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Obstacles and Opportunities: Funding Research at the 1890 Land Grant Institutions¹

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ABSTRACT Similar to other university faculties, faculty members at 1890 land grant institutions are expected to support their research programs with grants from sources outside their institutions. Although the expectation of securing grants has not received the public attention that the "publish or perish" dictum has, faculty at the 1890 institutions seeking promotion and tenure must increasingly demonstrate that they can procure grant funds. Numerous inhibitive factors, however, tend to attenuate the success of 1890 faculty in obtaining research grant funding and in implementing such research projects. In this study, three key factors are examined: political, research infrastructure and faculty initiative. The perceived importance of "benefits of conducting research" is also examined. Descriptive statistics and analysis of covariance are used to evaluate potential barriers to research, faculty access to information about research grants programs, opportunities to compete for grants, and experience in obtaining competitive grants. Data for this analysis are taken from a probability sample of faculty members at the 1890 land grant institutions and Tuskegee University. Also, activities are proposed that need to be implemented in order to minimize the factors preventing many scientists at the 1890 institutions from obtaining more competitive grants.

Introduction

Many administrators at the 1890 land grant institutions are exerting pressures on their faculty to augment their research programs with grants

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tence of state funds, and increasing efforts to maintain the quality of services as resources dwindle and the costs of doing business escalate. The result is that faculty members seeking promotion and security must teach, publish in refereed journals and procure grant funds.

This pressure is further complicated with the proliferation of think tanks, research organizations, etc., all with their highly qualified professionals that now compete for the shrinking pool of monies available for research. Since competition for any monies earmarked for research has intensified over the past two decades, each grantsman must be prepared to write a quality proposal that succinctly addresses the legitimate needs or problem areas of his/her constituency, and he or she must compete on an equitable basis.

Herein lies the problem. Given the minimal resources historically available at the 1890 institutions—compared to the 1862 land grant institutions and others—can the 1890 faculty compete successfully with other faculties or professionals in other agencies, commissions, think-tanks, and like organizations? In addition to having heavy teaching loads and a number of disadvantaged students that require additional time to address their special needs, the 1890 faculty must now exert a greater effort in another area, securing competitive grants. Confronted with the need to be more productive and without a research infrastructure or a commensurate increase in salary, many 1890 faculty members become frustrated in their attempts to compete successfully for grants to support their research. They are aware of some colleagues who have received grants repeatedly and of others who have never succeeded in receiving a grant. Some have concluded that politics, the status or size of the institution, institutional support, discrimination or other factors contribute to the success or lack of success in obtaining competitive grants. With respect to being awarded competitive grants from USDA and other sources, the history of the 1890 institutions is at best bleak. For example, during the last ten years, only *one* 1890 institution (Tuskegee University) has received a competitive grant from the CSRS Competitive Grants Program. If it were not for the entitlement monies in 1977 (i.e., Evans-Allen funds) the research programs at the 1890 institutions would be virtually nonexistent.

The viewpoints and findings presented here are not intended to be polemical, or to decry flagrant discrimination, or to advance controversial assertions but to examine critically the potential barriers to conducting research at 1890 land grant institutions. The study explicates the types of inhibitive factors observed by 1890 university faculty that may reduce the likelihood of being able to compete successfully with other faculty in obtaining competitive grants. Both structural and nonstructural factors are considered.

Historical context

In 1862, President Lincoln signed into law the first Morrill Act, establishing a land-grant institution in each state for purposes of educating U.S. citizens in agriculture, home economics, mechanical arts and other useful professions. However, because of high administrative costs and a soft market for land sales, most states had little money to use as a trust fund to endow such a college. Consequently, the states began to petition the federal government for additional monies, led again by Senator Justin Morrill of Vermont (Kerr, 1987).

Initially proposed in 1872, the Second Morrill Act was finally passed in 1890 to give direct annual appropriations to each state to support its land-grant college. During the first year, congress gave \$15,000 to each state and territory and then increased the appropriation in annual \$1000 increments until the sum reached \$25,000 annually. The Second Morrill Act incorporated one additional section: it forbade racial discrimination in admission to colleges receiving these funds. A state was permitted to escape this proviso, however, if separate institutions were established and the newly available funds were distributed in "a just and equitable," though not necessarily equal, manner. The Southern states hastened to comply with this new provision. Maryland, Alabama, Arkansas, Florida, Texas, Kentucky, Louisiana, Virginia, Mississippi, and Missouri gave portions to existing black colleges whereas Delaware, Georgia, North Carolina, Oklahoma, South Carolina, Tennessee and West Virginia created new land grant colleges for their black residents. These institutions became known collectively as the "1890 colleges²" (Kerr, 1987). Further, the Morrill Amendment of 1890 also included an enforcement mechanism to ensure the equitable distribution of funds. However, a challenge followed immediately; the challenge was successful and the Morrill enforcement mechanisms were diminished

²The 1890 institutions include Alabama A&M University, Alcorn State University, University of Arkansas at Pine Bluff, Delaware State College, Florida A&M University, Fort Valley State College, Kentucky State University, Langston University, Lincoln University, the University of Maryland—Eastern Shore, North Carolina A&T State University, Prairie View A&M University, South Carolina State College, Southern University, Tennessee State University, Virginia State University and Tuskegee University. Tuskegee University, although technically not a land grant institution, was created by an Act of the Alabama Legislature in 1881 and was granted 25,000 acres of land by congress in 1889. However, in 1893, the state established and incorporated a Board of Trustees and designated the school as private. This technicality notwithstanding, no one can question the numerous and significant contributions of the Tuskegee faculty to the land-grant mission. Throughout this paper, the historically black land-grant colleges and universities and Tuskegee University will be referred to collectively as the "1890 institutions." Finally, West Virginia State University relinquished its land grant status in 1957.

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permanently (Schor, 1985). Hence, blacks would obtain minimal Morrill funds, little or none for research.

To darken the research scenario at the 1890 institutions even further, the Hatch Act, passed before 1890, provided research funding for the agricultural experiment stations under the directions of the 1862 land grant institutions; consequently, almost all of the black land-grant institutions went without these necessary funds for research. Instead, for many years they were compelled to rely upon printed findings and could not initiate research geared to the specific needs of their clientele (Schor, 1985).

It was not until the 1960s that the USDA began to compile statistics on the quality of black agricultural education. Funds spent on research at these institutions were so minuscule that they became an outrage. Efforts were made to provide study grants to the 1890 institutions for purposes of initiating research funding (Schor, 1982, 1985).

In 1967, the USDA began to provide permanent monies to the 1890 institutions. Dr. George Mechren, Assistant Secretary of USDA, requested that the National Academy of Sciences (NAS) allocate \$283,000 for research at the 1890 institutions which had been available under provisions of Public Law 89-106. A formula was recommended, and the funds were made available for Fiscal Year 1967 at an average annual amount of \$17,658.50 per school (Mayberry, 1977:42-48).

In 1972, the research programs at the 1890 institutions received additional funding when the Secretary of Agriculture, empowered by Public Law 89-106, awarded grants to conduct research in agriculture and the food sciences. Further, as part of the Agricultural Research, Extension and Teaching Policy Act, congress passed in 1977 Public Law 95-113, Section 1445, known as the Evans-Allen 1890 Research Program. This legislation created permanent funding for the 1890 institutions under the Hatch Act. Congress authorized the 1890 institutions to receive at least 15 percent of the annual appropriation obtained from the Hatch legislation. Unfortunately, this percentage has been operationalized as a ceiling rather than as a floor. Evans-Allen funds currently constitute the major source of funding for the research programs at the 1890 institutions. For fiscal year 1988-89, about \$24 million were earmarked for the 1890 institutions.

With the availability of Evans-Allen funds, researchers at the 1890 institutions began to focus their efforts on various disadvantages of the rural populace. Because of the ubiquitous nature of rural social problems and the scarcity of funds, a need was felt for collaborative efforts; hence, the first regional research project at the 1890 institutions was established. This regional project (RR—1), "The Isolation of Factors Related to Patterns and Levels of Living in the Rural South," was initiated in Fiscal Year 1978. Drs. Edward Moe and McKinley Mays (USDA/CSRS), Dr. Melvin Walker, Jr. (Fort Valley State College), Dr. John Moland (Southern University), Dr. J.S.

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Dhillon (Florida A&M University) and Mrs. Marguerite R. Howie (South Carolina State College) were instrumental in developing this project. Eleven 1890 institutions participated in RR-1, and following this development, three other regional projects were begun at the 1890 institutions.

In light of the foregoing funding disparities, the Carter and Reagan administrations increased USDA funding, and in 1984 former President Reagan signed into law a \$50 million appropriation to provide basic research facilities at the seventeen 1890 land grant institutions (Schor, 1985). This one-time funding is not a panacea for the 1890 research programs' difficulties; however, these funds represent a recognition of the problem and may serve as a basis for obtaining a larger, more equitable, share of the *increase* in funds earmarked for agricultural research.

Finally, the contributions of the 1890 institutions are so numerous, extensive, and important that many of them will probably never be measured. Foremost among these contributions is the development of more than 300 derivative food and industrial products from peanuts and more than 100 from sweet potatoes by George W. Carver, while at Tuskegee University. Also, without the 1890 institutions, many blacks would have been denied a college education. Despite the increased concern shown by the predominately white 1862 institutions for equal access, continuing discrepancies in the level of social, economic, and educational opportunities make the 1890 institutions vitally important to the production of an educated black citizenry. Today, these institutions serve students of all races and enroll approximately one-fourth of all black students in higher education in the United States (ARD, 1986:3).

Background and structural context

Research on the procurement of grants or "grantsmanship" has become an important social and economic force, particularly during the last 25 years. Generally defined as the "bestowal of economic goods to accomplish purposes deemed to be publicly good" (Kalas, 1987), grants have resulted in the exchange of funds in excess of \$100 billion per annum. Persons desiring research grants must be able to produce public goods that are related to the organizational goals of the funding agency. The grant system and the institutions that compose it, both grantors and grantees, have taken on a normative structure of their own, operating by means of a highly complex set of rules and practices. According to Kalas (1987), "all of these characteristics illustrate that the grant system is now a permanent and self-perpetuating structure of society."

Despite the relatively recent development of the system, an extensive body of literature has evolved to describe, explain and analyze it (Derthick, 1970; Lauffer, 1984; Kalas, 1987). However, the literature is particularly

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scant with respect to differentials of grantsmanship, the politics of grantsmanship, and factors influencing the procurement of grants. Much of the literature is of the "how to do it" variety, sources of grants, preparing proposals, grants administration procedures, monetary amounts of spending on research and development and the accountability of funds. Further, many of these works are devoted to developing the skills of those who are—or wish to be—part of the system. Some of these studies are fairly elementary, directed toward the new practitioner, while some are quite technical—or, written for the professional grantsman. The one factor characterizing most of the literature on grants is that it is quite particular, dealing with specific grant programs or with particular operational aspects of the system. (Lefferts, 1978; Logsdon, 1982; York, 1982; Margolin, 1983; Bauer, 1984; White, 1984; Kalas, 1987).

One particular operational aspect of the grant system that has received considerable attention in the literature has been the peer review procedure. In a speech criticizing the peer review process, Representative R.E. Bauman of Maryland stated that

there is a need for revision of the basic system by which . . . research grants are made. They are handled out in an unregulated and secretive manner known as the "peer review system." This system allows cronies to get together and finance their pet projects, where grant application writing has become an art and where many people are not devoting themselves to basic research needs but rather to feathering their own nests. (Gustafson, 1988:1060)

According to other critics, members of external advisory committees are predominantly white, male and more than 35 years of age. Further, they are drawn from prestigious graduate universities, thus perpetuating existing biases by their long terms of service and by their tendency to maintain an entrenched "old boy network" by nominating their personal acquaintances to succeed them. Critics are equally concerned about equity, defined as equality of funding among regions and adequate representation for minority groups, small colleges and less prestigious institutions (Kalas, 1987).

Data from the National Research Council (NRC), National Science Foundation (NSF) and the National Institute of Health (NIH) tend to support the race, sex and age differentials; however, the data do not confirm the assertion that the top graduate institutions receive a disproportionate share of research grants. The data do, however, show that patterns of funding indicate a strong advantage for prestigious institutions. At both NIH and NSF, respectively, applicants from ten institutions accounted for 46 percent of all grant funds and applicants from the top 20 institutions represented one-third of total NSF obligations for all programs. In contrast, other studies have

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found that when one controls for institutional size, particularly the number of faculty members capable of performing or supervising graduate-level research, the funding distribution among institutions becomes more nearly uniform or that the distribution of grants generally parallels the distribution of researchers. In general, however, these conclusions are still tentative. There has been too little research into the impact of the peer review system on funding patterns and on the quality of the resulting research (Kalas, 1987).

A second operational aspect of the grant system that has received attention in the literature is the extent to which large universities have become key players. Participation in the grant system has become an integral component of the organizational operation of all major research universities. On the other hand, for the relatively small universities (i.e., the 1890 institutions), two arduous barriers exist.

First, the availability of grant funds can skew a university's goals and priorities. The university's (or scientist's) goal should be clearly stated before a decision is made regarding a specific grant program. Unless the project's goals are closely aligned with individual, professional, and institutional goals, the grant probably should not be sought. While this may sound truisitic, small universities are often beguiled into an inappropriate direction by the lure of grant dollars. This is not to imply that institutional goals must remain stagnant. Indeed universities must adapt over time, and the university that ignores shifting social and national priorities runs the risk of irrelevance. Some discipline needs to be exercised as part of the grant-funding process; thus, if a university defines its goals clearly and succinctly, and participates in the grant system to achieve those goals, then grant funding is an important contribution to a university (Schuh, 1986; Kalas, 1987). Successful participation in the grant system conveys both status and visibility and can become a threshold to growth. A major grant to a small university can strengthen that university by elevating it to a more prestigious level of operation.

Second, the grant process absorbs a great deal of a university's principal asset—human capital. If the efforts of the faculty are dissipated to achieve ends incongruent with the university's purposes (or the scientist's expertise), then whatever the immediate financial gains, the university has lost more than it has gained (Kalas, 1987). This problem is aggravated by the heavy teaching loads and other academic commitments of faculty at smaller universities. Stated differently, the faculty at the smaller universities compared to larger universities generally have less time to prepare grant proposals, tend to have fewer resources, financial or otherwise, to augment grant funds, and tend to have a more circumscribed domain of possible topics. The latter is due primarily to the lack of a critical mass in terms of faculty and the unequal distribution of available grant funding among specialty areas.

In sum, the grant system is an excellent example of a complex social system because it is relatively new and has grown quite rapidly. The interest

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in this case is heightened by the fact that grants are the vehicles through which major social purposes are achieved, thereby reflecting those commitments to which society is willing to allocate funds (Kalas, 1987). For the most part, the 1890 institutions are at the margin of this system and efforts are needed to integrate them.

Data and approach

The data for this study were obtained from a twenty percent random sample of all faculty at the seventeen 1890 land grant institutions. The sampling frame consisted of the 1988—1989 faculty directories of these institutions. Three mailings were used in the sampling process to maximize the response rate. The first mailing included a cover letter, the questionnaire and a return envelope. A postcard reminder was sent to all respondents several weeks later. The final mailing to nonrespondents again consisted of a cover letter, questionnaire and return envelope. Of the 1306 questionnaires mailed, 601 (a cooperation rate of 48.7%) were completed and returned.

The survey data were analyzed using descriptive statistics, factor analysis and analysis of covariance. Descriptive statistics (frequency and percentage distributions, means and standard deviations) were used to provide a socio-demographic and career profile of the 1890 faculty along with their evaluations of potential barriers to research and the procurement of competitive grants. Factor analysis was used to construct three composite indices that reflected the important dimensions extracted from twenty-three items related to a domain of inhibitive factors and research opportunities as articulated by the 1890 faculty. Finally, these composite indices were used as endogenous variables in analysis of covariance models to test the extent to which they are influenced by selected contextual and career-related variables.

Descriptive analysis

Table 1 presents frequency and percentage distributions and means and standard deviations for the socio-demographic and career related variables included on the questionnaire. The data show that nearly a fourth of the 1890 faculty responding to the survey had specialty areas in agriculture and the life sciences. Fifty-eight percent of the faculty are black compared to 31 percent white and 10 percent Asian or Pacific Islanders. Nearly 70 percent of the 1890 faculty are male. Less than 10 percent of the faculty responding to the survey are younger than 35 years of age; the average age of the faculty is 47 years, with a standard deviation of 9 years. These faculty members have been at their present institutions, on the average, 12 years; however, the variability is substantial—8 years. The range varied from less than one year of service to over 40 years. Fifty-three percent of the 1890 faculty are tenured while twenty-seven percent are on a tenure track but have not achieved tenure.

Funding Research at 1890 Land Grant Institutions—Thompson 9**Table 1. Sociodemographic and career-related characteristics of 1890 faculty**

RACE	NUMBER	PERCENT	FACULTY RANK	NUMBER	PERCENT
Black	340	57.5	Assistant Professor	182	30.8
White	183	31.0	Associate Professor	160	27.1
Asian/Pacific Islander	56	9.5	Full Professor	168	28.4
Other	9	2.0	Other	81	13.7
Total	591	100.0	Total	591	100.0
SEX	NUMBER	PERCENT	ACADEMIC DISCIPLINE	NUMBER	PERCENT
Male	398	67.2	Agriculture	88	16.1
Female	194	32.8	Life Sciences	42	7.7
Total	592	100.0	Business and Economics	39	7.1
AGE	NUMBER	PERCENT	Counseling	10	1.8
25 - 34	55	9.5	Education	45	8.2
35 - 44	194	33.3	Engineering	24	4.4
45 - 54	210	36.1	English/Communication	71	13.0
55 - 64	100	17.2	Health and Physical Education	14	2.6
65+	23	3.9	History	18	3.3
Total	582	100.0	Mathematics/Computer Science	37	6.8
Average	46.7		Music	16	2.9
Standard Deviation	9.2		Nursing	17	3.1
YEARS AT PRESENT INSTITUTION	NUMBER	PERCENT	Philosophy	10	1.8
0 - 4	138	23.2	Political Science	13	2.4
5 - 9	135	22.7	Psychology	12	2.2
10 - 14	107	18.0	Sociology	24	4.4
15 - 19	116	19.5	Other	67	12.2
20 - 24	56	9.4	Total	547	100.0
25 - 29	26	4.4	TYPE OF APPOINTMENT	AVERAGE	STANDARD DEVIATION
30+	18	2.8	Teaching	70.8%	27.0%
Total	596	100.0	Research	24.4	24.0
Average	11.8		Administration	31.9	28.5
Standard Deviation	8.0		Extension	27.4	38.3
TENURE STATUS	NUMBER	PERCENT	Other	17.5	20.1
Tenured	316	53.4			
Tenure Track	162	27.4			
Not Tenure/Tenure Track	114	19.3			
Total	592	100.0			

Twenty percent of the faculty are in tenuous positions with no prospect of being granted tenure. Finally, in Table 1, the major proportion of the 1890 faculty's appointment involves teaching (70 percent).

The latter finding notwithstanding, nearly three-fourths of the faculty (N=435) reported that research is something they are expected to perform and nearly two-thirds of the faculty (N=382) indicated that they were "very interested" in conducting research. Therefore, it is reasonable to conclude that

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the 1890 faculty would be engaged in considerably more research if the teaching constraint were not present. Individuals can not do much research when 70 percent of their time, on the average, is involved in resident instruction. Despite the disproportionate amount of time engaged in teaching, 1818 proposals were submitted over the last five years; fifty percent of these proposals were funded totalling roughly \$201 million. Of the 1818 proposals, 1406 (77 percent) were submitted to sources outside the institutions (also exclusive of formula funds); 684 (49 percent) of these proposals were funded totalling \$84 million. It should be noted that nearly 40 percent of the sample did not respond to these questions, and the distributions in this analysis were highly skewed.

The faculty were asked to respond to thirteen items pertaining to certain actions or activities that would assist them to do more research (Table 2). Over ninety percent of the faculty believed that seminars and workshops on grant application, reduced teaching loads, release time, sabbaticals, seed money for pilot studies, assistance in completing applications, receiving information more quickly, and the availability of research assistants would help them to be more productive in their research.

Teaching load was the modal response; hence, the biggest barrier to conducting more research (Table 3). There was a precipitous drop in the frequency of response between reduced teaching loads and the next biggest barrier, release time to prepare proposals. Further, the faculty felt that the third, fourth and fifth biggest barriers to research were, respectively, seed money for pilot studies, getting information more quickly and the availability of research assistants.

Subsequently, the faculty were asked a series of questions related to initiative. The data in Table 4 show that over one-half of the faculty indicated that their colleagues do not show much initiative in writing grant proposals. About 40 percent feel that their colleagues are not interested in obtaining competitive grants. Further, it appears that another important barrier, as stated above, is obtaining information early enough to prepare a quality proposal; sixty percent of the faculty felt that this was problematic. Finally, about one-fourth of the faculty believed that the 1890 administrators are not supportive of involvement in obtaining outside grants.

Perceptions of discrimination in the awarding of competitive grants are presented in Table 5. Nearly one-fifth of the faculty felt that they were discriminated against because of the status of the 1890 institutions. Discrimination because of race, gender, age, and education was perceived as virtually nonexistent.

Funding Research at 1890 Land Grant Institutions—Thompson 11**Table 2. Enabling and inhibitive factors in conducting research**

	PERCENT AGREEMENT
A. Seminars and workshops on how to apply for grant and contracts	91
B. Reduced teaching loads	93
C. Seed money for pilot studies to demonstrate the feasibility of a research project and therefore strengthen a proposal	92
D. More clerical assistance for the typing and preparation of grant proposals	88
E. Help in completing forms, developing budgets, and other details of grant proposal preparation	90
F. Release time to prepare grant proposals	91
G. Getting information more quickly about grant or contract opportunities	92
H. More travel to professional meetings to meet with other researchers	92
I. Availability of matching funds for grant or contract applications	87
J. Availability of research assistants to implement the research	90
K. Professional leave opportunities for improving research skills	92
L. Help in understanding political factors, that is, factors other than the quality of the research proposal that influence opportunities for funding	83
M. Seminars or workshops for faculty to improve their research skills	87

Factor analysis

Factor analysis was used to determine the underlying common structure(s) of 17 statements pertaining to actions, activities and barriers that are believed to affect the extent to which the 1890 faculty are able to obtain grant funding for research or to actually conduct research. Responses were coded on a four-point scale ranging from '1' (strongly agree) to '4' (strongly disagree). Positively and negatively worded items were transformed such that a low score would indicate a high level of agreement and a high score would indicate a low level of agreement. Upon doing this, a common factor analysis was used to account for the covariation among these 17 items. Employing the squared multiple correlation between a given variable and the rest of the

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Table 3. Main inhibitive factors in conducting research

INHIBITIVE FACTORS	NUMBER	PERCENT
Reduced teaching loads	236	39.3
Release time to prepare grant proposals	95	15.8
Seed money for pilot studies	40	6.3
Getting information more quickly	34	5.7
Availability of research assistants	30	5.0

Table 4. Potential barriers to obtaining grant or contract funding for research

	PERCENT AGREEMENT
Most faculty at my institution are not interested in obtaining competitive research grants	41
Faculty get information about grant or contract opportunities too late to prepare a quality proposal	60
Most faculty at my institution do not show much initiative in writing grant proposals	52
The administrators at my institution are not supportive of involvement in obtaining outside grants or contracts	27
In general, the research ideas of faculty at my institution are not in the academic mainstream	20

variables in the matrix of communality estimates, five factors were initially extracted. However, based on Kaiser's eigenvalue of greater than one and the scree test, it was determined that only two factors were meaningful. The nine variables that failed to load appreciably on the first two factors or had a factorial complexity larger than one were dropped from the analysis.³

³Factor analysis was used as a data reduction technique to empirically construct composite constructs or indices of the items related to structural and individual barriers in obtaining competitive grants. Factor analysis is based on the fundamental assumption that some underlying constructs (factors) are responsible for the covariation among the observed variables and can be employed to assist in conceptually identifying the "structure" or dimensionality of a set of variables drawn from the same domain. Thus, factor analysis is used here as an expedient way of determining a smaller number of constructs that will be interchangeable with twenty-three Likert-type attitudinal items. Two factor analyses were performed.

Table 5. Existence of discrimination in securing funding of grant or contract proposals

	PERCENT RESPONDING YES	
	OTHER FACULTY	RESPONDENT
Status of the institution where you are located	21	19
Racial or Ethnic Background	13	12
Gender	4	3
Amount of Education	8	4
Age	3	3
Subject of the Research	16	13

An oblique rotation was used to achieve simple structure. As such, Factor 1 accounts for 23.6 percent of the common variation among the variables while Factor 2 accounts 15.1 percent of the variation. Variables 1—5 (items) loaded significantly (0.40 or higher) on Factor 1 where as variables 6—8 loaded significantly on the second factor.⁴ The communalities (h^2), indicating the weight of each factor in explaining the variables, are also given in Table 6. For example, the two factors account for 60 percent of the variation on Variable 1, 57 percent of the variation in Variable 2, 42 percent of the variation in Variable 3, and so forth.

Once the variables were assigned to the factors with which they exhibited the closest linear relationship, the factors or constructs were identified. Based on the nature, magnitude and pattern of the loadings, Factor 1 was identified as *research infrastructure*. This composite measure consisted of five items: 1) "availability of matching funds for grant or contract applications," 2) "availability of seed money for pilot studies to demonstrate the feasibility of a research project and therefore strengthen a proposal," 3) "availability of research assistants," 4) "availability of clerical assistance," and 5) "availability of travel money to attend professional meetings to interact with other researchers." The second composite measure (Factor 2), identified as *faculty initiative*, consisted of three items: 1) "most faculty at my institution are not interested in obtaining competitive research grants," 2) "most faculty at my institution do not show much initiative in writing grant proposals," and 3) "in general, the research ideas of faculty at my institution are not in the academic mainstream."

A second factor analysis was performed to empirically confirm if the six items that were selected to be indicators for the question, "compared to other

⁴A factor loading indicates the relative importance of the variables to the underlying construct(s).

14 *Southern Rural Sociology, Vol. 7, 1990***Table 6.** Rotated factor pattern matrix for variables related to research infrastructure and faculty initiative composite indices*

VARIABLES	ROTATED FACTOR LOADINGS		
	F ¹	F ²	h ²
1. Availability of matching funds for grant or contract applications	.79	.02	.60
2. Availability of research assistants	.77	-.03	.57
3. Availability of seed money for pilot studies	.55	-.13	.42
4. Availability of clerical assistance	.48	.06	.53
5. Availability of travel money to attend professional meetings	.42	.09	.38
6. Most faculty at my institution do not show much initiative in writing grant proposals	.01	.85	.70
7. Most faculty at my institution are not interested in obtaining competitive research grants	-.03	.81	.69
8. The research ideas of faculty at my institution are not in the academic mainstream	.01	.72	.50
Variance Explained	23.6%	15.1%	

*An oblique rotation was used to achieve simple structure.

faculty at your institution, how often do you feel faculty who obtain grants and contracts received . . . benefits," were unidimensional. Responses were coded on a four-point scale ranging from '1' (almost never) to '4' (usually).

Employing the same factor analytic procedures discussed above, one factor was extracted (see Table 7).⁵ These results confirmed the unidimensionality of the six items. Thus, the third composite measure, identified as *research benefits*, consisted of six items: 1) "get better raises," 2) "are more respected by other faculty," 3) "increase their chances for tenure and promotion," 4) "increase their visibility outside your institution," 5) "receive more internal support, such as travel funds and research space," and 6) "are better able to negotiate job responsibilities."

Based on the results of the factor analysis, the inferential component of this analysis will focus on these three constructs instead of the twenty-three

⁵Since there was only factor extracted, no rotation method was needed to achieve simple structure.

*Funding Research at 1890 Land Grant Institutions—Thompson 15***Table 7. Factor loadings for variables related to research benefits composite index**

VARIABLES	F ¹	R ²
1. Receive more internal support, such as travel funds and research space	.81	.55
2. One better able to negotiate job responsibilities	.75	.53
3. Get better raises	.74	.54
4. Increase their chances for tenure and promotion	.74	.45
5. Are more respected by other faculty	.73	.59
6. Increase their visibility outside your institution	.62	.55

individual items. This will make for a more parsimonious discussion. The internal consistency or reliability, as reflected by Cronbach's alpha, of these three indices were, respectively, 0.71, 0.76 and 0.83. These values are acceptable (Nunnally, 1978; Heise and Bohrnstedt, 1970); thus, one may infer that the indices are reliable.

*Covariance analysis**Political factor*

Prior to discussing the three composite measures with respect to the hypothesized causal variables, let's examine the perceptions of the 1890 faculty regarding the importance of political factors in determining the procurement of competitive grants. The Likert-type item pertaining to political factors was conceptually defined as "factors other than the quality of the research proposal that influence opportunities for funding." Table 8 shows the source of variation, sum of squares, degrees of freedom, mean squares and F-ratios for the covariates—age and length of time at their present institution (hereafter referred to as years of service) and the direct effects of race, gender, degree and tenure status.⁶ The data indicate that the age of the 1890 faculty and the years of service do not have significant effects on their perceptions of the importance of political factors in determining who is

⁶The exogenous variables were recoded as follows: *Race*—1) Black, 2) White, 3) Asian/Pacific Islander; *Gender*—1) Male, 2) Female; *Type of Degree*—1) Bachelor's or Master's, 2) PH.D or equivalent; *Tenure Status*—1) Tenured, 2) Not Tenured and not on tenure track.

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Table 8. Analysis of covariance for political factors in obtaining competitive grants by race, gender, degree and tenure status*

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F
COVARIATES	0.57	2	0.28	0.65
Age	0.36	1	0.36	0.83
Time	0.53	1	0.53	1.21
MAIN EFFECTS	12.64	5	2.53	5.85**
Race	8.83	2	4.41	10.21**
Gender	2.42	1	2.42	5.60**
Degree	0.27	1	0.27	0.63
Tenure Status	0.05	1	0.05	0.51
EXPLAINED	13.21	7	1.89	4.36**
ERROR	217.92	504	0.43	
TOTAL	231.13	511	0.45	

*Controlled for age and length of time at present institution
 **Statistically significant at the 0.001 level.

awarded competitive grants. However, in examining the effects of the exogenous variables, significant differences are found among two of the four variables. To be specific, the black 1890 faculty are significantly more likely to feel that political factors are important in procuring grants than the non-black faculty, and the female faculty are significantly more likely than the male faculty to feel that political factors are important. The effects of the type of degree and tenure status are not significant.⁷

In general, the exogenous variables accounted for a significant amount of the variation regarding the importance of political factors in securing competitive grants; however, the effects of the covariates were negligible. At the univariate level, 84 percent of the 1890 faculty felt that political factors were important in determining the procurement of competitive grants. At the multivariate level, under controls, subgroup differences are apparent.

⁷In a preliminary analysis, there were no differences in perceptions between persons with bachelor's and master's degrees, nor were there differences between persons who were on tenure track but untenured and persons who were not on tenure track. Hence, in the analysis of covariance, these categories were collapsed.

Research infrastructure

Controlling for the covariates, in Table 9 the effects of race, gender, type of degree and tenure status on the importance of the research infrastructure in securing competitive grants are presented. Gender emerges as the most important variable in accounting for the variation in the research infrastructure as a barrier to conducting more research. The female faculty is significantly more likely to feel that the availability of research assistants and clerical assistance, together with the availability of matching funds, seed money and funds to travel to professional meetings are more important in securing competitive grants than the male faculty. The black and Asian/Pacific Islander faculty felt similar to the female faculty, although not as strongly; the white faculty did not feel that the research infrastructure was a factor in obtaining competitive grants. Differences due to type of degree and tenure status were not evident.

Again, the main effects model achieved statistical significance at the 0.001 level while the effects of the covariates were almost zero. Although the model, as specified, explained a significant amount of the variation, it is apparent that there are other factors not included in the model that would enable it to better account for the variation in the importance of the research infrastructure in obtaining competitive grants.

Faculty initiative

The purpose of this composite measure was to assess the perceptions of the 1890 faculty about some non-structural or non-institutional factors that may or may not contribute to the successful procurement of competitive grants. As presented in Table 6, slightly over one-half of the faculty felt that their colleagues did not show much initiative in preparing grant proposals. Under controls, it is apparent that this perception of faculty initiative varies significantly by race and, to a smaller extent, by type of degree (Table 10). The non-black faculty, particularly the Asians and Pacific Islanders, were overwhelmingly more likely to state that the 1890 faculty lacked initiative than the black faculty. In scanning the multiple classification scores, there is a 124-unit difference between the black 1890 faculty and the white 1890 faculty and a 162-unit difference between the black 1890 faculty and the 1890 Asian/Pacific Islander faculty.

The effect of type of degree approaches statistical significance at the 0.05 level. Faculty with doctoral degrees were more likely to agree that their colleagues were short on initiative than faculty with bachelor's and master's degrees.

Finally, the effects of the covariates, age and length of time at the institution, and tenure status failed to achieve statistical significance.

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Table 9. Analysis of covariance for effects of the research infrastructure in obtaining competitive grants by race, gender, degree, and tenure status*

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F
COVARIATES	0.37	2	0.17	0.48
Age	0.09	1	0.09	0.26
Time	0.45	1	0.45	0.14
MAIN EFFECTS	90.35	5	18.07	5.17**
Race	44.90	2	22.45	6.42**
Gender	45.27	1	45.27	12.94**
Degree	0.15	1	0.15	0.04
Tenure Status	0.01	1	0.01	0.00
EXPLAINED	90.68	7	12.96	3.70**
ERROR	1763.89	504	3.50	
TOTAL	1854.57	511	3.63	

*Controlled for age and length of time at present institution
 **Statistically significant at the 0.001 level

Research benefits

The sample was asked to respond to a unidimensional set of six items regarding the benefits that faculty had received who had successfully obtained competitive grants. In contrast to the models discussed above, type of degree emerged as the most important exogenous variable (see Table 11). Persons with bachelor's and master's degree were overwhelmingly more likely than persons with doctoral degrees to state that the faculty who receive competitive grants get more benefits. Although the magnitude of the relationship is not as strong, the black faculty had a greater propensity than the non-black faculty to feel that individuals who are awarded competitive grants receive better benefits. Again, similar to the findings related to faculty initiative, the effects of gender and tenure status are negligible.

One finding that emerged in this covariance model that failed to occur in the previous three models is the effect of years of service at the present institution. The effect of this covariate approaches significance at the 0.05 level. That is, the greater the length of service, the less likely a faculty member is to state that their colleagues who obtained competitive grants receive better benefits. Both the covariate and main effects components of the research benefits model is statistically significant; however, there are other exogenous variables that need to be included in the model.

Funding Research at 1890 Land Grant Institutions—Thompson 19**Table 10.** Analysis of covariance for effects of faculty initiative in obtaining competitive grants by race, gender, degree, and tenure status*

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F
COVARIATES	4.77	2	2.38	0.83
Age	4.47	1	4.47	1.64
Time	1.44	1	1.44	0.50
MAIN EFFECTS	240.50	5	48.10	16.67**
Race	214.61	2	107.31	37.20**
Gender	0.01	1	0.01	0.00
Degree	6.60	1	6.60	2.29
Tenure Status	0.35	1	0.35	0.12
EXPLAINED	245.27	7	35.04	12.15**
ERROR	1453.94	504	2.89	
TOTAL	1699.21	511	3.33	

*Controlled for age and length of time at present institution
**Statistically significant at the 0.001 level

Table 11. Analysis of covariance for benefits of research in obtaining competitive grants by race, gender, degree, and tenure status*

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F
COVARIATES	32.58	2	16.29	1.59
Age	4.61	1	4.61	0.45
Time	30.28	1	30.28	2.96
MAIN EFFECTS	180.47	5	36.09	3.52**
Race	56.57	2	28.29	2.76
Gender	9.73	1	9.73	0.95
Degree	108.74	1	108.74	10.61**
Tenure Status	2.05	1	2.05	0.20
EXPLAINED	213.05	7	30.44	2.98**
ERROR	5165.43	504	10.25	
TOTAL	5378.478	511	10.53	

*Controlled for age and length of time at present institution
**Statistically significant at the 0.001 level

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Summary and conclusions

This paper examined potential barriers to faculty research at the 1890 institutions. Descriptive statistics were employed to investigate a number of inhibitive factors. For purposes of parsimony, factor analysis and analysis of covariance were used to construct and empirically test three composite measures extracted from these factors.

An examination of the demographic and work-related variables reveals that the 1890 faculty is predominantly black, male, close to 50 years of age and tenured with about 12 years of service at their present institution. Further, most of the faculty is engaged primarily in teaching but have an ardent interest in research. A demanding teaching load (typically four courses per semester) is considered the biggest barrier to conducting research. The faculty felt that discrimination had little to do with their opportunity to procure competitive grants.

A majority of the 1890 faculty felt that political factors (factors other than the quality of the research proposal that influence opportunities for funding) were important in determining who were awarded competitive grants. Subgroup differences were apparent. Black and female faculty members were significantly more likely to feel that political factors were influential in deciding who received grants than their counterparts, white and Asian/Pacific Islanders and males.

Regarding the infrastructure supporting the research program, the female faculty were significantly more likely to cite the importance of this factor than the male faculty. The black, Asian and Pacific Islanders revealed feelings similar to the female faculty, although the magnitude of the effect was not as strong.

Type of degree emerged as the most significant variable in the "research benefits" model. Persons with doctoral degrees were less likely than persons with bachelor's and master's degrees to assert that the faculty members who receive competitive grants receive more benefits. In addition, blacks and the younger faculty felt that their colleagues who obtained competitive grants got better benefits.

The Asian/Pacific Islander faculty were significantly and substantially more likely to state that the 1890 faculty, as a whole, lacked initiative in preparing grant proposals and the like. It is not clear whether the Asian/Pacific Islander faculty indeed think that their 1890 colleagues do not demonstrate much initiative or whether the Asian/Pacific Islander faculty have qualitatively different perceptions of what constitutes initiative. Contrariwise, owing to the finding that the perceptions of white faculty were closer to the perceptions of the Asian/Pacific Islander faculty, one could argue that the non-black faculty feel that the faculty at the predominantly black 1890

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institutions lack initiative. Regardless of what line of reasoning is considered most tenable, the data do not permit one to partial out this effect.

Finally, the exogenous variables accounted for a statistically significant, though not substantive, amount of the variation in the political factor and the three composite indices. Thus, it is apparent that other variables (i.e. actual success in obtaining research grants; amount of time actually allocated to research or teaching, institutional support, number of publications, amount of collaboration with scientists at other institutions) need to be included in these models to increase their explanatory power. Only one of the covariates in the four models—years of service in the "research benefits" model—approached statistical significance. The effect of tenure status did not achieve statistical significance in any of the models. However, the differential effects of ethnicity were evident in all four models.

As a final summary of what has been presented in the preceding discussion, one may now reflect upon activities that need to be implemented in order to minimize the prohibitive factors affecting scientists at the 1890 institutions from obtaining competitive grants. First, the state legislatures need to set aside research monies for the 1890s. To date, only three 1890 institutions have received state funds for research. This new appropriation can serve as a threshold to growth and would give the research programs a degree of permanency in that they would not be totally dependent on federal funds. In addition, the new appropriation would permit the 1890 institutions to place the faculty with a majority research appointment in tenure track slots. The latter would undoubtedly bolster the moral of the faculty and lay the groundwork for matrices of infrastructural support (i.e. research assistants, faculty release time, equipment) that should increase the likelihood of 1890 faculty being more competitive in the grantsmanship arena.

Second, most of the 1890 institutions consider the Evans-Allen funds as soft monies. The faculty supported by the latter can not be placed on tenure track positions. Since these monies are based on a federal formula and have to be dispersed as long as there is a U.S. government, the institutions' disposition toward these funds needs to be changed. If not tenure, some form of modified tenure (i.e., 5 or 10 years) should be initiated.

Third, and finally, the trend is emerging that new funding initiatives are being aimed disproportionately toward the competitive grants program rather than the formula system. A case in point is the fairly recent report by the ESCOP Task Force on *Agriculture and Community Viability* (1988). Briefly, the report called for a permanent increase in Hatch formula and Evans-Allen funds to strengthen current research capacity and stimulate needed new research with most funds earmarked for the competitive and special grants programs. Formula distribution is an effective tool in correcting past funding disparities and achieving a more equitable distribution. In the period ahead, however, this trend is changing; the procurement of grants will continue to

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be an important social and economic force shaping and propelling the research agenda of institutions of higher learning, and other institutions and organizations as well. Together with the shrinking pool of research dollars, the increasing competitiveness of the research grant system and the obstacles or inhibitive factors to research identified in the preceding discussion, changing from marginal to full participation in the grant system for the 1890 institutions will be difficult, though not impossible. As discussed, history has shown that the faculty and administrators at the 1890 institutions have been confronted with and have overcome equally formidable barriers in the past. Thus, wielding the same diligence and perseverance that resolved the past barriers, the present ones will also be resolved.

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