The Texas Research Development Fund: Building Institutional Research Capacity at Texas Public Universities

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Author's Note

This paper is based on the author's dissertation entitled, *Texas research development fund awards to Texas public universities and their contributions to building institutional research capacity: A study of relationships and perceptions of effectiveness.* Portions of this paper have been derived from the dissertation.

Abstract

In 2001, the Texas state legislature created the Texas Excellence Fund (TEF) and the University Research Fund (URF) with the purpose of supporting institutional excellence and research capacity at general academic institutions. During the 2002-2003 biennium, participating Texas public universities received revenues from these funds (Legislative Budget Board [LBB] Staff, 2002). However, for the 2004-2005 biennium, Texas Governor Rick Perry vetoed appropriations for both funds (State of Texas, 2003). In 2005, as a replacement to the TEF and the URF, the Research Development Fund (RDF) was established to promote increased research capacity at eligible general academic institutions (Texas Education Code, Chapter 62.091, 2005). The purpose of this study was to examine the impact the RDF may have had in improving the research capacity of participating universities by examining the change in external sources in relationship to the change in the level of RDF resources. In addition, the study examined the relationship between changes in external resources and selected institutional characteristics. For purposes of this study, the state incentive funds, TEF, URF, and RDF were referred to as RDF since it is the latest designation and has the same purpose of all previous funds.

Keywords: Research development funds, higher education, research and development, research capacity.

Introduction

Since the 1940's and 1950's, the United States has sought to maintain its competitive edge in science and engineering. Prior to World War II, federal government resources devoted to scientific research and innovation were limited. However, by the end of the war, the United States realized that sustained scientific research could provide new technologies in communications, transportation, and weaponry. One of the best-known examples of the role of science in World War II is the Manhattan Project, which culminated in the creation of the first atomic bomb. In 1957, the Soviet Union launched Sputnik, the first artificial satellite to orbit the earth. Fearing that the Soviets would rise to superiority in math and science, the U.S. federal government further expanded its role of research in science (Lewis, 2005).

"Research and development (R&D) is essential for U.S. economic strength, technological leadership, and national security. Strength in science and technology is important because it is an essential ingredient for U.S. economic and military strength" (Lewis, 2005, p. 3). While the federal government has played an active role in funding R&D, its emphasis has been more on development than on basic research which according to Lewis (2005), is critical for the nation's economy and national security. Basic research has no immediate commercial application or use, but it fuels innovation. Because it takes years to see the results of basic research through products and services, and because businesses and industry seek more immediate return on their investments, private industry is less likely to fund basic research (Lewis, 2005). According to the National Science Foundation (NSF) (2007), colleges and universities spent over $45 billion in R&D expenditures in fiscal year 2005. Of that amount, over $29 billion came from federal sources and over $8 billion came from the institutions themselves. Industry, states/local governments, and other sources funded very little university-based R&D: over $2 billion, almost $3 billion, and over $3 billion respectively. Most federal funds are not applied to the research infrastructure of universities, but rather serves as the main source for specific research projects (Lewis, 2005). When equipment and labs, which build institutional research capacity, are included in a grant, they are usually targeted to a specific project. This leaves institutions to rely more on non-federal sources to increase their research capacity (Marburger, 2006).

The U.S. faces a number of challenges as it enters the 21st century: globalization, transition to an information economy, a competitive international business environment, the economic rise of Asia, and sophisticated commercial technologies. Without an increase in scientific research, investment in science and technology, and an enhanced research capacity, the U.S. will not maintain its competitive advantage in national security and economic strength (Lewis, 2005).

A Strategic Plan for Texas

In 1998, Don W. Brown, Texas Higher Education Commissioner, formed a panel of higher education professionals "to review the responsibilities and procedures of the Texas Higher Education Coordinating Board (THECB), and to recommend any changes that would increase its value to Texas higher education's quality, access, efficiency, and responsiveness to state needs" (Report of the Review Panel, 1998, Background section, para. 1). Commissioner Brown asked the panel to focus on two specific issues facing Texas: (1)

how to provide opportunities for individuals to participate and succeed in higher education in Texas, and (2) how to meet the growing demand of higher education over the next 10-15 years while state appropriations of general revenue are not expected to increase at the same rate (Report of the Review Panel, 1998).

The panel met with higher education representatives, legislators, the Governor, Texas business leaders who were former higher education institution trustees, THECB members, and Commissioner Brown. The panel also reviewed recommendations from colleges and universities, THECB planning documents, agendas, and legislation outlining the THECB's responsibilities (Report of the Review Panel, 1998). The Report of the Review Panel, issued in April 1998, made three main recommendations: (1) build on the THECB's strengths, (2) reassign responsibilities or streamline the procedures for addressing issues, and (3) adopt a long-term view that focuses on the most critical issues facing Texas and creates a public agenda for higher education in Texas.

As a result of the initial meetings, a Coordinating Board Planning Committee was appointed and charged with the task of developing a new higher education plan. The new plan included: (1) setting goals, (2) setting dates to reach the goals, and (3) creating a means to measure progress towards the goals. The efforts of more than 1,500 individuals and groups in the higher education community culminated in October 2000 with the THECB's Closing the Gaps Higher Education Plan (Texas Higher Education Coordinating Board, n.d.a).

This document outlines a long-term plan that addresses the four goals of closing the gaps in higher education-participation, success, educational excellence, and funded research over the next 15 years. These four goals were the most critical issues facing Texas higher education from the perspective of the committee and the higher education community. Each goal included interim targets for closing the gaps and success strategies for the state. The purpose of the *Closing the Gaps Higher Education Plan* was for Texas to develop a higher education system that would keep pace with the continued growth of the state's economic prosperity. The first goal, participation, addresses the challenge of increasing enrollment in higher education by 500,000 students by 2015. The second goal, success, seeks to increase by 50 percent the number of degrees, certificates, and other identifiable student accomplishments in high quality programs. Excellence, the third goal, seeks to increase the number of nationally recognized programs or services at colleges and universities (Texas Higher Education Coordinating Board [THECB], n.d.b). The fourth goal, funded research, is the issue to be addressed in this study.

To meet the fourth goal of funded research, the state initially planned to "increase the level of federal science and engineering research funding to Texas institutions by 50 percent to $1.3 billion" and to "increase research expenditures by Texas public universities and health-related institutions from $1.45 billion to $3 billion by 2015 (approximate 5 percent increase per year)" (THECB, n.d.b, p. 16). In October 2005, this goal was revised to read: "by 2015, increase the level of federal science and engineering research and development obligations to Texas institutions to 6.5 percent of obligations to higher education institutions across the nation" (Texas Higher Education Coordinating Board [THECB], 2006, p. 11). By measuring improved funding to Texas institutions in comparison to other states, the revised goal more clearly expressed the plan's intent (THECB, 2006).

The Texas Research Development Fund

The Texas Research Development Fund (RDF) and its predecessors, the Texas Excellence Fund (TEF) and the University Research Fund (URF), were developed by the Texas legislature to increase institutional research capacity at 32 participating Texas public universities that do not participate in the state's Permanent University Fund (PUF). Three institutions that receive funds under the PUF—The University of Texas at Austin, Texas A&M University, and Prairie View A&M University—are exempt from participating in the RDF. The fund links the level of RDF resources awarded to an institution to its success in attracting external funding for research. Specifically, universities participating in the RDF receive distributions based on the average amount of restricted research expenditures per year for the three preceding state fiscal years (Texas Education Code, Chapter 62.095, 2005). Restricted research expenditures are expenditures from a project classified as research, and the funds must be from a restricted funds group (Texas Higher Education Coordinating Board, n.d.c.).

The Study

Thirty-two Texas public universities participate in the Texas Research Development Fund (RDF). However, because one of the 32 universities reports its restricted research expenditures in conjunction with its main campus, for study purposes, there were a total of 31. Table 1 summarizes the 31 Texas public universities that participated in the study, including their Carnegie Classifications.

This cross-sectional study employed quantitative methods and focus groups/interviews. Its purpose was to examine the impact that the RDF may have had in improving the research capacity of participating universities by examining the change in external sources in relationship to the change in the level of RDF resources. Additionally, the study examined the relationship between changes in external resources and selected institutional characteristics. For purposes of the study, research capacity is defined as the amount of restricted research expenditures other than those from the RDF.

Table 1. *Research Development Fund (RDF) Participating Universities, Including Their Carnegie Classifications*

University	Carnegie Classification	Year Founded	Enrollment (Fall 2006)
Texas Tech University	Research-High	1923	27,996
The University of Texas at Arlington	Research-High	1895	24,825
The University of Texas at Dallas	Research-High	1969	14,523
The University of Texas at El Paso	Research-High	1913	19,842
University of Houston	Research-High	1927	34,334
University of North Texas	Research-High	1890	33,443
Texas A&M University-Commerce	Doctoral/Research	1889	8,496
Texas A&M University-Kingsville	Doctoral/Research	1925	6,700
Texas Woman's University	Doctoral/Research	1901	11,479
Lamar University	Master's-Large	1923	9,867
Sam Houston State University	Master's-Large	1879	15,893
Stephen F. Austin State University	Master's-Large	1923	11,633
Sul Ross State University	Master's-Large	1917	1,829
Tarleton State University	Master's-Large	1899	9,464
Texas A&M University-Corpus Christi	Master's-Large	1947	8,585
Texas State University-San Marcos	Master's-Large	1899	27,485
The University of Texas at San Antonio	Master's-Large	1969	28,379
The University of Texas at Tyler	Master's-Large	1971	5,926
The University of Texas-Pan American	Master's-Large	1927	17,337
University of Houston-Clear Lake	Master's-Large	1971	7,706
University of Houston-Victoria	Master's-Large	1972	2,652
West Texas A&M University	Master's-Large	1910	7,412
Angelo State University	Master's-Medium	1928	6,211
Midwestern State University	Master's-Medium	1922	5,945
Texas A&M International University	Master's-Medium	1970	4,917
Texas A&M University-Texarkana	Master's-Medium	1971	1,625
Texas Southern University	Master's-Medium	1947	11,224
The University of Texas at Brownsville	Master's-Medium	1926	4,917
The University of Texas of the Permian Basin	Master's-Medium	1969	3,462
Texas A&M University-Galveston	Baccalaureate	1962	1,553
University of Houston-Downtown	Baccalaureate	1974	11,449

The Results

The results of the study indicated that the RDF has made a positive impact on the research capacity of the 31 participating institutions of higher education in Texas. A t-test of repeated measures was performed to determine if the research capacity of the participating Texas public universities had increased significantly since implementation of the RDF. The results indicated a statistically significant increase in the research capacity of the participating institutions of higher education in Texas.

Next, an examination was conducted to determine if there was a relationship between the category of institution, based on the Carnegie Classification, and the rate of growth of research capacity. A chi-square test of independence showed no significant relationships between category of institution and the rate of growth of research capacity between fiscal years 2001 and 2005; however, a significant relationship was found between fiscal years 2005 and 2006 and 2006 and 2007. Between fiscal year 2005 and 2006, the phi-coefficient indicated that the Master's-Large, Master's-Medium, and Baccalaureate universities had a higher rate of growth in research capacity than the Research-High and Doctoral/Research universities. Between fiscal years 2006 and 2007, the Research-High and Doctoral/Research universities had a higher rate of growth in research capacity than the other lower ranking universities. Each university was categorized as high or low based on the mean rate of change of non-RDF funds for each of the years for which RDF awards were made and sorted into the two groups of institutions mentioned earlier. Figure 1 shows the changes in the mean rate of change in research capacity by year for each of the two categories of institutions.

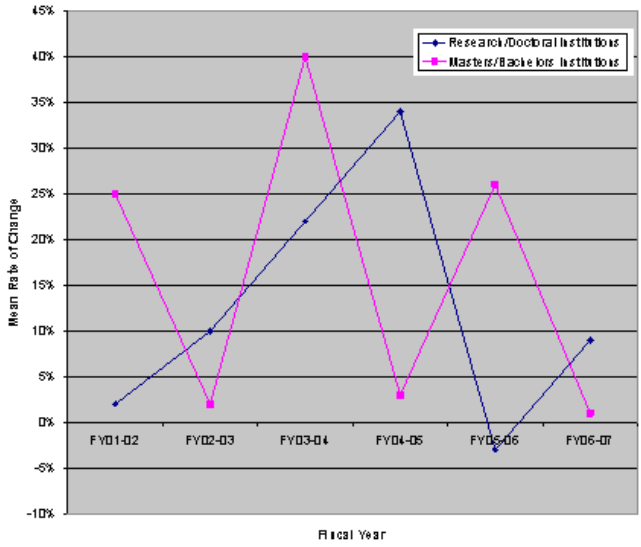

Figure 1. *Mean rate of change for RDF participating institutions by Carnegie Classification.*

Lewis (2005) stated that basic research has no immediate commercial application or use, but it fuels innovation. He contends that it takes years to see the results of basic research through products and services. Similarly, Paul Romer (1996), one of the primary developers of the New Growth Theory, characterizes our economy as one in which large upfront costs are incurred; but after the initial work is done, the cost of each additional unit is minimal or nil. Romer says that in a knowledge-based economy, returns increase rather than decrease and that knowledge builds on itself; as society learns more, it gets better at discovering new things (Kurtzman, 1997). Romer suggests that research and development activities, which are associated with long-term economic growth, are the driving force of long-term economic growth (European Commission, 2001). Using this logic and based on the research noted above, the lack of a significant relationship between category of institution and the rate of growth per year of research capacity for the early years of the RDF should not be surprising. The relationships between fiscal years 2005 and 2006 and 2006 and 2007 indicate that significant increases in research capacity are becoming visible four years after the initial institutional investments of RDF (fiscal years 2002 through 2005).

Another reason for the lack of a significant relationship between category of institution and the annual rate of research capacity growth in the early years could be due to institutions' hesitancy in coding restricted research expenditures. This was mentioned by university research representatives in the focus groups/interviews. In other words, institutions may not have accounted for all restricted research expenditures during the initial years of the RDF. In addition, the more experienced and larger universities may know how to increase research capacity consistently through RDF appropriation investments, while the smaller universities are less experienced and knowledgeable in using their RDF funds to increase research capacity.

A stepwise multiple regression analysis was conducted to determine which institutional variables among the 31 institutions could be related to the rate of growth of non-RDF funds between the first fiscal year of the RDF (2002) and the latest year available (2007). The rate of growth was the dependent variable, and the following demographic descriptors were the independent variables: (1) Age of institution; (2) Ratio of Graduate Student Headcount to Total Student Headcount; (3) Ratio of International Graduate Student Headcount to Total Graduate Student Headcount; (4) Ratio of Graduate Degrees Awarded to Total Degrees Awarded; (5) Ratio of Science & Engineering Graduate Degrees Awarded to Total Graduate Degrees Awarded; (6) Percent Full-Time Faculty; (7) Percent Part-Time Faculty; (8) Ratio of Full Time Equivalent Tenure/Tenure-Track Faculty to Total Full Time Equivalent Faculty; (9) Ratio of Part-Time Faculty Headcount to Full-Time Faculty Headcount; (10) Full Time Equivalent Student to Full Time Equivalent Faculty Ratio; (11) Ratio of Total Research Space to Total Space; (12) Ratio of Total Library Volumes to Total Student Headcount; (13) Ratio of Total Graduate Semester Credit Hour to Total Semester Credit Hour; (14) Total Number of Nobel Prize Winners and Members of National Academies; (15) Hispanic Serving Institutions; (16) South Texas Border Initiative Schools; (17) Federal Research Expenditures; (18) Total Research Expenditures; (19) Tenure/Tenure-Track Full Time Faculty Equivalent with Teaching Responsibility.

The only significant institutional demographic variable was the ratio of total part-time faculty headcount to total full-time faculty headcount. Those institutions with more part-time faculty may be able to alleviate teaching or other duties assumed by full-time faculty, allowing them to concentrate more on building research capacity. In addition, as

the rate of growth of non-RDF funds between the first fiscal year of RDF (2002) and the latest year available (2007) increases, so does the ratio of part-time faculty headcount to total full-time faculty headcount. Eventually, there could be diminishing returns. If an institution's part-time faculty grows at too great a rate compared to its full-time faculty, a decrease in research capacity could result.

Additional Analyses

Additional analyses were done to determine if relationships existed between the rate of change of research capacity and a related set of 2007 institutional variables. These analyses attempted to determine if a change in research capacity might have impacted other seemingly related institutional outcomes. Pearson r correlations were computed using rate of change as the independent variable and selected institutional demographic variables as the dependent variables. These analyses further questioned whether there was a relationship between growth in research capacity and some variables of interest. In other words, did research capacity influence current situations in fiscal year 2007? The results indicated that rate of change in research capacity did not influence current situations in fiscal year 2007. However, there could be other variables that were not identified and analyzed that could have influenced the current situations in fiscal year 2007.

For fiscal years 2002, 2005, 2006, and 2007, the THECB required all universities participating in the RDF to submit annual spending reports on their RDF appropriations. The annual reports included RDF expenditure amounts and details by project or initiative, and revealed the following items of interest: (1) the number of projects reported by each institution increased each year; (2) the total RDF appropriations reported by all participating universities each year did not match the total RDF appropriations distributed for each of the reporting fiscal years (universities have the option to roll over or carry forward RDF appropriations between fiscal years within bienniums); (3) universities have used the majority of RDF for research projects; (4) in fiscal year 2002, the first year of the RDF, the second most common RDF expenditure was on laboratory-startup, followed by research administration; for the remaining fiscal years, 2005, 2006, and 2007, the second most common RDF expenditure was on student assistantships and other student-related expenses (the majority of expenditures for students during these fiscal years were reported by one institution, the University of Houston); (5) the majority of RDF appropriations were used for science, mathematics, and engineering disciplines in all fiscal years reported.

Further analysis was conducted between the research/doctoral institutions and the masters/bachelors institutions. Between fiscal years 2003 and 2006, the research/doctoral institutions had a 17.19 percent increase in restricted research expenditures, compared to a 47.28 percent increase at masters/bachelors institutions. Comparing this with the 21.30 percent change in total federal research expenditures among all U.S. colleges and universities for the same years (NSF, 2007), it appears that the smaller schools are finding the Texas RDF to be making a positive impact on their research capacity.

Conclusion

This study showed a positive impact of the Texas Research Development Fund among its participating Texas public institutions, both for the research/doctoral-intensive universities and for the masters/bachelors universities. If the trend continues, participating Texas universities may be on their way to a higher level of research capacity.

Paul Romer, one of the primary developers of the New Growth Theory, held that ideas are goods that are produced and distributed in a similar way as other goods. He linked the neoclassical theory of inputs with technology (Romer, 1996). According to this theory, economic growth is sustained by the way societies deal with advances in technology. Romer contended that research and development activities, which are associated with innovation, are the driving force of long-term economic growth. With innovation, ideas are generated for new products or new processes. With new products and new processes, better quality goods are produced, raising productivity (European Commission, 2001). Using this logic, it may be concluded that increased research and research capacity in Texas can result in economic growth for the state.

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