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Measuring the Effectiveness of Research Grant Getting*

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ABSTRACT

To a very large extent, the national and international reputation of major research universities depends upon their research performance. That explains why competition is so fierce among them to get as much as they can from the three Canadian government major granting agencies. This study demonstrates how performance indicators were developed to measure the effectiveness of research grant getting among eleven Canadian universities. It shows how amount of money received, size of teaching staff, and disciplinary characteristics were standardized to yield objective disciplinary and institutional rankings.

RÉSUMÉ

La réputation nationale et internationale des principales universités où il se fait beaucoup de recherche dépend dans une très large mesure de leur rendement dans ce domaine. C'est pourquoi ces institutions mènent une lutte serrée pour obtenir le maximum de subventions des trois principaux organismes subventionnaires du gouvernement canadien. L'article porte sur l'approche utilisée pour mesurer, à l'aide des indices de rendement, l'efficacité des subventions de recherche réparties entre onze universités canadiennes. Il montre que pour en arriver à un classement objectif des disciplines et des institutions, il a fallu standardiser les sommes versées, l'importance numérique du corps professoral et les caractéristiques disciplinaires.

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In 1984-1985, the Government of Canada invested 0.7 billion$ in academic research through grants. That money was seen as a direct means to develop and train hundreds of young people, to contribute to the attainment of national economic growth, and to promote the production of new knowledge. Although this money constitutes a substantial capital outlay from the grantor's vantage point, it plays an even more important role in the organization of academe (Jencks and Riesman, 1969; Light, 1974).

Universities expect research activities from their faculty members in order to complete the triangle of their three major functions: teaching, research and service. The range of faculty workload percentage devoted to research in universities was found to vary between 14% and 25% on the basis of types of institutions (Ladd & Lipsett, 1972, 1974, 1976; Baldridge et al., 1978; Berkeley, 1978). Notwithstanding the existence of other forms of research output, publications are almost universally recognized by academics as the competence and performance test. To make that point, scores of authors have dealt with the evaluation of university professors' research productivity and performance (Jauch and Glueck, 1975; Rushton and Meltzer, 1981; Ingalls, 1982; Université de Montréal, 1985). Most were concerned with multiple measures of research output and impact, and with sophisticated weightings of various kinds of publications for inter-institutional disciplinary comparisons and quality rankings. Due mainly to the construction of Citation Indices in the Sciences (SCI) the Social Sciences (SSCI), and the Arts and Humanities (A&HCI), the list of articles dealing with bibliometric measures is almost endless. The pros and cons of using bibliometric data were competently summarized by Moed et al. (1984). By contrast to those finely tuned techniques, Jauch and Glueck (1975) studied eighty-six (86) professors in twenty-three (23) departments in natural, mathematical, medical and biological sciences who had been involved in significant research over a five-year period; they came to the conclusion that effectiveness could be measured by a simple count of the number of publications in respectable journals.

Getting a grant may not only facilitate publication productivity, but may depend on it. Therefore, it is no great surprise to observe fierce competition among universities and individual scholars to get as much as they can from the national pie. Aside from the sheer money involved, grant-supported research attracts high caliber graduate students, helps to build disciplinary empires, buys modern equipment, promotes publications, and provides travel money for scientific conferences. National and international reputations of universities as well as scholars are built on research performance and grantsmanship capabilities.

This paper is an attempt to develop research funding performance indicators that will measure the degree of grantsmanship effectiveness across institutions and within disciplinary fields. Should widespread performance discrepancies be found, institutions would undoubtedly be interested in identifying and explaining the factors which give them the edge or put them in an unfavorable position.

The Meritocratic Competition for Grants

The distribution of grants is selective because there exists some scarcity of funds. Given the disparity between demand and supply, grants of any size become important precisely because they are allocated on a competitive and meritocratic basis. Obviously, agencies differ in the competitiveness of their grants, or in the productivity of their recipients, in a rank order roughly similar to an intuitive ranking by cosmopolitanism (Liebert, 1977). The least competitive grants are those allocated at intramural, provincial and local government, and industrial levels. They aim at specific objectives often related to regional problem-solving activities and development. At the other end of the spectrum are the main federal granting agencies. In Canada, the agencies which can be considered in the major leagues are the Natural Sciences and Engineering Research Council (NSERC), the Medical Research Council (MRC), and the Social Science and Humanities Research Council (SSHRC). These three national councils distributed 0.5 billion $ Can. in 1984-1985 through a highly selective peer review process.

As was mentioned earlier, publications feed the communication system and identify the most productive and authoritative researchers in various specialties. Successful recipients are those with substantial track records of knowledge productivity. They are scholars who either publish a lot, or publish significant work or do both, with the implication that quantity over a career span implies quality. Skeptics may argue that aside from interfield differences, particular institutional circumstances and personal assets make the competition-on-merit principle more ambiguous. This line of reasoning might have some value with the lower-ranked granting agencies but is not substantiated by grantsmanship research findings when highly competitive grantors are considered. After analyzing factors such as institutional wealth, enrollment selectivity, library facilities, regional location, career age, salary, consulting activities, and other institutional and individual characteristics, Liebert (1977) and Bayer (1973) concluded that grant-supported research was "virtually unrelated to institutional and personal status characteristics". What is important is "individual productivity." Until the grant-getting process can be proven biased, it would appear that the correlation between publication productivity and grant recipientship is very high and credible.

Interfield Differences

A measure of caution must be exercised when dealing with different fields. First, not all fields need research grants to conduct research. Such is the case with a few disciplines in the humanities and letters where an excellent library and a competent mind are the two most essential elements to generate research and knowledge. Second, a number of disciplines must receive a certain level of grant support if they are to be research productive. However, the size of grants received can be kept relatively small because there is no or little equipment involved. These could be qualified first and foremost as labour intensive.

TABLE 1

DISCIPLINARY SECTORS

NUMBER	IDENTIFICATION	EXAMPLE
01	Peri-medical Sciences	Dentistry
02	Para-medical Sciences	Nursing
03	Pure Sciences	Geology
04	Applied Sciences	Engineering
05	Humanities and Social Sciences	History
06	Education	Educational Technology
07	Administrative Sciences	Health Administration
08	Arts	Music
09	Letters	Linguistics
10	Law	Law
11	Medicine and Specialties	Surgery

NOTE: The complete breakdown of each disciplinary sector can be obtained from the author or from the Quebec Ministry of Higher Education and Technology as indicated in the reference section.

Third, there are the medical, natural, and engineering sciences where large amounts of money are crucial. The larger the grants get, the more money goes to support a facility or an organized research team rather than merely a principal investigator. In many instances, the decision involved in giving grants to particular individuals is based not only on the track records of these researchers but also on the facilities and equipment already at the researchers' disposal. Critics might suggest that some fields attract more grants than others because their products and effects are deemed to have greater social value. Whatever the case may be, scholars of all fields are involved in the politics of priority setting to secure as much money as possible for their respective fields.

Despite that caution, it is interesting to point out that in a 1985 extensive study conducted at the Université de Montréal, 52% of all faculty members received grants in 1983-1984. One might believe that this high percentage was the result of a high degree of success observed primarily in the medical, natural, and engineering sciences. That was not necessarily the case, since in the same year, grants were received by 54% of humanities professors, 51% by education professors, and 47% and 41% respectively by philosophy and letters faculty members.

Although the number of grants might be on an equal footing across disciplines, numbers alone would not recognize the distinctiveness of the size of grants among various fields. This is a sufficient reason to regroup similar fields together and not to have comparisons across different disciplinary groupings or sectors. This methodological precaution must be secured if one is to make reasonable comparisons of similar sectors across institutions.

Developing Grantsmanship Performance Indicators

The computation of absolute dollar numbers for a single institution from year to year is a necessary exercise to monitor trends, but one that fails to capture the degree of success and/or competitiveness vis-à-vis comparable universities. In the development of a methodology that has the capability of assessing the competition, three factors must be accounted for: disciplinary groupings or sectors, teaching staff, and the actual amount of money received from granting agencies.

Disciplinary Groupings – Ideally, each field or discipline should be kept separate and analyzed separately. From a methodological point of view, this is easy to achieve assuming that an adequately detailed database is already in place. Oftentimes, given the multiplicity of academic units in large institutions, management is primarily interested in identifying the strengths and weaknesses of broader disciplinary areas as a whole for strategic planning purposes. This identification keeps the number of disciplinary sectors down to a manageable size and does not preclude the further probing into single disciplines if such probing is called for.

This study broke down fields to eleven (11) disciplinary sectors, the same ones used by the Quebec Ministry of higher education and technology to finance additional student enrollment (Ministère de l'éducation, 1983). The number of fields regrouped in each of the sectors presented in Table 1 is variable because sector 10 includes only law while sectors 05 and 11 aggregate many disciplines on the basis of established commonalities.

Grant Dollars Received – For the purpose of this article, only NSERC, MRC, and SSHRC, the three most competitive federal granting agencies were retained. All grants awarded to each recipient in all universities are recorded by the Canadian Institute for Scientific and Technical Information (National Research Council of Canada) in an annual publication called *Directory of Federally Supported Research in Universities*. The exploitation of that information for specific management objectives unfortunately must be conducted by hand since the Can-Ole system used by that agency is more amenable to bibliographic manipulations than to statistical and managerial tabulations. Despite the very cumbersome sorting out process involved, grants can be classified in any field and disciplinary sector chosen.

Teaching Staff – The previously explained distinctiveness of interfield differences in terms of grant-supported research funding volume makes it equally important to have the teaching staff categorized in the proper disciplinary sectors. Given the grant size variability among disciplinary groupings, one can readily assess how much distortion would be built into any comparison attempts if relative institutional disciplinary emphases were not accounted for.

Statistical readings of university teaching staff data should be a fairly straightforward affair. Nevertheless, they have generated much internal and external debate mainly because there exists more than one statistic per institution.

TABLE 2

RESEARCH GRANTS (NSERC, MRC, SSHRC) AND TEACHING STAFF
FOR 11 SELECTED MULTIVERSITIES AND TOTAL CANADA

Sectors		1982-1983		1976-1977		1972-1973	
		Multi-versities	Total Canada	Multi-versities	Total Canada	Multi-versities	Total Canada
Peri-	$[a]	11,293,711	12,995,102	4,677,457	5,443,277	3,332,319	3,871,473
medical	%$	86.9		85.9		86.0	
	F	673	818	637	788	543	665
01	%F	82.5		81.0		82.0	
	P	1.05		1.06		1.04	
Para-	$	1,461,466	2,037,192	307,861	466,989	151,186	280,766
medical	%$	71.7		65.9		53.8	
	F	698	1,039	688	1,031	527	737
02	%F	67.2		66.9		71.7	
	P	1.06		0.98		0.75	
Pure	$	64,867,707	108,178,958	25,887,187	42,424,480	18,460,067	29,496,124
Sciences	%$	59.9		61.0		62.5	
	F	2,787	6,017	2,763	5,937	2,556	5,523
03	%F	46.4		46.5		46.4	
	P	1.29		1.31		1.34	
Applied	$	39,003,865	67,047,005	14,032,090	22,796,127	11,399,097	17,475,456
Sciences	%$	58.1		61.5		65.2	
	F	1,428	2,943	1,360	2,683	1,311	2,361
04	%F	48.5		50.6		55.5	
	P	1.19		1.21		1.17	
Humanities	$	12,634,205	23,636,314	3,435,782	5,704,867	3,297,003	5,298,610
& Soc.	%$	53.4		60.2		62.2	
Sciences	F	3 343	8,723	3,300	8,429	3,024	7,534
05	%F	39.4		39.1		40.1	
	P	1.35		1.53		1.54	
Education	$	1,215,956	2,593,780	81,546	335,065	56,571	148,945
	%$	46.8		24.3		37.9	
	F	1,570	3,171	1,623	3,267	1,431	2,611
06	%F	49.5		49.8		54.9	
	P	0.94		0.48		0.69	
Adm.	$	1,087,980	2,099,130	146,044	313,732	82,955	178,516
Sciences	%$	51.8		46.5		46.4	
	F	807	1,875	698	1,505	572	1,059
07	%F	43.0		46.4		54.1	
	P	1.20		1.00		0.85	
Arts	$	555,609	815,909	129,849	168,508	129,121	163,822
	%$	68.0		77.0		78.8	
	F	535	1,446	516	1,279	429	1,014
08	%F	37.0		40.5		42.4	
	P	1.83		1.90		1.85	
Letters	$	1,233,185	2,527,071	380,122	614,929	500,189	802,698
	%$	48.7		61.8		62.3	
	F	1,353	3,113	1,368	3,179	1,440	3,296
09	%F	43.5		43.2		43.8	
	P	1.12		1.43		1.42	
Law	$	264,799	370,941	15,064	35,996	53,130	61,464
	%$	71.3		41.8		86.4	
	F	353	676	331	564	298	489
10	%F	52.3		58.6		60.9	
	P	1.36		0.71		1.41	
Medicine	$	71,302,350	85,209,008	29,811,995	34,894,959	21,406,544	24,992,841
&	%$	83.6		85.4		85.6	
Specialties	F	3,034	3,854	2,380	3,046	2,021	2,516
11	%F	78.8		78.3		80.3	
	P	1.06		1.09		1.06	
Total	$	204,920,833	307,510,410	78,907,997	113,198,929	58,868,182	82,770,715
	%$	66.6		69.7		71.1	
	F	16,674	33,722	15,664	31,682	14,152	27,813
	%F	49.6		49.4		51.0	
	P	1.34		1.40		1.39	

[a] $ = Absolute dollars
%$ = $ Multiversities/$ Total Canada
F = Number of faculty members
%F = F Multiversities/F Total Canada
P = %$/%F

This situation is a consequence of our Canadian decentralized education system, of university autonomy in defining their own internal parameters, and of the many different definitions used by agencies to which institutions are requested to report data. Statistical readings of staff are therefore difficult but should not be looked upon as totally atypical and insurmountable.

In this study, a special computer run of the Universities and Colleges Academic Staff (UCAS) file was done by the Education Division of Statistics Canada. The exploitation of that file yielded all full-time teaching faculty members excluding deans, librarians, research personnel with rank, central administration personnel, and clinicians. It must be noted that UCAS classifies each faculty member on the basis of the subject taught, and not according to the hiring unit or the specialization of the highest degree received. Hence, a faculty member with a Ph.D. in mathematics, hired by a business school and teaching computer science is classified in computer science (Sector 4). There remains some ambiguity as to whether his/her research activities and grants are related to business or to computer science. Other sorting out criteria have also their shortcomings including the reliability and comparability of the database. In any case, the Statistics Canada file was judged to be the best available and apparently the most reliable, since figures are forwarded by institutions. At the time this study was being conducted the last complete year on file was 1981-1982.

Performance Indicator – The development of this research grant getting performance indicator was based on the assumption that if all faculty members of each disciplinary sector for each university had the same motivation, competence, and productivity, a perfect correlation of 1.0 should be found between grant money received by a disciplinary sector as a percentage of the total national dollar amount awarded to that sector and the teaching staff classified in that same disciplinary sector as a percentage of total faculty members in the same sector across Canada. The mathematical expression of the performance indicator was as follows:

$$P_{ijt} = \frac{\%G_{ijt}}{\%F_{ijt}}$$

where P = Performance indicator
G = Grant money ($) received as a percentage of the total national (or of a more limited pool) dollar amount awarded
F = Faculty members as a percentage of the national (or a more limited pool) teaching staff
i = Specific disciplinary sector
j = Specific university
t = Year surveyed

Given the premises of that indicator, each university, either within each disciplinary sector or as a whole, can be assigned a performance ranking. The higher the ratio, the better the performance and vice-versa.

Presentation and Analysis of Results

As spelled out in the mathematical expression of the performance indicator, this methodology has the capability of yielding results at the macro or micro level. The initial incentive to generate this study came from the Planning Committee of the University of Montreal who was interested in having a better grasp of how effective or competitive the University was at getting grants when matched with similar institutions. Hence, selection of universities offering a wide coverage of academic programs including medical education and known for their excellence on graduate studies was made. Other criteria such as region, size, and operating budget were considered in arriving at the final selection. On that basis, eleven major research universities, referred to in this study as multiversities, were compared. There is no doubt that other institutions could have been included because of their excellence in specific disciplines and disciplinary sectors. It was felt necessary that each multiversity be represented in each of the disciplinary groupings. With the exception of McMaster University which does not have a Law School (Sector 10), that objective was achieved.

Table 2 gives the readers an overview of the relative importance of these eleven multiversities from a research grant and teaching staff point of view. First, it must be noted that three reference years were used. When this study was initiated in the Fall of 1984, National Research Council Canada had not completed its 1983-1984 *Directory* edition of research grants, and Statistics Canada did not have a complete file on teaching staff for 1982-1983. The 1982-1983 reference year is composed of 1982-1983 grant figures and 1981-1982 teaching staff data. The second feature of Table 2 can be readily shown by a reading of the Total Sectors row at the very bottom. The research grants received by the selected universities range from 71.1% in 1972-1973 to 66.6% in 1982-1983 out of the total grant dollar figure awarded to the more than fifty (50) Canadian universities, while their teaching staff accounted for approximately 50% of the Canadian pool. As a consequence, their overall performance as indicated by the performance indicators (P) was very strong.

Identification of the Best Performers – Tables 3 and 4 are intended to give a step-by-step approach to the mechanics of the performance indicator and to present the database used for each university. To the extent that data provided by the two national data gathering agencies are exact, Table 3 shows actual grant dollar amount and teaching staff numbers for each multiversity per disciplinary grouping. Table 4 is a conversion of absolute numbers of Table 3 into percentages. The very first line of the peri-medical (01) sector indicates that in 1982-1983, the University of Alberta with a teaching staff that represented only 9.6% was receiving 12.7% of the research grant amount allocated to the eleven multiversities in that same sector. The overall percentage comparison between grants and teaching staff of the University of Alberta can also be seen in the last three lines of Table 4. Across disciplinary sectors, the percentage of teaching staff is somewhat higher than that of research grants. That being the case, one should expect the

TABLE 3
RESEARCH GRANTS (NSERC, MRC, SSHRC) AND TEACHING STAFF
FOR EACH OF THE 11 SELECTED MULTIVERSITIES
PER DISCIPLINARY SECTOR

SECTORS	YEARS	ALBERTA		BR. COLUMB.		DALHOUSIE		LAVAL		MANITOBA		MCGILL		MCMASTER		MONTREAL		SASKAT.		TORONTO		W. ONT.		TOTAL MULTI	
		a $	b F	$	F	$	F	$	F	$	F	$	F	$	F	$	F	$	F	$	F	$	F	$	F
Peri-	1982-83	1435	65	2280	86	129	53	139	42	1071	50	567	31	-	18	245	104	1407	106	3439	83	583	35	11294	673
Medical	1976-77	1082	60	287	82	46	55	16	35	737	54	419	36	-	7	190	90	302	104	1400	70	198	44	4677	637
01	1972-73	421	48	671	70	5	36	89	26	519	51	421	10	-	8	42	97	196	86	824	71	146	40	3332	543
Para-	1982-83	64	89	581	99	-	48	324	42	93	67	16	39	12	35	31	87	86	46	244	82	10	65	1461	698
Medical	1976-77	37	86	145	89	-	41	40	45	36	70	-	43	-	31	17	102	21	47	11	72	-	62	308	688
02	1972-73	34	66	74	51	-	25	9	23	13	67	-	39	-	23	-	67	12	40	10	79	-	47	151	527
Pure	1982-83	5986	311	9635	410	2903	125	3348	289	4388	254	6472	302	5894	139	4667	264	5745	138	11667	359	4162	196	64868	2787
Sciences	1976-77	3421	290	3858	395	1250	135	1396	301	1769	230	2494	312	2637	152	2378	249	1316	139	3788	356	1580	204	25887	2763
03	1972-73	2009	289	2238	380	622	98	1221	265	1100	231	1656	284	2048	117	1838	237	543	153	3593	307	1591	195	18460	2556
Applied	1982-83	3559	129	4709	152	1109	7	2795	139	2646	124	3675	121	4392	78	4181	264	1802	105	8380	247	1756	62	39004	1428
Sciences	1976-77	1034	123	1701	142	226	6	1221	140	761	116	1465	125	1170	71	1622	225	1000	99	3337	252	495	61	14032	1360
04	1972-73	1133	116	1484	136	141	6	934	126	487	126	1318	123	1124	76	884	211	953	91	2564	242	377	98	11399	1311
Hum. &	1982-83	683	272	1651	328	807	136	634	364	513	312	1467	212	1101	231	1430	404	255	178	2397	669	1696	330	12634	3436
Soc. Sci.	1976-77	235	257	421	325	405	138	108	324	122	279	406	241	469	226	192	398	27	166	656	643	394	303	3436	3300
05	1972-73	166	261	319	306	215	127	273	249	99	287	404	235	583	201	261	271	86	154	616	614	275	319	3297	3024
Educatior	1982-83	34	237	67	261	44	54	332	110	-	107	61	95	33	24	52	149	4	124	566	296	21	113	1216	1570
	1976-77	37	249	5	256	-	52	3	126	18	98	1	93	-	21	-	159	-	118	17	312	-	139	82	1623
06	1972-73	34	219	8	213	2	39	4	136	-	81	-	84	-	30	1	93	-	119	7	307	-	110	57	1431
Adm.	1982-83	21	79	129	120	27	46	84	72	12	48	208	65	99	37	49	114	-	49	210	80	249	97	1088	807
Sciences	1976-77	10	66	60	104	4	40	10	55	-	52	24	55	5	37	-	90	3	44	18	73	12	82	146	698
07	1972-73	-	69	39	76	-	24	4	61	-	42	4	29	-	25	20	68	-	39	13	56	3	83	83	572
Arts	1982-83	-	72	79	66	-	17	-	59	-	54	104	50	48	20	-	37	-	29	286	69	39	62	556	535
	1976-77	-	77	2	64	-	20	-	56	-	47	1	48	-	18	75	24	-	31	48	71	5	60	130	516
08	1972-73	8	70	9	61	-	16	11	49	-	22	3	37	-	20	65	21	-	32	34	60	-	41	129	429
Letters	1982-83	49	153	59	207	-	46	109	103	222	69	109	115	93	67	248	44	19	59	255	379	6	111	1233	1353
	1976-77	7	155	46	168	7	59	117	106	14	72	31	127	-	71	80	33	10	57	24	402	44	118	380	1368
09	1972-73	11	156	20	172	21	64	181	104	23	86	36	119	13	68	36	65	2	68	136	402	21	136	500	1440
Law	1982-83	8	28	54	43	-	37	59	52	-	22	24	29	NA	NA	-	56	-	21	6	31	115	34	265	353
	1976-77	3	24	4	42	4	34	-	52	-	23	-	27	NA	NA	-	46	-	23	3	30	-	30	15	331
10	1972-73	-	17	5	36	-	28	23	44	6	21	-	18	-	1	3	65	-	19	15	28	-	21	53	298
Medicine & Spe-	1982-83	4658	158	6064	284	3122	234	3694	122	4801	242	13493	309	4704	286	8027	261	1572	213	16980	594	5188	331	71302	3034
cialties	1976-77	1752	166	2048	195	1053	204	1276	133	2310	210	5764	199	2306	197	3518	222	758	152	6981	437	2048	265	29812	2380
11	1972-73	1576	138	1676	165	627	160	779	126	1555	130	4464	190	1557	151	2835	228	608	127	4699	397	1030	209	21407	2021
TOTAL	1982-83	16496	1593	25310	2056	8141	803	11518	1394	13745	1349	26197	1367	16375	935	18929	1784	10892	1068	43429	2889	13888	1436	204921	16674
	1976-77	7619	1553	8577	1862	2996	784	4188	1373	5767	1251	10605	1306	6587	831	8072	1638	3437	980	16283	2718	4776	1368	78908	15664
	1972-73	5392	1449	6542	1666	1632	623	3528	1209	3803	1144	8306	1168	5325	720	5984	1423	2400	928	12512	2563	3443	1259	59868	14152

[a] $ = Dollar figures rounded out to nearest thousand
[b] F = Number of faculty members

TABLE 4
RESEARCH GRANTS (NSERC, MRC, SSHRC) AND TEACHING STAFF
FOR EACH OF THE 11 SELECTED MULTIVERSITIES AS A PERCENTAGE (%)
OF THE TOTAL MULTIVERSITIES PER DISCIPLINARY SECTOR

SECTORS	YEARS	ALBERTA		BR. COLUMB.		DALHOUSIE		LAVAL		MANITOBA		MCGILL		MCMASTER		MONTREAL		SASKAT.		TORONTO		W. ONT.		TOTAL MULTI	
		a %$	b %F	%$	%F	%$	%F	%$	%F	%$	%F	%$	%F	%$	%F	%$	%F	%$	%F	%$	%F	%$	%F	c %$C	d %FC
Peri-	1982-83	12.7	9.6	20.1	12.7	1.1	7.8	1.2	6.2	9.4	7.4	5.0	4.6	-	2.7	2.1	15.4	12.4	15.7	30.4	12.3	5.1	5.2	86.9	82.5
Medical	1976-77	23.1	9.4	6.1	12.8	0.9	8.6	0.3	5.4	15.7	8.4	8.9	5.6	-	1.0	4.0	14.1	6.4	16.3	29.9	10.9	4.2	6.9	86.9	81.0
01	1972-73	12.6	8.8	20.1	12.8	0.1	6.6	2.6	4.7	15.5	9.3	12.6	1.8	-	1.4	1.2	17.8	5.8	15.8	24.7	13.0	4.3	7.3	86.0	82.0
Para-	1982-83	4.3	12.7	39.7	14.1	-	6.9	22.1	6.0	6.3	9.5	1.1	5.4	0.8	5.0	2.1	12.4	5.9	6.5	16.6	11.7	0.7	9.3	71.7	67.2
Medical	1976-77	12.0	12.5	47.2	12.9	-	6.0	13.0	6.5	11.6	10.1	-	6.3	-	4.5	5.4	14.8	6.7	6.8	3.6	10.4	-	9.0	65.9	66.9
02	1972-73	22.1	12.5	48.7	9.6	-	4.7	5.9	4.3	8.6	12.7	-	7.4	-	4.4	-	12.7	7.9	7.5	6.6	14.9	-	8.9	53.8	71.7
Pure	1982-83	9.2	11.1	14.8	14.7	4.4	4.4	5.1	10.3	6.7	9.1	9.9	10.8	9.0	4.9	7.1	9.4	8.8	4.9	17.9	12.8	6.4	7.0	59.9	46.4
Sciences	1976-77	13.2	10.4	14.9	14.2	4.8	4.8	5.3	10.8	6.8	8.3	9.6	11.2	10.1	5.5	9.1	9.0	5.0	5.0	14.6	12.8	6.1	7.3	61.0	46.5
03	1972-73	10.8	11.3	12.1	14.8	3.3	3.8	6.6	10.3	5.9	9.0	8.9	11.1	11.0	4.5	9.9	9.2	2.9	5.9	19.4	12.0	8.6	7.6	62.5	46.4
Applied	1982-83	9.1	9.0	12.0	10.6	2.8	0.4	7.1	9.7	6.7	8.6	9.4	8.4	11.2	5.4	10.7	18.4	4.6	7.3	21.4	17.2	4.5	4.3	58.1	48.5
Sciences	1976-77	7.3	9.0	12.1	10.4	1.6	0.4	8.7	10.2	5.4	8.5	10.4	9.1	8.3	5.2	11.5	16.5	7.1	7.2	23.7	18.5	3.5	4.4	61.5	50.6
04	1972-73	9.9	8.8	13.0	10.3	1.2	0.4	8.1	9.6	4.2	9.6	11.5	9.3	9.8	5.7	7.7	16.0	8.3	6.9	22.4	18.4	3.3	4.4	65.2	55.5
Hum. &	1982-83	5.4	7.9	13.0	9.5	6.3	3.9	5.0	10.5	4.0	9.0	11.6	6.1	8.7	6.7	11.3	11.7	2.0	5.1	18.9	19.4	13.4	9.6	53.4	39.4
Soc. Sci.	1976-77	6.8	7.7	12.2	9.8	11.7	4.1	3.1	9.8	3.5	8.4	11.8	7.3	13.6	6.8	5.5	12.0	0.7	5.0	19.0	19.4	11.4	9.1	60.2	39.1
05	1972-73	5.0	8.6	9.6	10.1	6.5	4.2	8.2	8.2	3.0	9.4	12.2	7.7	17.6	6.6	7.9	8.9	2.6	5.0	18.6	20.3	8.3	10.5	62.2	40.1
Education	1982-83	2.8	15.0	5.5	16.6	3.6	3.4	27.3	7.0	-	6.8	5.0	6.0	2.6	1.5	4.2	9.4	0.3	7.8	46.5	18.8	1.7	7.1	46.8	49.5
	1976-77	45.4	15.3	6.1	15.7	-	3.2	4.4	7.7	21.5	6.0	1.9	5.7	-	1.5	-	9.8	-	7.3	20.3	19.2	-	8.6	24.3	49.8
06	1972-73	60.5	15.3	14.1	14.8	3.8	2.7	6.8	9.5	-	5.7	-	5.9	-	2.1	1.3	6.4	-	8.3	13.1	21.4	-	7.7	37.8	54.9
Adm.	1982-83	1.9	9.7	11.8	14.8	2.4	5.7	7.7	8.9	1.1	5.9	19.1	8.0	9.0	4.5	4.4	14.1	-	6.1	19.2	9.9	22.8	12.0	51.8	43.0
Sciences	1976-77	6.7	9.4	41.2	14.9	2.9	5.7	6.6	7.8	-	7.4	16.5	7.8	3.4	5.3	-	12.9	1.7	6.3	12.3	10.4	8.2	11.7	46.5	46.4
07	1972-73	-	12.1	46.6	13.2	-	4.2	5.0	10.6	-	7.3	4.9	5.0	-	4.4	23.6	11.8	-	6.8	15.7	9.7	4.0	14.5	46.4	54.1
Arts	1982-83	-	13.5	14.2	12.3	-	3.2	-	11.0	-	10.1	18.7	9.3	8.5	3.7	-	6.9	-	5.4	51.4	12.8	6.9	11.5	68.0	37.0
	1976-77	-	14.9	1.3	12.4	-	3.9	-	10.9	-	9.1	0.4	9.3	-	3.5	57.7	4.6	-	6.0	36.9	13.7	3.5	11.6	77.0	40.5
08	1972-73	6.5	16.3	6.7	14.2	-	3.7	8.3	11.4	-	5.1	2.0	8.6	-	4.7	50.3	4.8	-	7.5	26.0	13.9	-	9.6	78.8	42.4
Letters	1982-83	4.0	11.3	4.8	15.2	-	3.4	8.8	7.6	18.0	5.1	8.8	8.5	7.5	4.9	20.1	3.2	1.5	4.3	20.6	28.0	5.5	8.2	48.7	43.5
	1976-77	1.8	11.3	12.0	12.2	1.9	4.3	30.8	7.7	3.8	5.2	8.0	9.2	-	5.2	21.0	2.4	2.4	4.1	6.3	29.3	11.6	8.6	61.8	43.2
09	1972-73	2.2	10.8	4.0	11.9	4.2	4.4	36.1	7.2	4.6	5.9	7.1	8.2	2.5	4.7	7.1	4.5	0.4	4.7	27.2	27.9	4.1	9.4	62.3	43.8
Law	1982-83	2.8	7.9	20.4	12.1	-	10.5	22.1	14.7	-	6.2	9.0	8.2	NA	NA	-	15.9	-	5.9	2.1	8.7	43.2	9.6	71.3	52.3
	1976-77	21.2	7.2	28.1	12.6	29.7	10.2	-	15.7	-	6.9	-	8.2	NA	NA	-	13.9	-	6.9	20.9	9.0	-	9.1	41.8	58.6
10	1972-73	-	5.7	10.3	12.0	-	9.4	43.7	14.7	10.7	7.0	-	6.0	NA	NA	6.2	21.8	-	6.4	28.9	9.3	-	7.0	86.4	60.9
Medicine & Specialties	1982-83	6.5	5.2	8.5	9.3	4.3	7.7	5.1	4.0	6.7	7.9	18.9	10.1	6.5	9.4	11.2	8.6	2.2	7.0	22.4	19.5	7.2	10.9	83.6	78.8
	1976-77	5.8	6.9	6.8	8.1	3.5	8.5	4.2	5.5	7.7	8.8	19.3	8.3	7.7	8.2	11.8	9.3	2.5	6.3	23.4	18.3	6.8	11.1	86.4	78.3
11	1972-73	7.3	6.8	7.8	8.1	2.9	7.9	3.6	6.2	7.2	6.4	20.8	9.4	7.2	7.4	13.2	11.2	2.8	6.2	21.9	19.6	4.8	10.3	86.6	80.3
TOTAL	1982-83	8.0	9.5	12.3	12.3	3.9	4.8	5.6	8.3	6.7	8.0	12.7	8.1	7.9	5.6	9.2	10.6	5.3	6.4	21.1	17.3	6.7	8.6	66.6	49.6
	1976-77	9.6	9.9	10.8	11.8	3.7	5.0	5.3	8.7	7.3	7.9	13.4	8.3	8.3	5.3	10.2	10.4	4.3	6.2	20.6	17.3	6.0	8.7	69.7	49.4
	1972-73	9.1	10.2	11.1	11.7	2.7	4.4	5.9	8.5	6.4	8.0	14.1	8.2	9.0	5.0	10.1	10.0	4.0	6.5	21.2	18.1	5.8	8.8	71.1	51.0

a %$ = $ Specific Multiversity/$ Total Multiversities
b %F = F Specific Multiversity/F Total Multiversities
c %$C = $ Total Multiversities/$ Total Canada
d %FC = F Total Multiversities/F Total Canada

TABLE 5
PERFORMANCE (P) INDICATOR[a] (NSERC, MRC, SSHRC) PER DISCIPLINARY SECTOR

SECTORS	YEARS	MCGILL	MCMASTER	TORONTO	BR. COLUM.	MONTREAL	ALBERTA	SASKATCH.	MANITOBA	DALHOUSIE	WES. ONT.	LAVAL	TOT./TOT. MUL./CAN.
Peri-Medical 01	1982-83	1.09 (5)[b]	- (11)	2.46 (1)	1.58 (2)	0.14 (9)	1.31 (3)	0.79 (7)	1.27 (4)	0.14 (9)	0.99 (6)	0.19 (8)	1.05
	1976-77	1.58 (4)	- (11)	2.72 (1)	0.47 (6)	0.28 (8)	2.45 (2)	0.39 (7)	1.85 (3)	0.11 (9)	0.61 (5)	0.06 (10)	1.06
	1972-73	6.85 (1)	- (11)	1.89 (2)	1.56 (4)	0.07 (9)	1.42 (5)	0.37 (8)	1.65 (3)	0.02 (10)	0.59 (6)	0.55 (7)	1.04
Para-Medical 02	1982-83	0.20 (7)	0.16 (9)	1.42 (3)	2.80 (2)	0.17 (8)	0.34 (6)	0.89 (4)	0.66 (5)	- (11)	0.07 (10)	3.68 (1)	1.06
	1976-77	- (8)	- (8)	0.35 (7)	3.65 (1)	0.36 (6)	0.96 (5)	0.99 (4)	1.14 (3)	- (8)	- (8)	2.00 (2)	0.98
	1972-73	- (7)	- (7)	0.44 (6)	5.03 (1)	- (7)	1.76 (2)	1.04 (4)	0.67 (5)	- (7)	- (7)	1.36 (3)	0.75
Pure Sciences 03	1982-83	0.92 (6)	1.82 (1)	1.39 (3)	1.01 (4)	0.76 (9)	0.82 (8)	1.78 (2)	0.74 (10)	0.99 (5)	0.91 (7)	0.49 (11)	1.29
	1976-77	0.85 (8)	1.85 (1)	1.13 (3)	1.04 (4)	1.01 (5)	1.25 (2)	1.01 (5)	0.82 (9)	0.98 (7)	0.82 (9)	0.49 (11)	1.31
	1972-73	0.80 (8)	2.42 (1)	1.62 (2)	0.81 (7)	1.07 (4)	0.96 (5)	0.49 (11)	0.66 (9)	0.87 (6)	1.13 (3)	0.63 (10)	1.34
Applied Sciences 04	1982-83	1.11 (5)	2.06 (2)	1.24 (3)	1.13 (4)	0.58 (11)	1.01 (7)	0.62 (10)	0.78 (8)	5.80 (1)	1.03 (6)	0.73 (9)	1.19
	1976-77	1.13 (5)	1.59 (2)	1.28 (3)	1.16 (4)	0.69 (10)	0.81 (8)	0.97 (6)	0.63 (11)	3.64 (1)	0.78 (9)	0.84 (7)	1.21
	1972-73	1.23 (4)	1.70 (2)	1.21 (5)	1.25 (3)	0.48 (10)	1.12 (7)	1.20 (6)	0.44 (11)	2.69 (1)	0.74 (9)	0.85 (8)	1.17
Hum. & Soc. Sci. 05	1982-83	1.88 (1)	1.29 (5)	0.97 (6)	1.36 (4)	0.96 (7)	0.68 (8)	0.39 (11)	0.44 (10)	1.61 (2)	1.39 (3)	0.47 (9)	1.35
	1976-77	1.62 (3)	1.99 (2)	0.98 (6)	1.24 (4)	0.46 (8)	0.87 (7)	0.15 (11)	0.42 (9)	2.81 (1)	1.24 (4)	0.32 (10)	1.53
	1972-73	1.57 (2)	2.66 (1)	0.92 (6)	0.95 (5)	0.88 (7)	0.58 (9)	0.51 (10)	0.31 (11)	1.54 (3)	0.79 (8)	1.00 (4)	1.54
Education 06	1982-83	0.83 (5)	1.75 (3)	2.47 (2)	0.33 (7)	0.45 (6)	0.18 (9)	0.04 (10)	- (11)	1.05 (4)	0.24 (8)	3.90 (1)	0.94
	1976-77	0.34 (6)	- (7)	1.05 (3)	0.39 (5)	- (7)	2.96 (2)	- (7)	3.56 (1)	- (7)	- (7)	0.57 (4)	0.48
	1972-73	- (7)	- (7)	0.61 (5)	0.95 (3)	0.20 (6)	3.95 (1)	- (7)	- (7)	1.42 (2)	- (7)	0.72 (4)	0.69
Adm. Sciences 07	1982-83	2.37 (1)	1.98 (2)	1.94 (3)	0.79 (6)	0.31 (8)	0.19 (9)	- (11)	0.19 (9)	0.43 (7)	1.90 (4)	0.86 (5)	1.20
	1976-77	2.10 (2)	0.65 (7)	1.18 (3)	2.76 (1)	- (10)	0.71 (5)	0.28 (9)	- (10)	0.51 (8)	0.70 (6)	0.84 (4)	1.00
	1972-73	0.97 (4)	- (7)	1.60 (3)	3.50 (1)	1.99 (2)	- (7)	- (7)	- (7)	- (7)	0.27 (6)	0.47 (5)	0.86
Arts 08	1982-83	2.00 (3)	2.29 (2)	3.99 (1)	1.15 (4)	- (6)	- (6)	- (6)	- (6)	- (6)	0.60 (5)	- (6)	1.83
	1976-77	0.04 (5)	- (6)	2.68 (2)	0.10 (4)	12.41 (1)	- (6)	- (6)	- (6)	- (6)	0.30 (3)	- (6)	1.90
	1972-73	0.24 (6)	- (7)	1.86 (2)	0.47 (4)	10.27 (1)	0.40 (5)	- (7)	- (7)	- (7)	- (7)	0.72 (3)	1.85
Letters 09	1982-83	1.04 (5)	1.51 (3)	0.73 (6)	0.31 (10)	6.18 (1)	0.35 (9)	0.36 (8)	3.53 (2)	- (11)	0.68 (7)	1.16 (4)	1.12
	1976-77	0.86 (5)	- (11)	0.21 (9)	0.98 (4)	8.72 (1)	0.16 (10)	0.60 (7)	0.72 (6)	0.45 (8)	1.35 (3)	3.97 (2)	1.43
	1972-73	0.86 (5)	0.54 (7)	0.97 (3)	0.34 (9)	1.57 (2)	0.20 (10)	0.10 (11)	0.78 (6)	0.95 (4)	0.43 (8)	5.00 (1)	1.42
Law 10	1982-83	1.10 (4)	NA NA	0.24 (6)	1.68 (2)	- (7)	0.36 (5)	- (7)	- (7)	- (7)	4.48 (1)	1.50 (3)	1.36
	1976-77	- (5)	NA NA	2.30 (3)	2.21 (4)	- (5)	2.93 (1)	- (5)	- (5)	2.89 (2)	- (5)	- (5)	0.71
	1972-73	- (6)	NA NA	3.08 (1)	0.85 (4)	0.28 (5)	- (6)	- (6)	1.51 (3)	- (6)	- (6)	2.96 (2)	1.41
Medicine & Specialties 11	1982-83	1.85 (1)	0.70 (8)	1.14 (5)	0.90 (6)	1.30 (2)	1.25 (4)	0.31 (11)	0.84 (7)	0.56 (10)	0.66 (9)	1.28 (3)	1.06
	1976-77	2.31 (1)	0.93 (4)	1.27 (2)	0.83 (7)	1.26 (3)	0.84 (6)	0.39 (11)	0.87 (5)	0.41 (10)	0.61 (9)	0.76 (8)	1.09
	1972-73	2.21 (1)	0.97 (6)	1.11 (4)	0.95 (7)	1.17 (2)	1.07 (5)	0.45 (10)	1.12 (3)	0.37 (11)	0.46 (9)	0.58 (8)	1.06
TOTAL	1982-83	1.55 (1)[c]	1.42 (2)	1.22 (3)	1.00 (4)	0.86 (5)	0.84 (6)	0.83 (7)	0.82 (8)	0.82 (8)	0.78 (10)	0.67 (11)	1.34
	1976-77	1.61 (1)	1.57 (2)	1.18 (3)	0.91 (6)	0.97 (4)	0.97 (4)	0.69 (9)	0.91 (6)	0.75 (8)	0.69 (9)	0.60 (11)	1.40
	1972-73	1.71 (2)	1.77 (1)	1.17 (3)	0.94 (5)	1.01 (4)	0.89 (6)	0.62 (11)	0.79 (7)	0.63 (10)	0.65 (9)	0.70 (8)	1.39

[a] P = $/$F
[b] ( ) = Ranking
[c] = The 1982-1983 overall ranking explains the order of presentation of each multiversity.

overall performance of that institution to be somewhat below the established norm of 1.0. The same rationale applies to other institutions throughout.

When percentages were worked into the performance indicator formula (Table 5), each institution received its performance grades within and across disciplinary sectors. The order of presentation of each institution in Table 5 is based on the 1982-1983 overall performance. That explains why McGill University and Laval University appear first and last respectively. The three top-ranked universities perform well above the established norm in most disciplinary sectors. McGill has kept its number one position in medicine; McMaster did the same in the pure sciences; and Toronto has had a strong showing in the peri-medical sector. As for the eight remaining institutions, one can observe wide variations within and across sectors, although some strength areas are also noticeable. For illustrative purposes, let us pinpoint a few examples. Dalhousie has been a top performer in the applied sciences and shows an excellent track record in the humanities and social sciences. Laval has firmed up its competitive edge in the para-medical sector along with British Columbia. Finally, Montreal, as a middle-of-the-pack performer does very well in letters and medicine. As a general observation, fluctuations are likely to be more frequent and wider in traditionally low research-funded sectors. While the level of funding is a disciplinary characteristic, the cause of the fluctuations can be mostly explained by the coming into play of small numbers.

Implications and Conclusions

Grantsmanship performance indicators can be a useful monitoring device to complement bibliometric data. In fields such as the natural, mathematical and life sciences where there is a close correlation between grantsmanship effectiveness and research productivity, the results of such indicators constitute rather convincing evidence to assess the degree of excellence and competitiveness of a faculty and/or an institution. In areas where grants are less built into the tradition and the basic requirements of disciplinary knowledge production, one might sensibly argue that such information is scarcely necessary or not necessary at all. To counteract that argument, we might reply that even in those disciplines, there is a definite pecking order or track record whereby a faculty or an institution has perennially demonstrated strengths. Therefore, they must be doing something right.

Results of performance indicators enable university research policy-makers to reinforce successes and to dispel quickly incorrect claims of strong performance. Such vital information is a *sine qua non* of sound policies for academic staff management. First, provided that similar institutions and disciplines are compared, such indicators constitute means to quantify the quality of a faculty and/or institution. Second, they serve as a gauge to determine the degree of exposure to and association with the international academic community. Third, they keep

reminding universities of developing and applying high quality standards in their recruitment, promotion, and reward policies if those same universities wish to acquire, improve, or maintain an international or even a national reputation. Fourth, universities must create the appropriate environment to maximize output. Two essential means to arrive at that consist of differentiated teaching loads and multiform incentives. The former produces greater equity whereas the latter has a way to motivate humans. That seems to be the key of the most successful universities in Canada.

In the final analysis, there is no doubt that the production of performance indicators for eleven disciplinary sectors is a considerable improvement over the simple division of all grant money by all teaching staff. It is also a further refinement of a University of Western Ontario in-house study (1984) which produced similar indicators by matching each of the three largest federal granting agencies with their respective potential recipients. Ideally, each separate field, discipline, or profession should be compared across institutions and ranked. To realize that objective which does not seem too distant or so formidable, both federal data gathering agencies will have to make adjustments. National Research Council Canada will have to facilitate the database access through electronic means and Statistics Canada will have to refine the notion of teaching staff. As it currently stands, the UCAS file includes lecturers and visiting academic staff and excludes academic staff who have been hired as researchers rather than teachers. Hopefully, this paper will encourage the above agencies and the universities to pursue common approaches to assist all parties in their assessment and management efforts.

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