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From the Editor’s Desk

Timothy L. Linker
High Point University

The Journal of Research Administration (Journal) is dedicated to stimulating critical thought and creating a space for dialogue to answer pressing questions posed by our evolving field. The Journal continues to seek the best and most illuminating articles for you, our readers. Your success is our success.

Scholarship remains a time-tested method to discover and share what does and does not work. As a burgeoning and ever evolving field, we are most successful when we all engage in the scholarship process, regardless of our job, experience, or background, as everyone offers a unique viewpoint. To that end, the Journal supports those who want to learn more about the academic writing process in two important ways. First, the Journal will offer a free academic writing workshop and allied seminar at the 2017 SRA International Annual Conference. This workshop and seminar will provide instruction and resources in academic writing. Second, the Journal is instituting an academic writing fellowship program. I encourage you to take advantage of both of these opportunities. More information can be found on these programs can be found on the Journal homepage at or www.journalra.org.

As noted in the Fall 2015 issue, the Journal is moving to an open access and electronic distribution platform. This is in an effort to offer the Journal’s insights and content to a wider audience and in a more easily accessible medium. Hence, this will be the last printed edition of the Journal. It is my hope that if you will share this news with your colleagues and visit the Journal homepage. If you are a non-SRA International member and wish to have the Journal delivered to you via email, please send an email with your name and institution to journal@srainternational.org.

Speaking of the Journal’s insights, I encourage you to take a moment and explore the articles and see how they can better your research enterprise. Mulfinger and authors in their paper entitled “Trends in Large Proposal Development at Major Research Institutions” provide a baseline on how major research institutions structure their large proposal development operations. Mounce and authors in their article “Spotlight on Clinical Trial Sponsorship” discuss the Food and Drug Administration regulations on clinical trial sponsorship and how the courts interpreted those regulations in cases of injury claims. Nagy investigates the factors that shape the National Science Foundation’s broader impact activities and offers insights into the strongest predictors of broader impacts activity quality in her article “Determinants of Broader Impacts Activities: A Survey of NSF-funded Investigators.” Finally Philbin and Mallo, in their article “Business Planning Methodology to Support the Development of Strategic Academic Programmes” examine the risks and benefits of establishing new research centers, institutes, and facilities and offer a flexible management framework for the business planning of these operations.

As always, I want to thank the Journal’s Deputy Director, Dr. Nathan Vanderford, and editorial board for their untiring work to bring this issue to print. It is because of them that the Journal continues to flourish.
Editorial

Publishing in the Journal of Research Administration: A Call to Action for all Research Administrators

Tim Linker, CRA, MS, MIS and Nathan L. Vanderford, PhD, MBA

Author Information

Research administrators are critical actors in a complex research enterprise. Too often we do not disseminate our valuable knowledge and the innovative methods and systems that we use to solve complex problems that ultimately allow the research enterprise to move forward. Each of us has unique contributions to our field that should be shared with others, and the Journal of Research Administration is the ideal platform for doing just that.

The Journal of Research Administration is an award-winning, premier, academic, peer-reviewed publication in the field of research administration and management. For 47 years, the Journal has been dedicated to the education and professional development of research administrators and to the growth of the field through its publication of articles covering the evolving research environment and innovation in research administration. The Journal focuses on inclusivity in terms of content, visibility in terms of accessibility to both a national and international audience, and innovation by highlighting original research and novel research administration strategies that inform the field.

With an easy submissions process, including a rigorous and timely peer review, the Journal of Research Administration is the perfect venue for advancing your career, your ideas, and the field.

Being an influencer in one's profession begins by sharing your insight with your peers in order to facilitate learning from each other's practices, strategies, and research. This communication is the primary objective of the Journal of Research Administration: we enable administrators to share their experiences with their peers from other institutions. We encourage our readers to contribute to the ongoing dialogue offered by the Journal to provide a much-needed voice from the administrative perspective while supporting their overall growth as professionals working within the academy.

It is essential to recognize that the benefits of publishing extend far beyond those afforded to scholars and tenure-track faculty. In fact, there are many advantages to publishing as a research administrator. While LinkedIn posts and internal university or departmental publications help one develop a personal brand to some degree, a formal, peer-reviewed publication demonstrates that, more than just a participant, you are an influencer who actively changes and contributes to the field's growth and development. As a soon-to-be open access publication, the Journal of Research Administration ensures that your article will be discoverable by your peers and future employers, thus greatly enhancing your resume both in academia and beyond. As explained by marketing strategist Dorie Clark, "One of the most underused forms of professional development is creating [content]... when you share your knowledge publicly, your expertise can be recognized – and you'll reap the benefits" (2016). Publishing is one of the primary means by which one can contribute to one’s professional development; this trend is evidenced by leaders in a wide range of fields, from CEOs to publishers to human resource specialists.
Your contribution to an academic journal can be equally as significant, if not more, for your environment as it is for you personally. Research administrators are essential members of the research enterprise who both understand the issues faced by the contemporary university, non-profit, and industry environments and speak their languages. This means that you already have the field-specific vocabulary and communication skills needed to write an excellent and effective scholarly article. Additionally, you likely have something incredibly important to say as an influencer within your field. While you may find that key decision makers’ eyes glaze over when you speak up at meetings or that your emails get lost in the administrative deluge, academics and board members tend to have a high degree of respect for professional publications. Contributing an article to a scholarly journal is thus an excellent way to have your voice heard both by your current and future colleagues while contributing to the overall growth of your field. We encourage each of you to consider contributing an article to the Journal in order to benefit your individual career and the profession in general.

Tim Linker is the Director for Research Administration and Sponsored Programs at High Point University, High Point, North Carolina and the Editor for the Journal of Research Administration.

Nathan L. Vanderford is Assistant Professor, Department of Toxicology and Cancer Biology, College of Medicine; Assistant Director for Research, Markey Cancer Center; Assistant Dean for Academic Development, College of Medicine at the University of Kentucky, Lexington, Kentucky and Deputy Editor for the Journal of Research Administration.

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References


Notes

¹ Andrew Kucherav, Founder and CEO of Intechnic, explained that, “The most effective way to be known as an industry influencer is to add value to conversations in your industry” (2015, para. 7). One way “this can be done [is] through contributing articles to niche trade publications” (para. 7).

² In an article targeting university administrators, Professor Milton D. Cox of Magna Publications explained that, “Although only your department chair can say for certain whether your SoTL [scholarship of teaching and learning] project will help you achieve tenure and other career goals, all academics understand the importance of publishing” (2014, para. 8).

³ The American Association of Collegiate Registrars and Admissions Officers, AACRAO, includes publication as one of three key areas essential to professional development for administrative employees in college settings (2013).
A First Look: JRA’s Author Fellowship Program

Carson Harrod, PhD
Baylor Scott & White Health

Deborah B. Derrick, MA
University of Nebraska Omaha

Amy Cuhel-Schuckers, MRE, CRA, GPC
Franklin & Marshall College

The Society of Research Administrators International Journal of Research Administration (JRA) is a valuable resource for research administrators, providing peer-reviewed articles that analyze and improve all areas of our field. Authors who contribute to JRA also benefit personally from sharing their expertise and experiences with the research administration community. This personal benefit can include greater confidence in writing and skills, increased respect from faculty and administrative colleagues, a strengthened resume, and recognition by the broader research administration field.

The Editorial Board of JRA recognizes the values of authorship to both the research administration community and individual authors. To encourage research administrators who may not have experience writing journal articles to submit manuscripts for publication, the JRA Editorial Board wanted to develop an author fellowship program to guide new authors through the process of manuscript preparation. As such, an ad hoc Author Fellowship Working Group composed of three JRA Editorial Board members was tasked with developing an Author Fellowship Program.

As mentioned above, the goal of the JRA Author Fellowship Program is to increase the confidence, capacity, and willingness of research administrators to serve the field and share their expertise as journal or magazine authors. The program provides a mechanism through which experienced authors can serve as peer mentors to aspiring authors who are new to the publishing experience. By providing such support, authors are empowered to share their expertise with others, thereby strengthening the base from which articles can be solicited.

The value to the mentees is clear. They can receive needed support from a published author to guide them in the preparation of a first article, which can lead to increased confidence as well as greater recognition within their institutions and the research administration community. Mentors benefit from sharing their experience in writing and providing guidance to help their mentees increase confidence in writing and developing a first article.

The program establishes a time frame of three to six months for a given mentor/mentee period. After a mentor and mentee have been paired, it is expected that they will develop a mentoring plan that could include a brief outline of what will be accomplished and the timeline to completion.

The role of the mentor is to guide the development of the overall structure and content of an article. Mentors may work with mentees to: 1) develop ideas and concepts leading to an article
proposal, 2) provide guidance on the development of a literature review in support of a proposed topic, or 3) expand an article proposal to a complete draft. The mentor can provide advice on the best publishing venue for the proposed article, literature review sources, draft development, and responsiveness to reviewers’ comments.

At the end of the contracted time frame, both mentors and mentees will be asked to complete a brief survey on their experience that will include a list of outcomes achieved and a request for ideas to improve the mentoring process. Outcomes may include completed literature reviews, article proposals or abstracts for editorial consideration, article drafts, or articles submitted.

*JRA* Author Fellowship Program events will be planned at SRA Annual Conferences. They will serve as a means for mentor/mentee partners to meet and to convene a focus group to further assess the Author Fellowship Program. They will also provide an opportunity for people who are interested in the program to interact with those who have previously participated.

A call for both mentors and mentees will open soon. Those desiring to serve as mentors will complete an application that can soon be found on the *JRA* website. Prospective mentors will indicate their areas of expertise, willingness to work with mentees within the guidelines of the *JRA* Author Fellowship Program, and publication experience. Applications for mentors will be accepted on an ongoing basis.

Prospective mentees will complete a separate application that is also on the *JRA* website. They will describe the proposed article topic, publication experience, and the type of guidance that they are seeking from a mentor. The mentee application, availability of a suitable mentor and, if necessary, a follow-up personal discussion with the applicant will form the basis for selecting mentees. Applications for mentees will be accepted on a rolling basis.

The Author Fellowship Working Group, in collaboration with the *JRA* Editor and Deputy Editor, will administer the program. The Working Group will advise the *JRA* Editor and Deputy Editor of their recommendations for pairing mentors to mentees and make the initial contacts with mentors and mentees. The Working Group will also maintain regular contact with active mentors and mentees to provide assistance as needed.

In year one of the program, up to seven mentor/mentee partnerships will be accepted. A waiting list will be generated for future partnerships.
Information will be available soon on the JRA web site about how to participate in this program as either a mentor or a mentee. Applications forms will also be posted on the web site. Additionally, there will be several opportunities to learn about the JRA Author Fellowship Program at the SRA Annual Conference in San Antonio, Texas (October 22-26, 2016).

- **Saturday:** A Half-Day Preconference Workshop entitled ‘Stepping Stones to Becoming a Peer-Reviewed Journal Author’ (WS2)
- **Tuesday:** A Concurrent Session entitled ‘The Importance and Conduct of Scholarly Writing as Research Administrators’ (T102)
- **Tuesday:** A Learning Cafe entitled ‘Journal of Research Administration Editorial Chat’ (LC6)

The JRA Editorial Board is excited about this new program to help new authors navigate writing a first publication. We encourage people who are interested in preparing a first article and experienced authors who would like the opportunity to guide a new author in this process to learn more about the fellowship program. Should you like more information, visit the JRA website at www.journalra.org or email us at journal@srainternational.org.
Business Planning Methodology to Support the Development of Strategic Academic Programmes

Simon P. Philbin
Enterprise Division, Imperial College London, United Kingdom

Charles A. Mallo
Enterprise Division, Imperial College London, United Kingdom

Abstract: Higher education institutions are often required to design and deliver a range of strategic academic programmes in order to remain competitive, support growth and ensure operations are financially sustainable. Such programmes may include the creation of new research centres and institutes as well as the installation of major new research facilities. These programmes offer significant academic benefits but can often carry commercial risk associated with the major levels of financial investment that may be needed. There is also the need to develop a compelling case to secure the necessary funding. Consequently, this paper provides details of a management framework based on a business planning methodology, which can be applied to support the development of strategic academic programmes. Adapted from the recognised MSP (Managing Successful Programmes) management process, the framework has been explored as part of a case study investigation of a medical research facility. The case study highlights a number of managerial insights across the people, process, technology and knowledge dimensions that are pertinent to the management of strategic academic programmes. The management framework can be adapted to the needs of other organisations involved in the business planning for such complex initiatives.

Keywords: Strategic Academic Programmes, Business Planning, Medical Imaging Facility

Introduction

Universities and independent research institutions can often be large and complex organisations that need to be flexible and adaptable to continuous change (Navarro & Gallardo, 2003). Indeed universities are required to meet the needs of various stakeholders through providing academic services involving the delivery of education and in the case of research intensive universities, this also includes undertaking research. Furthermore, knowledge exchange activities result in the translation of knowledge and research outcomes into commercial benefits for partners or societal benefits for wider stakeholders (Philbin, 2015). In this context universities have increasingly been viewed as occupying a strategic role through stimulating innovation and economic growth through technology transfer and the resulting commercial exploitation of intellectual property (Hughes & Kitson, 2012).

Universities also face a number of challenges. There is increasing pressure on academic budgets, especially on the funding secured from governmental sources. There is an increasing level of
competition in terms of universities competing on multiple levels, e.g. competing for the best students and staff as well as for research funding. There is also a tendency for universities to be engaged in greater levels of performance measurement to underpin effectiveness across research, teaching and knowledge exchange activities (Ter Bogt & Scapens, 2012). But universities are also faced with the opportunities of adopting modern ICT (Information and Communications Technology) to improve the scope and quality of teaching (Selwyn, 2007). Additional educational channels are under development and offered by an increasing number of universities, e.g. through recent developments of MOOCs (Massive Open Online Courses) (Daniel, 2012). Other opportunities could, for example, be associated with responding to major funding calls and setting up multidisciplinary research centres (Philbin, 2011), or establishing new research facilities that bring together academic faculty to focus on a specific industrial requirement or societal need for research, such as healthcare, security or the environment.

In this context, universities need to be able to adapt to emerging opportunities and respond to strategic programme opportunities in an efficient and effective manner. In the case of major opportunities, there will be the need to assemble a supporting business case that underpins the opportunity. The business case will need to sit alongside the academic case for financial support and will jointly be reviewed by the funding body, which could be a government agency, industrial company, charitable foundation, philanthropic source or even the university itself. Development of a business plan for a new initiative requires appropriate commercial competencies in order to ensure a compelling and attractive case can be assembled, which can thereby attract the necessary funding. While companies are experienced in such business planning, in the Not-For-Profit (NFP) and academic sectors there has historically been less of a need for such commercial competencies and capabilities. This is changing, however, and increasingly universities and NFP research organisations are adopting management practices derived from the corporate world (Nickson, 2014). Nevertheless, in our experience we have found there can be certain challenges encountered, especially for strategic academic initiatives. These challenges are summarised in Table 1.

Table 1. Summary of challenges encountered for strategic academic initiatives pursued by universities.

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<td>• An inability to secure sponsorship or capital investment to support the initiative.</td>
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<td>• A lack of a robust business case to support the initiative.</td>
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<td>• Insufficient leadership of the opportunity, either academic or commercial.</td>
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<td>• The need for administration services to rapidly undertake financial and contracts related activities in order for a proposal deadline to be met.</td>
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<td>• Difficulties in the estimation of the true costs associated with the initiative.</td>
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<td>• Inadequate planning leading to difficulties in delivery of the initiative.</td>
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<td>• Difficulty in the effective review of commercial opportunities, which starts from the early conceptual stage and extends through to later stages in the development cycle.</td>
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<td>• Incomplete scope of work leading to the need for extensive change control that may result in cost overrun during delivery of the initiative.</td>
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<tr>
<td>• Insufficient capture of risks and the required mitigation measures needed to reduce such risks.</td>
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Consequently, this paper will describe an approach developed at Imperial College London in the United Kingdom to help support the development of strategic academic initiatives at universities through use of a structured business planning methodology. The framework is introduced and an illustrative case study is described in order to provide readers with insights into the benefits of adopting a structured business planning methodology at higher education institutions. Such a framework can be deployed to support the development of strategic programme opportunities such as new research centres, major infrastructure investment as well as the creation of new academic capabilities to support research and education delivery.

The Need for Business Planning

The process of business planning needs to capture the customer need in a succinct manner and then derive a viable solution and supporting approach in order for the need to be met. Addressing this need involves the deployment of the necessary resources along with management oversight and the costs for such activities need to be ascertained. There is also a need to identify the risks associated with such a business plan and other commercial factors such as the availability of investment capital and the level of competition from other suppliers in the sector. The use of structured methodologies, such as programme management, offers the ability to provide a systematic approach to support the business planning process. Indeed ensuring there is a robust process to support planning can help improve the success of strategic initiatives. Process considerations include the features of the planning stage, human-dimensions of decision-making, managerial and technical skills available to the team—both the internal and external context for the planning as well as the initial and final outcome measures of performance (Bryson & Bromiley, 1993).

In terms of developing strategic initiatives, there needs to be alignment with the relevant organisational strategy, which could be at the corporate, business or functional level (Grünig & Kühn, 2015). This alignment is required to enable the pursuit of new strategic opportunities and to help organizations receive the necessary funding. The development and maintenance of key infrastructure and facilities can be of strategic importance to academic institutions and initiatives that are pursued in order to maintain enterprise-wide research and associated experimental facilities can benefit from the support of standardised and transparent processes (Grieb, Horon, Wong, Durkin & Kunkel, 2014).

The capabilities required for universities to initiate and deliver strategic initiatives, such as new research centres or subsidiary companies, will be associated with the processes adopted as well as the structures and resources that are available. Moreover, business planning can support the decision-making process required for developing such strategic initiatives but while adopting a structured approach to business planning offers clear benefits it should be balanced against the need to avoid becoming overly rigid or bureaucratic (Oakes, Townley, & Cooper, 1998). Indeed business planning has historically been a recognised approach to support new venture creation (Delmar & Shane, 2003), which is highly dependent on being able to articulate the commercial value to be delivered by the venture. Developing a strategic programme at a university needs to capture and articulate the academic (or technical/scientific) and the commercial case, so it is
logical to draw on best practice from the corporate environment but crucially with refinement to
the university/NFP context.

Recognising the best practice and current approaches to programme management as well as
business planning for strategic initiatives, we identified the Managing Successful Programmes™
(MSP) framework (Office of Government Commerce, 2007) as a suitable methodology to
support the development and management of strategic initiatives at Imperial College London.
This was supported by consultations with members of staff at Imperial College on the need for

Table 2. MSP programme definitions and business planning applications for universities.

<table>
<thead>
<tr>
<th>Type</th>
<th>Programme Definition</th>
<th>Business Planning Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision-led programme</td>
<td>Focused on delivery of a strategic opportunity for the organisation and often driven top-down to meet a defined vision.</td>
<td>• Development of a new multidisciplinary research centre at a university.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Establishment of a joint venture company for the delivery of, for example, joint testing or analytical services with another organisation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Development of a new commercial educational initiative to provide university courses through an online platform on an international basis.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Developing a business case for a research services facility in order to respond to a major industrial funding opportunity.</td>
</tr>
<tr>
<td>Emergent programme</td>
<td>Evolves from concurrent, uncoordinated projects where there is recognition that coordination will deliver defined benefits.</td>
<td>• Developing a strategic alliance with an industrial organisation that builds on a set of existing research projects that were previously not coordinated as part of an integrated programme.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Linking together several disparate management accounting systems in order to provide an integrated approach to managing research administration activities across the university.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Establishing a single office to support technology transfer and intellectual property management for a university that previously had such activities carried out separately in different departments.</td>
</tr>
<tr>
<td>Compliance programme</td>
<td>The organisation has to undertake the programme so that compliance is achieved in the context of an external event such as new legislation.</td>
<td>• Implementation of an equipment maintenance system (including additional resources and new processes) in order to respond to new safety legislation relating to the operation of technical facilities.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Establishment of a research compliance office in order to respond to new legal requirements and obligations placed on the university by a major funding body such as a government healthcare agency.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Resourcing of an administration team for international students in order to administer and manage compliance with a new set of immigration requirements and procedures.</td>
</tr>
</tbody>
</table>
an efficient process for the management of major initiatives and also through capturing views on the matter from a range of senior stakeholders at Imperial College. Consequently, we sought to implement the MSP methodology through adapting the standard process model to Imperial College’s requirements for strategic academic initiatives and the process was also streamlined to be aligned with Imperial’s administrative systems and thereby avoid excessive bureaucracy.

MSP is a management standard that has been developed over the last several years by the United Kingdom’s Office of Government Commerce (OGC). This management approach is not derived from theoretical study but has been established through building on the knowledge and experience of practitioners and the approach therefore represents best management practice. The management standard relates a programme to the implementation of a set of related projects to deliver outcomes and benefits associated with the organisation’s strategic objectives. Moreover, a programme is focused on aligning corporate strategy with a delivery mechanism for change in the context of existing business operations, where according to the MSP framework a programme can either be vision-led, emergent or compliance. Table 2 provides the definitions for the three main types of programmes together with a series of illustrative business planning applications for universities according to the three types.

![Figure 1. Overall view of the management framework to support business planning and delivery for strategic academic programmes (adapted from the MSP methodology).](image-url)
Table 2 highlights that there are a range of business planning applications in higher education institutions that can be related to the programme management approach offered by MSP. Adoption of a recognised and structured methodology, such as MSP, offers a university a number of benefits. These include the efficient use of administration resources to support research programmes, effective planning according to recognised best practice for management initiatives, potential to be economical and offering value for money through avoiding duplication of management effort as well as capturing key data and information to support the ethical administration of research programmes.

**Business Planning Methodology for Strategic Academic Programmes**

The management framework to support business planning for strategic academic programmes has been developed through applying the MSP methodology to the academic context and is provided in Figure 1. The framework includes the business planning phase (pre-award administration) and the delivery phase (post-award administration), which together comprise the different stages of the programme lifecycle. The management framework also includes associated governance themes. The ten governance themes describe the different elements required to support the overall process, such as leadership and academic vision, organisational structure, faculty engagement as well as research support and coordination. These governance themes provide the supporting mechanisms to ensure programmes deliver the required outcomes and remain within corporate visibility and control.

In terms of a lifecycle perspective of strategic academic programmes, ideas for new programmes are initially created (initial idea stage), whereupon they are conceptually developed by the
relevant team (programme concept stage). This leads to establishment of the business case for the programme (business case stage), followed by programme development where the programme proposal and business case are refined in more detail (programme definition stage). These four stages represent the wider business planning process as part of the planning phase (pre-award administration) and are summarised in Figure 2.

The business planning phase (pre-award administration) includes the primary outputs for each stage as well as the corresponding stage gate reviews. The process recognises that there may be a need for a previous stage to be repeated subject to the outcome of the relevant stage gate review, e.g. where the funding body’s requirements have changed, or the stage output may be viewed as

Table 3. Key activities according to the main stages of programme management framework (business planning and delivery phases).

<table>
<thead>
<tr>
<th>Stage</th>
<th>Key Activities</th>
</tr>
</thead>
</table>
| Initial Idea (pre-award)     | • This is the preliminary stage where new ideas are driven by university strategy or academic need and created by senior or academic faculty members across the university.  
                                  • Ideas are validated to ascertain academic and commercial potential.  
                                  • There will be allocation and acceptance of responsibility for the validated idea to a designated programme leader.  
                                  • In order for a programme idea to be considered further then it is subject to an initial stage gate review. |
| Programme concept (pre-award) | • At this stage there should be agreement by key stakeholders on the need for the programme and the required trajectory to realise the programme benefits.  
                                  • The programme could potentially pass very quickly from programme concept to business case if there is a clear requirement to carry out the programme together with strong backing from the university’s leadership. Alternatively, there may be a need for more detailed work in the concept stage in order to qualify the programme opportunity.  
                                  • At this stage there should be an initial programme idea that has been communicated to internal stakeholders. |
| Business case (pre-award)     | • This stage turns the concept into a tangible business proposition.  
                                  • A major part of the business case stage involves generating the material to prepare for approval of the programme brief, which is a crucial document that provides background to the programme and defines the expected academic benefits, costs, timescales and risks.  
                                  • The programme brief should clarify what is to be achieved, thereby allowing a management decision to be made on whether the programme is desirable and appropriate as well as a commitment to be made to move to the next stage in the process (programme definition).  
                                  • The programme brief should set out the business case for the programme along with the available business structures, which could, for example, be the incorporation of a subsidiary company, or establishment of a strategic alliance with another organisation (university, company or government agency).  
                                  • There will need to be commercial due diligence on the available business structures and this may require the support of legal advisors as appropriate.  
                                  • As the programme definition stage progresses there will need to be engagement with the eventual funding organisation. To support the interface with external funders, there may be a need for a supporting Memorandum of Understanding (MoU) (or Heads of Agreement/Term Sheet, as appropriate) that sets out the principles for working together as well as the pathway for programme definition.  
                                  • The MoU may be accompanied by a Non-Disclosure Agreement (NDA) allowing all parties concerned to easily share confidential information. These pre-contract documents can also help bind the funding organisation to the emerging programme and they may also help clarify the objectives for developing the programme. |
### Stage | Key Activities
--- | ---
Programme definition (pre-award) | • This part of the process involves development of the detailed proposal documentation in order to secure the funding required to undertake the programme.  
• The programme definition stage will be informed by the programme brief.  
• There will need to be detailed planning around the scientific proposal and this will be led by the principal investigator (PI) with input from other faculty members.  
• Where it is appropriate, multidisciplinary proposals should be developed that draw on the academic strengths from relevant academic departments in order to provide the programme’s funder with the highest quality scientific offering.  
• Programme definition will involve detailed business planning including cost and income modelling. Programme costs should be calculated according to the university’s financial procedures, including costs for staff (namely academic, research and support), students (e.g. PhD) as well as laboratory and computing equipment, materials and other costs as required. Aropriate overhead calculations will also need to be carried out.  
• Typically the programme definition stage will need to include preparation of an outline programme management plan, including a programme schedule for the main programme activities and milestones. This will extend to the programme risk register that identifies the risks in terms of impact and likelihood along with mitigation measures and risk owners.  
• The programme’s governance arrangements need to be considered. There may be a need for appropriate boards of management (such as a strategic advisory board, or operations board) as well as programme reporting arrangements and any relevant performance measurement system such as the balanced scorecard.  
• Within programme definition there will need to be continued engagement with the potential funders of the programme as well as comprehensive due diligence of the proposed contractual framework.  
• The terms and conditions of the contract will be reviewed for acceptance to the university’s commercial requirements and in particular those relating to the allocation of intellectual property rights (IPR).  
• In order for the programme to move ahead there will typically be submission of the proposal plan including the business case, scientific proposal and any accompanying documents to the sponsoring organisation(s).

Programme delivery (post-award) | • Programme delivery takes place once funding has been approved and supporting contractual documentation has been signed by all the relevant parties.  
• Delivery will involve implementation of the programme management plan through appointment of the required staff and in particular there will need to be appointment of the principal investigator of the programme.  
• Programme benefits are realised as identified in the programme plan to be delivered incrementally over the programme’s delivery period so as to avoid an apparent lack of progress in the initial stages.  
• Programmes should preferably be structured to deliver ‘quick wins’, e.g. setting performance milestones for the recruitment of staff, or for the commencement of initial research or education activities. Then, over a longer timeframe other benefits should be realised, whether commercial or academic, such as establishment of new facilities, publication of research results in scientific journals, or negotiation of licensing agreements with industrial companies.  
• During the programme delivery stage there should be periodic review by the programme delivery team (and externally where appropriate) of the programme to check on progress, evaluate benefits realised, make adjustments as well as learn and decide on appropriate action, including eventually programme closure.

Programme closure (post-award) | • Upon completion of all programme activities, or following a strategic decision by the university (with other stakeholders involved as appropriate), formal closure of the programme will be undertaken.  
• It is suggested that a suitable programme exit plan is developed during programme definition so that programme closure can proceed smoothly if required.  
• In the case of subsidiary or joint venture companies, care will be needed to minimise the university’s financial exposure.
not being acceptable or not of the required quality standard. Once the necessary funding has been secured, programme delivery commences and this involves delivery of the capability alongside realisation of the programme's academic benefits (programme delivery stage). Upon completion of all programme activities the programme is formally closed (close programme stage).

Table 3 provides supporting details on the key activities to be carried out for all six stages (both pre- and post-award administration), although it is recognised that business planning refers only to the pre-award administration stage. These key activities are described in order to provide practitioners with greater insight into how the business planning methodology can be adopted in their own organisation. Application to a given organisation should however take account of the local environment as well as management needs and hence the specific activities would need to be adapted as required.

**Case Study Investigation**

*Introductory Comments*

The case study investigation involved the business planning for a medical imaging facility at Imperial College London in the United Kingdom. The case study is based on the experience of the authors who were directly involved with the programme through being part of Imperial’s Enterprise Division. The division is responsible for providing business development, programme management, commercial planning and support to faculty members across Imperial College and this includes the development of industry funded research projects, European Union funded consortium research projects as well as strategic academic programmes such as new research centres and institutes. The following case study is provided for illustrative purposes. The findings are reported through a process of reflective inquiry (Schön, 1983) by the authors and where appropriate, representative data and information is included to provide further context. The case study highlights the practitioner benefits of utilising the management framework to support the business planning for the development of strategic academic programmes that are pursued by a university or NFP research organisation.

*Need for Medical Imaging*

The medical research imaging facility includes PET-CT (Positron Emission Tomography–Computed Tomography) and MRI (Magnetic Resonance Imaging) scanning equipment and the initiative related to a requirement to upgrade the facility so that academic research could be carried out on the imaging equipment. PET-CT is a medical imaging technique that combines through a single system a PET (Positron Emission Tomography) scanner and an X-ray CT (Computed Tomography) scanner. This allows images to be taken sequentially from both scanners to build up a co-registered image. The PET imaging involves the patient receiving a small dose of a radioactive tracer, e.g. fluorodeoxyglucose or FDG protocol. The scans provide an image of how the tracer is processed by the body, where the PET-CT technique is based on the use of X-rays to generate images of the body. Conversely, MRI is an imaging technique that produces detailed anatomical images but without the need for radiotracers. An MRI scanner uses magnetic fields and radio waves to form three-dimensional images of the body. For further reference, Suetens
(2009) provides details on the fundamentals of medical imaging. Both MRI and CT scanning are increasingly used in the provision of modern healthcare services and this is illustrated in Figure 3, which highlights the growth in numbers of clinical imaging tests in England from 1995-96 to 2013-14. This data from National Health Service (NHS) England (2014) identifies that the rate of average annual growth over last 10 years for CT and MRI has been 10.1% and 12.1% respectively.


**Development of Imaging Facility**

The programme involved refurbishment of the facility so that it could be used to support the research needs of academic faculty members at the university. The initial idea was identified by senior staff at the university and this was communicated to Enterprise Division so that the business planning work could be initiated. The preliminary assessment of the programme opportunity was carried out and this highlighted the academic needs for the programme as well as the commercial potential. The programme then transferred to the programme concept stage, whereupon more detailed planning was carried out on the scope of the programme as well as the academic benefits. At this stage, a programme steering group was assembled. The steering group was a multidisciplinary team representing different functional areas, such as senior management, finance, facilities management, health and safety as well as general administration.

During the concept stage there was also allocation of a limited amount of internal funds to support an engineering feasibility study that was required in order to ascertain the overall costs.
of the main refurbishment and upgrade works. At the first meeting of the steering group, there was discussion on the work packages of the programme, namely the engineering feasibility study and the business case development. The feasibility study was required to determine the total programme costs for upgrading the facility and the business case was needed in order to derive the likely revenues to be generated by the facility through providing an imaging service to members of the academic faculty. After this initial meeting of the steering group, the programme transferred to the business case stage.

Knowledge Dimensions of the Case

The business case was dependent on developing an improved understanding on how the clinical scanning facility would complement other facilities operated by the university, thereby allowing an overall view to be established for the entire scanning services offered across the university. Knowledge was generated on the clinical research areas to be investigated through use of the enhanced medical scanning facility. This knowledge was obtained from a series of academic faculty consultations with leading medical research practitioners across the university’s various hospital campuses. Data and information was also acquired that related to the operation of the medical scanning equipment including operating conditions, throughput levels and maintenance regimes. Plus, information relating to sponsor needs was obtained, including potential funding opportunities with research councils and charitable foundations. Table 4 provides a summary of the medical research areas that would be accessible through use of the upgraded medical imaging facility, which were identified during the consultation meetings with faculty members.

Table 4. Summary of medical research areas accessible through use of the upgraded medical imaging facility.

<table>
<thead>
<tr>
<th>Medical Research Area</th>
<th>Description</th>
</tr>
</thead>
</table>
| Neuroscience          | • Investigation of the nervous system, including molecular and cellular research of nerve cells as well as imaging of brain functions.  
                        • For example, use of clinical imaging to improve understanding of Parkinson’s disease, dementia, movement disorders and multiple sclerosis. |
| Pharmacology          | • Investigation of the biological action of drugs.  
                        • For example, use of clinical imaging to understand the drug action pathways in order to improve the treatment of diseases of the central nervous system (CNS). |
| Oncology              | • Investigation of tumours and cancer, which involves abnormal cell growth that occurs in a particular part of the body and which results in cancerous cells destroying surrounding healthy tissue and organs.  
                        • For example, use of clinical imaging to monitor the response of cancerous tissue to therapeutic treatment regimes. |
Programme Lifecycle Management

Once the business case had been assembled for the enhanced facility and as part of the next stage in the lifecycle, the programme definition stage was undertaken. This involved more detailed financial modelling on the expected level of revenues for the facility that was related to the medical research areas identified in the business case stage. Revenue modelling also included a number of financial scenarios, including the so called best-case scenario (high level of revenues), worst-case scenario (low level of revenues) and base-case scenario (medium level of revenues). This form of financial scenario planning allowed probability factors to be applied to the various sources of funding so that a reasonable estimate could eventually be made through the base-case scenario that took account of the relative levels of risk (and corresponding probability) for each source of funding.

For example, in the scenario where a research programme has already been awarded by a medical research charitable foundation, this was viewed as a low risk source of funding corresponding to a high probability that there would be funding made available for imaging research on the upgraded facility. Whereas, in the case where a research proposal was to be submitted to a pharmaceutical company that had yet to make a decision on programme funding, this was viewed as a high risk source of funding and a corresponding lower probability that there would be funding made available for imaging research on the upgraded facility. Programme definition allowed the full business case to be prepared for the programme, including academic and technical aspects as well as commercial and business considerations. The funding proposal was submitted to the university’s management board and after careful consideration the programme’s capital expenditure (CAPEX) was approved.

Programme delivery took place after the allocation of programme funds and this involved the upgrade of the facility so that the required medical research could be undertaken using the imaging equipment. This stage proceeded smoothly and included the various engineering works, such as upgrades to the M&E (mechanical and electrical) services as well as installation of additional pieces of equipment. The facilities were tested for effective operations and subsequently opened for use as a medical research imaging facility at the university. Programme closure involved the facility being handed over from the engineering team to the academic department so that medical research studies and imaging activities could commence. Finally, programme finances were reconciled with all outstanding payments met and other programme administration activities completed allowing formal closure of the facilities development programme.

Managerial Insights from Case Study

A number of managerial or practitioner-related insights can be drawn from the case study that involved implementation of the programme management framework and these are summarised in Table 5. The insights are described in terms of the people, process as well as technology and knowledge dimensions.
### Table 5. Managerial insights from the case study investigation.

<table>
<thead>
<tr>
<th>Area of Consideration</th>
<th>Managerial Insights</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>People</strong></td>
<td></td>
</tr>
<tr>
<td>- The medical research facility was a strategic academic programme for the university that required senior level oversight and eventual approval by the university’s management board. It was therefore essential that senior stakeholders, including senior academic and management staff, were involved in the programme from the outset through to completion.</td>
<td></td>
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<tr>
<td>- The programme steering group benefited from being a multidisciplinary team that represented all the key functional areas that needed to be engaged through the programme lifecycle. This meant that the key internal stakeholders were engaged in the programme from the outset, thereby helping with governance of the programme as well as compliance with the university’s various protocols related to research facilities.</td>
<td></td>
</tr>
<tr>
<td>- The individual consultation meetings that were held with academic faculty members needed to be carried out in a highly structured manner in order to ensure the medical research needs for the facility were properly captured. Such meetings should ideally be conducted in an open and transparent manner to build trust. These meetings also provided the opportunity to highlight the research capabilities of the facility to be upgraded, thereby building a pipeline of potential work for the medical research facility.</td>
<td></td>
</tr>
<tr>
<td><strong>Process</strong></td>
<td></td>
</tr>
<tr>
<td>- Adapting the MSP methodology to the academic setting provided a clearly defined and structured approach that was used to guide the business planning work required for the medical imaging programme.</td>
<td></td>
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<tr>
<td>- Engineering risks were identified at an early stage in the overall process through the feasibility and design study that was carried out. These risks were mitigated through appropriate measures so that the programme could be completed in the required timeframe and according to the overall academic needs for the facility.</td>
<td></td>
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<tr>
<td>- Business case development through financial scenarios based on different levels of revenue generation for the upgraded facility supported the decision-making process and thereby helped senior management to weigh up the costs and benefits for the new facility. Process-driven management approaches also help give confidence to senior management that all the required factors have been properly identified when considering substantial CAPEX decisions.</td>
<td></td>
</tr>
<tr>
<td><strong>Technology and knowledge</strong></td>
<td></td>
</tr>
<tr>
<td>- Both the business planning and delivery phases should be supported by appropriate ICT (Information and Communications Technology). This may include use of the university’s ERP (Enterprise Resource Planning) system as well as standard tools, such as those from the Microsoft™ suite of products, such as MS Excel, MS Access, etc.</td>
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</tbody>
</table>
This paper was established in order to support the business planning and development of such initiatives. Moreover, the ability for such organisations to be able to adapt to changing circumstances and drive forward strategic academic programmes is likely to be a major indicator of success in the future.

As distinct from smaller scale research projects, strategic academic programmes are complex initiatives that require coordinated development. This complexity can be associated with a range of factors, such as the need for complicated legal arrangements, company formation, an international dimension, multi-department involvement, or a high-level partnership leading to significant funding. For example, this could include a high-value research programme enabling creation of a new centre or institute, or alternatively there could be development of the business case to support a new joint venture (JV) company, or an overseas campus initiative. In addition to the potential higher academic and commercial benefits, these programmes often carry an enhanced level of risk, for example, involving financial risk in the delivery period, or the possibility for the university’s brand to be tarnished. The management framework described in this paper was established in order to support the business planning and development of such strategic academic programmes and to help manage the significant complexity that often arises with such programmes.

### Area of Consideration

<table>
<thead>
<tr>
<th>Technology and knowledge</th>
<th>Managerial Insights</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• The case study also required the use of programme-specific technologies and this included the various diagnostic and testing systems used to collect environmental data on the facilities as part of the engineering facilities work package. The technical team also employed various clinical related technologies associated with scanning equipment. Such technologies should be driven by the specific needs of the programme and will clearly be different for different types of programmes. • In order for the programme to be effective, it will need to generate the required knowledge and this data and information is needed to inform the business planning phase. In the case study this included the knowledge generated on clinical research areas (namely neuroscience, pharmacology and oncology) that would be investigated through use of the medical scanning facility. A supporting culture of sharing such information is also desirable. Access to such knowledge is therefore a crucial factor in regard to the success of business planning and eventual delivery of complex academic programmes.</td>
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</table>

### Concluding Remarks

Universities and NFP research organisations face a number of challenges that include responding to increased pressure on funding and budgets as well as increasing levels of competition for funding and the recruitment of leading faculty. These challenges are, however, accompanied by various opportunities such as those presented by adopting different forms of ICT in regard to educational delivery as well as opportunities related to establishing major new research initiatives. Moreover, the ability for such organisations to be able to adapt to changing circumstances and drive forward strategic academic programmes is likely to be a major indicator of success in the future.
The programme management framework was developed through adapting the MSP methodology to the academic setting in order to derive a structured approach that is based on best management practice. This programme lifecycle approach is based on a stage-gate process that involves the business planning phase (including the initial idea, programme concept, business case and programme definition stages) and the delivery phase (including the programme delivery and programme closure stages). This framework provides a robust approach to support the business planning required for strategic academic programmes, including the so called vision-led, emergent and compliance type programmes.

The case study investigation reported in this paper highlights the utility of the programme management framework to support the business-planning phase for an enhanced medical research facility. The imaging facility includes PET-CT and MRI imaging equipment that can be used to support various medical research areas, such as neuroscience, pharmacology and oncology. Implementation of the programme management framework will be highly dependent on the people, process as well as technology and knowledge dimensions of a given a strategic academic programme. A supporting culture that promotes sharing of knowledge across the programme is also an important factor to the success of such programmes. Although the methodology provided in this paper provides an overall route map to help practitioners design and deliver major new academic programmes, the individual activities carried are contingent on the specific organisational context and the needs for a particular programme. Nevertheless, the programme management framework can be adapted to the needs of other universities and NFP research organisations as needed.

Future work is suggested on applying the programme management framework for business planning to other strategic academic programmes, such as the creation of multidisciplinary research centres and institutes or the creation of a new spin-out company arising from the commercial exploitation of intellectual property. Such applications would further highlight the practical benefits of adopting a structured business planning approach to the development of strategic academic programmes that support the growth and financial sustainability of university and NFP research organisations.

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Trends in Large Proposal Development at Major Research Institutions

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Abstract: Research administrator interest in large research proposal development and submission support is high, arguably in response to the bleak funding landscape for research and federal agency trends toward making more frequent larger awards. In response, a team from Penn State University and Huron Consulting Group initiated a baseline study to determine how research-intensive academic institutions are structured to provide large proposal support, with the aim of identifying support factors that are impactful on proposal success as defined by funding being awarded. The first step in this process was the development, administration and analysis of a survey on large proposal support and success rates. This first survey of large proposal support structures, support services, and associated metrics was completed by 20 of the top 100 research institutions as determined by rankings from the 2013 Higher Education Research Development Survey (HERD) as reported by the National Science Foundation. Conclusive findings are: 1) A decentralized College/Department/Center model is the most commonly used large proposal support model; 2) Different large proposal support models have similar criteria in selecting proposals to be supported, the most common of which is awards equaling or exceeding $1M; and 3) Institutional setting is a factor in success rates for larger proposals more than smaller proposals as evidenced by greater variability in these rates.

Keywords: Large Proposals, Proposal Success Rates, Proposal Administrative Support, Research Development, Research Administration Organizational Structure, Team Science
Introduction

Institutional change scholars rely on social psychology constructs, principles or models for designing organizational change strategies. Focusing on an understanding of the psychological basis for changing an individual mindset or managing the dynamics of a group, change scholars often develop tools that equip change agents to effectively engage institutions and steward the change process (Eisold, 2005; Gardner, 2006; Morgan, 1997). Both internal and external challenges can drive the institutional necessity for change. For institutions of higher education a legal mandate, such as, legislation, statutes, other policies and court decisions, serve as major external drivers of change bearing serious institutional risks including fines, non-fiscal punitive measures, loss of prestige and privilege, and public criticism.

Despite the high liability for higher education institutions, change scholars have yet to create a tool for implementing legally mandated change. Ideally, a tool that facilitates institutional compliance while minimizing legal liability would remedy this omission. Currently, institutions facing a changing legislative landscape must respond on a policy-by-policy basis to develop adequate plans. Each institution runs the risk of making changes that may not embed in institutional practices and result in non-compliance. Institutional non-compliance can manifest in several ways: by misinterpreting the law, by ineffectively implementing the law, or by failing to guide institutional enforcers of the law (Kern, 2014; Lipsky, 2010). Creating a remedy requires a solution that addresses each of these risks and removes barriers to effective change from a human behavior perspective.

Background

The Highly Competitive Funding Environment

The National Science Foundation (NSF) recently reported to the National Science Board (NSB) that the number of all proposals acted upon from 2001 to 2013 increased by 53% while the percent of submissions receiving awards (i.e., proposal success rate) over the same period decreased by 9% (National Science Foundation, 2014c), as reported by the NSF Enterprise System. In the same report a similar trend in research awards was noted for the same 2001-2013 period, showing a decrease in success rate of 27% in 2001 to 19% in 2013. NSF noted to the National Science Board that some specific factors (e.g., increase in mean award size and budget changes such as the Budget Control Act of 2011 and American Tax Payer Relief Act of 2012) affected the number of new awards that could be made in 2013 which resulted in a 5% decrease from 2012 to 2013. The overall increase in the total number of awards since 2001 is one story, but the decrease in proposal success rates (those acted upon by NSF) tells another. Although the American Recovery and Reinvestment Act (ARRA) of 2009 provided some temporary relief to the downward trend in funding rates at NSF (boosting the rate to 32% in 2009), this impact was short-lived (NSF, 2014a; 2014c).

A similar funding history is seen at the National Institutes of Health (NIH). While current budget discussions portend hope for a significant budget increase for the NIH in the near future, this agency has seen an overall drop in proposal success rates of more than 14 percentage points
between 1999 and 2013. In 1999, the overall success rate for all types of awards was 34% and this reached an all-time low of 18% in 2013 (NIH, 2014). ARRA had much less of an impact at NIH. Here the biggest drop in success rates occurred between 2003 and 2004 (a 32% to 26% drop), concurrent with the end of the historic annual budget increases that doubled the NIH budget between 1998 and 2003 (Smith, 2006).

Large Research Proposals and Team Science

The second factor impacting the size of grant requests and awards has been increased emphasis by funding agencies on collaborations across scientific disciplines, as reflected by an increase in multiple principal investigator (multi-PI) grants (including centers and other multi-year programs) and larger average award sizes. At NSF alone, the number of awards in both single PI grants and multi-PI grants has increased 4.8% and 18.6% respectively between 2004 and 2013 while the success rate of multi-PI grants has remained mostly unchanged with a slight decrease from 18% to 17% (NSF, 2014c). This impressive shift to larger and multi-PI research grants is even more prevalent at the NIH where the number of multi-PI grants has grown by two orders of magnitude from 2006 to 2013 (National Research Council Committee on the Science of Team Science, 2015). Therefore, the opportunity for this larger proportion of multi-PI grants is available and is just as competitive as it was more than 10 years ago. These multi-PI programs are especially attractive to research institutions not only because they are large dollar amounts per award, but most also cover a longer lifespan (5-7 years) compared to typical single investigator grants (2-3 years). This provides a certain level of economic stability not available with singular, smaller grants. Validation for this increased emphasis on team science is provided by a 2014 study by Stipelman et al. (2014) in which the impact of team-based transdisciplinary research was shown to have more rapid and broader impact across the science community than investigator-initiated programs.

Team Science approaches to research is clearly a developing trend among academic researchers. The trend is reflected in the nature of both publications and grants. A co-authorship analysis of articles published in three leading science journals (Nature, Proceedings of the National Academy of Science USA, and Science) shows a steady increase since 1958 in the number of authors per publications, extrapolating to a predicted average of 19 co-authors per publication by 2040 (Pavlidis, Petersen, & Semendeferi, 2014). While some agencies like the National Science Foundation (NSF) has long recognized multiple principal investigators on grants, The National Institutes of Health (NIH) formalized this multi-PI status in 2007 (NIH, 2006). NIH currently gives about a fifth of its external awards to projects with multiple PIs, and some suggest this trend could and should grow at the NIH and other funding agencies in the coming years (Chronicle Staff, 2014).

As team science seems to be blossoming, agencies have responded by making more large awards (Figure 1). Between 2000 and 2014 (U.S. Office of Management and Budget, 2014), a general trend toward more awards in either or both the $1-$5M and $5M-$25M ranges can be seen across at least four major agencies: NIH, NSF, USDA [US Department of Agriculture] and DoD [Department of Defense]. It is apparent that, despite often being affected by federal budgeting delays, economic policy change, and special initiatives such as the 2009 American Recovery
and Reinvestment Act, both trends and special windows of opportunity (e.g., DoD and DoE [Department of Energy] in 2010) are obvious for five of the six major agencies explored, even when award sizes are adjusted for inflation.

Anecdotal evidence suggests that research administrator interest in the topic of large research proposals is high—arguably in response to the trends described above. Feedback obtained at a session of a major research administrator conference (Dressler et al., 2014), a related webinar, and additional informal conversations around the topic of large proposal development provided anecdotal evidence that support for large, multi-investigator proposals was seemingly heterogeneous. An obvious question of interest for this group is whether evidence exists that specific support models impact proposal-funding success. Thus, a team from Penn State University

and the Huron Consulting Group developed and administered a survey to better understand the models that are being used to support these large, multi-investigator proposals. Many studies have been performed on the science of team science with the most recent comprehensive study published by The National Research Council Committee on the Science of Team Science in 2015 that focused on opportunities to enhance the effectiveness of collaborative research in science teams, research centers, and institutes. While typical science of team science studies such as this one focus on the teaming aspect of these groups, this study focused specifically on proposals submitted by such teams for large proposals. In this way, our research is complementary as this is one of many activities these teams perform in their pursuit of research and education outcomes.

Institutional Responses to Changes in the Funding Climate

A seminal study of the characteristics of research administration infrastructures at colleges and universities was conducted in 1996 by a team from Oak Ridge Associate Universities (ORAU) (Baker & Wohlpart, 1996). The ORAU study was a survey of 80 institutions that represented a wide range of Carnegie Classifications (Carnegie Commission on Higher Education, 1973) from Research 1 (R1) to Master’s 1 (M1). While some changes have occurred in the research administration landscape over the past 20 years, the Carnegie Classification and NSF-reported Higher Education Research Development Survey (HERD) expenditures continue to be important institutional characteristics reflecting mission and size. Because R1 institutions can be expected to more frequently submit large proposals, institutions from this category were chosen as the focus for this first exploration of large proposal support, and total HERD expenditures was used as an indicator of the relative size of an institution’s research enterprise. The ORAU survey explored many of the same or similar specific features of “Office Functions” and “Office Resources” but without differentiating the type or extent of services specifically devoted to large proposals as is the intent of this study.

The Penn State/Huron survey was designed with input from researchers and research administrators to determine how large proposals are being supported at different research institutions. The survey had two main objectives: 1) to characterize the heterogeneity of large proposal support models, and 2) to determine if there is a relationship between funding success rates and proposal support services or the models themselves. Three working hypotheses regarding successes in objective 2 tested by this survey included: 1) Research institutions with centralized, dedicated Research Development Offices (RDOs)/Large Proposal Offices (LPOs) are more successful at submitting large proposals and having large proposals funded; 2) A relationship exists between the number of dedicated RDO/LPO staff full-time equivalents (FTEs) and the success of large proposals; and 3) Research institutions with RDOs/LPOs have a higher award rate for large proposals than those without RDOs/LPOs.

The support models included LPO offices, LPO-type activity across different units, and combinations of support elements that can range from fully centralized to fully decentralized. In any case, the focus of this study was whether an institution supports strategic proposals any differently than other proposals, and if so, how. Success was measured as the percent of submitted proposals that were ultimately funded by the target agency (i.e., funding rates).
Methods

The survey content was developed through three main steps: 1) A six-member Penn State/Huron research team developed a draft survey based on team knowledge and experiences in research administration at multiple institutions; 2) The survey concept was shared at NCURA 2014 in a discussion session; and 3) A focus group was held by videoconference to solicit input from research administrators representing eight large institutions. Upon development of the draft survey in step one, the survey and research project plans were submitted to the Penn State Office for Research Protections for review and the project was determined to be exempt from Institutional Review Board review requirements (IRB #44907).

An important function of the survey focus group was to provide input on the definition of large proposal. For the purpose of this survey, the consensus of the focus group was to define large proposals as having two or more of the following attributes: 1) requesting funding totaling more than $1M per year, 2) involving more than two collaborating research institutions (i.e., subawards, federal laboratories/partners, industry partners, sites, or other), 3) involving two or more internal university departments participating in the proposal, or 4) responding to a funding opportunity for which submissions are limited by the funder. A fifth attribute identified as being able to function singularly as defining a large proposal was one that is requesting support for an activity that has been designated as strategic by the institution. The focus group also refined the large proposal support model definitions.

After the survey was adjusted according to feedback, an invitation to participate was distributed to senior administrators at the top 100 Research and Development (R&D) expenditure institutions, as reported by NSF for 2013 (NSF, 2014b). The top 100 were selected as a sample group because of the higher probability that they regularly submit large proposals, have established tracking systems, and have considered purposeful mechanisms for supporting such efforts. The survey was executed online using Qualtrics and managed by professional survey staff at the Penn State Survey Research Center.

Data

Survey participants were assured that the research team would not share the identities of the participating institutions and that published reports would avoid the inclusion of data that potentially could be used to identify individual institutions.

Following completion by the participants of the online survey, a data cleansing step included research team contact by telephone conference with each responding team to ensure that the survey questions were interpreted consistently across the participants and to verify input. These contacts used a standardized set of data follow-up questions. Subsequently, minor adjustments (e.g., adjustments to number of faculty, correction to R&D expenditures reported, inclusion of overhead when estimating proposal or award value) were made by a portion of institutions. Data and analysis in this report are inclusive of those minor adjustments. Importantly, none of these adjustments had significant effects on the reported results as the result of their inclusion.
Institutions were invited to report on either FY 2012 or FY 2013 depending on the window for which they could provide the most recent complete data. ARRA-funded projects were included if present in reported expenditure data for both of these fiscal years, but would not impact the success rates for either 2012 or 2013 because those awards were made only in 2009 and 2010. Because expenditure reporting was used only as a surrogate for institutional size, it is not viewed as a confounding factor for analyzing survey data on success rates and proposal support during the 2012-2013 timeframe.

**Table 1. Large Proposal Support Models**

<table>
<thead>
<tr>
<th>Model 1 - VPR Office</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The Sponsored Projects Office (SPO) handles the submission of the large proposals but staff members in the Vice President/Provost for Research (VPR)’s Office give special attention and support to proposals that fit within the definition of “large proposal.”</td>
</tr>
<tr>
<td>2. The VPR Office may also support proposals that are designated as strategic or that require some sort of internal selection process because applications from an institution are limited.</td>
</tr>
<tr>
<td>3. The VPR Office staff may not be supporting the whole proposal development process, and may be only managing or assisting with portions of some of the proposals or other internal factors such as internal selections or formation of collaborative teams.</td>
</tr>
<tr>
<td>4. A variation may include a VPR Office that has hired a proposal developer as part of their office to assist with the development of proposals.</td>
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<tr>
<th>Model 2 – General Staff in SPO (G_SPO)</th>
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<tbody>
<tr>
<td>1. “Large proposals” are handled in the same fashion as any other proposal proceeding through SPO for submission.</td>
</tr>
<tr>
<td>2. Proposals are not assigned to any particular individual but are assigned in the same fashion as all proposals.</td>
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<tr>
<th>Model 3 – Colleges, Departments &amp; Centers (CDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A “decentralized” model exists where proposal development occurs within the departments, centers, etc., and the SPO function is limited to the review and certification of the final submission.</td>
</tr>
<tr>
<td>2. A variation may be a system in which SPO handles the development of most proposals, but a specific center or department may have an in-house team devoted to developing and supporting “large proposals” for their particular area of expertise.</td>
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<tr>
<th>Model 4 – Special Unit or Staff in SPO (S_SPO)</th>
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<tbody>
<tr>
<td>1. SPO employs individuals who specialize in the development and submission of “large proposals.”</td>
</tr>
<tr>
<td>2. Large proposal support staff report directly to the head of SPO through the normal SPO chain of authority.</td>
</tr>
<tr>
<td>3. The large proposal experts may or may not have been specifically hired as such and may have gained expertise through handling “large proposals” through various years of submission; or they may have specifically hired as expert grant writers or technical writers but are working within the SPO hierarchy.</td>
</tr>
<tr>
<td>4. The key distinction of this model is that large proposal staff report through SPO and not a separate entity.</td>
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<tr>
<th>Model 5 – Independent Office (LPO)</th>
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<tbody>
<tr>
<td>1. This office is a named entity separate from SPO and other units that handles proposal development and/or submission for “large proposals” for other units.</td>
</tr>
<tr>
<td>2. The office may or may not have its own authorized organizational representative (AOR) who can submit proposals on behalf of the institution so there may still be a connection with the SPO at the institution.</td>
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</table>

<table>
<thead>
<tr>
<th>Model 6 – External Consultant (EXT_C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The Institution has an established practice of hiring external consultants as a technical or grant writers or in some other capacities to support the development and submission of “large proposals.”</td>
</tr>
</tbody>
</table>
Proposal support data were differentiated among six models (Table 1) as determined by feedback from the NCURA 2014 conference and the pre-survey pilot group. James et al. (2015) described the six models in more detail—they reported that models may not be all-inclusive but were meant to capture the heterogeneity of support infrastructure, known to this team, and the pre-survey feedback mentioned previously. Institutions can employ a multitude of models for large proposal support that includes elements from different models. For example, an institution may offer support functions that are both centralized (Model 1) and decentralized (Model 3) as their approach. A summary of model definitions is provided below and may also be found in James et al. (2015) where the models below were used to develop a conceptual model.

Results

Participating Institution Demographics

Twenty respondents from the 100 invited top-ranked research institutions (NSF, 2014b) provided partial or complete responses to the survey. The 20-institution sample was diverse with respect to the institution types and classifications represented by the overall top 100 from the 2013 HERD survey to the extent reflected by Table 2. The mix of public and private institutions was very similar.

Table 2. Institutional characteristics of survey participants and the top 100 institutions as ranked by 2013 research expenditures.

<table>
<thead>
<tr>
<th>Institutional Characteristic</th>
<th>Survey Participants</th>
<th>Top 100 R&amp;D Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carnegie Classification: RU/VH (research universities – very high research activity)</td>
<td>95%</td>
<td>84%</td>
</tr>
<tr>
<td>Members of Association of American Universities (AAU)</td>
<td>70%</td>
<td>54%</td>
</tr>
<tr>
<td>Public non-profit</td>
<td>65%</td>
<td>66%</td>
</tr>
<tr>
<td>Private non-profit</td>
<td>35%</td>
<td>33%</td>
</tr>
<tr>
<td>SPEC/MED (medical schools and medical centers)</td>
<td>5%</td>
<td>11%</td>
</tr>
</tbody>
</table>

Proposal Success Rates by Award Size

Reported proposal funding success rates were requested across four dollar ranges defined by $250K steps up to $1M. These results are summarized in Figure 2. Not surprisingly, a clear trend is evident for a lower mean funding rate as proposal values increase. Of interest, however, is that the larger range of institutional success rates seen for the category of proposals above $1M is larger than for any other category. This uniquely larger range might be indicative of institution-specific variables that impact proposal success in this size range more than in the lower ranges.
Institutional Expenditures and Proposal Success Rate

Noting the different average and variability in success rates for proposals over $1M, the survey data was next analyzed to determine if the size of the research funding base of the respondent institutions might correlate with proposal success.

As a standardized metric for institutional size and research funding, institutions were asked to provide the amount total of research expenditures reported to NSF for the HERD reporting year corresponding with their other reported survey data (FY2012 or FY2013) (NSF, 2013; 2014b). To provide anonymity, the expenditure number was then converted to a Relative R&D Expenditure Percentage based on the highest reported institutional spending level (i.e., the institution with the highest reported spending level has a 100% relative R&D expenditure). Based on this metric, success rates at the >$1M proposal size as well as across all award sizes were explored to determine any association with institutional relative R&D expenditures (Figure 3). A low, but positive correlation with R&D expenditure level was noted across the survey respondents for awards >$1M (Figure 3A; note the positive slope with $R^2 = 0.1845$) (NSF, 2013; 2014b). However, no positive correlation was evident between success rates of all proposals (i.e., any award size) and relative R&D expenditures (Figure 3B; note the negative slope). The correlation of expenditures with success rates for awards over $1M (Figure 3A) but not for awards in general (Figure 3B) suggests that institutions with larger expenditures may be doing something differently to facilitate large proposal success. Moreover, the lack of strong $R^2$ suggests that expenditure rates is not the only variable and that a closer look at other institutional characteristics is warranted in order to determine a formula for success and, thus, validated the need to look at other survey variables.
Figure 3. Award success rates as function of A) the percentage of awards greater than $1M and B) total institutional expenditures.
Support Model Types and Funding Rate of Proposals

The next step of the data analysis was to look for correlation of proposal success rates for any of the six models for large proposal support reported by institutions. Table 3 shows results for 20 participant institutions in order of overall proposal funding rates. Included are their institutional ranking within the survey sample based on R&D expenditures (i.e., relative R&D expenditure ranking), their funding rates for two larger proposal categories ($750K-$999K and >$1M), and their LP support models. When analyzed with respect to >$1M funding rates, there is clear heterogeneity in support model infrastructure among the institutions with 50% of them employing a combination of models. The CDC support model was most prevalent and present in 70% of the institutions, highlighted in the last column. Only three institutions reported separate LPO models; these were broadly distributed across success rates.

Table 3. Funding rates and support models for large proposals by institution. Funding rates and support models for large proposals by institution.

<table>
<thead>
<tr>
<th>St Dev Mean Overall % - Overall Funding</th>
<th>Overall % Funding</th>
<th>Relative R&amp;D Expenditure Rank</th>
<th>% Funding ($750K+)</th>
<th>% Funding ($1M+)</th>
<th>Models</th>
<th>Most Common Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>+2</td>
<td>58.88%</td>
<td>12</td>
<td>65.55%</td>
<td>80.00%</td>
<td>CDC</td>
<td>CDC</td>
</tr>
<tr>
<td></td>
<td>57.68%</td>
<td>10</td>
<td>73.53%</td>
<td>79.73%</td>
<td>VPR, CDC, G_SPO</td>
<td>CDC</td>
</tr>
<tr>
<td></td>
<td>56.44%</td>
<td>13</td>
<td>40.63%</td>
<td>40.91%</td>
<td>LPO</td>
<td></td>
</tr>
<tr>
<td>+1</td>
<td>54.66%</td>
<td>4</td>
<td>42.86%</td>
<td>45.12%</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>53.52%</td>
<td>6</td>
<td>21.06%</td>
<td>21.33%</td>
<td>CDC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>53.51%</td>
<td>8</td>
<td>34.57%</td>
<td>30.65%</td>
<td>VPR, CDC, G_SPO, EXT_C</td>
<td>CDC</td>
</tr>
<tr>
<td></td>
<td>52.30%</td>
<td>18</td>
<td>22.50%</td>
<td>22.90%</td>
<td>VPR, CDC, G_SPO</td>
<td>CDC</td>
</tr>
<tr>
<td></td>
<td>47.91%</td>
<td>5</td>
<td>27.60%</td>
<td>25.93%</td>
<td>LPO, CDC, EXT_C</td>
<td>CDC</td>
</tr>
<tr>
<td></td>
<td>48.71%</td>
<td>3</td>
<td>46.21%</td>
<td>46.67%</td>
<td>CDC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>44.90%</td>
<td>20</td>
<td>22.52%</td>
<td>21.18%</td>
<td>VPR, CDC</td>
<td>CDC</td>
</tr>
<tr>
<td>-1</td>
<td>43.88%</td>
<td>19</td>
<td>23.08%</td>
<td>20.77%</td>
<td>CDC, G_SPO</td>
<td>CDC</td>
</tr>
<tr>
<td></td>
<td>40.00%</td>
<td>15</td>
<td>40.00%</td>
<td>40.00%</td>
<td>S_SPO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>39.52%</td>
<td>9</td>
<td>18.56%</td>
<td>18.35%</td>
<td>G_SPO, CDC</td>
<td>CDC</td>
</tr>
<tr>
<td></td>
<td>39.13%</td>
<td>2</td>
<td>28.37%</td>
<td>27.75%</td>
<td>VPR, CDC</td>
<td>CDC</td>
</tr>
<tr>
<td>-2</td>
<td>37.35%</td>
<td>17</td>
<td>26.00%</td>
<td>22.54%</td>
<td>LPO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>35.40%</td>
<td>7</td>
<td>24.92%</td>
<td>23.78%</td>
<td>CDC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>35.21%</td>
<td>11</td>
<td>18.53%</td>
<td>17.07%</td>
<td>VPR, CDC, G_SPO</td>
<td>CDC</td>
</tr>
<tr>
<td></td>
<td>30.26%</td>
<td>1</td>
<td>25.14%</td>
<td>24.83%</td>
<td>CDC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not Reported</td>
<td>16</td>
<td>Not Reported</td>
<td>Not Reported</td>
<td>G_SPO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not Reported</td>
<td>14</td>
<td>Not Reported</td>
<td>Not Reported</td>
<td>VPR, EXT_C</td>
<td>CDC</td>
</tr>
</tbody>
</table>

Note: For each of the Overall %, $750K+, and $1M+ columns, values within one standard deviation of the mean within that category are in light grey and values between one and two standard deviations are in dark grey. Institutions with an LPO are highlighted by hatching in the models column.
Percent Effort in Relation to Proposal Funding

Data on the number of staff FTEs (Full-Time Equivalent Employees) dedicated to large proposal support was requested from survey participants. Percent FTEs were converted to number of hours using the formula: 100% FTE = 40 hours per week for 48 weeks or 1920 hours per year. This information was then plotted against the percentage funding of large proposals (Figure 4). Recognizing that this effort might be quantified with several highly variable approaches, two templates were offered to participants for systematically collecting this information.

![Proposal Acceptance vs Hours](Image)

**Figure 4.** Large proposal funding relation to personnel time.

In Figure 5, the percent funding of awards greater than $1M is plotted against all awards. The significant $R^2$ value of $\sim0.4$ indicates that these are related. This may indicate that success factors for large proposals may be related to the success factors for all proposals and vice versa. Successful institutions are successful in general and are resourcing personnel time for large proposals.

Discussion

This study is a baseline assessment of pre-award support for large proposals and various models that are employed at research-intensive institutions. The results provide a first look into how successful institutions with diverse characteristics address large proposals. A strong trend toward decreasing success rates as proposal size ranges increase is evident when considering the institutional medians, but trends are weak or inconclusive when success rates are associated with specific institutional characteristics such as overall R&D expenditures or support models.
A weak but positive trend was shown when considering the amount of personnel time spent on large proposals. The response rate for this aspect of the survey suggests that it was indeed challenging data to collect: only 14 respondents provided this data and only 21% confirmed use a template. While it might be expected that institutions with LPOs would be able to provide greater personnel time, Table 3 shows that only three institutions had LPOs and provided no suggestion of any trend of LPO offices being related to number of awards above $1M. Two of the three institutions with a specific LPO were within 1 and 2 standard deviations of the mean for the 4th and 12th, respectively. Two of the respondents (R&D ranks 14 and 16; see Table 3) did not report funding rates. However, the respondent institutions with Large Proposal Offices all indicated that they employ varied selection processes for determining which proposals they support, and none of the respondents indicated that these LPOs support all large proposals. These are key points because they confound any attempts to assess the impacts of Large Proposals Offices on funding success rates for proposals >$1M in this survey dataset.

The sample size for this study was relatively small, and could be confounded by a number of reporting variables. Data inquiry follow-ups with the respondents revealed that certain participants chose to report for a single institutional unit rather than institution-wide. Others indicated that success rates were likely boosted by inclusion of a large relative percentage of non-competing renewals in their portfolios.

Figure 5. Significance of funding among large proposals and all proposals.
Conclusions

This study was a baseline investigation into large proposal support. Conclusive findings are limited to three: 1) The decentralized College/Department/Center model is the most commonly used large proposal support model; 2) Large proposal offices and units have similar criteria in selecting proposals to be supported, the most common of which is awards equaling or exceeding $1M; and 3) Institutional setting is a factor in success rates for larger proposals more than smaller proposals as evidenced by greater variability in these rates.

While the conclusions are limited by data originating from a sample of 20 participants out of a possible 100, this study had broad representation (Table 1), and it is valuable in providing a structure for the data and metrics needed to more fully access proposal support infrastructure. For example, in addition to simply quantifying the number of staff FTE involved in the support process, the characteristics and experience of these personnel may be important. Looking forward, as more institutions may be considering establishing LPOs, it will be of interest to know how these offices select research teams worthy of proposal development support and how they identify funding opportunities appropriate for pursuing.

Over the long term, it will be worthwhile to assess whether certain LPO support models grow or diminish in popularity over time. Information that could help drive an informed choice of LPO models by institutions would include data on how large proposal success rates may be impacted by the time span over which a specific model is in existence at a particular institution. For example, institutions that chose to adopt new support models and infrastructures such as an LPO could consider tracking the overall number of proposals being submitted that are greater than $1M as well as the number of proposals they supported from this pool. This would allow them to measure the impact of any support infrastructure changes on the funding rate of large proposals within their institution. For example, if an institution’s overall funding rate drops from 21% to 19% while funding rates for large proposals not supported by an LPO goes from 14% to 17% and the funding rate for the proposals supported by the LPO goes from 14% to 29%, a closer look at the metrics associated with these two models would be warranted. This would then enable institutional resource decisions to be made based on quantifiable data and return on investment. However, a major caution to this approach is that environmental factors (e.g., uneven funding priorities across disciplines, geographical priorities among agencies, consistency among review panels, etc.) can be at play in large competitions, leading to a comparisons of “apples to oranges” from one proposal support unit to another or even within a competition. Large proposals are developed in teams and direct impact of singular inputs or activities are difficult to measure, especially given that proposal reviews do not generally identify items that produce tipping points, positive or negative. Thus, it is often difficult to measure the direct impact of LPO support on a proposal because of these and other confounding factors.

While funding rate is a typical metric used by administration to understand the bottom line, it is not a user-centric (i.e., faculty) assessment addressing overall impact. Additional user-centric metrics not assessed in this study but equally as important to successful proposal support models are parameters such as PI satisfaction, repeat PI customers, PI-valued services
(e.g., budgeting, reviews, grant writing, proposal coordination, etc.), and other support infrastructure variables (e.g., data management, outreach or diversity programs, dedicated proposal staff, etc.). Understanding faculty needs and the services they value most may provide the best potential for increasing the levels of skilled faculty participating in large proposals. An essential element of large proposal success is the leadership of an experienced, credible PI; thus, PI satisfaction with the process is essential to retaining a solid pool of willing PI candidates.

While this study focused only on pre-award proposal development support, post-award administration may be equally important to future large proposal successes. Institutional records for post-award management are often part of agency evaluation and selection criteria when awarding large projects. It is apparent through a limited set of ancillary questions and follow-up that post-award management of strategic awards is clearly complicated, but highly valued. Moreover, strategic awards often undergo greater scrutiny by sponsors and external auditors. In light of potential for more scrutiny and increased complexity, concerns expressed by the participants ranged from needed specialized training for individuals responsible for managing these strategic awards to significant administrative burdens that arise from reporting requirements, necessary relationships with subawardees, and daily oversight. Thus, future studies may want to address the relationship between resources and success in post-award management and future funding success for large proposals.

**Author’s Note**

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References


Spotlight on Clinical Trial Sponsorship

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Abstract: What liability is associated with assuming the role of the “sponsor” in a clinical trial? This article discusses the Food and Drug Administration (FDA) regulations governing sponsorship, and how courts have interpreted those regulations in cases with a claim of injury.

There is a natural concern with the responsibility implied by assuming the role of “sponsor” in a clinical trial agreement. In a commercially sponsored clinical trial, for example, the site can reasonably require that a drug company assume most liability for subject injury. Pharmaceutical companies are not the sponsor, however, for Investigator Sponsored Trials (ISTs, sometimes called Investigator Initiated Trials IITs).¹ Between these extremes are the complex cases where a mix of delegated roles and responsibilities are assigned, and where the “duty of care” relation between a physician and their patient may take precedence in any case. This article discusses sponsorship in terms of the FDA regulations, and reviews several cases where judicial interpretation of a sponsor’s duties had an impact on liability.

Keywords: Sponsor, Investigator, Clinical Trial, Injury Claims

The Company as Sponsor

The FDA regulations define “sponsor” as

a person who takes responsibility for and initiates a clinical investigation. The sponsor may be an individual or pharmaceutical company, governmental agency, academic institution, private organization, or other organization. The sponsor does not actually conduct the investigation unless the sponsor is a sponsor-investigator. A person other than an individual that uses one or more of its own employees to conduct an investigation that it has initiated is a sponsor, not a sponsor-investigator, and the employees are investigators. 21 CFR § 312.3(b) (2014)

As this definition makes clear, there is a difference between sponsoring a trial and conducting a trial, and this distinction can impact the sponsor’s responsibilities and liability. Further, an

¹ An IST is a clinical trial where the sponsor is not a commercial entity. What is an IST? IST JOURNAL. Retrieved from http://www.istjournal.eu/for-authors
investigator can also operate as a sponsor, with all the attendant responsibilities, if they both initiate and conduct an investigation.² *Id.* Sponsors are primarily responsible for selecting investigators, providing them with the information necessary to conduct a trial, monitoring the investigation, ensuring that it is conducted in accordance with the general investigational plan and protocols contained in the [Investigational New Drug Application (“IND”)](21 C.F.R. §312.20 and Subpart D), maintaining an effective IND with respect to the investigations, and informing investigators or the FDA of any new risks or adverse effects associated with a drug. 21 CFR §312.50. Investigators are also responsible for ensuring the investigation is conducted according to the investigational plan, but are also directly responsible for protecting the trial subjects, obtaining the informed consent of human subjects, and controlling the investigational drug. 21 CFR § 312.60.

Both the sponsor and the investigator are responsible parties. The Sponsor initiates the investigation, but the investigator actually conducts the trial.

### Sponsor and Investigator Responsibilities

Subpart D of Sec. 312.50 outlines the general responsibilities of sponsors and investigators. These are shown in Table 1 below, along-with 312.20 where the responsibility for the submission of an IND to FDA is explained.

2 Crucially, a commercial sponsor does not operate as a sponsor-investigator merely because they initiate a trial and their employees conduct the trial; the drug company funding the trial only assumes the roles of a sponsor, while its employees conducting the trial assume the roles of an investigator. See 21 CFR § 312.3(b) and the discussion of Darke v. Estate of Isner, infra.

#### Table 1. Responsibilities of Sponsors and Investigators

<table>
<thead>
<tr>
<th>Activity/ Responsibility</th>
<th>Sponsor – Sponsor roles and responsibilities can be delegated to a CRO unless otherwise noted</th>
<th>Investigator – all Sponsor responsibilities are also responsibilities for a sponsor-investigator</th>
</tr>
</thead>
<tbody>
<tr>
<td>312.20 IND Application</td>
<td>Responsible</td>
<td></td>
</tr>
<tr>
<td>312.50 General</td>
<td>Responsible for investigator selection, monitoring, study protocols, and adverse event notification</td>
<td></td>
</tr>
<tr>
<td>312.52 Transfer of Obligations to a CRO</td>
<td><strong>CRO is Responsible</strong> when assuming any obligation of a sponsor</td>
<td></td>
</tr>
<tr>
<td>312.53 Selecting investigators and monitors</td>
<td>Responsible, includes verifying investigator qualifications, control of drug, and monitor selection</td>
<td></td>
</tr>
</tbody>
</table>
Table 1. Responsibilities of Sponsors and Investigators (continued)

<table>
<thead>
<tr>
<th>Code</th>
<th>Activity/Responsibility</th>
<th>Responsible for monitoring exceptions and reporting to the FDA</th>
<th>Responsible for conducting exceptions from informed consent</th>
</tr>
</thead>
<tbody>
<tr>
<td>312.54</td>
<td>Emergency research</td>
<td>Responsible for the investigator brochure, and new observations</td>
<td></td>
</tr>
<tr>
<td>312.55</td>
<td>Informing investigators</td>
<td>Responsible for investigator compliance, evaluating investigator reports, and determining discontinuation</td>
<td></td>
</tr>
<tr>
<td>312.56</td>
<td>Review of ongoing investigations</td>
<td>Responsible for drug shipping records, financial interest related to payments, 2-year record retention, and reserve samples for testing</td>
<td></td>
</tr>
<tr>
<td>312.57</td>
<td>Recordkeeping and retention</td>
<td>Responsible for permitting FDA access</td>
<td></td>
</tr>
<tr>
<td>312.58</td>
<td>Inspection of sponsor’s records and reports</td>
<td>Responsible for assuring return of unused supplies</td>
<td></td>
</tr>
<tr>
<td>312.60</td>
<td>General responsibilities of investigators</td>
<td>Responsible for conduct according to the signed (Form 1572) investigator statement, the investigational plan, protecting the rights, safety, and welfare of subjects, control of drugs, and obtaining the informed consent</td>
<td></td>
</tr>
<tr>
<td>312.61</td>
<td>Control of the investigational drug</td>
<td>Responsible for administering the drug to subjects</td>
<td></td>
</tr>
<tr>
<td>312.62</td>
<td>Investigator recordkeeping and record retention</td>
<td>Responsible for disposition of the drug, case histories, and record retention,</td>
<td></td>
</tr>
<tr>
<td>312.64</td>
<td>Investigator reports</td>
<td>Responsible for progress reports, safety reports, final report, and financial reports,</td>
<td></td>
</tr>
<tr>
<td>312.66</td>
<td>Assurance of Institutional Review Board (“IRB”) review</td>
<td>Responsible for IRB review and approval, and reporting to the IRB</td>
<td></td>
</tr>
</tbody>
</table>
In Table 1, Section 312.52 is a unique feature because sponsors can delegate roles and responsibilities to a Contract Research Organization ("CRO"), which is able to "assume, as an independent contractor with the sponsor, one or more of the obligations of a sponsor, e.g., design of a protocol, selection or monitoring of investigations, evaluation of reports, and preparation of materials to be submitted to the Food and Drug Administration."

The Role of a Contract Research Organization (CRO)

A sponsor can delegate sponsor responsibilities to CROs. 21 C.F.R. § 312.52. Delegated responsibilities must be detailed by the sponsor on an attachment to the New Drug Application ("NDA") Form 1571, 21 C.F.R. § 312.23. An investigator, by contrast, is not allowed to delegate roles and responsibilities in terms of conducting the trial. A drug manufacturer, on the other
hand, must assume responsibility for applying current good manufacturing practice (CGMP) required under section 501(a)(2)(B) of the Federal Food, Drug, and Cosmetic Act (FD&C Act). The manufacturer’s responsibility is transferred if a CRO assumes the roles and responsibilities of the sponsor.³ See 21 C.F.R. § 312.52 (“A sponsor may transfer responsibility for any or all of the obligations set forth in [21 C.F.R. Part 312] to a contract research organization.”). A manufacturer who desires to retain commercial rights to a drug after it has been successfully tested must only show, “substantial support”—or more than 50 percent of the cost for conducting the trial. 21 C.F.R. § 314.50(j)(4)(iii). Delegation of sponsor roles and responsibilities has been an important feature in determining liability for subject injury.

**Sponsor’s Responsibility for Conducting a Clinical Trial**

In the case of Kernke v. the Menninger Clinic ("Kernke"), for example, Aventis sponsored a trial to test their neuroleptic compound M100907, with Menninger Clinic defendants identified as the investigator. 173 F.Supp.2d 1117, at 1119. A patient named Joseph Kernke participated in both Phase I and Phase II of the trial, and he received the investigational drug in both phases. *Id.* at 1120.

Mr. Kernke was an outpatient who later voluntarily became an inpatient to take part in the study, and he signed the consent form. *Id.* at 1119–20. The court noted, however, that throughout the treatment he repeatedly told his relatives and the clinical staff that he desired to return home. *Id.* at 1120. After two months, when the Dose Limiting Toxicity had been established in Phase I, he became eligible to participate in Phase II of the trial, and again signed a consent form. *Id.*

Three days after beginning the Phase II treatment, he left the clinic and was later found dead of exposure. *Id.*

The plaintiffs alleged that Aventis, as sponsor, owed Mr. Kernke the following three duties: (1) determining patient eligibility in terms of benefit and risk, (2) securing informed consent, and (3) supervising patients. *Id.* at 1124.

The court disagreed, and ruled for Aventis, stating:

> According to the FDA regulations, an investigator — in this case the Menninger defendants — is defined as “an individual who actually conducts a clinical investigation. . . .” On the other hand, a sponsor — in this case Aventis — “does not actually conduct the investigation unless the sponsor is a sponsor-investigator.” All of the duties alleged by plaintiffs in this case fall within the purview of the Menninger defendants as the investigator conducting the M100907 study; the duties do not rest with Aventis. *Id.*

In addition:

> The court notes that Aventis was not acting as a sponsor-investigator in this case. In fact, the record indicates that Aventis had delegated most of its duties as a sponsor of the drug study

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to Worldwide Clinical Trials, Inc., a nationally-known contract research organization hired by Aventis. *Id.* n. 3.

The court agreed that patient supervision was part of the conduct of the trial, and not a sponsor responsibility. *Id.* at 1123–24. Therefore, Aventis was only obligated to give adequate warning about the risks to the patient’s prescribing physician. *Id.* at 1121. The physician then assumed investigator responsibility for the conduct of the trial by virtue of administering the drug. *Id.* at 1122.

The claimants also argued that Aventis failed to warn patients about the risks associated with the experimental drug, but the court held that Aventis was shielded from liability by the “learned intermediary doctrine.” *Id.* at 1121. In *Humes v. Clinton*, cited by the Kernke court, the Kansas Supreme Court stated that the learned intermediary doctrine “allows a drug manufacturer to assume a patient places reliance on the physician’s judgment and relieves the manufacturer of a duty to assist the physician in communicating with patients.” 792 P.2d 1032, 1039 (1990). Thus, so long as a pharmaceutical company sponsor informs a prescribing physician of the dangers associated with a drug’s use, “the manufacturer’s duty to warn is satisfied.” *Id.* Although each state determines its own liability standards, the rule stated by the Kansas Supreme Court is currently the majority rule nationwide. See *Turbone v. A. H. Robins Co.*, 577 P.2d 975, 977 (Wash. 1978) (“it has become a well-established rule that in such cases, the duty of the manufacturer to warn of dangers involved in use of a product is satisfied if he gives adequate warning to the physician who prescribes it”).

It is worth noting that a recent Texas decision casts doubt on whether the learned intermediary doctrine applies as a matter of law in clinical trials, automatically shielding a sponsor from liability regarding improper consent. In *Rodriguez v. Gilead Sciences, Inc.*, the court stated that the learned intermediary doctrine may not apply if a physician was “incentivized to act as a drug marketer rather than as a treating physician.” No. 2:14-CV-324, 2015 WL 236621, at *5 (S.D. Tex. Jan. 16, 2015). As a result, the court declined to dismiss claims against the sponsor at the pleading stage, stating that whether the physician was adequately informed of the risks associated with a drug, or over-incentivized to enlist patients in a trial, was a question of fact that required further evidence before the learned intermediary doctrine could apply. *Id.*

As demonstrated by the above cases, the majority rule provides that a sponsor will typically have no duty to warn subjects of a trial’s risks so long as the sponsor provides adequate warnings to the investigator administering the trial. However, this does not mean that a sponsor is automatically shielded from all liability, as at least in Texas, over-incentivizing an investigator might negate the learned intermediary doctrine, and in all cases a sponsor is still potentially liable for subject injuries if they fail to adequately warn the prescribing physician or investigator.

**The Sponsor’s Obligations as Employer**

A treating physician’s obligation to their patient is called a “duty of care.” This is the first element that must be established to proceed with an action in negligence.

In *Darke v. Estate of Isner* (“Darke”), the court also held that the sponsor is not responsible for the care of the patient because, again, the sponsor does not conduct the trial unless they are a
sponsor-investigator. No. 022194E, 2005 WL 3729113, at *14 (Mass. Super. Nov. 22, 2005). In this case, the sponsor Vascular Genetics, Inc. (“VGI”) was named in a malpractice suit by the wife of Roger Darke, who died after receiving a gene therapy treatment—an injection of a substance called VEGF2 that promotes the formation of blood vessels—as part of his surgery to increase vascular blood flow. Id. at *3.

VGI’s gene therapy had been approved by the FDA in 1999 to allow experimental treatment for patients who were not candidates for bypass surgery or other standard procedures. Id. at *1. Mr. Darke had been advised by his physician not to repeat the coronary revascularization surgery he had previously received, and he was referred to the hospital’s gene therapy program. Id. at *2. There he consulted with Dr. Isner, who had formed VGI to develop and commercialize the gene therapy. Id. Both Dr. Isner and the hospital held a twenty percent ownership interest in VGI and were represented on the Board of Directors. Id. at *1.

Mr. Darke signed a consent form for the experimental procedure, but the form did not disclose Dr. Isner’s or the hospital’s financial interest in sponsor VGI. Id. at *2. The court stated:

In its role as sponsor, VGI supplied VEGF-2 to the clinical investigators to administer to patients participating in the trial. Furthermore, VGI, in accordance with the relevant FDA regulations, took on the responsibility of selecting qualified investigators, ensuring the proper conduct of the trial, monitoring the progress of the study, and ensuring the safety and effectiveness of the gene therapy treatment. 21 C.F.R. § 312.50. In essence, VGI supervised the implementation of the study. Id. at 14.

In other words, VGI maintained all the general supervisory responsibilities of a sponsor. However, the court found that, as a general rule, VGI’s control—in its role as the sponsor—over the conduct of the clinical protocol did not demonstrate control over the conduct of the investigators and, thus, this activity of a sponsor “is not enough by itself to inspire” liability on the sponsor. Id.

However, the court noted that its inquiry did not stop here and, thus, the court analyzed other factors and theories of law that might impose some liability on VGI. With regard to a claim that VGI was directly negligent, the court held that VGI owed Mr. Darke no direct duty of care, and thus could not be held independently negligent. Id. at *15. “Instead, such duties inhered in the responsibilities imposed upon the investigators in this case,” and the general sponsor responsibilities enumerated under 21 C.F.R. § 312.50 were not violated. Id. Therefore, the court found in favor of VGI regarding this claim of negligence. Id.

The court next evaluated VGI’s potential “vicarious liability” in its status as an “employer” for the actions of any of its “employees.”4 The court declined to state, as a matter of law, that the relation between VGI and Dr. Isner was not one of an employer-employee because VGI was paying Dr. Isner as a Principal Investigator (PI), and because Dr. Isner “devoted a significant portion of his professional life to VGI.” Id. While VGI had argued that Dr. Isner was only an independent contractor and not an employee, the court said it didn’t matter what the parties called Dr. Isner,

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4 “Vicarious liability” of an employer is the legal doctrine by which an employer might be held liable for the actions or omissions of its employee if it can be proven that the applicable actions/omissions occurred within the scope of employment.
as the financial relationship between the two parties militated against holding that Dr. Isner was not acting in the furtherance of VGI's objectives as a matter of law. *Id.* Therefore, the court left open the critical possibility that VGI might be vicariously liable for the actions of Dr. Isner due to an employer-employee relationship—which, in turn, would impute the potentially tortious conduct of Dr. Isner (as the employee) to the trial sponsor (as the employer). *Id*

The key takeaway from the *Darke* case is that while a sponsor’s control over the conduct of the clinical protocol does not, in and of itself, demonstrate control over the conduct of the investigators, a sponsor could potentially be held liable for the tortious acts of an investigator if a court finds an “employer-employee” relationship existed between the sponsor and a particular investigator and that particular investigator committed the tortious act within the scope of that employment relationship.

**Fiduciary Duties and Other Claims**

The sponsor role has also been the basis for claims that a drug company should provide free study drug after the end of a clinical trial. In the case of *Abney v. Amgen* (“*Abney*”), Amgen sponsored two trials to test a drug delivery method for patients suffering from Parkinson's disease, but unfortunately, both studies failed to prove that the experimental procedure was safe or effective. 443 F.3d 540 at 544 (2006).

This study was originally designed and initiated by physicians at the University of Kentucky (UK), but the court noted that “Amgen became a sponsor of the study, meaning it had funded the study and provided the study drug.” *Id.* at 543 n. 1. The Amgen trial at UK also used Amgen’s protocol, and UK was only one of several sites. *Id.* at 543.

The plaintiffs claimed that Amgen promised to continue providing the experimental treatment to subjects after the study ended. *Id.* at 544. However, the plaintiffs had entered into a contract with the investigators at UK, not with Amgen. *Id.* at 547. Further, because the investigators were independent contractors, not agents of Amgen, they had no authority to enter into a binding contract on Amgen’s behalf. *Id.* at 548. As a result, plaintiffs could not show that Amgen had ever directly promised anything to the study participants.

The plaintiffs also claimed that Amgen, working through its principal investigators, owed them a fiduciary duty to treat their illness. *Id.* at 550. However, a fiduciary duty is only created when two parties agree that one will act in the interest of the other, and there was no evidence that Amgen had undertaken sponsorship of the study primarily for the benefit of the plaintiffs. *Id.* Amgen further asserted that its role as the sponsor of clinical trials would be undermined if it could not terminate trials that were found to present a risk to study participants. *Id.* at 552. The court echoed the lower court’s sentiment that requiring pharmaceutical companies “to continue to produce and distribute a drug they believed to be dangerous” might deter those companies from sponsoring clinical trials. *Id.* at 553.

This same Amgen study was also at issue in *Suthers v. Amgen* (“*Suthers*”), which arose out of a controversy at another trial site, the New York University School of Medicine. 441 F.Supp.2d
In *Suthers*, two defendants who were part of the placebo group in Phase I were later recruited for the Phase II expansion, at which point they “experienced marked improvement” in their condition. *Id.* at 481. When Amgen received news of toxicity in a primate animal study, they terminated the human clinical trial and stopped supplying drug because they thought it was unsafe.⁵ *Id.* The plaintiffs alleged that their condition worsened in the months following the end of the trial and reverted to their state prior to the administration of the study drug. *Id.* at 481–82.

As in Abney, the court sided with Amgen and concluded that “there is no basis to impose a fiduciary duty on the sponsor.” *Id.* at 488. Further, the consent form made no promise of continued drug supply, and informed subjects that the study could be terminated or cancelled by the sponsor. *Id.* at 483. The court also found that there was no evidence the investigator had made any promise of continued drug supply—as in UK study—and that any alleged promise was contradicted by the clear terms of the informed consent document. *Id.* at 484. Finally, the negligence claim was also rejected, as the plaintiffs claimed to have benefitted from administration of the drug and their condition did not worsen from the pre-treatment baseline, and thus the plaintiffs could not allege that Amgen had violated a duty of care or caused an injury by ceasing its gratuitous conduct. *Id.* at 489–90.

The Investigator as Sponsor

“Sponsor-Investigator” means an individual who both initiates and conducts an investigation, and under whose immediate direction the investigational drug is administered or dispensed. The term does not include any person other than an individual. The requirements applicable to a sponsor-investigator under this part include both those applicable to an investigator and a sponsor. 21 C.F.R. § 312.3(b).

All sponsor obligations under 21 C.F.R. Part 312 apply to an investigator who takes on the role of sponsor. *Id.* An investigator typically does this by writing a protocol for the new use of an approved drug, which it sends to the manufacturer as a proposal to support the study with drugs and sometimes money. Although the pharmaceutical company is unlikely to profit from such a clinical trial, it might be willing to provide this support because the trial could generate useful information or yield a humanitarian benefit if successful. The support is not considered sponsorship under FDA regulations because the investigator writes the protocol, typically submits the IND, oversees the sites and other investigators, and generally assumes all other sponsor responsibilities except drug manufacturing and initial shipping. An investigator-sponsor therefore takes most of the roles and responsibilities of sponsorship away from the drug company. As a result, claims of injury arising out of the above-mentioned sponsor obligations expose the investigator to liability, instead of the drug manufacturer.

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⁵ Interestingly, the investigator at NYU contended that the primate test subjects had received dosages at least ten times higher than what would have been given to a human and that the cause of the primates’ cerebral toxicity was the abrupt withdrawal of the study drug. 441 F.Supp.2d at 481.
Conclusion

Liability (and the practical aspects at play with regard to potential liability) is often addressed in contract negotiation of indemnification provisions prior to the study. The scope of this article was not intended to address indemnification provisions. In light of the court cases cited above, the effect that indemnification provisions have on the actual allocation of risk is worth further investigation.

In any case, claims of injury arising from clinical trial investigations may involve everyone from the investigator and their institution to CROs and the drug manufacturer. The identity of the sponsor, and their obligations in any trial, depends on the nature of the investigation and the division and delegation of responsibilities. Initiating an investigation is distinct from conducting a clinical trial, and this distinction has important implications for one's liability exposure. The ill-defined boundaries of responsibility and liability amongst sponsors, investigators, CROs, and research sites will continue to evolve with revisions to FDA regulations and guidelines, and judicial interpretations of those regulations and guidelines. However, hopefully this article provides some guidance as to what liability is currently associated with assuming the role of “sponsor” in a clinical trial.

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Determinants of Broader Impacts Activities: A Survey of NSF-funded Investigators

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Abstract: This study investigated the factors that shape the broader impacts activities of NSF grant recipients. A random sample of NSF grantees was surveyed about the type and quality of their broader impacts activities, their views on knowledge production and the democratization of science, their experience and training, and the existence of a supportive climate and resources for community engagement at their home institutions. Respondents indicated that they shared an orientation towards knowledge production that was more democratic than technocratic and valued public engagement in science; that they had adequate experience but little training in community engaged activities and lacked confidence in their ability to evaluate such work; that executive leaders at their institutions encouraged community engagement but promotion and tenure policies did not recognize such activities; and that they had little access to training, funding, or infrastructure to support community engaged activities. A multinomial logistic regression showed that faculty expertise, available resources, and academic discipline were the strongest predictors of type of broader impacts activity ($p < .001$). A multiple regression analysis revealed that faculty expertise, a democratic orientation towards knowledge production, and a supportive climate were the strongest predictors of quality of broader impacts activity ($p < .001$).

Keywords: Broader Impacts, Sponsored Research, Institutional Support, Community Engagement

Background and Objectives

An enduring image of academia is that of an ivory tower, disconnected from the messy problems of the world. It is a recurring complaint that the primacy of basic research and the academy’s emphasis on abstract theory has eroded higher education’s connection to the world, isolating scholars from society and making their work obscure or irrelevant to the general public (Barker & Brown, 2009; Gibson, 2006). Decreasing appropriations for higher education heighten the need to convince the public about the value of university research. In response to prodding from Congress, federal funding agencies are increasingly requiring academic research grant proposals to include indicators of public impact that would result in social good.

In 1997, the National Science Foundation (NSF) established a policy that all funding proposals submitted to the agency would be evaluated on two criteria: intellectual merit and broader impacts. Broader impacts refer to “specific, desired societal outcomes” (NSF, 2012, p. III-2) such as the participation of underrepresented groups in science, technology, engineering, and mathematics (STEM); enhancing STEM education; public scientific literacy and engagement; and partnerships...
between academia, industry, and others. According to Arden Bement, former director of the NSF, “The [broader impacts] criterion was established to get scientists out of their ivory towers and connect them to society” (quoted in Lok, 2010, p. 416).

A national review of the effectiveness of these criteria conducted in 2000 revealed that, while most researchers had little difficulty identifying the intellectual merit of their plans, many struggled to adequately articulate the broader impacts of their proposed investigations (NSF, 2005). The study also found that the broader impacts criterion was consistently weighted less than intellectual merit in the proposal review process and that many in the scientific community were resistant to or dismissive of the requirement (NSF, 2005). The NSF responded with efforts to educate the scientific community about the agency’s rationale and expectations for broader impacts. A subsequent national evaluation of the NSF’s review criteria conducted in 2010 found that problems with the execution, understanding, and acceptance of the broader impacts criterion persisted, that assessment was unclear and inconsistent, that there was little variety in the type of activities performed to address the broader impacts criterion, and that principal investigators (PIs) needed greater institutional support to respond effectively to this requirement (NSB, 2011).

The purpose of this study was to investigate the factors that shape PI response to the NSF broader impacts criterion. The following research questions guided the study:

1. What are the different types of activity that PIs engage in to meet the broader impacts criterion of NSF-sponsored research?
2. What is the quality of the broader impacts activities, as assessed by PIs using evaluation criteria for the scholarship of engagement?
3. To what extent do PIs’ individual characteristics (expertise, epistemology, academic discipline, and rank) and institutional support (climate and resources) for community engagement predict the type of their broader impacts activities?
4. To what extent do PIs’ individual characteristics and institutional support predict the quality of their broader impacts activities?

The author gathered survey data to identify the types of broader impacts activities that PIs conduct, and their perceptions of the quality of these activities. The author then determined how much variance in type and quality of activity could be explained by the respondents’ personal characteristics and perceptions of institutional support for community engagement. In the survey, community engagement was defined as “The collaboration between institutions of higher education and their larger communities (local, regional/state, national, global) for the mutually beneficial exchange of knowledge and resources in a context of partnership and reciprocity” (Carnegie Foundation for the Advancement of Teaching, n.d., n.p.).

**Conceptual Framework**

This study is grounded in the theoretical framework of the scholarship of engagement. Such scholarship is academically relevant faculty work that simultaneously meets campus goals and community needs, incorporates community issues, and is integrative across teaching, research,
and service (Clearinghouse and National Review Board for the Scholarship of Engagement, 2002). Although there are subtle distinctions between the terms “scholarship of engagement,” “engaged scholarship,” and “community-engaged research,” they are used interchangeably throughout this study.

The NSF’s broader impacts merit review criterion has been an ongoing challenge within the scientific community, particularly in terms of conceptual clarity, assessment, and philosophical resistance. The persistence of the problem may stem, in part, from the paucity of literature on the broader impacts of academic research (Buxton, 2011). While scant research has been conducted on such impacts, volumes have been written on the scholarship of engagement. The engagement movement has spawned multiple journals, institutes, conferences, and consortia dedicated to studying engaged scholarship in its many forms. This study drew from this extensive literature base to better understand the issues that surround the broader impacts of academic research and connections between the academy and society. Framing the study within the context of the scholarship of engagement is appropriate not only because broader impacts activities may be viewed as an expression of engaged scholarship, but also because both struggle to achieve legitimacy and support within the academy.

The Scholarship of Engagement

The concept of engaged scholarship is often credited to Ernest Boyer, a renowned leader of educational reform. Boyer (1990) argued that the traditional definition of scholarship as research that advances disciplinary frontiers of knowledge was too limited. He countered the prevailing hierarchical view of scholarship with a more inclusive vision that added to the ranks of conducting original research such activities as identifying connections between concepts, bridging theory and practice, and effectively communicating knowledge. Boyer posited that faculty scholarly work included four “separate, yet overlapping, functions” (1990, p. 16) which he identified as the scholarships of discovery, integration, application, and teaching. Boyer (1996) proposed the term scholarship of engagement as interaction across these four realms to address community needs. He described the scholarship of engagement as “connecting the rich resources of the university to the most pressing social, civic, and ethical problems...creating a special climate in which the academic and civic cultures communicate more continuously and more creatively with each other” (pp. 19-20). Boyer asserted that it was time for higher education to renew its covenant with society and to partner with communities in directly addressing problems, with a reciprocal flow of knowledge.

Models of Knowledge Production

Epistemologies about knowledge production and distribution shape perceptions about the role of higher education in society, define relationships between campus and community, and govern the values, norms, and practices of scholars. Boyer raised critical questions of how knowledge is constructed and what is accepted as legitimate knowledge in the academy. Deeply embedded in academia is the traditional linear model of knowledge production and distribution, which prizes basic research that is disciplinary, removed from influence by outside interests, and conducted without consideration of use (Bush, 1945). Boyer countered the prevailing belief that basic
research was the most essential form of scholarly activity, with publications and teaching flowing from it. He argued that “knowledge is not necessarily developed in such a linear manner. The arrow of causality can, and frequently does, point in both directions. Theory surely leads to practice. But practice also leads to theory” (1990, p. 16). The national dialogue that ensued prompted academics to identify new models of knowledge creation, including that of use-inspired research (Stokes, 1997) and Mode 2 science (Gibbons et al., 1994).

**Linear**

The dominant, linear model of knowledge production begins with basic research, which may lead to applied research and technological development, and on to production or operations. This model has shaped U.S. science policy since it was first proposed by Vannevar Bush in his 1945 report to President Roosevelt (Mazuzan, 1994). Bush saw an inherent tension between the goals of understanding and use, and warned that the creativity of basic research would be stifled by premature thoughts of practical use.

**Use-inspired**

One year after Boyer’s call for engaged scholarship, Stokes challenged the traditional dichotomy between basic and applied research. Stokes (1997) argued that Bush’s premise that flows between science and technology are uniformly one way, from scientific discovery to technological innovation, was flawed and offered a limited understanding of how knowledge is generated and put to use. Stokes contested Bush’s cannon that the goals of understanding and use are dichotomous, arguing that research is often influenced by both goals. In his model, theoretical and practical research and application come together to create a dynamic cycle of innovation driven by changing conditions and the competitive landscape.

**Mode 2**

Gibbons and his co-authors (1994) offered another alternative to the static linear model of knowledge production. They determined that Bush’s old paradigm of discipline-specific, autonomous, university-grounded scientific discovery (“Mode 1”) was being supplanted by a new approach to knowledge production (“Mode 2”). Gibbons et al. posited that the new mode emerged from a parallel expansion in the demand for specialist knowledge and the number of potential knowledge producers, adding government laboratories, industry, consultancies, and others to the domain formerly ruled by universities. They described this new mode as socially distributed, application-oriented, trans-disciplinary, and subject to multiple accountabilities. This evolution, they argued, occurred in response to significant trends changing the research environment: the steering of research priorities, the commercialization of research, and the accountability of science. As a result, the research process was no longer an objective investigation, but rather an intense dialogue between research actors and subjects.

**Reciprocal**

In the dominant, technocratic culture of higher education, knowledge flows in one direction: from credentialed, detached experts ensconced in the university to its place of need and application in
the community (Hartley, Saltmarsh, & Clayton, 2010). The scholarship of engagement challenges the belief that knowledge is produced by academics and then transferred to the community. Instead, engaged scholarship builds reciprocal relationships between scholars and community partners, dynamic synergies between theory and practice, and research that benefits both the community and the academy (Nicoreta, Cutforth, Fretz, & Thompson, 2011). Such reciprocity has been defined as “democratic engagement” and described as “an epistemological shift...that favors mutual deference between lay persons and academics” (Hartley, Saltmarsh, & Clayton, 2010, p. 401).

Study Model

The study’s conceptual model, depicted in Figure 1, illustrates the congruence of NSF goals and broader impacts activities (bulleted lists) with Boyer’s domains of scholarship and the models of knowledge production described above. The model aligns these elements along the oppositional axes of democratic versus technocratic orientations and the goals of improving understanding versus improving technology.

![Figure 1. Alignment between NSF goals, Boyer’s concept of engaged scholarship, and models of knowledge production.](image)

Within the context of this conceptual framework, the author explored the relationships between the individual characteristics of faculty members, support at their home institutions, and the type and quality of their broader impacts activities. The scholarship of engagement literature suggests
possible associations between engagement in public scholarship and individual characteristics such as epistemology (Austin & Beck, 2010) and expertise (Baskurt, 2011), as well as demographic factors including discipline (Lunsford & Omae, 2011) and rank (Glass, Doberneck, & Schweitzer, 2011). The literature also indicates that institutions influence individual behavior by means of overall climate (Vogelgesang, Denson, & Jayakumar, 2010) and the allocation of resources for administrative support, faculty development, and incentives (Doberneck, Brown, & Allen, 2010). Figure 2 outlines the variables investigated in this study.

Figure 2. Variables that shape broader impacts activities of academic faculty.
Methods

Population

The population for this study was the 3,635 faculty members at institutions of higher education across the United States who received NSF research grants during Fiscal Year 2009 (October 1, 2008 – September 30, 2009). This period was selected because it not only follows on the heels of the NSF’s 2007 release of broader impacts criterion guidelines, but it also allows sufficient time for the completion of most projects. Research grant is a term used by the NSF to represent what may be considered a typical research award, particularly with respect to the award size (NSF, 2009). Education research grants are included in this category. Excluded are large awards such as centers and facilities, as are equipment and instrumentation grants. Also excluded are grants for conferences and symposia, grants in the Small Business Innovation Research program, Small Grants for Exploratory Research, and education and training grants. EAGER and RAPID grants were also excluded as they are exempt from external review.

Sample

A stratified random sample of 700 grant recipients was drawn from the population. This sample size was chosen to provide a pool of respondents large enough to restrict error to 5%, assuming a response rate of approximately 50% (Patten, 2002). A stratified random sample design was selected to reduce normal sample variation and to produce a sample more likely to resemble the total population than a simple random sample. Given the importance attributed to academic discipline in the literature, the sample was stratified along NSF Directorates to provide representation across a broad spectrum of disciplines. One hundred grant recipients were selected from each of the following directorates: Biological Sciences; Computer and Information Science and Engineering; Education and Human Resources; Engineering; Geosciences; Mathematics and Physical Sciences; and Social, Behavioral, and Economic Sciences. The population of grant recipients in each directorate was assigned consecutive numbers and the desired sample was drawn using a table of random numbers.

Instrument

As no instrument existed to collect the data necessary for this study, the author developed a special purpose survey derived from an extensive review of the literature. The survey items generated fell into five subsections: broader impacts activities, epistemology, expertise, institutional support, and demographics. The first section asked participants about the type and quality of their broader impacts activities and community partnerships. The second section attempted to capture participants’ epistemologies by inquiring about their views on knowledge production and the democratization of science. The section on expertise asked participants about their prior experience, training, and sense of ability with activities similar to those conducted to address the broader impacts criterion, both as graduate students and as faculty members. The next section asked participants about the existence of a supportive climate and resources for community engagement at their home institutions. The final section of the survey gathered demographic information on academic discipline and rank. The questions on discipline, rank, and activity type were multiple choice; the remaining items used a five-point scale, ranging from 1 (not at all) to 5 (fully).
The next step in survey development was a pre-survey evaluation conducted by a panel of field
experts in order to identify and correct any foreseeable problems prior to executing the survey.
The panel members were selected based on their expertise in engaged scholarship, survey design,
and sponsored research. The panel provided input on the conceptual accuracy of the items, the
length and legibility of the scale, and any missing or misrepresented dimensions of the constructs
to be studied. After integrating feedback from the expert panel into the instrument, the survey
received an exempt review and approval from the Institutional Review Board of the University
of South Dakota.

Data Collection

This cross-sectional study used an online survey to collect data from faculty at academic institutions
across the United States. The primary concern about web-based surveys is that they may introduce
type of broader impacts activity to meet
the broader impacts criterion of NSF-sponsored research? Type of broader impacts activity
was a categorical variable. The categories, identified by the NSF, were education, broadening
participation, infrastructure, dissemination, and other. Frequencies of responses to the question
about type of activity were tabulated to derive percentages of participation in each activity.

Research question 1. What is the quality of the broader impacts activities, as assessed by
PIs using evaluation criteria for the scholarship of engagement? Quality of broader impacts
deach area of assessment, and duration of community partnerships). Means
and standard deviations generated from these items, and composite means for each element,
provided information related to the areas of relative strength and weakness of broader impacts activities.

**Research question 3.** To what extent do PIs’ individual characteristics (expertise, epistemology, academic discipline, and rank) and institutional support (climate and resources) for community engagement predict the type of their broader impacts activities? *Expertise* was a summed score of questions about the respondent’s prior experience, training, and sense of ability related to community-engaged activities. *Epistemology* was a summed score of questions about the respondent’s views on knowledge production and the democratization of science. Responses were grouped into two categories: democratic and technocratic orientations. *Climate* was a summed score of questions about the respondent’s perceptions of institutional climate as expressed through rhetoric, recognition, and rewards for community engagement. *Resources* was a summed score of questions about the respondent’s perceptions of the administrative support, faculty development, and incentives available for community engagement. *Academic discipline* was operationalized as the NSF directorate to which the respondent applied. *Academic rank* was captured with dummy variables for assistant professor, associate professor, full professor, research scientist, and other.

After reverse coding negatively worded items and removing cases with missing observations on multiple indicators, a multiple logistic regression was conducted to determine how the variables ranked in terms of highest to lowest when it came to predicting the type of broader impacts activity.

**Research question 4.** To what extent do PIs’ individual characteristics and institutional support predict the quality of their broader impacts activities? *Quality of activity* was a summed score of assessment questions based on the scholarship of engagement criteria. The independent variables were the constructs identified in the analysis of research question 3 (individual characteristics and institutional support). Because the dependent variable was interval-scaled, a multiple regression analysis was employed. A stepwise multiple regression determined how much of the variance in quality of broader impacts activity scores could be explained by the respondents’ expertise, epistemology, rank, discipline, institutional climate, and resources.

**Results**

**Response Rate**

The rate of response to the study’s survey was low. Of the 700 surveys distributed, 15 were mail returns, 246 were viewed, 209 were started, and 124 were completed. The completed response rate was 18.1%. Although the limited number of cases restricted the options for statistical analysis, the low response rate did not necessarily invalidate the survey. An examination of the results of 81 national surveys with response rates ranging from 5% to 54% revealed that surveys with much lower response rates were only minimally less accurate (Holbrook, Krosnick, & Pfent, 2007).
Demographics

Of the 124 respondents who completed the survey, half held the academic rank of full professor \((n = 62, 50.0\%)\), while the bulk of the rest were associate professors \((n = 40, 32.3\%)\), with some assistant professors \((n = 14, 11.3\%)\). Table 1 reports the frequencies and percentages of the academic rank categories.

Table 1. Frequencies and Percentages of Academic Rank

<table>
<thead>
<tr>
<th>Academic Rank</th>
<th>(n)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full professor</td>
<td>62</td>
<td>50.4</td>
</tr>
<tr>
<td>Associate professor</td>
<td>40</td>
<td>32.5</td>
</tr>
<tr>
<td>Assistant professor</td>
<td>14</td>
<td>11.4</td>
</tr>
<tr>
<td>Research scientist/professor</td>
<td>5</td>
<td>4.1</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Note: \(n = 123\); one response was missing.

The degree to which the sample is representative of the population of NSF grantees is unknown because the NSF does not track the academic rank of their grantees. The NSF does, however, categorize their grantees as either “Early Career PIs” (investigators within seven years of receiving their last degree) or “Later Career PIs” (those who received their last degree more than seven years before the award date). In FY 2009, 78% of NSF grantees were classified as Later Career PIs; 22% were Early Career PIs (NSB, 2010). The fact that the promotion from Assistant to Associate Professor generally occurs within six years on the tenure track suggests that the distribution of the sample is reasonably representative of the population.

The respondents were fairly evenly distributed across the seven NSF directorates, as Table 2 depicts. The Directorate of Biological Sciences had the largest representation \((n = 27, 21.8\%)\); the next five directorates were closely clustered, with the number of respondents ranging from 19 (15.3%) to 15 (12.1%). The Directorate of Geosciences had the fewest respondents \((n = 11, 8.9\%)\).

Table 2. Frequencies and Percentages of NSF Directorates

<table>
<thead>
<tr>
<th>NSF Directorate</th>
<th>(n)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological sciences</td>
<td>27</td>
<td>21.8</td>
</tr>
<tr>
<td>Mathematics and physical sciences</td>
<td>19</td>
<td>15.3</td>
</tr>
<tr>
<td>Social behavioral and economic sciences</td>
<td>18</td>
<td>14.5</td>
</tr>
<tr>
<td>Computer science and engineering</td>
<td>16</td>
<td>12.9</td>
</tr>
<tr>
<td>Engineering</td>
<td>16</td>
<td>12.9</td>
</tr>
<tr>
<td>Education and human resources</td>
<td>15</td>
<td>12.1</td>
</tr>
<tr>
<td>Geosciences</td>
<td>11</td>
<td>8.9</td>
</tr>
</tbody>
</table>

Note: \(n = 122\); two responses were missing.
Type of Broader Impacts Activity

Research question 1 asked about the different types of activity that PIs engage in. The categories of activity, identified by the NSF, were education, broadening participation, infrastructure, dissemination, and other (NSF, 2008a). Frequencies of responses to the question about type of activity were tabulated to derive percentages of participation in each activity. Education was by far the most common activity \( (n = 71, 57.3\%) \), while dissemination was the second most reported activity \( (n = 29, 23.4\%) \). The remaining categories were substantially lower. Descriptive statistics generated from this item are presented in Table 3.

Table 3. Frequencies and Percentages of Type of Broader Impacts Activity

<table>
<thead>
<tr>
<th>Type</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>62</td>
<td>57.3</td>
</tr>
<tr>
<td>Dissemination</td>
<td>29</td>
<td>23.4</td>
</tr>
<tr>
<td>Broadening participation</td>
<td>12</td>
<td>9.7</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>9</td>
<td>7.3</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>2.4</td>
</tr>
</tbody>
</table>

Quality of Broader Impacts Activities

Respondents assessed the quality of their broader impacts activities in terms of goals, preparation, methods, results, presentation, critique, and ethics of the activity. The response scale was 1 (not at all) to 5 (fully). Respondents expressed the greatest confidence in their selection and use of methods (composite \( M = 4.18, SD = 0.64 \)). High scoring items included “I used methods appropriate to my goals” \( (M = 4.36, SD = 0.65) \) and “I effectively applied the methods selected” \( (M = 4.11, SD = 0.79) \). Scores were also relatively high for preparation (composite \( M = 4.16, SD = 0.82 \)), with the leading item being “I brought together the skills and resources necessary to move the project forward” \( (M = 4.30, SD = 0.74) \). Interestingly, the area of ethics included both the highest and lowest scoring items: “I followed all policies concerning the responsible conduct of research” \( (M = 4.61, SD = 0.74) \) and “I subjected my activity to university IRB review” \( (M = 3.10, SD = 1.82) \).

The area that showed the greatest weakness was critique (composite \( M = 3.49, SD = 0.98 \)). The lowest scoring items in this category were “I used an appropriate breadth of evidence for the critique” \( (M = 3.39, SD = 1.11) \) and “I used this evaluation to improve the quality of future work” \( (M = 3.51, SD = 1.01) \). Respondents also rated themselves lower in using the results (composite \( M = 3.87, SD = 0.80 \)). The items “I presented the results to both academic and non-academic audiences” and “The results of the activity added consequently to the field” received the relatively low mean scores of 3.73 \( (SD = 1.11) \) and 3.76 \( (SD = 0.97) \), respectively.

Thirty-eight respondents (30.6%) reported that their broader impacts activities involved collaboration with a specific community agency (such as a school, museum, organization, or
other group). These respondents assessed their community partnerships in terms of reciprocity, communication, structures, and duration of the collaboration. The scoring for this area of assessment was noticeably lower than the others (composite $M = 3.07$, $SD = 1.07$). The highest scoring items were “Communications between the community partner and I were ongoing and bidirectional” ($M = 3.53$, $SD = 1.13$) and “The relationship continued after the project ended” ($M = 3.47$, $SD = 1.43$). The items receiving the lowest ratings were “A formal agreement outlined roles and responsibilities” ($M = 2.55$, $SD = 1.33$) and “The community partner and I shared power and responsibility equitably” ($M = 2.74$, $SD = 1.25$).

Predictors

The literature suggests possible associations between engagement in public scholarship and personal and institutional characteristics. This study investigated these variables as predictors of type and quality of broader impacts activities.

**Expertise.** This variable was a summed score of questions about the respondents’ prior experience, training, and sense of ability related to community-engaged activities. Respondents indicated that they had a good deal of prior experience with activities similar to their broader impacts work as faculty members ($M = 4.01$, $SD = 1.01$), but they had received little faculty training for such work ($M = 2.72$, $SD = 1.22$). As graduate students, they received even less training ($M = 2.39$, $SD = 1.35$) and had less experience ($M = 2.78$, $SD = 1.39$). Respondents reported that they had a relatively strong sense of ability to implement broader impacts activities ($M = 3.75$, $SD = 0.90$), but they were less confident in their ability to evaluate these activities ($M = 3.27$, $SD = 1.09$).

**Epistemology.** This variable was a summed score of questions about the respondents’ views on knowledge production and the democratization of science. Responses were grouped into two categories: democratic and technocratic orientations. A technocratic orientation is characterized by the valuing of basic, discipline-specific, curiosity-driven research conducted exclusively by highly specialized academic experts. A democratic orientation values applied, trans-disciplinary, problem-centered, use-inspired research that welcomes collaboration with partners outside the academy. Survey responses indicated orientations that were more democratic ($M = 3.22$, $SD = 0.68$) than technocratic ($M = 2.85$, $SD = 0.68$). Respondents tended to view public engagement in science as a way to increase acceptance of the results and generate information that meets user needs ($M = 3.85$, $SD = 0.93$), and to take into account public values and contexts as well as local expertise ($M = 3.09$, $SD = 1.13$). Respondents did not agree that public ignorance should be corrected through a one-way flow of information from the academy to the community ($M = 2.17$, $SD = 1.01$), or that scientific research would be most productive if left to scientists alone ($M = 2.49$, $SD = 1.21$).

**Climate.** This variable was a summed score of questions about the respondents’ perceptions of institutional climate as expressed through rhetoric, recognition, and rewards for community engagement. The overall mean for this variable was moderate, at 3.02 ($SD = 0.79$). Respondents
indicated that the executive leadership at their institutions explicitly promoted community engagement as a priority \((M = 3.42, SD = 1.11)\), but their promotion and tenure policies did not reward such research \((M = 2.15, SD = 0.93)\).

**Resources.** This variable was a summed score of questions about the respondents’ perceptions of the administrative support, faculty development, and incentives available for community engagement. The overall mean for this item was low, at \(2.31 (SD = 0.82)\). Respondents reported that faculty training was not available in engaged scholarship \((M = 2.19, SD = 1.04)\) and that there was little financial support \((M = 2.20, SD = 1.10)\) or infrastructure to facilitate collaboration \((M = 2.38, SD = 1.07)\) and assessment \((M = 2.40, SD = 1.06)\) of community engaged activities.

**Influence on Type of Activity**

A multinomial logistic regression analysis was conducted to predict the type of broader impacts activity the respondents engaged in, using expertise, epistemology, institutional support, discipline, and rank as predictors. A test of the full model against a constant only model was significant, indicating that the predictors, as a set, reliably distinguished between types of broader impacts activity, \(\chi^2(52, n = 102) = 87.61, p = .001\). A Nagelkerke’s \(R^2\) of \(.644\) indicated a moderately strong relationship between prediction and grouping. The model’s overall prediction success was 68.3%. The likelihood ratio tests demonstrated that expertise, resources, and discipline contributed significantly to the model; expertise emerged as the strongest predictor (based on \(p\) value). Table 4 presents the contribution of each variable to the model.

**Table 4. Likelihood Ratio Test of Each Predictor’s Contribution to the Model**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>(\chi^2)</th>
<th>(df)</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expertise</td>
<td>22.61</td>
<td>4</td>
<td>.000*</td>
</tr>
<tr>
<td>Resources</td>
<td>17.28</td>
<td>4</td>
<td>.002*</td>
</tr>
<tr>
<td>Discipline</td>
<td>40.67</td>
<td>24</td>
<td>.018*</td>
</tr>
<tr>
<td>Rank</td>
<td>14.11</td>
<td>8</td>
<td>.079</td>
</tr>
<tr>
<td>Technocratic</td>
<td>5.13</td>
<td>4</td>
<td>.274</td>
</tr>
<tr>
<td>Democratic</td>
<td>0.67</td>
<td>4</td>
<td>.956</td>
</tr>
<tr>
<td>Climate</td>
<td>1.30</td>
<td>4</td>
<td>.861</td>
</tr>
</tbody>
</table>

* Significant predictors at .05.

**Influence on Quality of Activity**

A multiple regression analysis revealed that the linear combination of individual characteristics and institutional support was significantly related to quality, \(F(15,84) = 5.16, p = .000\). The sample multiple correlation coefficient \((R^2)\) was .70, indicating that approximately 49% of the variance in quality could be accounted for by the linear combination of individual characteristics and institutional support. A stepwise multiple regression presented a more parsimonious model with an equally significant regression equation, \(F(5,90) = 14.89, p = .000\), and an adjusted \(R^2\) of .42.
The stepwise model revealed that expertise accounted for 20% of the variance, and that the inclusion of climate into the model resulted in an additional 8% of the variance being explained. Table 5 presents indices of the relative strength of each predictor. These results suggest that faculty expertise is the greatest predictor of the quality of broader impacts activities. An institutional climate supportive of community engagement and a democratic attitude toward knowledge production are also predictors of high quality broader impacts activities. The results also indicate that full professors are more likely to report high quality broader impacts activities, while researchers who submit to the NSF Directorate of Biological Sciences are less likely to do so.

Table 5. Strength of Predictor Variables on Quality in Stepwise Regression

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Beta</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expertise</td>
<td>.312</td>
<td>.000*</td>
</tr>
<tr>
<td>Biology</td>
<td>-.256</td>
<td>.002*</td>
</tr>
<tr>
<td>Democratic</td>
<td>.247</td>
<td>.003*</td>
</tr>
<tr>
<td>Climate</td>
<td>.236</td>
<td>.005*</td>
</tr>
<tr>
<td>Full professor</td>
<td>.199</td>
<td>.016*</td>
</tr>
</tbody>
</table>

* Significant predictors at .05.

Open-ended Comments

The survey concluded with an invitation for participants who wished to comment on the survey to do so in an open text box. Feedback from participants covered the following topics: appreciation for the study (4); suggestions to improve the study by clarifying the language (5) and allowing respondents to select multiple options (4); and complaints about the broader impacts criterion in terms of how the NSF manages it (2), how researchers respond to it (2), and the need for support (5). The strongest feedback focused on the need for support with broader impacts activities. This concern was expressed both in the comment box as well as through email responses to the author from sample members who chose not to complete the survey.

Discussion

Personal Characteristics

All of the individual traits postulated in the literature to influence faculty community engagement examined in this study emerged, to varying degrees, as determinants of the broader impacts activities of academic faculty.

Expertise. Broader impacts activities generally push investigators beyond their particular areas of specialization and require additional skill sets. Many scientists believe they do not have the skills necessary to develop appropriate outreach activities (Lok, 2010; Mathieu, Pfund, & Gillian-Daniel, 2009; Tretkoff, 2007). This theme pervading the literature was supported by the study’s finding that respondents had received little training to develop and
implement work similar to their broader impacts activities. Sample members in the survey and email responses to the researcher also reiterated this belief.

The data analysis revealed that expertise was the strongest predictor of the type and quality of broader impacts activities. Because this variable emerged as such a significant predictor, the author repeated the analysis with a more conservative computation of faculty expertise by removing the items referring to prior experience and training as a graduate student. This narrower perspective on expertise did not diminish the significance of this variable in any of the regression analyses. The survey findings and supplemental responses underscore the need for faculty development and training in broader impacts, as well as institutional support to assist with implementation and evaluation.

Epistemology. The influence of epistemology was manifested in this study in more than one way. Negative bias in the scientific community against the broader impacts criterion appears to have limited the survey response rate. Several members of the sample opted to reply to the author with negative comments rather than complete the survey. The following example of a response to the author’s email invitation to complete the survey provides anecdotal evidence of persistent resistance to the broader impacts criterion:

“Most everyone I know that submits to NSF *HATES* to come up with arguments about broader impacts for NSF proposals. They hate doing it, they hate thinking they had to do it, etc. So, when a request like yours comes in, most folks can’t delete your unwelcome spam-like message fast enough.”

The literature reviewed documents with similar negative responses from researchers, describing the broader impacts criterion as burdensome, counterproductive, and punitive (Tretkoff, 2007); confusing and frustrating (Sarewitz, 2011); irrelevant, ambiguous, and poorly worded (Holbrook & Frodeman, 2005); and undermining the autonomy of the scientific enterprise (Holbrook & Frodeman, 2011).

Some of this resistance stems from the fact that the revisions to the merit criteria had little impetus from the scientific community, but were instituted in response to Congressional prodding (Bozeman & Boardman, 2009). The broader impacts criterion is interpreted by some as an introduction of extraneous political, cultural, or economic concerns into basic research (Holbrook & Frodeman, 2007); bringing considerations external to science into the peer review process (Holbrook, 2005), and politicizing the value-neutral pursuit of science (Holbrook & Frodeman, 2007). Holbrook and Frodeman (2007) suggested that agitation over the broader impacts criterion is to be expected from anyone who believes that beneficial societal impacts will eventually follow from a laissez faire approach to basic research. Thus, reaction to the broader impacts criterion may depend on one’s conception of knowledge production, one’s views on the democratization of science, and the degree to which one supports the Bush model of opposition between basic and applied research.

Survey responses revealed that epistemology shaped participants’ response to the broader impacts criterion, with a democratic orientation towards knowledge production emerging as a predictor of the quality of broader impacts activities. A democratic orientation recognizes that public engagement increases the acceptance of research results, generates information that meets user
needs, accounts for public values and knowledge, and improves the quality of science policy decisions. Participants shared an orientation towards knowledge production that was more democratic than technocratic. Yet, despite this appreciation for the socially embedded context of application, respondents favored research that was curiosity-driven rather than use-inspired. The apparent incongruity between respondents’ valuing of public engagement to increase the acceptance of results and meet user needs, while favoring research that is curiosity-driven rather than use-inspired, may indicate an emerging culture shift. Researchers appear to be embracing an alternative value system that acknowledges the need for public engagement while clinging to traditional norms regarding what constitutes proper academic science.

A similar dynamic tension was evident in questions about how knowledge is generated. Survey respondents indicated a strong belief that knowledge is generated through trans-disciplinary collaboration that brings together multiple sources of distributed knowledge, a view characteristic of a democratic orientation. Interestingly, they also expressed the concurrent belief that knowledge is generated through objective disciplinary expert-led investigation, suggesting they did not perceive these opposing approaches to knowledge production as dichotomous.

**Rank.** While prior research suggested a significant relationship between an investigator’s professional career status and engagement in community-based research, the direction of the relationship was inconclusive. It has been reported that the types of publicly engaged scholarship faculty members pursued varied by rank in statistically significant ways, with full professors more likely than associate professors to report such work (Glass, Doberneck, & Schweitzer, 2011); that lower ranked faculty were more frequently involved in public service (Antonio, Astin, & Cress, 2000); that faculty members of various ranks reported using scholarship to address community needs at similar levels (Vogelgesang, Denson, & Jayakumar, 2010); and that tenured and untenured faculty showed similar levels of frequency in conducting the scholarship of engagement (Braxton & Luckey, 2010). Some argue that junior faculty trained in an environment where engaged scholarship is increasingly viewed as an important part of the mission of modern universities are more likely to engage than senior faculty who were not trained in such an environment (Jaeger & Thornton, 2006). Others contend that successful senior scholars with tenure have the flexibility and freedom to pursue non-traditional research (Scott, 2007). One finding that is consistently reported is that junior faculty members are routinely counseled to avoid service activity that may interfere with their research productivity (Stanton & Wagner, 2010).

This study found that academic rank was a predictor of the quality of broader impacts activities. The finding that being a full professor was a significant predictor of quality aligns with reports in the literature that full professors are more likely than associate professors to conduct community engaged work (Glass, Doberneck, & Schweitzer, 2011) and that successful senior scholars with tenure have the flexibility and freedom to pursue non-traditional research (Scott, 2007).

**Discipline.** The literature suggests that the ways in which faculty members define, design, and enact their community-engaged scholarship are largely driven by discipline (Doberneck, Glass, & Schweitzer, 2010). This aligns well with the study’s finding that discipline contributed
significantly to the predictive model for type of broader impacts activity. In this study, discipline was operationalized as the NSF directorate to which the researcher applied. The results revealed that researchers who submitted to the NSF Directorate of Biological Sciences were less likely to report high quality broader impacts activities. This supports various reports in the literature that community engagement was less prevalent in the physical sciences (Lunsford & Omae, 2011; Vogelgesang, Denson, & Jayakumar, 2010).

Institutional Support

One of the key predictors of engaged scholarship is institutional practices and policies that support engagement (Lunsford, Bargerstock, & Greasley, 2010). Faculty motivation to engage in public scholarship is influenced by institutional characteristics including mission, resources, norms, and evaluation policies (Colbeck & Wharton-Michael, 2006). Some theorists have noted that institutional characteristics have a greater impact than personal motivation and commitment when it comes to scholarly productivity, and that faculty productivity may be stimulated or stifled by organizational culture and administrative structure (Freedenthal, Potter, & Grinstein-Weiss, 2008). A study based on the Higher Education Research Institute’s 2004-2005 national survey of college and university faculty revealed that the perception of institutional support matters, even above and beyond the individual dispositions of faculty members, and even when disciplinary culture is accounted for. Every one-step increase in perceived institutional support was associated with a 10% increase in the likelihood of a faculty member collaborating with the local community in research or teaching (Vogelgesang, Denson, & Jayakumar 2010). Institutional support can be conveyed through both climate and resource allocation.

Climate. Campus climate is a function of interpersonal interactions and includes dimensions such as “perceptions, attitudes, and expectations” (Cress, 2002, p. 390). A multiple regression analysis revealed that an institutional climate supportive of community engagement is a strong predictor of high quality broader impacts activities, accounting for 8% of the variance explained by the model. The literature identified the university reward system as the greatest obstacle to community engaged research (Pfirman, Collins, Lowes, & Michaels, 2005). Responses to the author’s survey concurred that promotion and tenure policies were the feature of institutional climate least supportive of community-based research.

Resources. While faculty recognition and rewards are important motivators to initiate change, organizational structures must be in place to sustain the work (Brukardt, Holland, Percy, & Zimpher, 2004; Stanton, 2007). When the NSF asked the scientific community what role their institutions should play to ensure that broader impacts are realized, the majority response was that home institutions should increase support for broader impacts by establishing mechanisms for those activities, increasing financial or in-kind support, or encouraging involvement through changes in value systems and incentives (NSB, 2011). The allocation of resources for administrative support, faculty development, and incentives is the second largest barrier to engaged scholarship (Pfirman et al., 2005). Although resources emerged as a strong predictor of type of broader impacts activity, participants reported limited access to training or infrastructure to facilitate collaboration and assessment of community-engaged activities.
Type of Broader Impacts Activity

NSF guidelines to proposers and reviewers identified general areas of broader impact: education, broadening participation, enhancement of infrastructure, broad dissemination, and other social benefit (NSF, 2008a). Despite admonitions from the NSF that PIs “are expected to go beyond their normal teaching duties and faculty commitments” (NSF, 2008b, p. 1), the category of education is by far the most common broader impacts activity, often with researchers simply repackaging what they are already doing (Lok, 2010). The chemistry division director at the NSF reported that “Overwhelmingly, the number one broader impacts that most people in the chemistry division are using is ‘training graduate students and postdocs’” (Lok, 2010, p. 417). In 2010, the National Science Board (NSB), the agency charged with NSF oversight, commissioned a topic modeling of the project summaries of approximately 150,000 NSF proposals. The analysis revealed that the education category occurred in more than 60% of the proposals (NSB, 2011). This was roughly three times the size of the next largest category. The results of the present study were congruent with the topic modeling; education was by far the most commonly reported activity at 57.3%.

The America COMPETES Reauthorization Act of 2010 (P.L. 111-358), which provided reauthorization for the NSF, established new goals and policies for the broader impacts criterion. The Act stipulated that the NSF must apply this criterion to achieve an array of societal goals, including increasing economic competitiveness; developing a globally competitive workforce in science, technology, engineering, and math (STEM); expanding the participation of women and underrepresented minorities in science and engineering; increasing partnerships between academia, industry, and others; improving STEM education at PK-12 and undergraduate levels, including teacher development; increasing public scientific literacy; and expanding national security (Sec. 526[a][1]-[8]). The NSF integrated this expanded vision of broader impacts into a new Proposal and Award Policies and Procedures Guide (NSF, 2012). Congress’ identification of eight national goals to which broader impacts activities should be directed underscores the need for greater variation in the types of broader impacts activities PIs pursue. The results of this study suggest that limited resources and training constrain researchers to engaging in broader impacts activities that are the most familiar and least demanding (i.e. education).

Quality of Broader Impacts Activity

Hampering effective peer review of broader impacts is the fact that no standards have been set and no evaluation target provided (Bozeman & Boardman, 2009). The NSF does not systematically track how its broader impacts requirements are being met, nor does it have a system in place to evaluate project effectiveness (Lok, 2010). The first comprehensive analysis of the NSF’s review criteria, conducted in 2000, recommended that the NSF develop an evaluation strategy based on measures and performance indicators to track the objectives and implementation of the new criteria supported by both qualitative and statistical data collection methods capable of measuring incremental movement towards achieving the NSF’s strategic goals (National Academy of Public Administration, 2001). One of the six major themes of the second national review of the NSF criteria, conducted 10 years later, was that post-award assessment of broader impacts activities was weak and should be improved (NSB, 2011). Given the variation in size and scope of projects, the
report indicated that the effectiveness of broader impacts would be more meaningful if they were aggregated at a higher level than the individual project.

Without established metrics and data collection, it is impossible to objectively assess the broader impacts of sponsored programs. Instead, this study asked PIs to evaluate the processes with which they devised and implemented their broader impacts activities using the standards of scholarship (clear goals, adequate preparation, appropriate methods, significant results, effective presentation, reflective critique, and ethical conduct). Given the subjectivity of self-assessment, better objective metrics of the quality of broader impacts activities are clearly needed. The criteria used in this study appeared to engender a social desirability bias. Respondents showed little variation in their high ratings of the quality of their broader impact activities, presumably because they wanted to believe that they were practicing good scholarship. It is likely that those who reported working with a specific community agency were more critical of these partnerships because such activity is traditionally less highly regarded in the academy and thus subject to a more frank assessment. Identifying valid and feasible ways to assess research impact more objectively should be a priority of future studies. Self-reported information needs to be balanced with multiple kinds and sources of data. An important contribution to the field would be the development of multiple well-defined measures, consisting of both hard and soft data, which can be systematically analyzed.

**Implications**

This study makes several contributions to the field of research administration. By providing a snapshot of the type and quality of broader impacts activities conducted by PIs, it enhances understanding of the training and support faculty members need to successfully meet the broader impacts requirements of federally sponsored research. In addition to data collection, the study examined the associations between relevant personal, professional, and institutional factors, and broader impacts activities, identifying patterns and highlighting barriers and facilitators to guide the decision making of higher education administration as well as federal funding agencies seeking to expand or enhance the broader impacts of university research. This study was designed to stimulate discussion among higher education administrators about community engagement, inform initiatives to expand interactions between campuses and external entities, generate strategies to improve the quality of broader impacts activities, and identify faculty development objectives that are scholarship-based. Linking broader impacts activities with forms of engaged scholarship reinforces the value of such work and establishes new indicators for the institutionalization of engagement at research universities.

The results of the study also hold practical implications. Expertise emerged as the strongest predictor of broader impacts activity type and quality, yet respondents reported receiving little training in such work. The study identified the need for faculty professional development in effective evaluation, putting the results to use, establishing clearly defined partnerships with community agencies, and equitably distributing power and responsibility with community partners. Such training need not be limited to faculty. Respondents reported that they had received little to no training and experience in community engagement as graduate students. Because graduate school is where researchers are socialized as scholars and where they develop
their professional identities, extending training to graduate students and postdoctoral researchers will help create a cadre of professionals who conduct high quality broader impacts activities as a natural part of their research programs.

While there is clearly a need for training, faculty may be reluctant to pursue it. This disinclination was expressed both via email responses and through the survey’s open comment box. Participants asserted that they lack both the time and desire to learn how to implement broader impacts activities; that it did not make sense to require scientists to do such work; that trained experts are better suited to public outreach than research scientists; and that it would be preferable to partner with experts in broader impacts than to learn how to conduct such activities. These comments point to the need for campuses to provide professional staff trained in implementing broader impacts activities to collaborate with and support researchers.

Survey respondents reported limited infrastructure available to assist with their broader impacts work. Existing service-learning and civic engagement centers, or other campus-wide coordinating units, can fill that gap by providing researchers with practical assistance; links to community partners; information about established, well-aligned projects with which to connect; and a venue for interdisciplinary partnerships. Technical assistance would be especially important in assessment and evaluation of the outcomes of broader impacts activities.

Beyond investing in training and infrastructure, institutions can also enhance and expand the quality and type of their broader impacts activities by providing incentives (such as stipends, release time, and seed grants) for faculty to build engagement into their work. An institutional climate supportive of community engagement was a strong predictor of high quality broader impacts activities. An institution’s climate is shaped by values expressed through rhetoric, public recognition, and reward systems. Respondents indicated that the executive leadership at their institutions explicitly promoted community engagement as a priority, but their promotion and tenure policies did not recognize anything other than peer-reviewed publications and grants as measures of productivity. If researchers are to be motivated to conduct high quality work in the community, tenure and promotion guidelines must be revised to ensure that they receive professional recognition and advancement for engaged scholarship.

Overhauling the faculty-reward system will not work without a broad shift in the attitudes of professors, especially those on promotion and tenure committees. Simply adding new metrics or categories of work to evaluate as part of the faculty reward systems is not enough. Academics must be encouraged to think differently. Executive leaders can inculcate a supportive climate by publicly promoting community engagement as a priority and ensuring that engagement activity is publicly recognized through award programs, university publications, and events that showcase the work of engaged scholars. By creating new traditions, rituals, and symbols that reinforce the value of community-based work, institutions can foster an epistemological shift toward democratic engagement and ease the dynamic tension accompanying the transition from traditional to alternative value systems, creating enduring and pervasive change.

With decreasing appropriations for public higher education and shrinking budgets, academics are under growing pressure to secure external funding for their research. In response to prodding
from Congress, the NSF and other federal funding agencies are placing more, not less, emphasis on public accountability for and engagement in federally sponsored research. As prestigious federal grants increasingly require an outward-looking orientation, more and more scientists are finding themselves compelled to practice engaged scholarship. Research administrators must continue to explore how investigators can be both socialized and supported so that they embrace community engagement as an important and necessary element of federally funded research.

Author’s Note

This paper is extracted from the author’s dissertation entitled “Evaluating the Broader Impacts of Sponsored Research through the Lens of Engaged Scholarship.” This paper won the Best Paper Award for the 2014 SRA Symposium.

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