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Publication Effectiveness of Academia Employees in Poland: A Case Study

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Abstract

Effectiveness in publishing is currently the most important criterion in the process of the evaluation of scientific and research units in Poland. In the national evaluations system for such units, this criterion has the largest relative impact on their final assessment and rating, on the basis of which, in turn, financial resources are allocated. The key question in this context was what factors are correlated with publication effectiveness of employees in the domain of science?

The aim of the analysis was to determine correlations between selected factors such as an employee's academic title and position in a scientific unit's hierarchy or their teaching load and their scientific effectiveness as measured by publications. The study was conducted on the entire staff population of the Faculty of Political Sciences and International Studies at Nicolaus Copernicus University in Toruń. As a result, it was found that the selected factors only to a marginal degree were correlated with publication effectiveness in the group studied.

Keywords: *evaluation of scientific research, publication impact, social sciences and the humanities*

Introduction

Evaluation of scientific research is one of the most frequently discussed problems in both scientometrics and studies in higher education. The topics covered as part of this broad discussion range from the discussion of existing evaluation systems and implementations of various models in different countries (Bloch & Schneider, 2016;

Hicks, 2012) to research on identifying the most effective and impactful publication models. Scholars' attitudes toward the evaluation process and its impact on their later careers are also subject to analysis (Rousseau & Rousseau, 2017; Jeran, Kącka & Piechowiak-Lamparska, 2017; Kącka, Michalak & Piechowiak-Lamparska, 2018). Researchers also quite keenly turn to the topic of (broadly understood) scientific performance indicators in attempts to define their role in the process of the evaluation of scientific research in selected countries (Fukuzawa, 2017; Prathap, 2017). In our study, the key issue was the impact of the scholarship work of individual researchers and the factors that might be correlated with it.

The purpose of this study was to determine the existence and, if it is confirmed, the nature of the correlation between the impact of researchers' publications and selected factors such as professional degree or title, and teaching load. The last step in the research was analysis of the results according to the principles and requirements of the Polish model of evaluation of scientific units (Comprehensive Evaluation of Scientific Units), which determines the overall ranking of scientific publications submitted for evaluation by an institution based on journal or channel prestige and parametric impact. The study is based on a detailed analysis of the structure of scholarship work and the variables of the complete population of employees of the Faculty of Political Sciences and International Studies (FPSIS), Nicolaus Copernicus University (NCU) in Toruń (Poland). Due to a relatively small sample, the results of the analysis cannot be extrapolated onto the entire scientific community in Poland. Nevertheless, the sample size allows for the research to be considered as a *case study*, which may be an interesting contribution to any research focused on scholars and research units at a national level, as well as to studies analyzing particular domains of science or disciplines. The basic research question put forward in this paper is: Are selected factors, such as professional degree or title, and teaching load correlated with the impact of scholarship work of individual researchers? The answer is particularly interesting since the presented study is a pioneering one – so far, no results of multi-variate analyses focused on links between a scholar's publications' impact and selected variables have been published.

Research Methodology

Materials and variables

The following data sets were used to perform the presented analysis:

1. Scientific publications of the staff of FPSIS (2013–2016, parametric evaluation period).

2. Information on key traits of researchers employed by FPSIS: position of an employee in the academic hierarchy as defined by their academic degree or title as recognized in Poland [Master's, PhD, PhD Hab. (a post-doctoral title), Full Professor], and teaching load (an employee's number of teaching hours in an academic year).
3. Specific point scores obtained by individual employees were calculated on the basis of publication data from the Expertus system (Bibliography of publications of employees and doctoral students at NCU). The publications were catalogued and aggregated according to the division provided for in the Ministry of Science and Higher Education Regulation (2016). Next, they were assigned parametric points in accordance with the same Regulation and the *Catalog of Scientific Periodicals with a full history of their position in the published catalogs of scientific periodicals in the years 2013–2016 and corresponding points to be awarded* (2017).

Objectives of the study

The purpose of the study was to determine the existence of (and if existing, the nature of) a correlation between selected socio-demographic variables (independent variables) and the publication impact of researchers employed at the FPSIS as measured by relevant points awarded by MSHE for scientific publications of the unit's employees depending on their ranking as part of the process of parametric evaluation of scientific and research units in Poland (dependent variable).

The following specific research questions were posed:

Q1. Is there a statistically significant relationship between an employee's place in the scientific hierarchy and the impact achieved by their publications in terms of impactful points obtained during the evaluation, and if so, is it positively or negatively correlated?

Q2. Is there a statistically significant relationship between an employee's teaching load and the impact achieved by their publications in terms of relevant points awarded in the evaluation process, and if so, is it positively or negatively correlated?

These questions led us to the below suggested interlinked answers (research hypotheses):

H1. There is a negative and statistically significant relationship between an employee's place in the unit's scientific hierarchy and his/her total relevant (impactful) points scored for their publications.

Research on the relationship between the scientific title held (or position occupied in the academic hierarchy) by a scholar and their productivity and impact

of their publications has been ongoing for many years (Puuska, 2010; Sabharwal, 2013). Results of a study carried out in Italy on a population of nearly 12,000 full professors (Abramo, D'Angelo & Murgia, 2015) clearly show that the position (title) held by an academic significantly differentiates productivity of researchers in terms of publications and resulting impactfulness of their scholarly work. A similar correlation was determined by Jung (2014) in his research focusing on the Korean scientific community. Jung indicates that scientific productivity is variable to a significant degree and dependent on the career stage where the scholars in question find themselves. He also notes discernible differences between various scientific disciplines.

Evaluation of one's scientific performance – specifically, of the impact and quality of one's scientific publications – is the basis for gaining more advanced degrees and titles. Here, our hypothesis is that the lower the position of an employee in the scientific hierarchy, the more points they would strive to obtain. Several factors would be conducive to such starting-level researchers obtaining a larger number of points for publications. The first is the desire for rapid professional advancement, gaining prestige and recognition in the research community. The second factor is having a good understanding of the evaluation system for scientific publications, which should foster the development of an individual's publication strategies (e.g., submitting papers exclusively to high-impact journals with a global reach) and their effective implementation.

H2. There is a negative and statistically significant relationship between an employee's teaching load and the number of impactful (relevant) points scored.

Similarly as in the case of family obligations, no attempt has been made thus far to investigate the correlation between productivity of academic staff in terms of publications and their teaching load. As mentioned, Cronin & Meho (2007) point out the fact that the model of scientific activity changes with age, and well-established researchers place more emphasis on didactics – especially teaching a new generation of young academics. No one, however, has thus far undertaken a detailed and comprehensive analysis of how the number of teaching hours impacts on employees' productivity in the academia.

In our study, we hypothesized that among FPSIS employees the teaching load is indeed a differentiating factor as concerns productivity expressed in the number of publications. We do understand that in practice, an employee burdened with overtime teaching hours will be less productive and publish less frequently. Success in the academic world, as measured by the publications impact and influence, is, however, conditioned by many more factors than just the number of teaching

hours and other didactical obligations. It may depend on, e.g., personality traits (diligence, industry), other contributions to the academic world (involvement in management of a given unit, serving as editor for scientific journals, conference organization), etc. More diligent employees can perform at equally high levels both in terms of scholarship and their didactical work.

Characteristics of the data set

The collected data set consists of 61 units of enquiry (61 academic employees of the FPSIS), and the analyzed data are mostly quantitative variables. All dependent variables referring to employee publication impact (as expressed by the number of relevant points obtained during the unit evaluation process) are ratio variables. The "degree or academic title" variable, describing the position of an employee in the scientific hierarchy, is an ordinal variable. This gave us an opportunity to analyze and test the statistical significance of the collected data using tools such as regression analysis and correlation coefficients (R-Pearson and Spearman's rank correlation coefficient). The analyzed data set is not a representative sample, but can be treated as an independent and discrete population, thus giving the authors an opportunity to treat their research as a *case study.*

Table 1. Characteristics of the analyzed population

Variables	N	%
Degree or academic title:		
Master's	0	0
PhD	29	47.54
PhD Hab.	22	36.07
Full professor	10	16.39
Total	**61**	**100**

Source: Own analysis.

Research Results

General characteristics of FPSIS employees' scholarly output

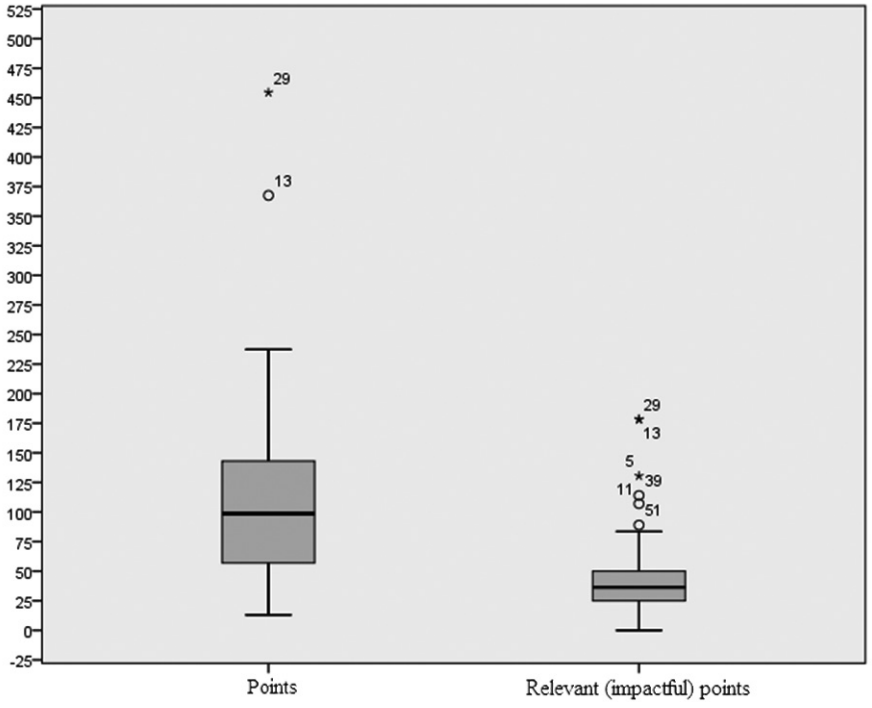
Statistical analysis of the studied data set shows its wide variability, both regarding the total point scores per employee, as well as in the case of relevant (impactful) points only (Table 2).

Table 2. Descriptive statistics of total point scores obtained by employees for publication activity

Descriptives				
			Statistic	**Std. Error**
Points by the MSHE	Mean		110.481	9.9289
	95% Confidence Interval for Mean	Lower Bound	90.620	
		Upper Bound	130.342	
	5% Trimmed Mean		102.136	
	Median		98.667	
	Variance		6013.511	
	Std. Deviation		77.5468	
	Minimum		13.0	
	Maximum		454.5	
	Range		441.5	
	Interquartile Range		87.0	
	Skewness		2.110	.306
	Kurtosis		6.782	.604
Relevant (impactful) points	Mean		41.852	4.9233
	95% Confidence Interval for Mean	Lower Bound	32.004	
		Upper Bound	51.701	
	5% Trimmed Mean		37.528	
	Median		36.333	
	Variance		1478.570	
	Std. Deviation		38.4522	
	Minimum		.0	
	Maximum		178.5	
	Range		178.5	
	Interquartile Range		31.0	
	Skewness		1.804	.306
	Kurtosis		3.964	.604

Source: Own analysis.

The range between the lowest and the highest point score awarded to an employee was 441.5, and in the case of parametrically relevant (impactful) points, the range was 178.5. The box plot graph (Figure 1) shows two outlier observations in the former and six in the latter case. The classical variation coefficients for the



Source: Own analysis.

Figure 1. Analysis of the number of total points obtained by an employee versus the number of relevant (impactful) points

analyzed data were 69.6% and 91.9%, which means that with such variability, the arithmetic mean cannot be used as a good measure of the central tendency for this set. For this reason, the median was used as such measure in all further analyses.

Analysis of the employees' points scores from the point of view of the scientific evaluation process of FPSIS showed that the Faculty reported 1200 publications with a total value of more than 7800 points (1077 publications merited points scores according to the MSHE regulation). From this total, 177 of the highest-rated publications were taken into account in the final parametric questionnaire. The cut-off point for publications taken into consideration in the evaluation process was 12 points. The average number of points per publication submitted by FPSIS was 6.6. Finally, the ratio of the number of relevant (impactful) points (i.e., points for publications that were taken into account in the unit's final evaluation questionnaire) to irrelevant (lost) points was 2010 to 3802. Analysis of the employee

publications impact against the structure of scholarly output of FPSIS as a whole (Table 2) allows for drawing the following conclusions:

- 10 employees had zero fully parametrically relevant (impactful) publications,
- 34 employees had 1–2 such publications,
- 7 employees had 3 relevant (impactful) publications,
- 10 employees had over 3 publications in that category.

Taking into account only the relevant (impactful) point scores earned by the FPSIS employees, it was determined that:

- 8 employees contributed 0 points to the total final score of the unit,
- 7 scholars earned 8–15 points,
- 31 researchers brought 25–50 points for the unit,
- 15 employees contributed over 50 points to the score, out of whom 5 were responsible for more than 100 points each.

Table 3. Structure of overall scholarly output of FPSIS employees

Type of publication	Number of publications	Total points
Articles in journals (List A)	4	70
Articles in journals (List B)	252	2367
Articles in journals (List C)	26	293
Scientific monographs	64	1551
Editing of multi-author monographic publications	107	510
Chapters in multi-author monographs	399	1715
Total	**852**	**6506**

Source: Own analysis.

Verification of research hypotheses

The main purpose of the study was to verify the hypotheses posited as possible answers to the research questions formulated.

H1. There is a negative and statistically significant relationship between an employee's place in the unit's scientific hierarchy and the total relevant (impactful) points scored for their publications.

Analysis of the correlation between the position of an employee in the Faculty structure (Table 4) as manifested by the hierarchy of degrees and academic titles held by the employee (independent ordinal variable) and the number of relevant (impactful) points scored (dependent ratio variable) carried out using the Spear-

man rank correlation coefficient (r_s) showed no statistical significance ($p>0.05$). This does not allow for a full verification of H4. However, the comparison of median values sheds more light on the matter.

Table 4. Analysis of correlation between the position of an FPSIS employee in the academic hierarchy and the number of relevant (impactful) points scored for publications

Report				
Degree or academic title		**Points by the MSHE**	**Relevant (impactful) points**	**Irrelevant (lost) points**
PhD	Sum	3223.6	1320.5	1639.1
	Median	94.500	39.000	40.000
	Mean	111.159	45.534	56.521
	Std. Deviation	71.5579	39.0398	43.3127
	N	29	29	29
PhD Hab.	Sum	2229.3	755.2	1414.1
	Median	82.833	25.500	50.167
	Mean	101.331	34.326	64.278
	Std. Deviation	91.1180	38.7090	56.9637
	N	22	22	22
Full professor	Sum	1286.4	477.3	749.1
	Median	142.667	32.500	65.500
	Mean	128.643	47.733	74.910
	Std. Deviation	64.9185	37.3984	42.9733
	N	10	10	10
Total	Sum	6739.3	2553.0	3802.3
	Median	98.667	36.333	49.237
	Mean	110.481	41.852	62.333
	Std. Deviation	77.5468	38.4522	48.2933
	N	61	61	61

Source: Own analysis.

Employees with a doctoral (PhD) degree obtained the most points, both total and as relevant (impactful) points, compared to those holding a post-doctoral degree (PhD Hab.) and the title of full professor. Holders of a PhD Hab. degree obtained the lowest results.

It seems, therefore, that the hypothesis that the lower an employee's position is in the scientific hierarchy, the more points they obtain for their publication is only partially true, specifically, it holds only as regarding the variable of impactful (relevant) points scored. Full professors show a significantly higher number of total points scored, but overall, their publications are much less impactful parametrically (as measured by relevant points). The group of PhD Hab. employees recorded the lowest scores. This conclusion is somewhat surprising and raises the need for more thorough research into the matter.

H2. There is a negative and statistically significant relationship between an employee's teaching load and the number of impactful (relevant) points scored.

The use of regression analysis (for the independent variable of teaching load and the dependent variable of total points scored for publications) to test the above hypothesis has led to surprising conclusions. First and foremost, a large teaching load did not negatively impact on the employee's performance in terms of points earned for publications. We have in fact observed the opposite effect (Figures 2a, b, c, d). Among all the regression models tested using the curve estimation function in the SPSS software, the best-fit and most statistically significant ($p<0.05$) model turned out to be the S-shaped curve regression model. It should still be noted that its coefficient of determination is still not particularly high (R Square = 0.308). For the dependent variable "impactful (relevant) points scored," the linear regression model turned out to be statistically significant ($p<0.05$). However, its coefficient of determination is negligible (R Square=0.079).

Model Summary			
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
.555	.308	.296	.573

Figure 2 a. The independent variable is teaching hours (teaching load)

ANOVA					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	8488	1	8488	25822	.000
Residual	19.065	58	.329		
Total	27.553	59			

Figure 2 b. The independent variable is teaching hours (teaching load)

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 / Teachung hours	-931.149	183.241	-.555	-5.082	.000
(Constant)	5.116	.146		35.060	.000

Figure 2 c. The dependent variable is ln (Points by the MSHE)

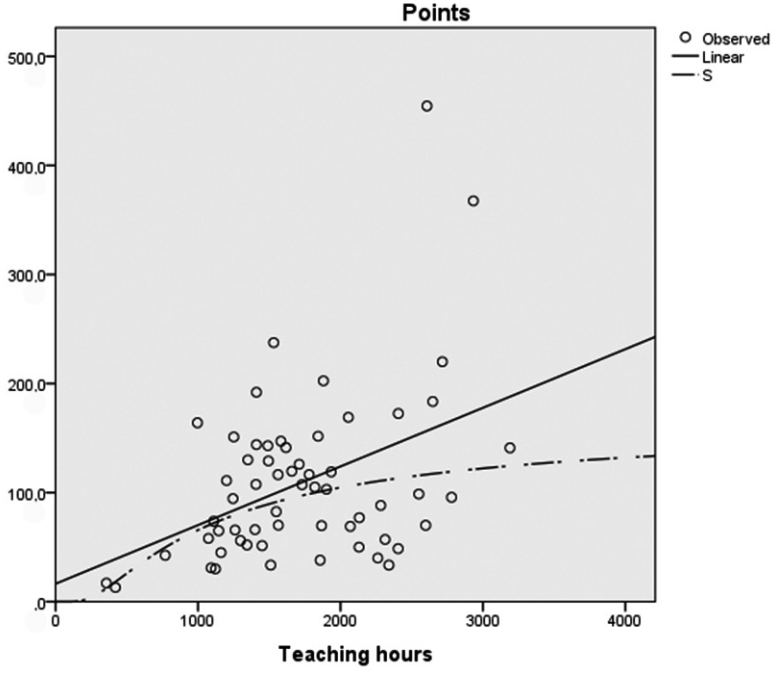


Figure 2 d.

Figures 2 a, b, c, d. Analysis of the correlation between teaching load of an employee and number of points obtained for publications

Regression analysis did not allow for an unambiguous verification of the formulated hypothesis. The regression model does not link the number of points scored to the number of teaching hours. However, looking at the scatter plot, it is quite clear that a larger teaching load does not interfere with earning a large number of points. The record setters (two outlier observations) had a high number of teaching hours. In turn, people with few teaching hours also obtained only a small number of points. Accordingly, based on the data analyzed, it cannot be said that a large number of teaching hours always translates into a high number of points earned, but it can be stated that a smaller teaching load is not conducive to obtaining a larger number of points for one's publications.

Conclusions

The purpose of the presented analysis was to determine the correlation between a scholar's publication impact (expressed as a number of relevant points scored for the unit in the evaluation process) and selected factors such as a degree or academic title and teaching load. We presented the analysis in the context of principles and requirements of the Polish model of evaluation of scientific units, as it is the most decisive framework shaping scientific policies of individual research units. Being aware of the advantages (coverage of an entire population) as well as flaws of the conducted study (small and non-representative sample of the population of researchers in Poland), we can confidently state that our detailed analysis of the publications structure and variables of the employees of FPSIS has allowed us to draw interesting conclusions. The socio-demographic factors considered in the study have shown relatively weak with the number of impactful (relevant) points earned by the Faculty employees for their publications. However, it is particularly worthwhile to look into the detailed results. An important factor turned out to be also the researcher's position in the scientific hierarchy, i.e., the degree or academic title they hold. The study showed that although the employees at lower hierarchy levels in the Faculty structure had a better ratio of relevant (impactful) points to total ones in the evaluation process, the holders of a full professor title turned out to be more effective in terms of total points scored. The result of the analysis of the relationship between teaching load and the number of impactful (relevant) points scored was particularly interesting. It allowed us to conclude that with personal diligence, the impact and high frequency of publications can go hand in hand with a significant teaching load.

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Rozporządzenie Ministra Nauki i Szkolnictwa Wyższego z dnia 12 grudnia 2016 r. w sprawie przyznawania kategorii naukowej jednostkom naukowym i uczelniom, w których zgodnie z ich statutami nie wyodrębniono podstawowych jednostek organizacyjnych. *Dziennik Ustaw*, poz. 2154 [Regulation of the Minister of Science and Higher Education of 12 December 2016 on granting of scientific ranks to scientific units and universities in which, pursuant to their statutes, core organizational units have not been delimited, *Journal of Laws*, item 2154].

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