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Probing the Outliers: Predictors of Research Productivity at DLSU

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Abstract: De La Salle University (DLSU) has through much of its history been a teaching university, but it has in the last twenty years changed its vision to that of a research university. Structures and mechanisms that worked well towards achieving excellence in teaching-learning may not be optimal for achieving a research university status. This study looks at some factors that are generally thought to have impact on research productivity, with the goal of drawing lessons that could help the university accomplish its vision sooner, without sacrificing its other core functions. Effects on research productivity of factors like academic inbreeding, obtaining doctorate from foreign universities, age at which doctorate was earned are thus far mainly conjectural or hypothetical. This study surveys the status of full-time faculty members in these aspects, and correlations with research productivity are determined. Research productivity in this study is measured through the number of Scopus-listed output, including journal publications, conference papers, books and monographs, authored by each faculty member with DLSU as their affiliation. This study also takes a close look at the top performers, investigating in particular their attributes, and their research collaborations.

Key Words: research productivity; Scopus; academic inbreeding; academic mobility; research collaboration

1. INTRODUCTION

Studies on research productivity have been conducted in many settings, relating these to researcher attributes like age, gender, doctorates, academic inbreeding and others. (Levin and Stephan 1991, Xie and Shauman 1998, Sax et al 2002, Clemente 1973, Ramsden 1994, David 1994, Dundar and Lewis 1998, Horta et al 2010, Inanc and Tuncer

2011, McGee 1960, Eells and Cleveland 1999). Literature in this area is still relatively sparse, with studies mainly tracking those with research output. In exploring the conditions in a research university aspirant like De La Salle University (DLSU), a more complete picture can only be attained if members of the community who are not so active in research are also included in the study. This is one aspect by which this study differs from the others.

Through much of its history, DLSU has been



recognized for excellence in teaching, but the general academic community has become mindful of research only in the last two decades. With its newly declared aspiration to be a leading research university, this study was conducted in order to better understand factors that could influence this drive. The study is essentially an output analysis, relating faculty attributes with research productivity, which is measured through the number of Scopus-listed research output.

2. FACULTY ATTRIBUTES

To be a leading research university, an institution must not only produce numerous research output, but that these outputs must have impact to the research and academic communities at large, and to society and humanity as a whole. One of the most commonly-used measure for the impact of research is the number of citations, which is measured by indexing services like Scopus. On the practical side, reliable data on research production depends on an efficient reporting system. In the absence of this, indexing services like Scopus provide an alternative, though admittedly incomplete source. Given the state of research and the state of reporting system in the University, research productivity is measured in this study in terms of Scopus-listed output with DLSU affiliation from 1982 to 2013. Data was retrieved from Scopus on November 22, 2013 and the 2013 data updated on January 13, 2014.

The faculty attributes considered in this study are: (1) gender, (2) age, (3) faculty rank, (4) doctorate, (5) age at which doctorate was earned, (6) foreign doctorate, (7) longevity, (8) academic inbreeding, and (9) academic mobility. The population comprise all full-time faculty members of the university as of first trimester of the academic year 2013-14, who have been with the University for at least one year.

Correlation between faculty attributes and Scopus output were computed using the following coding schemes for attributes: For gender, male is coded as 1, and female 0. For faculty rank, instructors are categorized as 0, assistant professors as 1, associate professors 2, and full professors 3. Those with PhD are given doctorate label 1, and those with none 0. Those with foreign doctorates are given FD labels of 1, and local doctorates 0. An academically inbred faculty member is defined as one whose highest degree was earned at DLSU, the category is labeled 0, and non-inbred are labeled 1.

Mobility categories are defined using a scheme modifying that of Horta (2013), accounting for both mobility in their education, and mobility in academic and/or research employment.

Table 1. Academic Mobility Classification Scheme

Mobility Scale	Educational Mobility	Academic Employment
0	All academic degrees from DLSU	Worked only at DLSU
1	Highest degree from DLSU but has degree from another institution	Worked only at DLSU
2	All academic degrees from DLSU	Worked or had post-doctoral stint in another institution
3	Highest degree from DLSU but has degree from another institution	Worked or had post-doctoral stint in another institution
4	All academic degrees from one institution other than DLSU	Worked only at DLSU or DLSU and the alma mater
5	All academic degrees from one institution other than DLSU	Worked or had post-doctoral stint in an institution other than DLSU or the alma mater
6	Academic degrees from different institutions, and highest degree is not from DLSU	Worked only at DLSU or DLSU and the alma mater
7	Academic degrees from different institutions, and highest degree is not from DLSU	Worked or had post-doctoral stint in an institution other than DLSU or the alma mater

3. RESEARCH PRODUCTIVITY AND ITS CORRELATES

Research output of the University began to rise above the occasional-paper level in 1996, and production rapidly increased between 2003 and 2008, before settling down to a slower pace that continues until today.

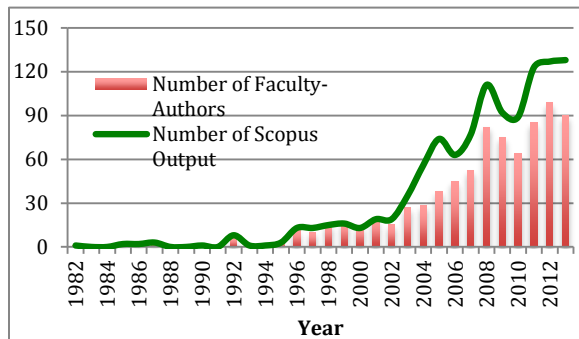


Fig. 1. Scopus output of De La Salle University from 1982-2013

Getting the Pearson-R between the faculty attributes mentioned in the previous section and the Scopus output, it can be seen from Table 2 that age, faculty rank, doctorate, doctorate age, and longevity correlate significantly with research productivity. Partial correlation calculations using the other attributes as control however rooted out age as a predictor.

Table 2. Correlations of Faculty Attributes with Scopus Output.

Faculty Attribute	Pearson-R	P-value (2-tailed)
Gender	.016	.740
Age	.100*	.039
Longevity	.155*	.002
Doctorate	.214**	.000
Doctorate Age	-.154*	.017
Foreign PhD	.102	.116
Faculty rank	.418**	.000
Academic Inbreeding	.061	.210
Academic Mobility	.079	.113

* significant at 0.05 level ** Significant at 0.01 level

The correlation between faculty rank and research productivity is only to be expected as research output is a requirement for faculty promotion. This attribute was included in the study mainly to serve as a yardstick for the other

correlates. That the correlation is rather low at .418 is attributable to the fact that from the population of 425, only 196 (46%) have Scopus-listed output, and only 55 have at least 5 Scopus-listed outputs. The high number of low-level or non-producers of Scopus-listed work meant that only about 13% of the population have significant number of output, and that these people are the outliers rather than the norm.

It is but reasonable to expect longevity to be a predictor of Scopus-listed output, as production is obviously a function of how long one stays in the organization. It should be noted that historical records indicate that it takes about 5 years for faculty members of the University to put their research program on solid footing, and for them to consistently produce Scopus-listed output afterwards.

Because of the research orientation of doctorates, it is also but natural for this to correlate with research production. The age at which doctorate is obtained is also a factor, and it is found that in the case of DLSU, there is a population inversion between “Scopus producers” (SP) and those that are “out-of-Scopus’-view” (OSV) at doctorate age of 45. There are significantly more SP at the lower age and more OSV at the higher age levels.

Age appeared to be a correlate of research productivity only because it has strong correlations with the other true correlates. Notably, gender, having a PhD from a foreign university, academic inbreeding, and academic mobility do not significantly correlate with Scopus output.

When correlation calculations are limited to the 55 Outliers, only faculty rank remained a significant predictor of Scopus-listed output. Even then, simple linear regression models with this as predictor is at best only 25% accurate.

4. Co-Authorship Networks

About 75% of the University’s Scopus output are co-authored. This indicates that a comprehensive study of research productivity should at least cover co-authorship network analysis.



Co-authorship network analysis (Liu et al 2005, Barabasi et al 2002, Borner et al 2005, Sun et al 2011, Wagner and Leydesdorff 2005, Leydesdorff and Wagner 2008, Chompalov et al 2002, Ynalvez and Shrum 2011, Steyvers et al 2004, Zhou et al 2007, Kretschmer 2004, Chan et al 2006, Cheong and Corbitt 2009, Newman 2001a, 2001b, 2001c, 2004a, 2004b) is an outgrowth of social network analysis first used by sociologists in studying social relations and structures. Such studies has been aided by the introduction of network metrics from graph theory (Prell 2012), and development of softwares such as NodeXL (Smith et al 2009), a free Excel add-in that is used in this study.

Focusing on the Outliers, the following network metrics were considered: (1) *degree centrality*, a measure of how many ties a player has; (2) *betweenness centrality*, the proportion of shortest paths between all other players in the network that go through a particular player; (3) *closeness centrality*, a measure of how far a player is to all the other players in the network; (4) *eigenvalue centrality*, a measure that takes into account the ties of a player as well as those to whom the player is connected to; (5) *PageRank*, a metric that measures the likelihood that if one starts from a player chosen randomly, a path could be traced to a particular player; (6) *local clustering coefficient*, a measure of how close the partners are in forming a clique.

Table 3. Correlations of Faculty Network Metrics with Scopus Output.

Faculty Network Metrics	Pearson-R	P-value (2-tailed)
Degree Centrality	.723**	.000
Betweenness	.405**	.003
Closeness	-.106	.457
Eigenvalue	.103	.472
PageRank	.499**	.000
Clustering	-.199	.161

* significant at 0.05 level ** Significant at 0.01 level

Three network metrics are found to correlate significantly with Scopus-listed output: degree centrality, betweenness centrality, and PageRank. These metrics however also correlate with each

other. When partial correlation calculations are carried out using the other two as control, it is found that only degree centrality is significantly correlated to Scopus output.

What is notable though is that among the Outliers, the only faculty attribute that remains a predictor of Scopus output, faculty rank has a Pearson-R of only .284, significant at 0.05 level. Among the network metrics however, degree centrality has a Pearson-R of .723, significant at 0.01 level. With causality between faculty rank and Scopus output being complicated, it is clear that network metrics are better predictors of research productivity than faculty attributes.

5. CONCLUSIONS

In search of factors that could drive research in the University, correlation of research productivity and faculty attributes were evaluated. It is found that only faculty rank, longevity, possession of doctorate degree, and age of conferment of doctorate significantly correlate with Scopus-listed output, among the general population of full-time faculty members of DLSU.

Among the 55 faculty who have at least 5 Scopus-listed output, only faculty rank is a predictor of productivity, which is more likely to be an artifact of reverse causality (i.e., research productivity enable attainment of higher rank). An analysis of the co-authorship ranks among the Outliers on the other hand indicates that network metrics, particularly degree centrality, are much stronger correlates of research productivity.

The difference between faculty attributes and network metrics is that the former depends on circumstances, while the latter to some extent may be planned. Age and gender are attributes that a researcher cannot do anything about, while doctorate, doctorae age, longevity, faculty rank are attributes acquired over the long term. Co-authorship networks, on the other hand, are dynamic, and provide an opportunity for engineering university policy interventions in order to improve long-term research outcomes.

That networks are better correlates of productivity than attributes is a good sign, as it indicates that the quest for research universityhood is something that can be accomplished even in the short-term. The push towards the goal can be more



easily attained by providing support more strategically to the present crop of faculty members, rather than to build some ideal faculty profile. It is perhaps that intrinsic motivation of the individual faculty members need only to be triggered and nurtured, particularly through the development of collaborative networks.

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