Business Research in Eight Business Disciplines

by

Larry M. Robinson, Rice University
(lrobin@rice.edu)

and

Roy D. Adler, Pepperdine University
(roy.adler@pepperdine.edu)

ABSTRACT

This study recorded nearly 1.5 million citations to measure research productivity of the 4,918 full time faculty members with doctoral degrees at 51 leading US business schools. These schools had been included at least once in the 25 most recent ranking lists produced by three major business publications. This research included lifetime citation counts for each faculty member, and resulted in 1,497,162 citations that were recorded between March and June 2003.

The citation counts were cumulated by academic discipline. The disciplines for which rankings were made were accounting, economics, finance, information systems, marketing management science, organizational behavior, and strategy. Ranked lists of the top 25 schools in each disciple are included.

The paper contains a review of the literature on citation analysis, and suggests how citation analysis might be used as an assessment tool by business school administrators, professors, students, and corporate managers.

INTRODUCTION

Measuring the quality of academic faculties is a task that is both easy and difficult. It can be extremely easy, because one has only to ask the apparent leaders in the academic discipline, record their assessments of the reputations of various faculties, and draw conclusions based on their opinions. This can be done in a single day.

A more rigorous approach is to examine quantitative factors that might go into the recipe for reputation. Chief among them is the number of publications. The implicit assumption is that an author with a great number of publications has his or her work read very frequently by others in the field, and that the more often a n author is read, the more impact he or she has on the thinking of others.

The difficulty with this line of reasoning is that it is based on *quantity of production,* because only the number of articles is tallied. There is no attempt to measure whether the articles have influence or, in fact, whether they are even read by anyone. It could be, for example, that an author might have published dozens of articles, but none of the articles were ever used by anyone else to shape their thinking. In that case, an author rated fairly high in production quantity would be rated very low on measures of impact on others.

Impact measures would be very valuable, but they are elusive. It would not seem to be an easy task to determine the impact of the 4,918 full time faculty members with doctoral degrees at 51 leading US business schools. That task was accomplished using citation analysis, however, and the results are presented here as a series of rankings of the productivity of each school's business research in eight academic disciplines.

BACKGROUND ON CITATION ANALYSIS

Citation analysis is a process that measures the number of times a published article has been referenced in other articles worthy of publication. The overall concept is to regard an article as having impact if a subsequent author deems it important enough to merit citing it in her own published work. Authors, articles, and journals with the most citations can logically be considered to have had the most impact. The process can be used to measure that impact of individual articles, the impact of the authors of those articles, the impact of institutions, or the impact of groups of articles. In this particular case, it measures the impact of one school's faculty in a given discipline.

Citation analysis became an accepted method for analysis of research quality in the natural sciences in the early 1960s following the introduction of the *Science Citation Index (SCI)*. In 1969, the *Social Science Citation Index (SSCI)* became a new source of information about the citation practices of major journals in the social sciences. Since that time the number of social science journals included in *SSCI* has grown to about 1,700, with many of the journals including all citations dating back to 1975.

A citation is recorded when an article in one of the 1,700 journals indexed by *SSCI* has referenced a previous work, and that previous work is credited with the citation. Citation analysis is an established procedure for the analysis of contributions to knowledge, dissemination of knowledge, and extent of knowledge exchange in a given field (Garfield 1979), and is a way of tracing the development of thought in a discipline. Citation analysis can be used for several purposes, including evaluation of scientists, publications and institutions, investigation of hypotheses concerning the history or sociology of science and technology; and in the study of information search and retrieval procedures. (Peritz 1992).

Citation analysis has several advantages over other methods of evaluating research productivity in that it is objective, quantifiable, and a logical measure of quality. It is evidence that an article has not only been published, but has been read and referenced by someone else in an article good enough to be published in a journal included in the *SSCI*. The reference provides evidence of influence on the author who referenced it. As a quantifiable indication of influence on the work of others, it is an objective measure of research quality. Citation analysis has also been correlated with scientific productivity and peer judgments of performance (Bayer and Folger 1966).

Citation analysis is not without issues, and citation practices vary greatly by author. A critical review of citations analysis by MacRoberts and MacRoberts (1989) examined the issues in use of citation counts, including biased citing, self-citing, and difficulties in treating citations of multiple authors for an article. The article also noted variations in citation rate related to type of publication, nationality, time period, and size of specialty area. Low citation rates for many journal articles suggest much of published work in social science journals does not get read (Mahoney 1987, Hamilton 1991).

The first known use of citations in the marketing discipline was the measurement of the impact of marketing scholars and institutions over the four-year period 1972-1975 (Robinson and Adler 1981). The accounting discipline began to use citation analysis to assess the impact of journals and articles in accounting research (Brown and Gardner 1985). In 1990, the *Journal of Financial Economics* provided citation index rankings, and Alexander and Mabry (1994) ranked journals based on the number of citations, and identified the 50 most cited journals and the 50 most-cited authors in finance for the time period 1987-1991. Borokhovich, Bricker, and Simkins (1994) studied 15,110 footnotes appearing in 685 articles in eight major finance journals for 1990-1991, and concluded that two journals provided the research core of finance research, most journals publish in a greater variety of areas than they have influence, and there was a low level of borrowing across disciplines.

The applied operations research journal *Interfaces* used citations analysis to examine 1,294 articles, 2,194 authors, and over 2,500 citations over a 23 year period (Gupta 1997). Gupta found that about 48 percent of articles were never cited, and the average number of citations for those with at least one citation was 3.63. He also found that most citations occurred in the first three years after publication. Vincent and Ross (2000) provide perhaps the strongest recent review of the literature on citations analysis, and its uses and potential uses in business research. Both advantages and pitfalls are highlighted in their work.

METHOD

This study was designed to extend previous work done by authors who identified and ranked business schools based on measures of research productivity. Earlier work in this area was limited in scope, due primarily to a limited ability to access relevant data. For instance, most studies of business school research productivity focused on a specific discipline, or on a specific journal for a limited time period.

The design of the present study benefits from recent advances in information technology. The researchers were able to gather all data needed for the study by using unobtrusive means. The study was divided into three phases.

The first phase began by identifying the set of US business schools ranked in the top 30 at least one time by well-known business school ranking systems (*Business Week*, *US News and World Report*, and *Financial Times*) over the period 1988 to 2003. The next step was to identify the faculty members to be included in the study, and to record the following data for each.

- Last Name, First Name, Middle Initial(s)
- Current School
- Current academic rank (Assistant, Associate, Full, Endowed Chair, Other)
- Current academic title (full title as listed on the school's website)
- Ph.D. School, year, and discipline(s)
- Primary teaching/research discipline
- Secondary teaching/research discipline;

School websites varied greatly in the amount of information available. For those instances when supplemental information was needed, the researchers used Digital Dissertations, internet search engines, and directories for faculty (Hasselback, 2002).

The second phase of the study gathered citations data for each of the 4.918 faculty members identified in the first phase. The researchers used the Web of Knowledge to gather lifetime citations data from online data compiled and updated weekly by the Institute for Scientific Knowledge (ISI) from the *SSCI*. The endnote provides details about the process used to develop lifetime citation counts. All citation counts were captured between March 1 and June 30, 2003.

The third phase ranked the 51 business schools in various ways using the citation count data. Total and average citation counts were developed for the faculty members of the 51 schools, so rankings could be generated for the 51 schools and for eight academic disciplines within the 51 schools. The resulting rankings based on citation counts were compared with rankings for the disciplines developed *US News and World Report* for perceived research quality.

RESULTS

The results were based on 1,497,162 citations, which was a snapshot of the lifetime citation counts for the 4,918 full time faculty members at the 51 business schools included in the study. The faculty members at these schools were then sorted into eight academic disciplines of interest, which were: accounting, economics, finance, information systems, marketing, management science, organizational behavior, and strategy. Ranked lists of the top 25 schools in each disciple were then developed.

Table 1 is an alphabetical list of the 51 business schools included in the study. The 51 schools are all the schools that have been listed as being in the top 30 at least once by *Business Week*, *US News and World Report*, and *Financial Times*. There were 25 rankings lists generated by these publications between 1988 and 2003.

The eight columns show the rank order for each university in a given discipline. The order is based on the mean number of citations for the business faculty within the discipline under examination. The mean number was chosen as the primary indicator, in order to more accurately reflect the research productivity of each faculty member.

Table 1 - Mean Citation Rankings for 51 US Business Schools in 8 Disciplines

Based on Mean Number of Citations for the Business Faculty

	Accounting	Economics	Finance	Info syst	Marketing	Mgmt sci	Org beh	Strategy
Arizona	24	25		14	28	25	21	
Arizona State							26	19
Babson								
BYU				26				
Cal-Berkeley	12	2	12	2		17	1	1
Cal-Irvine		7	23	10	26			
Carnegie Mellon	7	13	29	20		11	13	
Case Western				24				23
Chicago	8	5	1	6	29	6	4	6
Columbia	17	6	5		7	27	9	
Cornell	5	14	19	4	4	26		
Dartmouth	19	17	10		12	7		11
Duke	13	18	6		2	3	10	4
Emory	29		20	9				
Florida		26	22		5	29	22	
Georgetown					24			21
Georgia Tech								27
Harvard	3	19	13	5	22	30	19	9
Illinois		23	24	23	23		24	
Indiana		20		16		21	11	22
Iowa	15	21			20	24	8	
Maryland	27			19			30	28
Michigan	9	15	26	22	14		6	18
Michigan State				28		44	17	
Minnesota	21		21	21	17			17
MIT	11	1	2	12	1	5	16	12
North Carolina	14		27	15	11	12	12	8
Northwestern	16	22	16		3		27	26
Notre Dame								
NYU	10	12	7	18	18	22		24
Ohio State			15			8		2
Penn State	20			30	19		23	3
Pennsylvania	2	8	11		8	9	29	13
Pittsburgh	25	9		7		1	20	29
Purdue		30	17			20		15
Rice	23			3	6	14	28	
Rochester	4	11	3			18		
SMU		29	25	13	16			16
South Carolina		24		29	15		18	14
Stanford	1	3	14	1	10	4	2	7
Texas	26		28	17	27	19	15	30
Thunderbird	28							
Tulane							5	
UCLA	22	4	4	8	13	2		10
USC	18		18	25	21	23	7	
Vanderbilt		27	8		9	13	14	20
Virginia		28			25	28		25
Wake Forest				27		16		
Washington U	30	16	30					
Wisconsin					30	15	25	
Yale	6	10	9	11		10	3	5

The table shows that a surprisingly large number of schools dominate the lists. Four schools were ranked within the top 30 for all eight disciplines (i.e. Chicago, Harvard, MIT, and Stanford) but nine schools were within the top 30 seven times, and nine additional schools were ranked six times.

Tables 2 through 9 show rankings for faculties based on the mean number of citations per faculty member. The total number of citations is also shown, along with rankings on that measure, although ranking by total citations obviously favors schools with large faculties. Faculty size is given. There is a comparison with the ranking generated by *US News and World Report* in their 2003 update survey of the top schools in specialty areas of business for the six specialty areas that coincide with the eight under study. *USNWR* had surveyed deans and MBA directors at business schools to get "top 10" rankings for programs in those specialty areas .

The specialty programs keyed to the table number are Accounting (2), Economics (3), Finance (4), Information Systems (5), Marketing (6), Organizational Behavior (7), and Strategy (8). In each case, the top 25 schools in terms of mean citations are shown.

Table 2 - Rankings for the Accounting Faculties

	CITATIONS MEAN	CITATIONS TOTAL	USNWR	CITATIONS MEAN	CITATIONS TOTAL	FACULTY
Stanford	1	6	6	367	2939	8
Pennsylvania	2	1	1	343	5493	16
Harvard	3	2		329	4606	14
Rochester	4	8		327	2614	8
Cornell	5	5		268	2944	11
Yale	6	21		201	1004	5
Carnegie Mellon	7	19		181	1265	7
Chicago	8	4	2	178	3381	19
Michigan	9	10	5	153	2148	14
NYU	10	3	8	145	3774	26
MIT	11	20		143	1004	7
Cal-Berkeley	12	39		114	454	4
Duke	13	11		112	1572	14
North Carolina	14	13	10	112	1456	13
Iowa	15	12		111	1549	14
Northwestern	16	14	9	110	1435	13
Columbia	17	15		107	1392	13
USC	18	7	7	106	2855	27
Dartmouth	19	37		102	510	5
Penn State	20	17		92	1386	15
Minnesota	21	22		90	995	11
UCLA	22	28		89	886	10
Rice	23	40		83	415	5
Arizona	24	27		83	909	11
Pittsburgh	25	29		80	881	11

Table 3 - Rankings for the Economics Faculties

	CITATIONS MEAN	CITATIONS TOTAL		CITATIONS MEAN	CITATIONS TOTAL	FACULTY
MIT	1	4		1464	21959	15
Cal-Berkeley	2	3		1211	25428	21
Stanford	3	2		1178	30632	26
UCLA	4	14		1088	6529	6
Chicago	5	1		968	39704	41
Columbia	6	16		935	5611	6
Cal-Irvine	7	27		846	2537	3
Pennsylvania	8	6		803	12841	16
Pittsburgh	9	28		794	2381	3
Yale	10	11		701	7008	10
Rochester	11	25		687	2746	4
NYU	12	7		577	12120	21
Carnegie Mellon	13	5		518	12938	25
Cornell	14	24		508	3049	6
Michigan	15	23		459	3216	7
Washington U	16	20		416	4156	10
Dartmouth	17	26		389	2726	7
Duke	18	18		343	4461	13
Harvard	19	9		331	9279	28
Indiana	20	22		314	3764	12
Iowa	21	10		313	7523	24
Northwestern	22	13		311	6538	21
Illinois	23	8		245	10028	41
South Carolina	24	21		230	4143	18
Arizona	25	17		222	4671	21

Table 4 - Rankings for the Finance Faculties

	CITATIONS MEAN	CITATIONS TOTAL	USNWR	CITATIONS MEAN	CITATIONS TOTAL	FACULTY
Chicago	1	2	2	1220	28056	23
MIT	2	5	5	1042	18752	18
Rochester	3	6		787	12591	16
UCLA	4	8	7	684	10945	16
Columbia	5	1	6	556	29461	53
Duke	6	12		485	6787	14
NYU	7	3	3	479	24444	51
Vanderbilt	8	19		435	3919	9
Yale	9	11		432	6914	16
Dartmouth	10	18		429	4294	10
Pennsylvania	11	4	1	428	20979	49
Cal-Berkeley	12	15	9	354	4600	13
Harvard	13	7	9	337	12138	36
Stanford	14	13	4	320	5761	18
Ohio State	15	14		317	4753	15
Northwestern	16	10	7	317	6965	22
Purdue	17	24		249	3240	13
USC	18	9		242	7750	32
Cornell	19	26		239	3113	13
Emory	20	25		229	3211	14
Minnesota	21	23		203	3241	16
Florida	22	21		196	3334	17
Cal-Irvine	23	38		194	1359	7
Illinois	24	16		183	4577	25
SMU	25	28		179	2858	16

Table 5 - Rankings for the Information Systems Faculties

	CITATIONS MEAN	CITATIONS TOTAL	USNWR	CITATIONS MEAN	CITATIONS TOTAL	FACULTY
Stanford	1	1	7	5110	15331	3
Cal-Berkeley	2	2		1379	6893	5
Rice	3	13		868	1735	2
Cornell	4	9		719	2156	3
Harvard	5	3		543	3798	7
Chicago	6	28		486	486	1
Pittsburgh	7	8		424	2545	6
UCLA	8	20		327	1308	4
Emory	9	15		320	1598	5
Cal-Irvine	10	16		303	1515	5
Yale	11	22		297	891	3
MIT	12	12	1	293	1758	6
SMU	13	14		230	1613	7
Arizona	14	7	4	203	2641	13
North Carolina	15	24		195	586	3
Indiana	16	35		192	192	1
Texas	17	5	3	188	3001	16
NYU	18	4	9	181	3258	18
Maryland	19	6	8	170	2724	16
Carnegie Mellon	20	11	2	170	2038	12
Minnesota	21	10	5	162	2101	13
Michigan	22	17		149	1488	10
Illinois	23	23		147	736	5
Case Western	24	18		146	1463	10
USC	25	21		145	1307	9

Table 6 - Rankings for the Marketing Faculties

	CITATIONS MEAN	CITATIONS TOTAL	USNWR	CITATIONS MEAN	CITATIONS TOTAL	FACULTY
MIT	1	5		1014	8109	8
Duke	2	2	4	845	12682	15
Northwestern	3	1	1	693	13863	20
Cornell	4	6		681	6810	10
Florida	5	7		612	6730	11
Rice	6	12		608	5468	9
Columbia	7	4	6	552	8273	15
Pennsylvania	8	3	2	520	12484	24
Vanderbilt	9	19		519	3630	7
Stanford	10	18	7	485	4366	9
North Carolina	11	11		365	5844	16
Dartmouth	12	33		355	2132	6
UCLA	13	28	9	338	2705	8
Michigan	14	8	5	336	6725	20
South Carolina	15	15		324	4864	15
SMU	16	32		324	2269	7
Minnesota	17	16		324	4854	15
NYU	18	9		304	6691	22
Penn State	19	14		296	5028	17
Iowa	20	20		276	3593	13
USC	21	17		264	4744	18
Harvard	22	10	3	258	6203	24
Illinois	23	24		257	3340	13
Georgetown	24	30		255	2299	9
Virginia	25	38		250	1502	6

Table 7 - Rankings for the Management Science Faculties

	CITATIONS MEAN	CITATIONS TOTAL	USNWR	CITATIONS MEAN	CITATIONS TOTAL	FACULTY
Pittsburgh	1	4		938	8445	9
UCLA	2	3	9	795	10341	13
Duke	3	1		616	10467	17
Stanford	4	5	5	609	7306	12
MIT	5	2	1	581	10458	18
Chicago	6	15		503	3524	7
Dartmouth	7	13		480	3840	8
Ohio State	8	10		474	4269	9
Pennsylvania	9	19	4	424	2967	7
Yale	10	29		372	1487	4
Carnegie Mellon	11	6	3	371	5569	15
North Carolina	12	7		367	5503	15
Vanderbilt	13	24		365	2190	6
Rice	14	47		336	336	1
Wisconsin	15	17		288	3461	12
Wake Forest	16	26		287	1722	6
Cal-Berkeley	17	32		285	1426	5
Rochester	18	8		260	4685	18
Texas	19	9		244	4644	19
Purdue	20	11	2	237	4268	18
Indiana	21	18		236	3305	14
NYU	22	14		227	3627	16
USC	23	16		205	3483	17
Iowa	24	22		197	2561	13
Arizona	25	42		191	572	3

Table 8 - Rankings for Organizational Behavior Faculties

	CITATIONS MEAN	CITATIONS TOTAL		CITATIONS MEAN	CITATIONS TOTAL	FACULTY
Cal-Berkeley	1	6		1499	14987	10
Stanford	2	1		1487	34194	23
Yale	3	23		1282	5129	4
Chicago	4	7		1065	10646	10
Tulane	5	21		1050	5248	5
Michigan	6	3		991	19815	20
USC	7	4		851	16176	19
Iowa	8	8		834	10013	12
Columbia	9	17		793	6341	8
Duke	10	18		743	5947	8
Indiana	11	14		723	7229	10
North Carolina	12	15		717	7171	10
Carnegie Mellon	13	13		672	7388	11
Vanderbilt	14	29		643	4498	7
Texas	15	24		614	4913	8
MIT	16	5		606	15765	26
Michigan State	17	10		583	8160	14
South Carolina	18	25		542	4881	9
Harvard	19	2		518	20216	39
Pittsburgh	20	20		483	5318	11
Arizona	21	22		474	5219	11
Florida	22	36		471	2825	6
Penn State	23	27		470	4701	10
Illinois	24	26		439	4824	11
Wisconsin	25	16		403	6450	16

Table 9 - Rankings for the Strategy Faculties

	CITATIONS MEAN	CITATIONS TOTAL	USNWR	CITATIONS MEAN	CITATIONS TOTAL	FACULTY
Cal-Berkeley	1	2	10	1757	12297	7
Ohio State	2	11		1026	5128	5
Penn State	3	10		867	5201	6
Duke	4	7	8	613	6740	11
Yale	5	29		578	1734	3
Chicago	6	12		528	4754	9
Stanford	7	4	2	516	7229	14
North Carolina	8	14		500	3999	8
Harvard	9	1	1	497	23832	48
UCLA	10	19		473	2840	6
Dartmouth	11	16	6	446	3564	8
MIT	12	8		443	5313	12
Pennsylvania	13	18	5	424	2967	7
South Carolina	14	35		386	1157	3
Purdue	15	17		375	2996	8
SMU	16	28		365	1825	5
Minnesota	17	5		364	6913	19
Michigan	18	6	4	356	6771	19
Arizona State	19	9		350	5244	15
Vanderbilt	20	43		335	335	1
Georgetown	21	26		280	1958	7
Indiana	22	13		275	4123	15
Case Western	23	25		272	2176	8
NYU	24	15		260	3643	14
Virginia	25	21	7	259	2330	9

DISCUSSION

At first glance, the overall results of this study are what would have been expected. Four very prestigious schools were ranked within the top 30 for all eight disciplines (i.e. Chicago, Harvard, MIT, and Stanford). What was unexpected was that nine additional schools were within the top 30 seven times, and another nine schools reached that level six times. This means that there are a total of 22 schools with very solid performance across disciplines.

A second way to reach the same conclusion is to examine the number of schools that reached within the top three of the disciplines covered. Stanford and California reached these levels four times, MIT three times, and Duke twice. Eleven additional schools reached that level once (Chicago, Harvard, Northwestern, Ohio State, Pennsylvania, Penn State, Pittsburgh, Rice, Rochester, UCLA, and Yale). A total of 15 schools reaching into the top three says much for the depth of excellence across business schools.

Although there is a high degree of correspondence between the *USNWR* specialty rankings and the ones found through citation analysis, one may question why the correspondence is not greater. One possible reason is a difference in definition. For instance, this study included strategy and organization behavior, while *USNWR* had a category for management that included both strategy and organization behavior. Perhaps a more important difference is that of procedure. *USNWR* took essentially a reputational approach, surveying deans and MBA directors at business schools to get "top 10" rankings for these programs. The citation analysis provided results that were impartial, and not subject to individual opinion. It is not unreasonable that the results would be different.

There is a caution about using citation counts to compare faculty members from different disciplines with each other, because the disciplines differ in average numbers of citations. For example, the mean for all faculty members

in this study was 311 citations, and the mean for five of the eight specialty areas was within 25 percent of that overall mean. The mean for economists, however, exceeded the overall mean by 49 percent and the organizational behaviorists exceeded it by 72 percent. On the other hand, the accountants were cited at an average rate 69 percent below the overall mean. This means the average number of citations for the organizational behaviorists was five and one half times that of accountants.

The reasons for the differences across disciplines are probably due to factors unrelated to research productivity, such as nature of discipline-specific research and the reference practices used by journals. Such outside influences limit the value of cross-discipline comparisons. Average citation counts tend to be lower for schools whose faculty includes a high percentage of accountants and be higher for schools with a high percentage of faculty members in organizational behavior or economics.

It is noteworthy that 29 of the 51 schools (57%) ranked in the top 10 for at least one discipline, and 17 out of 51 (33%) ranked there for at least two. This suggests that there are a number of schools with high research productivity in multiple specialty areas. A search for a strong business program should not stop at the level of the school, but instead extend down to the level of the discipline.

IMPLICATIONS

Citation analysis can be used as a scoring system by business school faculty, administrators, students, prospective students, alumni, donors, legislators, and others searching for evidence of excellence in research productivity for various business schools. The technique has the advantages of being empirical, unobtrusive, logical, simple, robust, and relatively unbiased. The major drawback to use of citation analysis has been the difficulty in creating the data that could be applied to large samples of schools and specialties. The present study shows that such a database can be constructed, given current information systems technology.

The database of nearly 1.5 million citations was not created merely to serve as a simple scoring system to rank research productivity in business schools, however. Citation analysis can also be used to trace the origin of a stream of research, almost as if one were tracing back ancestry on a genealogical chart. Along the way, citation analysis is an efficient way to answer simple and not so simple questions. Is the stream more heavily weighted towards books, articles, or monographs? Is the apparent popularity of specific source materials supported by hard data concerning their use by others? Which journals have had the most impact?

Which specific articles in a field have had the most impact? Are there otherwise-unrecognized separate streams of research that are discovered when one travels upstream from the present broad confluence of the research river? How have the answers to any of these questions changed over time? Citation analysis can provide answers to these and other questions in an extraordinarily efficient way.

Although it can be an invaluable research tool, an immediate use for citation analysis may be as an assessment tool. In that role, it can be used to create both rankings and ratings for schools, departments within schools, business journals, individual faculty members, and prospective faculty members. Many of these data build upon each other, but each brick in the foundation is part of the citation analysis.

Schools can be assessed based on total citations, average citations, median citations, or combinations thereof. Comparisons can be made to any set of peer schools one may select. Although the research reported here used 1.5 million citations to assess 51 schools, the basic process can be applied to any set of schools or disciplines. In addition, any school or set of schools can be evaluated over a period of time to reflect trends in research productivity.

The assessment of research productivity at schools is based on the productivity of various constituent departments, and citation analysis can be used to make assessments at the department level with comparisons against peer departments or within the same department over time. Individual professors within a department can also be evaluated on the quality of research productivity, by using the same assessment tools and database. With controls to measure self-citations, the objective nature of citations analysis can be an important factor in evaluating research productivity component of promotion and tenure decisions.

Two other important assessment problems concerning personnel decisions can be addressed through citation analysis. The first concerns the evaluation of the vitae of prospective new faculty members, at which time citation analysis can add a quality dimension to the assessment of publications included in a vita. The second concerns decisions about the quality of the journal in which a professor's article may appear. This is a difficult problem because individuals in one discipline may be called upon to assess the quality of an unfamiliar journal for the purpose of evaluating the work of a colleague outside of their discipline.

The merit of journals can be assessed using citation analysis. What is the total number of citations a journal is receiving? What percent of articles in a given journal are cited? What is the percentage of articles cited by authors in other journals? How soon after publication are articles being cited? Over what duration are journal articles being used? How often are self-citations appearing? The authors have begun a research stream to address these questions.

Schools, departments, journals, individual faculty members, and alumni are not the only elements that can be evaluated through the use of citation analysis. To paraphrase Vincent and Ross (2000), the opportunities for assessment using citations analysis are unlimited. It is hoped that this article provides some insight into the potential that the technique holds for providing an accurate assessment of a number of elements related to faculty productivity in US business schools.

A NOTE ON HOW THE DATA ISSUES WERE HANDLED

Who was included and excluded in the study? All fulltime professors with doctorates were counted, including visiting professors tenured elsewhere. If a visiting faculty member were tenured at another top 51 school, the faculty member was included in the study as being at the school that granted tenure. The study excluded emeritus faculty and adjuncts (even if they had doctorates) as well as faculty listed as "all but dissertation," fulltime lecturers, and research associates without doctorates. Deans were included if there was evidence the dean had a record of research activity in an academic business discipline.

What was done when data were unavailable on the website of the business school? Missing information was located by accessing the Digital Dissertations lists of doctoral dissertations accepted, Hasselback's *Guide(s) to Marketing and Accounting Professors*, and internet search engines.

How were citation counts done? Citation counts were developed for all published work of each professor included in the study. The citation count process began with a review of the information available about the professor at the business school website. All business schools in the study included information about each member of the faculty. Many of the websites included both a biographical sketch and curriculum vitae for each professor.

The authors reviewed the available vitae information and went to the Web of Knowledge to get citation counts for the professor in two separate searches. The first search was of citations for the full last name, first and middle initial. Special care was taken to sort out the business school professor from any other cited authors with the same last name and first two initials. In several instances involving common names, the researchers had to make judgments based on the vita, the disciplines taught and researched, and the co-authors of the pieces.

The authors did a second citation count for each professor by using the last name and only the first initial. This additional search yielded about 30 per cent of the total citations in the study and was necessary because those who index the SSCI must index the footnotes in the form in which it is presented by the author(s) of the article they are indexing, and the footnote often has only has the last name and first initial. In this second search, numerous researchers in other fields were typically co-mingled with the business school researcher(s), so the judgment process described in the previous paragraph was necessary.

Which citations were included or excluded? Citations were included for both primary and secondary authors of journal articles indexed by the SSCI. For example, if Professor Wright was the first-listed author of an article and Professor Wong was a co-author of the article published in 1975 or later, then *both* authors receive *full credit for all citations* for the article.

Some journals were added to the SSCI in recent years. For years prior to being indexed by SSCI, primary authors were the only ones to receive credit for a citation of work that had multiple authors. For instance, *Marketing Science* began publication in 1982, but only articles published since 1987 attribute citations to secondary authors as well as primary authors. For some journals that either debuted or reached prominence after 1975, the start date for SSCI attribution of article citations to both primary and secondary authors may be after 1975. This limitation means citation counts for work done before SSCI began indexing the journal are only attributed to the primary author of multiple authored publications.

The citations count does include citations of one's own work. The authors found that there was no practical way to identify and omit self-citations on a mass basis, although that could be accomplished to respond to specific requests.

How were academic specialties selected for the faculty members included in this study? Academic specialties were developed by review of the 51 schools websites to determine the core specialties common to all schools: accounting, economics, finance, management information systems, management science, marketing, organization behavior, and strategy. Additional specialties included business law, business ethics, business history, risk and insurance, logistics, supply chain management, international business, international economics, public policy, real estate, entrepreneurship, negotiations, and electronic commerce. The additional specialties did not include enough faculty members at enough schools to permit meaningful analysis at the specialty level. All faculty members were included in any rankings of the 51 schools or doctoral programs.

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ABOUT THE AUTHORS

Larry M. Robinson received his Ph.D. in Marketing from The Ohio State University. After receiving teaching awards at Georgia State University, he entered the insurance industry, where some of his programs transformed the way that the industry conducts marketing research. He recently returned to the classroom at Rice, where he is a Distinguished Visiting Associate Professor.

R. D. Adler received his Ph.D. in Marketing from the University of Alabama. After teaching at Xavier, he became Professor of Marketing at Pepperdine University in Malibu. He is a Fulbright Professor, a Distinguished Fellow of the Academy of Marketing Science, and recipient of teaching awards.

Professors Robinson and Adler have worked together for 25 years, and their initial article using citation analysis to rank faculties and institutions appeared in 1981.