Following the Path from Teaching to Research University

Following the Path from Teaching to Research University: Increasing Knowledge Productivity

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CHAPTER I

NEW LANDSCAPING FOR UNIVERSITIES

Introduction

A new entrepreneurial trend among private research universities has become visible since the 1980s. Many factors, such as escalating costs of labor and insurance, technological innovations, new government policies, and government budget cuts for higher education, have produced a greater demand for resources (Metcalfe & Fenwick, 2009; Slaughter & Leslie, 1997). This increasing pressure is pushing universities to search much more aggressively for external sources of funding (Francis & Hampton, 1999; Sidhu, 2009). Universities are being compelled to generate new sources of revenue to accomplish their goals. Liaisons with businesses, corporations, and foundations are becoming a common occurrence at many doctorate-granting universities, whether public or private (Bok, 2003). At the same time, private corporations are supporting universities to enhance their businesses and access to markets (Baker & Wiseman, 2008).

There has been a remarkable shift in the relationships between universities and industry and federal government (Powers, 2004). Government legislation such as the Bayh-Dole Act of 1980 has encouraged nonprofit organizations and even small businesses to retain the property rights to inventions derived from federally funded research (Powell & Owen-Smith, 1998). Thus, the commercialization of research is permitted and stimulated through patents and the profitable licensing of university/industry/government partnerships. The Bayh-Dole Act and many others were a response to external changes such as the end of the Cold War and the globalization that pushed government and business to new paradigms (Berman, 1998). Moreover, corporations and large businesses needed outside support to develop research and new technology transfer. According to Rosenbloom and Spencer (1996):

> Within the large corporations, there was growing recognition that firms had become much less self-sufficient in their ability to generate the science and technology necessary to fuel economic growth. 'What was once a race has become more like a rugby match.' They anticipate a

> 'diminishing role for corporate laboratories as the wellspring of innovation', and suggest that the 'seeds of new technological advance will probably sprout more often in university or government laboratories.' (As cited in Powell & Owen-Smith, 1998, p. 173)

These political and corporate shifts generated changes in the environment surrounding universities and triggered "a second revolution" in higher education, as Etzkowitz, Webster, and Healey (1998) put it:

> The academic revolution of the late nineteenth and early twentieth centuries introduced a research mission into an institution hitherto devoted to the conservation and transmission of knowledge. Building upon the first revolution, the second academic revolution is the translation of research findings into intellectual property, a marketable commodity, and economic development. (p. 21)

This entrepreneurial environment is challenging the mission and traditional view of the university. The "ivory tower" model of the university, where knowledge is produced in a "pure" form, is no longer feasible (Duderstadt, 2000).

Universities are seen as boosters of economic development. At the same time, universities pursue linkages with outside resources to gain access to better facilities, increased budgets, ways to improve research programs, and financial stability (Becker & Lewis, 1992; Bok, 2003; Bowie, 1994; Callan & Finney, 1997; Duderstadt, 2000; Lapidus, Syverson, & Welch, 1995; Slaughter & Leslie, 1997). This new university paradigm focuses on a broader network of interdependent relationships in which government and industry-business serve as partners for knowledge production. This is also known as the "Triple Helix Model" (Etzkowitz, 1996).

Modern society depends on improvements that come from using knowledge to develop solutions to problems (Kezar & Eckel, 2000; Meyer, 2003; Ortega y Gasset, 1992). Faculty research productivity in terms of publications and externally funded projects is essential to achieving these improvements (Etzkowitz et al., 1998). Much of the research/knowledge is produced at top research universities (Bok, 2003; Powers, 2004; Slaughter & Leslie, 1997). However, some less-productive universities seem to struggle with balancing teaching and research. Often faculty members at these institutions are expected to teach a full load of classes while also working on research and publishing articles (Blackburn & Lawrence, 1995). In spite of these expectations, these institutions have differing levels of faculty productivity. It is crucial to understand both the personal characteristics of productive researchers and the organizational

characteristics of a university that promote or discourage research productivity (Siegel, Waldman, & Link, 2003; Tien, 2000). Knowing, controlling, and managing these characteristics could accelerate the advancement of knowledge production and the improvement of universities and communities towards higher levels of excellence.

Many studies address the performance of top major research universities in the United States (US). However, the small- and mid-sized doctorate-granting universities are much less studied, although they contribute to research (Mansfield & Lee, 1996).

There is a growing desire to understand how research is accomplished, under what conditions it may be stimulated, and particularly how organizational practices and faculty characteristics influence research productivity (Powers, 2004; Siegel et al., 2003). Moreover, these smaller universities need to enhance their research performance in order to keep up with a new model of the proactive university: a university that produces research to expand knowledge and enhance people's lives (Boyer, 1990; Glassick et al., 1997).

In addition, research is becoming a defining quality feature for higher education (Salmi, 2007). Many accrediting agencies are looking for research outputs as ways of measuring academic performance and overall quality (Portnoi, Rust, & Bagley, 2010).

The Focus of This Study

Businesses, industries, and communities rely on universities as producers of knowledge. The faculty is central to the research process (Boyer, 1990; Braxton, Luckey, & Helland, 2002; Glassick, Huber, & Maeroff, 1997). Universities also reap benefits from producing knowledge, such as finding new sources of income, receiving donations, and expanding the opportunities available to students (Lee & Rhoads, 2004). Therefore, it is essential for administrators and policy-makers to unlock barriers that may hinder faculty research productivity[1] (Middaugh, 2001; Vardi & Weitz, 2004).

This study is intended as a contribution to untangling the effects that organizational environment and faculty characteristics have on faculty

[1] Note: *Faculty research productivity*: This dependent variable measures the specific publishing outputs of faculty members, such as articles, book chapters, and books edited published under a peer-review system. These productivity measures are also related to later stages of organizational procedures, beyond the scope of this study, where research is translated into technology transfers such as patents, licensing, and start-ups.

research output at doctorate-granting universities[2]. Little has been written about the effects of organizational practices and the personal characteristics affecting faculty research productivity at small- to medium-sized doctorate-granting universities (Carnegie Foundation, 2007). By definition, these small- and medium-sized universities graduate at least 20 doctoral candidates each year. Research, therefore, is critical to the mission of these universities. Therefore, the purpose of this study is to investigate the relationship of organizational environment and personal characteristics of faculty members on their research productivity. The study was done on small- and medium-sized not-for-profit, private, doctorate-granting universities.

Figure 1 shows how the parts of the system interact; it also shows the concept-variables selected for analysis.

The general question that guides this investigation is, "What are the environmental[3] and personal[4] characteristics that relate most highly to

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[2] Note: *Doctorate-granting Universities***:** According to the 2005 Carnegie Classification (Carnegie Foundation, 2007), these institutions typically offer a wide range of baccalaureate programs, and they are committed to graduate education through the doctorate level. They award at least 20 doctoral degrees per year overall. These institutions can be subdivided into two large groups. The first group includes comprehensive doctoral universities with or without a medical/veterinary school. All these institutions offer a wide set of doctoral programs grouped as follows: (a) humanities and social sciences dominant (HSCD); (b) science, technology, engineering, and mathematics (STEM); and (c) professional fields other than engineering (PD). The second group of universities is delimited by the "center of gravity" of their doctoral program. This means these universities are either HSCD-, STEM-, or PD-oriented, although they may also offer professional education at the doctoral level or in fields such as law or medicine.

[3] Note: *Environmental characteristics*: According to Blackburn and Lawrence (1995), these independent variables include exogenous factors such as the following: 1. Environmental Conditions: These variables describe the type of institution in which the faculty member works, including location, mission, and assets such as endowment, grants, external funding, equipment, and library size. 2. Environmental Response: These variables measure whether faculty perceive the institution as promoting research productivity through contributions such as secretarial support, rewards, research assistants, funds for travel, etc. 3. Social Contingencies: These variables characterize events and crises that may affect faculty members and can affect research productivity. Examples are illness, financial or marital crises, and the birth of a child.

[4] Note: *Personal characteristics*: These are independent variables that can affect professors' access to opportunities, commitment to research, and performance of research. Five categories of personal characteristics are considered in this study:

faculty research productivity at small- to medium-sized doctorate-granting universities?" Research questions derived from this main question are:

1. To what extent do different personal variables such as demographic characteristics and career-achieved experience relate to faculty research productivity?

2. To what extent do (a) environmental conditions, (b) environmental responses, (c) social knowledge, (d) self-valuation, (e) social contingencies, and (f) scholarly behavior relate to faculty research productivity?

A delimitation of this investigation is its focus on one aspect of scholarship, the discovery of knowledge, while it excludes other dimensions of faculty productivity such as teaching and service. This study focuses only on faculty perceptions and does not take into account various administrators who are closely involved with the professors. Also, the factors studied include certain influences on faculty research productivity, but exclude some other potentially valid variables.

There are several dimensions to research productivity's effects on and interactions with government, industry-business, and universities. Then: this study intentionally focused on the doctorate-granting universities' process of knowledge creation in the form of published studies, particularly, how faculty members' perceptions of themselves and their environment influence their ability to perform as researchers. This study did not include factors that produce financial returns from faculty members' inventions, such as technology transfer, partnership with industries and business, and various legal issues.

Due to time and length constraints, the universities selected for study were only private, not-for-profit doctorate-granting universities (Carnegie Foundation, 2007). This study did not consider the hundreds of large public and top private institutions with very high levels of research activity.

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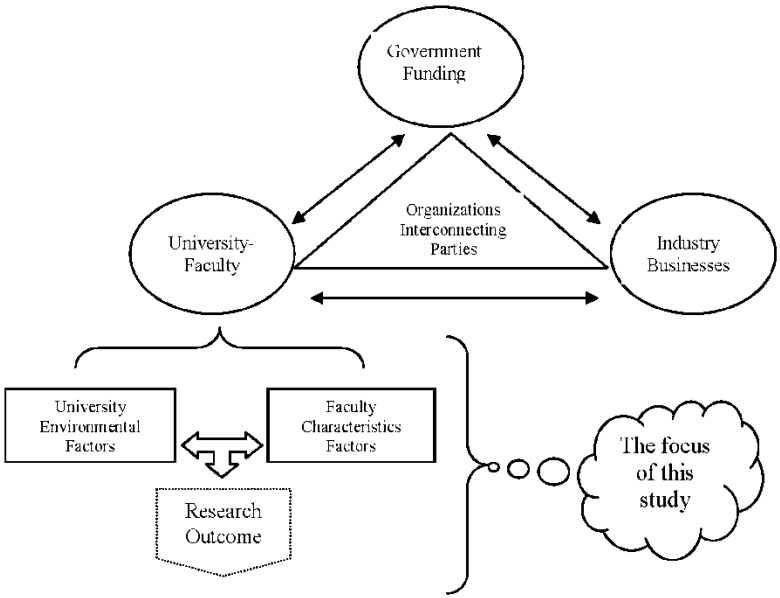
1. Socio-demographic: These variables include personal details such as gender, race, and age. 2. Professional Career: These variables are related to a faculty member's professional life, such as publication record, specialization, rank, length of career, tenure status, and administrative involvement. 3. Self-Perceptions: This is the self-image that a professor has regarding his/her research abilities, self-efficacy, general competence, commitment to research, motivations, and values. 4. Social Perceptions: These are dynamic variables referring to the interaction of self with one's institutional perceptions, which create the motivational basis for scholarly behaviors. 5. Scholarly Behaviors: These are activities such as giving conference presentations, submitting proposals for funds and grants, reviewing articles and discussing research topics with other colleagues, and submitting articles for publication.

Figure 1. *The Focus of This Study*



Although the dependent variable used in this study, number of publications, is widely accepted as an indicator of faculty research productivity, there are some important limitations. First is the understanding of what constitutes "professional writing," which in this case are refereed publications. Some professors' differences in interpretation may blur the results of this study by including papers that are not "professional" publications. Second, the accuracy of responses depended on the extent to which faculty could recall the number of writings published during the last 2 years. Third, the dependent variable emphasizes quantity of publications without regard to quality. Data on the difference and influence of the writings, the selectivity of the review processes, etc., would be nearly impossible to collect and analyze for a sample this large. Fourth, the collection of data was based on a static design, a snapshot of the reality and perceptions of faculty within a given university. A more complete understanding of faculty research productivity could be gained through a longitudinal process that includes several moments in time, which is beyond the scope of this study.

Relevance of the Study

A research area of increasing interest for administrators and faculty of private institutions[5] is the challenges that doctorate-granting universities face to maintain effective teaching and service while developing an identity for research.

Faculty research productivity also triggers a domino effect that goes beyond research itself. Consider the following points:

1. *Enrollment and retention*. Universities with high levels of research attract more resources, such as investments for facilities, endowments, equipment for research, internal budgetary resources, grants, and scholarships for students (Lee & Rhoads, 2004). Research brings prestige and a broader recognition, making the university more attractive to good students (Dey, Milem, & Berger, 1997; Dundar & Lewis, 1998; Serow, Brawner, & Demetry, 1999). Universities and colleges that have various methods of helping students pay for college are more attractive to prospective students and are better able to retain students (Melendez, 1997; Tinto, 1987). Several studies have confirmed the importance of all forms of financial aid (i.e., grants, loans, and work study) as positive impacts on enrollment and retention (Braunstein, McGrath, & Pescatrice, 1999; Heller, 1999; St. John, 1990a, 1990b, 1993; St. John, Andrieu, Oescher, & Starkey, 1994).

2. *Teaching*. There has been an extensive discussion about whether the teaching-research integration produces positive results at the undergraduate level (Braxton, 1996; Kinkead, 2003). Colbeck (1998) found, through several faculty interviews, that teaching and research are mutually supportive. The professors surveyed perceived benefits from integrating research with classes (p. 663). Braxton (1996) emphasized the importance of and benefits from that integration. In fact, Kim, Rhoades, and Woodard (2003) traced a significant correlation between the amount of money spent on research and the undergraduate graduation rates at public research universities. The integration of research and teaching can potentially benefit students through "active learning" (Braxton, Milem, & Sullivan, 2000). Nagda, Gregerman, Hippel, and Lerner (1998) found a correlation between research performed by undergraduate students and the

[5] Note: *Private universities*: According to the 2005 Carnegie Classification (Carnegie Foundation, 2007), there are two types of private universities: not-for-profit and for-profit. This study focuses on the not-for-profit universities. Based on knowledge production levels, these private institutions can also be subdivided as research universities (very high research activity), research universities (high research activity), and doctoral/research universities.

retention of those students. This correlation was especially strong among African-Americans. Stack (2003) pointed out a significant connection between research productivity (number of publications) and students' evaluation of teaching. The students perceived professors who performed more research to be better teachers.

3. *Professional development*. Faculty research productivity opens the door to benefits such as tenure, rewards, higher salary, better reputation, and increased visibility, which in return link professors to more opportunities and resources (Creamer, 1998). A faculty member who produces research and collaborates within and between institutions can be the main source of knowledge for an institution and a certain discipline, bringing prestige to that professor's department and university (Moore, Newman, & Turnbull, 2001).

4. *Industry and business*. Lee (2000, p. 114) gave the following reasons for industries and firms to collaborate with academics: (a) to solve specific technical or design problems, (b) to create new products and processes that would yield new patents, (c) to improve product quality and develop new technology to avoid negative environmental effects, and (d) to maintain relationships and network with universities to gain access to fundamental research and to recruit university graduates. This collaboration is increasingly supported by the federal government and benefits both the university and business-industry (Kirwan, 2010).

5. *Employment and community*. Universities that produce research can be a benefit to surrounding communities by creating employment through spin-off, start-up, and other business opportunities that research can generate (Bessette, 2003; Jankowski, 1999; Powers, 2003, 2004). Research done at universities has made a significant contribution to humanity by solving problems; these solutions may improve the quality of life for individuals, communities, and society at large (Bradshaw et al., 2003; Zucker, Darby, & Armstrong, 1998).

In short, research is a multi-dimensional activity that has numerous beneficial effects on professors, students, universities, and surrounding communities.

CHAPTER II

STUDIES ABOUT FACULTY RESEARCH PRODUCTIVITY

Dimensions and Controversies of Research Productivity

Over the last 15 years, there has been growing concerns about the mission and future of higher education. Every year universities are becoming increasingly influential institutions in the new globalized society (Baker & Wiseman, 2008; Etzkowitz, 1996; Etzkowitz, Webster, & Healey, 1998). The economies of the US and other countries are fueled by new knowledge that translates into expanding opportunities for new generations (Kezar & Eckel, 2000; Meyer, 2003; Ortega y Gasset, 1992). It is also true that universities are becoming entrepreneurial to survive and prosper within a continually changing and unstable environment and economies (Becker & Lewis, 1992; Bowie, 1994; Callan & Finney, 1997; Duderstadt, 2000; Lapidus et al., 1995; Slaughter & Leslie, 1997).

In short, universities are in a compelling situation in which it is critical for them to achieve a balance. On one hand, higher education needs more resources to cope with increasing costs and demands; many of the traditional sources of income, such as state support and federal grants are diminishing. On the other hand, new missions of a knowledge-driven economy and society are also creating confounding paths through a transition that seems never-ending (Middaugh, 2001). The modern economy depends on the discovery of new solutions for real problems and universities are having a huge effect on employment opportunities, new business opportunities, and quality of life (Mansfield & Lee, 1996). But in doing so, institutions also have to cope with new tensions and threats that may affect faculty productivity.

The Impact of Research

Increasing university-industry collaboration toward for-profit purposes is making significant contributions to the economy and to society. Bradshaw et al. (2003) observed that these trends are altogether positive:

> The university knowledge base can serve as the intellectual capital supporting industrial growth, providing the foundation for applications and ongoing research, which provides an expanding job market for students trained in the new field, and ultimately the commercial application of the research through new or improved products, processes, or regulatory procedures. (p. 297)

The same author also pointed out that there are at least three positive benefits of university-industry collaboration (p. 298):

1. *Knowledge benefits*. Knowledge is the major contribution that universities bring to industry and society; whether that knowledge is applicable is another issue. Knowing causes, consequences, and mechanisms of any given fact is a plus by itself.
2. *Employment and skill benefits*. Students and society in general benefit by acquiring new skills through university-industry integration. This leads to job creation and social improvements.
3. *Technological application and product innovation benefits*. The development of new technological solutions is an incremental benefit of the innovations that students and professors, before and after graduation, develop to enhance businesses.

Technology transfer has been of considerable influence beyond universities' walls (Bessette, 2003; Jankowsky, 1999; Powers, 2003, 2004). Lee (2000) explored the type of benefits faculty and industries seek from each other, as shown in Table 1.

Although industries are more oriented toward the application of research, and academics are more interested in basic research and idea generation, academics also need opportunities to secure resources and test research. According to Lee and Rhoads (2004), institutions involved in research can secure more financial support as they see and work on leveraging their knowledge for application.

> Entrepreneurialism is particularly beneficial for institutions confronted with decreasing revenue. Faculty at research universities who bring in substantial funds can subsidize an institution's operating costs and administrative salaries, allowing a university to maintain its course or even thrive in the midst of declining endowment income and/or government cutbacks. (p. 741)

Table 1. Motivations for Research Collaboration[6]

Rank	What firms seek from academics	Rank	What academics seek from firms
1	Research on product development	1	Secure funds for graduate assistants and lab equipment
2	Conduct 'blue sky' research in search of new technology	2	Gain insight into one's own research
3	Solve technical problems	3	Field-test application of one's own theory
4	Design prototypes	4	Supplement funds for one's own research
5	Provide seminars and workshops	5	Assist university's outreach mission
6	Conduct fundamental research	6	Create student jobs and internships
7	Support universities	7	Gain knowledge useful for teaching
8	Develop software	8	Look for business opportunity

Finally, the transference of technology into market-driven industries has been boosting economies both within and beyond the US (Bell, 1996; Etzkowitz et al., 1998; Fisher & Atkinson-Grosjean, 2002; Slaughter & Leslie, 1997). The link between universities and business-industry is widespread and is likely to increase in coming years (Anderson, 2001). Since this collaboration is stronger and is becoming a defining feature rather than merely a trend among research universities, the reactions of professors and administrators to these new extra missions for universities vary especially in the sample for this study.

[6] Note: From "The Sustainability of University-Industry Research Collaboration: An Empirical Assessment," by Y. Lee, 2000, *Journal of Technology Transfer, 25*(2), p. 130. Copyright 2000 by Kluwer Academic Publishers.

Criticism and Conflicts Regarding Research

The production of knowledge and in particular the translation of knowledge into money are not without criticism. Faculty must produce in an environment of conflicting situations. One of the most repeated concerns regarding universities engaging in entrepreneurial activities is the conflict of the missions, values, and cultures of businesses and academia (Bleiklie, 2005; Bleiklie & Powell, 2005).

According to Campbell (1997, p. 359), there are at least three areas of conflict. First, there is the potential conflict of interest. The use of funds, patents, and licensing, and influences such as ownership of stocks, may mix federal and private monies in the development research, which in turn benefits industry and business. Campbell asks, "Is it appropriate for faculty to act as entrepreneurial, holding patents and starting spin-off-companies, when they are drawing a full-time salary from the institution?" (p. 359). In other words, how do professors use their time and resources when they are paid for a certain performance? It is likely that "industry-university temptations" of making money from inventions would create a conflict of duty.

Second, there is a potential conflict of commitment. To balance teaching, doing research, and serving the public is difficult for most faculty members. It is possible that accumulating resources for the university and for the professor's pocket, while not bad in itself, may also diminish their focus and effectiveness in teaching and public service roles (Porter & Toutkoushian, 2006).

The third potential conflict is that of internal equity. Academic departments that are less able to attract external funds from business or industries often are downsized or face budgets reductions (Slaughter, 1993). Professors' academic workload may be reduced in light of collaborative activities with industries. The professors involved in collaboration make more money for a smaller workload at their universities. The comparisons and special treatment within departments are an endless source of conflict.

Hackett (1990, p. 266) found, in an early study, that changes in organizational culture related to university-industry collaboration have brought at least seven value conflicts for science researchers, as follows:

1. *Freedom and autonomy versus accountability and direction*. This is the difficult balance between having freedom to publish and express ideas freely and feeling the pressure of potential consequences that knowledge has produced for industry and society at large. Industries tend to control

their subsided research from being freely published. This, for instance, ensures their profit over competition.

2. *Producing research results versus educating students.* Professors and even administrators find themselves facing tough decisions about setting priorities and how to spend resources. Research can be a "money maker" for universities and professors, overthrowing teaching activities.

3. *Local versus cosmopolitan orientation.* Faculty members rely on institutional organizations such as centers of research to get funding for their projects. This relationship is strong, leading faculty to become more dependent on their local university. At the same time, industry is pulling faculty members toward broader relationships outside of the university, to the region, state, nation, or even global concerns.

4. *Quality versus quantity*. Some system incentives reward high-quantity performance. Such systems may need to deemphasize quantity and focus more on a production of research with higher patterns of quality.

5. *Specialization versus generalization.* Research requires specialization, but education involves generalized learning. It is difficult to bring diverse approaches to an integrated relationship among scientists, and as researchers they tend to center on a narrow field of study.

6. *Competition versus cooperation.* Cooperation among faculty members from different universities may mean that they lose projects. This leads to the isolation of professors within their own universities or teams of work.

7. *Efficiency versus effectiveness*. Since financial shortages are common, faculty members are pressured to use funds to achieve the highest possible level of research productivity. This tendency toward efficiency rather than effectiveness can waste resources and make both faculty and universities less productive of good.

Another source of conflict is the importance given to basic and/or applied research. Basic research is frequently associated with long-term inquiry, whereas applied research is more focused on solving immediate problems and business needs (Anderson, 2001, p. 240). This focus on applied research can conflict with the mission of higher education and raise questions about public-private accountability (Francis & Hampton, 1999; Milem, Berger, & Dey, 2000).

Campbell and Slaughter (1999) found, in a study of 86 colleges and universities, that university-industry collaboration also produces conflicts between faculty and administrators, since the latter treat professors as industrial managers would. As a result, faculty members lose ownership of their inventions and autonomy over their professional activities (p. 310). However, the same authors discovered that the most rigid tension between

faculty and administrators was the conflict of commitment. Professors want to keep their autonomy to increase their income and prestige. Being loyal to a local institution may limit scholars in their own professional businesses, because, as Ylijoki (2003) commented, "it is not easy to serve two masters simultaneously" (p. 332).

Faculty at Research Universities

Knowledge production is an overwhelming priority among faculty at top research universities, as Serow et al. (1999) pointed out:

> No sector within higher education has been more closely linked to the movement away from teaching than the research universities, the 125 institutions that award large numbers of doctoral degrees and that receive the heaviest volume of external research support. These institutions not only tilt their own faculty evaluation criteria toward research but, by virtue of their prestige and visibility, set a standard that ambitious institutions in other categories seek to emulate. (p. 412)

Evidently, faculty at research universities differ from their counterparts in other institutions (Blackburn & Lawrence, 1991, 1995, 1997; Boyer, 1990) in that they have broader limits and hold and fulfill a wider range of responsibilities (Finkelstein, 1984). Intrinsic motivations and extrinsic rewards play an important role in the teaching-research dynamic. Personal interests are powerful motivators, driving professors to do what they most enjoy, as are the draw of wider recognition and the access to better resources that come as a result of becoming an expert in one's field (Clark, 1997; Massey & Zemsky, 1994; Serow, 2000).

Recognition for teaching does not transcend the local campus, while research brings national recognition and more personal and departmental resources, among other benefits (Fairweather & Beach, 2002; Tang & Chamberlain, 1997). Massey and Zemsky (1994) suggested that institutions and faculty are seeking prestige, and thus are reducing teaching time at the undergraduate level, as follows:

> Our proposition is that as faculty place greater value on discretionary time, undergraduate teaching is accorded less importance. Put simply, those hours not used for teaching courses, for grading papers, or for meeting with students become available for research and scholarship, for consulting and other professional activities, and in most research universities, for specialized teaching at the graduate level. (p. 2)

Winston (1994) arrived to a similar conclusion when he said that, "An endless spiral of reward-equality-reward-equality results in increases in discretionary time, and hence, higher instructional costs all around and reduced attention to undergraduates and teaching" (p. 8). With similar concerns, Porter and Toutkoushian (2006) remarked that universities are searching for visibility and prestige, through research productivity, eroding quality teaching and time for professor-student rapports.

Two categories of educators are emerging: first, the prestigious researchers who are well known and have greater income and autonomy, and second, the traditional teaching-oriented faculty (Lee & Rhoads, 2004). Campbell and Slaughter (1999) warned that the disparities between these two types of professors will increase in coming years, which is happing now (Spanier, 2010).

Another important element that seems to affect faculty research productivity is the institutional evaluation-promotion system, including tenure and career rank. This system is based on grants received and publications generated, and pushes faculty to spend more time on research and collaborative work with business-industry in order to fund their departments and graduate students (Fairweather & Beach, 2002). The reward system of research universities is a constant affirmation of the importance of research for the betterment of faculty members and universities (Leslie, 2002). Tang and Chamberlain (1997) found, by studying several public universities in Tennessee, that administrator and faculty perceptions of teaching rewards were contradictory: "Administrators believe that professors' teaching effectiveness is rewarded, whereas professors do not" (p. 224). As Wolverton (1998) put it, "Outstanding teacher awards recognize only a small percentage of good teachers and usually carry little cash value and fleeting fame and punishment for poor teaching are rare" (p. 64). Simply put, faculty members know that being rewarded involves research productivity. This is a paradox because universities are supposed to be places of teaching, but teaching is time taken away from research, and research is a key issue for career advancement. Professors who are researching or working with industry may have difficulty finding time to teach classes effectively. Therefore, with resources coming in from research sponsors, professors give graduate students financial assistance in exchange for the graduate students' help with research or teaching (Slaughter, Archerd, & Campbell, 2004).

College students have a paradoxical perception of teaching quality, as Grunig (1997) pointed out:

> Faculty with high research and publication outputs are regarded as being more effective educators than faculty engaging in less research. In turn,

> the perceived excellence of faculty may contribute to enhance undergraduate educational reputation....Yet despite the potential decreases in student satisfaction that can be a side effect of institutional research activity, most students, like other members of society, believe that institutions that strongly engage in research are superior in important ways to institutions with lower research outputs. (pp. 42, 44)

Many of the undergraduate students are attracted to these top schools because of star professors or well-known researchers. However, there is a poor connection between those professors and undergraduate students (Grunig, 1997; Lincoln, 2000).

Time devoted to teaching seems to be negatively correlated to research effort (Lee & Rhoads, 2004; Patrick & Stanley, 1998). Marsh and Hattie (2002) statistically confirmed their previous investigation (1996) with the following findings:

> It is important to recognize that teaching effectiveness and research productivity are not naturally complementary.... We maybe should accept the conclusion that teaching and research are unrelated and move on to ask how we should enhance this relation. Good researchers are neither more nor less likely to be effective teachers than are poor researchers. Good teachers are neither more nor less likely to be productive researchers than are good teachers. There are roughly equal numbers of academics who—relative to other academics—are: (a) good at both teaching and research; (b) poor at both teaching and research; (c) good at teaching but poor at research; and (d) poor at teaching but good at research. (pp. 632, 635)

With data gathered in the 1992-93 National Survey of Postsecondary Faculty, Fairweather and Beach (2002) explored the percentage of faculty who were productive both in teaching and research. They found that only 22% of all faculty were simultaneously highly productive in both teaching and research. This percentage dropped to 6% when corrected for collaborative/active instructional approach to teaching quality. It is highly difficult for faculty to achieve teaching and research at the same time; as Fairweather and Beach (2002) put it, "the complete faculty member is rare" (p. 44).

According to Leslie (2002), moving to an institution with lack of pressure to publish would lead to a clustering of a certain type of professor. Such professors

> Tend not to trade teaching for research, even knowing that higher pay comes with publication if they had the opportunity. Given a reasonable level of security and compensation, faculty, on the average, would prefer

> to teach and to be rewarded for teaching than to seek opportunities for higher pay if it means doing more research and publication. (pp. 69, 70)

This means that the institutional characteristics (such as mission, incentives, and rewards) and intrinsic motivators are important conditioning factors that shape faculty preferences. Also Bland, Center, Finstad, Risbey, & Staples (2005) found similar results among professors from a medical school, asserting that, "institutions that want most of their faculty, instead of a few stars, to be highly research productive should emphasize institutional and leadership characteristics such as clear coordinating goals, research emphasis, communication, and assertive–participative governance" (p. 236).

Some Determinants of Research Productivity

Faculty Attributes and Conditions

Several researchers have studied the dynamic between faculty and university in terms of research productivity. Some of the most renowned investigations are organized as follows.

Gender and minorities

According to Sax, Hagedorn, Arredondo, and Dicrisi (2002), female professors are generally less productive, although there have been significant improvements in research productivity of women that have narrowed the gap (Fox, 2005; Toutkoushian & Conley, 2005). Women make up one-third of faculty members nation-wide and are underrepresented in the more prestigious institutions. Long, Allison, and McGennis (1993) discovered, in an early paper, that women are less likely to be promoted and are expected to meet higher standards for promotion, especially in prestigious departments. In a more recent study, Xie and Shauman (1998) found that the productivity gap between men and women has decreased over the last two decades. They discovered that the disparity in research productivity corresponds to differences in personality or personal characteristics, as well as to different organizational positions with different access to resources for research. Sax et al. (2002) supported the same finding:

> Women publish less in part because they are less driven by a desire to produce numerous publications and receive professional accolade. It is quite possible that for many women, time not spent publishing is spent

> instead on projects or other activities perceived as having more direct societal impact. (p. 436)

Vasil (1996) studied the impact of perceptions of self-efficacy on research publishing. He contrasted male and female faculty members at selected New Zealand universities. Men were found to have stronger self-efficacy perceptions, which promoted research productivity. Specifically, men had greater confidence to shape the "rules of the game." In other words, men had more control over resources and power structures, enabling them to produce more. This greater control promotes self-efficacy in male faculty members and weakens females' self-efficacy perceptions. Brown, Lent, and Ryan (1996) found that efficacy perceptions affect one's ability to transition from research training to publishing. This effect is stronger among women, who are more prone to be affected, whether positive or negatively, by self-efficacy perceptions in a given environment.

Women faculty members tend to be located at community colleges or 4-year colleges and in the non-sciences/non-engineering departments, where resources for research are fewer (Gander, 1999). Long and Fox (1995) confirmed that women and minorities have traditionally been behind in terms of earning doctorate degrees, particularly in scientific disciplines. This situation makes them less productive in research publishing, since scientists are the most prolific researchers. This condition prevents women and minorities from being leading generators of knowledge, as the Johnsrud and Des Jarlais (1994) described:

> The pattern of lower proportions of women and blacks in universities merits attention because it is in these institutions that human and material resources are available to support research with equipment, libraries, graduate student assistantships, and collaborators. These resources in turn affect research productivity and ultimately scientific stature. (p. 51)

Confirming these trends, Bradley (2000) conducted a longitudinal study of university graduation based on gender and found that women are more likely to graduate from education, arts, humanities, social sciences, and law, while men are more likely to graduate from natural sciences, mathematics, and engineering. Men's traditional fields of study are linked to resources that allow them to be more productive in research. Creamer (1998) arrived at a similar conclusion and stated that "stratification in science, or the concentration of women and minorities in the lower ranks and at less prestigious institutions, cannot fully be justified by the assumption that impersonal, universal criteria are equitably applied" (p. 3). In other words, there are some differences in access to resources and

advancement opportunities for minorities and women. Kolpin and Singell (1996) arrived at a similar conclusion:

> The research productivity of a faculty member is not simply a function of individual skills but is also affected by the 'quality' of colleagues, it is not surprising that some studies have found women tend to publish less than men. (p. 421)

The same authors found, among economics faculty, that departments with high-ranked faculty research publishing were the least likely to hire female faculty members.

Perna (2001) remarked that a balance must be found to allow all segments of faculty, including women and minorities, to have equal opportunities for research productivity:

> If research performance is to continue to be a predominant criterion in an institution's faculty reward system, then individual colleges and universities must ensure that women and minority faculty have equal access to the experiences and opportunities that have been shown to promote research productivity. Particular faculty experiences and responsibilities that should be examined are the time available for research, the magnitude of the teaching load and the teaching level, the availability of support for securing funded research projects, the level of advising and service responsibilities, and the availability of support to facilitate completion of the doctoral degree. External barriers to research productivity (e.g., lack of graduate assistants, inadequate work space) must be eliminated and effective research behaviors must be nurtured so that the time spent on research more readily translates into valued research products (p. 564).

Sax et al. (2002) explored family-related factors, like childrearing, and did not find them to prevent women from being productive in research; women facing these factors actually published more, on average. Stack (2004) also noticed that women with children produce more research publications. Similarly, Fox (2005) reported that women with preschool-aged children were more productive than those without children or with school-aged children. However, in social sciences, women with children under the age of 2 were less productive in research than the women with older children. Bellas and Toutkoushian (1999) found that married faculty members are more productive than unmarried ones. Nevertheless, female scientists are less likely to be married, yet they are among the most productive women-scholar groups (Long & Fox, 1995).

Faculty Age

The age of faculty members does not seem to be a limiting factor for research productivity (Battersby, 1993; Blackburn & Lawrence, 1995; Lawrence & Blackburn, 1988). According to Perry, Clifton, Menec, Struthers, and Menges (2000), older professors see themselves as having slightly more research expertise, which helps them in their studies. Goodwin and Sauer (1995) studied 140 tenured economics faculty members in seven research-oriented academic departments. They discovered that research productivity increases rapidly in the initial stages of a career, peaks at the tenure review, and then begins to slowly decline. The same authors pointed out that one of the most important factors leading to a decline in publishing activities for a faculty member is to go into administration. Highly productive researchers promoted to some kind of administrative position usually never return to their previous level of publishing productivity, even if they leave administration and go back to research.

According to Hu and Gill (2000), older senior professors may be more productive "due to favorable teaching loads, opportunities to work with multiple junior faculty members and doctoral students on research projects, or more time for research activities due to fewer new preparations for classes" (p. 24). In an early study of science researchers, Levin and Stephan (1989) noticed that age is a weak predictor of performance, as they asserted, "The graying of America's scientific community was accompanied with slowed rates of research in higher education" (p. 545). In short, as stated by Collins (1993), it is very difficult to generalize about the relationship between age and research productivity.

On a related note, Smeby and Try (2005) concluded that although aging of individual faculty members may be accompanied by a decrease in productivity, combining of older faculty members with younger ones can have a positive overall effect. Senior professors have more prestige and stronger research records, which help them to get more funding from grants. The different age groups benefit from each other as part of a research team within a departmental structure.

Rank and Promotion

Long et al. (1993), among others, remarked that the rewarding system of tenure is based on research productivity. Moving up the rank