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FROM THE EDITOR'S DESK

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From the Editor's Desk

Holly R. Zink
Children's Mercy Hospital

Creative Curiosity and Thinking like a Researcher

Every day, Research Administrators demonstrate creative vision, professional ability, and ethical standards to provide leadership and promote research project management. There is an opportunity for research administrators to think and act like any other scholar, and this includes sharing our knowledge through publication. While administrators are used to playing the role of a project manager, we must also become accustom to playing the role of a researcher by sharing best practices through the research administrator community. The Journal of Research Administration provides a scholarly venue to share your findings and expand the knowledge of our profession.

Who among us has not asked whether this or that research project is a meaningful one? Who has not wondered—on a sleepless night during a long stretch of dull or taxing work—whether in the end it all adds up to anything? Meaningful work must feel meaningful and be worthwhile; both valued and valuable. This applies to research administration and the various research projects that fill our time and spend our energy. A meaningful research project must, in some sense, feel worthwhile. The team conducting the research must be excited and absorbed by it. However, for a project to be meaningful, it must also be worthwhile. As a modern philosopher famously stated, "Engagement in a life of tiddlywinks does not rise to the level of a meaningful life, no matter how gripped one might be by the game" (May, 2011). However, value is only obtained through shared understanding. Without fully understanding the nature of research, how can you ever find its true value? And by reflection, your own value within the profession of research administration? What is called for now is an approach to thinking about the meaning of research administration that can draw us together, one that exists alongside the scientific and academic tradition (May, 2011).

Transformative research is more likely to result when a research administrator thinks and acts like a research scholar in the field of research administration. However, not all research administrators are trained in research methodology, and many come from backgrounds not steeped in scientific or academic traditions. Research is simply the pursuit of understanding, explaining, or predicting unknown phenomena. In short, it is the study of applied curiosity.

All scientific methods and scientific thinking are framed through the lens of metaphor—symbols we attach to bundles of meaning that we hold and share with those around us. Scientists, just like every other line of work, invent concepts or constructs to think about and communicate abstract ideas. These concepts are used at the theoretical level to explain and put a framework around research programs and projects. By understanding the basic concepts or theories that scientists use to frame their research, administrators can begin to understand both the work that is being done currently and the broader context of a scientist's lifespan continuum of research.

Good research is based on sound reasoning—and both the scientist and the shrewd administrator alike practice thinking habits that reflect sound reasoning—finding the true facts, testing the connections between those facts and assumptions, and making claims based on the evidence provided. Making claims is the foundation of research because it gives us an opportunity to assess the truth or falsity of the relationship between our facts and assumptions. When we put forth a claim for discussion and testing, we are hypothesizing. "A good hypothesis is one that can explain what I claim to explain; is testable; and has greater range, probability, and simplicity than its rivals" (Cooper & Schindler, p. 55). Research is the structured exploration of reasonable potentialities—it is not left to chance, but is simply the exploration of the full range of capacities for sensing, wondering, learning, and understanding the world around us.

It is often only through creativity and curiosity that meaningful research is born. They are inextricably linked. Creativity requires the freedom of curiosity to consider unthinkable alternatives, and to doubt the worth of cherished practices within the academic field. To think like a researcher means stepping outside of how practices have always been done and stretching to see what might be possible tomorrow. It is well-known that Thomas Edison tried thousands of different experiments before producing a working lightbulb. Imagine if he had a research administrator with paperwork to document every experiment and cost transaction. Imagine the grant manager discussing the viability of the research at weekly meetings. Imagine the thousands of failed tests piling up in the corner. Imagine the sense of failure and worthlessness the team must have felt. And yet, Edison saw the meaning and value—he had the creativity and curiosity to envision light in a dark world.

As Research Administrators we often provide creative solutions to complex problems within our institutions. Administrators are used to playing the role of a project manager, but we must also become accustom to playing the role of a researcher with our own taste for curiosity and creativity. Strive for levels of curiosity that rival the stamina of Thomas Edison, and see where it leads you. We believe that Research Administrators can and should share those curious experiments and creative solutions through scholarly publication, and we hope that you continue to look to the Journal of Research Administration to do so.

Holly R. Zink, MSA, ACRP-CP is a Project Development and Education Manager in the Department of Pediatrics at Children's Mercy Hospital, and Associate Editor for the Journal of Research Administration.

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ARTICLES

Reflections from a Fellow in the Journal of Research Administration's Author Fellowship Program

Angela J. Silva

With the completion of the third cohort of the *Journal of Research Administration's* Author Fellowship Program (*JRA*-AFP), I suspect many of the Fellows are deep in the manuscript development stage, refining their ideas for a *JRA* submission. Just a few short years ago, I was doing the same thing—writing and revising my article as part of the first Fellowship cohort. You might be wondering what I thought about the program and what my overall experience was like. Let me share a bit of my journey with you.

For me, being a published author was always a dream and seemed almost unattainable. In my role as a senior research administrator, I had a broad scope of responsibilities and worked with clinicians to help them increase their capacity to conduct community-based research. I had limited time to pursue anything related to developing a manuscript and honestly had no idea where to even begin. Then, in the Fall of 2016, I saw the email announcement about *JRA's* Author Fellowship Program. This six-month pilot program was offered to encourage more interest in the journal by matching research administrators (fellows) with published *JRA* authors (peer advisors).

Part of the *JRA* application process involves describing the steps you as a future fellow would need to complete and submit a manuscript. In my application, I wanted to primarily focus on defining strategies that I could adopt for developing my article while also considering how to frame and shape this article to ensure it would be relevant to a broad audience of research administrators. I want to emphasize that the goals are set by the future fellow. These objectives are not prescribed or dictated. The fellow decides and then drives the progress.

Beyond writing and submitting a manuscript, fellows may propose goals centering around many things such as building skill and confidence; developing a topic idea; conducting a literature search; defining a research question and direction for a future research project; or getting feedback on a draft article or manuscript. During the program, fellows and their peer advisors frequently connect to map out incremental targets and timelines to figure out what is needed to accomplish these goals, including a future manuscript submission to *JRA*.

This email from *JRA* piqued my curiosity and presented an opportunity that I never knew was available. If I was selected, I would be matched with an advisor that would help me figure out how to publish in the *JRA*. I was thrilled that a program to support would-be authors existed and quickly submitted my application. A few short months later, I began my journey as one of the inaugural Fellows in the *JRA*-AFP.

That's when things got interesting.

The first cohort began in January 2017. I was one of seven Fellows. Being in this program gave me much-needed guidance and practical tools. Over the next six months, I noticed my mindset

shifted. I went from a place of "*wishing I could*" to "*I can*" and "*I did*." What kept me grounded and on track was my Peer Advisor, Alicen Nickson, Director of Research & Enterprise at Royal Holloway (University of London, UK).

Her mentorship was a critical contributor to my success. Alicen was a published author with similar interests. She provided some key insights during our regular calls and many email exchanges as I wrote and rewrote sections of my manuscript. In our initial discussions, we reviewed the goals I wanted to achieve during and after the Fellowship ended. As you read this, you might be thinking, *why discuss goals for after the fellowship?* I had the same thought. Alicen emphasized that developing a manuscript takes time. The Fellowship program was only six months long and while I would be working on my article, I needed to balance this with work and family commitments. Basically, I shouldn't rush through the process or set unrealistic expectations. This was sage advice that I continued to be mindful of throughout the program.

In our next set of conversations, we discussed the process of developing the article. I needed to figure out the nuts and bolts of this process and build my confidence. We started with a simple outline of my topic. I took an extra step here and made sure I incorporated the specific *JRA* formatting requirements into each section of the outline. This would make it easier for me to finalize the manuscript and not have to figure out those details later. As the months progressed, I found dedicating time to work on the manuscript challenging. Trying to find time to think and write was nearly impossible. During these times, Alicen continued to check in with me via email and comment on the manuscript sections that I had drafted. Even if I made a little bit of progress, it was still progress and this was good.

Still, there were some doubts taking root. I was beginning to think my idea of becoming a published author was more fantasy than reality. *What was I thinking?*

Alicen's steadfast guidance was so impactful during this time. She reminded me how resilient I am and kept encouraging me. She also reminded me that writing a manuscript takes both discipline and time. Her unwavering support kept me moving forward.

Still, this wasn't an easy journey. Over the next several months, I spent many an evening and weekend writing and rewriting various sections. When I submitted the manuscript to *JRA*, I felt like I had just completed 26.2 miles of a writing marathon. I gave myself a big pat on the back for this accomplishment. "*I did it!*"

Then, I got the *JRA* editorial review board's comments and the "do-over" process began.

I approached the manuscript revision in phases. For the first several months, I looked over reviewer comments and let them soak in. These comments were very comprehensive and there were many areas of the article that I needed to fine-tune. I had lingering bursts of self-doubt: "*Can I do this? Is it worth it?*" In one moment of self-reflection I reminisced on one of my conversations with Alicen Nickson. I could almost hear her reminding me that developing an article for a peer-reviewed journal is a process. I needed to accept the high points and the low points and stay the course.

It took courage and self-discipline to get back on track. After I reconfirmed my commitment to getting this article revised and published, I spent several more months reshaping each section. It was at this stage that I found the reviewer comments very helpful. These comments helped me realize that I needed to explain things a bit more clearly. I shifted my perspective and started to think about writing in a way that would make my work relatable and interesting to a broad audience of research administrators.

My manuscript was based on a two-part pilot survey project that I completed during my doctoral dissertation in 2015. In this scholarly research project, I really wanted to learn how aware the broader research administration (RA) community was of Peter Senge's Five Disciplines model and the extent that universities, academic medical centers, community hospitals, federal and state facilities, and for-profit and nonprofit institutions used this model. In the *JRA* article, I shared the results of what I learned.

One of the last steps I took during the revision stage was to share the working draft with SRAI colleagues outside of my home institution for their critiques. The feedback from this peer-review circle was a critical step and helped me ensure that the themes and recommendations I presented were relevant to the broader RA community. I edited and updated my manuscript based on their feedback.

The resubmission process was much smoother, and my manuscript, "Research Administration Organizations: Results from and Investigation into the Five Disciplines," was published in the Fall 2018 edition of *JRA* (Volume XLIX, Number 2). I learned that I was the first Fellow from my cohort and the Author Fellowship Program to publish in the *JRA*. At first, this felt a bit unbelievable, but then as this news sunk in a bit more, I became really proud of what I had accomplished. My experience in this program, combined with solid mentorship, sheer willpower and tenacity helped me get to this point. I doubt I would have ever published my manuscript without this opportunity.

The *JRA* Author Fellowship Program was meaningful to me personally and professionally. I was very happy with my experience. I tend to have a leap-before-looking approach to my work and just dive into whatever I am doing. The Fellowship program provided me with the structure and guidance I needed. I also had a lot of autonomy and ownership in the process. There was no requirement for me to publish within the six months of the program. I got to set my goals and work with my peer advisor to figure out how to accomplish them.

The *JRA*-AFP also provides an opportunity to give back and help develop other would-be authors. I am continuing to learn and grow through this program. This year, I served as a Peer Advisor to Ms. Allen Mukhwana, MBA, Research Systems Manager at The African Academy of Sciences. I enjoyed mentoring Allen and supporting her goal to become a published author.

Shifting from a Fellow to a Peer Advisor requires a thoughtful approach. I combined some of the mentoring techniques I learned from Alicen along with my personal experiences. I shared these experiences with Allen. I am so proud of how her confidence has grown while in the program and I look forward to continuing to champion her success as a peer-reviewed author.

I am also interested in continuing to share stories in peer-reviewed publications. In 2017, I transitioned from a Senior Grants Administrator to a Research Project Manager II role. This allowed me to shift from a purely administrative role to one where I am directly involved in conducting the research. I have learned so much about designing, implementing, and keeping projects on track. I am excited to author and co-author manuscripts to other peer-reviewed journals to share the results and experiences from this work.

So, what I want to share with you as I bring this article to a close is to encourage you to lean in and embrace the unknown. Leap before you look and be open to the amazing opportunities that we have in the broader RA community. When I was asked to write a *Voices of Experience* article for *JRA*, I didn't hesitate. I wanted to share my story and hopefully this will inspire you to take the same leap of faith I did. The journal's editorial team is very supportive and always looking to promote the scholarship of those who work in our innovative field.

For me, I know there are many more stories to come. I wish you well on your journey to authorship.

Operational and Fiscal Management of Core Facilities: A Survey of Chief Research Officers

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Abstract: *Sharing research equipment and personnel across investigators and laboratories has a long-standing history within research universities. However, the coordinated management of centralized, shared resources (i.e., core facilities) that provide access to instruments, technologies, services, expert consultation, and/or other scientific and clinical capabilities by Chief Research Officers (CROs) represents a more recent shift within the academy. While a number of recent surveys and studies have focused on the experiences of core facility directors and users, there has not yet been a targeted survey of CROs. Partnering with the Association for Public and Land Grant Universities Council on Research, fifty-eight CROs (or their designee) from research universities completed an electronic survey on core facilities (response rate = 35%). Core facilities formally reported to a range of entities within the university (and many to multiple entities), including the CRO office (83%), colleges/schools (67%), institutes/centers (42%), and departments (42%). Forty percent of respondents indicated that their university does not have a formal process to become and/or retain status as a recognized core facility. CROs also perceived that different types of core facilities directors differed in their general effectiveness ($F(3,179)=6.88$, $p<.001$); professional staff and administrators were rated as significantly more effective at directing/*

supervising core facilities than were tenure/tenure-track faculty (Tukey's post-hoc; p<.005). Core facilities were funded through a variety of mechanisms, with the most common being use fees (96%), central and/or decentralized funding of directors or staff (77%), annual general fund allocation (62%), a designated portion of Facilities & Administration (F&A) reimbursements (46%), and internal grant programs (31%). Funds for purchasing new equipment within core facilities came from a number of sources, with the most common being external grants (87%), central institutional funds (83%), college/school/department funds (73%), use fees (50%), F&A resources (50%), and donations (27%). There are significant challenges to managing and funding core facilities; the present study provides new insights into the various strategies and tactics being taken by CROs to address these real and perceived challenges.

Keywords: *Research Facilities, Shared Facilities, Research Infrastructure, Research Efficiency, Scientific Research, Clinical Research*

Introduction

The sharing of research equipment, facilities and personnel across multiple investigators and laboratories is common within research universities. At many institutions, and for the purposes of this paper, these shared resources are often referred to as core facilities. In some disciplines (e.g., astronomy and various domains of the biomedical sciences) the sizable expense associated with state-of-the-art equipment, facilities, and trained operators necessitates the centralized operation of shared resources (Farber & Weiss, 2011; Chang, Birken, Grieder, & Anderson, 2015). Indeed, the various federally-funded National Laboratories that exist throughout the United States (e.g., Oakridge National Laboratory, Los Alamos National Laboratory, etc.) perhaps best illustrate the long-standing history of core facilities, which provide access to cutting-edge equipment and technical personnel to accelerate research outcomes and impacts.

Sharing of research facilities, and the resources within them, at modern research universities has tended to occur through ad-hoc and/or historical arrangements, and in many cases they have been managed outside the oversight of the Chief Research Officer (CRO), such as within colleges, schools, departments, and research centers/institutes. However, the coordinated management of core facilities by the CRO office has increased dramatically over the past decade. The need for centralized, higher-level coordination of university research facilities is the result of multiple factors, including (but not limited to) rising research costs, economic constraints, a desire to maximize research efficiency, a mandate to improve research transparency, and the highly competitive landscape of global research and development (Farber & Weiss, 2011; Chang et al., 2015).

While there have been a number of recent surveys and studies on core facility use and management, they have focused on core facility directors, supervisors, and/or users. For example, the Federation of American Societies for Experimental Biology (FASEB, 2017) conducted a survey that focused primarily on core facility directors, professional staff, faculty users, and student users. The FASEB

survey demonstrated a perceived value of core facilities through improved access to advanced equipment and analyses, specialized expertise, cost savings and efficiencies, and increased opportunities for transformative collaborations. Similarly, a 2016 Core Facilities Management Benchmarking Study conducted by iLab Solutions (Agilent Technologies) surveyed 282 core facility directors representing over 50 types of core facilities at 156 institutions (iLab Solutions, 2016). This survey reported that the costs of new technology and lack of sustainable funding are primary challenges and threats to core facilities (iLab Solutions, 2016). More recently, Hockberger, Weiss, Rosen, and Ott (2018) detailed a variety of strategies taken at Northwestern University to 1) improve the coordination between core facility directors and central administration (i.e., CRO office), and 2) support core facilities in a manner that ensures compliance with federal regulations, fiscal sustainability, and alignment with institutional priorities.

Whereas these recent studies provide valuable insights, a comprehensive survey of CROs is warranted given the expanding need for government cost compliance, centralized oversight, and equitable access and resource allocation of core facilities. Therefore, the purpose of this study was to survey CROs on the actual and/or aspirational structure, operational management, and fiscal management of core facilities at their respective institutions.

Methods

This study was conducted in partnership with the Association for Public and Land Grant Universities (APLU) Council on Research (CoR) as part of their new Research Leader Fellow Program. Briefly, the CoR Research Leader Fellow Program was designed to provide training and skill development to APLU administrators who work closely with CROs and aspire to consider a transition into such a role in the future. The authors of this paper represent a subsection of the initial CoR Research Leader Fellow Program (selected in the summer of 2017) that expressed interest in focusing on Core Facilities operation and management as a special project area for the 18-month fellowship.

The Michigan Technological University Institutional Review Board approved the following study procedures. A self-report survey administered using Qualtrics was distributed electronically to CROs within the United States during the spring of 2018. Specifically, an email link to the survey was sent to 148 CROs included in a database maintained by the APLU CoR on May 1, 2018. Three subsequent reminder emails were sent on May 24, June 5, and June 19, 2018. In late May, APLU CoR updated their CRO database, which led to an additional 20 CROs for the June 5 and June 19 correspondence. Of the 168 CROs contacted, 58 completed the survey, yielding a response rate of 35%.

Respondents were instructed that the survey should be completed by the CRO (i.e., Vice President/Vice Chancellor/Vice Provost for Research) or their designee, and that only one survey should be completed per institution. In addition to the survey instructions and the Qualtrics link, the initial email included an attached PDF of the survey so participants could consult with other institutional officials prior to formal submission of the survey responses. This is relevant because participants were informed that certain questions required financial knowledge broken down by

core facility categories, and that these questions would likely require input from the core facility directors and/or financial managers.

The survey questions were conceived and designed by a group of Research Leader Fellows within the APLU CoR. A draft survey was developed in the fall of 2017. Four CROs (Vice Presidents and Vice Chancellors for Research) provided expert review of the survey questions, and a revised version of the survey was presented to the APLU CoR Executive Committee. The APLU CoR Executive Committee approved the distribution of the survey at their Executive Committee meeting in February of 2018. The survey included a total of 41 questions designed to capture key institutional demographics (Carnegie classification, land-grant status, research expenditures, etc.); how core facilities were defined, approved, and evaluated; how core facilities were financially supported; how they were perceived by the CRO and other institutional leadership; and what tools were used to evaluate the success of each core facility. The results section is organized to reflect these key components of the survey. A copy of the survey questions is included as Appendix A.

When appropriate, data were analyzed using SPSS version 25.0 (IBM Corp, Armonk, NY). Two types of statistical tests were performed as appropriate: One-way analysis of variance (ANOVA), and Tukey's honestly significant difference (HSD) tests for applicable post hoc tests. Statistical significance was set a priori at $p<0.05$. Where applicable, results are presented as mean ± standard deviation. Word clouds to summarize qualitative responses were created by standardizing plurality and tense. Responses were then put into Wordle™ (Feinberg, n.d.). Font size is proportional to the number of times a given word was used in open-ended responses.

Results

Institutional Profiles

Of the 58 respondents, 46 (79%) held the title of VPR/VCR, four (7%) held the title of Vice Provost for Research, and eight (14%) held another title. Thirty respondents (52%) were from institutions with a Carnegie Classification of Doctoral Universities: Highest Research Activity, 27 respondents (47%) were from Carnegie classified Doctoral Universities: Higher Research Activity, and one respondent (2%) was from a university that Carnegie classified as a Doctoral University: Moderate Research Activity. Fifty-five respondents (95%) were at public institutions, while three (5%) were from private institutions. Over half of the institutions were designated Land Grant universities (31 respondents, 53%) as defined by the Morrill Acts of 1862 and 1890 (or similar legislation). With respect to size of the institutions, there was a wide range in the number of full-time tenure/tenure-track faculty (range = 207 to 2000 faculty; mean = 993 ± 457 faculty) and full-time non-tenure/non-tenure-track faculty (range = 0 to 2000 faculty; mean = 507 ± 535 faculty). Finally, institutions ranged in FY16 National Science Foundation (NSF) Higher Education Research and Development (HERD) expenditures from $13 million to $1,194 million (mean = $244 ± 235 million).

CRO Operating Budget

Twenty-nine respondents (50%) indicated that the general budget model at their institution was one in which unit budgets were "*typically based upon previous year's levels.*" The remaining respondents indicated that unit budgets were "*dependent upon revenue generation by the unit such as student credit hours, enrollments, research awards, etc.*" (12 respondents; 21%), or "*based upon performance funding models such as graduation rates, research expenditures, etc.*" (6 respondents; 10%), or "*cleared each fiscal year and future funding is based upon annual request*" (5 respondents; 9%).

Thirty-three respondents (57%) indicated that the size of the CRO budget was directly linked to F&A reimbursements, while 25 respondents (43%) said it was not. Of the 32 respondents that indicated a direct link to F&A reimbursements in support of research initiatives, 18 respondents (56%) indicated that F&A contributed <50% of the CRO operating budget, whereas the remaining 14 respondents (44%) indicated that F&A contributed >50% of the CRO operating budget.

CRO perceptions of the level of overall budget autonomy and adequacy of resources were queried. When asked "*How much flexibility do you have with the VPR/VCR budget?*" the following responses were provided: no flexibility (1 respondent; 2%), little flexibility (10 respondents; 18%), moderate flexibility (28 respondents; 51%), considerable flexibility (11 respondents; 20%), and complete flexibility (5 respondents; 9%). When asked "T*o what extent do you feel the VPR/VCR office is provided with adequate resources when compared to other budgetary units on campus?*" the following responses were provided: inadequate (7 respondents; 13%), somewhat inadequate (24 respondents; 44%), adequate (22 respondents; 40%), somewhat plentiful (2 respondents; 4%), and plentiful (0 respondents; 0%).

Core Facility Reporting Structure

For the purpose of the survey, core facilities were defined as "*shared facilities and infrastructure (including equipment and personnel) that support research across multiple colleges/schools/units.*" Of the 55 respondents who completed this question, 52 (95%) indicated that their institution had core facilities consistent with this (or a related) definition, while three respondents (5%) indicated that their institution did not have facilities that met this definition. Reasons for not having formalized core facilities were either 1) having too little research to justify or 2) having a lack of adequate resources. At this point, the questionnaire ended for the three respondents who did not have core facilities and the remaining 52 respondents proceeded on to the remainder of the survey.

To whom core facilities reported varied across and within institutions. Forty-three respondents (83%) indicated that some or all of their core facilities reported to the VPR/VCR office. Other units to which core facilities reported included colleges/schools (35 respondents; 67%), institutes/centers (22 respondents; 42%), departments (22 respondents; 42%), provost offices (4 respondents; 8%), and other (6 respondents; 12%). Respondents could endorse all options that applied to their institution. The response box for "other" included the Chancellor's Office, Chief

Information Officer, and the Office of Grant and Contract Accounting.

Core Facility Application, Evaluation, and Renewal

When asked "*Does your institution have a formal application process to become a designated core facility?*" 20 respondents (40%) indicated that their institutions do not have a formal process. Of the remaining 30, 16 respondents (32%) indicated that they had a formal application process that was managed centrally by the office of the VPR/VCR or provost, and seven respondents (14%) indicated the formal application process was managed by the unit it reported to. The remaining seven respondents (14%) selected "Other" and indicated that the approval was managed centrally through their service center process, through the Office of Grants and Contracting, or by multiple units (i.e. VPR/VCR Office in combination with other units). Respondents were given the opportunity to qualitatively detail their responses; examination of these responses indicated that several institutions that did not have a formal application process were currently working on establishing one. Additionally, one institution uniquely noted a shared governance approval process that required approval from their Academic Senate (in addition to central administration approval).

Results concerning the evaluation and/or renewal process for core facilities paralleled the application process. When asked "*Does your institution have a formal evaluation and/or renewal process for designated core facilities?*" 21 respondents (40%) indicated that their institution did not have a formal process. Of the remaining respondents, 21 (40%) indicated that they had a formal evaluation/renewal process that was managed centrally by the VPR/VCR or Provost Office, while 7 respondents (14%) indicated that the formal evaluation/renewal process was managed by the unit it reported to. The remaining three respondents (6%) indicated a hybrid system (evaluation/renewal by multiple units) or that evaluation/renewal was managed by the Office of Grants and Contracting. Review of the optional, qualitative responses indicated two themes: 1) three institutions that did not have a formal evaluation/renewal process were working on establishing processes, and 2) the timeframe of evaluation/renewal ranged from one year to as long as five years.

Financial Support of Core Facilities

Figure 1 depicts that core facilities are funded through a variety of sources, including: 1) use fees; 2) central and/or decentralized funding for directors or professional staff; 3) annual general fund allocation; 4) an allocated percentage of F&A); and 5) internal grant programs. Respondents were able to "*select all that apply,*" thus the total number of responses was not equal to the number of unique institutional respondents. Qualitative responses indicated that other sources included philanthropy, state funding, and personnel time/effort built into grants.

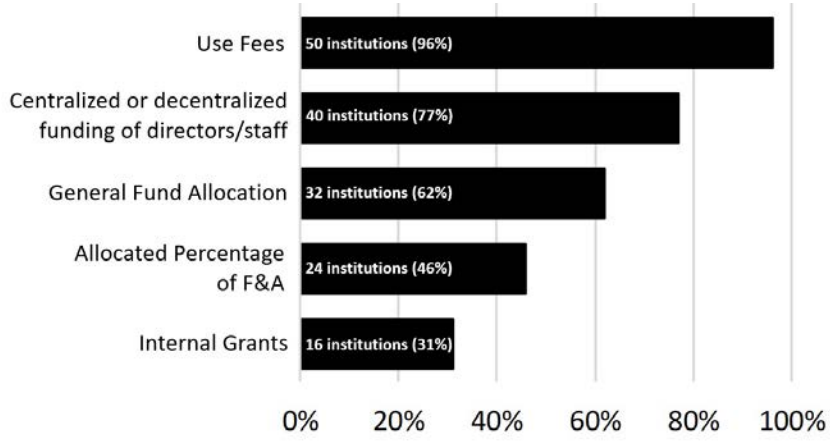

Figure 1. Prevalence of funding sources used to support core facilities.

Given the tremendous heterogeneity in the way in which institutions classified and/or named their core facilities, CROs were asked to indicate if their institution had designated core facilities in the following seven broad (i.e., "common") areas: 1) microscopy/imaging; 2) microanalytic chemistry and/or molecular; 3) fabrication or microfabrication; 4) animal care; 5) high performance computing; 6) marine or aquatic; and 7) agricultural or field-based. Figure 1 demonstrates that >90% of the respondents indicated that their institutions had designated core facilities related to microscopy/imaging and animal care. Marine/aquatic and agricultural/field-based cores were not reported as frequently as the other "common" core facilities.

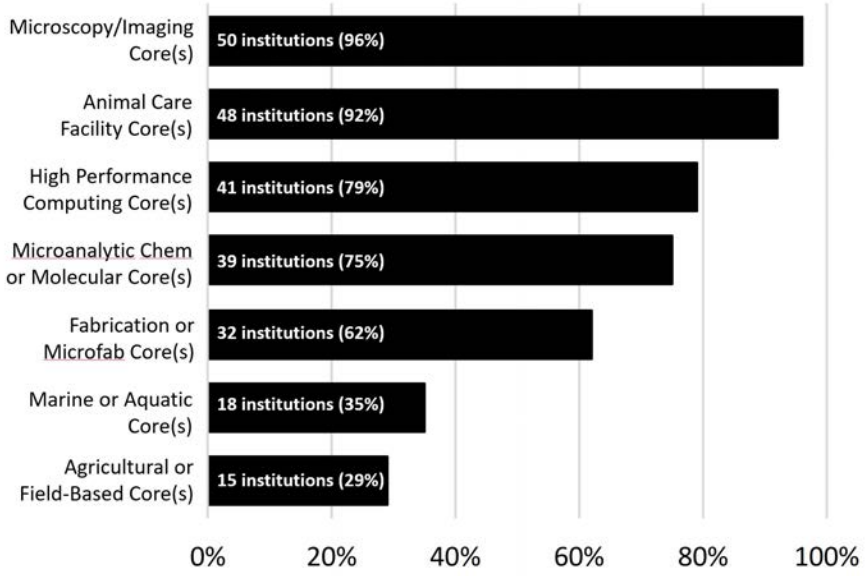

Figure 2. Prevalence of designated core facilities in seven broad areas.

Table 1 includes current estimated financial contributions, as well as aspirational financial contributions, for the seven "common" core facilities. Although there is substantial variability, the percentage of internal use fees was highest for animal care (~44%), microanalytical chemistry and/or molecular (~42%) core facilities, and lowest for high performance computing (~23%). With respect to external use fees, only the fabrication/microfabrication core facilities garnered external use fees that contributed >10% of the core's budget.

Table 1. Current Estimated and Aspirational Financial Contributions to Core Facilities

	Internal Use Fees	**External Use Fees**	**General Fund Allocation**	**F&A**	**Internal Grants**	**Other**
Current Estimated Financial Contribution by Core Facilities						
Microscopy and/or Imaging	35 ± 23%	8 ± 14%	27 ± 27%	14 ± 24%	3 ± 8%	15 ± 26%
Microanalytic Chem and/or Molecular	42 ± 23%	8 ± 9%	28 ± 27%	9 ± 17%	2 ± 5%	11 ± 21%
Fabrication and/or Microfabrication	37 ± 28%	11 ± 14%	34 ± 35%	8 ± 14%	3 ± 10%	7 ± 19%
Animal Care	44 ± 27%	4 ± 6%	27 ± 30%	19 ± 27%	2 ± 8%	4 ± 14%
High Performance Computing	23 ± 26%	2 ± 7%	43 ± 33%	11 ± 23%	8 ± 18%	12 ± 20%
Marine and/or Aquatic	37 ± 25%	2 ± 5%	38 ± 38%	9 ± 20%	4 ± 10%	11 ± 25%
Agricultural and/or Field-Based	37 ± 27%	3 ± 4%	40 ± 27%	6 ± 14%	1 ± 3%	13 ± 20%
Aspiration Financial Contribution by Core Facilities						
Microscopy and/or Imaging	49 ± 22%	14 ± 15%	16 ± 21%	12 ± 20%	2 ± 7%	8 ± 14%
Microanalytic Chem and/or Molecular	50 ± 20%	16 ± 13%	14 ± 16%	11 ± 17%	2 ± 7%	7 ± 12%
Fabrication and/or Microfabrication	47 ± 21%	20 ± 18%	16 ± 22%	7 ± 10%	1 ± 4%	8 ± 14%
Animal Care	52 ± 24%	9 ± 11%	18 ± 22%	14 ± 17%	1 ± 7%	7 ± 14%
High Performance Computing	35 ± 28%	9 ± 13%	33 ± 32%	9 ± 15%	2 ± 7%	12 ± 19%
Marine and/or Aquatic	47 ± 28%	15 ± 13%	17 ± 22%	4 ± 11%	2 ± 5%	17 ± 27%
Agricultural and/or Field-Based	42 ± 23%	13 ± 14%	26 ± 25%	10 ± 16%	2 ± 4%	11 ± 18%

CROs reported seeking more financial contribution from both internal and external use fees, and less from general fund allocations for all of the "common" core facilities. The goal to shift away from general fund support appears to be most dramatic for marine/aquatic (aspirational reduction of ~21%) and fabrication/microfabrication (aspirational reduction of ~18%). Finally, aspirational contributions from "internal grant programs" was minimal (≤2%) for all of the "common" cores.

CROs were also asked "*To what extent do you feel your core facilities are provided with adequate resources for their given mission and responsibilities?*" Ten respondents (21%) indicated resources were "inadequate", 25 (53%) indicated resources were "*somewhat inadequate*", 12 (26%) indicated resources were "*adequate*", and none indicated resources were "*somewhat plentiful*" or "*plentiful*". When asked how their core facility directors or supervisors would answer that same question, there was general recognition by the CROs that perceptions were likely more negative among their directors/supervisors. Specifically, in predicting what their directors/supervisors would say, 22 respondents (48%) chose "*inadequate*", 21 (46%) chose "*somewhat inadequate*", three (7%) chose "*adequate*", and none chose "*somewhat plentiful*" or "*plentiful*".

Perceived Effectiveness of Core Facilities Directors

Figure 3 depicts CRO perceived effectiveness of core facilities directors based upon four common employee classifications, including professional staff, administrators (e.g., associate VPRs, institute/center directors, etc.), non-tenure/tenure-track research faculty (NTTF), and tenure/tenure-track faculty (TTF) . A one-way ANOVA examining perceived effectiveness ratings significantly differed across groups ($F(3,179) = 6.88$, $MSE = 2.64$, $p<.001$). Tukeys HSD revealed that TTF were rated as significantly less effective at directing/supervising core facilities than administrators and professional staff ($p<.005$). No other group comparisons were significant.

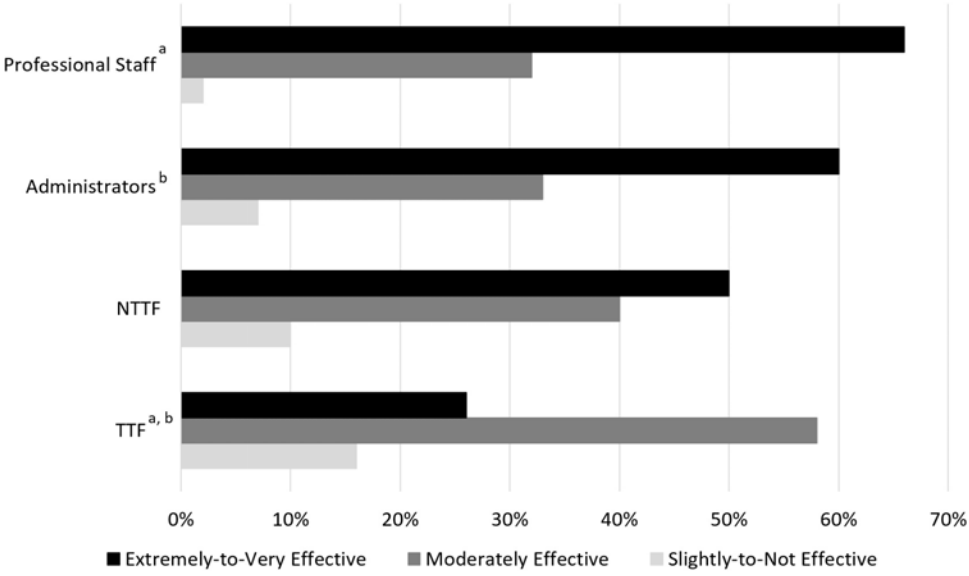

Figure 3. Perceived effectiveness of core facilities directors by job classification. Administrators included associate VPR/VCR, institute/center directors, etc; NTTF, nontenure/tenure-track faculty; TTF, tenure/tenure-track faculty. [a,b]Groups sharing superscripts differed in effectiveness ratings at $p<0.05$.

CROs were next provided an opportunity to list "2-*3 key characteristics of effective/highly effective core facilities directors/supervisors.*" Figure 4 shows a Word Cloud from the compiled responses, where frequency of response correlates with font size. CROs emphasized the importance of characteristics such as "collaborative", "expertise", "skills", "business", "management", "ability", "service", "technical", and "professional".

Figure 4. A Word Cloud from the compiled responses to list "*2-3 key characteristics of effective/highly effective core facilities directors/supervisors.*" Responses were standardized for plurality and tense, and font size is proportional to the number of times a given word was used.

Preferred Investments and Purchasing New Equipment

CROs were asked to rank order their preference for funding if they had designated funds and/or new resources to support core facilities. The top priorities included "*maintaining/repairing/replacing current equipment*" (1st priority for 24 respondents, 2nd priority for 11 respondents; 76% of respondents chose these as their top two priorities) and "*new equipment*" (1st priority for 13 respondents, 2nd priority for 13 respondents; 76% of respondents ranked within the top two priorities). Lower priority areas included "*core facilities directors/supervisors*" (1st priority for 5 respondents, 2nd priority for 6 respondents; 24% as a top two priority), "*other facility personnel such as technicians/students/etc.*" (1st priority for 2 respondents, 2nd priority for 5 respondents; 16% as a top two priority), and "*space rental/renovation*" (1st priority for 1 respondent, 2nd priority for 4 respondents; 11% of respondents ranked within the top two).

CROs were queried on existing mechanisms to purchase new equipment for core facilities. The most common mechanisms included 1) external grants such as the NSF Major Research Instrumentation program (45 respondents; 87%), 2) central institutional funds (43 respondents; 83%), 3) college/school/department funds (38 respondents; 73%), 4) F&A resources (28 respondents; 54%), 5) use fees (26 respondents; 50%), and 6) donations (14 respondents; 27%).

Service Contracts vs. Other Options

For each of the seven "common" core facilities, CROs were asked to indicate their preference for service contracts versus on-campus service options. Table 2 demonstrates that service contracts were preferred for: 1) microscopy/imaging, 2) micro-analytical chemistry and molecular, and 3) high performance computing. Animal care was the only core facility that had a higher percentage of CROs who preferred on-campus services to maintain facilities and equipment.

Table 2. Respondent Preference for Service Contracts or On-Campus Service Options

	Prefer Service Contract	**Prefer On-Campus Service Options**	**Do Not Have a Preference**
Microscopy/Imaging	35 respondents (78%)	3 respondents (7%)	7 respondents (16%)
Microanalytic Chem and/or Molecular	24 respondents (69%)	7 respondents (20%)	4 respondents (11%)
Fabrication and/or Microfabrication	11 respondents (39%)	13 respondents (46%)	4 respondents (14%)
Animal Care	10 respondents (23%)	24 respondents (56%)	9 respondents (21%)
High Performance Computing	20 respondents (54%)	9 respondents (24%)	8 respondents (22%)
Marine and/or Aquatic	4 respondents (27%)	6 respondents (40%)	5 respondents (33%)
Agricultural and/or Field-Based	3 respondents (23%)	6 respondents (46%)	4 respondents (31%)

*Note.*While the number of respondents across each row varies due to unique number of core facilities at each campus, the percentage reported in each row is associated with that particular core facility, and thus should equal 100% (with minor rounding errors).

Defining "Success" of Core Facilities

CROs were provided an opportunity to qualitatively answer the following questions via open-response text: "*How do you characterize success of a core facility?*" Figure 5 depicts a Word Cloud generated from the compiled responses, with responses such as "extramural", "funding", "publications", "usage", "faculty", "timely", "utilization", "state-of-the-art", and "data" highlighted by the CROs.

Figure 5. A Word Cloud from the compiled responses to the question "*How do you characterize success of a core facility?*" Responses were standardized for plurality and tense, and font size is proportional to the number of times a given word was used.

Discussion

The present study is the first to survey CROs on their current and aspirational structure for the creation and management of core facilities. Several key findings emerged from the study. The results emphasize the varying roles of CROs in approving, evaluating, and renewing core facilities including preferred investments (e.g., new equipment). It also provides a comparison of current versus aspirational fiscal management of core facilities, including a breakdown by common core facility categories. One of the most intriguing findings is the perceived effectiveness of core facility directors based upon employee classification with TTF deemed less effective core facility leaders. The characteristics that CROs deemed the key characteristics of effective core facilities directors were identified, as were the criteria by which CROs judged the success of a core facility. These findings are intended to provide a reasonable, yet limited, window of insight into how CROs are attempting to support and fund core research facilities. More importantly, we hope they provide CROs, core facilities directors, and users some potential data for comparison and benchmarking aimed at improving the structure and functionality of their core facilities.

There is a perception among universities that CROs are increasingly involved (or should be involved) in overseeing and allocating resources to core facilities, and this assumption appears supported by the present data. Specifically, the reporting structure, application process, and evaluation/renewal process of core facilities was most often associated with the CRO. Other key units involved in oversight, application process, and evaluation/renewal process were the colleges/schools, centers/institutes, and departments. Indeed, both the quantitative and qualitative data support that this is often a hybrid structure, with multiple units involved in the coordination and oversight of core facilities. To this point, one institution indicated their process required University Senate approval to be a designated core facility. Nevertheless, the data from the current study support that the CRO office appears to be the key unit overseeing core facilities, with input and assistance from other academic units.

Core facilities are expensive. They often require state-of-the-art equipment and facilities, as well as highly-trained personnel to run and maintain federally compliant facilities (Farber & Weiss, 2011; Chang et al., 2015). Moreover, the coordination of multiple users across a variety of units that often span an entire university (and even across institutions) adds a layer of complexity that can require centralized and/or decentralized business/fiscal managers (Hockberger et al., 2018). Given both federal mandates and the costs of maintaining high quality core facilities, we surveyed the CROs with a variety of fiscal questions related to their general operating budget, their core facilities costs (actual vs. aspirational), and their priorities for investments in core facilities.

Given that the majority of respondents were from public universities, in which resources can be scarce, it is perhaps not surprising that nearly 75% of the respondents indicated that resources for core facilities were either "*inadequate*" or "*slightly inadequate.*" The CROs were aware that their perception was more optimistic than they anticipated from core directors suggesting that a more centralized allocation of resources might impose budgetary constraints on those cores even with increased resources.

Prior studies have suggested that funding of core facilities is complex and met through a variety

of resources (Farber & Weiss, 2011; Chang et al., 2015; Hockberger et al., 2018). The present study advances prior work in several ways. First, it provides both quantitative and qualitative data from a CRO perspective, with a variety of funding streams that included (in order of prevalence): 1) use fees, 2) central and/or decentralized funding for directors or professional staff, 3) annual general fund allocation, 4) an allocated percentage of F&A, and 5) internal grant programs. More importantly, the CROs provided actual and aspirational funding levels based upon the various funding mechanisms and the type of core facility. As shown in Table 1, the CROs were queried on seven "common" core facility categories. While all seven categories had the largest percentages of the current fiscal contributions coming from either internal use fees (mean range, 23 – 44%) or general fund allocations (mean, 27 – 43%), there were fairly limited contributions from external use fees (mean range, 2 – 11%) and internal grants (mean range, 1 – 8%). Interestingly, there was a marked and consistent shift in aspirational contributions from external use fees, with targets of doubling-to-tripling current percentages (in some cases even more). Likewise, CROs desired increased fiscal contribution through internal use fees among the seven "common" core facility categories, but this was not nearly as aggressive of a target increase as desired for external use fees. Overall, the data suggest that CROs desire to see more fiscal contributions from internal and external use fees, and a reduced reliance on general fund allocations. Nevertheless, CROs do not expect a "one-size-fits-all" approach, as there is clear heterogeneity in the expectations. For example, CROs desired ~25% from internal/external use fees for high performance computing compared to ~50% internal/external use fee contributions for micro-analytical chemistry/molecular, fabrication and/or microfabrication, and animal care facilities. Also, the high standard deviations within Table 1 suggest large variances in actual and aspirational goals of institutions.

While potentially contentious, the findings related to perceived effectiveness of the directors are novel and may be helpful. Figure 3 shows a clear difference between core facility directors that were TTF when compared to other employment classifications (i.e., professional staff, administrators, and NTTF). Specifically, ≥50% of CROs indicated that professional staff, administrators and NTTF were "*extremely-to-very effective*" as core facility directors. In contrast, only 26% of CROs deemed TTF as "*extremely-to-very effective*" as core facility directors. Some of the qualitative responses suggest that while not universal, TTF can be conflicted between core facilities management and their own research/scholarship. Moreover, CROs acknowledged that a "*service*" mindset, coupled with "*business*" savvy are key characteristics of effective/highly effective core facilities directors. This does not mean that TTF should not serve as core facility directors. Rather, what it suggests is that different strategies, training, on-boarding, and/or support mechanisms might be needed when considering TTF for core facilities directorships. As detailed in Hockberger et al. (2018), there are various combinations of centralized and decentralized support that should be considered for any core facility (whether it is directed by a TTF or one of the other categories represented in Figure 3).

Most core facilities obtain equipment from companies that offer service contracts. In some cases, service contracts are very expensive, but necessary due to the expense of the equipment and/or the technical skills required to maintain it. Service contracts were strongly "*preferred*" with microscopy/imaging and micro-analytical chemistry/molecular core facilities. Indeed, only

three respondents (7%) indicated they preferred on-campus service options for their microscopy/imaging facilities. In contrast, ~50% of CROs indicated a preference for on-campus service options for fabrication/microfabrication, animal care, and agricultural/field-based core facilities. These findings again highlight that there does not appear to be a one-size-fits-all approach to maintaining and servicing equipment.

Finally, CROs were surveyed on how they deal with new equipment purchases, and how they would prefer to invest in core facilities if they had designated and/or new resources specific for core facilities. Perhaps not surprising, the top two priorities were "*maintaining/repairing/replacing equipment*" and "*new equipment.*" Regarding the purchase of new equipment, CROs acknowledged that external grants (e.g., NSF Major Research Instrumentation grant), central institutional funds, and unit-level funds (i.e., college/school/departments) were primary resources. Additionally, ~50% of CROs indicated F&A and use fees as sources for new equipment purchases. Surprisingly, only 27% indicated fundraising donations as a source. Given the high expectations at universities to develop, grow, and sustain institutional endowments, CROs might consider strategies for having their core facilities prioritized within institutional fundraising/endowment efforts.

Several of the funding and usage metrics reported in this study are notably variable. This is likely due, in part, to the varying institutional missions. Each CRO is tasked with navigating under various fiscal, political, and governance structures that likely impact support levels for a given core facility. For example, universities with strong engineering programs likely have a longer history (and perhaps more funding) for fabrication facilities than universities focused more heavily on molecular genetics. That said, the results of this survey suggest tremendous heterogeneity in how CROs are supporting core facilities, and should offer hope to those struggling to support areas of targeted growth. We interpret the notable variance as an opportunity to exchange ideas, and to creatively address the local circumstances and priorities at a given institution.

There are several limitations to the present study. First, the limited sample size (n=58) prevented sub-analyses based on institutional profiles (i.e., Carnegie classification, institutional size, etc.). We acknowledge there are likely very different strategies that might be needed for institutions with NSF HERD expenditures in the hundreds of millions or above when compared to an emerging research university at $50-100 million in expenditures (National Science Foundation, 2017). Nevertheless, we were pleased to have a wide, representative sample of institutions with a respectable 35% response rate. This response rate is admirable when one considers the effort it took to gather the fiscal information and complete the 30-40 minute survey, and we believe it demonstrates the growing interest of CROs in better identifying effective practices for core facilities management and sustainability. Second, this survey was the result of a partnership with APLU. It is not surprising therefore that the majority of respondents were from public universities. Future studies would benefit from greater representation from private research universities. Third, we condensed the "common" core facilities into seven arbitrary categories. The research team debated the pros and cons of more categories to increase granularity verses a longer survey that may reduce response rate. This debate extended beyond the authors, as we sought opinions of several CROs, as well as the APLU CoR Executive Committee.

In summary, the present study represents the first comprehensive survey on core facilities that focused on the perspectives of CROs. Such insight is important and timely given the complex and consistently evolving role of the CRO at research institutions of higher education (Droegemeier et al., 2017). The results suggest that the role of CROs in core facility creation, funding, and management is expanding, making this study both timely and relevant. A higher-level coordination of core research facilities is becoming necessary to improve research productivity, efficiency, and global competitiveness. The findings of this study are intended to help not only CROs, but also core facilities directors and researchers, to identify innovative solutions for supporting and funding core research facilities.

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Strategies for Increasing Research at a PUI

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Abstract: *The purpose of this study was to analyze and develop an in-depth understanding of the characteristics of an R3, predominantly undergraduate institution of higher education with a high-performing externally-funded research portfolio. This study used a qualitative single-bounded case study approach and utilized a focus group structure for the interviews. The research questions sought to identify the perceived factors, characteristics, and resources believed to motivate researchers to participate and succeed in externally-funded research. Active faculty researchers comprised the target audience and focus group participants for this study. The results revealed a cohesive infrastructure with high levels of mutual gratitude and respect among the diverse groups of individuals and the entities that constitute the research infrastructure. The collective efforts to support research, funded and unfunded, is immense and strategic at this institution. Researchers believe the leadership embodies the definition of transformational leadership by utilizing their personal experiences and knowledge to create positive change, motivate and encourage, and build confidence and respect toward and from their researchers. In addition, the leadership recognizes the need for continuous change and improvement of the research infrastructure and actively acknowledge, seek, and act on the needs of the research community. This institution has actively facilitated a culture shift to focus on research at a predominantly undergraduate, teaching-focused institution. This study identified and explored the myriad of resources provided to faculty researchers in the area of research and scholarship and identified those found most beneficial by the researchers. It identified the perceptions and attitudes regarding infrastructural resources in support of research activities. The results of this study will help doctoral level PUIs strengthen their faculty scholarship base, develop a more robust and efficient infrastructure, and increase their externally-funded research portfolio. Successful and meritorious faculty will further engage students and positively affect student recruitment and retention.*

Introduction

Prior to 2008, funding for higher education was plenty and institutions were financially healthy. However, the economic crisis and budget cuts in education caused institutions to look differently at the role external grants can play. The 2009 American Recovery and Reinvestment Act (ARRA) propelled new interest in grantsmanship (Waite, 2012). ARRA earmarked billions of dollars in federal funds for a wide variety of initiatives that were meant to reinvest in the economy by creating jobs and improving K-12 and postsecondary education. A supplement to the ARRA, the America COMPETES Act required a portion of these funds to be awarded to institutions of higher education in the form of competitive grants (Waite, 2012).

These new grant opportunities led to a realization by faculty and leadership at institutions of higher education (IHEs) of the significant benefits, both financially and professionally, of externally-funded grant activity (Behar-Horenstein, Garvan, Catalanotto, & Hudson-Vawell, 2014). One of these benefits is that faculty who receive external grants can provide their students with invaluable hands-on experiences that otherwise would not be available. According to the American Council of Learned Societies, "faculty who involve students in their research projects sharpen students' expertise in a specific area and foster discipline, independent thought, creativity, and responsibility" (2007, p. 10). In addition to student employment and experience, grant funds are commonly used to purchase expensive, specialized pieces of laboratory and simulation equipment that otherwise would be out of reach by many IHEs, especially publicly-owned, predominantly undergraduate institutions (PUIs).

According to the literature, IHEs with large and diverse externally-funded grants portfolios have leaders who understand what it takes to be successful and, therefore, pro-actively support grantsmanship. They provide resources that further develop faculty expertise and credibility in their fields (Hardre, Beesley, Miller, & Pace, 2011; Waite, 2012). This additional support is necessary because many faculty, especially those teaching at PUIs, may not have had research-active faculty to expose them to research during their educational tenures (Burgoon, 1988; Hardre, et al., 2011).

Providing focused and customized professional development opportunities that specialize in grantsmanship help motivate faculty, remove roadblocks, and increase the potential for successful grant awards (Burgoon, 1988; MacFarlane & Hughes, 2009; Waite, 2012). Understanding both the benefits of external funding and the various challenges faced by faculty researchers is essential to creating and maintaining a supportive and successful research environment (Akerlind, 2008; Behar-Horenstein et al., 2014; Waite, 2012). This holistic understanding recognizes that the integration of faculty members' research and scholarly activities with their teaching and service requirements is the underlying objective of academia. The successful integration of these factors creates the ultimate teacher-scholar (Akerlind, 2008; Behar-Horenstein et al., 2014; Simmons, 2009). Knowing the factors that motivate faculty to participate in research and understanding best practices in the field of faculty professional development and grantsmanship will allow university administrators to make educated decisions regarding the use of institutional resources to help strengthen their externally-sponsored research portfolios (Hardre et al., 2011). Creating an effective infrastructure that provides resources that address both teaching and scholarship will allow institutions to deal effectively with cyclical declines and variances in funding opportunities.

IHEs are classified, among other variables, according to their research portfolios. This classification is used by the NSF to assess eligibility for various grant opportunities. The Carnegie Classification System is the recognized method of classifying IHEs. The Carnegie System distinguishes IHEs using a multitude of variables, including but not limited to undergraduate and graduate enrollment, disciplines, location, and research activity. A doctoral granting institution can be classified in one of three levels: R1 (highest research activity), R2 (higher research activity), and R3 (moderate research activity). According to the Carnegie Classification criteria, R3 universities

award at least 20 research doctoral degrees in the humanities, social sciences, and STEM fields and maintain a "moderate" level of research activity (Carnegie Foundation, 2007). Institutions that hold an "R" classification may offer master's or professional practice degrees in fields other than medicine, dentistry, or veterinary medicine, as well. These institutions, although classified as doctoral, may also have a predominantly undergraduate population (Carnegie Foundation, 2007). The institutions that are categorized as R3 (moderate research) and considered predominately undergraduate are the focus of this study. This single case study examines the characteristics or factors perceived to influence researcher participation and success at a high-performing R3 PUI.

Problem and Purpose of the Research Study

PUIs classified as doctoral research universities are distinct because faculty at this type of institution face unique challenges. Faculty employed at a PUI commonly define themselves as teacher-scholars but commonly lack the research infrastructure and resources available to their R1 or R2 colleagues. Teacher-scholars have a commitment to both scholarship and teaching and they allow their scholarship to inform and improve their teaching (Akerlind, 2008; Bailey, 1999; Behar-Horenstein et al., 2014; Kuh, Chen, & Laird, 2007; Waite, 2012). This goal is noble, ambitious, and resource-intensive. As discussed above, financial resources are dwindling in education, and institutions are struggling to find alternative ways to fund these ancillary, yet necessary, activities (Waite, 2012). It is, therefore, becoming increasingly necessary for faculty to find alternate sources of funding to support their research. External grants are an ideal solution to this financial problem (Hardre, et al., 2011; Waite, 2012).

The contractual workload for faculty at PUIs is less flexible than their research-intensive counterparts or the institutions with a larger faculty base (Waite, 2012). Heavy teaching assignments, undergraduate and graduate student advising, and both institutional and community service requirements are common at PUIs (MacFarlane & Hughes, 2009). Generally, PUI faculty have little ability for an institutionally-funded reduced load. Faculty at PUIs are at a disadvantage because of these workload characteristics and may, subsequently, not be as successful in securing external grants as their counterparts at research-intensive institutions. Faculty at research-intensive universities have an unfair advantage over faculty from PUIs when competing for external funds (Porter, 2007; Waite, 2012).

A broader, more far reaching impact of the inequity deals with attracting and retaining students and faculty members. Enrollment continues to decline across the country, and institutions are struggling to reconcile the costs of doing business with increasing budget cuts and decreasing revenue streams (Bailey, 1999; Buller, 2013; Hardre, et al., 2011; Waite, 2012). The budget deficits affect an institution's ability to provide up-to-date technology, laboratory facilities, libraries, graduate assistantships, and a multitude of other educational resources. Recruiting and retaining quality faculty becomes difficult when the institution is unable to provide the extrinsic motivators that top research institutions take for granted. Having quality resources and a strong research infrastructure will attract highly qualified teacher-scholars who are committed to the success of the PUI model (Akerlind, 2007; Kuh, Chen, & Laird, 2007; Ware, 2006).

To best understand why the teacher-scholar model is essential to the success of higher education, it is necessary to understand how and why research originally started in the field of academia. The "nexus" of academia is reached when teaching and research overlap and become mutually dependent activities (Clark, 1997). We will, therefore, explain some of the history of research within academia.

Higher education in America and abroad has undergone significant change since Harvard's founding in 1636 (Kane, 1999). Harvard and other early American universities held teaching (primarily of the clergy) as their core function. It was not until the nineteenth century when Germany introduced the concept of including research as a "vital component of higher education" that research became part of academia (Gellert, 1993, pp. 3-14). Germany, therefore, can be credited with incorporating research into academia and realizing the mutually beneficial relationship between teaching and scholarship. American students being educated in Germany, upon return, gained prominence and respect within their American institutions when they influenced the expansion of their graduate programs to include research-based coursework and internship-type experiences (Kane, 1999). According to Kane, this was the impetus to the creation of a classification system in approximately 1920. This classification system was officially named the Carnegie Classification System of Higher Education in 1970 by the Carnegie Commission on Higher Education.

Last updated in 2015, the Carnegie system classifies institutions of higher education into eight categories based on degree levels offered and program foci. These eight basic Carnegie classifications include doctoral institutions, master's colleges and universities, baccalaureate colleges, baccalaureate/associates, associate's colleges, special focus: two-year, special-focus: four-year, and tribal colleges. Each of these eight classifications are then segregated into 33 subcategories that further distinguish the number of degrees conferred, research activity, dominant student type (traditional, nontraditional, mixed), and more discreet, discipline specific concentrations. Then, doctoral granting institutions are subdivided into highest research activity (R1), higher research activity (R2), and moderate research activity (R3).

In Fiscal Year 2015, the National Science Foundation awarded 78% of their overall grant budget to institutions of higher education. Table 2 below depicts the trend in proposals, awards, and success rates from 2005 through 2015 by the National Science Foundation (NSF). It is noted in the 2015 NSF Merit Review Report that the uptick seen in 2009 and 2010 is the direct result of the federally-appropriated ARRA funds. This explains the downturn in subsequent years (NSF, 2015, p. 9).

Table 1. National Science Foundation: Proposal, Award, and Success Rate Trends

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Proposals	41,722	42,352	44,577	44,428	45,181	55,542	51,562	48,613	48,999	48,051	49,620
Awards	9,757	10,425	11,463	11,149	14,595	12,996	11,192	11,524	10,829	10,958	12,007
Success Rates	23%	25%	26%	25%	32%	23%	22%	24%	22%	23%	24%

Note: Obtained from NSF's 2015 Merit Review Report

According to an article by Slocum and Scholl (2013) in the Fall 2013 C*ouncil on Undergraduate Research Quarterly*, the National Science Foundation has competitions designated to support PUIs. The Faculty Early Development (CAREER) awards support junior faculty with research interests in the science, technology, engineering, and math (STEM) disciplines. The Research Experiences for Undergraduates (REU) program supports PUIs with a focus on including undergraduate students as research assistants. Additionally, the Research at Undergraduate Institutions (RUI) competition restricts submission to PUIs and supports both individual and collaborative projects.

Although the NSF has the CAREER, REU, and RUI opportunities restricted to PUIs, the disproportionate success rates between PUIs and non-PUIs are problematic. From 2002 through 2012, the NSF supported undergraduate research, with $1.24 billion in competitive grant awards (Slocum & Scholl, 2013). The study completed by Slocum and Scholl (2013) found that PUIs received only 8% of all NSF awards, equating to only 4.9% of the total award amount, while non-PUIs received 92% of the awards and 95.1% of the awarded dollars. Slocum and Scholl's (2013) study utilized the criteria developed by the Carnegie Classification System to identify eligible PUIs and then compared the results with the NSF's award data from 2002-2012. After filtering for PUI eligibility and duplicates, Slocum and Scholl (2013) utilized data from 2,104 institutions of higher education meeting the PUI criteria. They then further segregated the PUIs and identified those with "substantially greater resources" (Slocum & Scholl, 2013 p. 38). The 80 institutions (3.8% of all PUIs) that were identified as having greater resources submitted 23.5% of the total PUI proposals and received over 35% of all PUI awards (Slocum & Scholl, 2013). The inequity among the various doctoral/research classifications of institutions has been a concern for some time. Kane (1999) called higher education steeply hierarchical and argued for improving and increasing the research activities at teaching institutions (PUIs). It can be posited, therefore, that the greater the resources available to PUI researchers, the more likely they will be to submit and succeed with competitive grant awards from agencies like the NSF.

It was not until the mid-2000s that the teaching-focused institutions realized the benefits of an active research faculty base. Prior to 2008, institutions were financially healthy and external research was less of a priority (Akerlind, 2008). Until the government could no longer fund institutions of higher education through federal and state allocation dollars at the levels to which they had become accustomed, there was no need for institutions to look elsewhere for

funding. The subsequent 2009 American Recovery and Reinvestment Act (ARRA) is credited for advancing an interest in grantsmanship (Waite, 2012). Billions of dollars in federal funds were allocated by the ARRA for a wide variety of initiatives that were meant to create new jobs, reinvest in the economy, and improve both the K-12 and postsecondary education. The America COMPETES Act, a supplement to the ARRA, initiated grant competitions with a small percentage of these funds for institutions of higher education who supported student engagement (Waite, 2012). The economic downturn in education and these new ARRA grant opportunities led to a realization by institutions and faculty of the significant benefits, both financially and professionally, of externally-funded grants.

Institutions of higher education have teaching (producing quality, high performing, graduates ready to enter the workforce) as their primary mission:

> The history of educational development is rooted in the improvement of teaching techniques…educational development is chiefly concerned with improving teaching practices and techniques including assessment and curriculum design; contributing to strategic policy development and implementation in relation to learning and teaching; conducting research into the student learning experience; and working in support of professional staff and student development. (MacFarlane & Hughes, 2009, p. 5).

According to MacFarlane and Hughes (2009), much of this discourse is caused by the perception that teaching and research are at opposite ends of the academic spectrum. Human Resources divisions in higher education may distinguish between teaching faculty and research faculty. Often these differences are accentuated by different salary scales and promotion and tenure requirements. Members of the two groups often occupy space in completely separate areas of a university (MacFarlane & Hughes, 2009). For those research faculty, the professional development is concentrated to their specific area, discipline, or department while professional development related to teaching is more centralized and covers a wider range of disciplines. This structure does not lend itself to inclusion and further separates the research faculty from the teaching faculty (Abraham, 2012; Austin, 1996). According to MacFarlane and Hughes (2009), this "persistent demarcation" has forced faculty to identify with or choose either teaching or research (p. 12). This current demarcation underscores the need for an institution's professional development structure to be centralized, holistic, and inclusive of teaching pedagogy and research in order to unite faculty expertise for the betterment of the students' academic experiences.

MacFarlane and Hughes (2009) attempt to transform this conviction by emphasizing the similarities between teaching and research rather than the differences:

> Dissemination of ideas to appropriate audiences is necessary for teachers in the classroom and for researchers at conferences. The skills required to give a conference presentation are similar to those presenting material to learners, including features such as clear structuring and maintaining contact with the audience. Professional requirements for teaching and research also share much in common. Both activities involve reviewing and giving feedback on the knowledge production of others whether for papers for academic journals or for student assessment. (p. 11)

Still others counter that combining teaching pedagogy and research professional development is virtually impossible and doing so hinders the interests of both parties (Boughey, 2012). The only possible way the connection between research and teaching can be made strong enough to see benefits is if the integration is systematically built into the curriculum and the class assignments. As Boughey (2012) described "An active researcher might be 'good' at research yet might not even be interested in teaching with detrimental effects on practice" (p. 630). So, unless the researcher conscientiously applies the research concepts in the classroom, Boughey believed integrating research into the classroom could have negative effects on the students' learning outcomes. Therefore, if higher education is going to encourage and support research, researchers should be taught how to teach students about the practice of research, not just the science.

Teaching the practice of learning, or cognition, is explained in the following way:

> This sort of ability is not based on knowing but rather on knowing how to know – on being able to make knowledge not as a matter of 'skill', but rather as a way of being. ... university teachers do not teach knowledge but rather *how knowledge is made* regardless of the level at which they teach. (Boughey, 2012, p. 634)

Hardre, et al. (2011) counter this belief by emphasizing the "accumulative advantage" of employing faculty who do both research and teaching well (p. 36). Supporting the development and integration of research and teaching attracts better teachers and researchers to the institution and, in turn, improves the quality of both the individual faculty member and the institution (Hardre, et al., 2011; Waite, 2012).

Understanding the benefits of and the challenges faced by faculty researchers in the competitive game of external grants is essential to building a supportive and beneficial research infrastructure (Akerlind, 2008; Bailey, 1999; Burgoon, 1988; Fitzsimmons, 2010; Waite, 2012). This global understanding recognizes the underlying goal of all academic initiatives: the integration of the faculty members' full range of ideas, experiences, expertise, and passions with the numerous ways teaching, service, and research (scholarship) interact to create the ultimate teacher-scholar (Colbeck, 1998; Simmons, 2009). Numerous studies, reports, and articles have been published providing long lists of incentives, benefits, disincentives, and challenges to external research. A focused review of literature was accomplished, narrowed to examine nonresearch-intensive, public institutions. These benefits and barriers distinctive to PUIs are summarized below.

The Benefits of Sponsored Research

Indirect costs, also referred to as facilities and administrative (F&A) costs, are the "costs incurred for a common or joint purpose benefitting more than one cost objective, and not readily assignable to the cost objectives specifically benefitted, without effort disproportionate to the results achieved" (Government Publishing Office, 2018). Indirect recovery funds are dollars received by an institution receiving an externally-funded award. The IHE, by constraints of a negotiated agreement, includes this expense to the funding agency to administer the grant funded activity. Indirect costs recovered are not profit; they are intended to reimburse the institutions for the "general" costs of the research projects and related activities.

Indirect costs recovered on external grant projects should be reinvested to support the research infrastructure. This indirect recovery has a direct impact on institutions and their faculty to support, write, and submit external grant proposals (Ware, 2006). "Consistent application of any perceived fair and equitable system will build faculty morale and confidence in the sponsored research office and the university supporting the research endeavor" (Ware, 2006, p. 17). It is essential that the perceived use of indirect funds is clear, fair, and consistently applied. Examples of investments that can be made with indirect funds include, but are not limited to, the purchase of or maintenance of laboratory facilities, equipment, and the provision of start-up funds to new researchers.

Faculty benefit financially from externally-funded grant projects, as well (Fitzsimmons, 2010; Ware, 2006). Grant funding can provide the time to commit the necessary effort in the form of course releases, summer contracts, and when appropriate, supplemental pay. Release time allows the faculty member to be bought out from a course, thus providing additional time to participate and perform research activities. Summer contracts can replace a course or provide additional compensation otherwise not available.

Additionally, external grant funds can be used to purchase high-end or specialized equipment that otherwise would be unattainable by most PUIs. This equipment can then be used to attract and retain higher quality students, faculty, and administrators. In addition to equipment, faculty often need to travel to collect their data and then present their research findings at conferences. Travel to conduct the research as well as to conferences to disseminate the results are often funded by grant dollars (Hardre, et al., 2011).

The benefits of a strong research portfolio extend beyond the individual faculty members to include students' achievements, experiences, and recruitment. External grants can fund libraries and technology and allow universities to purchase expensive, high-end laboratory equipment necessary for many academic majors, assignments, and courses. The benefits of external grants are especially crucial, considering the difficulties that some institutions currently face. As enrollment continues to decline, institutions struggle to recruit and retain students (Bailey, 1999; Buller, 2013; Hardre, et al., 2011; Waite, 2012). A quality faculty base is a cornerstone to a healthy institution and without it student retention becomes even more difficult (Ware, 2006). External grant dollars supplement the financial strains and improve the financial health of the institution (Hardre, et al., 2011).

This study identified and utilized the following three theoretical frameworks to support and explain the effects of a research infrastructure on the participation and success in sponsored research at a PUI: Etienne Wenger's Communities of Practice, Rosabeth Moss-Kanter's Organizational Support Theory, and Albert Bandura's Theory of Self-efficacy.

Communities of Practice

Wenger's (1998) Communities of Practice (CoP) is a social learning theory that supports group or team learning. Developed originally by Jean Lave and Etienne Wenger in 1991, it continues

to be further developed and more widely utilized by scholars (Wenger, McDermott, & Snyder, 2002).

Wenger et al. (2002) defined Communities of Practice as:

> groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis... These people don't necessarily work together every day, but they meet because they find value in their interactions. (p. 4)

Wenger (1998) put few constraints on CoP and intentionally allows the theory to be modified to fit the purpose. At a minimum, Wenger (1998) stated that there need to be three components required to fit his definition:

1) A domain – there has to be a commonality among the participants (teachers, researchers, athletes, gamers, etc.).
2) A community – the individuals must participate in regular activities and interact with each other. These activities can be formal or informal but they must support the domain and allow the participants to share experiences, challenges, questions, and expertise so they learn from one another.
3) A practice – the community must consist of practitioners within the domain. Individuals must not just be interested in the domain but actually work and/or practice in the field. A teaching CoP must include practicing teachers and the research CoP must include active researchers.

Members of the CoP will be motivated to be integral and central members of a group with which they share common interests and respect for the membership. This shared interest motivates, encourages, and supports the cause and, subsequently, its members. Therefore, researchers at a PUI would benefit from such a community within their institution (Wenger et al., 2002). Organized and structured by discipline, IHEs model Wenger's Communities of Practice by grouping common interests.

Organizational Support Theory

To develop effective CoPs, the institutional infrastructure must support the collective needs of the researchers. Rosabeth Moss-Kanter's Organizational Support Theory discusses how to build a beneficial and sustainable ethos of institutional support around the existing communities. It assumes that organizational leaders do not question whether or not change needs to happen but rather how to make the change happen successfully (Kanter & Brinkerhoff, 1981). Higher education leaders are no different than corporate leaders in this regard. Moss-Kanter (2006) supported the philosophy that managers need to effectively and appropriately measure effectiveness of all parts of the organization in order to best support its constituents. "Managers need to differentiate parts of organizations, to spot trouble areas, and to compare this year's overall performance to that of previous years" (Kanter & Brinkerhoff, 1981, p. 326). This understanding

of the trouble spots allows managers to allocate support (financial and strategic) to the area before it becomes truly troublesome (Kanter & Brinkerhoff, 1981). Moss-Kanter (2006) also realizes that organizations will have a variety of goals, all of which may contradict one another. IHEs often send inconsistent messages regarding the importance of both teaching and research. True effective leadership includes "the balanced attainment of many goals" (Kanter & Brinkerhoff, 1981, p. 327). Helping faculty balance their teaching with their research is essential in developing the knowledge, skills, and attitudes that promote and produce a successful research portfolio at a PUI.

In addition to the imbalance between teaching and research, IHEs fall subject to complex and sometimes inconsistent leadership. Academia has been described as an "organized anarchy" due to its multi-level substructures of colleges, departments, units, and complicated hierarchy (Kanter & Brinkerhoff, 1981). Leaders must ensure that all colleges, departments, and units measure effectiveness in the same way and that goals at all levels are defined and accepted by all involved. To account for this imbalance and develop effective support structures, Kanter (2006) suggested addressing three bottlenecks: 1) theoretical bottlenecks—make sure people know how to do the task (research); 2) resource bottlenecks—make sure people have the resources required; and 3) organizational bottlenecks—make sure people can put the resources together. To mitigate the "organized anarchy" and address the bottlenecks in the realm of research in higher education, leaders must provide adequate and appropriate professional development to ensure faculty have the knowledge to perform research. They must then ensure the appropriate resources are available (adequate laboratory space, policies, procedures, and a research infrastructure). Empowering the stakeholders involved in the research endeavors to create a robust, communicative, and viable research enterprise that stimulates a balance between teaching and research is the ultimate goal. Hardre et al.'s (2011) study found that faculty prioritize their personal research projects in the same way the institution establishes their tenure and promotion processes. If the institution puts more weight on teaching expectations and student evaluations, that is where the faculty will devote the majority of their time. This inequity in worth is at the detriment of the research portfolio (Hardre et al., 2011). Finding a manageable balance among teaching, research, and service must be a priority of administration.

Moss-Kanter (2006) stressed confidence as the primary factor in success in any field. Confidence is defined as: "... the bridge connecting expectations and performance, investment and results" (Moss-Kanter, 2006, p. 3). Confidence in self, colleagues, leaders, and the overall structure are imperative for continued participation and success. Researchers must have confidence in their own abilities, believe in the importance of their research topic, and be assured that their leaders and infrastructure will support them in their quest.

To develop confidence in research and the researchers, administrators should invest in the researchers' expertise and the research infrastructure. According to Moss-Kanter (2006) "confidence influences the willingness to invest—to commit money, time, reputation, emotional energy, or other resources—or to withhold or hedge investment. This investment, or its absence, shapes the ability to perform" (p. 7). Researchers who have leaders who believe in their abilities

enough to invest precious institutional resources are more likely to invest their own precious time to achieve the institutional goals. Moss-Kanter (2006) also addressed the problem of relying too heavily on just a few active researchers. She uses the analogy of a sports team relying on just a few superstars. When the superstars get hurt or retire, the team scrambles to replace their talent. Relying on just a few individuals to carry the team, or the research enterprise, is sabotage to the rest of the team. Not only does leadership need to invest in the current researchers but they need to develop new researchers at the same time:

> Winning on the playing field is influenced heavily by what goes on off the field—the nature of the system to attract people, develop people, build bonds among team members, gather external support, and do all the other behind the scenes work, before and after each game, before and after each season. (Moss-Kanter, 2006, p. 24)

Investing in the researchers and showing recognition and thanks for their efforts will maintain and grow the research enterprise. "Leaders of high-performing organizations don't count on impulse or emotions alone to produce the behavior of winners. They establish disciplines and embed them in formal structures" (Moss-Kanter, 2006, p. 47). Informed decisions and proven best practices in grantsmanship will allow leaders to use their limited resources in the most cost-effective and beneficial ways.

Theory of Self-efficacy

There has been much discussed on the knowledge, skills, and abilities of faculty to perform research. Albert Bandura's Theory of Self-efficacy is a relevant framework for this study because it defines an individual's ability (or inability) to perform certain tasks (in this case, research) successfully. Self-efficacy, defined by Bandura and cited in Weibell (2011), states:

> People's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" and is considered a theoretical framework "in which the concept of Self-efficacy is assigned a central role, for analyzing change achieved in fearful and avoidant behavior. (Chapter 3)

People who possess positive self-efficacy have the following characteristics in common:

1. They see difficult or new tasks as challenges (not threats or obstacles).
2. They intentionally set goals that are challenging and outside their comfort zone.
3. They use failure as motivation and maintain a commitment to achieving their goal(s).
4. They see failure as inadequate effort or lack of skills that can be overcome.
5. They acknowledge fear or hesitation with the difficult (or threatening) task but are confident in their ability to succeed. (Weibell, 2011, Chapter 3)

To account for these characteristics, Bandura identified four factors that influence our level of self-efficacy: 1) prior accomplishments or experiences, 2) vicarious experiences, 3) persuasion,

and 4) physiological and emotional states.

Bandura (1986) argued that succeeding personally with a task that was originally viewed as difficult or threatening is the best way to build self-efficacy and confidence in your ability to grow in a particular area. Seeing others succeed or master skills desired increases your confidence and develops a stronger interest and commitment to the task at hand. External or social persuasion is another strong aspect of one's level of self-efficacy. The power of persuasion is stated this way: "People who are persuaded verbally that they possess the capabilities to master given activities are likely to mobilize greater effort and sustain it than if they harbor self-doubts and dwell on personal deficiencies when problems arise" (Weibell, 2011, Chapter 3). The final characteristics, one's physiological and emotional states, are inert traits that are more difficult to explain. Although self-efficacy has little or no effect on one's physiological health, Bandura insisted that those with higher levels of self-efficacy view their health challenges as less impactful and work harder to overcome these challenges:

> Inasmuch as a person has both the component skills needed to succeed, and the incentive to engage, Self-efficacy plays an important role in determining what activities a person will choose to engage in, how much effort they will expend, and how long that effort will be sustained when things get tough. (Weibell, 2011, Chapter 3)

This quote and Bandura's Theory of Self-efficacy epitomize the benefits of a solid research infrastructure that provides professional development opportunities and resources. The more faculty that are prepared, understand, and have the knowledge needed to succeed in grantsmanship, the more likely they are to succeed early in their career. Not only is this early success dependent upon adequate preparation and training, but it will further strengthen the self-efficacy levels and interest in continued participation in external research (Sterner, 1999).

Bandura's Theory of Self-efficacy is consistent with and supports Wenger's (1998) communities of practice as it suggests teamwork and continuity with colleagues possessing similar interests. Moss-Kanter's (2006) Organizational Support Theory further enhances the administrators' ability to develop and implement strategic and focused resources.

These theories, collectively, support the overarching implications of academic leaders' commitment and explicit support of faculty research endeavors. To assist faculty in reaching the highest level of efficacy, administrators should recognize faculty at all stages of development and for all the efforts expended, not just the successes achieved. Proposal submissions should be recognized as well as awards received because extending appreciation for the attempts (proposals submitted) will encourage researchers to keep trying. This recognition for effort will equate to a more robust, stable, and successful research portfolio (Hardre et al., 2011; Waite, 2012).

Although literature and studies exist that identify priority needs and desires of researchers, there is no research that identifies best practices in research support specifically for a PUI. This study will bring to light the untold stories and perceptions of the various key stakeholders at a high-performing doctoral granting PUI. It also will identify linkages between and among the various

stakeholder roles, goals, obstacles, and research outcomes.

The purpose of this study was to analyze and develop an in-depth understanding of the characteristics of an R3, PUI with a high-performing externally-funded research portfolio. During Fiscal Year 1617 (FY1617) (July 1, 2016 – June 30, 2017), a known R3 and predominantly undergraduate institution received approximately $14,000 per faculty member in federally funded research and serves as the "base" institution. This study, therefore, examined an R3, PUI with a research portfolio that exceeded $30,000 in federally funded research per faculty member in FY1617. This site institution contradicts, in many ways, the stereotypical characteristics of a PUI described above.

This study examined the myriad of resources and support that the purposefully selected institution of higher education provides in research and scholarship. It then analyzed the outcomes and identified the characteristics and aspects of the successful model. Specifically, it identified the perceptions and attitudes regarding infrastructural resources in support of research endeavors. The results of this study will help doctoral level PUIs strengthen their faculty scholarship base, develop a more efficient, cost-effective, and robust infrastructure, and increase their externally-funded project portfolios.

The central phenomenon that was studied was the overarching research infrastructure and attitudes as reflected in 'confidence'. The various component parts and the way in which they work together to support and promote research are central to this study. Researching such structures can provide exemplar models that can be replicated by other PUIs seeking to increase their research footprint.

Research Questions

The research questions of this qualitative study include:

1. What are the characteristics of an R3 PUI with a successful external grants portfolio?
2. What do faculty identify as priority resources needed to support a successful grants portfolio?

The purpose of the research questions and the in-depth, qualitative, focus group interview structure was to extract the perceived details, characteristics, support mechanisms, and infrastructure that promote and support participation and success in external grantsmanship. The perceptions of all key individuals and offices were integral to understanding and analyzing the high performing institution.

This study is based on three influential frameworks that all provide mechanisms for developing expertise, confidence, self-efficacy, and success. The basic principles of Ettiene Wenger's Communities of Practice, Rosabeth Moss-Kanter's Organizational Support Theory, and Albert Bandura's Theory of Self-efficacy will be applied to participation and success rates in externally-sponsored research. These theories will be integrated into the anecdotes and responses provided by the participants to frame an effective, cost-efficient, and successful research infrastructure.

Methods

The institution identified for this study was purposefully selected because it is a PUI with a research portfolio of an R3, boasts more than $30,000 in federal funding per faculty member, and is demographically similar to the base institution. The site institution employs approximately 400 tenure/tenure track faculty with an enrollment of nearly 15,000. The academic offerings are characteristic of a PUI as it does not house a medical or engineering school. To identify and analyze the selected high-performing institution's sponsored research portfolio and research infrastructure, a qualitative case study design was used.

A case study was the appropriate method of research for this project, as Creswell (2013) stated:

> Case study research is a qualitative approach to which the investigator explores a real-life, contemporary bounded system (a case) .... Over time, through detailed, in-depth data collection involving multiple sources of information (e.g., observations, interviews, audiovisual material, and documents and reports) and reports a case description and case themes. (p. 97)

The intentional use of the case study approach enhanced the rigor and credibility of the research design (Creswell, 2014). The case study approach used was the single instrumental case study. This type of case study focuses on a specific issue or phenomena and selects a single bounded case to research (Stake, 1995). The selected institution of higher education is a prime example of a single instrumental, bounded case study.

To expound upon the phenomenon of a high-performing PUI, this case study included focus group interviews, follow-up interviews, review of artifacts, and researcher observations. Multiple semi-structured focus group interviews, follow-up interviews, and analysis of relative artifacts provided beneficial insight and an in-depth understanding of the components of the research portfolio at the site institution. The survey questions were reviewed by a qualitative researcher and two pilot interview sessions were conducted with active researchers at the base institution.

The research site institution's Office of Sponsored Research served as the initial point of contact and assisted in locating relative artifacts and in identifying members of the core group. The researcher obtained e-mail addresses of individuals meeting the criteria for this study and communicated directly with each potential participant via e-mail and telephone. Three days on-site immersed in the research infrastructure were needed to complete the data collection.

Semi-structured focus group interviews were scheduled at the convenience of each participant. Due to various schedules and availability of participants, several sessions were needed to obtain adequate representation and participation. Fifteen (out of an estimated 150 possible) active researchers were interviewed. Only researchers active in externally competitive grants were included and the general pool was identified by the Office of Sponsored Research. The interview questions gathered information on existing professional development resources for faculty, desired and prioritized resources, perceived challenges, and incentives to grantsmanship. Follow-up interviews were offered to all participants of the focus groups and were scheduled at the

convenience of both the interviewee and the researcher. The follow-up interviews were done via Skype, telephone, or e-mail at the discretion of the interviewee. The follow-up interviews allowed interviewees to expand upon discussions, provide additional information, and add descriptive details to the previous conversations. This additional information provided more depth and meaning to the results and allowed for a more acute analysis. Follow-up interviews also provided the researcher the opportunity to ask follow-up questions based on information gathered from all core groups and revisit ideas or themes that were identified by previous groups.

Participation in the focus group interviews was completely voluntary. Participants had the ability to cease participation in the interview(s) at any point. In the event a participant ceased the interview, no data from that resource was utilized and they were not included in the participation numbers or rates. Ensuring the participants confidentiality was of primary concern throughout the process. While the Office of Sponsored Research identified the pool of candidates, the respondents and the scheduling remained confidential to administration. To further ensure confidentiality, the interview space was across campus from the administrative and sponsored research offices and pseudonyms are used throughout for both the participants and the site location.

To ensure integrity of the responses, the interviewer audio-recorded the interviews and the responses were transcribed. The transcriptions were offered to the participants for member-checking. To ensure that the data and the participants remain confidential, the verified transcripts were stripped of all identifiable data and saved both electronically and hard copy. The original data recordings, the redacted transcriptions, and any researcher notes were saved in separate electronic and physical locations.

Physical documents and artifacts appropriate to this study were secured from the Office of Sponsored Research. Examples of physical documentation include research administration policies and procedures, researcher handbooks, relevant sections of faculty union contracts, relevant compensation policies or regulations, research administration handbooks, professional development resources, and sponsored research portfolio reports. Each artifact was reviewed and notations made for the relevant sections, topics, and facts.

The data collected were coded and analyzed using NVivo software. The researcher developed a codebook and each datum point was entered, resulting in the identification of themes. The complete transcriptions, snippets of the recorded interviews, excerpts from the physical documents, excerpts from follow-up e-mails, and the researcher's personal observation notes were included as nodes in NVivo.

Research Participants

The initial focus groups included 11 researchers while an additional four researchers, not available at the time of the on-site interviews, responded to an invite for one-on-one sessions or follow-up telephone/Skype interviews. These additional four telephone/Skype interviews brought the active researcher participation to 15. Three of the initial 11 participants responded to the invite for a follow-up interview and participated in subsequent telephone calls and/or e-mail

communication.

The participants can be further categorized into seven male and eight female faculty, six of whom consider themselves senior researchers. Four classified themselves as junior researchers while the remaining five placed themselves somewhere in the middle. These data were self-reported, and it was made clear to the researchers that classifying themselves as junior or senior researchers should have no correlation to their faculty (assistant, associate, or full professor) position. Interview questions and observations allowed for the differentiation of the results by rank, gender, and confidence level. Table 2 below summarizes the 15 researchers' demographics.

Table 2. Active Researcher Study Participant Demographics

Gender	Rank as a Researcher (self-reported)	Confidence Level in Securing (self-reported)	Confidence Level in Managing (self-reported)
F (8)	Jr Researcher (3) Sr Researcher (3) Middle (2)	Jr & High = 1 Jr & Neutral/Low=2 Sr & High = 1 Sr & Neutral/Low = 2 Mid & High = 1 Mid & Neutral/Low = 1	Jr &High = 2 Jr & Neutral/Low = 1 Sr & High = 1 Sr & Neutral/Low = 2 Mid & High = 0 Mid & Neutral/Low = 2
M (7)	Jr Researcher (1) Sr Researcher (3) Middle (3)	Jr & High = 1 Sr & High = 0 Sr & Neutral/Low = 3 Mid & High = 2 Mid & Neutral/Low = 1	Jr & High = 1 Sr & High = 3 Mid & High = 3

Results

Although the literature is saturated with information on research success at research-intensive institutions of higher education, little literature exists about research at institutions with a large undergraduate population. By exploring a high-performing R3 PUI, characteristics, themes, best practices, and faculty perceptions were identified. The results of this study help mitigate the disparity in the literature between research-intensive institutions and PUIs. These data can be used by PUIs to strategically support research and scholarship thereby developing a larger research base.

The results of the interviews are organized by the two research questions this study was designed to answer. The first reveals the characteristics of the site institution as reported by researchers interviewed, personal observations, and review of archival data. The second identifies and explains the resources and support opportunities available. Integrated within the two questions are the primary themes and beliefs that emerged from the analysis. Themes are further distinguished,

where appropriate, by gender, research classification (junior or senior level) and confidence levels. Research classification and confidence levels are self-reported data. The aggregate data, as collected, is shown in Table 3. Several subthemes are integrated throughout to expound upon and better articulate the beliefs of those interviewed. The stories told are meant to capture the culture of the research infrastructure and all those encapsulated within it. For the sake of confidentiality, pseudonyms for the institution and the individuals interviewed are used.

Research question number one, "What are the characteristics of an R3 PUI with a successful external grants portfolio?" addressed the overall characteristics of the research infrastructure. The characteristics that were perceived to be fundamental to the ability, desire, and success of university researchers include a positive relationship with the office of sponsored research and research administration team, the support and ability to utilize graduate students, the impact of research on tenure and promotion, a continual increase in the expectation to participate in research, genuine gratitude for early-career support and a desire to give back and support the reputation and growth of the institution.

All 15 researchers interviewed were adamant that they could not "do what they do" without the Office of Sponsored Research. Without exception, each researcher was extremely positive about the support and the relationships with the Office of Sponsored Research staff and leadership. Because the question was not asked, it is essential to note that each interviewee volunteered gratitude and respect for the staff members in the Office of Sponsored Research and the leadership. Many comments were made about the extensive efforts and kindness exuded by the entire research administrative team. Four of the researchers commented specifically on the office's ability and desire to help researchers turn "fuzzy ideas" into fundable, coherent grant proposals. The respect for the Office's knowledge and expertise with funding agency guidelines, submission requirements, and budgetary guidelines was expressed by seven faculty, but observable agreements were made by all. One faculty member expressed it this way:

> There is a culture of gratitude here that many of my faculty friends at research intensive universities don't have. Our leadership is sincerely thankful for what we do, and they are always trying to support us in whatever way possible. We could not do what we do without them.

Because faculty (even the top researchers) are teacher-oriented, finding ways to balance teaching with research is essential to the overall success of both activities. Including students in their research projects is one of the best ways to accomplish this balance. The majority of the faculty confirmed that they often include students as research assistants on their research projects. One of the more seasoned researchers and a self-reported senior researcher explained why they feel research is an important part of academia:

> If our research doesn't benefit students our work is going to vain, right? I teach Intro to Research and being able to say 'here is a research project I did that illustrates X and here's another research project that illustrates Y gets the students more involved and the class just seems to go better.

Those who indicated that they do not include students in their research projects cited the lack of graduate programs in their discipline as the primary reason. It can be inferred, therefore, that graduate programs strengthen the inclusion of students on research projects and further support faculty research activity. Faculty agreed that it would be beneficial if administration would support a restructure of the graduate assistantship distribution model to equalize the support across the institution, including those disciplines with only undergraduate programs.

Teaching, service, and scholarly activity are the three tenets of tenure and promotion within academia. Research, funded or unfunded, falls within the definition of scholarly activity. Tenure and promotion was a topic of discussion in all three of the focus groups. A question addressed the importance of research on the tenure and promotion process. While everyone agreed that grant awards are a consideration of tenure, the weight allocated was not clear. Many of the participants felt the dollar value of the award and the prestige of the funding agency made a difference to the committee. One researcher, looking at a colleague, stated: "My $10,000 award from an unknown agency does not hold as much weight as the $500,000 award from, like, NSF that someone in your department recently got. It's more about the prestige of the grant and the agency than the effort and success."

Without exception, the faculty expressed strong desires for a better and consistent understanding of the value of grants as a factor determining tenure and promotion. Although not unanimous, there was a noticeable belief that attempts (proposals submitted but not funded) are not considered equally (or at all) for tenure and promotion. There was consensus among all participants that a more consistent and clear understanding of the weight held by both unsuccessful grant proposals and awards would be beneficial.

While the tenure and promotion criteria vary among the disciplines at the site institution, there is a clear understanding that research is an expectation of all faculty. Based on responses received, leadership has been successful in communicating this message. Thereby increasing the prestige, accountability, and recognition of research. All participants thought that the institutional leadership is extremely supportive and recognizes the efforts put forth and the overarching challenges faced by active researchers. There was a unanimous desire for the criteria to be more standardized among all disciplines for clarity and consistency.

Because of the strong expectation to participate in research, all faculty are offered an ongoing three-credit course release each semester to stay engaged and active in their research. Undergraduate programs offer faculty a three-three load and graduate programs provide a two-two load. This course release for research is ongoing throughout the faculty member's academic career and is in addition to other course releases such as serving as departmental chairperson. This course release is intended to allow the faculty to start, maintain, or increase their efforts in their personal research agendas. There is no requirement that the research be externally funded but outcomes are a clear expectation. If a faculty member does not produce, they are eventually required to increase their teaching load. The decision to rescind the course release is at the discretion of the academic chairperson and/or college dean. Faculty are given the resources, the support, and the encouragement to participate in external research, but they are also given the option to not take

advantage of these opportunities and focus solely on teaching.

The pressure to secure external funding at this institution has increased over the past ten years, evidenced by the responses of the faculty. Faculty reported more communication from the Office of Sponsored Research, more recognition of proposals and awards, and overall increased attention on funding opportunities. This comment by a faculty researcher received nods of agreement and consensus within the focus group: "I really get the impression that across the university the pressure to research has increased a lot and we are on an upswing around the pressure to do research and bring in external funds and to publish the results. Whereas we used to be more teaching focused."

Some of this top-down change was credited to the current research leadership having firsthand knowledge of the challenges faced by researchers. The top three administrators, collectively, have countless external grant projects on their Curriculum Vitae. According to one faculty, "Having leadership that actually understands what it means to apply for an NSF grant and how to do that and giving me the kind of support that is needed is extremely helpful."

The participants communicated immense gratitude for the support received at the beginning of their careers. Strong belief was expressed that the early support enabled them to continue and eventually be successful in securing external funds. One participant's remark caused chuckling agreement in one focus group: "I see support not just if you're getting that funding, but if you're going after it, even. I think that gets you these little gold stars on your chart on the refrigerator that you can build up to trade in for some ice cream."

Interviewees participated actively in a conversation about the way in which start-up funds are provided to faculty. Several noted that they could have accepted faculty positions at more "research prestigious" institutions but that they appreciate the more consistent and patient support received. This comment by a researcher sums the sentiment well:

> I think of us as a little different compared to some other universities where I have other colleagues. A lot of those places you're going to come in and they'll throw you this big start-up package on the front end and say, 'All right, I supported you now go for it'. It's different here. You prove yourself a little bit and then once they see that you are committed to that research culture, then you start getting more and more benefits. It then snowballs.

Although support is important, research has concluded that confidence influences the desire, willingness, and success potential with everything individuals attempt to accomplish (Moss-Kanter, 2006).

Overall, only 37.5 % of females considered themselves confident in both securing and managing a grant, while 43% of the males ranked themselves as confident in securing and 100% were confident in managing the grant. The observable behavior that elicits a stronger understanding of this data is that the female participants took more time to answer and seemed to think about their responses much more than the male participants. While most of the focus groups were of mixed-genders, one was comprised of all female participants. This group spent an inordinate amount of

time deliberating their confidence levels. There was extreme uneasiness about ranking themselves and some changed their minds several times during the conversation. A follow-up interview with a female participant provided a heartfelt explanation of her struggles and how she feels they differ from her male colleagues. She summarized her perception by saying:

> I would have to say that as a woman, I have been very challenged by the need to balance life and profession. So, by default, I cannot have the motivation and time that the men have. Nor do I have the professional strength (we are not Stanford after all). So, I can only do that much in research. On the other hand, most of the rules in academia are set from the point of view of the 'male warrior'. I had to prove myself much more than my male counterparts as I was working on my tenure and promotion. And although I reached full professor, I feel that I am not in the right crowd. My interest is more in having a good work environment rather than reaching high level research goals that have eluded me so far and have consumed most of my professional time to the point of exhaustion and sickness. At this time, I am protecting myself and my health by saying NO a lot more than I used to. I would rather spend my time on my strengths rather than my weaknesses in terms of profession.

This individual was the only female participant in her original focus group and communicated thanks when given the opportunity for a follow-up interview and the ability to voice these considerations. This researcher expressed passion and frustration with the lack of understanding from her male colleagues. Although only expressed by one researcher, it is important to note the significance and passion that was noted in her voice. The fact that she was unwilling to share her feelings of frustration during the focus group is extremely telling. It would be beneficial to expand on this topic with faculty researchers.

The male participants, on the other hand, seemed sure of their responses to both parts of the question and did not deliberate or expound upon their answers. The reasons for their answers differed in context as well. The female participants cited personal reasons for their answers, while their male counterparts cited the current funding climate as a reason to not be as confident in their ability to secure a grant. One male participant said it this way:

> To write and secure grant, I'd say I'm neutral. Some of that is based on individual abilities, but the secure part is partly, probably a lot, based on the funding climate and that really provides uncertainty no matter even with an established research agenda.

Table 3 provides a visualization of the self-reported confidence levels in writing and securing and managing an external grant by gender.

Table 3. Researcher Gender Differences by Confidence Level

Gender	Confidence in Writing/Securing	Confidence in Managing
F = 8	Mid/High = 3 (37.5%)	Mid/High = 3 (37.5%)
M = 7	Mid/High = 3 (43%)	Mid/High = 7 (100%)

The comparison of the researcher classification (junior versus senior) and confidence levels in securing/writing and managing a grant is interesting, as well. Only one in six senior researchers reported being at least confident in writing/securing while four in six felt confident managing the grant. Two of four junior researchers reported feeling confident in writing/securing and three-fourths are confident in managing the grant. The neutral researchers reported confidence by three of five respondents in both writing/securing and managing. Therefore, six out of the 15 (or 40%) reported high levels of confidence in writing/securing and ten of the 15 (or 67%) reported high confidence in managing the grant once awarded.

This group of researchers epitomizes the definition of a teacher-scholar. The consistent and unanimous desire to use their research to influence their teaching and their teaching to influence their research is impressive. The overarching support network at this institution includes the researchers, the sponsored research staff, and the leadership. The collaboration among these groups is a factor in the success of this institution's grants portfolio.

The second research question, "What do faculty identify as priority resources needed to support a successful grants portfolio?" identified the resources and skill sets active researchers feel most essential to research success. The resource identified to be essential at this institution is intangible and somewhat obscure. The collective comments from researchers revolve around the feeling of support and understanding of their needs by leadership and is an immeasurable piece of the infrastructural support. The anecdotal stories and examples provided by researchers all point to the culture of respect and gratitude for the efforts in support of external research.

A question that addressed the key skills felt to be essential for success in external research received very specific answers. After very little thought or deliberation, the faculty participants identified the following as their collective top four key skills needed for success in grantsmanship. Each of the four skills were stated by a minimum of three separate individuals participating in the active researcher groups.

1. Time Management/Ability to Prioritize
2. Known Expertise/Publications
3. Perseverance/No Fear of Rejection
4. Collaboration

Time management and the ability to prioritize among all of the tasks on the "to do" list was identified by all researchers involved in this study as the top most beneficial skills. Regardless of the teaching load reduction available, time remains constant. One researcher explained the need for both time management and prioritization: "What has priority and what's urgent don't always match up. Because this one thing HAS to be done today because it's urgent, or at least it seems urgent, but it may not have as big an impact and be as important as this other thing. You need to be able to manage your priorities in terms of urgency and impact all within the same time frame."

Researchers also identified expertise as a necessary skill. Expertise should be proven with a history of publications and prior relative research. A faculty researcher with some self-reported success said: "You're being hired because of what you know and/or your ability to find it out. I think I have a good reputation and people know in certain areas that I have something credible to say. That has certainly helped me a lot." A researcher with minimal success in external research stated her need to participate more in scholarly activities to build her credentials this way: "I think part of the reason I have not been as successful is that I don't have the reputation in the field. I need to submit for a small internal grant that will allow me to gather some data and get some publications or presentations. Then, maybe I'll be more successful."

Agencies are more likely to fund proposals by researchers with experience and expertise in the discipline. Researchers can gain credibility by conducting preliminary or pilot research and publishing the results. Institutional resources are often used to fund the collection of pilot data to build the researchers confidence and credibility.

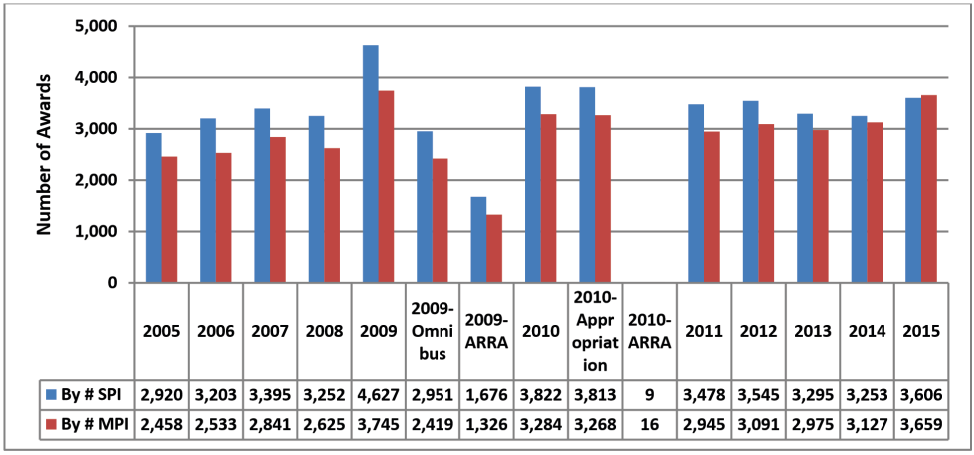
The third most popular skill believed to be integral to a successful research career is perseverance. The success rate with competitive (federal) grant proposals is, at best, 34% (NSF, 2015). This statistic includes all proposal submissions by faculty at all levels of their careers and from a wide variety of institutions. Being told "no" is common in grantsmanship because of the competitiveness. Researchers must become accustomed to unsuccessful proposals and be willing to look closely at the feedback provided and integrate the comments into a revised re-submission. One researcher cleverly associated the determination with that of writing one's dissertation:

> It's just the determination. Like we all did in our dissertations. You're going to wrestle that damn thing to the ground before it kills you. Just never give up on your idea. You submit a proposal to an agency, they give you feedback, and you make the changes they want and resubmit it again and again until you get it right.

This determination was evident in review of the sponsored projects reports that indicated a high percentage of resubmissions of the same grant proposal over the course of several years. A member of the leadership also stated that the role of the Sponsored Research Office is to review feedback provided by the grant reviewers and assist the researchers in addressing the feedback and improving the quality of resubmissions.

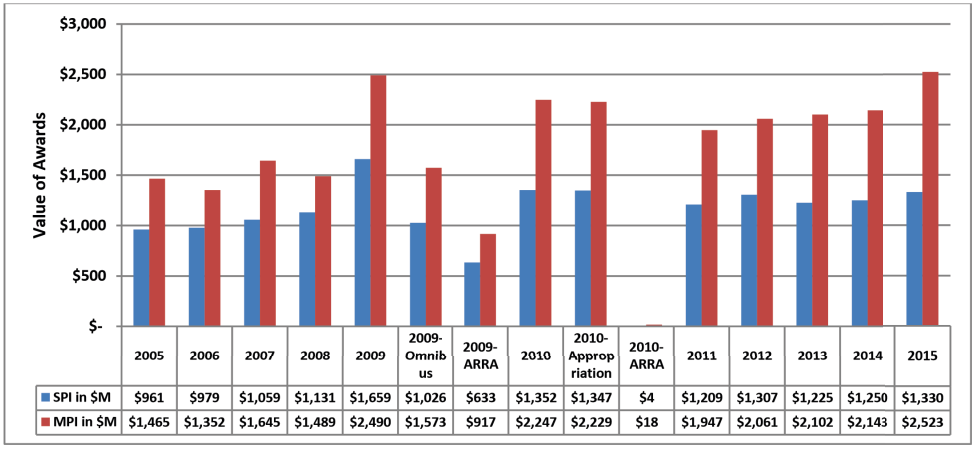
The fourth most important skill perceived to be integral to grantsmanship success is collaboration. Collaboration was also addressed by the National Science Foundation. Collaboration with other researchers and/or other entities produces a more competitive proposal. No one individual, regardless of how intelligent and how hardworking, can be an expert in every area, discipline, or activity. If researchers want to be successful with a large, complex grant proposal, they must ensure that they have the capabilities in place to perform the myriad of required tasks. While collaborations were always encouraged, this greater emphasis on collaboration, as cited by the NSF (2015), is fairly new. In 2015, NSF, for the first time, made more grant awards to collaborative or partnership efforts. The value associated with the multi-authored awards greatly surpassed the single-authored awards by more than $1 billion. This difference is significant enough to warrant

the push to collaborate with colleagues. Figures 1 and 2 below provide citation and additional detail from the NSF.



	2005	2006	2007	2008	2009	2009-Omnibus	2009-ARRA	2010	2010-Appropriation	2010-ARRA	2011	2012	2013	2014	2015
By # SPI	2,920	3,203	3,395	3,252	4,627	2,951	1,676	3,822	3,813	9	3,478	3,545	3,295	3,253	3,606
By # MPI	2,458	2,533	2,841	2,625	3,745	2,419	1,326	3,284	3,268	16	2,945	3,091	2,975	3,127	3,659

Figure 1. NSF research projects with single PIs (SPI) & multiple PIs (MPI), by number. From NSF Enterprise Information System, 10/01/15. Note: In FY2010, a total of only 25 research projects were funded from the ARRA appropriation (including one collaborative project). These are barely visible in the figure.



	2005	2006	2007	2008	2009	2009-Omnibus	2009-ARRA	2010	2010-Appropriation	2010-ARRA	2011	2012	2013	2014	2015
SPI in $M	$961	$979	$1,059	$1,131	$1,659	$1,026	$633	$1,352	$1,347	$4	$1,209	$1,307	$1,225	$1,250	$1,330
MPI in $M	$1,465	$1,352	$1,645	$1,489	$2,490	$1,573	$917	$2,247	$2,229	$18	$1,947	$2,061	$2,102	$2,143	$2,523

Figure 2. Research projects with single PIs (SPI) & multiple PIs (MPI), by dollar amount.

Conclusion/Summary

As institutions of higher education across the country continue to struggle with financial stability, PUIs must continue to seek ways to supplement the declining tuition revenue, recruit, and retain high-performing students and faculty (Bailey, 1999; Buller, 2013; Hardre, et al., 2011; Waite, 2012). Developing the credibility and expertise of researchers will aid in increasing the success rate of externally-funded research and provide additional revenue to the institution. Research has suggested that institutions and administrators who have faculty who feel prepared, are well-positioned, and have the infrastructural support needed are more productive and more successful (Akerlind, 2008; Hardre et al., 2011; Waite, 2012). The greater the resources available to researchers, the more likely they will embrace the teacher-scholar role and, therefore, become more active and more successful with external funding (Akerlind, 2007; Kuh, Chen, & Laird, 2007; Ware, 2006). Now is the time for institutions, especially PUIs, to formalize and implement a strategic plan for the future of their research endeavors.

This institution's research infrastructure reaffirms the ideals established in the three frameworks used to structure this research study. Leadership emphatically confirmed that they are placing more weight on the research expectations of all faculty, including using research experience as a factor when selecting new faculty hires. The more faculty with the interest, expertise, and credibility in research endeavors, the stronger the research Community of Practice. Since the principle foundation of a CoP is one of commonality, the more faculty with similar interests, needs, and potential, the stronger the shared voice will be to advocate for additional resources and increase the credibility, reputation, and notoriety of the research base.

Moss-Kanter's Organizational Support Theory builds an ethos of institutional support around these CoPs. Organizational support, to be effective, must address the needs of the community it intends to support (Moss-Kanter, 2006). Therefore, having leaders who understand the needs, challenges, and motivations behind external research is critical. It was evident from the interview results that researchers have a strong level of respect for the leadership and that leaders use their personal experiences to drive a successful support network.

The leadership's recognition of the challenges faced, and the success achieved by the researchers support Bandura's Theory of Self-efficacy. Bandura defines his Theory as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (1986, p. 391). Bandura found four factors that influence our self-efficacy or confidence: prior accomplishments, vicarious experiences, persuasion, and physiological and emotional states. The leadership works diligently to support the researchers both financially and psychologically. There is a strong culture of understanding, respect, and confidence in the abilities of both the researchers and the research infrastructure that promotes success. The institution studied ensures that all research efforts are recognized, rewarded, and promoted within the institution.

The institution chosen for this study embraces these ideals and have found creative ways to eliminate the common PUI barriers and compete, quite successfully, with the research-intensive

institutions. The researchers described a culture in which the leadership intentionally and strategically commit institutional resources that encourage research while building the capacity of both the researchers and the research infrastructure. The results revealed a cohesive infrastructure with high levels of mutual gratitude and respect among the diverse groups of individuals and entities that constitute the research infrastructure.

Although the culture at this institution epitomizes success, there is, still, room for improvement. Faculty participants in this study identified the following as recommendations for improvement:

1. A more consistent method of evaluating research (proposals and awards, regardless of success) among all disciplines, departments, and colleges for tenure and promotion purposes.
2. A better, more strategic and inclusive use of graduate students, especially to those majors without graduate degree programs of their own.
3. More clarity and understanding of the repercussions if the course release provided for research is not utilized.
4. Additional professional staff housed in each of the academic colleges to more effectively assist researchers in the development and execution of their research agendas.
5. A formalized mentorship program, customized for research and scholarly activity, to further engage and support research success.

The single and probably shortest comment of all the interviews summarizes the impression received while performing the interviews, interacting with the university community, and subsequently, analyzing the results: "We have a pretty good gig here." The collective efforts to support research, funded and unfunded, is immense and strategic at this institution. Another comment epitomizes the basic human need of recognition: "There is a culture of gratitude here… Our leadership is sincerely thankful for what we do."

The leadership at this institution embodies the definition of transformational leadership by utilizing their personal experiences and knowledge to create positive change, motivate and encourage, and build confidence among their researchers. In addition, the leadership recognizes the need for continuous change and improvement of the research infrastructure and actively acknowledge, seek, and act on the needs of the research community.

Author's Note

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Enabling Collaborative Work in Higher Education: An Exploration of Enhancing Research Collaborations Within an Institution

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Abstract: *Higher education institutions are facing an increasing demand to collaborate with each other in the knowledge economy. Yet, research on how higher education management enhances collaborative work is rare. This paper takes research collaboration as an example and presents a provisional exploration initiated by a higher education institution in Singapore to enhance collaborations among researchers within the institution. The paper first explores three key challenges (i.e., harnessing differences, avoiding counterproductive coercing of collaborations, and optimizing team size) and introduces a social network perspective as a means to understand research collaboration. It uses analytic tools from Social Network Analysis to provide insight into the patterns and dynamics of collaborations among researchers within the institution. The insights are used to inform the institution's formulation of strategies to enhance research collaboration, including strategies for research development, research community engagement and talent retention. Critical considerations are given to the ways in which management might adopt and adapt a social network perspective to facilitate collaborative work in higher education. Exploring the utility of social theories and tools for enhancing collaborative work in higher education contributes to 'importing' theories to higher education research, particularly the institutional management and the knowledge and research themes of higher education research.*

Keywords: *Higher Education Management, Research Collaboration, Social Network Perspective, Social Network Analysis, Theory-Practice Translation*

Introduction

With the rise of the knowledge economy in the 21st century, higher education is facing demands for enhancing collaborations in order to strengthen its ability to create and disseminate knowledge and to maximize impact on practice (Bleiklie & Byrkjeflot, 2002; Katz & Martin, 1997). These demands call on higher education institutions (HEIs) to be networked not only with their stakeholders, but also with other HEIs as well as within their own institutions (Jongbloed, Enders, & Salerno, 2008). Building collaborations and networks in higher education contribute to both the institutional management theme (for building collaborations in general) and the

knowledge and research theme (for building research collaborations specifically) of higher education research (Tight, 2014).

While the benefits of collaboration are well documented in higher education literature (Katz & Martin, 1997; Lewis, Ross, & Holden, 2012; Tuire & Erno, 2001), research on how higher education management enables and enhances collaboration is still rare. Kezar (2005) calls on managers in higher education to shift from supporting individual work to facilitating collaborative work. Critically, she observes that there is "virtually no research on how to enable higher education institutions to conduct collaborative work" (p. 831). More recently, in their consensus study on research collaboration, Cooke and Hilton (2015) observed scant literature addressing how to enhance research collaborations in higher education. They had to rely heavily on inferences drawn from the literature of group dynamics in other settings.

As a response to what appears to be a significant gap in the higher education literature, this paper explores how higher education management may enhance collaborative work, particularly research collaborations. More specifically, the focus is on research collaboration within an institution. Collaborations among researchers within an institution enhance an institution's research capacity at an interpersonal level (Huang, 2014). Such a capacity, for example in the context of innovation and collaboration among enterprises, is found to strengthen an enterprise's ability to succeed in external collaborations (Bougrain & Haudeville, 2002).

Importing theories from various disciplines for application to higher education research is recognized by Tight (2014) as one important approach to advance higher education as an emerging field of research. In this study, the utility of a social network perspective, specifically Social Network Analysis (Burt, Kilduff, & Tasselli, 2013) embedded within social exchange theory (Cook & Rice, 2006), in research collaboration is explored. Collaborations as a form of social exchange relationships is examined to understand the challenges in building research collaborations. A case study is reviewed on how a HEI in Singapore uses a social network perspective and related tools to explore the enhancement of research collaborations within the institution. The exploration is then discussed in relation to 'importing' social theories to higher education research and practice.

Challenges in Building Research Collaboration

Researchers are knowledge workers (Olssen & Peters, 2005). In research collaboration, researchers with diverse perspectives, and commonly from different disciplines, have to work together on highly interdependent research tasks in order to achieve deep knowledge integration (Cooke & Hilton, 2015).

How to effectively harness these differences in pursuing deep knowledge integration is often a key challenge faced by higher education management (Bammer, 2008). Firstly, it is challenging to foster collaboration between heterogeneous researchers who have diverse expertise and social norms (Bammer, 2008). Collaboration between homogenous researchers is easier, given their cognitive and social proximity (i.e. the extent to which people share the same knowledge base

and social relationships). As McPherson, Smith-Lovin, and Cook (2001) observe, "birds of a feather flock together" (p. 417). However, Kimble, Grenier, and Goglio-Primard (2010) caution that such a homogenous collaborative group tends to reflect its own norms, resulting in cognitive lock-in (Boschma, 2005), and hence is unlikely to generate novel ideas on its own. To break away from the lock-in effect, deep knowledge integration among heterogeneous researchers is necessary (Cooke & Hilton, 2015). Yet, collaboration among heterogeneous researchers is challenging due to the very fact that they lack cognitive and social proximities (Challenge 1).

Secondly, coercing researchers to collaborate can be counterproductive. When coercing researchers to collaborate, management can ensure the complementarity of knowledge and expertise in the team necessary for knowledge integration. Despite these efforts, Kraut, Galegher, and Egido (1987) highlight that forming a collaboration involves not only a task aspect (e.g., completing research work) but also a relational aspect (e.g., forming and maintaining relationships). A systematic examination of 53 collaboration cases in physics by Shrum, Genuth, and Chompalov (2007) shows that collaboration is more likely to be productive when researchers have autonomy in choosing collaborators they trust. Arne Brekke, Nyborg, and Rege (2007) also find that when the formation of a research team is endogenous (i.e., through self-selection), individual researchers make more effort to collaborate. Therefore, coercing researchers to collaborate may impede successful collaborations (Challenge 2).

Thirdly, optimizing collaboration is challenging. Empirical data (Heinze, Shapira, Rogers, & Senker, 2009; Kenna & Berche, 2012) suggests that collaboration contributes effectively to research performance when the team size is within certain upper and lower thresholds. For example, according to Kenna and Berche, upper thresholds are estimated to range from four to forty-eight depending on specific academic disciplines. Hence, achieving the optimal team size for greatest efficacy in collaboration is challenging as well (Challenge 3). One way to address this challenge is to make progressive enhancements and continuous calibration towards the optimal team size.

To attend to these challenges, one may conceive research as the social production of new knowledge and regard collaborations as a network of social activities and relationships among researchers. Shrum et al. (2007) find that research collaborations are more likely to take place among researchers with pre-existing relationships. Existing collaboration networks are also found to be more influential than synthetic new networks created (e.g., through the coerced assembly of research teams) as part of the change process (Cole & Weinbaum, 2010). These findings support social networks as a significant complementary lens in understanding and influencing research collaborations.

Social network perspective as a complementary lens to understand research collaboration is considered in the next section.

A Social Network Perspective on Research Collaboration

The network is a fundamental analytic construct in social science. Network analysis examines

how social relationships among individuals in a social system form network structures and influence joint activities (Burt, 2000). Social theories embedded in the network perspective provide explanations on why and how people interact and with what kind of outcomes.

Kapferer (1972) proposes that social exchange theory provides the most suitable theoretical basis for analyzing social interactions. Social exchange assumes that rewards and costs drive relationship decisions. Each party pursues options to maximize rewards and minimize costs. Fulfilling self-interest is the guiding force for each party, and the outcome is interdependent —based on both parties' efforts and mutual and complementary arrangements. For example, for a customer to procure a loaf of bread from a store, a good way to balance costs and benefits for both parties is to offer the store owner the amount of money printed on the price tag. From the perspective of social exchange theory, research collaboration may be conceived as two or more researchers exchanging research ideas and contributing their research expertise and time together to obtain desired outcomes, such as attainment of a research grant.

The social exchange theory provides explanations to the consequential effects of network structures. For example, Granovetter (1973) refers to strong ties as relationships among friends and weak ties as relationships among acquaintances. Information within a cluster of strong ties tends to be rather homogeneous and redundant as a result of frequent communication among members within the cluster. To garner new information or insights, members of a cluster will have to look beyond the cluster – to its acquaintances. Hence, an individual with more weak ties has an advantage when seeking information and innovation. This phenomenon is called "the strength of weak ties" (Granovetter, 1973, p. 1360). According to social exchange theory, weak ties contain new information (or research expertise) and have higher rewards for social exchange. Building social relations among weak ties hence have the potential to prepare researchers for future grant collaboration (i.e., strong ties).

When two separate clusters have control over and access to non-redundant information (e.g., novel research ideas or new expertise), there is said to be a structural hole (Burt, 2000) between them since they are not connected to each other. An optimal network structure has a vine and cluster structure (Granovetter, 1973), providing access to many different clusters and structural holes. The individuals, whose ties are usually weak, bridge structural holes and play the role of brokers and bridges. They have a network advantage in social exchange because it is only through them that non-redundant information flows between the two otherwise separate clusters.

If a social network perspective is adopted, research collaboration can be considered in terms of social exchange networks that connect researchers. It is possible to discern a 1+1>2 effect when researchers collaborate with each other within an institution. Such an effect cannot be explained merely by the sum of individual researchers' capacities. Network patterns, for example, the existence of weak ties and structural holes could affect how knowledge is shared, cross-fertilized and integrated among researchers, and influence research productivity (Burt, 2000; Granovetter, 1973).

In the following case study, a Singapore institution's provisional exploration is presented on how a social network perspective was adopted to enhance research collaboration within the institution,

making use of social network analysis tools (Burt et al., 2013). Exploring the utility of social theories in higher education management practice complements the existing literature in higher education, in which social network analysis is used to characterize and evaluate collaboration networks (Aboelela, Merrill, Carley, & Larson, 2007; Fagan et al., 2018).

A Provisional Exploration Initiated by a Higher Education Institution in Singapore

Informed by a social network perspective, a Singaporean HEI (hereafter referred to as SHEI) used Social Network Analysis to analyze collaboration patterns among researchers within the institution. The analysis was used to inform SHEI's formation of administrative strategies to progressively enhance collaborations within the institution.

After the strategies presented in this paper were enacted, SHEI underwent a change of management, leading to formal structural changes, which included restructuring the existing research centers and forming formal research clusters. These changes make it difficult to attribute the enhancement of expanded collaboration within the institution solely to the administrative strategies presented in this paper or the subsequent structural changes. Therefore, semi-structured interviews were conducted to understand the implementation of the strategies presented in this paper, their benefits in enhancing research collaborations, and issues to deal with when enacting these strategies.

The Context

SHEI is an institution based in a comprehensive university in Singapore. It focuses primarily on teaching and research in the social science domain, with a strong professional commitment and a close working relationship with a government agency. At the point of data collection, SHEI has 14 academic departments with about 400 academic staff. About half of the departments are defined by a distinct disciplinary subject (i.e., subject-specific), and the other half are defined by themes that range across disciplines or subjects (i.e., subject-general). With dedicated research funding, SHEI transformed from a predominately teaching-oriented institution to a research-intensive institution over a period of 15 years. It has consistently ranked among the top 20 in the QS subject ranking in recent years.

SHEI identified a need to enhance internal research collaboration in order to benefit from cross-fertilization of ideas and to deepen research integration across departments. Often segregated by departmental structure, especially between subject-specific and subject-general departments, researchers are heterogeneous in expertise and social norms (Challenge 1). Coercing them to collaborate can be counterproductive (Challenge 2). Identifying strategic opportunities to optimize collaboration is also challenging (Challenge 3). To gain the insight required to address these challenges effectively, SHEI adopted a social network perspective to analyze the collaboration patterns among researchers within SHEI, drawing specifically on Social Network Analysis.

Social Network Analysis

Social Network Analysis (SNA) (Burt et al., 2013) studies the patterns of social relations by examining how the structure of social relations influences information flow, constrains behaviour, and channels social change. It evaluates the location of actors in the network by providing both a visual and a mathematical analysis of human relationships (Burt et al., 2013). In the visualization, the nodes in the network are the people while the links represent relationships or information flow between the nodes. In the mathematical analysis, the centrality of a node (i.e., how well a node is connected to the rest) is analyzed by measuring the network location of the node. These measures give insights into the various roles and groupings in a network, for example, who are the leaders, hubs, bridges, brokers, and isolates, where and who the organic clusters comprise, core network composition, and who is on the periphery. Examining organic clusters (i.e., informal self-organizing research clusters as compared to research clusters established formally by institutions) complements understanding of human interactions based on organizational hierarchy (e.g., departmental charts).

The particular SNA tool used in this example is ORA NetScenes (Carley, 2014). The tool contains a large number of built-in social network metrics and procedures for grouping nodes, thus allowing identification of local patterns and comparing and contrasting network clusters, groups and individuals. The figures presented in this paper are reproduced for better visibility in black and white. They retain all the nodes and links of the original ORA analysis figures.

Social Network Data, Coding and Representations

SHEI used 'grantsmanship' data (i.e., internally and externally funded research grants) to map out the collaboration network within the institution. As a result of dedicated research funding, most of SHEI's researchers are active in research grant acquisition (i.e., collaborate with each other in bidding for research grants and subsequently conducting research). SHEI's provisional exploration focused on research development, particularly by facilitating more grant collaborations among researchers across departments.

The five-year grant data, available on SHEI's database, captured a total of 463 researchers (including 56 researchers, who had left SHEI at the point of data collection) taking part in 201 research grants. The data was exported to ORA NetScenes and we manually added researchers' profiles, such as departmental affiliation and academic appointments. The total number of collaboration links is 1,144. The number of researchers per grant is 2.02 (2) ± 0.2. The number of collaborators per researcher is 1.83 (2) ± 0.97. Except for new staff who had not attained any grants at the point of data collection, the data is generally representative of SHEI's staff profile in academic ranks (roughly 34% assistant professors, 27% associate professors and 3% full professors. Teaching staff, such as teaching fellows, are generally less involved in research grants).

Figure 1 shows an example of the social network diagram used by SHEI to map out the links between a Principal Investigator (PIs, A), a co-PI (B) and a collaborator (C) in a research grant. Their collaboration links are represented in Figure 1. Node A is connected to Nodes B and C, showing that Researcher A is in collaboration with Researchers B and C.

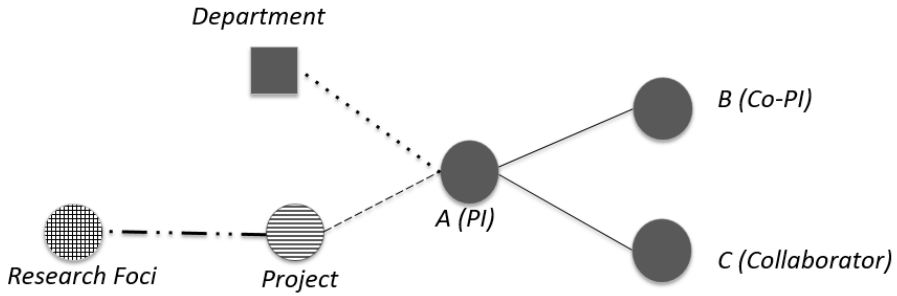


Figure captions

Circular Nodes refer to researchers; ***Square Nodes*** refer to departments; ***Horizontally Lined Circular Nodes*** refer to research grants; ***Checked Circular Nodes*** refer to research foci; ***Solid Lines*** refer to research grant collaborations between researchers; ***Dotted Lines*** connect researchers with their departments; ***Dashed Lines*** connect projects with their respective PI; ***Dashed and Dotted Lines*** connect projects with the research foci they contribute to.

Figure 1. An example of the social network diagram.

The tie between Researchers B and C (i.e., co-PI and collaborator) is a weak tie. In this paper, these ties are not included in the diagram for simplification. This is because the number of researchers per grant in SHEI is 2.02 (2) ± 0.2, suggesting that most projects only have a PI and a co-PI (or a collaborator). In this case study, the trail analysis also revealed that the inclusion of these weak ties had only negligible effects on the analytical outcomes. The limitations of making this simplification in the case of SHEI is discussed later.

In Figure 1, in addition to grant collaborations, researchers (e.g., Researcher A) are also indexed by the academic departments they belong to and the research grants awarded as PIs. Each grant is also indexed by the research foci. Research foci are research areas within a broad academic discipline, differing from academic departments. For example, in research on higher education teaching, creative thinking can be a research focus. A project on creative problem-solving in engineering contributes to research foci such as creative thinking, engineering education, etc. It is possible for researchers in both engineering and humanities departments to conduct research on creative thinking through STEAM (Science, Technology, Engineering, Art and Mathematics) education.

Four Research Collaboration-Building Scenarios

Four scenarios are presented, which describe how SHEI used SNA to identify opportunities to build collaborations within and between departments, as well as across SHEI. The analytics informs the formation of research development strategies (e.g., developing departmental collaboration), facilitating research community development and engagement, and supporting decision-making related to research talent retention. The scenarios are briefly summarized in Table 1.

Table 1. Summary of the Scenarios

SN	Purpose	Analysis	Findings	Strategies
1	Individual researchers' roles in research network/ community	Sphere of influence and cluster analysis	Identification of research stars (e.g., prominent researchers), collaboration hubs and brokering researchers	Staff reward, retention and succession planning
2	Departmental collaboration	The shortest path between two departments	The two research-intensive departments did not collaborate directly	Using research seminars and joint appointments to facilitate dialogues and idea exchange
3	Departmental research performance and growth	Collaboration networks at the departmental level, the department's sphere of influence	Staff members in a department were not PIs, but a few staff members participated in other departments' grants	Using a 'Start-up Grant' to assist the department's staff members to build research leadership
4	Growing organic research clusters	Cluster analysis	The existence of organic research clusters and the need to bridge structural holes	Facilitating dialogues, informal meetings

A socio-cultural context for understanding these scenarios is SHEI's proactive stance in anticipating and addressing issues while calibrating resources to optimize organizational performance. Such a disposition is not uncommon in Singapore higher education (Ng, 2013).

Scenario 1: Identifying and empowering research hubs and brokering researchers

This scenario explores the network roles played by individual researchers. In higher education management, there is a tradition and tendency to focus on grooming research 'stars' who are prominent researchers with a high potential in research productivity and leadership. From a social exchange theory perspective, research stars, while having high research capacities at the individual level, may not be playing a central role in research collaborations at the network level. In contrast, researchers who are hubs and brokers in research collaborations may play critical and central roles in cultivating vibrant research collaboration networks (i.e., networks of exchange relationships) within an institution, yet often they may not be identified and well recognized by the management.

In the SHEI case, the collaboration hubs and brokering researchers were identified using the networks metrics and triangulated by the management's observation of their research collaboration activities. Research stars, on the other hand, were first identified based on their research performance and outputs (without using SNA) and then their network metrics were examined allowing comparison among the three types of researchers. Technical terms (e.g., between centrality, exclusivity and centrality hub) are included to provide analytical support in comparing the three types of researchers. Brief descriptions of the terms are included in this paper.

Four figures (Figures 2 to 5) are presented to illustrate Scenario 1. Figure 2 presents SHEI's overall network diagram based on grantsmanship data. In the figure, we also highlight the locations of three researchers being analyzed in Scenario 1. Figures 3 to 5 represent the degrees of influence of a research star, a research hub and a brokering researcher respectively. The research hub and brokering researcher are usually not research stars, nor leaders within the organizational hierarchy. These individuals, however, play important network roles in bringing researchers together.

The overall network diagram on research collaboration (Figure 2) reveals that a research star had a high degree of centrality, but only at the local cluster and was peripheral in the overall network.

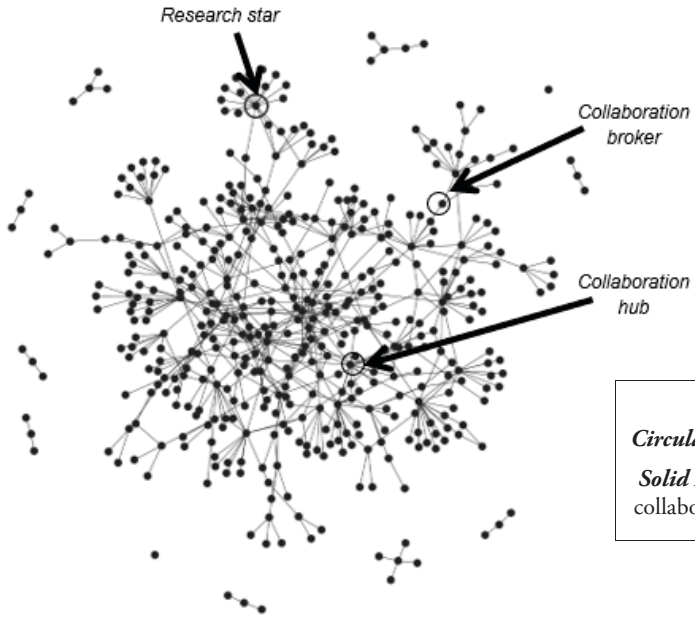


Figure captions

Circular Nodes refer to researchers;

Solid Lines refer to research grant collaborations between researchers.

Figure 2. Overview of the network diagram on research collaboration.

Figure 3a reflects that the research star was in collaboration with 11 researchers in the first degree of influence (i.e., researchers collaborated with the research star directly). At the third degree of influence (Figure 3c), the research star was connected to only 9.7% of SHEI's researchers represented in the network diagram. The low value (0.0002) of the centrality hub metric suggests that the research star was not collaborating with researchers, who had numerous collaboration links.

3a ***First degree of influence***	***3b*** ***Second degree of influence***	***3c*** ***Third degree of influence***
		
Nodes connected: 16 (3.5%) *Between centrality: 0.9917*	*Nodes connected: 22 (4.8%)* *Between centrality: 0.9264*	*Nodes connected: 45 (9.7%)* *Between centrality: 0.6642*
Between centrality in the whole network: 0.0584 *Exclusivity (i.e., has ties that few others have): 0.0283* *Centrality Hub (i.e., connecting to a large number of others who have many links): 0.0002*		

Figure captions
Circular Nodes refer to researchers; ***Solid Lines*** refer to research grant collaborations between researchers.

Figure 3. A research star's sphere of influence.

In comparison, Figure 4 refers to a researcher who was playing the role of a collaboration hub (identified using the centrality hub metric). Figure 4c shows that the collaboration hub researcher's third degree of influence covered 31.6% of the total researchers in SHEI. The researcher's centrality hub metric (0.0319) was significantly higher than that of the research star in Figure 3 (0.0002). The collaboration hub researcher's location in the overall collaboration

network (as shown in Figure 2) also suggests that this category of researcher was central in the research collaboration network.

4a ***First degree of influence***	***4b*** ***Second degree of influence***	***4c*** ***Third degree of influence***
		
Nodes connected: 14 (3.0%) *Between centrality: 0.8974*	*Nodes connected: 55 (11.9%)* *Between centrality: 0.6156*	*Nodes connected: 146 (31.6%)* *Between centrality: 0.4094*
Between centrality in the whole network: 0.1270 *Exclusivity: 0.0098* *Centrality Hub: 0.0319*		

Figure captions

Circular Nodes refer to researchers; ***Solid Lines*** refer to research grant collaborations between researchers.

Figure 4. A collaboration hub's sphere of influence.

Figure 5 shows the characteristics of another type of researcher, the brokering researcher who served in a coordinating role (identified as high in centrality hub metric but low in nodes connected in the first, second and third degrees of influence). SHEI's purpose was to identify key individuals at the institution to reward and retain. It is important to note that when using network metrics to identify brokers, SHEI did not set specific cutoff points and used qualitative observation of everyday research activities as a complement.

The brokering researcher in Figure 5 was connected to a very small percentage (i.e., 0.6%) of researchers in their first degree of influence (Figure 5a). This is much lower than that of the research star in Figure 3a (i.e., 3.5%) and of the research hub in Figure 4a (i.e., 3%). However, the brokering researcher had a very high overall centrality hub metric value (0.5914), particularly when compared to the research star in Figure 3 (0.0002) and the collaboration hub in Figure 4 (0.0319). The overall network diagram (Figure 2) reveals that the brokering researcher played a significant coordination role in linking a research cluster to the rest of the research community.

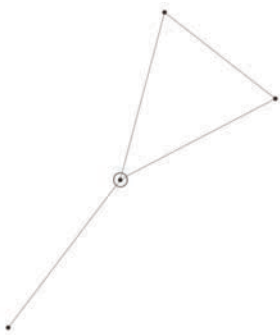
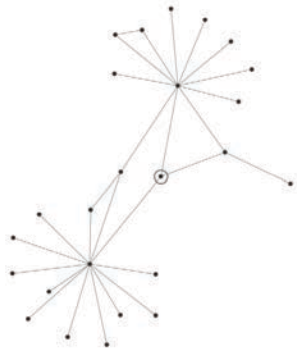
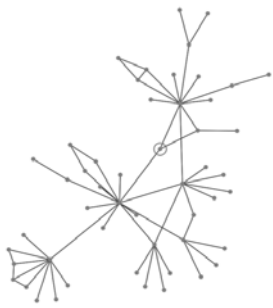
5a *First degree of influence*	*5b* *Second degree of influence*	*5c* *Third degree of influence*
		
Nodes connected: 3 (0.6%) *Between centrality: 0.6667*	*Nodes connected: 24 (5.2%)* *Between centrality: 0.0870*	*Nodes connected: 50 (10.8%)* *Between centrality: 0.0473*
Between centrality in the whole network: 0.0055 *Exclusivity: 0.0003* *Centrality Hub: 0.5914*		

Figure captions

Circular Nodes refer to researchers; ***Solid Lines*** refer to research grant collaborations between researchers.

Figure 5. A brokering researcher's sphere of influence.

Scenario 1 suggests that a HEI's research environment includes at least three important types of researchers: (a) research stars who have high individual research capacity, (b) collaboration hubs which bring researchers together, connecting them into organic research clusters, and (c) brokering researchers who bridge structural holes so that two otherwise separate clusters are connected and coordinated.

These three types of researchers play different network roles in growing an institution's research capacity and research culture. For example, a researcher shared how much she appreciated a collaboration hub who connected her with other researchers:

> *I am interested in a certain research methodology. If I find someone who is doing some work on this, now I can find this opportunity (through the informal group with xxx as the hub) to connect with them so in that way, by building this social connection via this (informal group), I can also strengthen my position within the network.* (Excerpt 1, a researcher)

A different collaboration hub also shared that:

> *Actually quite a lot of times people met through this (i.e., my networks), and then they work together. They would have met (each other) anyway (i.e., in other occasions), but (it would) probably take them a lot more time (to build the trust, if it is not through this informal group).* (Excerpt 2, a collaboration hub)

Scenario 1 informed SHEI on faculty staff development, recognition, reward and retention, because replicating a collaboration hub in a HEI is not easy, as suggested by a challenge highlighted by a collaboration hub:

> *My main challenge is that I have to be typically the one initiating (interactions)... It is not a fully organic group that happens fully (from) bottom-up... If I'm not around, then I don't have people who are as motivated as me to keep the work, to keep the (informal) group always alive.* (Excerpt 3, a collaboration hub)

The above sharing reveals the contribution of a collaboration hub, which is not easily visible to the management. Traditionally, universities focus on developing and retaining research stars. This scenario suggests that identifying, developing, rewarding and retaining the other two types of researchers (i.e., brokering researcher and collaboration hubs) may have the potential to positively influence research collaboration as a form of social exchange.

Scenario 2: Identifying collaboration opportunities between two departments

Research increasingly requires interdisciplinary collaboration. Contrasting ideas and dispositions between researchers in two departments may lead to more research innovation and productive research partnerships (i.e., more rewards in social exchange). Yet, identifying collaboration opportunities should not just be based on intuition. How could institutions identify collaboration opportunities?

In Scenario 2, SHEI analyzed the social network diagram to identify collaboration possibilities between departments A and B. This was accomplished by tracking the shortest path in the social network diagram between the two departments. SNA was supplemented with the examination of the research foci of departments A and B (conducted without the use of SNA), which revealed that the two departments had similar research foci (e.g., creative thinking), but different research methodologies.

Figure 6 visualizes the collaborative relationships between the two departments by mapping the shortest paths between them. Pseudonyms have been included for the individual researchers for easy referencing.

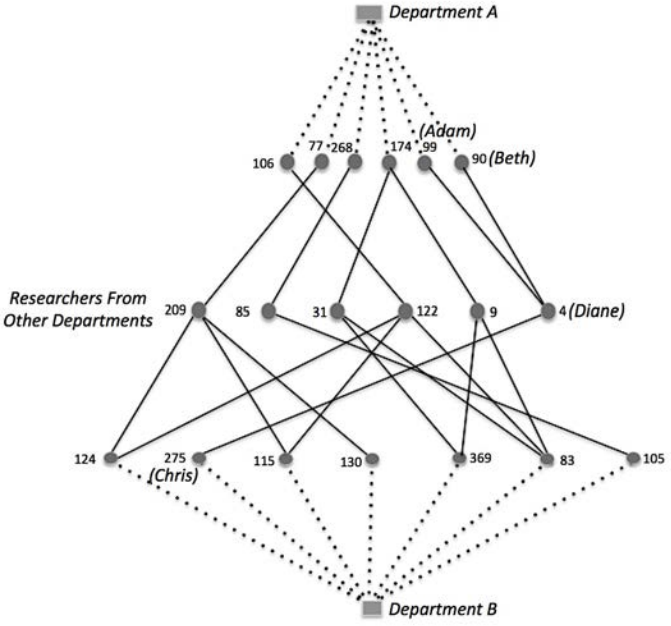


Figure captions

Circular Nodes *refer to researchers;*

Solid Lines *refer to research grant collaborations between researchers;*

Rectangular Nodes *refer to departments;*

Dotted Lines *refer to researchers' belonging to departments.*

Figure 6. Collaboration between two departments.

In the figure, Researchers 106, 77, 268, 174, 99 (Adam) and 90 (Beth) belong to department A, and Researchers 124, 275 (Chris), 115, 130, 369, 83 and 105 belong to department B. Analysis revealed that the researchers in departments A and B did not collaborate with each other directly. Rather, the collaboration path went through Researchers 209, 85, 31, 122, 9 and 4 (Diane), who are from other departments.

The fact that researchers from other departments worked with researchers from both departments A and B suggests a possibility for the two departments to collaborate directly. For example, Figure 6 shows that Diane from a third department worked in collaboration with Adam and Beth from department A and Chris from department B. How can a direct collaboration be facilitated between departments A and B?

As SHEI's strategic response, departments A and B jointly organized a series of research seminars. Their collaboration partners in other departments attended as participants. The seminars were held to foster dialogues and promote the collaboration of research ideas between the departments. A researcher in department B shared the benefit gained from attending the seminars:

> *Our relationships grow because we learn about each other and we have an opportunity to find out who we really are, what our interests are and what personality and character we have. (These) would pave the way for working together in future*. (Excerpt 4, a researcher)

The manager who organized the seminars found it "*important for departments A and B's collaboration partners in other departments to take part in the seminar* because *(they) make researchers in departments A and B feel more at ease*". The manager also found it beneficial in creating opportunities for repeated interactions among researchers. In this endeavor, the focus was on establishing routines and choosing sharing topics of common interest.

> *For anything to be really successful, (it) is (necessary to) create a routine or put a habit in mind. If I can set up a routine where it becomes a habit to have (the seminar) once a month, then we will have in our back of mind that we have some norm or expectation that this will happen....*
>
> *... The fact (is) that people are very busy. The institution is huge, and if you attend everything that sounds interesting to you, you will be attending stuff all the time. When people are super busy, you need to be very selective (in choosing the sharing topics of the seminars you organize). The other day there was this one (researcher) talking about xxx data analysis. I know many people are not going to be interested in that. So some people just don't show up.* (Excerpt 5, a manager)

With these intentional strategies, the seminars gradually led to greater mutual understanding and trust amongst the staff members in the two departments. To further nurture the potential for collaboration, three of the staff members received joint appointments by both departments. A researcher holding the joint appointment shared their role in bridging the two departments:

> *I'm not an expert at each of the unique areas, but what I bring along with me is my flexibility or adaptability. I can more or less understand what your project's trying to do and be able to plan out and strategise what are the kinds of things that we all can do together.* (Excerpt 6, a researcher)

Another researcher, who received a joint appointment presented a challenge she faced in coping with her own academic development. SHEI managed this challenge through other strategies, such as recognizing, developing and providing socio-emotional support to the researchers.

> *It's like you're Jack-of-all-trades, master of none. In fact, it's not a very settling feeling.* (Excerpt 7, a researcher)

Scenario 2 reveals how SHEI develops collaborations between two departments. SHEI leveraged the two departments' common collaboration partners in a third department, using joint seminars and joint appointments and creating opportunities for repeated interactions amongst the researchers in the two departments. These interactions facilitated direct collaboration, while also providing socio-emotional support. Joint seminars as a social facilitator of exchange will be discussed later in the section.

Scenario 3: Evaluating and developing departments' research performance

Scenario 3 reviews departments as the unit. The analysis suggests a formative way to evaluate departmental research performance for the purpose of fostering research leadership in collaboration.

Traditionally, departments are compared in terms of their grant attainment, which is calculated based on a principal investigator (PI)'s home department. For example, researcher A belongs to department X. She is the PI of a $500,000 grant and a co-PI of a $700,000 grant. Based on PI status, only the $500,000 grant is considered as contributing to department X's grant income and performance.

Using this traditional evaluation method, only one research grant was attained by department C of SHEI, because only one staff member of the department held a grant as PI. Compared to other departments, department C was viewed as seriously underperforming in research.

SHEI, using the grantsmanship data, constructed a network diagram at the department level (see Figure 7). The nodes are the departments, with the links representing research grant collaborations between departments. For example, if researcher 1 of department X and researcher 2 of department Y are the PI and co-PI of a research grant, departments X and Y are linked, reflecting a collaboration link based on the research grant.

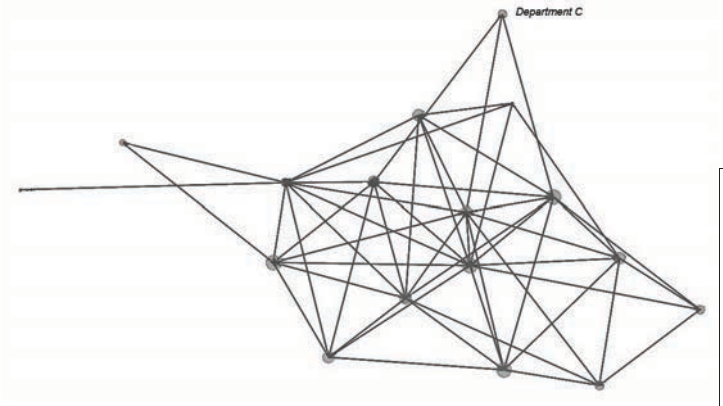


Figure captions

Circular Nodes *refer to departments;*

Solid Lines *refer to research grant collaborations between departments;*

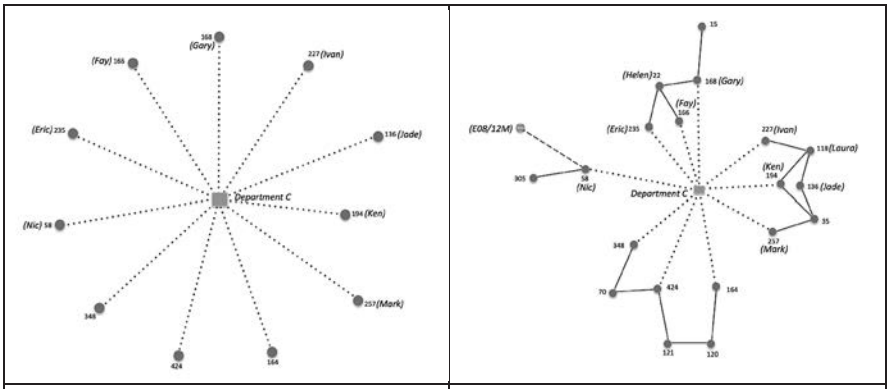
Figure 7. Centrality of inter-department collaborations.

In Figure 7, department C is not an isolated node. Although it is at the periphery of the inter-department collaboration map, department C has research collaborations with three other departments, suggesting that staff members of department C may have served as co-PIs and collaborators on grants awarded to staff members in the other three departments. In terms of interdisciplinary collaboration across departments, department C performed better than a number

of other departments. This finding is contradictory to the perception by SHEI's management.

The further analysis presented in this scenario only reflected the second degree of influence. Analyzing additional degrees of influence is possible, but extremely complex based on the patterns presented in the data.

Figure 8 shows department C's degrees of influence in research participation. Figure 8a presents department C's first degree of influence (i.e., researchers in department C). Figure 8b shows the department's second degree of influence (i.e., department C staff who have collaborative activities external to the department.). Pseudonyms have been assigned to designated researchers.



8a
First degree of influence

8b
Second degree of influence

Figure captions

Circular Nodes refer to researchers; ***Square Nodes*** refer to departments; ***Horizontally Lined Circular Nodes*** refer to research grant; ***Solid Lines*** refer to research grant collaboration between researchers; ***Dashed Lines*** connect projects with their respective PI.

Figure 8. Collaboration across departments (first and second degrees of influence).

Figure 8b reveals that only researcher 58 (Nic) is directly connected to a grant, which indicates that Nic is the PI of a project (E08/12M). Additionally, some staff members in department C collaborated with corresponding staff members in other departments. For example, researchers 235 (Eric), 166 (Fay) and 168 (Gary) in department C worked collaboratively with researcher 22 (Helen) from another department; researchers 227 (Ivan), 136 (Jade) and 194 (Ken) worked with researcher 118 (Laura) from another department.

Figure 8b suggests that some of department C's researchers, for example, Ivan, Ken and Jade

who collaborated with a common PI, Laura, might be able to bring researchers in department C together to form a research team and to develop the department's research strength.

To enhance the department's research capability, SHEI encouraged the selected researchers in department C to make use of a start-up grant scheme to facilitate researchers in the department collaborating together. The intention was to create an opportunity for the task and relational features (i.e., collaborative work in grant and social relationships among researchers) to reciprocally enhance each other. This strategy may have resulted from a researcher's discontent with superficial social interactions with other researchers in the department.

> *I don't see any (structure) that exists to bridge people. It's basically just, if you see people along the hall way, you say hi and hello and that's it... But you see, these kinds of interaction are not really (developed and) sustained. It's when you have a joint endeavor, that's when it gets (developed and) sustained.* (Excerpt 8, a researcher)

She further articulated a need to create accountability structures to sustain the joint endeavour.

> *Because everyone has time constraints. Usually, the interactions will just fizzle over time. But if you (are subject to) a structured accountability structure, you tend to continue your collaborations. I feel that that's a good way to ensure that you're continually in contact with people and the network gets sustained.* (Excerpt 9, a researcher)

In Scenario 3, SHEI engaged researchers in department C in a start-up grant as the joint endeavor (i.e., to facilitate social exchange) and used the grant (e.g., progress reports, final report, etc.) as the accountability structure to sustain the interactions. With support from the management, the joint endeavor eventually led to a competitive grant awarded to Ivan of department C as the PI.

Scenarios 2 and 3 deal with formal research structures (e.g., departments in SHEI), but management often needs to attend to informal research clusters, which are organic in nature. An informal organic network cluster entails a collection of individuals with dense connection patterns internally and sparse connections externally. It is different from traditional clustering (e.g., based on department and/or research foci) grouped by management. Organic research clusters are analyzed in Scenario 4.

Scenario 4: Identifying and developing organic research clusters

Scenario 4 reveals how SHEI examined organic research clusters, which emerged from researchers' grant collaborations. Some technical details on the clustering methods are provided, though a deep understanding of these details is not critical for this paper.

ORA's Newman's clustering algorithm method was used to determine clusters. Newman Modularity (ranging from -1 to 1) of 0.806 indicates good clustering. Excluding seven splinter clusters (i.e., dyad and triad groups), a total of 19 clusters were identified. The sizes of these clusters range from 4 to 52 with a median of 23. They are generally within the upper critical masses (i.e., 4 to 48) as identified by Kenna and Berche (2012). Other methods were also explored but did not yield satisfying clusters (e.g., low Newman Modularity, splinter clusters with one mega cluster of 429 members, etc.).

Figures 9 and 10 are two organic research clusters being identified. Cluster 1 (Figure 9) has a relatively higher density and appears to be one coherent body (i.e., researchers are more equally connected with each other). In contrast, cluster 2 (Figure 10) has less density and seems to comprise three to four loosely connected small groups. Pseudonyms have been given to certain researchers.

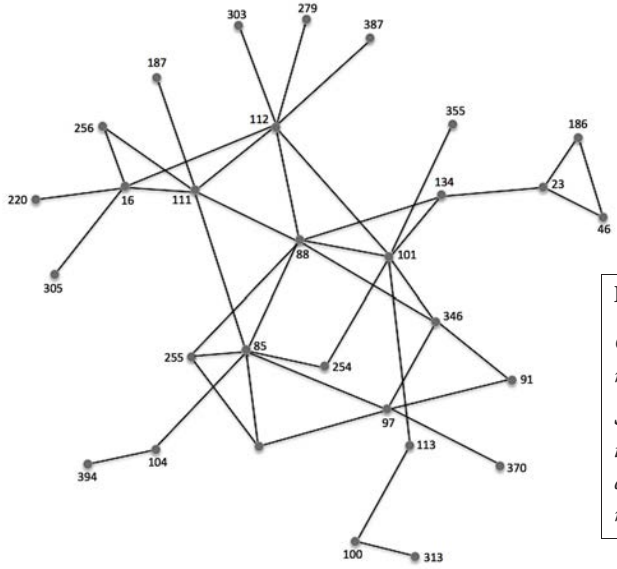


Figure captions

Circular Nodes *refer to researchers;*

Solid Lines *refer to research grant collaborations between researchers;*

Figure 9. Organic research cluster 1.

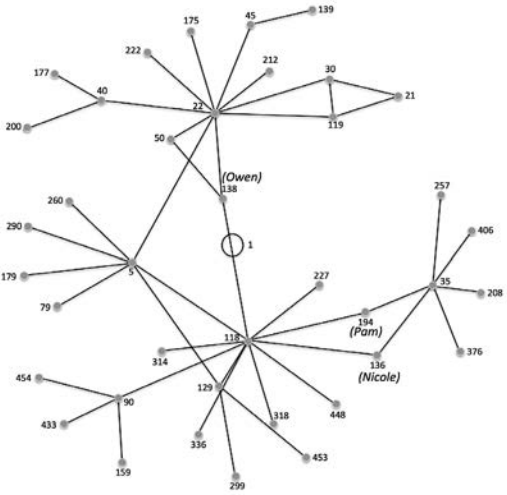


Figure captions

Circular Nodes *refer to researchers;*

Solid Lines *refer to research grant collaborations between researchers;*

Figure 10. Organic research cluster 2.

A more detailed examination of cluster 2, complemented by observing the roles played by researchers in everyday research activities, revealed that researchers 136 (Nicole), 138 (Owen) and 194 (Pam) were playing important bridging roles. In the event that these researchers leave the institution, cluster 2 is likely to become fragmented. This may affect SHEI's research capacity at an interpersonal level (Huang, 2014) and undermine SHEI's research productivity. A more quantitative way of analyzing structural holes and identifying bridging nodes was carried out by ORA's built-in functions but not, for the sake of brevity, presented in this paper.

To deal with the risk of fragmentation of cluster 2, SNA was used by SHEI again, as a complement to observations of everyday research activities, to identify opportunities to build research collaborations upon the existing clusters. As illustrated by the two dotted lines in Figure 11, if collaborations can be fostered between researchers 35 (Quinn) and 22 (Rachel) and between Quinn and researcher 5 (Stuart), the research cluster will have a much higher density. These are the ties that may have high leverage effects to optimize research collaboration.

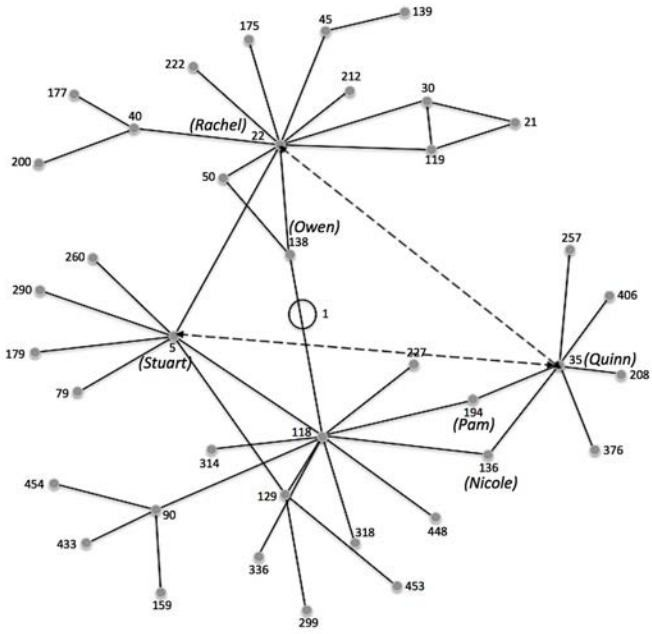


Figure captions

Circular Nodes *refer to researchers;*

Solid Lines *refer to research grant collaborations between researchers;*

Dotted Lines *refer to opportunities for building collaboration.*

Figure 11. Collaboration between two departments.

With the findings from the SNA analysis, SHEI examined contextual factors, such as the researchers' research interests and subject areas, to evaluate whether the building of these two suggested collaboration ties would be feasible. While identifying opportunities for building collaborations, SHEI also considered potential negative impacts of the collaboration building

efforts on existing collaboration networks. This review of collaborations was to prevent researchers (such as Owen, Pam and Nicole) from potentially feeling their research collaboration was being threatened or discouraged.

When facilitating the interactions among selected researchers, one researcher and manager highlighted the need to create an informal non-threatening environment:

> *There needs a certain level of comfort (among people) ... I rarely send something formal. Because I feel that it looks much more intimidating, much more rigid... I intentionally try to create an environment where you can say anything you want. Sometimes I tend to say very stupid things so that people just laugh, just to be a group of friends. This (environment) is not something formal where you need to behave yourself or give politically correct answers or anything like that.* (Excerpt 10, a manager)

Eventually, with funding support to facilitate dialogue between selected staff members, Quinn and Stuart collaborated together for publication and jointly submitted a research grant proposal.

In summary, through four scenarios, this paper describes a provisional exploration in which a social network perspective, supported by SNA as the analytical tool, was adopted by SHEI to build research collaborations strategically. Building collaboration among heterogonous researchers (Challenge 1) was carried out by leveraging the existing collaboration ties within their sphere. In this way, coercing collaboration was avoided (Challenge 2). Strategic opportunities were identified through analytics to progressively optimize collaborations (Challenge 3).

Conclusion and Discussion

Using research collaboration as an example, this paper presents how SHEI adopted a social network perspective and made a provisional exploration of the utility of social theories and tools for enhancing research collaboration within the institution. The paper responds to Kezar's (2005) advocacy for higher education management to better enable and enhance collaborative work in the knowledge economy.

As a practice-driven exploration, 'importing' social theories and tools has a different approach compared to social scientists' theory-driven 'exporting' of social theories to higher education for application and development. Each has a complementary role in advancing higher education as an emerging field of research. As an innovative work 'importing' social theories to higher education, while this provisional exploration may not be adequately sufficient or conclusive, nonetheless offers a useful point of departure in building what Huang and Hung (2018) envisioned as the science of research management, the body of scientific knowledge on research management.

'Importing' Theories to Advance Higher Education Research

This provisional exploration is timely and offers a useful context for taking a critical lens on 'importing' social theories. First, social network analysis is an analytical tool for applying social theories (Martin & Wellman, 2010). Using the tool, interpreting findings and forming

administrative strategies should be explicitly informed by social theories. For example, in this provisional exploration, SHEI used start-up grants, joint seminars and joint appointments creating useful social facilitators of exchange among researchers. Bringing the theory 'importing' work further, SHEI's strategies may be critically challenged with questions such as what are the mechanisms that accelerate research collaboration, in what conditions could their effectiveness be further enhanced and more. Manipulating environments is another way to influence exchange relationships (Baldwin, 1978). Thinking along this line, what research policies and environments could higher education management manipulate to enhance research collaboration? Raising these questions with critical examination advances the 'importing' of theories to higher education.

Next, it is important to critically assess the theories and tools being 'imported'. For example, the network perspective adopted for this paper tends to place emphasis on the properties of relations among individuals (Kadushin, 2011) and neglect the characteristics of the individuals themselves (Martin & Wellman, 2010), such as individuals' research skill and foci. SHEI made necessary adaptations by considering researchers' research interest, when identifying who to choose for building collaborative ties, coping with some researchers' negative feelings that their existing collaboration ties were threatened by management's attempts to build new or structured collaboration ties, etc.

These adaptations must be critically evaluated as well. For example, SHEI simplified the network data by not including the weak ties among co-PIs and collaborators within projects. While not normal, nor advisable to exclude this data, the decision was justifiable because most projects in the dataset had only two team members. If most projects have more than two team members, weak ties among researchers in the same project are important data for enhancing collaboration across projects. In this case, different types of collaborative relationships (e.g., PI to collaborator versus co-PI to collaborator) and the same type of association in different projects could have different degrees of strength. This requires advanced network analysis.

Finally, 'importing' theories—making necessary adaptations and critically evaluating them—potentially leads to a body of literature contributing to 'home-grown' theories in higher education. This attends to Cornelissen and Durand's (2014) caution of one-side 'borrowing' without reciprocally developing 'home-grown' theories to 'export' out. For example, according to Molm (2001), based on the mutual dependence of exchange structure, social exchange may include direct exchange (i.e., A provides value to B, and B to A), generalized exchange (the benefit received by B from A is not reciprocated with B directly giving to A, but indirectly by B's giving to another member of the same network) and productive exchange (both parties in a relationship must contribute in order for either to obtain benefits, such as research collaboration or co-authoring). While generalized exchange and direct exchange are dominant in the literature of social exchange theory, productive exchange is of particular interest to research collaboration. 'Importing' the social exchange theory not only informs research and practice in higher education but also creates an opportunity to study productive exchange in the context of research collaboration and contribute back to social exchange theory.

'Importing' Theories to Impact Higher Education Practice

For 'importing' social theories to impact higher education management practice, some important challenges need to be considered. Higher education needs to be receptive to changes induced by 'imported' theories. For example, if social network analysis is to be adopted as a new management practice in higher education, data availability and analytical capacity become critical in higher education management. Terenzini (2013) and Volkwein (2008) highlight data-collection capability and analytical capability as the HEI's analytical intelligence. Such intelligence contributes to new potentials in higher education.

Cultural and mindset changes induced by the 'imported' theories can be controversial in higher education. In this paper, social network theories and tools are not used just to identify and evaluate collaboration patterns that are hard to detect in conventional approaches. SHEI takes a proactive stance to use social theories and tools to identify opportunities to influence and enhance collaborations within the institution. It further extends Harris' (2010) recognition of the significant roles that administrative leaders play in developing cultural and belief systems to support interdisciplinary collaboration.

However, not all institutions would agree with SHEI's approach. Some institutions may conceive research collaboration as a bottom-up activity (De Zilwa, 2007) requiring minimal top-down intervention. Other institutions may be driven by more urgent imperatives to directly intervene in the assembly of research teams in order to submit research proposals. These institutions may find SHEI's provisional exploration inappropriate for their institutional culture and needs. While such cultural differences and management choices should be respected when 'importing' theories from other disciplines, we reason that there is a need for more innovation and open-mindedness in higher education. Acknowledging and working on these differences helps to advance higher education as an emerging field of research.

Limitation

A key limitation of this paper needs to be highlighted. Often, the HEIs need to constantly adjust their administrative strategies to achieve their missions effectively. After enacting the four administrative strategies presented in this paper, SHEI implemented other strategies such as structural changes, which made it difficult to collect robust direct evidence on the effects of the four strategies implemented. This limitation makes SHEI's exploration provisional and not conclusive. The administrative strategies are only suggestive, not normative. If SHEI held the four strategies constant without introducing new strategies to respond to the change of its environment, this work could be considered ethically questionable because this is not how HEIs function. Future research in higher education needs to effectively balance research rigor with institutional adaptations.

In summary, in the knowledge economy, it is imperative for higher education management to better enable collaborative work. Using research collaboration as an example, this paper presents a provisional exploration of the utility of social exchange theory and social network analysis for

enhancing collaborative work within a HEI. Research collaboration enriches higher education management's thinking for facilitating collaboration work, which contributes to the institutional management, knowledge and research themes of higher education research and offers a useful point of departure in building the science of research management (Huang & Hung, 2018).

Authors' Note

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How the Federal Government Actually Works: The Reflective Experiences of a University Research Administrator Who Took a Federal Government Job (VA)

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Abstract: *Even though research administration is governed by one body of law and regulations within the United States of America, there are many differences on how these laws are implemented. These differences are determined by the type of entity (Federal, state, non-profit, corporation) and may have further laws and regulations imposed by the state in which the organization is located. This paper will compare the differences of internal processes associated with operations, financial, and personnel management between a U.S. Federal Government agency and private sector organizations within the United States through the experiences of a seasoned U.S. research administrator who transitioned into Federal service near the end of her career.*

Keywords: *Research, Administration, Management, Government, Financial*

Problem Statement

Research Administration/Management appears to be similar to other institutions in the United States of America. This is due to the U.S. Federal Government (USG) creating and maintaining laws and regulations for the country. The system provides for states and subsidiary units to also maintain laws and regulations, as long as they do not contradict the USG's laws and regulations.

However, experience in the private sector does not prepare someone for a job in the USG (at least in the U.S. Department of Veterans Affairs), even in research administration, due to the culture and organization of each type of institution. So, what does one need to know to make a smooth transition between a private sector entity and a U.S. Executive Department?

Observations

Business and public administration theories provide the foundations for research administration, but with various caveats. The variances, arising from laws, regulations, and policies imposed by sponsors and/or Federal and state governments, focus on facets specific to research administration. Therefore, a trained body of professionals to oversee the administration of research has been developing over the decades.

However, being a successful research administrator with nearly three decades of advancement and experience only provided the foundation for service in the U.S. Federal Government. After accepting a research administration position within the U.S. Department of Veterans Affairs (VA), it came to light that the VA is a divergent entity; beginning with the Oath of Office, both

signed and oral, with witnesses, to be impartial and uphold the U.S. Constitution. The research administration and business processes may appear to be similar, but are in fact very different. Not only are job titles prescribed by the U.S. Office of Personnel Management, many policies and procedures are also prescribed from the VA central office, also known as VACO, which is the office for the appointed U.S. VA Secretary. One must note that policies are not called policies, but they are titled directives. Procedures may be found in 'Handbooks' and/or SOPs (standard operating procedures) at a particular VA. Additionally, each VA is provided the ability to implement the directives and general procedures in a way that best serves the veterans who frequent its facility.

As one searches and applies for external funding for his/her project, the pre-award process has many similarities. The Principal Investigator (PI) determines which funding announcement s/he will pursue, creates the proposal, and provides it for review and submission; however, the procedures to accomplish this endeavor have many deviations. In addition to applying for funding from different U.S. agencies or other sponsors, the VA has its own research funding that is available only to VA employees with at least a 5/8th (62.5%) appointment. A person who works full-time for the VA is considered an 8/8th appointment. The 8ths configuration was a new experience. Additionally, the agency requires its researchers to secure funding from the VA to maintain a position within the agency, regardless of other external funding. The result is that a PI could maintain a million dollar externally funded portfolio, but lose his/her position if s/he does not maintain VA funding. The only exception is if the PI is a full-time appointed physician.

The VA funding requires similar forms that are completed differently. The Health Services, Research and Development (HSR&D) funding is one portion of the research funds in VACO. The Cleveland HSR&D process will be described. Note, the process may vary at each of the 168 medical centers. The process is determined by the Medical Center Director in consultation with the ACOSs (Associate/Assistant Chief of Staff) and incorporates the Medical Center Director's level of acceptable risk for assorted items.

The difference with the pre-award process starts with an Intent to Submit (ITS) or a Letter of Intent (LOI) application, through the agency's portal. This requires the research office's official to submit the ITS/LOI. However, prior to the submission, the PI needs to obtain approval from the Research & Development Committee (R&D) to submit. To gain this approval, a research routing sheet is completed, along with two completed review forms from non-team members, abstract template, budget template, letter of support from other Services (if required), letter of support from the Community Based Outpatient Clinics (CBOCs, if utilizing these facilities), data management and access plan, and conflict of interest disclosure for all PIs. Within the VA, a service is the equivalent to a department. In turn, if the PI is utilizing other departments (i.e. medicine, laboratory services, etc.), the PI must obtain a letter of support that the department is willing to work with the PI. The support letter must include any requirement that will be imposed upon the project.

All deadlines within the government are mandatory. If the information is not received by the date listed on the meeting sheet, it will not be reviewed by the committee. If it is not reviewed and approved, there will be no submission. There are no exceptions. After providing the packet for R&D review, the PI will begin the actual proposal that will be submitted to the VACO area

(i.e. Health Services Research & Development) through Grants.gov. Naturally, this process is concurrent; however, it is expected to be subsequent. The process of proposal creation is very similar to the variety of universities and medical centers where previous employment was held. The PI provides the research office the proposal and necessary forms for review and submission through Grants.gov.

Even though the proposal submission appears to be very similar to the non-federal entities (same forms & web portal), there are many differences within this process. It begins with an Intent to Submit (ITS) application, through the agency's portal. Once accepted, the PI must follow the dedicated VA Application Guide SF424 (R&R), which describes the requirements for the VA. The PI must be thoughtful in creating the title of the project, since whatever is submitted in the ITS is the title for the grant application. The SF424 face page and Research Related forms are completed the same, except the budget pages have different requirements. The difference in the budget pages are the fields that are to be completed on the SF424 form. In the Senior/Key Person section, one is only to place the PI, no additional persons. The Other Personnel section is where the effort, salaries and fringe for all others involved with the project are listed as one person. Finally, all other expenses are listed under the Other Direct Costs on a blank line as "All other direct costs". The budget justification document must include a Summary Budget Worksheet, as well as the budget justification. One must note that medical personnel are never to receive funding from the VA research projects. This restriction includes non-VA medical personnel working with the VA.

The Summary Budget Worksheet breaks out the costs by budget period of salaries and fringe for the PI and Other VA Personnel. The number of unique persons must be placed in the field as well as a total of calendar months. Additionally, it breaks out equipment, travel, and other direct costs by budget period. If the project has multiple VA sites, there is a separate summary budget worksheet for each. This is like having subcontracts. The balance of the budget justification must list each person, degree, role, number of calendar months, the General Services (GS) level and step, the portion of 8/8th the person is working for the VA, the total salary and fringe for the full project, followed by for what each person will be responsible by site. If the project is requesting travel funds (Figure 1), one must describe the reason for travel, as well as a prescribed format in a table of who will be traveling, whether the person is VA or not, purpose of the travel, the destination, amount of time traveling and the estimated cost of travel.

Traveler	Status (VA, IPA, or consultant)	Purpose	Destination	Date	Estimated Cost
Happy G. O'Luckee	VA	Train study team	New Castle VAMC	2 days	$1034
Doh Pei	VA	Train study team	New Castle VAMC	2 days	$1034
Rogers Nelson	consultant	Train study team	New Castle VAMC	2 days	$1462
Total					$4070

Figure 1. Budget Justification Format: Travel.

The Attachments on the R&R are the same, including the Project Summary/Abstract, Project Narrative, Bibliography & References Cited, Facilities & Other Resources, and Equipment. However, the Other Attachments are prescribed and have prescribed specific file names (Figure 2):

See the VA-ORD Service-specific FOA/RFA for guidance on required attachments and appendices for application submissions.

Attachment Template	Required Filename	MS Word or PDF Template
1. Introduction to the Revised Application (response to Reviewers)	01_VA_Intro.pdf	01_VA_Intro.doc
2. Specific Aims	02_VA_Specific_Aims.pdf	02_VA_Specific_Aims.doc
2a. Research Plan	02a_VA_Research_Plan.pdf	02a_VA_Research_Plan.doc
2b. VA Career Plan	02b_VA_Career_Plan.pdf	02b_VA_Career_Plan.doc
2c. Mentoring Plan	02c_VA_Mentoring_Plan.pdf	02c_VA_Mentoring_Plan.doc
3. Progress Report and Publications from the Previous Funding Period	03_VA_Prog_Report_Pubs.pdf	03_VA_Prog_Report_Pubs.doc
4. Human Subjects	04_VA_Human_Subjects.pdf	04_VA_Human_Subjects.doc
5. Vertebrate Animals	05_VA_Animals.pdf	05_VA_Animals.doc
6. Multiple PD/PI Leadership Plan	06_VA_Multiple_PI.pdf	06_VA_Multiple_PI.doc
7. Consortium/Contractual Arrangements	07_VA_Agreements.pdf	07_VA_Agreements.doc
8. Signed Director's Letter	08_VA_Director_Letter.pdf	(Scan to PDF)
8a. R&D Committee Letter	08a_VA_R_D_Committee_Letter.pdf	(Scan to PDF)
8b. Letters of Support	08b_VA_Letters_of_Support.pdf	(Scan to PDF)
9. Data Management and Access Plan **(New October 2016)**	09_VA_DMAP.pdf	09_VA_DMAP.pdf
10. Appendix 1**	10_VA_Appendix_1_descriptor.pdf	10_VA_Appendix_1_descriptor.doc
11. Appendix 2**	11_VA_Appendix_2_descriptor.pdf	11_VA_Appendix_2_descriptor.doc
12. Appendix 3**	12_VA_Appendix_3_descriptor.pdf	12_VA_Appendix_3_descriptor.doc

** Only Appendix names may have additional text added to the name (i.e., 10_VA_Appendix_1_Response). Such additions will, however, result in a "warning" from eRA Commons indicating the attachment name(s) may not be correct. This warning should be ignored.

Figure 2. VA-SF424 Attachments.

The balance of the pre-award process is the same. The proposal goes to the research office for review and approval. It is submitted through Grants.gov; however, if you submit the proposal two days prior to the deadline, the PI is able to review and correct any errors that may have occurred during the transmission. Once the deadline occurs, this ability ends.

Post-award processes are more similar, with a few caveats. The Just-in-Time (JIT) notification arrives in the research office. The PI must provide the necessary documents for transmission and the research office uploads the documents into the system. But here again, the documents are different. HSR&D requires a Quad chart, revised Budget Justification if any changes are required, an OMB Exemption Brief, as well as the Associate Chief of Staff (ACOS) Just-in-Time (JIT) Assurance Document. Once HSR&D accepts the documents, an award sheet is processed and the funds are transferred on a quarterly basis with the expectation that these funds will be expended during the grant period. If the award is for a pilot program, the JIT requires notification of the approved human subjects protocol. This protocol requires both the approval of the Institutional Review Board (IRB) and the R&D committee. The ACOS will provide this assurance after the R&D Committee approves the grant.

Accounting within the Federal Government is very segregated to ensure proper disposition of taxpayer funds. After three years in the position, the actual numbering system is not fully understood by me. Payroll is handled through the Department of Defense Financial Services and the information is returned to the services for which the person is assigned. In this case, it is the medical research division. The person's pay is designated by percentage to his/her assigned projects. Transferring a specific dollar amount is not possible. If the projects are funded by operations monies, the division requires discussion with the VA Fiscal Services division on who and what percentage should be applied to the fund. Only in rare instances are historical transfers of salary executed. If a mistake is made, it is expected to be corrected through reallocation of the future salary distributions. This creates difficulties when managing personnel on grants with other VA medical centers. Should a partner determine a person should no longer work on a specific project, the execution of this decision will occur in future distributions even if this decision was made previously and the information was not forwarded to the appropriate accounting personnel in a timely manner.

Management of the balance of grant purchases requires following standard procedures. The government staff work on a first in, first out (FIFO) basis. This reduces the effect of favoritism. Each type of purchase requires following a process. To obtain a contract (purchase order/PO) listed in the proposal with a non-VA entity, one must provide substantial documentation. It requires the Purchase Request form, an explanation of why this vendor should be selected over all other vendors (form) and documentation to support the explanation. Additionally, a form with the information for the selected vendor must accompany the request. The request is routed through the Fiscal Service person to the contracting group. This group is independent of the medical center/agency of origin. Again, this group's workload is performed on a FIFO basis. When the request finally reaches the head of the line (this could be three to six months later), it is analyzed by the contracting officer to ensure that all documents support the request. Should

the contracting officer determine that a different vendor is able to supply the item/services; the contracting officer will award the PO with the different vendor. Smaller purchases are readily made through a request (form) to the assigned purchasing agent. All vendors must meet certain requirements for the PO to be executed. The purchase of paper, pens, envelopes, postage, etc. is never allowable on a project.

If a grant includes a person from an affiliated organization, an Interagency Personnel Agreement (IPA) is required. These agreements are utilized to pay the associated entity for the effort from their employee. Basically, an IPA is an agreement in which the Federal Government hires the entity's employee for which the Federal Agency's unit does not have the expertise or time to perform the specific work. Depending on the person and the affiliated organization, these agreements are able to be executed within 60 or 365 days. The two variables that determine the length of time are 1) if the originating agency has someone who can oversee the internal steps, while 2) ensuring that the affiliated organization executes the agreement in a timely manner. The Federal government has processes to follow in the order in which it is prescribed. Communication with the appropriate person within the Federal Agency is paramount in reducing the time required for execution. VA Northeast Ohio Healthcare System (VANEOHS) requires that the date on the IPA is 30 days in advance to provide time to obtain the VANEOHS' Medical Center Director's signature.

If the project includes travel, the process requires a memo of approval from the supervisor, in addition to the details of the request. This is forwarded to the travel group within VA Fiscal Services. The group will determine if the hotel is allowable, or they may book you with a different hotel. The airline is selected by determining which airline is able to have the person arrive at the appropriate time. One is only able to provide a preference of airline and hotel. Fiscal Services determines what is best for the agency.

The USG is an organization that is accountable to the people through fairness and equity and not just a burdensome bureaucracy. An understanding of how the government functions from within provides an appreciation as to why working with the USG requires more time to execute agreements. The difference in requirements between the USG and private sector in all processes reflect the requirement to be transparent with taxpayer dollars and to work for the public interest.

Evaluate and Analyze the Emergent Concepts

As a research administrator, this paper will discuss the main points of administration, then address its applicability to research administration through the experience of a prior university director of research who took a job in the Federal Government's Executive branch within the Department of Veterans Affairs with experience in public and private universities, a public medical center, a non-profit, and corporations.

Background

Societies are characterized by two distinct sectors—the public and the private. The public sector is monopolistic, providing essential services, while the private sector is competitive, with

alternative sources for the goods and services it produces (Division for Public Administration and Development Management, United Nations, 2007). Even though the private sector is characterized as competitive, over the last century, capitalism has had a major influence over the focus of the U.S. government.

The private sector's goal is to make the most money for the organization. Once the Industrial Revolution began, various fields of administrative scientific research began (i.e. management, economic development, organizational theory, etc.). Organizational Theory is based on Fredrick Taylor's 1911 book entitled *The Principles of Scientific Management*. Lewis, Passmore and Cantore (2008) summarize:

> Effectively it gave managers a story of 'righteousness' that supported their right to run the business in the most productive and profitable way regardless of the views of the employees. It did this by making it possible for managers to refer to a higher-order authority or power than their own personal whim, in this case the power of science as expressed through the authority of logic and reason. (p. 13)

Lounsbury & Ventresca (2003) found that as the field of Organizational Theory developed, research focused on "issues of relevance to managers and leaders of for-profit enterprises, which in turn focused attention on questions of internal organization structure and process as well as the relationship between organizations and their resource environments" (p. 461). In the 1990s, there has been a reemergence of social structural approaches to organization analysis (Lounsbury & Ventresca, 2002). The refocus of the field drew its inspiration from some conceptual methodological resources that interface with sociological subfields on organizations, stratification, culture and politics (Bourdieu, 1984; Breiger, 1995; Mohr, 2000; Scott, 1995).

The influence of the private sector's efficiencies, structure, and culture created change in the public sector. In the 1930s, the U.S. public sector changed due to the New Deal liberalism and became the foundational system for governance (Orren & Skowronek, 1998). Orren & Skowronek found that through various reorganizational legislation enacted by the U.S. Congress in the 1930s and 1940s, the rearrangement of agencies and relationships produced influential stabilizing governmental operations. By the 1970s, this arrangement came under severe strain and through a new governmental reorganization, it marginalized the bureaucratic influence (Coleman, 1996). With marginalization of the U.S. bureaucracy and changes within the educational system, the understanding of how the U.S. government functions has been minimalized within the citizenry.

Today, private sector management still has the goal and focus of making the most money for the owners and stockholders. However, organizational culture and structure has changed since the beginning of automation. The comparison of research administration between private and public sectors will be viewed through operations, financial management, and personnel management.

Operations

The field of organizational theory developed as a means to analyze organizations. After a review of field work, Dwight Waldo wrote in 1978: "Organization theory is characterized by vogues,

heterogeneity, claims and counterclaims" (p. 597). The Industrial Revolution (private sector) and the need for improved Public Administration (public sector) created the Classical perspective of organizational theory. The focus of organizational theory is structure, culture, leadership, efficiency, accountability, and responsibility (Waldo, 1978; Weber, 1978; Taylor, 1911; Smith, 1776).

When analyzing private and public entities' structures, they appear to have many similarities. Most universities, non-profits, and corporations have a governing board, president/chancellor/executive director, vice presidents/directors/managers, faculty, and staff, while corporations also have owners. The actual title used is determined by each institution or system.

A university may be a private or public entity. If the university is a public entity, with the change in budgeting that has occurred over the last few decades (i.e. lower allocations) it must still raise external dollars through grants and donations to balance its financial statements. A public university functions more like a private university due to these lower allocations.

When someone speaks of the USG, most often, s/he is referring to the employees of the Executive Branch, as will be done here. The USG has a President and Congress (436 person - governing board), Secretaries (23 person - vice presidents), upper level governmental employees a.k.a. Senior Executive Service (~7800 person - faculty), general governmental employees (~1,350,000 - staff), and owners (taxpayers). The titles are regulated by the U.S. Office of Personnel Management. These structures are compared in Table 3.

Structure	University	Non-Profit	Corporation	U.S. Government
Type	**Public/Non-Profit/For-Profit**	**Non-Profit**	**Private**	**Public**
Owners	**Taxpayers/No one/ Shareholders**	**No one**	**Shareholders**	**Taxpayers**
Governance	**Board of Directors/Trustees**	**Board of Directors**	**Board of Directors**	**President/Congress**
Organizational Lead	**President/Chancellor**	**Executive Director**	**Chairman/CEO**	**Secretaries**
Management	**Provost/Vice Presidents/Chancellors**	**Directors/Managers**	**Vice Presidents**	**Under Secretaries**
	Associate Vice Provost/ President/Chancellor			**Directors/Chief of Staff**
	Deans/Directors		**Directors**	**Administrative Officer**
			Managers	**Supervisors**
Employees	**Faculty**		**Supervisors**	**Area Leads**
	Staff	**Staff**	**Staff**	**Staff**

Figure 3. Organization structure comparison.

Even though universities, non-profits, corporations, and the USG are similar in structure, most similarities end there. This is due to how each organization is created and under which laws and regulations it functions.

Private entities are created by a person or people and the owner(s) create the mission and goals. Public entities are created by the U.S. Constitution and federal and/or state laws. The mission is incorporated into the law that provides for the public entity's creation. From this point forward,

public universities will be included in the private sector entities group due to being two levels below the Federal Government.

When accepting a position in a private sector job, one may or may not need to sign an employment contract depending on the institution and/or position. When accepting a job in the U.S. Federal public sector, after all the signatures have been executed, one must sign and take an Oath of Office, which is a sworn and written statement to uphold the U.S. Constitution and the U.S. laws and regulations. Even though U.S. research administrators adhere to organizational applicable laws and regulations, the USG has to adhere to all Federal laws and regulations. Vowing to uphold them places them at higher level of focus (reverence) for USG employees. The use of public sector here forward will focus only on the Federal Executive branch.

Today, one hears a lot about "Institutional Culture." It was the institutional culture that allowed sexual harassment or racism to occur. But, an institution's culture is more than harassment. Soeters, Winslow and Weibull (2006) find that culture is the product of the social environment and that includes the norms, ideas, values and meanings. Considering how an organization is created, the culture of the organization begins at this point. When a person enters the private or public sectors, the organization has a distinct culture, since the culture of the organization is about the goals of that entity. In general, private sector is about making the most money, while the public sector is about "public interest" (Joyce, 2016). Private sector employees focus on advancing the mission of the organization, making money, and complying with applicable governing laws and regulations within the budget provided, while public sector employees focus on fairness, public interest, and obeying all laws and regulations within the budget provided. Obviously, not all private sector entities totally focus on money, as non-profits focus more on their social mission; however, they all must make a profit in some manner in order to maintain the business. The focus of the organization creates the institutional culture.

The institutional focus for the private sector is different. Since organizational culture is formed through the organization's mission, policies and procedures, one is able to understand that some private sector organizations are less transparent than the public sector. For example, most universities and non-profits' culture focuses on their mission, which usually is posted on their website; they are externally focused with an internal component and measured by stability. After reviewing multiple large corporations' websites, a mission statement was not to be located. This is due to the private nature of corporations; therefore, they are internally focused and measured by profitability. Nearly all the private sector's actions occur in private, while government actions take place in the public (Joyce, 2016). The institutional focus for the public sector is on the "public interest" without bias by obeying all the laws and regulations (orders), is law and process focused and is measured by achievement of outcomes. These focal differences affect the culture of the organizations.

An institution's culture affects information flow and processes. Even though information flows within all structures, the degree and authority does not. Both sectors have delegation of authority. In the U.S private sector the authority can be rescinded easily. For example, if the supervisor

determines that the person who has been delegated authority is not performing as expected, s/he is able to remove the delegation to protect the interests of the entity. If the administration determines that the issue requires dismissal, the process is executed, and a person could be released as quickly as a day or two, acknowledging that this process is country specific. The process within these organizations is simpler as the private sector only has to abide by the laws and regulations that affect the entity. The flow of information in the private sector is more fluid. Communication occurs more directly between levels and with other parallel units. Within the private sector, business confidential information is not available to the public and usually is not available to everyone within the organization, but internally, the employees know the policies and procedures and follow them.

In contrast, the current U.S. public sector began developing during the first Session of the first U.S. Congress in 1789, Congress created various U.S. Federal Departments: Foreign Affairs (State), War (Defense), and Treasury (Library of Congress, Unknown). Over 58% of the first Congress had military experience with 85% of Congressmen having held officer positions; in turn, they, along with President Washington, fashioned these departments in a manner that aligns with the military structure (First Federal Congress Project, 2012). Like the military, the information flow within the USG is through a chain of command on a "need to know" basis (Atuel & Castro, 2018). A public sector's employee only has the authority of the position regardless of the employees' experience or abilities. There is no expansion of duties/authority (Redmond, et al, 2014). For example, if a U.S. Federal employee becomes AWOL (absent without leave), there is a process through which this is handled. Which process is utilized depends on the reason associated with AWOL. The USG process is overseen by the U.S. Office of Personnel Management and the Merit Systems Protection Board (MSPB). If a person is suspended over 14 days or is removed, s/he usually has appeal rights to the MSPB (U.S. Merit Systems Protection Board, 2017). Dismissal is further controlled by legislation, since Congress enacted the Lloyd-LaFollette Act of 1912, which stated that removal actions must be for merit-based reasons and not inappropriate causes, such as whistleblowing. Finally, due to the ever-growing complexity of personnel rules over time, Congress further reformed the personnel laws and regulations in 1978 with the Civil Service Reform Act and related Reorganization plans. The law provides for the MSPB standards; prohibited personnel practices; divided responsibilities between MSPB and the U.S. Office of Personnel Management; and finally, provides that personnel authority would be exercised by the individual agencies.

In addition to the authority distribution, the USG employee is expected to follow the directions (commands) of the superior. Asking for information must go up the chain of command, and the person provided with the authority will ask the unit's person of authority for the information. The second person of authority will ask for the information from his/her subordinate. Upon receiving the information, the second person of authority will provide the information to the first person of authority, who will then provide the information to the requestor. Information about policies and/or procedures are readily available, but only if one knows how to locate the item. This is due to how the public sector is structured. Communication is not fluid within this structure. Public sector procedures are very detailed. A portion of each procedure will be provided to the person

who is responsible for that portion of the process. Only after trust is built between the employee and the person with authority will information potentially begin to flow more readily. This results in highly structured processes for the public sector. It reduces ability and flexibility of lower staff to be able to provide complete information to the private sector.

In turn, if the private sector needs information from the public sector, they need to direct their questions to the person of authority. For instance, a Director of Research in the private sector is equal to the AO/Research or the Administrative Officer of Research. This person oversees all personnel within their division and is usually the only person able to provide the full necessary information to the private sector.

The culture of a public vs. private sector entity is determined by its creation, mission, and organizational structure. The culture of private sector entities focuses on mission and goals with their social environment focusing on outcomes. The culture of public sector entities focuses on its legislatively established mission with their social environment focusing on compliance (obeying orders).

Reviewing the organization, culture, and information flow of the public and private sectors, the implications for private sector research administrators are: 1) communications between sectors are difficult at best and impossible at worst, due to the differences due to the organizational structures; 2) public sector's information, procedures and processes are segregated to task, while the private sector's information, procedures and processes are more fluid; and 3) locating the appropriate person with whom to speak in the public sector can be daunting, but can be overcome with research and knowledge of with whom to communicate. Extracting information from the public sector becomes easier when one understands that s/he needs to communicate with the commander, as the troops (lower personnel) are delegated to a mission by the commander in which to execute.

Financial Management

Accountants learn the practice of accounting; along with theory, Financial Accounting Standards Board (FASB) and/or Governmental Accounting Standards Board (GASB) standards and generally accepted principles of financial management during their education. Upon graduation, they enter the workforce to utilize this education. Even though every institution may process income and expenses differently, these transactions must align with the applicable FASB and GASB standards. Additionally, accountants are taught to be skeptical of transactions. This skepticism is to ensure that the expense is appropriate, budgeted, allotted, and approved appropriately. If these conditions are met, the expense will be processed for payment.

Research financial management is incorporated into the entities' financial statements. Large universities will have either a specific office or a group of accountants who handle the account establishment, oversight, reconciliations and/or invoicing. Within smaller private sector institutions, the general accountants may be responsible for the financial oversight. Depending on the general accountants' understanding of research, this may result in conflicts between the

research and the financial portions of the entity.

Financial management within the USG is different. It is not an acceptable practice to transfer funds between agencies. In turn, if the research is funded by a different agency, the funds must go to a non-profit foundation associated with the agency. The VA has foundations (i.e. National Association of Veterans Research and Education Foundation ([NAVREF]) at most medical centers that are specifically created by law to handle the funded research from other agencies and non-federal sponsors. If the funded research is within the same agency, i.e. from central VA to a medical center, the part of the award is transferred on a quarterly basis. For these grants, account establishment, oversight, and reconciliations are handled by the research office within the particular VA. If the research is funded by a different agency or non-federal sponsor, then account establishment, oversight, and reconciliations are handled by the NAVREF staff through their system.

The way items are processed in the public vs. private sector are very different. The public sector is very linear and divided, while the private sector has the freedom to process items differently, as long as the items are recorded in compliance with applicable governmental laws and regulations. An example of a public-sector purchase is: A person at the VA wants to purchase copier paper. Here it is quite simple. The person informs his/her ADPAC (Automated Data Processing Application Coordinator). The ADPAC enters the information into the system and if it is an internal order, the item will arrive to the unit within 3 business days (or less). In the private sector, a person ordering the item will go to the designated person who does the ordering; however, if it is something that is of high necessity, the person is able to walk the paperwork through each area to expedite the process. Most of time, paperwork expedition is not possible in the public sector, as the public sector functions on the FIFO basis. Only a person in high command could alter the established process on a rare occurrence.

Personnel Management

In general, all employees of the USG must be U.S. citizens to work. The private sector is able to hire any legal alien and/or citizen. This requirement may be different in U.S. states, as each state is able to determine what is acceptable for employment within the state's government system.

In the private sector, often one is able to negotiate his/her salary within a set structure for the position. The private sector has to follow U.S. labor laws and classifications that are applicable only to the entity. A person's title may be more flexible, especially after being employed with the entity for a time. Within the private sector, a position will be classified with a wage range; however, various titles may be used for similar positions. Private sector position titles can be changed readily as well as have flexibility within the entities' pay structures.

The personnel structure of the public sector is established by the U.S. Office of Personnel Management. The General Schedule (GS) position structure has fifteen grade levels and ten steps within grade. Advancement through a grade is determined by the length of time in a particular step. The length of time is shorter (1-2 year/s) in the lower steps and longer (3 years) in the higher steps. USG employees are structured by classification, title and rank. Classification depends on

which of the twenty-three (23) occupational series a position aligns. Titles are created within that series with specific minimum requirements for holding the position. The title determines the rank (Grade) and is performed by the U.S. Office of Personnel Management (U.S. Office of Personnel Management, 2019).

For example, every person in the same geographical area, grade and step will be compensated at the same rate. Of the 168 VA medical centers in the U.S., forty-two geographic areas have a locality payment. This payment is set to subsidize employees in higher cost-of-living areas as found in Public Law 111-84 Section 1911, the Non-Foreign Area Retirement Equity Assurance Act of 2009. These areas are separated from the General category where all non-specified VAs are placed. Figure 4 randomly compares wages for an entry-level position (GS 1) through the ten steps (which is truncated for brevity) within the USG.

Grade 1 Wages for selected cities						
	Locality %	Step 1	Step 2...	Step 8	Step 9	Step 10
General pay scale	0.00%	18,785	19,414	22,891	22,915	23,502
Kansas City-Overland Park-Kansas City, MO-KS	16.10%	21,809	22,540	26,576	26,604	27,286
Las Vegas-Henderson, NV-AZ	16.49%	21,883	22,615	26,666	26,694	27,377
Albany-Schenectady, NY	16.50%	21,885	22,617	26,668	26,696	27,380
Buffalo-Cheektowaga, NY	19.18%	22,388	23,138	27,281	27,310	28,010
Cleveland-Akron-Canton, OH	20.08%	22,557	23,312	27,488	27,516	28,221
Atlanta--Athens-Clarke County--Sandy Springs, GA-AL	21.16%	22,760	23,522	27,735	27,764	28,475
Portland-Vancouver-Salem, OR-WA	22.53%	23,017	23,788	28,048	28,078	28,797
Dallas-Fort Worth, TX-OK	23.40%	23,181	23,957	28,247	28,277	29,001
Philadelphia-Reading-Camden, PA-NJ-DE-MD	24.59%	23,404	24,188	28,520	28,550	29,281
Chicago-Naperville, IL-IN-WI	27.47%	23,945	24,747	29,179	29,210	29,958
Boston-Worcester-Providence, MA-RI-NH-CT-ME	27.48%	23,947	24,749	29,181	29,212	29,960
Washington-Baltimore-Arlington, DC-MD-VA-WV-PA	28.22%	24,086	24,893	29,351	29,382	30,134
Los Angeles-Long Beach, CA	30.57%	24,528	25,349	29,889	29,920	30,687
New York-Newark, NY-NJ-CT-PA	32.13%	24,821	25,652	30,246	30,278	31,053

Figure 4. Entry-level USG wages.

The organizational culture has major effects on processes of that organization. The culture also "significantly impacts knowledge and knowledge management" (Lehman, 2017, p. 55). In turn, having an understanding of how the U.S. Federal government is organized may reduce the learning curve for new employees.

Reflect and Recommend Solutions

Being part of the U.S. Government has been a very sobering journey. I am an educated public administrator and a trained research administrator. When joining, I had 25 years of experience in the field and worked within multiple public and private universities, consulting, and a public hospital during this time. Over the course of my career, I had advanced myself into two different positions as a Director for the entity's research offices. I entered the position at the VA with

confidence in my leadership, accounting, research and public administration skills, only to realize after five months that I had no clue as to what I was doing within the USG. I felt that I had entered a military organization.

During a meeting, I was asked "Why do you need to know?" for which I was shocked that an answer to my question was not provided. In turn, I explained what I did know about how research administration worked outside the USG. After which, my CO (commanding officer) provided me all the information and more. Her Budget Analyst and I work well together and have the fiscal portion of my job down pat. My interpersonal skills provided me the ability to accomplish things for which my supervisors (not formal) were amazed.

During my first year, I learned that the Cleveland VA IRB considered a veteran subject as vulnerable as an impregnated incarcerated juvenile subject. Hence, the six-month delay in receiving IRB approval for a minimal risk protocol (see Figure 5). Budgeting within the USG is precise and highly regulated. With more than 30 years of accounting experience, it took three months to have a basic understanding of what is allowable and the revision process which I am still learning. Budget revisions are difficult and basically not allowed for personnel. This is understandable, considering the salary payments for all of the VA's 377,000 plus personnel in addition to other Federal departments are handled by the Department of Defense Finance and Administrative Services. It took nearly 1.5 years for someone to mention this fact to me.

Item	Length	When	Prior Length
Initial training	10 days	November 2015	.25 days
Prepare first IRB	3 weeks	November/December 2015	1 week
Reconcile unit's budgets	4 days	December 2015	.25 days
Safety training	.5 day	December 2015	Never
Purchase first item	5 days	January 2016	1 hour
Request budget revision	1 day	January 2016	<1 hour
Learned budgeting process	3 months	January-March 2016	<1 hour
Proposal development	-	April 2016	-
IRB Continuing Review	2 weeks	April 2016	1 day
Begin process to hire 2 staff	-	May 2016 (early)	.25 days
Appointment Scheduling training	5 days	May 2016	-
Budget revision approved	-	June 2016	(immediately)
Positions posted	-	June 2016 (late)	(within the week)
IRB approved	-	July 2016	(within the month)
Interviewed candidates	-	July 2016 (early)	(within the month)
Candidates offers sent	-	July 2016 (late)	(within the week)
Candidate 1 began employment	-	August 2016	~ within two weeks
Candidate 2 began employment	-	September 2016	~ within two weeks
Internal proposal submission	-	September 2016	2 days prior deadline
Meeting with CO	.25 day	October 2016	1 hour
Annual training	1.25 days	October 2016	Never
Grants.gov proposal submission	1 day	November 2016	2 days prior deadline

Figure 5. First year of learning vs. prior employment.

In contrast, with my previous understanding of hiring processes, I was able to complete the process within three months from start of paperwork to offer. My informal supervisors had warned that the process is at least six months from start to offer.

Three years later, I am comfortable with the processes. I now have an understanding of how the Federal Government really works (at least my VA). I have informally advanced to a position of 'authority' knowing that the true authority for things resides up the ladder with my CO who is responsible for all research personnel. We work very well together and often things are deferred to me to handle for the CO's approval. If I had a mentor or an 'insider' who would have directed me over some of the hurdles, it would have been an easier transition.

My recommendation to the private sector is to realize that first and foremost, the USG's mission is to be unbiased and comply with all federal laws and regulations. This means that items are handled on a first come first served basis. Unless one is speaking with a person of authority, you may only receive the information that is known at the lower levels. Each General Service (GS) level is provided with only the necessary information for that level and position. In turn, know with whom you should speak and begin the process with that person.

Authors' Notes

The contents of this article does not represent the views of the U.S. Department of Veterans Affairs or the United States Government.

This article is based on a presentation accepted and presented at the SRAI 2018 annual meeting. The author has nearly 30 years of experience in progressively responsible positions in research administration and was a PhD student of Public Policy and Urban Studies, but due to life circumstances, she did not complete the final two chapters of her dissertation. Much of the information in this article comes from the knowledge learned from education, as well as literature review, and on the job training.

As an aside, my late husband received his wish, which was "if you had been in the military, you would know how a team works." I am the closest I ever will be to military service and it is an honor to serve those who were willing to protect the country's freedoms, our Veterans.

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Success Factors for University Research Development Offices and Activities

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Abstract: *As a relatively new function of the academic research enterprise, research development offices and research development activities are being used to improve grant funding success and achieve university research goals. This article describes and analyzes survey data collected as part of a sequential explanatory mixed methods investigation of university research development activities and research development offices. The purpose of this investigation was to determine administrators' perceptions of what research development activities and best practices have contributed to increasing a university's annual sponsored funding totals.*

The data referenced in this article was collected via an electronic survey instrument posted to a listserv of members of the National Organization of Research Development Professionals. Data was collected on 21 research development activities, with support for large, multi-investigator project grants selected as the most important and impactful research development activity. Other highly-ranked research development activities are internal grant programs, grant team project management, and grant writing workshops. The responses helped to create a profile of university research development offices and revealed general agreement that the research development function in universities does improve grant funding success and also helps universities achieve their research goals.

Understanding the roles that research development offices and activities play in supporting and improving grant funding success and university research goals is critical to organizational decision making. Keeping in mind the goals of their institution, research development professionals can consider the results of the present study in determining what research development activities have the most impact.

Keywords: *Research Development, Research Office, Research Administration, Research Capacity, University Research Support, University Research Infrastructure*

Introduction

Innovation resulting from university research has made an enormous impact on our world, producing discoveries like penicillin, the Internet, and computers (National Research Council, 2012). Keeping up with the cost of innovation is a growing challenge, and universities are taking a hard look at their research development infrastructure and whether it is maximizing their success at getting grant funding for research (Nguyen & Meek, 2015). Research development as a relatively new field encompasses many activities that are implemented in a variety of organizational structures. Within universities, a common theme is that research development is evolving as a formal function of university administration, as universities try to better support and grow their research capabilities. In many research universities, research development activities are administered by a research development office. These offices are distinct in the university organizational structure from research administration offices, which manage the pre- and post-award administration of sponsored funding (Nguyen & Meek, 2015).

The functions of research development offices in universities vary; a review of the literature on these offices suggests that they manage and perform activities that help a university to sustainably develop research capacity and research funding. The National Organization for Research Development Professionals (NORDP, 2015) groups research development activities into broad categories of proposal support functions, strategic research advancement, communication of research and research opportunities, and enhancement of team science and collaboration. Research development activities and offices play a key role in supporting the university research and researchers, however little information about these offices and research development activities has been collected (Ross, 2017). Therefore, a quantitative study was conducted that examined university research development activities and research development offices. The purpose of this investigation was to determine administrators' perceptions of what research development activities and best practices have contributed to increasing a university's annual sponsored funding totals.

Background

This topic is ripe for investigation. A review of the literature shows that in today's universities, research and research capacity are often used as measures of success and prestige (Connell, 2005; Hazelkorn, 2004; Lombardi, 2013; Nash & Wright, 2013; National Research Council, 2012). While it is generally agreed that a university's research enterprise is of primary importance to the success of the university in today's environment, it is not clearly defined in the literature which research development activities are most likely to enhance a university's research capacity and increase annual sponsored funding totals. Both Edgar and Geare (2013) and Bosch and Taylor (2011) describe the mounting pressure on universities to produce research and increase research

capacity, but also acknowledge the dearth of information about building research capacity in today's university setting. Bosch and Taylor note that there is a gap in existing literature, which does not describe the developmental phases of an institution as it evolves from a non-active research environment to research active. They state that a knowledge base about developing a research-active environment could assist administrators responsible for managing the university research environment. Improving the current understanding of research development strategies "will lead to the stimulation and growth of research" (Bosch & Taylor, 2011, p. 445).

The literature on university research shows a growing discussion of the best way to provide support for the university research enterprise (Baum, Kurose, & McPherson, 2013; Birx, Anderson-Fletcher, & Whitney, 2013; Lombardi, Phillips-Capaldi, Abbey, & Craig, 2014; Petrova & Hadjianastasis, 2015). Still, best practices in the structure and organization of the university research infrastructure is an area that has not received a great deal of attention as a research topic (Bosch & Taylor, 2011; Edgar & Gear, 2013; Nguyen & Meek, 2015). One notable exception is Briar-Lawson et al. (2008), who found significant benefits from research development support in a study of 14 universities that received NIH funding. The research development support included information on funding opportunities, proposal editing, form preparation, institutional review board assistance, budget development assistance, secretarial supports, and incentives to faculty grant-seekers (Briar-Lawson et al., 2008).

Organizational theorists since the mid-twentieth century have emphasized the important role an organization's environment plays, and how the influence of internal and external forces can change that environment. An open systems model is often used to examine how institutions adapt to forces that change their environments (Helmer, 2005). Kezar (2014) points out that a scientific management theory such as contingency theory can be used to understand the environment of a university as a system. Contingency theory provides a theoretical framework to understand and evaluate the forces that shape a university's organization; Lawrence and Lorsch (1967) who helped to develop contingency theory defined three parameters. First, as an open system, internal and external forces permeate the borders of an organization. Second, there is no single optimal way to organize; what is best for an organization depends on the environment to which it must adapt. Finally, an organization's leadership must reconcile market demands with the organization's resources and capabilities (Morgan, 2007). University leaders must consider how to optimize management practices and organizational structures to handle the pressures of external forces like reduced funding and the demand for research in the competitive higher education marketplace (Helmer, 2005). Internal forces such as a university's research capacity, faculty's capacity for performing research and grant-seeking, and the support systems for these influence the highly complex system that is the university organizational environment.

The literature includes some discussion on whether measuring the success of research development offices and research development activities through outcomes such as grant funding is appropriate. After all, research development professionals who staff these offices and facilitate the research development activities are not conceiving of or conducting the research, and there are typically other factors that contribute to the success of a grant proposal (Birx et al., 2013; Briar-Lawson et al., 2008; Cantwell & Mathies, 2012; Evans, 2011; Lintz, 2008; Rosenbloom, Ginther, Juhl,

& Heppert, 2015). Although there are differing opinions on how to fairly measure the success of research development offices, Bevil et al.'s study (2012) showed that research offices used measures of grant dollars and grant funding success, along with other measures, to demonstrate their effectiveness. Thus, part of this study was to collect data on what research development activities and best practices have contributed to increasing a university's annual sponsored funding totals.

Methods

This article describes the quantitative data collected via a survey instrument (Ross, 2017) whose participants were selected through a purposive sampling methodology. This sampling methodology was used based on the author's judgement of professionals in the research development field that have expertise in this particular topic. The author elected to sample members of the National Organization of Research Development Professionals (NORDP), an organization that comprises a group of professionals who have, through their membership in the organization, identified their connection to research development. At the time, there were approximately 700 members of the NORDP organization. After receiving Institutional review Board approval, the survey was disseminated to the NORDP listserv. A total of 116 individuals responded to the survey; however, because the NORDP organization was not able to provide the total number of members who subscribed to the listserv, a response rate could not be calculated.

The development of the survey instrument was a 4-month process, and was supported and shaped by 15 individuals who provided formative and summative input and served as pilot participants. The survey included 27 items and was a combination of Likert scale, multiple choice, short answer, and open-ended questions. There were response pathways in the survey, which were activated by the responses to certain questions. For example, participants who indicated their universities had formal research development offices were asked questions about that office. The invitation to participate in the survey was posted to the NORDP listserv in the fall of 2016.

Results and Discussion

A total of 112 responses were analyzed using descriptive statistics and provided data on research development professionals, research development activities, research development offices, and how success is measured. An additional four responses could not be used because the respondents were not employed by universities. The data collected on survey participants, their universities and their research development offices provide a context for the information collected about the functions and activities of those offices.

Institutional Demographics

The survey responses indicate that the majority of the 112 participants work for a public university (82%), and those institutions have a Carnegie Classification of research university with high research activity (19%) or very high research activity (60%). The majority of survey participants (59%) work for a university with enrollment that exceeded 20,000 students. To quantify the

level of research activity at participating universities, two questions were included about annual sponsored funding dollars. Participants were asked to identify their institution's approximate total annual sponsored funding, and also their university's approximate total annual sponsored research funding expenditures (see Figures 1 and 2; Ross, 2017).

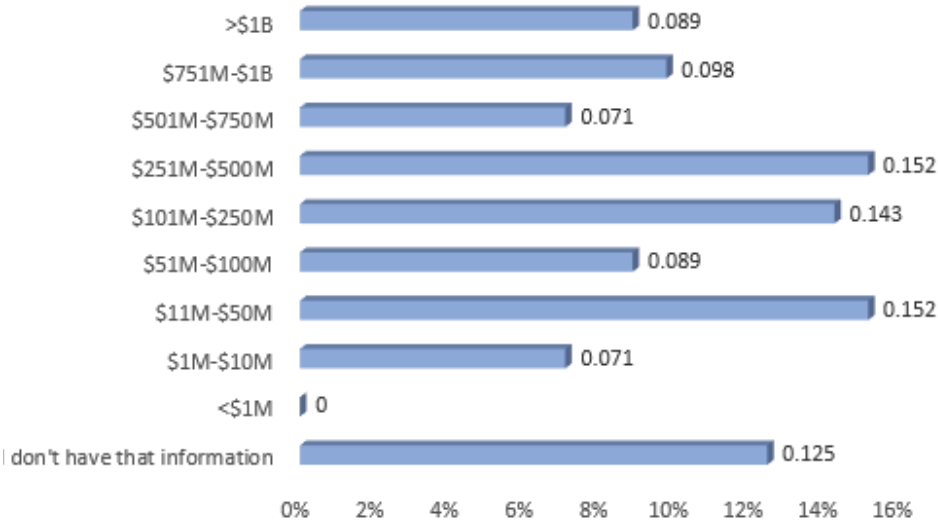

Figure 1. Total approximate annual sponsored funding.

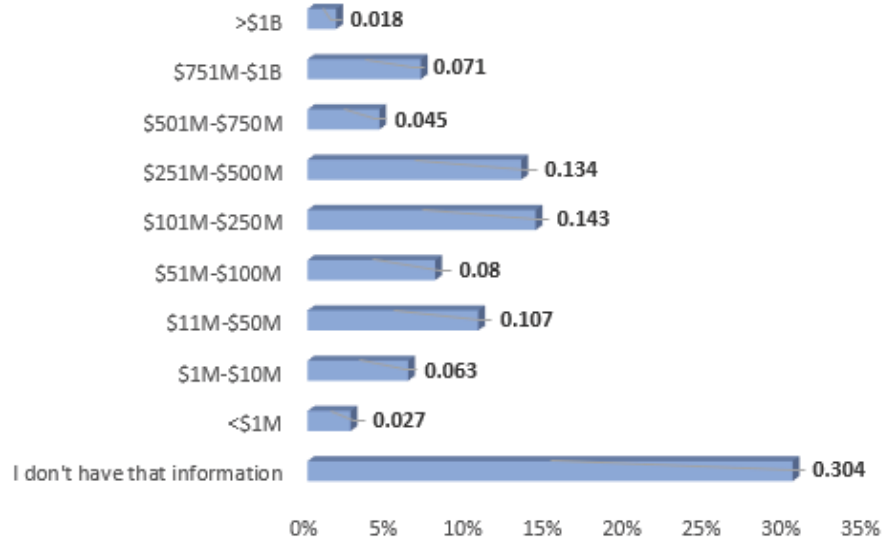

Figure 2. Total annual sponsored research expenditures.

Figure 1 illustrates that participants' universities have annual sponsored funding that ranges from $1 million to over $1 billion, with the majority reporting $11 million to $50 million (15.2%), $101 million to $250 million (14.3%), and $251 million to $500 million (15.2%). I don't have that information was chosen by 12.5% of participants. Figure 2 shows a range for total annual research expenditures at participants' universities to be less than $1 million to over $1 billion, with the majority of total annual sponsored research expenditures (46.4%) in the $11 million to $500 million range. Figure 2 also shows a marked increase in the number of participants (30%) who chose *I don't have that information as their response*. The National Science Foundation (2016) utilizes total annual research and development expenditures to rank academic institutions. Many major research universities describe their level of research activity in terms of total annual sponsored research expenditures. However, this study revealed that approximately one third of respondents are not able to provide their institution's total annual sponsored research expenditures. In general, participants seemed more familiar with the total approximate annual sponsored funding at their universities, where only 12% selected *I don't have that information as their response* (Ross, 2017).

The function of research development in universities has existed for decades, but since the early 2000's when formal research development offices began appearing on many university campuses, research development as a profession has gained acknowledgement (Levin, 2011). Survey participants overwhelmingly identified themselves as research development professionals (92%). Survey participants who indicated they did not consider themselves to be research development professionals (4%) held the position of dean or were not part of their institution's research development office. One-third of respondents (33%) do not work in a formal research development office, while two-thirds (67%) do work in their institution's formal research development office. The majority of participants (57%) had more than 5 years' experience in university research development. Also, 58% of participants indicated that 76%-100% of their job duties pertained to research development (Ross, 2017).

Profiles of Research Development Offices

For those who work at a university that has a research development office, the survey also included questions about the structure of the office. Sixty-seven percent of survey participants indicated that their university has an office dedicated to research development functions that is separate from a sponsored programs office or other research administration office. Eighty-five percent of participants indicated they have a central research development office that serves the entire institution, while 12% have a research development office that only serves a specific college or unit (e.g., a medical school) within the institution. Three percent of participants have both central and unit-level research development offices.

Regarding the number of staff in these offices, 80% have three or more full-time employees. Some offices are significantly larger, with 17% of research development offices having seven or more full time employees. Seventy-nine percent of survey participants who indicated that their institutions have formal research development offices work in that office. Participants with a research development office were also asked when their office was established. The first research

development office among participants was established in 1980, followed by one in 1990, and one in 2001 (see Figure 3). The establishment of research development offices peaked from 2010 to 2013, with 28 offices (45%) established in those years (Ross, 2017).

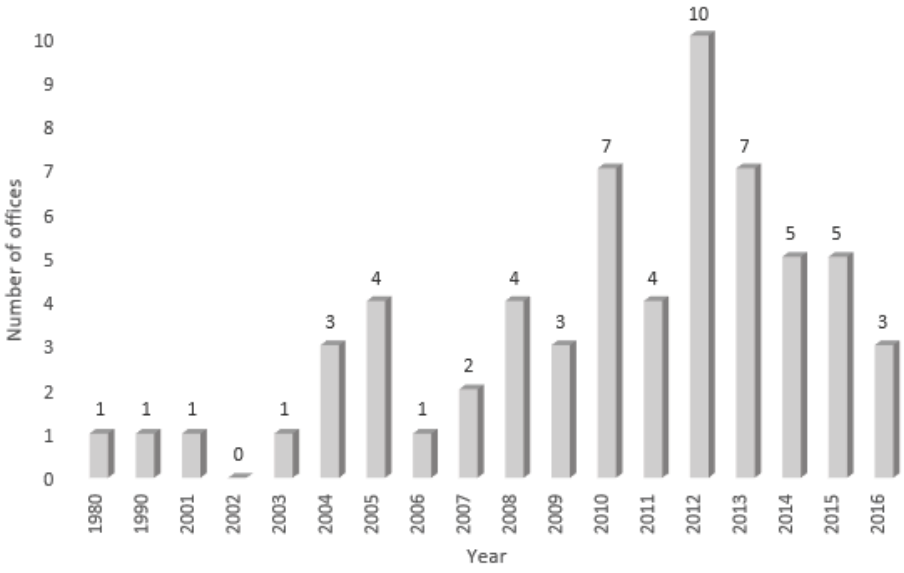

Figure 3. Year research development office was established.

Research Development Offices

There were several survey questions that explored the value placed on research development offices. Participants who answered that their institutions did not have a dedicated research development office, or 33% of the total participants, were asked what impact creating such an office would have on increasing their institution's sponsored funding success. Survey participants were offered a choice among *no impact, minimal impact, some impact, major impact*, or *not sure*. Eighty-three percent of participants indicated that creating a dedicated research development office would have *some impact* (36%) or a *major impact* (47%). All survey participants were asked if they would recommend that universities without a separate office establish one "for the purpose of providing enhanced research development functions to increase the university's sponsored funding success" (Ross, 2017, p. 121). A majority of survey participants (78%) responded that they would *recommend* establishing a research development office, while 5% would *not recommend* this and 17% were *not sure* (Ross, 2017).

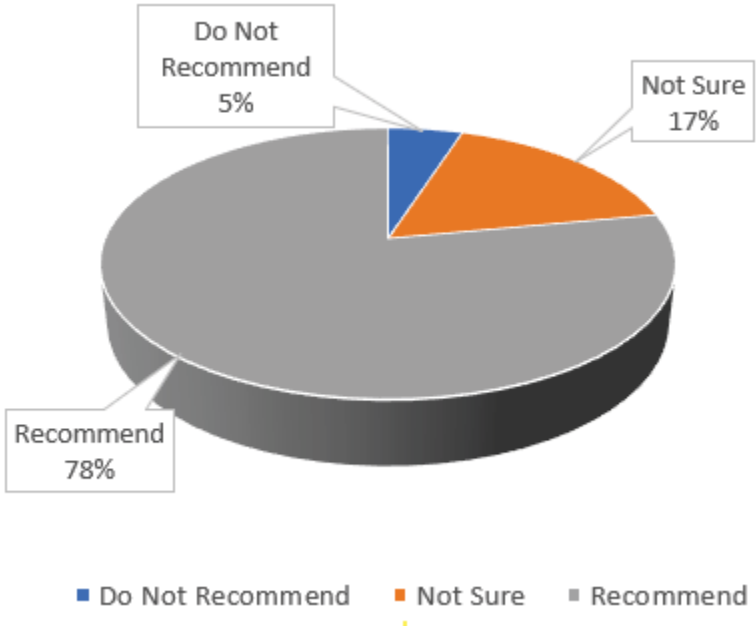

Figure 4. Percentage recommendations on establishing separate research development office.

An open-ended follow-up question asked why or why not in reference to participants' recommendations on whether to establish an office. This open-ended question produced numerous responses about the value and role of research development offices within an institution's research infrastructure. The responses were analyzed using Colaizzi's (1973) method of phenomenological analysis, which included reviewing the responses multiple times to extract and record significant statements that relate to the study's phenomenon. Once these significant statements were extracted, meanings were formulated and sorted into categories. The categories were then connected to themes and these were integrated into a comprehensive description of the study's phenomenon. These findings were validated by having a qualitative expert verify the meanings, categories, themes, and descriptions.

The analysis revealed that in general, participants perceive value in a formal research development office, and many participants noted that the value of research development offices goes beyond increasing university-sponsored funding goals. The significant statements from survey participants reflected the previous discussion of the theoretical framework for this study; the changing university environment is shaped by the drive to expand research capacity even while the availability of funding is reduced. Survey participants who responded to the open-ended follow-up questions cited the forces and complex interactions that influence a university research enterprise. Several survey participants commented that research development offices offer specialized services that are not duplicated in other units in the university research infrastructure,

and many survey participants commented that researchers need research development support to be successful. Some significant statements from survey participants who responded to the open-ended follow-up questions are shown in Table 1 (Ross, 2017). The favorable comments shown in Table 1 demonstrate a theme that a central office dedicated to research development provides important services to investigators and plays an important role in the research infrastructure. A few unfavorable comments came from participants who responded that they do not recommend a separate research development office. These comments reflect that an office should not be established for the sole purpose of increasing sponsored funding, and that in smaller institutions the research development function can be a part of other offices.

Table 1. Recommendations For or Against Establishing a Separate Research Development Office

Recommendation	Significant Statements
Favorable	"A central RD office can effectively work across colleges and support important strategic research initiatives that transcend college boundaries"
	"a separate Research Development Office allows the people in that office to focus on development and not get bogged down in the day-to-day activities that occur in the Office of Sponsored Programs...separate provides a clear identity and function to Research Development personnel"
	"Faculty need help."
	"Our faculty, especially new faculty, are floundering. They need help that the sponsored programs office just cannot fully deliver."
	"having an infrastructure of support and resources for faculty members is critical. The structure of such an office and the emphasis placed on certain services (writing, editing, finding funding, developing seminars and workshops, assistance with large/small proposals) should be tailored to meet the specific needs of faculty at each institution."
Unfavorable	"I wouldn't recommend it for the exclusive purpose of increasing sponsor funding totals, but depending on how the office is set up it can be useful in coordinating large proposals, educating on best practices in grant writing, providing support for individual proposals, etc."
	"I don't think it needs to be a 'separate' office. In smaller schools, like my present one, it can be part of a multiple function office."

Research Development Activities

Survey participants were also asked about the importance of research development activities to increasing sponsored funding success at universities. Research development activities were defined in the survey instrument as "those that support and enhance the university's research activity without being a part of the actual research" (Ross, 2017, p. 116). The responses to the importance of research development activities to increasing sponsored funding success at universities are shown in Table 2. While each of the 21 research development activities on the survey received some votes for being important or critically important, the highest-ranking activity that participants chose is *proposal development support for large, multi-investigator project grants* (92.9%). Among the top five activities were also *Internal grant programs to provide seed funding for research* (83.9%), *Grant team project management (coordination of meetings, proposal development deadlines, shared documents, etc.)* (83.1%), *Facilitating internal collaborations* (83%), and *Working with investigators on resubmissions* (83%). The lowest ranking activity in terms of importance was *Grant writing technical sections of a proposal* (30.3%; Ross, 2017).

Table 2. The Importance of Research Development Activities

Research Development Activity	Important or Critically Important
Proposal development support for large, multi-investigator project grants	92.9%
Internal grant programs to provide seed funding for research	83.9%
Grant team project management (coordination of meetings, proposal development deadlines, shared documents, etc.)	83.1%
Facilitating internal collaborations	83.0%
Working with investigators on re-submissions	83.0%
Grant proposal editing	80.3%
Grant writing workshops	78.6%
Mentorship program for investigators	76.8%
Coordinating the limited submission process	75.0%
Research faculty onboarding	74.1%
Helping/training faculty to find funding opportunities	71.5%
Facilitating external collaborations	69.6%
Grant writing of non-technical sections of a proposal	67.8%
Helping faculty in navigating through internal pre- and post-award processes	66.1%
Assisting investigators in getting a peer review of their proposal	65.2%
Disseminating funding opportunities	64.3%
Research events such as faculty symposia	47.4%
Research communications (newsletters, listservs, brochures, webpages, etc.)	45.5%
Creating a library of successful proposals	40.2%
Recognition events/programs for investigators' success	39.3%
Grant writing of technical sections of a proposal	30.3%

Survey participants were also asked to consider the 21 research development activities listed and choose the top three most impactful at their own institution. Table 3 shows the most impactful, second most impactful, and third most impactful, as well as the overall ranking for most impactful research development activity. Once again, the top ranked activity is *proposal development support for large, multi-investigator project grants* (overall 44.6%, with 25% selecting it as most impactful). Among the top five activities chosen were also *Grant team project management (coordination of meetings, proposal development deadlines, shared documents, etc.)* (overall 28.5%, with 8.9% selecting it as most impactful), *Grant writing workshops* (overall 26.8%, with 10.7% selecting it as most impactful), *Internal grant programs to provide seed funding for research* (overall 20.5%, with 8.0% selecting it as most impactful), and *Grant proposal editing* (overall 20.5%, with 8.9% selecting it as most impactful). The lowest ranked research development activity in terms of impact was *Recognition events/programs for investigators' success* (0.0%; Ross, 2017).

It is interesting to note that three research development activities most frequently chosen as either important or critically important (i.e., *proposal development support for large, multi-investigator project grants; internal grant programs*; and *grant team project management*) are slightly different from the activities ranked as the three most impactful within participating institutions. Specifically, grant-writing workshops were chosen in the top three most impactful research development activities, but this activity ranks seventh in the list of important activities (Ross, 2017). There could be several reasons for this difference. Participants were asked to rank the importance of research development activities to universities in general, and to rank the impact of research development activities within their own institution. Rankings for impact could reflect the different university environments. Some institutions may not have all 21 activities listed in the survey. Thus, while a participant may have an opinion of the importance of each of the 21 activities, their perception of the top three most impactful could be based on their own environment. The rankings of research development activities could also reflect differences in university priorities and research goals. While an activity may be deemed important, the investment required for that activity and its fit within a particular university environment may make it more or less impactful. The differences in rank between importance and impact could also be reflective of a lack of standardized metrics for research development activities, which makes quantifying impact and importance very subjective.

Table 3. Most Impactful Research Development Activities

Research Development Activity	Most Impactful	2nd Most Impactful	3rd Most Impactful	Overall
Proposal development support for large, multi-investigator project grants	25.0%	9.8%	9.8%	92.9%
Grant team project management (coordination of meetings, proposal development deadlines, shared documents, etc.)	8.9%	11.6%	8.0%	28.5%
Grant writing workshops	10.7%	12.5%	3.6%	26.8%
Internal grant programs to provide seed funding for research	8.0%	7.1%	5.4%	20.5%
Grant proposal editing	8.9%	8.0%	3.6%	20.5%
Facilitating internal collaborations	5.4%	4.5%	9.8%	19.7%
Mentorship program for investigators	5.4%	4.5%	8.0%	17.9%
Helping faculty in navigating through internal pre- and post-award processes	4.5%	7.1%	4.5%	16.1%
Helping/training faculty to find funding opportunities	2.7%	3.6%	6.3%	12.6%
Facilitating external collaborations	4.5%	5.4%	1.8%	11.7%
Grant writing of non-technical sections of a proposal	1.8%	4.5%	5.4%	11.7%
Research faculty onboarding	1.8%	6.3%	2.7%	10.8%
Working with investigators on re-submissions	0.0%	1.8%	6.3%	8.1%
Coordinating the limited submission process	1.8%	0.9%	4.5%	7.2%
Disseminating funding opportunities	2.7%	0.9%	2.7%	6.3%
Assisting investigators in getting a peer review of their proposal	0.9%	2.7%	1.8%	5.4%
Research communications (newsletters, listservs, brochures, webpages, etc.)	0.9%	0.0%	3.6%	4.5%
Research events such as faculty symposia	0.0%	0.9%	1.8%	2.7%
Creating a library of successful proposals	0.0%	0.0%	0.9%	0.9%
Grant writing of technical sections of a proposal	0.0%	0.0%	0.9%	0.9%
Recognition events/programs for investigators' success	0.0%	0.0%	0.0%	0.0%

Conclusions

Research university administrators have an important perspective of the value of research development offices and activities for securing sponsored research funding and achieving the institution's research goals. The data collected on the survey participants, their institutions, and institutional research development offices helped to provide a context for the data collected about the functions and activities of the offices.

Survey Participants, Their Institutions, and Institutional Research Development Offices

A common metric to describe the level of research activity at a university is total annual sponsored research expenditures. It is interesting that almost a third of survey participants, people who serve in research development functions in a university, do not have this type of information. This could be an indicator of the differences in the role of the research development professional within a university, where some research development professionals are not closely connected to the measurement or tracking of research expenditures. It could also be an indicator of differences in how universities quantify their research activity. One challenge in the emerging field of research development is communication. Without a common vernacular, it can be difficult for people from different institutions to effectively communicate about research development activity and compare benchmarks. The need to communicate and benchmark is important for many reasons, not the least of which is to identify best practices and make strategic decisions about managing the internal and external influences on the university research infrastructure.

Research Development Offices

Quantifying the value of research development offices can be difficult. The information gathered on research development offices shows that these are perceived to have value in helping institutions achieve their research goals. There is an increasing trend of research development offices being established throughout the last few decades. A large majority (78%) of survey participants recommend that universities without formal research development offices establish one. Survey participants shared administrative strategies being employed to help develop university research, and an analysis of these responses suggests that this topic merits a much deeper exploration. Many survey participants noted that the value of research development offices goes beyond increasing university sponsored funding goals. Some significant statements from survey participants included that research development offices offer specialized services that are not duplicated in other units in the university research infrastructure, and research development support is perceived to make researchers more successful.

Research Development Activities

Universities that do not have formal research development offices may still engage in research development activities to help support and achieve university research goals. Survey participants

both with and without formal research development offices ranked the most important research development activities as: (a) proposal development support for large, multi-investigator project grants; (b) internal grant programs; and (c) grant team project management. Participants also ranked the three most impactful research development activities at their institutions in terms of increasing sponsored funding as: (a) proposal development support for large, multi-investigator project grants; (b) internal grant programs; and (c) grant writing workshops. Data on which research development activities are most important and impactful is necessary for sound decision-making within the university research infrastructure.

Future Directions

An important topic for further study is research development activities. For example, the activity identified in this study as the most important and most impactful is proposal development support for large, multi-investigator project grants. It would be interesting to know more about how this function is handled on college campuses, and what the best practices are related to getting this type of proposal funded. A better understanding of how each of the 21 research development activities are implemented on college campuses would certainly be beneficial to all research development professionals.

Another topic of interest not sufficiently explored by this study is the structure of research development offices and their placement in the larger university infrastructure. Of the survey respondents with a research development office, a majority (85%) have a central office that serves the entire university. However, one of the study participants noted that the future direction for her central research development office is to try to shift more of the research development functions to the individual academic units, including creating unit-level research development offices. It would be interesting to know if this is a trend and if there is evidence of better service given in a decentralized research development organization. Finally, the sample for this study was members of NORDP, and it would be beneficial to gather similar data from university research administrators across the nation including those who are not NORDP members as well as other stakeholders in the university research enterprise so that the results could be compared.

Ultimately, data on research development activities and the best practices can inform the strategy employed by university leaders. Understanding the roles that research development offices and activities play in supporting and improving grant funding success and accomplishing university research goals is critical to organizational decision making. Are research development offices and activities worth the investment of precious university resources? Keeping in mind the goals of their institution, research development professionals can consider the results of the present study in determining the answer to this question.

Authors' Note

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Retraction Notice

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At the request of the author, the following article has been retracted.

Jenkins, C. (2014). Trends in United States Biological Materials Oversight and Institutional Biosafety Committees. Journal of Research Administration. Online First Spring 2014

After an investigation, the members of the Graduate Public Health Academic Integrity Committee of Saint Louis University found instances of plagiarism in the article.



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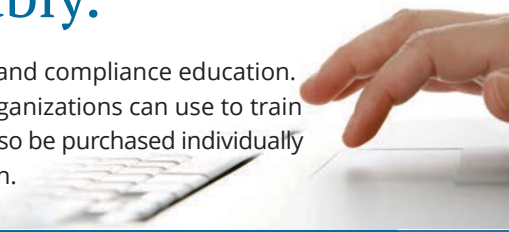

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