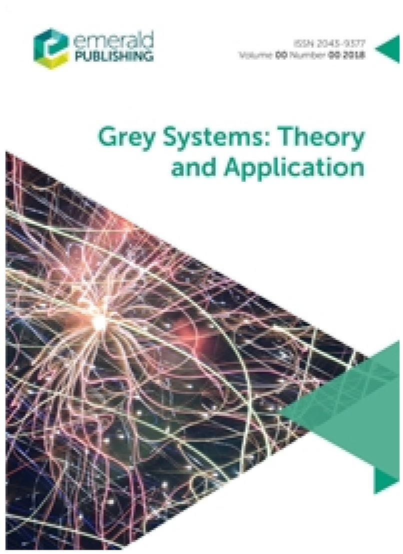

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A Novel Synthetic Index of Two Counts and Mathematical Model for Researcher Evaluation

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Abstract

Purpose – The purpose of this paper is to present a novel synthetic index of two counts and mathematical model for researcher evaluation.

Design/methodology/approach –A synthetic index L for researcher evaluation considering both the total number of other citations (C) and non-academic impact (I), and a synthetic evaluation model is proposed in this paper. C and I are verified impact indexes. According to investigation by Delphi method, researchers are divided into five different classes of “below average”, “average”, “good”, “excellent” and “stellar”. The threshold values for counts C of grey class “stellar” are determined by deep investigation. The possibility functions of the two counts C and I on four grey classes of “below average”, “average”, “good”, and “excellent” are built.

Findings –The novel synthetic index of two counts and mathematical model for researcher evaluation providing a better way to conduct researcher assessment.

Practical implications –The synthetic index L presented in this paper can be used to evaluate a researcher. It’s more reasonable than the current research assessment indexes such as the number of publications and the numbers of so called high quality journal publications, and the amount of granted funds, etc. The synthetic index L reflect the actual value created by a researcher. No artificial manoeuvre can change them significantly.

Originality/value –A synthetic index L for researcher evaluation considering both the total number of other citations (C) and non-academic impact (I), and a synthetic evaluation model is proposed in this paper.

Key words: researcher evaluation; synthetics index; the numbers of total other citations; non-academic impact; mixed center-point possibility function; grey clustering evaluation model.

Paper type Research paper

1 Introduction

In our daily life, a defined unit enables us to do measurements quantitatively. For example, a metre is a unit of length measurement and a kilogram is used as a unit of weight measurement. However, there is no such a unit to measure knowledge and it is very difficult to assess an individual's research outputs. In 1934, Otlet proposed "bibliometrics" firstly (Otlet,1934). In 1950s, Eugene Garfield identified the importance of the citation and then promulgated the idea of the Science Citation Index(SCI) as a database for capturing citations(Garfield,1955). Although his initial purpose was not research or researcher evaluation, but rather help for researchers to search the literature more effectively(Mingers and Leydesdorff, 2015). In 1971, "scientometrics" was first defined by Nalimov& Mulcjenko (Nalimov & Mulcjenko, 1971), it trying to find ways of measuring research quality and impact, understanding the processes of citations, mapping scientific fields and the use of indicators in research policy and management(Mingers and Leydesdorff, 2015). In 2014, Altmetrics–"The study and use of scholarly impact measures based on activity in online tools and environments"(Priem, et al, 2014) which also known as Scientometrics 2.0, came into being. It tried to replaces journal citations with impacts in social networking tools such as views, downloads, "likes", blogs, Twitter, Mendelay, CiteULike.

In a world with limited resources, researcher or research assessment is often needed by research managers and policy makers for purposes such as recruitment, promotion and award of grants, etc.

Researchers are usually assessed both on their productions as well as the impact of their documents, such as the number of publications and the numbers of so called high quality publications, and the amount of granted funds, etc. Such a researcher assessment encourages the one-sided pursuit of funds and the quantity of outputs published with a general journal or so called top journal rather than true value of the output. We found that as a general rule, the true value of most research output show themselves after many years. There is no assessment index or method that can evaluate a research output immediately. That is, there is an effect of time lag. The only way to judge the true value of research output is by waiting. Nobel prizes are awarded to research output which has produced the greatest impact. Most Nobel Prize winners have waited for several decades. Charles Kuen Kao received the Nobel Prize in Physics 2009 for his contribution to the development of low-loss optic fiber used in optical fiber communication systems though his creativity thinking published by an ordinary journal in 1966(Kao and Hockham, 1966).

Most of stakeholders accept that researchers can be assessed by their outputs because quantification can create an illusion of precision or justification. The utilitarian academic ethics encourage utility outputs. Guided by the current researcher or research assessment system, most researchers are directing their efforts toward the utility direction following the favoured indexes. As a result, significant resources and energy of researchers are diverted to activities other than academic innovation. It is really wasting taxpayers' money and researchers' valuable time and full potential. According to Goodhart's law, once a measure is chosen for making policy decisions, it begins to lose value as a measure(Goodhart and

Money, 1975). But the stakeholders need such a measure to assess researchers. We will discuss the malpractice of researcher performance appraisement which pursuits for the quantity of outputs and try to find a better index for research evaluation(Liu and Yang,2019).

2 The Main Problems in Research Evaluation

(1)It's very harmful that one-sided pursuit for the quantity of outputs

Along with the gradual intensification of competition, the addiction of one-sided pursuit for the quantity of outputs is growing day by day in academic institutions and universities. As a result, the amount of requested outputs has increased step by step and all the pressure of producing more and more publications has shifted to each researcher. "Publish or perish" has become a universal law.

In some research universities in the USA, an associate professor has to published around 40 publications if he/she wants to be considered for promotion to a full professor.

In general, of the 211 universities in China, the basic requirement for an associate professor to be considered for promotion to a full professor, is to have published more than 10 first authored papers with the recognized core journals and at least two of the papers published with top journals.

The one-sided pursuit for the quantity of outputs only leads to more and more publications becoming meaningless. Most of researchers would rather publish meaningless publications if it favors their personal utility. Many early career researchers benefiting from garbage papers will give up their significant and valuable research and exploration, and finally give up their research life. This is truly a great loss for mankind.

(2)The rank of a journal shouldn't be used as proxy for quality of publication

It is widely acknowledged that researchers who are assessed solely via quantification do not rank so highly. Quantification alone is not enough, the so called high quality publications are also important. It is suggested that the rank of a journal can be used as a proxy for quality of its publications and it is generally accepted that an article published in a top (specifically, top five) journal will have higher quality.

In most institutions around the world, top journal publications have been considered equal to high quality publications.

In China, a researcher has a much better chance to be recognized or selected as a named scholar such as "outstanding youth scholar", "excellent youth scholar" or "Changjiang scholar", etc. if he/she has some international top journal publications.

However, Gangaram Singh et al found that there were substantial classification errors from using journal ranking as a proxy for quality(Singh, Haddad and Chow, 2007).

In fact, a lot of important scientific outcome had not been published in the so called top journals. Equally, many top journal publications do not necessarily have significant innovations. The true value of research output show themselves if we can wait for another ten, thirty, fifty years or sometimes even longer. It is a result of their real impact verified by public through a long term of practice. Different from the verified impact, a paper published in a top journal needs to satisfy only the limited reviewers, its impact is at most a hypothesis rather than a fact. In the same time, a high impact factor does not necessarily mean a high quality journal. The recent article of Watch(Watch, 2016) demonstrates how a lot of low quality papers had been published by so called top journals, some of them with a high impact factor(IF=34). Therefore, top journal seeking leads to a large stash of followers, because most of the output of original innovation can't be published in so called top journals.

Seeking top journals may lead to a great loss of priority. Such as Professor Zhuo-Hua Pan and Professor Alexander Dizhoor who may have invented optogenetics first. But after being rejected by three of so called top journals, somebody published the similar work first(Vlasits, 2016).

(3) H-index is a good but biased index for research assessment

One of the most influential indexes that has been used to assess researchers is the H-index which was proposed by J. E. Hirsch in 2005(Hirsch, 2005). In summary, a scientist has count H if he or she published N papers and H of his or her N papers have at least H citations each and the other (N-H) papers have <H citations each. H-index can reflect the impact of a researcher to a certain extent. But Van Raan et al stated that the H-index is size-dependent(Raan, 2005). A researcher with only a few of very high influence publications may have a very lower value of H. A researcher who publishes 10 articles each cited at least 1000 times the H-index will be only 10, is the same as a researcher who published 10 outputs each with 10 citations; a researcher who published 15 medium-impact documents with 15 citations each will get a much higher H-index than a researcher who published 5 high-impact documents with 3000 citations each(Costas and Bordons, 2007). In fact, there are many Nobel prize winners who published only a few of outputs with tremendous influence. These are extreme examples.

In general, H-index can be used to measure an individual's research output. A researcher can find his/her H-index by google scholar or web of science. Many researchers put their H-indexes on their webpage.

According to J. E. Hirsch, for faculties at major research universities, H around 12 might be a typical value for advancement to tenure (associate professor) and that H around 18 might be a typical value for advancement to full professor. Fellowship in the American Physical Society might occur typically for H from 15 to 20. Membership in the National Academy of Sciences of the United States of America may typically be associated with H about 45 and higher, except in exceptional circumstances(Hirsch, 2005).

(4) Granted funds shouldn't be viewed as research outputs

In many institutions around the world, the amount of granted funds is counted as a kind of outputs for researcher evaluation. It is even counted as an important condition for promotion in most institutions. Some faculty members who win a major funding grant are promoted as a full professor even without significant publications.

In general, of the 211 universities in China, the basic requirement for an associate professor to be considered for promotion to a full professor, is to have grants secured by the NSFC.

Even key projects granted by the NSFC or other national foundations are required if a Chinese researcher seeks to be recognized or selected as a named scholar such as “outstanding youth scholar”, “excellent youth scholar” or “Changjiang scholar”, etc.

Undoubtedly, project funding helps research, but the funding itself shouldn’t be counted as research output. The granted funding is a kind of inputs for research rather than outputs. A researcher that has gained significant funds without enough valuable outputs should be viewed as a problem rather than achievement in a researcher or research accountability system.

3 The Synthetic Index for Research evaluation

The problems in research assessment could be solved easily if we can wait rather than evaluate a publication immediately.

The factors that affect researcher’s performance are very complicated. We pay close attention to the quality of research outputs in terms of their ‘originality, significance and rigour’ only. Which counts can be used to reflect the quality of research outputs? There are a lot of different viewpoints.

After four rounds of expert investigation, two evaluation counts are selected, including the academic impact which is represented by the total number of other citations (C), some experts suggested that the cited number of articles published by an OA journal should be take 80% off, and non-academic impact (I). In fact, both academic and non-academic impact is the perpetual measurement for research outputs(http://www.ref.ac.uk/).

The index that can be used to assess researcher is very simple. The index of impact (both academic and non-academic impact) is enough. The number of publications, top journals and the amount of granted funds, etc. are all beneath consideration.

(1) The total number of other citations

Undoubtedly, most people recognise that positive citation by others is an important count to reflect the quality of research outputs. So, the total number of other citations (C) can be used to assess academic impact of an individual’s research. J. E. Hirsch et al didn’t incorporate the count C in their research evaluation. They attributed this to several disadvantages, such as (a) hard to find, (b) may be inflated by a small number of ‘‘big hits,’’ which may not be representative of the individual if he or she is a co-author with many others on those papers, and the count C gives undue weight to highly cited review articles versus original research contributions(Hirsch, 2005).

Recently, it is far easier to find the total number of citations of an individual because many databases have been built. The so called “big hits” of some publications with very high citations, also reflect the important contribution of the researcher. Co-authors' citations can be calculated based on their contributions. In addition, many people believe that the highly cited review article is very important even versus original research contributions.

Therefore, we use C as one of the two counts for research evaluation, to reflect the academic impact of the outputs.

(2) Non-academic Impact

Non-academic impact (I) means the ‘reach and significance’ of impacts on the economy, society and/or culture that were underpinned by excellent research conducted, as well as the approach to enabling impact from its research. Samuel et al had studied this issue(Samuel, et al, 2015). There is research output which produces enormous impact but with only a few publications and very low citations. For example, Professor Tu Youyou, a Nobel Prize winner in Physiology or Medicine, her research output had brought about a huge impact, though her output was never published by a so-called top journal. Professor Tu discovered artemisinin (also known as qinghaosu) and dihydroartemisinin, used to treat malaria, a significant breakthrough in twentieth century tropical medicine saving millions of lives in developing countries in South Asia, Africa, and South America (https://en. wikipedia.org/wiki/Tu_Youyou).

(3) The Synthetic Index L of Two Counts

A synthetic index L with two counts of the numbers of total other citations (C) and non-academic impact (I) can be used to reflects the synthetic level (quality, impact) of a research output or an individual(x)’s research.

We invited 32 experts in different fields of Innovation Management(IM), Scientific Metrology(SM), System Sciences, Data Science(DS), Computer Science(CS), Mechanical Engineering(ME), Medical Science(MS) and Mechanics(M) to take part in the Delphi investigation to determine the classification, the weight and classification criteria of each count. Experts' opinions are basically agreed after 3 cycles. There are 19 experts from China, UK, USA, France, Poland and Canada returned the questionnaires of 3 cycles. Professional distribution of consulting experts are shown in Table 1.

Table 1. Professional distribution of consulting experts

Field	IM	SM	SS	DS	CS	ME	Total
Number	3	2	4	4	4	2	19

According to advisory opinion of the experts, researchers are divided into five different classes of “below average”, “average”, “good”, “excellent” and “stellar”. Most general researchers belong to the former four classes. Only a few of extra-excellent researchers belong to the class “stellar”.

The two counts for research evaluation and its weight are shown in Table 2.

Table 2. The two counts for research evaluation and its weight

Count	Total other citations (C)	Impact (I)
Weight	0.7	0.3

Among the two counts, the total number of other citations (C) is a quantitative count. The unit of C is the number of total other citations. C is a positive count; that is the bigger the number, the better. Non-academic impact I is a count with both qualitative and quantitative characteristics. It's suggested that according produced impacts on the economy, society and/or culture, count I quantitative grading as a 10-point scale score.

Count C reflects the total academic influence of an individual's research, and count I reflects the non-academic impact of the research. Both C and I are real historical impact indexes. They reflect the actual value created by a researcher. No artificial manoeuvre can change them significantly. The true value created by a researcher will be recognised by C or/and I finally. It just takes time and patience.

The standard to divide research output or individual(x)'s research in different fields are difference. As an example, we present the standard to divide individual(x)'s research in system science and system engineering as follows.

Based on in depth investigations, when $C \geqslant 20000$, a researcher in system science and system engineering is classified as "stellar". For count I, there are different standard for impacts on the economy, society and/or culture. It's suggested that a researcher can be classified as "stellar" if his research have created direct economic value $\geqslant$ one billion euros or have benefited over 5 million people. As a synthetic result, a researcher is rated in class "stellar" if there is at least one of the two counts belonging to class "stellar".

Therefore, for a general researcher in system science and system engineering other than stellar, $C \in [0,20000]$, and $I \in$ [0,1 billion] or $I \in$ [0,5 million] or a researcher have created some direct economic value and benefited many people at the same time, $I \in [0,10]$. We divide the intervals [0,20000] and [0,10] into 4 small intervals corresponding to "below average", "average", "good", and "excellent".

4 The grey cluster evaluation model based on mixed center-point triangular possibility functions

There are different models that could be applied in the evaluation, such as fuzzy clustering(Zadeh,1975) and grey clustering(Deng, 1985; Liu, Yang and Wu, 2014). Here, we apply grey clustering evaluation models based on mixed centre-point triangular possibility functions for synthetic assessment(Liu et al, 2015). An example is given to show the feasibility of the proposed index L. The same conclusions hold for other evaluation models, such as fuzzy clustering.

The grey clustering evaluation model based on mixed center-point triangular possibility functions is suitable for those problems that is easier to find out the most likely points belonging to each grey class, but the grey boundary is not clear(Liu et al, 2015). In researcher evaluation, it's difficult to determine the boundary of different grey class. As usually, determine the point which most likelihood of belonging to a grey class is easier.

The point most likely belonging to a grey class is called the center-point of the grey class. The center-point can be the midpoint, or may not. It is determined by the maximum likelihood of belonging to the grey class.

Assume that the researchers should be divided into s grey categories, the modelling steps of the grey clustering evaluation model based on mixed center-point triangular possibility functions are as follows(Liu, Yang and Forrest, 2017; Liu et al, 2019):

Step 1: For count j, assume that $[a_j, b_j]$ is the range of the count j. According to the evaluation requirements, we divide the $[a_j, b_j]$ into s small intervals. Then determine the turning point λ_j^1, λ_j^s of grey class 1 , grey class s, and the center-point $\lambda_j^2, \lambda_j^3, \cdots, \lambda_j^{s-1}$ of grey class $k (k \in \{2,3,\cdots,s-1\})$ respectively;

Step 2: Construct the corresponding lower measure possibility function $f_j^1[-,-,\lambda_j^1,\lambda_j^2]$ and upper measure possibility function $f_j^s[\lambda_j^{s-1},\lambda_j^s,-,-]$ for grey class 1 and grey class s (See Fig. 1).

Assume x is an observation of count j, when $x \in [a_j, \lambda_j^2]$ or $x \in [\lambda_j^{s-1}, b_j]$, the possibility $f_j^1(x)$ or $f_j^s(x)$ regarding to grey class 1 and grey class s can be calculated by the formula (1) and (2) respectively

$$f_j^1(x) = \begin{cases} 0 & x \notin [a_j, \lambda_j^2] \\ 1 & x \in [a_j, \lambda_j^1] \\ \dfrac{\lambda_j^2 - x}{\lambda_j^2 - \lambda_j^1} & x \in [\lambda_j^1, \lambda_j^2] \end{cases} \tag{1}$$

$$f_j^s(x) = \begin{cases} 0 & x \notin [\lambda_j^{s-1}, b_j] \\ \dfrac{x - \lambda_j^{s-1}}{\lambda_j^s - \lambda_j^{s-1}} & x \in [\lambda_j^{s-1}, \lambda_j^s] \\ 1 & x \in [\lambda_j^s, b_j] \end{cases} \tag{2}$$

Step 3: For the grey class $k (k \in \{2,3,\cdots,s-1\})$, connecting point $(\lambda_j^k, 1)$ with the center-point $(\lambda_j^{k-1}, 0)$ of grey class $k-1$ (Or the turning point $(\lambda_j^1, 0)$ of grey class 1) and connecting $(\lambda_j^k, 1)$ with the center-point $(\lambda_j^{k+1}, 0)$ of grey class $k+1$ (Or the turning point $(\lambda_j^s, 0)$ of grey class s), we got triangular possibility function $f_j^k[\lambda_j^{k-1}, \lambda_j^k, -, \lambda_j^{k+1}]$, $j = 1,2,\cdots;m; k = 2,3,\cdots,s-1$ of count j regarding to grey class k .(See Fig. 1).

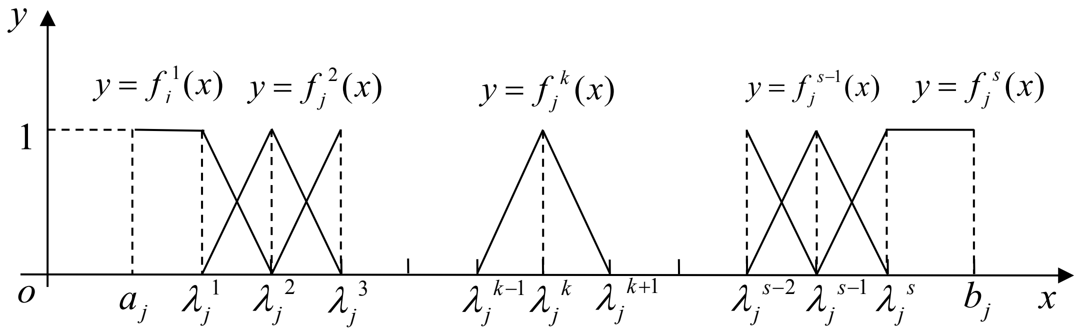

Fig. 1 Center-point mixed possibility function

Assume that x is an observation value of count j, the possibility $f_j^k(x)$ regarding to grey class $k(k \in \{2,3,\cdots,s-1\})$ can be calculated by the formula (3).

$$f_j^k(x)=\begin{cases} 0 & x \notin [\lambda_j^{k-1},\lambda_j^{k+1}] \\ \dfrac{x-\lambda_j^{k-1}}{\lambda_j^k-\lambda_j^{k-1}} & x \in [\lambda_j^{k-1},\lambda_j^k] \\ \dfrac{\lambda_j^{k+1}-x}{\lambda_j^{k+1}-\lambda_j^k} & x \in [\lambda_j^k,\lambda_j^{k+1}] \end{cases} \tag{3}$$

Step 4: Determine the weight $w_j, j=1,2,\cdots,m$ of each count;

Step 5: Compute clustering coefficient σ_i^k of object $i(i=1,2,\cdots,n)$ regarding to grey class $k(k=1,2,\cdots,s)$;

$$\sigma_i^k=\sum_{j=1}^{m} f_j^k(x_{ij})\cdot w_j \tag{4}$$

where $f_j^k(x_{ij})$ is possibility function of count j for subclass k, w_j is the weight of comprehensive clustering of count j.

Step 6: By $\max_{1\le k\le s}\{\sigma_i^k\}=\sigma_i^{k^*}$, determine that object i belongs to grey class k^*.

For the example presented in above section, let the turning point of grey class "below average" is $\lambda_N^1 = 500$ and turning point of grey class "excellent" is $\lambda_N^4 = 15000$, as well as the most likely points $\lambda_N^2 = 3000$ and $\lambda_N^3 = 8000$ belonging to the grey class "average" and grey class "good" in turn for count C.

So, the possibility functions of count C on four grey classes of "below average", "average", "good", and "excellent" are as follows

$$f_N^1(x)=\begin{cases} 0 & x \notin [0,3000] \\ 1 & x \in [0,500) \\ \dfrac{3000-x}{2500} & x \in [500,3000] \end{cases} \quad f_N^2(x)=\begin{cases} 0 & x \notin [500,8000] \\ \dfrac{x-500}{2500} & x \in [500,3000) \\ \dfrac{8000-x}{5500} & x \in [2500,8000] \end{cases}$$

$$f_N^3(x)=\begin{cases}0 & x\notin[3000,15000]\\ \dfrac{x-3000}{5000} & x\in[3000,8000)\\ \dfrac{15000-x}{7000} & x\in[8000,15000]\end{cases}\qquad f_N^4(x)=\begin{cases}0 & x\notin[8000,20000]\\ \dfrac{x-8000}{7000} & x\in[8000,15000)\\ 1 & x\in[15000,20000]\end{cases}$$

For count I, let the turning point of grey class “below average” is $\lambda_I^1=5$ and turning point of grey class “excellent” is $\lambda_I^4=9.5$, as well as the most likely points $\lambda_I^2=7$ and $\lambda_I^3=8.5$ which belonging to the grey class "average" and grey class "good" in turn.

Therefore, the possibility functions of count I on four grey classes of “below average”, “average”, “good” , and “excellent” are as follows

$$f_I^1(x)=\begin{cases}0 & x\notin[0,7]\\ 1 & x\in[0,5)\\ \dfrac{7-x}{2} & x\in[5,7]\end{cases}\qquad f_I^2(x)=\begin{cases}0 & x\notin[5,8.5]\\ \dfrac{x-5}{2} & x\in[5,7)\\ \dfrac{8.5-x}{1.5} & x\in[7,8.5]\end{cases}$$

$$f_I^3(x)=\begin{cases}0 & x\notin[7,9.5]\\ \dfrac{x-7}{1.5} & x\in[7,8.5)\\ \dfrac{9.5-x}{1} & x\in[8.5,9.5]\end{cases}\qquad f_I^4(x)=\begin{cases}0 & x\notin[8.5,10]\\ \dfrac{x-8.5}{1} & x\in[8.5,9.5)\\ 1 & x\in[9.5,10]\end{cases}$$

Using Table 1 and the corresponding possibility functions, we can obtain a synthetic index L which reflects the synthetic level (quality, impact) of an individual(x)’s research in system science and system engineering as follows:

$$L^k(x)=0.7f_C^k(x)+0.3f_I^k(x), k=1,2,3,4 \tag{5}$$

K=1,2,3,4 correspond to the classes of “below average”, “average”, “good” , and “excellent” respectively.

If $\max_{1\le k\le 4}\{L^k(x)\}=L^{k^*}(x)$, then we conclude that x belongs to grey class k^*.

When there are multiple researchers belonging to the same grey class, we can further determine the precedence of researchers in the same grey class based on the values of the synthetic index L.

5. Examples

For a researcher x who in system science and system engineering with C=12600, and I=6.5, we have

$$L^1(x)=0.7f_N^1(x)+0.3f_I^1(x)=0.075$$

$$L^2(x) = 0.7 f_N^2(x) + 0.3 f_I^2(x) = 0.225$$

$$L^3(x) = 0.7 f_N^3(x) + 0.3 f_I^3(x) = 0.24$$

$$L^4(x) = 0.7 f_N^4(x) + 0.3 f_I^4(x) = 0.46$$

From $\max_{1 \le k \le 4}\{L^k(x)\} = 0.46 = L^4(x)$, so we can conclude that x belong to the grey class "excellent".

The publications of professor L. A. Zadeh, the founder of fuzzy mathematics, had been cited more than 150,000 times; as the founder of grey system theory, professor Julong Deng's outputs have been cited more than 70000 times; as the founder of Synergetics, the publications of professor H. Haken had been cited more than 45000 times; as the founder of rough set, professor Z.I. Pawlak's outputs had been cited more than 40,000 times. They all belong to grey class "stellar". We have checked with all the 2015 Nobel prize winners in different fields, some of them such as Professor Tomas Lindahl and Professor Paul Modrich, et al have very high values of C. The others like Professor Youyou Tu et al with huge impact. All of them belong to grey class "stellar" too.

6 Concluding Remarks

The impact (both academic or non-academic) of valuable research output of a researcher coming into being is a natural process. Normally, the impact of research output lags behind many years of publication. There is no assessment index or method that can evaluate a research output immediately. The true value of most research output show themselves after many years. Nobel prizes are awarded to the researchers those research output has produced the greatest impact. Most Nobel prize winners have waited for several decades.

Researcher assessment is a very important but difficult area of work. Significant work has been carried out to find a better way to conduct researcher assessment. However, all the available indexes are associated with some significant problems.

The managers finally realized the serious drawbacks of the current academic evaluation system after 40 years over advocating SCI and top journal papers. On 18th February, 2020, Ministry of science and technology of China and Ministry of education of China dispatched a joint document of *Some opinions on standardizing the use of SCI papers related indexes in Colleges and universities and establishing correct evaluation orientation* to get rid of the chronic malady in the evaluation of science and technology(http://www.moe.gov.cn/jyb_xwfb/gzdt_gzdt/s5987/202002/t20200223_423329.html). It is expected that from then on, China's science and technology evaluation system and science and technology undertakings will be on the track of healthy development.

The new synthetic index L which with two counts of the numbers of total other citations(C) and non-academic impact (I) reflects comprehensively the synthetic level (quality, academic and non-academic impact) of a research output or an individual(x)'s research. The new index L reflects the verified value of a research. No artificial manoeuvre can change them significantly. We believe that index L with the grey clustering evaluation models can provide a beneficial supplement to the available indexes for researcher assessment.

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