CANADIAN CUP UNIVERSITY PUBLICATIONS

Canadian University Publications 2006

METHOD

Introduction

- In an effort to better understand the underlying publication output trends at Canadian universities, RE$EARCH Infosource Inc. brings together 4 distinct databases: publication output and average relative impact data from l'Observatoire des sciences et des technologies (OST) at the Université du Québec à Montréal (UQAM); faculty data from Statistics Canada; sponsored research income from Statistics Canada/Canadian Association of University Business Officers (CAUBO); and international publication output and citation data from the US National Science Foundation.

- This report includes the most up-to-date data available for the 6-year period 1999 to 2004.

- The report is broken into two main sections: data for 69 research universities[1] at the national level and by university type[2].

- The OST classification, with some modification, was used to allocate publications to various fields, subfields and disciplines[3]. In the main report, the data reported are at two levels: field level which includes Natural Sciences and Engineering, Health Sciences, Social Sciences and Humanities and subfield level. The Appendices contain data broken down further to the discipline level. For a description of each field, subfield and discipline, see Appendix Y.

- The chief aim of this report is to track overall trends, and not to compare individual universities. However, there are various Appendices that provide individual universities the opportunity to benchmark and compare themselves with other like universities if they choose, as well, to examine an in-depth profile of data available for each university over the past 6 years.

[1] Universities that received research income between 1999-2004 and are a member of Canadian Association of University Business Officiers (CAUBO).
[2] University Type: Tier 1: Medical/Doctoral – universities with a medical school; Tier 2: Comprehensive – universities with a wide range of undergraduate and graduate programs; and Tier 3: Undergraduate – universities with mainly undergraduate programs.
[3] In order to classify the journals by field, subfield and discipline, the OST classification was carefully reviewed. As a result, some disciplines were grouped in a different fashion than traditionally grouped by OST. For example, we reclassified publications about Veterinary Medicine with Biological and Agricultural Sciences rather than with Clinical Medicine. After reviewing Psychology and Psychiatry (which was grouped under Psychology), it was determined that some journals were more closely related to Psychiatry and hence regrouped in the Clinical Medicine subfield. The Communications discipline was regrouped with Humanities rather than with Social Sciences, etc.

- When interpreting the various indicators included in the report (ARIF, publication intensity, publication efficiency and publication effectiveness), it is recommended that the corresponding raw data for publication and faculty counts, as well as research income be reviewed to ensure base sizes are sufficient before drawing conclusions. This is particularly important when comparing universities in the Undergraduate and Comprehensive tiers.

- Most data sets have limitations and the data included in this report are no exception. Our intent is that when examined as a whole, the data will lead to a convergent validity and establish some major trends.

- The parameters used may not satisfy all readers, but our desire is to meet the needs of the broadest range of interests, and bring together related data under one cover that would be useful for universities and other organizations interested in the university research system. The selection of data included in this report will hopefully allow for a fresh view to emerge of the publication output scene at Canadian universities.

Database Sources

Publication Data

- All publication data were obtained from l'Observatorie des sciences et des technologies (OST) at the Université du Québec à Montréa (UQAM). OST obtains their data from Thomson Scientific who publish the Science Citation Index, Social Sciences Citation Index and the Arts and Humanities Citation Index[4].

- "Publications" include articles, notes and reviews.

- CUP utilizes 2 slightly different data sets in its analysis. The number of Canadian university publications includes the total number of publications written by researchers at Canadian universities and affiliated hospitals in approximately 6,000 peer-reviewed international journals covering fields of natural sciences, health sciences, social sciences and humanities. The number of world publications includes the material published by researchers worldwide from all sectors – universities, industry, government and other. Canadian university publication output was on average, 90% of the total Canadian output from all sectors during this period. Therefore CUP can compare the Canadian academic publishing output to world publishing activity.

[4] Thomson Scientific citation databases (like any databases used for bibliographic analysis) have certain limitations that will affect the validity of the data. The main limitations include: coverage, exclusion of certain document types, mistakes in allocating citations or classification of documents and journals. In the Social Sciences and Humanities (in particular), coverage of publications is considered to be more limited as these researchers may be more likely to write books or monographs which are not covered in the citation indexes. As well, the Social Sciences and Humanities Citation Index has a high content of English language journals, and in fact researchers in these areas are more likely to publish in journals in their native language. (Éric Archambault, Étienne Vignola-Gagné, Grégoire Côté, Vincent Larivière and Yves Gingras, "Benchmarking scientific output in the social sciences and humanities: The limits of existing databases." *Scientometrics Vol. 68, No. 3*.)

- The university data were obtained at the institution, field, subfield and discipline levels. Note that one article may have multiple authors from multiple institutions. In these cases, the publication is counted more than once – per institution. Therefore, when reviewing the data by institution, the total publications for all institutions will be greater than the true total of all unique publications for all Canadian universities.

- The world data were obtained at the country and field levels. Similarly, there could be multiple mentions between countries and therefore, the total publication counts of all countries will be greater than the true sum of all unique publications worldwide.

Average Relative Impact Factor (ARIF)

- CUP utilizes the average relative impact factor (ARIF) that has been developed by OST to measure "quality". OST developed this indicator based on the impact factor metric[5] that measures the perceived impact of research through a calculation of citations received by journals. The impact factor does not measure the specific number of citations per article (direct impact), but is rather a measure of the probability of being cited (perceived impact) in a journal. It is considered to be an indicator of research quality.

- Since an article's probability of being cited is not the same for all fields, the ARIF makes it possible to compare the impact factors from several specialties. For example, the average impact factor for biomedical research journals is much higher than for chemistry or physics journals, given that the average number of citations per article is much higher in biomedical research than in the other two fields. The ARIF takes into account the average impact factor of journals in a specialty and compares the publications in each journal with an average journal impact in its specialty. When the ARIF is greater than 1.00, the researchers' publications have a perceived impact above the world average, and vice versa.

- The Humanities field is not included in the ARIF analysis. Thomson Scientific does not calculate impact factors for Humanities journals.

- When reviewing the ARIF data, keep in mind that an ARIF can be a value from 1 to infinity on the positive side, but the value can only be from 0 to 1 on the negative side. Therefore, calculating a percent change or computing a "gap analysis" between ARIFs between institutions, fields, etc. should not be done. The ARIF should only be compared with the world baseline of 1.0 and/or by comparing the rank positions.

- When interpreting the ARIF, the publication counts should be reviewed to ensure base sizes are sufficient before drawing conclusions. Caution should be used in interpreting any group or institution's ARIF when the ARIF is based on less than 20 publications and should be viewed as trend information only (as per OST).

[5] The impact factor is the number of citations received during one year for articles published in a journal during the previous two years divided by the total number of articles published in the same journal over the same two year period.

Faculty Data

- Faculty data include full-time full, associate and assistant professors for the academic years 1996-1997 to 2001-2002. Faculty data do not include postdocs although they are included in the publication counts. This should have no significant affect on the calculations, as postdoc numbers are comparatively small.

- Faculty data were obtained at the institutional, field, subfield and discipline levels[6]. Where required, data from affiliated institutions were combined with those of the main university.

- Especially at the discipline level, numbers may not add as Statistics Canada randomly rounds the numbers either up or down to a multiple of "3" for confidentiality reasons.

- The discipline classification was reviewed and adjusted where necessary to better match the discipline, subfield and field classification as set out by OST. Although there was not always an exact match between the discipline classification used for faculty and publication output data, every attempt was made to match these two classifications as closely as possible.

Sponsored Research Income

- Sponsored research income includes funds received either in the form of a grant or by means of a contract or contribution from a source external to the institution to support research. The sponsored research income data included in this report covers Fiscal years 1999 to 2002[7] and is used to help calculate 2 indicators - Publication Efficiency and Publication Effectiveness (see below).

- Research income is obtained directly from the universities and compiled by Statistics Canada for Canadian Association of University Business Officers (CAUBO).

- Where applicable, RE$EARCH Infosource Inc. has combined data from affiliated institutions with those of the main university.

[6] Less than 1.0% of faculty each year were not classified by discipline and are not counted in the total faculty numbers.
[7] Sponsored research income for Fiscal years 1999 to 2004 for each universities are included in the Appendices for reference.

Indicators

Publication Intensity

- Publication intensity is defined as the total number of publications per full-time faculty (full, associate and assistant) in approximately 6,000 peer-reviewed international journals.

- Faculty data included in this report is offset with publication data by approximately 2.5 years for this indicator. For example, the number of faculty for the academic year Fall 1996-Spring 1997 is used with the publication year 1999 (based on a calendar year). This offset allows for the research to be completed and published. It is understood that this time period varies for different disciplines, therefore, the offset of 2.5 years is an average.

- It is important to keep in mind that the publication intensity could be somewhat skewed as there is not an exact match between the Statistics Canada faculty and OST discipline classifications. For instance, the faculty discipline classification includes various study areas that have no corresponding journals included in the OST classification. Therefore in these cases, the number of publications would be understated in relation to the faculty counts. On the other hand, in many cases faculty from one discipline have written articles classified in other disciplines. In this case, the faculty counts would be understated when compared with publication output.

- Although there are some inherent difficulties in bringing together faculty and publication data, useful insights can be gained by examining the movement of publication and faculty counts. However, the reader should treat these faculty numbers (and any indicators that use faculty data) with caution and view them as trend data only.

Publication Efficiency

- Publication efficiency is a new indicator developed by RE$EARCH Infosource Inc. to compare each university's efficiency (cost advantage) in converting research investment into publication output. It is essentially a cost-per-publication calculation.

- Publication efficiency scores are best compared within university groupings (tiers) – Medical/Doctoral, Comprehensive, Undergraduate – but not across tiers as these tiers tend to engage in different kinds of research. Medical/Doctoral universities, for example, typically undertake the most advanced – and often most costly – forms of research.

- Publication efficiencies are calculated for 4 of the 6 years in the study period (2001-2004). This allows 2.5 years for research to be conducted and published. Year 1 funding is compared with Year 3 publications, to account for the delay in conducting and publishing research. For example, the research income for Fiscal 1998-1999 (year-end usually between March and June) is used with the publication year 2001 – which is based on a calendar year.

Publication Effectiveness

- Publication effectiveness is another new indicator developed by RE$EARCH Infosource Inc. In essence it is a value-for-money calculation. Publication effectiveness compares each university's efficiency (cost advantage) with its impact (quality advantage) in relation to those of similar institutions. Publication effectiveness presupposes that an institution that consistently delivers high quality research at low cost is more effective than a similar institution that consistently produces lower quality research at higher cost.

- Specifically, RE$EARCH Infosource Inc. assigns a value to each university's efficiency advantage and its impact advantage. The efficiency advantage is a university's publication efficiency as a fraction of the average efficiency of similar universities. Likewise, the impact advantage is a university's publication impact as a fraction of the average impact of similar universities. The product of the two numbers is publication effectiveness. For example, a hypothetical Tier 1 Medical/Doctoral university calculation might go as follows:

Sample Publication Effectiveness Calculation				
Cost Advantage Calculation		**Impact Advantage Calculation**		**Effectiveness Calculation**
University Efficiency	$80.5	University Impact	1.34	
Avg. Tier Efficiency	$106.4	Avg. Tier Impact	1.11	1.0 x 1.0 = 1.00 Baseline
Cost Advantage ($106.4/$80.5)	**1.32**	Impact Advantage 1.34/1.11	**1.21**	1.32 x 1.21 = **1.60**

- Publication effectiveness scores can be compared within university groupings (tiers) – Medical/Doctoral, Comprehensive, Undergraduate – but not across tiers. Effectiveness scores cannot be added, divided, subtracted or multiplied.

- The publication effectiveness scores are available for 2 of the 6 years covered by CUP 2006 and based on the assumption that funding received in Year 1 will produce results (publications) in Year 3 and in turn, these publications will have impact in Year 5. Thus, there is a 4 year lag between research funding and publication impact, meaning that in any 6 year period we can only calculate 2 years of publication effectiveness. The report contains the publication effectiveness scores for 2004.