Final Report

Assessing Economic and Social Impacts of Basic Research

DE-FG02-96ER45562

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Summary

Since 1999, researchers at the Georgia Tech Research Value Mapping (RVM) Program have been working, with the support of the Department of Energy (DOE) under grant DE-FG02-96ER45562, to develop the state-of-the-art in research impacts evaluation. More recently, DOE support has been used to develop a large-scale, representative sample of university research faculty, one of the most comprehensive such data bases yet compiled (see Appendix). As a result of our data, from different study projects, we have been able to publish research on wide ranging topics pertaining to university-based scientific research and scientific careers. Among other topics, important contributions have been made to the understanding of scientific collaboration dynamics, academic productivity in terms of publications and patents, and university collaborations with industry. Many of these studies have received wide attention from academic researchers, but also the results have been used to inform research policy decisions at the National Institutes of Health, the National Science Foundation, the Department of Commerce, and, of course, the Department of Energy. Further, the results of our studies have been used in high levels of government in other nations.

In this final report, we provide summary information from our DOE-funded research and training for the entire period of funding, but since previous reports have provided detailed information about earlier work, we focus here on our more recent results. Most of this recent work has been focused on topics pertaining to the evaluation of university-based research and technology development, especially research in multidisciplinary, multi-institutional research centers and collaborations between university programs and faculty and industry. In general, the evidence suggests that university-industry collaboration is somewhat more salutary than has been portrayed in the research literature, especially with respect to effects on graduate training.

Assessing Economic and Social Impacts of Basic Research

Renewal of DE-FG02-96ER45562

I. Introduction

Recent research under the project "Assessing Economic and Social Impacts of Basic Research" (DE-FG02-96ER45562) has focused on the impacts of university centers and grants on the careers of academic researchers. This work has been based on a comprehensive and representative survey of sciences and engineering faculty in Carnegie Extensive (formerly, "Research I") universities in the United States. Our more recent data has been combined with earlier databases we compiled to examine broader analysis of issues pertaining to developing capacity and "scientific and technical human capital."

Our most recent research since that reported in our August, 2005 renewal request and interim report, has been comprised of two dissertations, one recently completed (Ponomariov, 2006) and the other scheduled for completion (Boardman, 2006), as well as three published (or accepted for publication) research papers. This most recent work is closely related to our previous work inasmuch as the recent work uses theory and techniques developed in our previous research on: grants impacts (Gaughan and Bozeman, 2002); mentoring and student support (Bozeman and Corley, 2004; Gaughan and Bozeman, 2005); scientific collaboration (Lee and Bozeman, 2005); Bozeman and Corley, 2004), and measurement of industrial impacts from grants supports (Dietz and Bozeman, 2005; Wei-Lin and Bozeman, 2006).

II. Results of Department of Energy Support (2001-2006)

During the entire span of the work supported by the Office of Basic Energy Sciences (BES) under the project title "Assessing the Economic and Social Impacts of Basic Research Sponsored by BES," the production of research papers and publications has been considerable. We have also been quite active in training students. While this is true in the most recent work as well, we have also had considerable impact in public policy application, both in the U.S. and in other nations. Further, the type of training and education we normally provide our students has been extended in practice to other places, including other nations. Thus, our review of results focuses on four parts, "Databases," "Publications, Dissertations, and Presentations," "Scientific and Technical Human Capital Contributions," and "Policy Evaluation and Policy Advice."

A. Databases

First and foremost, the RVM work for Department of Energy has been focused on increasing the data resources available for research evaluation, assessment and management. In this section we review the more significant data acquisition efforts. It is important to note that these remain on-going even as the DOE support has been discontinued.

1. RVM 2005.

The most important data element for the projected study from current sources is the RVM Survey of Academic Researchers (hereafter "RVM 2005"). While these data are described in detail in the Appendix, we describe its basic features here.

The RVM 2005 data were compiled in 2004 and coded, cleaned, and distributed in 2005. Whereas our earlier research targeted center-based researchers (Bozeman and Corley 2004; Corley, Bozeman and Gaughan 2003; Gaughan and Bozeman 2002), the RVM 2005 data targets the population of scientists and engineers in tenure-track (or tenured) academic positions at Carnegie Extensive universities (formerly known as Research I; Carnegie 2000).

Using the Carnegie list, we retained all universities (n=150)[1] that produced at least one Ph.D. in 2000 in at least one of 13 science and engineering disciplines. We excluded health sciences and economics from the National Science Foundation definition of science and engineering (NSF, 2000), and we subdivided engineering into 5 major specialties. The resulting disciplines include: biology, computer science, mathematics, physics, earth and atmospheric science, chemistry, agriculture, sociology, chemical engineering, civil engineering, electrical engineering, mechanical engineering, and materials engineering.

Having delineated the target population of universities and disciplines, we then collected the names of tenure-track faculty in each university by discipline. The list of faculty was obtained from (1) the on-line university catalog, or (2) the on-line departmental website. This resulted in a sampling frame of 36,874 scientists and engineers occupying a tenure-track or tenured faculty position. The target sample was for 200 men and women from each of the 13 disciplines. Because the size of disciplines varies, as does the representation of women in each discipline, the sampling proportions varied from 0.21 (for women in biology) to 1.0 in five disciplines (e.g., the "sample" is actually a census of the women in the discipline). The male sampling proportions varied from 0.06 in biology, to 0.23 in agriculture. The final target sample (accounting for women representing fewer than 200 in the discipline) was 4,916.

The survey was administered by mail, focusing on the following domains of faculty activity: funding, collaboration, institutional affiliations, career timing and transitions, and distribution of work effort. The survey also obtained basic demographic information about the researchers, their research-specific motivations and values, and the perceived benefits derived from their work. Appendix 3 includes the codebook for the study.

We obtained 1,769 survey responses from scientists and engineers who were in tenure track positions, had an earned Ph.D., and who had completed information on center participation. It is these 1,769 who form the bases of these analyses; there are 693 center-based researchers, and 1,076 researchers who report departmental affiliations only

[1] www.carnegiefoundation.org/Classification/CIHE2000/PartIfiles/DRU-EXT.htm

(note, because of the sample design, all center-based researchers also have a departmental affiliation).

2. RVM 2005 CV.

We obtained curriculum vitae from about one-third of the 1,769 respondents and we are in the process of coding the CVs. As we have reported elsewhere (Dietz et al., 2000), this is a laborious task, involving hundreds of thousands of records and hundreds of hours of coding time. It is expected that these data will be available and cleaned by November 2005.

3. RVM 2001 Centers Study.

Data developed in previous phases of BES-supported research remain useful for the projected study. In this study, we focused on the educational activities of center affiliates and non-affiliates with the objective of better understanding the role that centers play in the training and placement of students. There are two components to this data. In 2000, RVM researchers collected 1,370 curricula vitae (CV) from a complete list of university professors and researchers affiliated with National Science Foundation (NSF) or Department of Energy (DOE) research centers at U.S. universities. The CV data include 3,000 variables on demographic information, degrees, jobs, publications, patents, professional affiliations, and grants.

The 2001 *RVM Survey of Careers of Scientists* (RVM 2001) was conducted in October 2001. A mailed questionnaire was sent to the 997 university faculty members from the RVM CV data (retired professors and one industrial researcher were deleted). We received 443 returns for a 44% response rate. The survey included questions about research collaboration, grants and contracts, job selection and work environment, and demographic information. The respondents included: engineering faculty (*n* 181, 41%); bioscience faculty (*n* 66, 15%); computer science faculty (*n* 25, 6%); chemistry faculty (*n* 47, 11%); physics faculty (*n* 43, 10%); and faculty from other science fields (*n* 57, 13%). Among the respondents are the following: tenured faculty (*n* 278, 63%); untenured faculty (*n* 165, 37%); men (*n* 383, 87%); women (*n* 58, 13%); U.S.-born scientists (*n* 303, 68%); and foreign-born scientists (*n* 139, 32%). The average age of the respondents was 46 years in 2000. The sample had a larger proportion of foreign-born scientists, but a smaller proportion of women when compared with the national population of scientists (but the results for science and engineering centers were more representative).

B. Publications, Dissertations, and Presentations

We include in this category refereed journal articles, Ph.D. theses, and presentations to academic and professional research conferences (presentations to policy-makers and public officials we consider separately). The time period covered is the span between our most recent renewal request (submitted late 2001) and the present. Previously submitted proposals and reports may be examined for details on earlier work.

The publications based on BES studies are substantial and cut across many different areas of research evaluation and science policies studies. Below, we group the publications into two categories: (1) research evaluation and productivity studies and (2) industry interaction studies.

1. Research Evaluation and Productivity

Sooho Lee and Barry Bozeman (2005) "The Effects of Scientific Collaboration on Productivity," *Social Studies of Science*, 35, 673-702.

Summary
Based on the curricula vitae and survey responses of 443 academic scientists affiliated with university research centers in the USA, we examine the longstanding assumption that research collaboration has a positive effect on publishing productivity. Since characteristics of the individual and the work environment are endogenously related to both collaboration and productivity, this study focuses on the mediating effect of collaboration on publishing productivity. By using the two stage least squares analysis, the findings indicate that in the presence of moderating variables such as age, rank, grant, gender, marital status, family relations, citizenship, job satisfaction, perceived discrimination, and collaboration strategy, the simple number ('normal count') of peer-reviewed journal papers is strongly and significantly associated with the number of collaborators. However, the net impacts of collaboration are less clear. When we apply the same model and examine productivity by 'fractional count', dividing the number of publications by the number of authors, we find that number of collaborators is not a significant predictor of publishing productivity. In both cases, 'normal count' and 'fractional count', we find significant effects of research grants, citizenship, collaboration strategy, and scientific field. We believe that it is important to understand the effects of the individual and environmental factors for developing effective strategies to exploit the potential benefits of collaboration. We note that our focus is entirely at the individual level, and some of the most important benefits of collaboration may accrue to groups, institutions, and scientific field.

Sooho Lee, (2004) "Foreign-born Scientists In The United States –Do They Perform Differently Than Native-born Scientists? " Ph.D. dissertation: Georgia Institute of Technology

Summary
Are foreign-born scientists different from native-born scientists with respect to research activity and performance? This question has important policy implications not only for immigration policy but also for science policy because a substantial part of scientific research in the United States is conducted by foreign-born scientists. This study examines the differences between foreign-born and native-born scientists in research collaboration, grants, and publication productivity. The data for this study are 443 curricula vitae (CVs) and survey of scientists and engineers that Research Value Mapping Program (RVM) at Georgia Tech conducted from 2000 to 2001. By using the multiple indicators, the findings show that foreign-born scientists do not differ significantly in research collaboration and grants from their native-born counterparts. But in terms of publication productivity, foreign-born scientists are consistently more productive than their native-born counterparts. This study also examines the impact of being foreign-born on research collaboration, grants, and productivity, and which factors account for the differences between foreign-born and native-born scientists in collaboration, grants, and productivity. When other relevant variables are controlled for, being foreign-born still has a strong positive effect on publication productivity. Collaboration and grants have a significant positive effect only on the productivity of native-born scientists, whereas strong research preference of foreign-born scientists contributes to their relatively higher productivity. Differences are also found among foreign-born scientists, largely depending on their national origin categorized by the similarity of language and culture. The theoretical and policy implications are also discussed.

James Dietz, (2004) "Scientists and Engineers in Academic Research Centers—An Examination of Career Patterns and Productivity" Ph.D. dissertation: Georgia Institute of Technology

Summary
Science policymakers and research evaluators are increasingly focusing on alternative methods of assessing the public investment in science and engineering research. Over the course of the last 20 years, scientific and engineering research centers with ties to industry have become a permanent fixture of the academic research landscape. Yet, much of the research on the careers patterns and productivity of researchers has focused on scientists rather than engineers, specific job changes rather than the career as a whole, and publication productivity measures rather than patent outcomes. Moreover, much of the extant research on academic researchers has focused exclusively on the academic component of careers. As universities increasingly take on roles than were once considered the responsibility of the private sector—such as securing patents—and build greater ties with industry, it is timely to reexamine the nature of the contemporary “academic” career.

In this research, I draw on scientific and technical human capital theory to situate the central research question. Specifically, I examine the nature of the career pattern and publication and patent rates of scientists and engineers affiliated with federally-supported science and engineering research centers. The research makes use of curriculum vita (CV) data collected through the Research Value Mapping Program headquartered at the School of Public Policy. Tobit, Poisson, and Neural Network models are used in analyzing the data. In addition, I examine the career patterns of highly productive scholars and contrast those with less productive scholars. The findings suggest that the ways in which academic productivity and career patterns have been conceived may be in need of revision, with a greater attention to diverse productivity outcomes and diverse career patterns. Some of the interpretations of empirical findings in the literature may be misconceived. Moreover, it may be the case that postdoctoral fellowship—a common component of government support for scientific and engineering research—may be associated with lower career productivity rates. This research contributes to our understanding of research careers with implications for policies that may affect the outputs of governmentally supported research. Finally, the relatively new method of collecting and analyzing CVs is discussed along with appropriate modeling techniques and the challenges posed by this method.

Barry Bozeman and Elizabeth Corley (2004) “Scientists’ Collaboration Strategies: Implications for Scientific and Technical Human Capital,” *Research Policy*, 33, 4, 599-616. [Note: part of a refereed special issue on *Research Policy* on the topic “Scientific and Technical Human Capital.”]

Summary
“Scientific and technical human capital” (S&T human capital) has been defined as the sum of researchers’ professional network ties and their technical skills and resources [Int. J. Technol. Manage. 22 (7–8) (2001) 636]. Our study focuses on one particular means by which scientists acquire and deploy S&T human capital, research collaboration. We examine data from 451 scientists and engineers at academic research centers in the United States. The chief focus is on scientists’ collaboration choices and strategies. Since we are particularly interested in S&T human capital, we pay special attention to strategies that involve mentoring graduate students and junior faculty and to collaborating with women. We also examine collaboration “cosmopolitanism,” the extent to which scientists collaborate with those around them (one’s research group, one’s university) as opposed to those more distant in geography or institutional setting (other universities, researchers in industry, researchers in other nations). Our findings indicate that those who pursue a “mentor” collaboration strategy are likely to be tenured; to collaborate with women; and to have a favorable view about industry and research on industrial applications. Regarding the number of reported collaborators, those who have larger grants have more collaborators. With respect to the percentage of female collaborators, we found, not surprisingly, that female scientists have a somewhat higher percentage (36%) of female collaborators, than males have (24%). There are great differences, however, according to rank, with non-tenure track females having 84% of their collaborations with females. Regarding collaboration cosmopolitanism, we find that most researchers are not particularly cosmopolitan in their selection of collaborators—they tend to work with the people in their own work group. More cosmopolitan collaborators tend have large grants. A major policy implication is that there is

great variance in the extent to which collaborations seem to enhance or generate S&T human capital. Not all collaborations are equal with respect to their "public goods" implications.

J. Dietz and B. Bozeman (2005) "Academic Careers, Patents, and Productivity: Industry Experience as Scientific and Technical Human Capital," *Research Policy*, 34, 349-367.

Summary
We examine career patterns within the industrial, academic, and governmental sectors and their relation to the publication and patent productivity of scientists and engineers working at university-based research centers in the United States. We hypothesize that among university scientists, intersectoral changes in jobs throughout the career provide access to new social networks and scientific and technical human capital, which will result in higher productivity. For this study, the curriculum vitae of 1200 research scientists and engineers were collected and coded. In addition, patent data were collected from the U.S. Patent and Trademark Office. The overarching conclusion from our analysis is that the academic scientists' and engineers' research careers we studied are quite different than characterized in the research productivity literature that is a decade or more old. The wave of center creation activity that began in the early 1980s and continues today has resulted not only in greater ties between universities and industry, but also markedly different academic careers.

Monica Gaughan and Barry Bozeman (2005) "The Educational Mission of University Multidisciplinary Research Centers, paper presented at the Triple Helix conference, Turin, Italy, May 2005.

Summary
Increasingly, U.S. science funding agencies are supporting centralized, interdisciplinary research centers that represent a different institutional form from the decentralized, individual-investigator research of the past (Bozeman and Boardman 2004). Managers of university-based science centers face many challenges that are different from the challenges faced by traditional, academic department directors: namely, how to manage research within a new organizational structure that involves researchers from different disciplines, who bring diverse collaboration incentives and research goals to center-based research (Boardman and Bozeman forthcoming; Bozeman and Boardman 2003). Even though there is recognition that multidisciplinary university-based science centers represent a new institutional form for the performance of scientific research, few studies have focused on exploring the effects of the new institutional form on the one of the core missions of the university: that of educating the next generation of scientists and engineers. What roles do researchers affiliated with multidisciplinary university-based research centers, in which 40% of academic scientists and engineers now work, play in the training of the next generation of scientists and engineers? How, if at all, do the educational roles and attitudes of traditional department-based scientists and engineers differ from those of their center-affiliated colleagues? With what consequences?

E. Corley, B. Bozeman and M. Gaughan (2003). "Evaluating the Impacts on Grants on Women Scientists' Careers: The Curriculum Vita as a Tool for Research Assessment," In P. Shapira and Stefan Kuhlmann, Learning from Science and Technology Policy Evaluation: Experiences from the U.S. and Europe, Cheltenham, UK: Edward Elgar Publishing. Book chapter.

Corley, E., and Gaughan, M. (2005) "Scientists' Participation in University Research Centers: What Are the Gender Differences?" *Journal of Technology Transfer*, Vol. 30, No. 4

Summary
University-affiliated multidisciplinary research centers have grown in importance in academia. Most research to date has focused on these centers from an institutional perspective, with recent work only beginning to explore the ways in which such centers affect the development of academic careers. Hence, little is known about how scientists who are center-affiliated differ from those that are not affiliated. Clearly, both selection and influence effects may be expected to operate in terms of research productivity,

timing, and resources. A further puzzle is how center affiliation may differ between male and female scientists. In this study, we use a new, nationally representative dataset of scientists and engineers working in Carnegie Research Extensive Universities to develop an understanding of how center-affiliated scientists differ from exclusively department-based academic scientists and engineers, and investigate the extent to which gender moderates the effects of centers. As expected, our national sample shows that women are younger, whiter, less likely to be tenured, and at a lower rank than their male colleagues. We find that women are as likely to join centers as men, and do so at a similar stage in their career. Most of the male – female differences observed in disciplinary settings are sustained in centers, but women appear to have greater research equality in them (compared to departmental settings). In particular, men and women in centers spend the same amount of time writing grant proposals, conducting both grant-supported and unfounded research, and administering grants. This suggests that centers may constitute an institutional context in which some aspects of gender equality in science may be achieved.

Corley, E. (2005) "How Do Career Strategies, Gender, and Work Environment Affect Faculty Productivity in University-Based Science Centers?" *Review of Policy Research*, Vol. 22, No. 5

Summary

Recent studies have shown that in many science and engineering fields, almost 40% of faculty are affiliated with university-based research centers (Corley & Gaughan, 2005). As major science funding organizations continue to increase annual levels of funding for interdisciplinary science centers, it is likely that this number will increase significantly in over the next decade. Moreover, some scholars have argued that the rise of university-based science centers has already led to the development of a new institutional form for the execution of university-based research (Bozeman & Boardman, 2004). Yet, interestingly few researchers have studied the impacts of this new institutional form on the productivity of individual researchers. The purpose of this paper is to begin to address how individual career strategies and perceptions of scientific work environments within university-based science centers relate to the productivity of academic scientists who participate in federally funded science centers. In particular, this paper investigates the relationships between productivity, individual career strategies, and perceptions of scientific work environment across gender. The results of the study demonstrate that university-based science centers might serve as an equalizing mechanism for male and female productivity levels. Yet, women scientists affiliated with these centers are significantly more likely to feel discriminated against – and they are less likely to embrace the most promising career strategy for the current structure of these centers.

Monica Gaughan and Barry Bozeman (2002). "Using Curriculum Vitae to Compare Some Impacts of NSF Research Center Grants with Research Center Funding." *Research Evaluation*, 11, 1, pp. 17-26.[2]

Summary

This paper addresses a significant aspect of the interaction between structural features of research units and the creation of S&T human capital embodied in the researchers that work in them. The creation of larger research organizations, such as the user facilities and research centers, provides new ways of leveraging capacity in multidisciplinary projects. At the same time, they have different managerial characteristics both in the composition of research teams and the patterns of funding that are applied in these contexts. The CV database, created with prior BES support, allows a novel form of analysis to address questions such as these. For example, they show that conventional individual grants and center-based grants have different impacts on the careers and scientific activities of center-affiliated scientists. Significantly, the center grant awarding process has an impact on the position of the researchers in the inter-institutional linkages relevant to his or her work. Receiving a center based grant increases the probability of receiving funding from industry to pursue research.

[2] Note: An earlier draft of this paper was previously reported, but as a conference presentation.

Gaughan, Monica and Stephane Robin. (2004) "National Science Training Policy and Early Scientific Careers in France and the United States." *Research Policy* 33:569-581.

Summary

The economic health of nations and regions is increasingly coming to rest on the scientific and technical labor force conducting scientific research. As such, enormous social resources are directed to educating and training those who will fire the engines of economic growth. In the first part of this paper, we compare recent investment in the scientific and technical labor forces by two giants of nationally-supported research endeavors: France and the United States. We find that France is more invested in scientific and technical training, but that both nations invest directly and indirectly in the scientific and technical labor force. French policy is more likely to support the individual graduate student directly through a national grant, while graduate students in the US tend to rely indirectly on federal support through research grants to other researchers. We then use duration models on individual data to predict entry into a permanent academic position within three years of completing a Ph.D. We do not find that industrial support of graduate training has any effect on later success in obtaining a position. There is, however, evidence of different academic labor markets operating in each country. In France, entry into a position has not depended on period factors, while in the US more recent cohorts have been more successful in obtaining permanent employment. Furthermore, postdoctoral positions in France delay or deter academic careers, but have no impact on entry in the US: this suggest that two different modes of scientific human resources management operate in France and in the USA. In the USA, Ph.D.s are seen as an essential element in the process of knowledge transfer, and early mobility does not affect entry into permanent academic careers. In France, few incentives are given to encourage mobility, which merely deters the access to permanent jobs. Finally, we found that graduates of the most prestigious undergraduate institutions were systematically advantaged in obtaining permanent academic employment, suggesting that academic stratification occurs very early in the training path in each country

Youtie, J., Libaers, D., Bozeman, B., (2006) "Institutionalization of University Research Centers: The Case of the National Cooperative Program in Infertility Research Program", forthcoming, *Technovation*

Summary

This study uses an institutional design theoretical framework and a cross case analysis qualitative research methodology to consider the National Cooperative Program in Infertility Research (NCPIR) centers as a effort to enhance scientific and technical knowledge by designing institutions (in this case the NCPIR centers) to promote the growth of knowledge by promoting collaboration, building collaborative networks and promoting "scientific and technical human capital." In considering the NCPIR centers from an institutional design perspective, we consider their level and type of institutionalization of the centers. Then we seek to assess the extent to which the level and type of institutionalization developed within these centers optimizes the objectives that have been set forth. We found that although the NCPIR centers have some if not many administrative elements found in fully articulated research centers and substantial quantities and varied types of research and training outputs, they are not sufficiently institutionalized to achieve ambitious and challenging goals of serving as a national infertility research source, national training resource, and national inter-institutional linkages over the long run.

Bozeman, B., and Boardman, C., (2003) "Managing the new Multipurpose, Multidiscipline University Research Centers: Institutional Innovation in the Academic Community" Washington, D.C.: IBM Endowment for the Business of Government.

Summary (foreword by Paul Lawrence and Tim Burlin)

Since the creation of the IBM Center for The Business of Government five years ago, we have been interested in the study of new ways to operate within large institutions. A recent IBM Center report by William Snyder and Xavier de Souza Briggs, “Communities of Practice: A New Tool for Government Managers,” examines the use of informal communities of practice as a new way to work within traditional hierarchies. In this report, Professor Bozeman and Mr. Boardman look at the evolution of the multipurpose, multidiscipline university research center (MMURC) as a new, more formal approach to organizing research centers in the academic community.

Bozeman and Boardman contrast the new MMURCs with the traditional university research center (URC) and academic departments, which tend to be more disciplinary and single-problem focused. In contrast, the new MMURCs are almost entirely problem driven and do not track closely to existing disciplines and established scientific and technical specializations. Because of this, Bozeman and Boardman conclude that the potential for the MMURC is great. They write, “The MMURC has the potential to harness the historical advantages of university research and at the same time transform university research into a mechanism for solving a broader and deeper array of scientific, technical, and social problems.”

This report is aimed at two distinct sets of audiences. One is university officials and university administrators, including MMURC directors, who deal directly with university research centers. The second is government program managers who are either currently managing an MMURC or considering establishing one. The report presents reasons why MMURCs are a potentially important tool for the government to use as it seeks to collaborate with the academic community in addressing national problems. We trust that this report will be helpful and useful to both audiences as they face the challenge of marshaling the nation’s research community to address large-scale science and technology problems that require an integrated research approach.

2. Industry interaction studies

Min-Wei Lin and Barry Bozeman (2006) “Researchers’ Industry Experience and Productivity in University-Industry Research Centers: A Scientific and Technical Human Capital Explanation,” *Journal of Technology Transfer*, vol. 31, no. 3, March, 2006.

Summary
We examine the impact of researchers’ previous industry experience on the research outputs and outcomes of university faculty affiliated with NSF and DOE research centers. Using a dataset combining curriculum vita and surveys, our results indicate significant differences between the researchers who have previous industry experience and those who do not. Using a simple model of research productivity, we found that academic researchers who had prior industry exposure produce fewer total career publications, but they support more students. Most important, and perhaps surprising, we could not establish any difference between the two groups’ publication activity when focusing on a five-year cross-section (years 1996 to 2000) rather than total career publications. We found statistical evidence that previous industry experience raised the annual publication productivity of junior faculty members and women researchers in our sample of research center personnel. We believe the unique blend of research center affiliation, academic post, and past industry experience gives an individual who embodies or possesses all three characteristics a diverse source of scientific and technical human capital and particular advantages over those who have no industry experience (though the “academic-only” set also has particular advantages in cumulative publishing productivity).

Boardman, P. Craig and Branco L. Ponomariov (2005) “Reward systems and NSF university research centers: the impact of tenure on university scientists’ valuation of applied and commercially-relevant research” *Journal of Higher Education*, In Press.

Summary
U.S. universities are under pressure to contribute to commercially-relevant research. At the same time, the character of the university reward system has not changed much in its emphasis on publications. This paper provides empirical evidence indicating that not having tenure is associated with a devaluation of commercially-relevant research.

Boardman, P. Craig and Bozeman, Barry (2004) “Implementing a ‘bottom-up,’ multi-sector research collaboration: the case of the Texas Air Quality Study” *Economics of Innovation and New Technology*, In Press.

Summary
The vast majority of research collaboration between firms is informal. Unfortunately, little research has focused on informal, multi-institutional research collaboration, in part because by their very nature these collaborations are difficult to study systematically. In this study, we employ case study methodology to examine a large scale research collaboration, the 2000 Texas Air Quality Study, that could be labeled “multi-sector, multi-institution” and “informal.” We develop the case based on a contingency model of research collaboration effectiveness, our chief objective being to assess the impacts of various characteristics of the collaboration on the project’s outcomes. We find the case to align with the terms of the model, thereby distilling some implications for a theory of research collaboration effectiveness, at least within the domain of large-scale, multi-institutional, multi-sector research collaborations.

Bozeman, Barry and Craig Boardman (2004) “The NSF Engineering Research Centers and the University-Industry Research Revolution: A Brief History Featuring an Interview with Erich Bloch” *The Journal of Technology Transfer* 29:3-4, pp. 365-375.

Summary
The NSF engineering research centers (ERC) program served notice of a sea change in university research funding and institutional designs, representing a transition from department-based, principle investigator-oriented university science to a new center-based model encouraging universities to work with industry and to work beyond the strictures of academic disciplines. In our view, the past three decades of U.S. science and technology policy have not seen an institutional change of greater importance. This paper begins with a brief history of the ERC program, including discussion of the program's origins, goals and research foci, growth, and influence as a model for other science center programs in the U.S. and abroad. Our "primary data" include an interview with Erich Bloch, former NSF director who was one of the chief architects and advocates for the ERC program. Because of the historical importance of this interview, we present the entire interview with the original material largely unaltered. We conclude with discussion of the managerial challenges that ERCs face within the context of traditional university structures

1. Conference Organization

On March 11, 2005, Georgia Tech hosted the Research Value Mapping (RVM) - Public Management Conference wherein eleven students presented their academic papers on the topics of science policy and public management. The student-organized conference was modeled on an academic symposium in every respect. To illustrate, students were required to submit the abstracts of their papers several months prior the conference to be considered for inclusion. If an abstract was accepted, several weeks before the conference the student was required to deliver her paper to discussants from the Georgia Tech and Georgia State University faculty. At the conference, each student gave a fifteen minute presentation before an audience that included fellow students, discussants and additional faculty, as well as outside visitors. Following each presentation, a discussant provided feedback, highlighting the positive and negative attributes of the paper, providing guidance for strengthening the study's scholarly merit. Each student was allowed time at the end to respond to the discussant and to field questions from the audience.

From the feedback we have received, the 2005 RVM - Public Management Conference was successful on all counts. Faculty commented on the high quality of the papers and presentations, and the students appreciated the opportunity to receive feedback from the discussants and audience members. Additionally, for some students this was the first time they had presented a paper in a professional, academic setting while for others they were able to use the conference as an opportunity to hone their skills. Some of the papers presented have been accepted for publication in scholarly journals.

B. Scientific and Technical Human Capital Contributions

The "Scientific and Technical Human Capital" contributions are divided into two categories. One category lists the various students we have employed working with the Research Value Mapping program, students at the undergraduate, master's, and Ph.D. level. The program has also attracted visiting researches, more than we can accommodate. The second category describes our work, recent and planned, in training or developing research evaluators in other nations.

1. Students supported

Visiting researchers supported or affiliated[3]

Researcher Name	Title	Home Institution
Olli Vuola	Doctoral researcher	University of Lausanne and CERN Technologies
Stephane Robin	Postdoctoral researcher	University of Grenoble
Youngsun Baek	Doctoral researcher	Seoul National University

Doctoral and Masters students supported

2003

Student Name	Degree	Title	Term	Home Dept
Branco Ponomariov	Ph.D.	GRA	fall/spring	Pub Pol
Delia Elders	M.S.	GTA	fall/spring	Pub Pol
Sooho Lee	Ph.D.	GRA	spring	Pub Pol
Min Wei Lin	Ph.D.	GRA	spring	Pub Pol

2004

Student Name	Ph.D.	Title	Term	Home Dept
Boardman, Craig	Ph.D.	GRA	fall/spring	Pub Pol

[3] Generally, the program provides no support for visiting researchers other than office space, computer access, and other such work support.

Brown, Lisa	M.S.	GRA	fall/spring	Pub Pol
Hirsch, Paul	Ph.D.	GRA	fall/spring	Pub Pol
Elder, Delia	M.S.	GRA	fall/spring	Pub Pol
Epstein, Jason	Ph.D.	GRA	fall/spring	Pub Pol
Lee, Sooho	Ph.D.	GRA	fall/spring	Pub Pol
Lin, Min-Wei	Ph.D.	GRA	fall/spring	Pub Pol

2005-2006

Student Name	Ph.D.	Title	Term	Home Dept
Boardman, Craig	Ph.D.	GRA	Both	Pub Pol
Brown, Lisa	M.S.	GRA	fall	Pub Pol
Feeney, Mary	Ph.D.	GRA	Both	Pub Pol
Hirsch, Paul	Ph.D.	GRA	fall	Pub Pol
Tucker, Phaedra	M.S.	GRA	Both	Pub Pol
Kim, Euiseok	M.S.	GRA	Both	Pub Pol
Libaers, Dirk	Ph.D.	GRA	Both	Pub Pol
Epstein, Jason	Ph.D.	GRA	Both	Pub Pol

Undergraduate students supported

2003

Student Name

Arce, Rebecca
Graybeal, Katherine
Lee, Elyette
Newton, Donovan
Puckett, James
Yick, Anna

2004

Student Name

Arce, Rebecca
Atkins, Tim
Atkinson, Emily
Graybeal, Katherine
Newton, Donovan
Steiner, Eric
Whaler, Heather
Yick, Anna

2005-2006

Student Name

Arce, Rebecca
Atkins, Tim
Finney, Sharyn
Gladden, Doug

Graybeal, Katherine
Ng, Michael
Putrich, John
Smith, Jessica
Steiner, Thomas
Suarez, Alejandro
Willis, Hallie

2. Training and Development

The approaches to evaluation of publicly-funded research are applicable in many contexts, including developing countries. University researchers and government officials in Chile and Argentina have shown interest and, as a result, we have recently conducted joint activities and are planning future joint projects in both countries.

Chile

The Office of Research of the Universidad de Concepción, Chile, invited the RVM team (Barry Bozeman, Monica Gaughan, Phil Shapira and Juan Rogers) to conduct a week-long workshop on the Management and Evaluation of University-Industry collaborations from May 30 to June 3, 2005. The workshop was attended by faculty, administrators, and officials of academic institutions and government agencies at the regional and national levels.

Findings from BES supported research – including the importance of capacity-based approaches to evaluation, the management of linkages across sector boundaries, the multiplicity of roles of creators and users of knowledge, and the importance of grant funding in various research career patterns – were considered highly important by workshop attendees. As a result, plans are being developed to collaborate in the implementation of R&D management and assessment structures for the Bío region with the participation of the University of Concepción, private firms, and the regional government.

Argentina

The Argentine office of science and technology of the national government (SECYT or Secretaría de Ciencia y Tecnología) invited three members of the RVM team (Barry Bozeman, Monica Gaughan, and Juan Rogers) to conduct a workshop in Buenos Aires on June 7-9, 2005, with the managers of R&D agencies at the national level. SECYT is in the process of institutionalizing an evaluation process for the R&D sector and RVM approaches developed with BES support are at the center of their interest. The needs of smaller innovation systems are not properly addressed with standard bibliometric approaches to evaluation. Development of capacity is one of their main interests and capacity-based approaches to evaluation are particularly suited to the assessment of their performance in reaching those goals. In particular, Argentina, together with several other South American countries, has put in place a national repository of researchers' curriculum vitae (CV) for assessment purposes. RVM approaches to CV analysis, developed with BES support, will be key to the further development and use of this database for evaluation. Plans are currently being developed to define our participation in the implementation of some of the workshop recommendations.

3. Policy Evaluation and Policy Advice

The BES-sponsored research reported here, and also previously reported research, has been recognized by policy-makers as relevant to their own research planning, evaluation, and management work. All of the policy evaluation, advice, and consulting developed from the BES-supported work has been provided pro bono. Some examples are given below.

Consulting with the Ministry of Research, Science and Technology, New Zealand

Since 2002, we have worked closely with policy-makers in New Zealand who are interested in using RVM-developed methods to assist in their planning and evaluation activities. Professor Bozeman was asked to provide a keynote address in connection with a New Zealand science policy meeting.[4] In the address, Bozeman presented research findings from BES-sponsored studies. Subsequently, New Zealand research evaluation professionals visited Georgia Tech to work with RVM researchers.

Consulting with the Republic of South Africa

The research developed under this contract was employed as a fundamental basis for innovation policy planning in South Africa. The principal investigator was invited to provide the keynote address[5] at South Africa's meeting of its National Advisory Commission on Innovation and, subsequently, to consult with the nation's National Science Council and also with the Minister for Science and Technology. This was followed by visits to Georgia Tech by several high-level South African policy makers and university researchers. Results from the RVM program were also used to help design the government's national science centers competition. RVM researchers were among the reviewers of these proposals.

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[4] "Institutional Innovation in University-Industry Science and Technology Centers: The Role of S&T Human Capital," invited lecture, Ministry of Research, Science and Technology and University of Victoria, Wellington, NZ, December, 2002.

[5] "Technology Transfer and Knowledge Diffusion: Lessons from a 15-Year Research Program," Keynote Address, National Advisory Commission on Innovation, Pretoria, South Africa, October, 2003.

Presentations and Consulting for U.S. Government Agencies
Examples of presentations to policy makers based on BES-supported research findings include:

- B. Bozeman, Invited Speaker, ComSci Fellows Program, Office of the Undersecretary of Commerce for Technology Policy, Commerce Department, Washington, DC, January 26, 2005.
- B. Bozeman, Invited Speaker, National Institute of General Medical Science, NIH, March, 2004
- B. Bozeman, Invited Speaker, National Institute of Medicine, Washington, D.C., 2002 [and subsequent participation on Institute of Medicine panel on "Managing Large Scale Research," 2003-2004.
- B. Bozeman, "Evaluating National Laboratories' in the U.S.," G-8 Nations' Research Assessment Workshop, AAAS, Washington, D.C., October, 2002.
- B. Bozeman, "Evaluating Scientific and Technical Human Capital in Public R&D Programs," NIH/NIEH Workshop, Keynote Speech, November 20, 2002, Wilmington, NC

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Appendix: RVM Codebooks and Questionnaire

The Research Value Mapping Program

Survey of Academic Researchers

CODEBOOK

Document version: 2.0
Date: 13 April 2005

Georgia Institute of Technology

This document contains the codebook for the 2004-2005 RVM survey of academic researchers. Additional sections include: a timeline of alterations made to the data set, history of the survey administration, the sampling frame report, the response rate report, and the RVM usage policy for the data set.

RESEARCH VALUE MAPPING PROGRAM
Georgia Institute of Technology – School of Public Policy
Atlanta, GA 30332-0345
USA

This study is supported by the National Science Foundation and the Department of Energy.

Contents

Click a link to jump to a section.

Codebook history

This section includes a comprehensive timeline of all edits, additions made to this document.

Date	Changes made	Comments	Filename
January 25, 2005	Original draft	VERSION 1.0 of 2005 RVM survey codebook for data set that is “incomplete” in that it does not include all returned surveys (minus 40). Codebook only, does not include sampling report, response rates, data use policy, etc.	rvm codebook_01.25.05.doc
April 12, 2005	ADDED: new frequencies and descriptives for complete data set, sampling frame report, “problem” data point report, response rate report, data set history, codebook history, data use policy, survey administration report.	VERSION 2.0 of 2005 RVM survey codebook for data set that is “complete” in that it includes all returned surveys.	rvm codebook_04.12.05.doc

Data set history

This section includes a comprehensive timeline of all cleaning, additions made to the official data set.

Date	Changes made	Comments	Filename (master data set)
April 1, 2005	CLEANED: most of the funding source string variables per the nomenclature created by Bozeman.	Still about 40 surveys to code. So the file is "incomplete."	rvm_04.01.05.xls
April 8, 2005	ADDED: Remaining (40) surveys coded to the master data file.	This is the first rendition of the data set that is "complete" in that it includes all returned surveys.	rvm_04.08.05.xls
April 12, 2005	CLEANED: RESEAR01-07, TIMEAL01-TIMEAL10, remaining (40) funding source string variables per the nomenclature created by Bozeman, PHDYEAR, TENUREYR, YRBORN. ADDED: SAMPCODE to indicate the discipline/field for the respondent.	This is the second rendition of the data set that is "complete."	rvm_04.12.05.xls

“Problem” data points

This section details data points that contain irregularities that cannot be cleaned in the conventional sense, primarily due to respondent misunderstanding and/or error. All irregularities listed apply to the most recent version of the master data set, indicated above in Data set history.

Date	Irregularity	Variable(s)	ID(s)*	Comments
April 12, 2005	The responses to question 8 add up to more than 100%.	RESEAR01 RESEAR02 RESEAR03 RESEAR04 RESEAR05 RESEAR06 RESEAR07	500262 500398 500838 501032 501061 501439 501564 501653 501992 501993 502094 502284 502365 502542 502614 502753 502928 503101 503128 503229 503313 503395 503417 503636 503739 504022 504813 504882 505169 505172 505262 505910 600310 601708 602538 602613 603442 703268	For these variables there are also data points that total less than 100%; however, these were not investigated due to the question 8’s omission of an “other” option to ensure that RESAR01-RESEAR07 encompassed every possibility of research activity for respondents.
April 12, 2005	Some of the responses to question 10 add up to unusually high amounts.	TIMEAL01 TIMEAL02 TIMEAL03 TIMEAL04 TIMEAL05 TIMEAL06 TIMEAL07 TIMEAL08 TIMEAL09 TIMEAL10	501453 501854 502059 502179 502500 502582 503141 503174 503326 503482 503593 503682 503817 504504 504543 504561 505395 505547 505692 505694 505835 505836 505842 505925 600798	For these data points the reported hours worked in the last week (per question 10) range from 90-528 hours.

Date	Irregularity	Variable(s)	ID(s)*	Comments
			602528 602796 603262 603551 700928 701032 701787 701825 703130 703196 703855	
April 12, 2005	In questions 17 and 18, some respondents indicate having received tenure before having earned their doctorates.	PHDYEAR TENUREYR	500235 502529 502593 601086 601148 601325	This may not be a problem. In earlier periods having a PhD was not always requisite to receive tenure.
April 12, 2005	In question 7, some respondents indicate having collaborated with a huge amount of faculty, students.	MALEFACY FEMAFACU MALEGRAD FEMAGRAD OTHCOLLA	505082	Reports are as high as 770 and have been verified that these values are not due to coder error.
Apr. 12, 2005	In question 10, some respondents indicate working more hours in a work week than are mathematically possible.	TIMEAL02 TIMEAL03 TIMEAL05	503326	
	In question 11, 743 people responded that they affiliate with centers; however, each of the answers to question 12 have more than 743 responses.	CENTYEAR CENTAFF01 through CENTAFF16		

*Note: These are the identification numbers listed under the variable name “MasterID” in the master data set.

Sampling report

The sampling frame targets the population of scientists and engineers in tenure-track academic positions at Carnegie Extensive (Research I) universities. This sampling report does not address issues related to either the HBCU or EPSCOR special samples.

We pursued a multi-stage probability sample as follows:

STAGE 1: COLLECT DISCIPLINARY LISTS OF ACADEMIC SCIENTISTS

Objective: Identify Carnegie Extensive Universities employing academic scientists.

Population Frame: Carnegie Doctoral/Research Universities—extensive.

N=151

http://www.carnegiefoundation.org/Classification/index.htm

We excluded Teacher's College of Columbia University to result in N=150.

Objective: Identify Universities offering doctorates in each S & T discipline, and create discipline-specific sampling frames.

We classified disciplines in S & T Field as defined by NSF
NSF/Division of Science Resources Statistics, Survey of Earned Doctorates. 2000.

http://www.nsf.gov/sbe/srs/nsf03310/start.htm

We excluded health sciences and economics to develop 13 sampling frames.
SAMPCODE
1. Biology
2. Computer Science
3. Mathematics
4. Physics
5. Earth and Atmospheric Science
6. Chemistry
7. Agriculture
8. Sociology
9. Chemical Engineering
10. Civil Engineering
11. Electrical Engineering
12. Mechanical Engineering
13. Materials Engineering

Note that although NSF classifies Engineering disciplines together, Bozeman wanted samples drawn of five engineering disciplines (9 through 13 above).

Note also that SAMPCODEs of 14 and 15 are HBCUs and EPSCORs, respectively.

The nuts and bolts of list development:
Five undergraduate research assistants were employed to develop the lists of scientists and engineers. Using the internet, the assistants were instructed to download the section of the current university

catalog related to the focal discipline/department if it listed tenure-track faculty. If the current university catalog did not list faculty by department, the assistants were instructed to obtain the list of faculty from the departmental website.

Each list was printed, and coded to allow for stratification as follows:

1. Stratify by rank

   Rank stratification from NSF "Full-time ranked doctoral science and engineering faculty at 4 year colleges and universities, by academic rank, age, sex, race/ethnicity, and disability status: 1995."

2. Stratify by gender

   Select women with certainty, men randomly. (if enough women, then can select randomly; possible in biology)

Sample Frames Usage notes:
The original sample frames are contained in the GCATT filing cabinet next to the photo copier in large binders.

--Each binder represents one of the 13 disciplines.

--The internet printouts of catalog/web pages are unordered; anyone taking additional samples should bear this in mind.

--Handwritten codes:

Green highlighter: Full Professor
Orange (sometime pink) highlighter: Associate Professor
Yellow highlighter: Assistant professor
Red check mark: Woman professor
Star or arrow: Scientists selected into current RVM sample.

STAGE 2: DRAW SAMPLE BY DISCIPLINE WITH STRATIFICATION BY GENDER AND RANK

Target Sample: 200 male and female scientists from each discipline.

Sample adequate number to achieve:

1. Target sample of 2,500 (assumes 50% response rate)
2. Large enough sample of each discipline for within-discipline analysis
3. Each discipline representative of academic rank.
4. Female over-sample.

Note: Current strategy does not over-sample top Carnegie Extensive Universities, which was one of Bozeman's original objectives..

ORIGINAL TARGET SAMPLING PROPORTIONS
Note that sampling proportions of 1 refer to census of population.

Women: Sample 200 from each discipline

	Women	sampling proportion	Men	sampling proportion
Biology	200	0.21	200	0.06
Computer	200	0.64	200	0.07
Math	200	0.46	200	0.05
Physics	200	0.68	200	0.05
EAS	200	0.74	200	0.12
Chemistry	200	0.45	200	0.06
Agriculture	163	1	200	0.23
Sociology	200	0.21	200	0.12
Chem E	162	1	200	0.15

Civil	212	1	200	0.10
Electrical	200	0.78	200	0.06
Mechanical	178	1	200	0.08
Materials	89	1	200	0.21
	2404		2600	

Implementation

The Carnegie Extensive plan was developed prior to the plan to include HBCU and EPSCOR Universities. There are 500 scientists sampled from each type of institution, half are women, half are men. Analysts using the combined data set should take care in including the HBCU and EPSCOR scientists in their analyses.

A	B	C	D	E	F	G	H
	sampcode	Total	Men	men sampling proport.	Women	women sampling proport.	pilot returns
Biology	1	400	200	0.06	200	0.21	6
Computer	2	400	200	0.07	200	0.64	2
Math	3	400	200	0.05	200	0.46	1
Physics	4	399	199	0.05	200	0.68	2
EAS	5	400	200	0.12	200	0.74	3
Chemistry	6	400	200	0.06	200	0.45	5
Agriculture	7	352	199	0.23	153	1	1
Sociology	8	400	200	0.12	200	0.21	2
Chem E	9	331	200	0.15	131	1	7
Civil	10	400	200	0.1	200	1	2
Electrical	11	400	200	0.06	200	0.78	9
Mechanical	12	362	200	0.08	162	1	3
Materials	13	272	200	0.21	72	1	5
R. Extensive Total		4916	2598		2318		48
HBCU	14	500	250		250		0
EPSCOR	15	500	250		250		2

A	NSF DISCIPLINE/ENGINEERING SUBDISCIPLINE
B	SAMPCODE TO DISTINGUISH RESPONDENTS
C	TOTAL NUMBER IN DISCIPLINE SAMPLED
D	TOTAL NUMBER OF SAMPLED MEN
E	MEN'S SAMPLING PROPORTION
F	TOTAL NUMBER OF SAMPLED WOMEN
G	WOMEN'S SAMPLING PROPORTION
H	PILOT RETURNS: ORIGINALLY DRAWN INTO THIS SAMPLE, BUT REPLACED BECAUSE THEY RESPONDED TO THE PILOT SURVEY

Stratification by race

Any scientists or engineers from underrepresented racial or ethnic groups are included exclusively by random selection.

Stratification by R & D rank

The original plan called for stratifying by R & D rank of the university. This plan was abandoned when we decided to define the population of scientists in Research Extensive universities, and to sample according to individual, and not institutional characteristics. The systematic random sample employed in the next stage samples from the entire population of academic scientists and engineers in Carnegie Extensive universities; the sorting of the list by rank has no effect on probability of selection (once the first case is drawn).

Institutional Profile: R & D Expenditures Ranking Tables, 2000 http://www.nsf.gov/sbe/srs/nsf02308/start.htm. SOURCE: National Science Foundation/Division of Science Resources Statistics, Survey of Research and Development Expenditures at Universities and Colleges, Fiscal Year 2000. The short version is that it is possible to create a university-specific 2000 R & D rank for each scientist and engineer in the final sample.

Disciplinary Weighting
The final decision was to sample sufficient numbers to allow within-discipline analysis by:

1. academic rank
2. gender

One must take care not to report statistics as if they are representative of scientists and engineers within or among these disciplines. In every discipline, women are over-represented in this sample; in some disciplines, women are sampled with certainty. This allows for analysis of male-female differences within each discipline, but does not allow one to make inferences about the discipline as a whole without adjusting for the over-representation of women in the sample.

Furthermore, the sample was not drawn with any attention to achieving proportional representation by discipline. If an analysis wishes to make conclusions to science as a whole (or at least, the disciplines represented here), s/he should construct sample weights based on the actual distribution of scientists and engineers by discipline. See: http://www.nsf.gov/sbe/srs/srs01406/tables/tab7.xls.

Survey administration report

The study protocol was reviewed and approved by the Institutional Review Board of Georgia Tech. Every effort, within reason, was made to encourage university researchers in the sampling frame to complete the survey. However, with each contact respondents were advised about the voluntary nature of the study and informed that while RVM greatly appreciates participation in the study, potential respondents could choose not to participate in the study. No follow-up efforts were directed at university researchers indicating a wish not to participate in the study, which respondents could indicate, per RVM directions, by returning a blank survey.

Minimizing non-response, both to the survey and to specific survey items, was a primary goal in the administration of this version of the RVM survey. To do this, we employed, for the most part, Dillman's (1999) comprehensive "tailored design method" approach for maximizing response rates, which is comprised of:

1. A questionnaire with well-designed content;
2. Surveys formatted in accordance with latest advances in cognitive research;
3. Multiple personalized contacts, each contact accompanied with a carefully crafted message to encourage the respondent to complete the survey;
4. Use of pre-notice letters and post cards;

The data collection phase of the study began in Spring of 2004 and concluded in the Spring of 2005. First, respondents were sent a pre-notice letter informing them about the study and requesting their cooperation in completing a survey to be mailed later. Approximately two weeks after the initial alert letter, the survey was mailed to the respondents (Wave 1). The cover letter accompanying the survey outlined the study objectives, indicated the voluntary nature of the study, requested participation, and provided contact details. About ten days later, a combination thank you/reminder postcard was sent to all respondents. Two months after the mailing of the postcard thank you/reminder, a new cover letter and replacement survey were sent to non-respondents (Wave 2). The cover letter emphasized the importance for everyone to respond (unless for some reason or other the respondent chose not to respond). The final step in survey administration took place in the Fall of 2004 later when non-respondents were sent a new cover letter and a third survey (Wave 3). This final mailing emphasized that this was the last opportunity for the respondents to complete the survey.

References

Dillman, D. A. (1999) *Mail and Internet Surveys: The Tailored Design Method, 2nd Ed.,* New York: John Wiley.

Response rate report

Before calculating the response rates, we took some measures to ensure accuracy. Namely, we subtracted from the denominators, which indicate the total number of surveys sent to eligible respondents per sampling strata (Research Extensive, EPSCOR, HBCU, all), the following: (1) retirees, (2) deceased, (3) wrong addresses, and (4) non-researchers. The quantities eliminated for one or more of these reasons are denoted by asterisks below.

Response rates

Total sample……2086/(5916-154*)=36%
Research extensive universities……1795/(4916-134*)=38%
EPSCOR universities……186/(500-5*)=38%
HBCUs……105/(500-15*)=22%

Surveys sent

Total surveys sent……5916
Surveys sent to research extensive universities……4916
Surveys sent to EPSCOR universities……500
Surveys sent to HBCUs……500

Surveys received

Total (usable) surveys received, all three waves……2086
Surveys received during Wave 1……1372
Surveys received during Wave 2……449
Surveys received during Wave 3……265

Surveys received from research extensive universities…1795
Surveys received from EPSCOR universities……186
Surveys received from HBCUs……105

Codebook

This section includes variable name, frequency, and other descriptive statistics for each survey item (in blue, bold font). This information is incorporated into the below copy of the actual 2004-2005 RVM survey, which has been modified somewhat for formatting purposes (though content-wise it is identical to that which RVM sent to the sample).

INFORMED CONSENT FORM

You are being asked to volunteer for a research project. The research value mapping study seeks information about the careers and research experiences of scientists and engineers working in the nation's universities. The study's purpose is to increase our understanding of scientific collaboration, grants and contracts, career trajectories and personal and professional characteristics.

This study is being conducted by a team of researchers at the Georgia Institute of Technology (Georgia Tech) through funding provided by the National Science Foundation (NSF) and the U.S. Department of Energy (DOE). The contents of the study – including this survey and its questions – represent the work of the Georgia Tech research team (not the NSF or the DOE). Neither federal agency will be provided information about who participated in the survey. All data will be held at Georgia Tech.

There is no direct benefit to you by participating. There are no foreseeable risks to you. You will not be paid nor is there any cost to you by participating.

The survey is for scientific purposes and individual data will not be analyzed. All analyses will be conducted at the aggregate level. Your responses will remain confidential and – in accordance with the Privacy Act – we will not release data publicly that will enable others to infer your identity. We estimate that the questionnaire will take approximately 30 minutes to complete. Taking part in this study is completely voluntary. If you have questions about this research or questionnaire, please contact the project manager:

Project Director:
Barry Bozeman
Regents' Professor of Public Policy
RVM Program
School of Public Policy
Georgia Institute of Technology
Atlanta, GA 30332-0345
rvm@pubpolicy.gatech.edu
(404) 385-4618

Assistant Project Director:
P. Craig Boardman
Senior Research Associate
RVM Program
School of Public Policy
Georgia Institute of Technology
Atlanta, GA 30332-0345
rvm@pubpolicy.gatech.edu
(404) 385-4611

If you do not wish to take part, you will have no penalty. You may stop taking part at any time. If you have questions about this research, the questionnaire, or your rights in completing this questionnaire, please call or write:

Alice Basler
Office of Research Compliance
Georgia Institute of Technology
Atlanta, GA 30332-0420
Voice (404) 894-6942 Fax (404) 385-0864

If you have read the statement above and consent to participate, check the box below and proceed to the next page. If you do not wish to participate, simply stop here. We thank you for your interest.

❑ **I have read the above statement and grant my informed consent.** **CONSENT (n=2086; "1"=1320, "0"=766; mean=.63)**

❑ **Please inform me of results of this study** **INFORM (n=2086; “1”=803, “0”=1283; mean=.38)**

Section I. Research Grants

1. If you spend any time writing or participating in the preparation of proposals for contracts or grants, please indicate your agreement or disagreement with the statements below.

- ❑ Thus far, I have not participated in the preparation of grants or contract proposals **[Please go to the next question]** **NOPARTGR (n=2086; "1"=52, "0"=2034; mean=.02)**

	Strongly Agree "4"	Agree Somewhat "3"	Disagree Somewhat "2"	Strongly Disagree "1"
I feel that my administrative superiors expect me to Pursue grants and contracts **GRANT01 (n=2015; mean=3.86), valid percent/frequency:**	☐ **88.7/1787**	☐ **9.2/186**	☐ **1.5/31**	☐ **.5/11**
I sometimes pursue grants and contracts that are not of great interest to me………………………………………. **GRANT02 (n=2008; mean=2.3), valid percent/frequency:**	☐ **9.4/189**	☐ **37.2/746**	☐ **27.3/548**	☐ **26.1/525**
Generally, I enjoy preparing research proposals……… **GRANT03 (n=2009; mean=2.57), valid percent/frequency:**	☐ **13.8/278**	☐ **43.3/870**	☐ **29.3/588**	☐ **13.6/273**
Writing proposals is a formal requirement for my job … **GRANT04 (n=1996; mean=3.08), valid percent/frequency:**	☐ **48/959**	☐ **25.2/502**	☐ **13.8/275**	☐ **13/260**
The primary reason for I prepare research proposals is to support the research topics that are of greatest intellectual and professional interest to me…………….. **GRANT05 (n=2009; mean=3.49), valid percent/frequency:**	☐ **61.1/1228**	☐ **29.1/584**	☐ **7.9/159**	☐ **1.9/38**
The ability to succeed in grants and contracts is (or was) important to my tenure and promotion………………..... **GRANT06 (n=2005; mean=3.67), valid percent/frequency:**	☐ **75.9/1522**	☐ **17/341**	☐ **4.9/99**	☐ **2.1/43**
A major motivation for my preparing proposals is to support graduate students………………………………… **GRANT07 (n=2010; mean=3.37), valid percent/frequency:**	☐ **56.5/1135**	☐ **29.5/592**	☐ **8.6/173**	☐ **5.5/110**
I try to obtain grants or contracts to "buy out" from teaching…………………………………………………….. **GRANT08 (n=2003; mean=1.79), valid percent/frequency:**	☐ **7.8/157**	☐ **15.5/311**	☐ **24.9/499**	☐ **51.7/1036**
I try to obtain grants or contracts for salary funding…… **GRANT09 (n=2006; mean=2.78), valid percent/frequency:**	☐ **27.8/557**	☐ **39.3/788**	☐ **15.7/315**	☐ **17.2/346**

2. Currently, what percentage of your work time, if any, is supported by government-sponsored grants, contracts and cooperative agreements?

_____ % of work time supported by government-sponsored grants, contracts, and cooperative agreements

TIMEGOVT (n=2085; mean=20.05; range=0-100)

3. How many students and postdocs, if any, are currently supported by grants or contracts on which you are PI?

Number of undergraduate students supported currently: ☐
STDSUNDE (n=2084; mean=1.22; range=0-50)

Number of masters students supported currently: ☐
STDSMAST (n=2085; mean=.84; range=0-20)

Number of doctoral students supported currently: ☐
STDSPHDS (n=2085; mean=1.71; range=0-25)

Number of postdoctoral researchers supported currently: ☐
STDSPOST (n=2085; mean=.49; range=0-30)

4. *If you are currently supported by grants or contracts*, whether as principal investigator (PI), co-PI or affiliated researcher, please indicate the source of this support *[Please check all that apply]:*

- ❑ I am not currently supported by grants or contracts. **[Please go to the next question]** **"0"**
- ❑ I am currently supported by grants or contracts from the following sources: **"1"**

NOGRANTS (n=2035; "1"=1599, "0"=436; mean=.79)

____

____

5. Have you had any working relations with private companies during the past 12 months? *[Please mark one box]*

- ❑ No **[Please proceed to Section II]** **"0"**
- ❑ Yes **"1"**

WORKCOMP (n=2043; "1"=952, "0"=1091; mean=.47)

***During the past twelve months*, I have worked with one or more private companies in the following capacities:**

- ❑ Persons from a private company have asked for information about my research and I have provided it.
  WORKREL01 (n=2086; "1"=684, "0"=1402; mean=.33)
- ❑ I contacted persons in industry asking about their research or research interests.
  WORKREL02 (n=2086; "1"=351, "0"=1735; mean=.17)
- ❑ I served as a formal paid consultant to an industrial firm.
  WORKREL03 (n=2086; "1"=329, "0"=1757; mean=.16)
- ❑ I helped place graduate students or post-docs in industry jobs.
  WORKREL04 (n=2086; "1"=458, "0"=1628; mean=.22)
- ❑ I worked at a company with which I am owner, partner or employee.
  WORKREL05 (n=2086; "1"=66, "0"=2020; mean=.03)

- ❑ I worked directly with industry personnel in work that resulted in a patent or copyright
  WORKREL06 (n=2086; "1"=99, "0"=1987; mean=.05)
- ❑ I worked directly with industry personnel in an effort to transfer or commercialize technology or applied research.
  WORKREL07 (n=2086; "1"=288, "0"=1798; mean=.14)
- ❑ I co-authored a paper with industry personnel that has been published in a journal or refereed proceedings.
  WORKREL08 (n=2086; "1"=270, "0"=1876; mean=.13)
- ❑ Other (Please specify) ____
  WORKREL09 (n=2086; "1"=207, "0"=1879; mean=.10)

Section II. Research Collaboration

6. If we define research collaboration as "working closely with others to produce new scientific knowledge or technology." In your current career stage, how important are each of the following factors in your decisions to collaborate? *[Please check one box in each row]*

	Very Important "4"	Somewhat Important "3"	Somewhat Unimportant "2"	Not Important "1"
Length of time I have known the person	☐	☐	☐	☐
COLLAB01 (n=2053; mean=2.59), valid percent/frequency:	10.4/214	49.5/1016	28.5/585	11.6/238
Responding to requests of my administrative superiors	☐	☐	☐	☐
COLLAB02 (n=2041; mean=1.76), valid percent/frequency:	2.8/57	20.2/412	27.4/560	49.6/1012
Interest in helping junior colleagues	☐	☐	☐	☐
COLLAB03 (n=2036; mean=2.71), valid percent/frequency:	17.3/352	49.7/1011	19.4/394	13.7/279
Desire to work with researchers who have strong scientific reputations	☐	☐	☐	☐
COLLAB04 (n=2038; mean=3.09), valid percent/frequency:	35.9/731	43.7/890	13.6/278	6.8/139
Desire to work with researchers whose work skills and knowledge complement my own	☐	☐	☐	☐
COLLAB05 (n=2055; mean=3.77), valid percent/frequency:	80/1643	17.9/367	1.3/27	.9/18
Quality of my previous collaborations with the person	☐	☐	☐	☐
COLLAB06 (n=2049; mean=3.66), valid percent/frequency:	73.3/1502	21.9/448	2.6/54	2.2/45
Interest in helping graduate students	☐	☐	☐	☐
COLLAB07 (n=2039; mean=3.15), valid percent/frequency:	38.4/783	44.1/900	11.3/231	6.1/125
The extent to which working with the individual is fun or entertaining (apart from the work itself)	☐	☐	☐	☐
COLLAB08 (n=2050; mean=2.78), valid percent/frequency:	22.7/465	44.7/916	21/430	11.7/239
Desire that the collaborator be highly fluent	☐	☐	☐	☐

in my native language **COLLAB09 (n=2043; mean=2.00), valid percent/frequency:**	**6.8/138**	**24.6/503**	**30.7/628**	**37.9/774**
Desire to work with researchers from the same country of origin **COLLAB010 (n=2037; mean=1.32), valid percent/frequency:**	☐ **.7/14**	☐ **4/81**	☐ **21.7/442**	☐ **73.6/1500**
The collaborator should have a strong work ethic **COLLAB11 (n=2048; mean=3.51), valid percent/frequency:**	☐ **58.3/1194**	☐ **35.5/728**	☐ **4.7/97**	☐ **1.4/29**
The ability of the collaborator to stick to a schedule **COLLAB12 (n=2046; mean=3.16), valid percent/frequency:**	☐ **32.3/661**	☐ **53.8/1101**	☐ **11.1/228**	☐ **2.7/56**
Practices for assigning credit (e.g. order of authorship) **COLLAB13 (n=2036; mean=2.47), valid percent/frequency:**	☐ **13.7/279**	☐ **38.9/791**	☐ **28.4/579**	☐ **19/387**

7. For the past twelve months, please tell us the approximate number of people in each of the following categories with whom you have had research collaborations:

Number of male university faculty: ☐
MALEFACU (n=2085; mean=4.64; range=0-770)

Number of female university faculty: ☐
FEMAFACU (n=2085; mean=1.57; range=0-710)

Number of current male graduate students: ☐
MALEGRAD (n=2085; mean=2.68; range=0-200)

Number of current female graduate students: ☐
FEMAGRAD (n=2085; mean=1.42; range=0-75)

Others (both male or female): ☐
OTHCOLLA (n=2082; mean=1.71; range=0-150)

8. Scientists work on their own and in research groups. For the past twelve months, could you please estimate the percentage of your research-related work time devoted to each of the following categories. *[Percentages should add up to 100; your best estimate will do]*

Work Setting	Percentage of Research Time
Working alone (on research that at no point includes a collaborator) **RESEAR01 (n=2083; mean=21.66; range=0-100)**	%
Working with researchers and graduate students in my immediate work group, laboratory, or research center **RESEAR02 (n=2083; mean=42.55; range=0-100)**	%
Working with researchers in my university, but outside my immediate work group, laboratory or research center **RESEAR03 (n=2082; mean=10.48; range=0-100)**	%

Working with researchers who reside in nations other than the U.S. **RESEAR04 (n=2082; mean=5.25; range=0-100)**	%
Working with researchers in U. S. universities other than my own **RESEAR05 (n=2083; mean=10.15; range=0-100)**	%
Working with researchers in U. S. industry **RESEAR06 (n=2083; mean=2.71; range=0-50)**	%
Working with researchers in U. S. government laboratories **RESEAR07 (n=2083; mean=3.33; range=0-100)**	%
Total	100 %

Section III. Scientific Work Experiences and Values

9. Please indicate the extent to which you agree or disagree with each of the following statements. *[Please check one box in each row]*

Statement	Strongly Agree 4	Agree Somewhat 3	Disagree Somewhat 2	Strongly Disagree 1
Worrying about possible commercial applications distracts one from doing good research……………….. **SCIVAL01 (n=2008; mean=2.20), valid percent/frequency:**	☐ **8.1/163**	☐ **29.5/593**	☐ **36.7/736**	☐ **25.7/516**
I enjoy research more than I enjoy teaching………….. **SCIVAL02 (n=2016; mean=2.69), valid percent/frequency:**	☐ **19.7/398**	☐ **38.9/785**	☐ **32/646**	☐ **9.3/187**
If you do not teach check here: ☐ **SCIVAL03 (n=2086; “1”=27, “0”=2059; mean=.01)**				
Government has too big a role in setting priorities for research…………………………………...... **SCIVAL04 (n=2026; mean=2.74), valid percent/frequency:**	☐ **15.7/318**	☐ **47.4/961**	☐ **32.1/651**	☐ **4.7/96**
I’d rather double my citation rate than double my salary………………………………………………… **SCIVAL05 (n=2020; mean=2.24), valid percent/frequency:**	☐ **11.7/236**	☐ **26.3/531**	☐ **36.2/731**	☐ **25.8/522**
My colleagues in my home department appreciate my research contributions……………………………...... **SCIVAL06 (n=2031; mean=2.84), valid percent/frequency:**	☐ **20.1/408**	☐ **51.9/1055**	☐ **19.9/405**	☐ **8.0/163**
I am satisfied with my job…………………………...... **SCIVAL07 (n=2042; mean=3.13), valid percent/frequency:**	☐ **37/756**	☐ **44.3/905**	☐ **13.5/276**	☐ **5.1/105**
I think I am paid about what I am worth in the academic market…………………………………………. **SCIVAL08 (n=2035; mean=2.49), valid percent/frequency:**	☐ **15.3/311**	☐ **36.4/740**	☐ **30.5/621**	☐ **17.8/363**
In government decisions about research funding, the scientist’s intellectual curiosity should be much <u>less</u> important than the potential of the research to improve people’s lives……………………………………………… **SCIVAL09 (n=2010; mean=2.26), valid percent/frequency:**	☐ **6.5/131**	☐ **30.9/622**	☐ **44.8/901**	☐ **17.7/356**

10. For the most recent full academic term, please indicate the average number of hours per week devoted to each of the activities below *[Your best estimate will do].*

Work Activity	Average Hours Per Week
Writing or developing proposals for grants and contracts **TIMEAL01 (n=2081; mean=4.63; range=0-50)**	

Work Activity	Average Hours Per Week
Conducting research related to grants and contracts **TIMEAL02 (n=2081; mean=11.76; range=0-140)**	
Conducting research <u>not</u> related to grants and contracts **TIMEAL03 (n=2081; mean=5.40; range=0-140)**	
Administering grants and contracts **TIMEAL04 (n=2081; mean=2.44; range=0-30)**	
Teaching undergraduate students (including preparation time and meeting outside class) **TIMEAL05 (n=2081; mean=10.68; range=0-140)**	
Teaching graduate students (including preparation time and meeting outside class)**TIMEAL06 (n=2080; mean=6.18; range=0-84)**	
Advising graduate and undergraduate student advising for curriculum and job placement **TIMEAL07 (n=2080; mean=2.6; range=0-30)**	
Professional and community service work (not part of university service) **TIMEAL08 (n=2081; mean=2.53; range=0-50)**	
University, departmental or research center service and committee work **TIMEAL09 (n=2081; mean=5.19; range=0-65)**	
Paid consulting **TIMEAL10 (n=2080; mean=.52; range=0-20)**	

Section IV.Center Affiliations

Definition: A <u>university research center</u> is a "research institution that has five or more faculty and postdoctoral researchers and includes participants from more than one discipline and more than one academic department."

- ❑ **Considering the above definition, I am <u>not</u> affiliated with a university research center [Please proceed to Section V]** **"0"**

- ❑ **I am affiliated with a university research center. The name of the Center I am affiliated with is [Note: if affiliated with more than one, list affiliation most important to you]:** **"1"**

CTRAFF (n=2028; "1"=753, "0"=1275; mean=.37)

____

_

____

_

11. During what year did you affiliate with the center?

______ Year affiliation began

CENTYEAR (n=743; mean=1996; range=1963-2004)

12. Affiliation with a university research center can have important positive and negative effects on one's career. Below, please mark the position on the scale that seems to best fit your views about the career impacts of your research center affiliation.

		Very Negative -3	-2	-1	No Effect 0	+1	+2	Very Positive +3
Opportunities for consulting CENTAFF01 (n=765; mean= .39)	val. percent/freq.:	1.2/9	2.0/15	.8/6	65.1/498	20/153	6.1/47	4.8/37
Opportunities for research grants or contracts:								
From government agencies CENTAFF02 (n=767; mean=1.51)	val. percent/freq.:	.8/6	.3/2	.9/7	18.5/142	27.2/209	29.7/228	22.6/173
From industry CENTAFF03 (n=762; mean= .72)	val. percent/freq.:	1.4/11	.9/7	1.2/9	49.1/374	24.7/188	13.3/101	9.4/72
Ability to publish journal articles CENTAFF04 (n=770; mean=.93)	val. percent/freq.:	.6/5	.5/4	1.7/13	42.6/328	23.6/182	18.6/143	12.3/95
Ability to publish interdisciplinary journal articles CENTAFF05 (n=769; mean= 1.18)	val. percent/freq.:	.4/3	.1/1	.5/4	33.9/261	26.7/205	21.3/164	17/131
Ability to publish research that is more applied CENTAFF06 (n=767; mean= .80)	val. percent/freq.:	.7/5	4/3	1.8/14	50.5/387	19.3/148	17.2/132	10.2/78
Ability to patent or commercialize research findings CENTAFF07 (n=762; mean= .35)	val. percent/freq.:	1.4/11	.9/7	.9/7	69.9/533	15/114	8.1/62	3.7/28
Research autonomy CENTAFF08 (n=761; mean= .37)	val. percent/freq.:	1.6/12	3.7/28	12/91	50.6/385	12.4/94	10.8/82	9.1/69
Likelihood of getting my research proposals approved CENTAFF09 (n=765; mean= .89)	val. percent/freq.:	.9/7	0/0	1.6/12	39.7/304	30.3/232	19.7/151	7.7/59
Research collaboration opportunities CENTAFF10 (n=769; mean=1.87)	val. percent/freq.:	.4/3	.1/1	.1/1	7.8/60	24.2/186	37.5/288	29.9/230
Access to new equipment and facilities CENTAFF11 (n=769; mean=1.55)	val. percent/freq.:	.7/5	.8/6	.7/5	18.9/145	25.6/197	26.5/204	26.9/207
Reduced teaching load CENTAFF12 (n=768; mean= .19)	val. percent/freq.:	3.5/27	1.7/13	2.7/21	72.4/556	8.7/67	6.1/47	4.8/37
Impact on tenure CENTAFF13 (n=760; mean= .56)	val. percent/freq.:	1.4/11	.9/7	2.8/21	52.5/399	25/190	12.4/91	5.4/41
Ability to recruit or retain students CENTAFF14 (n=762; mean=1.07)	val. percent/freq.:	.4/3	1.2/9	1/8	28.7/219	36.6/279	21.5/164	10.5/80
Ability to place students CENTAFF15 (n=755; mean= .9)	val. percent/freq.:	.4/3	0/0	1.1/8	42.6/322	28.3/214	18.5/140	9.0/68

My overall satisfaction working at this university	-3	-2	-1	0	+1	+2	+3
CENTAFF16 (n=767; mean=1.41) val. percent/freq.:	**1.3/10**	**2/15**	**2.9/22**	**13/100**	**28.4/218**	**33.5/257**	**18.9/145**

13. What percentage of your salary, if any, comes from the center(s) with which you are affiliated? [*Include any salary from center-based grants and contracts*]

_____ % of my salary compensated by center(s)
CENTSALAR (n=2085; mean=5.34; range=0-100)

14. What percentage of your research work time is allocated to center-related work?

_____ % of research work time devoted to center-related work
CENTWORKT (n=2082; mean=11.31; range=0-100)

Section V. Demographic Characteristics

15. Have you ever been a university-based post-doctoral researcher or fellow? If so, please provide the years during which you were a postdoc.

- ❑ No, I have never been a postdoc. **"0"**
- ❑ Yes **"1"**, I was a postdoc from ___postdocyb_____ to __postdocye______.

POSTDOC (n=2041; "1"=955, "0"=1086; mean=.47)

POSTDOCYB (n=949; mean=1986; range=1952-2003); POSTDOCYE (n=949; mean=1989; range=1954-2005)

16. Are you: ❑ Male **"1"** ❑ Female **"0"**

GENDER (n=2031; "1"=979, "0"=1052; mean=.48)

17. In what year were you born? 19_____

BORNYR (n=2022; mean=56.38; range=22-77)

18. In what year did you *[Leave items blank if they are not applicable]:*

	Year
Complete your Ph.D. **PHDYR (n=2033; mean=1986; range=1951-2003)**	________
Start in a tenure track position **TETRAKYR (n=1980; mean=1989; range=1952-2004)**	________
Obtain tenure **TENUREYR (n=1437; mean=1990; range=1954-2005)**	________
Attain rank of Associate Professor **ASSOCYR (n=1432; mean=1990; range= 1954-2004)**	________
Attain rank of Full Professor **FULLPRYR (n=920; mean=1992; range=1960-2005)**	________

19. What is the discipline of your doctoral degree (e.g. physics, chemistry, electrical engineering)?

❑ Check here if you do not have a Ph.D. degree **"1" if checked**
PHDDGREE (n=2086; mean=.02; "1"=32, "0"=2054)

Discipline of Ph.D. degree: ___________________________________
PHDDISCP (n=2086)

20. What is your racial/ethnic identification?

- ❑ Asian **ASIAN (n=2086; mean=.1; "1"=218, "0"=1868)**
- ❑ Black **BLACK (n=2086; mean=.03; "1"=64, "0"=2022)**
- ❑ Hispanic **HISPANIC (n=2086; mean=.04; "1"=76, "0"=2010)**
- ❑ Native American **NATIVEAM (n=2086; mean=0; "1"=7, "0"=2079)**
- ❑ White **WHITE (n=2086; mean=.79; "1"=1653, "0"=433)**
- ❑ Other [*Please specify*] **OTHRACYN (n=2086; mean=.02; "1"=36, "0"=2050)**

___________________________________ **OTHRACE (string)**

21. What is your current citizenship status?

- ❑ Native born U.S. citizen **USCITZ (n=2086; mean=.72; "1"=1500, "0"=586)**
- ❑ Naturalized U.S. citizen **NATUSCIT (n=2086; mean=.14; "1"=283, "0"=1803)**
- ❑ Non U.S. citizen with a permanent U.S. resident visa **PERMVISA (n=2086; mean=.09; "1"=178, "0"=1908)**
- ❑ Non U.S. citizen with a temporary U.S. resident visa **TEMPVISA (n=2086; mean=.04) "1"=86, "0"=2000)**

22. [*IF U.S. NATURALIZED CITIZEN OR NON U.S. CITIZEN*], of which country are (were) you a citizen?

____ **COUNTRY (string)**

23. Currently, are you either married or living with a domestic partner?

❑ Yes ❑ No **[If No, please go to Question 26]**
MARRIED (n=2038; mean =.85; "1"=1731, "0"=307)

24. Which of the following best describes your spouse or partner's current position?

- ❑ Full time homemaker or family caregiver
  SPOUJOB1 (n=2086; mean = .17; "1"=355, "0"=1731)
- ❑ Private business or professional (e.g. lawyer, physician, accountant)
  SPOUJOB2 (n=2086; mean=.18; "1"=384, "0"=1702)
- ❑ Government or nonprofit employee
  SPOUJOB3 (n=2086; mean=.06; "1"=124, "0"=1962)
- ❑ University or college faculty or researcher
  SPOUJOB4 (n=2086; mean=.25; "1"=513, "0"=1573)
- ❑ Other university position
  SPOUJOB5 (n=2086; mean=.06; "1"=116, "0"=1970)
- ❑ Other [*Please specify*]
  SPOUJOB6 (n=2086; mean=.12; "1"=256, "0"=1830)
  ______________________________ **SPOUOTHR (string)**

25. Currently, do you have children living with you as part of your family? If so, how many?

Number of children living with you: _____
CHILDREN (n=2085; mean=.83; range=0-10)

26. What is your parent's highest level of formal education? *[Please check one box in each column]*

	Father	Mother
Not a high school graduate **1**	❑	❑

High school graduate **2**	❑	❑
Attended college, but did not graduate **3**	❑	❑
College graduate (B.A., B.S.) **4**	❑	❑
Post graduate **5**	❑	❑
Not sure/Don't know **99**	❑	❑

FATHREDU (n=2034; "1"=294 at 14.5 percent, "2"= 342 at 16.8 percent, "3" = 185 at 9.1 percent, "4" = 479 at 23.5 percent, "5" = 728 at 35.8 percent, "99" = 6 at .3 percent)

MOTHREDU (n=2033; "1"=257 at 12.6 percent, "2"= 545 at 26.8 percent, "3" = 256 at 12.6 percent, "4" = 527 at 25.9 percent, "5" = 439 at 21.6 percent, "99" = 9 at .4 percent)

27. To develop further information about career histories we are also collecting curriculum vita (CV) of our survey respondents. We hope that you will provide us yours. *We will use your CV only for research purposes and will not examine individual-level data*. If you would like to see an example of the ways we use CV's for research please go to http://www.rvm.gatech.edu/cv

- ❑ I am including my CV with this survey
  CVSURVEY (n=2086; mean=.19; "1"=398, "0"=1688)
- ❑ I am sending my CV via a separate email [*Please send file to* rvm@pubpolicy.gatech.edu]
  CVEMAIL (n=2086; mean=.19; "1"=393, "0"=1693)
- ❑ You can download my CV at:
  CVDOWNLO (n=2086; mean=.11; "1"=233, "0"=1853)
  [Please give website] ____
  CVADDRES (string)

28. Regardless of how happy or unhappy you are with your scientific career, what is the single most important factor *(other than more research funding or a higher salary)* that, if it could be changed, would increase your satisfaction with your work? **HAPPYFAC (string)**

Thank you for taking your time to complete this questionnaire. Your assistance in providing this information is very much appreciated. If there is anything else you would like to tell us about any of the topics covered by this questionnaire, please do so in the space provided below: Commentsy/n (string)

Data use policy

The use of data compiled under this project (referred to as "RVM 2005") is subject to conditions set forth in this policy statement. First, and foremost, all users of the data have an affirmative obligation to safeguard the confidentiality of survey respondents. Obviously, this means that the data should be stored in well-secured media and environments such that unauthorized persons do not have access to it. This affirmative obligation also requires researchers to abide by the following guidelines (Use of RVM 2005 data is viewed as unconditional acceptance to abide by these guidelines.)

1. RVM 2005 data may be used only for performing statistical analyses at an aggregate level.
2. Researchers should make no attempt to identify individual respondent(s). Furthermore, any inadvertent discovery in this regard should be reported immediately to the Project Directors.
3. No attempt should be made to link RVM 2005 dataset with other dataset(s) containing individually identifiable information on human subjects.

Academic use of the data is defined as use of RVM 2005 data to produce journal articles, conference papers, books, and book chapters. In keeping with the project goal of advancing empirical research on public management and health policy and facilitating development of cumulative knowledge in those fields, the RVM 2005 data will be made public domain following two periods of exclusive use (PEU-I and PEU-II).

During PEU-I, the Project Directors (Barry Bozeman, Juan Rogers, and Monica Gaughan) and collaborating researchers will use the data. This will be followed by a PEU-II during which data may be made available to select researchers. Public management and health policy researchers must contact and obtain written authorization from the Project Director to use the data during PEU-II. During PEU-II, preference will be given to scholars who have been associated with prior RVM activities. Data use during PEU-I and PEU-II is subject to following conditions:

1. To coordinate efforts in an optimal manner, avoid duplication and maintain an institutional history of RVM, researchers are asked to consult with the Project Directors when initiating new projects that make use of RVM 2005 data.
2. Data is made available for individual use only and researchers are prohibited from distributing (either for free or selling) the database to a third party.
3. Computer files on RVM 2005 data and related documentation are provided on an "as is" basis and no warranties are made. Users are encouraged to use virus detection and elimination software prior to using RVM 2005 files. The user as a condition of receiving and using RVM 2005 files agrees to hold harmless the RVM 2005 project and Project Directors for any perceived or real consequent damage.
4. Due acknowledgments of study sponsors and project administration should be made in all products based on RVM 2005 data. At a minimum the following suggested language needs to be incorporated as part of the author's note:

   "Data analyzed in this paper were collected under the auspices of the 2005 Research Value Mapping Survey of Academic Researchers (RVM 2005), a project funded by the National Science Foundation and U.S. Department of Energy. Barry Bozeman, Regents' Professor of the School of Public Policy at Georgia Tech, is Principal Investigator and Project Director for RVM 2005. Opinions expressed in this paper are not necessarily shared by the RVM 2005 project leadership and/or Georgia Tech."