DOI : 10.36347/sjebm.2014.v01i11.011

Scholars Journal of Economics, Business and Management e-ISSN 2348-5302
Ng KH *et al.*; Sch J Econ Bus Manag, 2014; 1(11):598-605 p-ISSN 2348-8875

(An International Publisher for Academic and Scientific Resources)

Bibliometrics Performance Evaluation: A Case Study on University of Malaya

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Abstract: This study investigates the influence of native Malaysian academic staffs' characteristics on the research performance of University of Malaya (UM). The research performance is assessed by bibliometrics indicator, namely the number of publications, which is collected from Google Scholar. The academic staffs' characteristics in this study comprise of gender, ethnicity, academic position and academic age. The results show that the percentage of publications by male academic staffs are significantly more than that of by female academic staffs. Moreover, academic staffs who pose higher academic position or have longer years since awarded PhD are more likely to have higher number of publications. Ethnicity has also a significant influence on the research performance. Cross-tabulations and correspondence analysis are used to determine the mentioned objectives.

Keywords: Bibliometrics indicators, Gender, Ethnicity, Academic position, Academic age, University of Malaya.

INTRODUCTION

Research performance plays an important role in university performance. While good quality research publications can be of upmost benefit to public knowledge as well as to serve as valuable input to policy making, there are also evidences where research performance could pose a significant contribution to a university's reputation. For example, Times Higher Education Supplement (THES) [1] recently acknowledged the uses of Information Sciences Institute (ISI) data in its university rankings method. Furthermore, it was also noted that 20% of the Quacquarelli Symonds (QS) world university ranking is based on citations per faculty [2]. Hence, following the importance of research performance both at university and society level, there was a tant amount interest with regards to this topic. Indeed, such interest has led to a large body of literature which describes the determinants of research performance. For instance, the effects of individual academic researcher background characteristics have been studied widely in different countries, such as Switzerland [3], South Africa [4] and Belgium [5]. These studies mainly incorporate informed peer review and bibliometric indicators to measure research performance. The previous findings also seem to suggest that some background characteristics such as age, gender, professional category, and so on may have a significant impact on the research performance [3, 6, 7].

Malaysia is increasingly paying attention to the ranking of Malaysian universities in the world perspective. Moreover, the Tenth Malaysia Plan sets out public universities to receive financial allocation derived from the accomplishment of their research performance [8]. Hence, this development has led to concerns regarding the research performance of Malaysian universities. According to our knowledge, a few studies might have been carried out to investigate the effect of background characteristics on research performance in Malaysia. Thus on that note, this study aims to value add and to further investigate the effect of background characteristics on research performance of individual researchers in Malaysia social sciences field.

University Malaya (UM), the foremost and premier research university in Malaysia is now in Top 200 (151th) of the QS world university ranking. It is interesting to conduct a study to investigate the research performance in UM as it relates to the university's ranking. With that view in mind, this study is undertaken to determine the effect of background characteristics on research performance of individual researchers in the Faculty of Business and Accountancy (FBA) and Faculty of Economics and Administration (FEA) of UM by using bibliometrics indicators from Google Scholar database as a measurement of individual research performance. The study employs gender, academic position and academic age, which are identified in the previous studies [3, 6, 7] to investigate

whether these background characteristics also have significant effects on research performance in FBA and FEA of UM. Since, most of the variables in this study are categorical variable, it is more appropriate to analyse by using cross-tabulations between the variables as well as Correspondence Analysis. This study utilized the dataset where accumulated publications per researcher within the most recent time slot (2010-2014).The results of the analysis were generated by using Statistical Package for Social Sciences (SPSS) software.

The rest of this paper is organized as follows. Section 2 reviews some of the studies on bibliometric indicators and the factors influencing research performance. This will be followed up by Section 3 which demonstrates the chosen methodology. Section 4 provides a descriptive summary of the data as well as presents the findings and discussions on the explanatory factors for the research performance using the chosen statistical methods. The last section then concludes this study.

LITERATURE REVIEW

The usage of bibliometric indicators have been cited in several papers. For example, Diem and Wolter [3] mentioned that the use of bibliometric indicators in rating research performance has been popular and applicable to worldwide research institution due to the highly impact, easy to handle, and objectively measured of the output. The number of publications, such as academic journals or summative index constructed from counts of conference papers, journal publications and books are the most common measure of research productivity [10].

The usage of bibliometric indicators is robust in international ranking of universities and faculties especially in scientific and economic fields [1]. The rating of research performance based on bibliometric indicators directly increases the likelihood of receiving financial rewards [11], job-attaining, promotion chances [12] and quality assessment of research model in physical sciences [13]. Various methods can be applied for counting number and citations of publications, including software such as Google Scholar, Scopus, the Web of Science citation indexes, and self-reporting of publications. The ubiquitous of bibliometric assessment, has gradually shifted from macroscopic level into individual level. However, the use of bibliometric parameters in assessing research performance is limited and biased [9].

There have been various studies conducted on factors influence research performance. From university resources and capacity perspective, one of the factors is the use of electronic resources for research. The provision of low cost and easy to be used online resources can quantitatively enhance academic performance of lecturer [15] as well as the students' performance [16]. Meanwhile, departmental capacity can also be a factor. For example, Fabel et al. [17] concluded that researchers in larger departments are more productive; however the effect of department size on individual productivity is rather non-linear. Furthermore, according to Iqbal et al. [18], teaching load and administrative tasks is hurdle in writing and presentation of research papers, resulting to low research productivity.

Other than that, according to Godin [19], research funding is useful in supporting research work to greater extent, increase the number of scientific publications and promote better collaboration between academic and industrial researchers. These findings are further supported by Gulbrandsen and Smeby [20], who suggested research funding to be significantly related to research performance.

Previous studies also relate professors' relative background to research performance. For example, there have been several opinions with regards to the effect of biological age and research performance. Older researchers are more productive relative to their younger counterparts [21]. Contradictory, Costas et al. [22] reported older scientists had lower research productivity due to higher work load, time constraint and higher administrative duties. Meanwhile on gender, studies tend to agree on better research performance in male than in female [4, 23, 24]. But a finding stated that female has positive effects on research performance [5], and female focus on publication quality instead of number of publication [25].

In addition, Shin and Cummings [26] found academic age of researcher to have a significant positive effect on the publication performance of a research institute. In this case, the academic age begins with PhD degree, post-doc experience and research involvement. The general belief is that researchers gain knowledge, skills and experience throughout the year of academic and research work, and this leads to better research performance. More experienced researchers also may have developed working network. For instance, Bales et al. [27] claimed that a more effective network, better collaboration and mixed authorship of higher academic age researcher may aids in the publication of journal.

Academic position also plays a role in research performance. Puuska [24] argued that knowledge is a cumulative process and publishing is facilitated as scholar becomes in higher position rank, therefore researchers who had higher academic positions are

more likely to be more productive. However, researchers in higher academic position had to deliver more lecture, lead to lower research performance [28]. The language factor is also mentioned in previous studies. Van Leeuwen [29] mentioned that English as an internationally used language plays a dominant role in publication, example like more than 95% of the publications in the Social Science Citation Index are in English language. Therefore, the non-English writing authors face difficulties to being represented in the Web of Sciences [30].

There are many other factors mentioned in previous studies which are related to research performance of academia, namely the research climate [6], the research performance of colleagues [28], and lack of research skills [18] amongst others. Pfeffer and Langton [31] also did a study on salary in universities where they found wage dispersion among colleges and universities to be negatively correlated to research performance, working collaboration, and work satisfaction. Examining the factors as mentioned in the previous studies, this study has narrowed the factors to five elements; gender, academic position, academic age, and ethnicity.

Indeed, analysis techniques are highly dependent on the types of data that have been obtained. A few types of statistical methods have been used to analyse the factors determinants to number of publication. For example, multiple linear regression was applied to obtain the prediction model of the number of publication [26]. Meanwhile according to Pusska[24], the Poisson multilevel regression was used to analyse factors of publication performance. Furthermore, the count data of number of publication and number of citation was also suitable to be analysed by Negative binomial regression [3].

Cross-tabulations and correspondence analysis was considered in this paper. The cross-tabulations analysis, which was first used by Pearson [32] and later mentioned by Smith et al. [33]. It was used in examined the managerial and economic aspects of the introduction of information technology at a university Tellis [34]. Sax et al. [35] used this technique to examine gender differences in research productivity by family-related factors.

Correspondence analysis was first introduced by Hirshfeld [36] and later was further developed by Blasius and Greenacre [37]. Correspondence analysis is a statistical technique measuring correlations between two or more categorical variables. To some extent, correspondence analysis is similar to Principal to Component Analysis (PCA), but it incorporates categorical instead of continuous data [38, 39]. Correspondence analysis has been used to examine the university-industrial relationship in US and Europe [40]. Besides, Shen et al.[41] utilized correspondence analysis to evaluate China's university library websites. Correspondence analysis has its merits; it is able to resolve the limitations of other techniques such as Fisher's Exact Probability Test, G-Statistics, and Z-Test in social science studies [42].

MATERIAL AND METHODS

Research performance is the output of research activities and it is usually measured with bibliomatric indicators. In order to investigate the research performance of the two selected UM faculties, FBA and FEA, for the 2010-2014 period, number of publications is selected as dependent variable while academic staffs' characteristics are considered as independent variables. Further information of each selected factor are as follows.

Number of publications: number of publications in the 2010-2014 period.

Gender: Several studies argued that gender gap still exists in research performance [4, 23, 24], therefore this factor is considered in this study.

Academic position: Studies reported contracting findings on the influence of academic position on research performance [24, 28], thus this variable is selected in this study.

Academic age: The number of years since an academic staff obtained PhD is selected because it has positive effect on the publication performance of a research institute [26].

Ethnicity: Ethnicity factor is considered because limited studies were done on this factor. Another reason to consider this factor is because the existence of multi-races in Malaysia (67% Malays, 25% Malay, 7% Indian and other races).

Data are collected from three main sources: Google Scholar database, curriculum vitae (CV) of each academic staffs from UM Expert webpage (umexpert.um.edu.my) and library webpage of each academic staffs' PhD graduated university. The data consist of 85 active academic staffs from both faculties (FEA and FBA) in University Malaya. Publications for the most recent 5 years (from year 2010 to 2014) such as journal articles, editorials, reviews, non-published discussion papers, conference papers, monographs, book chapters, reports as well as gray literature and lectures are considered as part of data pool in this study.

The CVs from UM Expert webpage contain information on the academic staff's gender, ethnicity, academic position, and awarded PhD year. However, data on awarded PhD year are available for only less than 5 academic staffs in the CVs. Hence, the next step is to fill in the missing data by examining the published year of their PhD thesis from the library webpage of universities. This significantly solves the problem of missing year of awarded PhD.

The obtained data are later transferred into coding sheets and analysed using the SPSS. Cross-tabulation is performed to compare the number of publication by academic staffs' characteristics. Correspondence analysis is also conducted to visualize the similarities and dissimilarities amongst the respective academic staffs' characteristics (gender, ethnicity, academic position and academic age) with respect to the three numbers of publication groups, and the relationship between research productivity and academic staffs' characteristics in 2-dimensional plot. Indeed, the usage of cross tabulations and correspondence analysis is deemed appropriate given the use of categorical data.

RESULTS AND DISCUSSION

Descriptive analysis of the academic staffs' characteristics is shown in Table 1. The majority of the academic staffs are female, Malay, pose as Lecturer, with academic age ranges between 0 and 4, and have had 8-14 publications in the 2010-2014 period.

Table 1: Characteristics of academic staffs.

Factors	Gender		Ethnicity			Academic Position		Academic age (years)			Number of Publications		
	Female	Male	Malay	Chinese	Indian	Professor	Lecturer	0-4	5-9	10 and above	0-7	8-14	15 and above
Number	54	31	50	21	14	27	58	38	28	19	31	34	20
Percentage	63.5	36.5	58.8	24.7	16.5	31.8	68.2	44.7	32.9	22.4	36.5	40.0	23.5

Cross tabulation analysis was run on each independent variables and the results are as in Table 1. Assuming a 5% significance level, the number of publications shows a significant difference among all the independent variables. These significant research results validate the findings of the previous studies [3, 6-7], which indicated research productivity and academic staffs' background characteristics are significantly dependent. So, it is evident that gender, ethnicity, academic position and academic age also have significant effects on research productivity in FEA and FBA, UM.

For more than 15 publications, male has more publications as compared to female. Nonetheless, for more than 8 publications, female does better than male by 3.5%. Previous studies argued that male academic staffs performed better than their female counterparts [4, 23, 24].

From ethnic perspective, Malay has the least publications while Indian have the most number of publications. Support from existing literatures for this finding could be constrained in part due to limited previous studies done on the impact of ethnicity towards research performance among professors. Despite that, this finding should provide a valuable starting point to future research.

Meanwhile, there is a significant difference on research performance when involved academic positions. Results show that the Professor level, which include Full Professor and Associate Professor, over-performed Senior Lecturer and Lecturer category. Indeed, the results are consistent with findings reported by Puuska [24], which suggested that the academic staff with higher academic positions tend to be more productive in research performance. In contrast, based on the findings of Smeby& Try [6], the increase in academic position does not necessarily show positive relationship with the number of publications.

For academic age of 10 years and above, the number of publications is higher as compared to below 10 years. At 5% significance level, there is a significant difference in research performance across the number of academic age. Similar to findings by Shin & Cummings [26], the academic age has positive effect on the publication performance.

Table 2: Cross-tabulations of number of publications and background characteristics in percentage.

Number of publications	Gender		Ethnicity			Academic position		Academic age		
	Female	Male	Malay	Chinese	Indian	Professor	Lecturer	0-4	5-9	10 and above
0-7	35.2	38.7	46.0	28.6	14.3	7.4	50.0	68.4	10.7	10.5
8-14	50.0	22.6	42.0	47.6	21.4	40.7	39.7	21.1	64.3	42.1
15 and above	14.8	38.7	12.0	23.8	64.3	51.9	10.3	10.5	25.0	47.4
x^2 computed	8.548*		17.764*			22.659*		34.142*		
* Significant at 5% level.										

Examination of the similarities and differences of the respective background characteristics (gender, ethnicity, academic position and academic age) with respect to the three number of publications groups is carried out using correspondence analysis. Two 2-dimensional plots are generated and are shown in Figure 1 and Figure 2. This is due to, both gender and academic position only have $k = 1$ dimensional, where k is the minimum number of rows (3) and columns (2) minus one, respectively.

Based on Figure 1, all ethnic groups are far apart from each other. The individual points representing the number of publication of the academic staffs are also spread out. This indicates that the researchers' ethnicity profiles are very different. The results are consistent with the cross-tabulations of number of publications groups and ethnicity (Table 2). Malay academic staffs tend to have publications ranges between 0 and 7. Whereas, Chinese academic staffs tend to have 8-14 publications. Meanwhile, Indian academic staffs tend to have at least 15 publications. Hence, each ethnic group has different research productivity. Thus, from this finding, it could be assumed that the certainty of academic staffs' publications behaviour amongst ethnic groups may be influenced by cultural differences.

Figure 2 visualises the relationship between number of publications and academic age. As expected, there is a high association between the number of publications and academic age. Notice that the points for at least 10 years academic age and at least 15 publications are very close together and are separated from the other points. This indicates that academic staffs with at least 10 years academic age tend to be associated, almost exclusively, with at least 15 publications. Similarly, academic staffs with 5-9 years academic age tend to be associated, to a lesser degree, with 8-14 publications. Whereas, academic staffs with 0-4 years academic age tend to be associated with 0-7 publications. Therefore, from this analysis, Figure 2 implies the higher number of publications with greater number of years since awarded PhD. These findings are consistent with the cross-tabulations results for number of publications groups and academic age (Table 2).

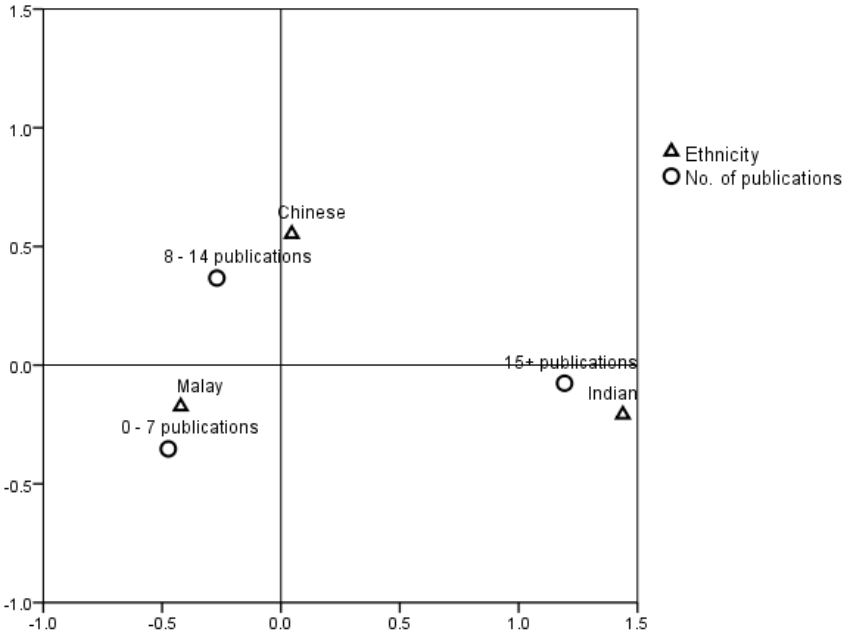

Fig-1: Correspondence plot of number of publications and ethnicity.

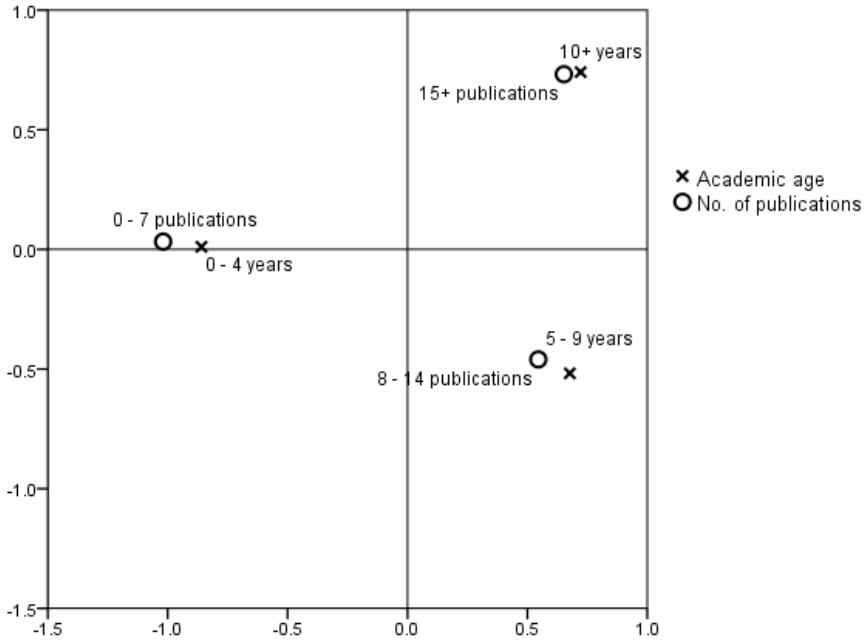

Fig-2: Correspondence plot of number of publications and academic age.

According to Horta [43], the academic training which begins with PhD degree, post-doc experience and projects involvement will directly influence researchers' performance. Furthermore, results from Figure 2 also seems to validate the findings from the study conducted by Shin and Cummings [26], which suggested that there is significant positive relationship between research productivity and academic age of researchers.

These correspondence plots, as shown in Figure 1 and Figure 2, demonstrate the relationship between number of publications with ethnicity and academic age in the best possible way. However, for future studies, the sample size of data used in this study should be increased. For instance, all faculties of UM could be considered in future researches. Thus, each background characteristics of individual academic staffs can be categorized into more detailed categories without having structural zeros (zero cells) issue in the contingency tables. For example, academic position can be categorized into full professors, associate professors, senior lecturers and lecturers, instead of only categorized into professors and lecturers. Therefore, better insights of the relationship between background characteristics and number of publications can be represented graphically in a 2-dimensioanal correspondence plot.

CONCLUSION

In conclusion, the considered academic staffs' characteristics (gender, ethnicity, academic age, and academic position) have a significant influence on the research performance of FBA and FEA in UM. For example, a higher percentage of male academic staffs has more than 15 publications compared to female academic staffs. Besides that, this study also finds the number of publications to vary among the different ethnic group during the observed period. Experience in academic also has its importance to research performance. For instance, our analysis concludes that academic staff has higher number of publications when they have longer years since awarded PhD as well as higher academic position. For further references, this study could be improved. Further study of research performance may as well consider to include all faculties in UM to increase the sample size and to examine the impact of different disciplines to research performance. Meanwhile, to further add value to this study, other possible factors such as research funding, faculty size, accessibility of resources instead academic staffs' characteristics can also be investigated in the future.

Acknowledgement

We would like to express our utmost appreciation to Mr. Tan Wee Kem for helping the collected data.

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