Analysis of Grant Activity of Computer and Information Science Faculty: Exploring Productivity

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Abstract

Obtaining grant funding is an important component for faculty members in higher education. This study examined the grant productivity of computer and information sciences faculty using the National Study of Postsecondary Faculty 1999 (NSOPF-99) data. The study utilized an ex-post-facto design. The objectives of the study were to: 1) describe the grant productivity of computer and information sciences faculty in terms of dollars generated and numbers of contracts, 2) examine the grant productivity of faculty by academic rank, 3) describe the sources of external funding for computer and information sciences faculty, and 4) determine if the relationship of selected individual productivity variables and the amount of funding as measured by total funds receive during a single academic year. The literature review examined personal characteristics and attitudes, occupational characteristics, and organizational context. The study found that only 26% of the faculty had grant-sponsored research. Of that 26%, more than half had only one grant contract. The majority of CIS faculty sponsored research was funded internally by their own institution. Of the faculty with externally funded grants, the federal government was the source of 43% of the funds. Two variables of productivity, career juried publications and recent joint juried publications moderately correlated with grant funding. CIS administrators now have a baseline for dollar amounts generated from grants, average number of grants generated, rank of faculty members that generate funding, and sources of grant funding. In addition, this study provides evidence that grant productivity needs to be explored in a larger context to include other variables of productivity.

Keywords: Grant Productivity, Faculty, NSOPF-1999, Computer and Information Science Faculty.

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The classic roles of faculty members in higher education institutions include teaching, research, and service. The majority of faculty members believe in the importance of all three parts of the university mission (Bartlett, Kotrlik, Higgins, & Williams, 2002). According to a recent national study of faculty, Williams, Bartlett, Kotrlik, & Higgins (2002) reported allocation of work time across teaching, research, service, and administration. The similarities include teaching, research, and service and the belief is similar for the Computer and Information Sciences (CIS) professoriate.

Research indicates faculty research productivity plays a major role in attaining success in academia as it relates to promotion, tenure, salary, and the fringe benefits of the profession (Bartlett at el., 2002). Evaluations of faculty in academia commonly weight all roles equally, however according McKeachie, "it is not uncommon to find that research is more equal" (1994, p. 7). For those who participate in sponsored research, the benefits include better support such as teaching release, extra administrative support, and recognition for publications (Monahan, 1992). The President of Northwestern University warned faculty that not being productive will cost space (Smallwood, 2001). In addition to individual rewards, grants can benefit students, teachers, institutions, and communities. Even with the importance of grant funded research, only 20% of the faculty in New Jersey state universities reported being engaged in research that was grant funded and about half reported never or rarely engaging in grant development (Monahan, 1992).

In many instances publications are viewed as a surrogate to research productivity. Even though this measure is important, it alone does not provide a full view of how faculty research productivity advances the organization as well as other stakeholders. In addition to generating publications, grant sponsored research often supports aspiring graduate students, institutional fiscal health, researchers salaries, as well as equipment and resources.

Review of Literature

The review of literature will incorporate factors that have been associated with grant productivity. Because of a dearth of literature in the field of computers and information sciences (CIS) on grant productivity, the literature review will include research productivity in business and closely related fields. The factors will be presented in terms of personal characteristics and attitudes, occupational characteristics, and organizational context.

Factors associated with publication productivity

In this section, personal factors such as gender, age, educational level will be presented in relation to productivity in higher education. In addition, productivity variables related to occupational characteristics such as rank, salary, and time spent on duties will be examined. The section will conclude with a with organizational and institutional support factors that have been examined in terms of productivity.

Personal factors influence grant productivity. Liebert (1976) states personal factors have a minor relationship to obtaining grant funding. Williams at el. (2001) reported age, gender and martial status as personal variables relate to faculty research

productivity with mixed results. According to Denton and Hunter (1995) economics faculty that were highly successful in attaining grants were influenced by satisfaction, recognition, college goal, flexibility, income enhancement, and increased responsibility. However, recruitment to submit proposals and participating in mentoring did not influence grant submissions. Personal satisfaction, flexibility, and responsibility appeared to be the greatest motivational factors for grant submission (Denton and Hunter, 1995). Lawrence (1989) stated that consistent grant involvement correlated with publication rates.

Gender. Bailey (1992) and Bartlett at al. (2002) reported males had higher research productivity than females. This is consistent with a majority of the literature. However, a few studies including Kotrlik et al (2002) and Williams et al. (2002) with human resource faculty found no significant differences in publication productivity.

Age. Age has been reported to relate to research productivity with younger faculty being rated as higher producers (Blackburn, Bieber, Lawrence, Trautvetter, & Blackburn, 1991). Other researchers (Bland & Berquist, 1997) reported senior faculty members are active in research. However, productivity may decelerate with the changes in increased responsibility for service indicative of tenured faculty. In a national study with human resource faculty Willams et al. (2001) reported no relationship to age and productivity. Kotrlik (2002) found similar results with a group of university career and technical educators.

Education level. Cox, Boze, and Schwendig (1987) reported that business faculty with Ph..Ds had a more positive attitude towards research. Kelly and Warmbrod (1985)

also reported that educational experiences in graduate school such as research methods courses, work on research projects, discussions with other graduate students, and help from advisors and researcher were enablers of research productivity in faculty. Blackburn et al. (1991) reported that graduates from research extensive universities published more than those from other types of institutions.

Occupational characteristics. The occupational characteristics that will be discussed include type of appointment by activity, discipline, salary, rank, tenure, time spent with graduate students, and time spent on duties. The occupational characteristics have been shown to have mixed results with productivity. Radhkrishna et al. (1994) reported tenured faculty held publishing at a higher level of importance than non-tenured. In a study of business faculty Bartlett et al (2002) reported tenure did not explain variance in research productivity.

Rank. Taylor (2003) reported that rank played a significant role in affecting external grant funding. In contrast, Williams et al. (2001) reported rank to not be a significant predictor of research productivity. In studies of faculty from other related disciplines Bailey (199) Dundar and Lewis (1998) and Vasil (1992) did find rank as a significant variable for research productivity.

Salary. Salary in of faculty has been shown to relate to rank, reward structure, years of full-time teaching, and degree. In other studies, faculty salary has been show to be significantly related to productivity (Jacobson, 1992; Pfeffer & Langton, 1993; Rebne, 1989; Tornquist & Kallsen, 1992). Bartlett et al. (2002) and Kotrlik et al. (2002) reported that findings with salary that are self-reported need to be examined with caution due to

the general high nonresponse rates on that item. Academic Leader (2004) reported that The University of Arkansas-Fayetteville placed a faculty incentive plan into action that provides salary bonuses to faculty who acquire salary from an external research grants. Similar practices were report at the University of Southern Mississippi (Robin, 2003).

Time spent on duties. Monahan (1992) noted working on grants provided release time from teaching and advising and enabled a shift in duties. This is significant because William et al. (2001) found that the largest amount of time spent for faculty was on teaching. In the same study, Williams et al. (2001) reported faculty choose to split their time among research, teaching, service, and administration duties explain a significant amount of the variance in research productivity. Contrarily, Bartlett et al. (2002) and Kotrlik et al. (2002) found that time allocation was not significant in explaining research productivity. Monahan (1992) reported that heavy teaching loads, other scholarly interests, other entrepreneurial interests, committee work, and lack of advanced warning were obstacles to grant writing. However, grant productivity is a criteria when determining Carnegie rankings.

Organizational context. Organizational context has been shown to be both positively and negatively related to research productivity. Institutional size and type have been related to productivity. Radhakrishna et al. (1994) reported that faculty at research universities produced more than those at four-year colleges. Bailely (1992) found similar results and reported that productivity increased as Carnegie ranking increased from Liberal Art II colleges to Research I universities. Other studies found institution rank was a predictor of research productivity.

Institutional Support. A clear strategic goal, emphasis on the goal, recognition for meeting the goal, and faculty support (i.e. administrative support, extending appointments) were related to increased productivity (Denton and Hunter, 1995). Landers (1986) concluded that changes to organizational value systems, monitoring and reporting, leadership by example, positive rewards and planning increased grant productivity over a five year period. Monahan (1992) reported that faculty that participated in grant activities received recognition for their work in publications was an enabler for grant productivity. Kleinfelder, Price, & Dake (2003) "that inducements to grant writing included the provision of release time and the offer of technical and personnel support" and barriers include "heavy teaching loads, administrative or committee assignments, and other scholarly or entrepreneurial interests." Eissenberg (2003) reported that a grant writing course was offered for graduate psychology students to help support grant writing. This type of institutional support aided the students and was demonstrated by all 6 of the students that wrote proposals for the National Institutes of Health (NIH) were successful in obtaining grants.

Purpose

Some past research has investigated grant funding and publications in relationship to research productivity. Porter and Umbach (2000) identified research publications and external grant funding as a surrogate of faculty research productivity. Huettner and Clark (1997) integrated grant support into their model to examine research productivity. The purpose of this research is to analyze the factors associated with grant productivity, in

terms of dollars generated in the 1998-99 academic year of CIS faculty. Specifically, the research objectives are:

> Objective 1: Describe the grant productivity of CIS faculty in terms of dollars generated and numbers of contracts
>
> Objective 2: Describe the sources of external funding for CIS faculty.
>
> Objective 3: Determine if selected measures of faculty productivity correlate with external funding as measured by total funds receive during a single academic year.

Methods

The methods section will be presented in terms of the data set, description of participants, description of the instrumentation, and overview of the data analysis.

Data Set. The National Center for Education Statistics offers the most recent examination of the professoriate in the 1999 National Survey of Postsecondary Faculty (NSOPF-99). The sample was selected in three stages. First, 960 institutions were selected from the 1997-98 Integrated Postsecondary Education Data System and asked to provide a list of all full and part-time faculty. Of the schools, 84% (n=819) responded and provided a list of faculty. From these lists a total of frame consisted of 596,813 faculty and instructional staff was created. The second stage of the sampling selected 28,576 faculty from the frame using stratified methods. Of the total sample, 27,044 were determined eligible for the sample. After the final stage of subsampling, 19,813 faculty were selected for the study and the completed data set had 18,043 usable responses (NCES, 2002).

Participants. Since computer and information sciences is a dynamic and developing field it is not always in a consistent academic home. The researcher selected faculty members that met the following criteria: (1) full-time faculty member, (2) held a position with instructional duties, (3) were employed at 4 year college or university, and (4) identified computer and information sciences, computer programming, data processing, or other computer science as their primary field of teaching or research (n=176).

Instrument. The NSOPF-99 study was designed using the previous NSOPF-93 study, National Technical Review Panel, and a field test. The survey collected data on employment, academic and professional background, institutional responsibilities and workload, job satisfaction, compensation, socio-demographic characteristics, and opinions. During the field test questions were modified or deleted based on high item nonresponse or low reliability (NCES, 2002).

Data Analysis. Data analysis was conducted using SPSS 12.0. To answer research objective one, the grant productivity of CIS faculty in terms of dollars generated and numbers of contracts, means, standard deviation, frequencies and percents were computed. Frequencies and percents were used to answer objective two, the sources of external funding. For objective three, regression analysis was used to explore the amount of variance in total grant funding using the personal characteristics, occupational characteristics, and organizational context.

Findings

Of the 176 faculty members, 46 (26.1%) reported to engage in funded research or funded creative work including grants, contracts, or institutional awards. Consulting was not included in funded research. Of those 46 faculty members, 35 (76.1%) were the principal investigator (PI) or co-principal investigator (Co-PI) for one or more funded project. On average, PI or Co-PIs that have obtained funding have 1.85 (sd=1.85) contracts. Table 1, shows that the majority of the faculty members had one contract (n=19, 54.3%). Only 2 (5.8%) faculty members served as PI or Co-PI on more than 3 grant contracts.

Table 1. *Number of Grant Contracts Generated by Computer and Information Science Faculty Across Rank*

	Rank							
	Professor		Associate		Assistant		Total	
Number of Grants	f	P	f	P	f	P	f	P
1	4	21.1	9	47.4	6	31.6	19	54.3
2	4	44.4	2	22.2	3	33.3	9	25.7
3	2	40.0	1	20.0	2	40.0	5	14.3
4	0	0.0	0	0.0	0	0.0	0	0.0
5	1	100.0	0	0.0	0	0.0	1	2.9
6	0	0.0	0	0.0	0	0.0	0	0.0
7	0	0.0	0	0.0	0	0.0	0	0.0
8	0	0.0	1	100.0	0	0.0	1	2.9
Total	11	100.0	12	100.0	11	100.0	35	100.0

The faculty members reported that their average grant funding was $162,938.65 (sd=$180,626.94). Table 2 shows that 12 (34.3%) of the grants were greater than $100,001. Additionally, of the 10 faculty members at rank of full professor generated half (n=5, 50.0%) of the grants over $100,001.

Table 2.
Number of Grant Dollars Generated by Computer and Information Science Faculty by Rank

	Rank							
	Professor		Associate		Assistant		Total	
Number of Grants	f	P	f	P	f	P	f	P
Don't Know	0	0.0	3	8.6	1	2.9	4	11.4
$1 - $10,000	1	2.9	0	0.0	3	8.6	4	11.4
$10,001 - $30,000	1	2.9	1	2.9	0	0.0	2	5.7
$30,001 - $50,000	1	2.9	3	8.6	3	8.6	7	20.0
$50,001 - $100,000	1	2.9	4	11.4	1	2.9	6	17.1
$100,001 - $500,000	5	14.3	2	5.7	3	8.6	10	28.6
> $500,001	1	2.9	1	2.9	0	0.0	2	5.7
Total							35	100.0

Note. 6 Faculty that had contracts did not report total funding

Table 3 provides the sources of funding for grants generated by computer and information science faculty. The funding sources for the grants varied. From the data provided, it can be seen that many of the grants were funded by multiple sources. The faculty members institution was a funding source for 49% (n=17) of the funded projects and the federal government was a source for 43% (n=15) of the projects.

Table 3.
Sources of Grant Contracts Generated by Computer and Information Sciences Faculty

	Faculty		
Number of Grants	n	F	P
This Institution	35	17	48.6
Foundation/nonprofit organization	35	2	5.7
For profit business or industry in the private sector	35	7	20.0
State or local government	35	4	11.4
Federal government	35	15	42.9

Note. Percents do not add to 100% because respondents selected multiple sources.

Table 4 shows the correlations of measures of faculty productivity in relationship to dollar of grant funding in an academic year. Measures of productivity were both recent and career juried creative works, nonjuried create works, book reviews, textbooks, and reports, exhibitions, performances, patents, and computer software. There was a moderate association of career juried works (r=.37) and recent joint creative juried (r=.34) with grant dollars generated. Recent sole presentations, books textbooks, reports, and creative juried works had a negligible association with grant dollars. All of the other variables had low association with grant dollars generated.

However, interpretations of the above result require great caution. First, the researchers found cases that grant dollar amount was not reported when grant contracts existed. Another caution, even though this study included major categories of productivity, other measures of productivity need to be explored. This study primarily focused on selecting continuous or similarly scaled variables for exploratory purposes. Further studies using a regression analysis to explore the variance of grant dollars

generated in relation to other personal, social, and environmental variables to build up the knowledge base on this topic is important.

Table 4.
Relationship of Grant Dollars Generated and Other Measures of Faculty Productivity

Measure of Productivity	*r*	*Associate*	*p*
Career creative works, juried media	.37	Moderate	<.01
Recent joint creative works, juried media	.34	Moderate	<.01
Recent sole reviews of works, books	.28	Low	.02
Recent joint books, reports	.27	Low	.03
Recent sole creative works, nonjuried media	.26	Low	.03
Career creative works, nonjuried media	.24	Low	.05
Recent joint reviews of books, creative works	.23	Low	.06
Career patents, computer software	.19	Low	.12
Recent joint creative works, nonjuried media	.20	Moderate	.10
Recent joint patents, computer software	.17	Low	.17
Recent joint presentations, performances	.17	Low	.16
Career reviews of books, creative works	.12	Low	.38
Career books, textbooks, reports	.11	Low	.38
Recent sole patents, computer software	-.10	Low	.41
Career exhibitions, performances	.07	Negligible	.56
Recent sole presentations, performances	-.07	Negligible	.57
Recent sole books, textbooks, reports	-.03	Negligible	.81
Recent sole creative works, juried	.01	Negligible	.93

Conclusions and Recommendations

A little over a quarter of the faculty members had funded research. This study demonstrates that computers and information systems faculty are involved in funded research and for the most part, only have one grant at a time. Additionally a little over one third of the grants were over $100,001. Of the faculty that have generated funding, full professors generated the grants with the largest dollar amount of funding which is supported by previous literature that relates to productivity (Bartlett, Yoon, Marvel, 2003; Williams, Bartlett, Kotrlik, & Higgins, 2002; Bailey, 1992; Dundar & Lewis, 1998; and Vasil, 1992). Furthermore, this provides evidence that faculty rank is related to grant

productivity and that junior faculty would benefit from collaborating work with experienced senior professors for large grants.

The funding for the grants came primarily from their own institution and the federal government. These two funding sources need to be explored by faculty just starting out in the grant seeking process. Seasoned faculty need to explore other funding sources to be obtained untapped grant dollars.

While relationships with other productivity measures were explored, there were only moderate correlations with grant productivity in regards to recent career creative works-juried media and recent joint creative works-juried media. This might help in examining the productivity record of faculty to seek out those successful in obtaining funding. Also, the relationship between the number of publications and grant dollars needs to be explored to examine how many articles are generated from the grant projections.

Implications for Higher Education

This study provides a national baseline to start benchmarking the grant productivity of CIS faculty nationally. Additionally, this provides evidence that faculty members in fields and departments that are titled computer and information sciences, computer programming, data processing, or other computer science obtained a greater amount of funding than business faculty in the human resource/training area (Bartlett, Yoon, & Marvel, 2003). This is very essential for Chairs, Deans, and other administrators when evaluating faculty that are in a department or college that is multidisciplinary. Examples of departments that might fit in this category are Technology and Training Management (University of South Carolina) or Technology Support and Training (Indiana University

of Pennsylvania). Additionally, administrators might want to provide opportunities for groups of highly successful grant seekers to partner with disciplines that have not been as successful in the past to build success.

For faculty to be successful in grant seeking, it was identified that grant seeking was a primary activity. This suggests that providing individuals with the opportunity to have research as their primary function will increase grant funding. In addition, refereed manuscripts were also moderately correlated with grant funding. More research is needed to examine if the funded research produces the refereed manuscripts or if publishing in the refereed manuscripts offers more opportunities for funded research.

This study found that in CIS faculty, the variables related to research productivity in terms of publications are not the same in terms of grant funding in many cases. In the future, findings from this study will help to lead in the development of a model to explain faculty grant productivity. It has become evident that other variables not in the literature need to be explored. The researcher suggests that a qualitative study be conducted with individuals that are the highest producers of funded research to better understand grant productivity phenomena.

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