

A Novel Evaluation of the Research Productivity of University Professors

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ABSTRACT: This paper is offering a timely needed solution to evaluate university professors according to their activities in research in order to establish an incentive system to motivate professors to participate actively in research. A novel evaluation method is presented to measure the research productivity of university professors. The evaluation is based on four criteria, namely, paper publications and patents, ability to attract research-funding, working with a team, and other scientific activities. For each criterion, a few indicators are introduced. The professor who gets the highest total scores in each criterion will be given the highest grade for the criterion, where all others will be given grades relative to his/her grade according to their scores.

KEYWORDS: Evaluation, Research productivity, University professor, Paper publications, Patents.

I. INTRODUCTION

For promotion and tenure purposes, almost all universities worldwide have a system for evaluating the productivity of professors. However, there may be two or three promotions in the academic life of faculty members. The universities that follow the American academic system have three grades, namely: assistant professor, associate professor, and professor (or full professor). An active faculty member may become a full professor within 8-10 years. What happens after that varies from one professor to another. Some may like to get rest after they have reached (in their view) the top, while others may increase their effort and continue to escalate to reach other types of achievements until they retire. Some even may never rest after retirement as far as they can become emeritus professors where they continue working and supervising others to produce research results.

On the other hand, there are faculty members who reach retirement while still in the rank of assistant professor. Although there is nothing wrong in this, as far as they are good teachers, instructors or facilitators. All universities need both types of faculty: teachers and researchers. Those who can harmonize both duties are really the best choice. However, should universities deal equally with all faculty members? On the other hand, should there be distinction according to the research productivity?

This paper is introducing a novel evaluation of the research productivity of university professors so that professors with high productivity can be well known on an international level. If university ranking is now recognized worldwide then the authors believe that it is time for professors also to be ranked in one way or another to get the recognition they deserve.

II. RELATED WORK

Different types of evaluation have been introduced by other researchers. For instance, Yongqiang [1] and Shihui [2] put a quantitative model for the performance evaluation for university researchers, while, Colugnati et al [3] presented a multidimensional evaluation program for early-career researcher in Brazil. Shi et al [4] also offered an evaluation

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method for vital researchers, whereas Jia [5] proposed achievements evaluation index. Yuanfang [6] and Jianyang [7] concentrated on the evaluation and validation of Scientific Paper, while Georghiou and Roessner [8] presented some evaluating technology programs for research policy. Finally, Salles-Filho et al [9] proposed multidimensional assessment of technology and innovation programs for research evaluation. The authors find none of these studies is comprehensive. Hence, they introduced the present study.

III. CRITERIA FOR THE EVALUATION

The authors have selected four criteria to evaluate the research productivity of faculty members. Namely, paper publications, research funding, teamwork and other scientific activities. Each criterion is calculated using several indicators. The weights for the criteria are shown in Table 1, while the indicators for each criterion are given in the following sections.

Table 1 Weight of each evaluation criterion

	Criterion	Weight (%)
1	Paper publications and patents	40
2	Ability to attract research funding	40
3	Teamwork	10
4	Other scientific activities	10
Total		100

IV. INDICATORS OF THE EVALUATION CRITERIA

1. Paper Publications and Patents

The present evaluation is based on publications of scientific papers in Institute for Scientific Information (ISI) list of journals. Publishing papers in an international conference is also considered but with much less weight. Registration of patents with international organizations is considered as publishing paper in journals of ISI list. Table 2 summarizes the indicators in this criterion.

Table 2 Indicators related to publications and patents

	Indicators	W	JF	n	$\sum_{i=1}^n (w * JF)_i$
1.1	Publishing in ISI Journals	5			
1.2	Publishing in International Conference	1	1		
1.3	Registering Patent	5	1		
Total					

In Table 2, W is the weight given to each indicator, n is the number of papers for each indicator, JF is “Journal Factor”, which is a factor given to each journal used for publication. This factor was introduced to encourage professors to publish in journals that have higher citation according to their impact factor. JF is calculated from equation 1.

$$JF = H - (x - 1) \frac{H-L}{N-1} \tag{1}$$

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The calculation is based on x , which is the rank of the journal in its category in the ISI list of journals, where H and L are factors given to the first and last journal, respectively, in the category, and N is the number of journals in this category.

To clarify the matter, the “International Journal of Mechanical Sciences” was selected. From the ISI lists of journals, this journal was found to belong to two categories as shown in Table 3.

Table 3 ISI Information for the International Journal of Mechanical Sciences

Category Name	Total Journals in Category	Journal Rank in Category
ENGINEERING, MECHANICAL	122	29
MECHANICS	133	47

In the present analysis, H and L are given arbitrary values as 5 and 1 respectively. For x equals 29 and N equals 122, JF was calculated as 4.074, while for x equals 47 and N equals 133, JF was calculated as 3.606. In this case, the highest factor will be considered for this journal.

For international conference papers and for patents the JF is taken as 1.

The professor who gets the highest total of score will be given the grade of 40, where all others will be given grades relative to 40 according to their scores.

2. Research Funding

Since the ability to attract research funding plays a vital role in research activities, this criterion has also been given a high score in the evaluation. However, the evaluation suggested here makes distinction between the funding sources. Getting research funding from international organizations is given the highest weight, while getting research funding from any source within the university is given the lowest weight. Table 4 summarizes the indicators in this criterion.

Table 4 Indicators related to research funding

	Indicators	W	n	B	$\sum_{i=1}^n (w * B)_i$
2.1	Getting fund from within the university	1			
2.2	Getting fund from national organizations	3			
2.3	Getting fund from international organizations	4			
Total					

In Table 4, W is the weight for the indicator, n is the number of funded projects in each indicator, and B is the budget of each funded project.

Here too, the professor who gets the highest total score will be given the grade of 40, where all others will be given grades relative to 40 according to their scores.

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3. Teamwork

Working in teams is very important in the academic field. University professors are expected to teach others and supervise faculty members who are in lower academic ranks. Professors should be leaders. Hence, it is important that they form teams or research groups. The authors have summarized the indicators in this criterion in Table 5, where W is the weight for the indicator and n is the number of people in each indicator.

Here, the professor who gets the highest total score will be given the grade of 10, whereas all others will be given grades relative to 10 according to their scores.

Table 5 Indicators related to team structure

	Indicators	W	n	W*n
3.1	Associate Professors	4		
3.2	Assistant Professors	3		
3.3	Other Staff (Lecturers, Research Assistants, TAs)	2		
3.4	PhD Students	3		
3.5	Master Students	2		
3.6	Bachelor Students	0.5		
3.7	Members from other national organizations	according to rank+1		
3.8	Members from international organizations	according to rank+1		
Total				

4. Other Scientific Activities

Scientific activities are numerous. The authors have mentioned a lot of them in Table 6 with suggested weights, W and number of activities, n. Here again, the professor who gets the highest total score will be given the grade of 10, whereas all others will be given grades relative to 10 according to their scores.

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Table 6 Indicators related to scientific activities

	Indicators	W	n	W*n
4.1	Holding seminar within the university	1		
4.2	Holding seminar outside the university	2		
4.3	Holding international seminar	3		
4.4	Organizing workshop within the university	2		
4.5	Organizing workshop outside the university	3		
4.6	Organizing international workshop	4		
4.7	Evaluating science and/or research strategies	1		
4.8	Evaluating an existing Academic Programs	1		
4.9	Developing an existing Academic Program	2		
4.10	Establishing a new Academic Program	3		
4.11	Supervising Graduate Students	4		
4.12	Teaching graduate courses	2		
4.13	Being an Editor-in-Chief to international scientific journal	3		
4.14	Being an Editor-in-Chief to ISI scientific journal	4		
4.15	Initiating an international scientific journal	4		
4.16	Developing a scientific journal to be ISI journal	6		
4.17	Reviewing proposals of research projects	1		
Total				

V. CONCLUSION

The authors believe their criteria and the indicators related to each criterion cover the most important aspects that university professors should care for in their careers. This study came out from comprehensive discussion and through

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debate with colleagues. When adopted by a university, it may be modified to cater to particular and confined circumstances, where some indicators may be insignificant, or some other indicators need to be added.

In this way full professors can be distinguished from each other. A system of incentives needs to be introduced to encourage professors to compete with their colleagues. This may be in the form of salary increase, award winning, prize system and/or honour list.

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