or not citing cannot reveal the actual reasons why the author cited as he/she actually did (Nicolaisen, 2007, p. 615).

So, although the I. Tahamtan & L. Bornmann (2019) stated that “in practice they (citations – V.S.L.) are based on different reasons and have different functions”, that “giving all citations equal value overlooks the numerous potential functions they have for citing authors” and that, consequently, “through conventional citation analysis, we are unable to identify the *specific* contribution of a given work to the citing work” (italicized by me – V.S.L.), I, having grounded on the above consideration, cannot believe that the described attempts “to identify the specific contribution” based on the described conditional and disputable classification schemes are fruitful. I think that at this stage of analysis it is a high time to recollect the following wording by Anthony van Raan: “It is if a physicist would strive for creating a framework of thermodynamics by making a ‘theory’ on the behaviour of individual molecules. Certainly there are crucial ‘behaviour characteristics’ of molecules: magnitude and direction of velocity, angular momentum. But only a statistical approach in terms of distribution-functions of these characteristic variables brings us to what we need: a thermodynamic theory” (van Raan, 1998, p. 136). Analogously, if we accept that “all citations” are equal, we inevitably come (rather return!) to an obvious conclusion that citation counts reflect just *use* of the cited works – and nothing else (that specific reasons, motives and *kinds* of the use may be, of course, different). Citation counts reflect *use* of the cited works – this viewpoint was expressed in a number of works (Mirskaya, 1976; van Raan, 1998, p. 133; Glaser & Laudel, 2007, p. 104-105; Bornmann, Mutz, Neuhaus, & Daniel, 2008, p. 93 and many more, not mentioning the ones published by me!).

But *what property of the document* is reflected by its use? Use, in turn, reflects their *value*. “In fact, in the Information Science, the notion of value is defined as “the property of information determined by its suitability for practical use in various areas of purposeful human activity to achieve a certain goal” (Dictionary, 1975, p. 464). The value of information is directly related to the use of the document, no matter whether it is use of a single *document* or of a scientific periodical as an organized set of *documents*: outside the scientific document, human society does not have scientific information, since it is the document that is the material form of its fixation. So, it should be clear that, as a method of *direct* assessment of the actual use of <...> cited issues <...>, citation counts is a method of *indirect* assessment of their *value*. The updated definition of *value* does not contradict the above, but confirms it as it runs that “value, including scientific one, is not a purely natural property of the object (in our case, information), but is formed as a result of the subject-and-practical interaction of the object and the subject. Any value is conditioned by practice, understood in the broadest sense of the word, and practice acts as an objective determinant of value. <...> Value is an objective property being a product of the practical relationship (interaction) of the object and the subject (Zozulich & Vendeleva, 2008, p. 232)” (Lazarev, 2018a, p. 96-97).

Some supporting ideas might be found in the paper by C. Thornley et al. (2015) which is also analyzed in the review by I. Tahamtan & L. Bornmann (2019). For instance, C. Thornley et al. (2015) stated, that “this study does show that when a researcher cites a work it is nearly always because that work has something *valuable* to contribute to the researcher's own work and that the researcher regards the cited work and its author as reliable and trustworthy sources”

(italicized by me – V.S.L.). So, C. Thornley et al. (2015) drove to the conclusion that citations reflect value.

It is believed that citations count may reflect various properties (Bredikhin, Kuznetsov, & Shcherbakova, 2013, p. 95-110; Lazarev, 2017, p. 5; Lazarev, 2018b, p. 17-51). Very much indirectly and probabilistically it may. But *value* of scientific document is a property that is reflected *par excellence* as having causal associations with citedness via *use* (of the cited works by citers). There is only one intermediary between the indicator (citations count) and the reflected property (value); so, reflected by the documents citedness *in the least indirect way possible*.

Conclusions

The presented analytical interpretation evidence that, in spite of themselves, the reviewers I. Tahamtan & L. Bornmann (2019) supported the obvious idea that citation counts is a method of *direct* assessment of the actual use of cited issues and, consequentially, is a method of *indirect* assessment of their *value*. Also, I believe that it follows from the review by I. Tahamtan & L. Bornmann (2019) – contrary to the wishes of the authors, – that a detailed examination of the reasons, motives of citations, the use of their detailed classifications of citations are not a prospective direction branch of bibliometric/scientometric research. The undertaken interpretation shows that *value* of scientific document is a property that is reflected *par excellence* as having causal associations with citedness via *use* (of the cited works by citers).

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ПРО МОЖЛИВОСТІ ОЦІНКИ ВЛАСТИВОСТЕЙ НАУКОВИХ ДОКУМЕНТІВ НА ОСНОВІ ЇХ ЦИТОВАНІСТІ (АБО ЗНОВУ ПРО ТЕ, ЯКА Ж, НАРЕШТІ, ВЛАСТИВІСТЬ ВІДОБРАЖУЄТЬСЯ В ЦИТОВАНІСТІ *PAR EXCELLENCE?*). ЧАСТИНА 1: ЦІННІСТЬ

Метою дослідження є розгляд найбільш свіжих робіт з проблеми феномену, відображеного кількістю цитувань наукових документів. **Метод** полягає в інтерпретації останніх наукових публікацій фахівців в області бібліометрії. Отримані **результати** свідчать про те, що властивість наукових документів, переважно відображена їх цитованістю, це – їх цінність. Робиться також **висновок** про те, що спроби визначення "відносного вкладу" цитованих документів на основі умовних і спірних класифікаційних схем цитування, які здійснювалися в 2006-2018 роках, не є плідними.

Ключові слова: кількість цитувань; причини цитування; мотивація та функції; класифікаційні схеми; цінність