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FROM THE EDITOR’S DESK
I recently began my 20th year of professional service in healthcare and biomedical research leadership. Reflecting back on these nearly two decades, I recall often how my entry into the world of research was such a contradiction. I never claimed to have any talent for the physical sciences. Yet from the time that I first stepped into the laboratories, something captured my attention. Simply, it was the dedication of the researchers themselves: their long hours, their love of what they were doing, the impatience with their own efforts or with the system, their passion when they spoke of the impact their work could have for others. Over the years, as an academic in the humanities, I have wondered what has kept me so attracted to the laboratory life in which I was immersed for so long. If nothing else, I have come to identify getting caught up in the fire of discovery and innovation that has been at the heart of every researcher I have come to know over the years. But what is this fire all about?

As a popular movie character coined it years ago, the journey of human discovery and innovation is marked by an insatiable curiosity. The human animal engages in research to make life better, to transcend the self and grow, to fill up our urgent inner longings and desires to know more and to be more. There is nothing new about this. This is fundamental to our human story. Fifty years ago, this curiosity poised our world for a quantum leap as we entered into what we call today the Information Age. It was in 1960 that the mathematical genius of Admiral Grace Murray Hopper led to the invention of the computer language, COBOL. Human communication changed forever. Yet there is nothing new about this. Each significant human discovery always leads us to the profound changes that Thomas Kuhn called “paradigm shifts” in his work, *The Structure of a Scientific Revolution*.

In this edition of the *Journal of Research Administration*, it is fitting, then, that we shape our reading through the metaphors of discovery and innovation. These energies are not limited to the traditional laboratory. They are the mark of our profession as well. We seek to facilitate new strategies, opportunities, and methods of professional service. We promote the quantum leap of leadership to create an atmosphere in which researchers of all fields in the arts and sciences can develop knowledge, processes, and technologies for the betterment of human life. To celebrate the continual discovery and innovation in our profession, this edition of the Journal features a special prelude and book review on the life and significance of Admiral “Amazing Grace” Murray Hopper. The articles featured in this edition mark new and inventive ways by which colleagues of ours from around the world deepen our leadership and service in intriguing ways.

I invite you then to be insatiably curious. Read and catch some of the spark that continues to energize us as research leaders to make all things continually new.
PRELUDE
Prelude:
The Capture and Challenge of Discovery and Innovation, Celebrating 50 Years of the Information Age

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Editor’s Note
To celebrate this year’s landmark half-century of the Information Age, an SRA International leader in Knowledge Science and Information Systems offers a careful reflection to begin this edition of the Journal. Reflecting on the life and times of one of the 20th century’s pioneers in computer science, the author asks us to consider carefully the exacting price and the exciting horizons that discovery and innovation in any field pose for the way we think, live, and relate in a fast-paced global culture. Such reflections give much food for thought as we continually reinvent our profession of research leadership, administration and management.

Introduction
From the simplest to the most sophisticated human activities, the power of computing has changed the way we interact individually, socially, governmentally, culturally, and globally. Yet have these influences been for the good or have they been less than positive? This year, we celebrate the 50th anniversary of the implementation of COBOL, a.k.a. Common Business Oriented Language, one of the most well-known of computer fundamentals.

COBOL arose from the profound scholarship and industry of Admiral Grace Murray Hopper. “Amazing Grace,” as she was known, was one of the greatest American pioneers in the history of computer science. COBOL, one of the oldest programming languages, is an acronym for COmmon Business-Oriented Language, which defines its primary domain in business, finance, and administrative systems for companies and governments. Obtaining her doctorate in mathematics at a time when such academic achievements were not the usual experience for American women, Admiral Hopper was eventually elevated to her Navy rank by a specific honor from the Congress of the United States because of her genius, dedication, forward thinking, and unprecedented discoveries. She was an inventor par excellence whose personal life sustained the price of dedicated scholarship.
The reflections and contributions of Admiral Hopper can be found today throughout our information industry. Just as we now develop new software or design new data chips, Admiral Hopper discovered the path to wide-spread usability from “debugging” software to developing the software engineering disciplines necessary to carry out today’s demand for information. Her belief in decentralization opened new thought-provoking collaborative models that have both leap-frogged the advancement of technologies and, ironically, added to the many challenges we face today in managing the application of such new technologies.

Reflections and Impact: From Mathematician to Professor, to Programmer, to Icon

The many contributions of Admiral Hopper are well discussed in Kurt Beyer’s 2009 work published by the Massachusetts Institute of Technology, *Grace Hopper and the Invention of the Information Age*. Among these contributions is debugging, a methodical process of finding and reducing the number of bugs, or defects, in a computer program or a piece of electronic hardware, to make it behave as expected. The terms “bug” and “debugging” were popularly attributed to Admiral Hopper in the 1940s. While she was working on a Mark II Computer at Harvard University, her associates discovered a moth stuck in a relay, thereby impeding operation; thereupon she remarked that they were “debugging” the system.

Sub-routines, as the name “subprogram” suggests, behave in much the same way as a computer program used as one step in a larger program or another subprogram. A sub-routine is often coded so that it can be started (“called”) several times and/or from several places during a single execution of the program, including from other subroutines, and then branch back (return) to the next instruction after the “call” once its task is done. Sub-routines today can be found in many object-oriented programming development models known as classes which represent real world activities and objects.

More famously, Admiral Hopper had a strong belief in decentralized management — a process of dispersing decision-making governance closer to the users of software applications. It includes the dispersal of administration or governance in sectors like engineering, management science, political science, political economy, sociology and economics. Decentralization has enormous significance beyond software usage or computer governance. It is fundamental to contemporary organizational systems development and the structures and substructures of institutional life, including universities and research institutions.

Another significant contribution of Grace Hopper’s is her notion of using pseudo code before actually developing a software application. Pseudo code is a compact and informal high-level description of a computer programming algorithm that uses the structural conventions of a programming language, but is intended for human rather than machine reading. Pseudo code typically omits details that are not essential for human understanding of the algorithm, such as variable declarations, system-specific code and subroutines. The programming language is augmented with natural language descriptions of the details, where convenient, or with compact mathematical notation. Pseudo code is easier for humans to understand than conventional programming language code, and it is a compact and environment-independent description of the key principles of an algorithm. It is commonly used in textbooks and scientific publications to document various algorithms, and also in planning of computer program development for sketching out the structure of
the program before the actual coding takes place. From my own experience as a software developer, pseudo code provides me the opportunity to sketch out a prototype that fosters the ability to create new ideas before investing many hours of ad-hoc coding.

**The Critical Importance of Collaboration**

The environment of our information age today is strongly dependent on collaboration. However, that is essentially also true of research and academic inquiry in all disciplines. Collaboration is a recursive process where two or more people or organizations work together in an intersection of common goals — for example, an intellectual endeavor that is creative in nature — by sharing knowledge, learning and building consensus. Many of the contributions of Admiral Hopper’s discoveries have given us the abilities to pursue an environment and culture of nurturing, providing valuing, recognizing collaboration in the integration of processes as a unique quested value standard, effected by process owners, leveraging technology and cultural change, enabling decision support for best organizational or business practices, nurtured and guided.

As a thought-provoking gesture, the enhancement of current partnerships and development of new relationships, both internal and external, are required to migrate from a static environment to one that is dynamic, virtual, and transparent in execution. Established partnerships need to be based upon the partners’ core organizational functions and competencies to add to an information value chain. It is critical to integrate each organization’s uniqueness and outcomes to the processes that will lead to an increase in quality and innovation.

Collaboration with partners should be focused on user-centricity instead of techno-centric models. This guarantees an emphasis on how work is accomplished as results-driven. Given the extensive disparity between present configurations, approaching a global standardized configuration management and interoperability assurance requires, in concert with other organizations and expected partners, initial steps toward regionalization to reach configuration uniformity. In short, collaborations and partnerships are not easy to establish, maintain, and develop given the usual way in which human beings engage today in institutional life, including in business models. Collaborations demand a new way of thinking, even a shift in the paradigms by which we model our professional interactions, behaviors, and structural modeling.

**Obstacles and Challenges in Computing**

This is not to say that there are not difficulties and issues. Decentralization without governance, perhaps made too easy, changed the landscape of computing, marketing the desktop computer. Our environment today is dominated by a plethora of non-interfacing applications and systems development. The currently practiced government development methodology either dis-incentivizes or inherently prohibits exchange of information, agile migration to evolving technologies, reuse of programming code due to “proprietary” attributes embedded in development of applications and systems, programmatic inconsistencies with complementary systems and, inordinately prolonged start-to-finish timelines.
Restricted access to systems/data and lack of portability and configuration management have led to numerous isolated data sources that are merely varied “copies” of others. This commonly used practice results in duplicative work, unreliable synchronization, and informational inconsistencies resulting in decisions made on questionable data and an inability to replicate or update reliably the information from/to the primary source.

Our decentralized train of thought is blemished by repetitive and obsolete information, lacks navigational intuitiveness, hides the laborious processes of instilling any form of content management and, reflects yesterday’s requirements and constraints rather than tomorrow’s unheeded needs and opportunities. Information management strategies and methods and their supporting technology must not be a black box to managers.

In short, while we have made enormous quantum leaps in computer science, information technology advancements have equally been plagued by a wide variety of discipline-specific or technology-specific issues that inherently have impeded much-needed development and progress. This gives us yet another cause for reflection for wider social and institutional progress. In the face of discovery and innovation, are we capable of taking the time and measured thought to face the inherent challenges and problems that come with any form of invention? Are we prepared to engage in long-range development, or do we hold naïve beliefs that one-time inventions do not have long-term requirements for oversight, correction, revisions, and change?

Facing New Horizons in Computer Science and Information Management

We are living in an evolutionary process. History repeats itself, no matter in what age or era we live. Reiterative use of discarded, inefficient, ineffective, and resource-intensive processes, such as the return of centralized data management, has prevented data access from meeting the needs and requirements of the client or community member. Maintenance and life cycle management of systems must revolve around the process owner. Data access must move from an application-centric approach to a service-centric approach where desired outcome specifies the function. In other words, as classic philosophy taught, form must follow function. Interdependent services are common organizational and/or business functions that can and must be linked together to provide enhanced functionality without regard to how the information is presented (presentation layer). Not focusing on a fixed presentation layer permits data to remain independent of time, place and available to those in need in any situation through a variety of end user devices (EUDs) hence enabling interoperability.

Organizations have accumulated vast stores of transaction data over the decades. In the wake of the World Wide Web and its information deluge and the salience of homeland defense, we require a disciplined analysis methodology such as Enterprise Architecture Planning (EAP).

To optimize fully the information management resources available, as most of this information remains dormant, residing in unused data sources, a complete asset inventory is required. The inventory must not be limited to information technology resources but include governance, policy, and business processes. Along with this inventory is the need
for knowledge management and the use of Business Intelligence (BI) —the harnessing, organizing, and delivery of information assets.

In its most basic form, BI, the essence of knowledge management, is a strategy, not a purchased software product. Knowing how to manage and leverage knowledge assets can significantly enhance the use of information. For this reason, business intelligence is becoming critical to our future.

“Re-Thinking:” The Discomfort of Shifting Paradigms

Steaming forward requires an understanding of an information management culture. This is the multifaceted integration of business processes, enterprise applications, and organizational structures refined through ever-revised and reshaped techniques leading to the creation of a high-performance model for organizational systems. Success will not come simply from choosing the right applications to “webify,” or web-enabling the right process, or forging the right links to legacy systems. Instead, success requires fundamental changes in our organizational systematization, our corporate behavior, and even the way that we think — inside and outside of our corporate spheres of influence; getting back to the basics … laying a solid foundation upon which the enterprise can grow and meet tomorrow’s expected and un-anticipated exigencies focusing on agility, scalability, and simplicity. “Webifying” applications and services are often the easy part. Changing our organization and culture to realign with the basics, recognizing the value of information and how to apply it to knowledge, are more difficult.

From Information to Knowledge to Wisdom

A fast-changing digital world enables endeavors to reach “information” superiority. Yet is the purpose of any information system simply the amassing of “information?” Rather, the whole intention of information systems has always been to promote and benefit the common good of individuals and nations, indeed the entire global community. As a computer scientist myself, and one who knows well the genius of Grace Murray Hopper, there is definitely more to information science than just the collection of information alone. Information needs to be put to use for the ongoing development of individuals and societies. It has to become knowledge. Yet it strikes me that this is not yet the finished product.

Real change, growth and development happen when they effect personal and community maturity. What began as information must become knowledge, and knowledge must mature into wisdom. In other words, how is the information we are gathering and the knowledge we are producing making for human betterment and increased quality of life? How is knowledge evolving into a source for our becoming ever more human and humane in our personal development, our human interactions, our business and academic involvements, and our political developments as peoples and nations? How indeed are we becoming more and more “homo sapiens:” the wise creature? I wonder. Becoming wise means making the best use of information and knowledge with the best practices and processes we can devise, and applying through experience. This takes a lifetime. It has taken us 50 years of an Information Age to begin to ask these very questions. It will be interesting and curious to watch what answers and further questions evolve in the next.
Inside the Triple Helix: 
An Integrative Conceptual Framework of the Academic Researcher’s Activities, a Systematic Review

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Author’s Note
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Abstract
In the Triple Helix of University-Industry-Government relations, the academic researcher plays a predominant role as he participates in research, which provides opportunities for innovation; in teaching, which develops highly qualified personnel; and in entrepreneurialism, which represents the transformation of knowledge in a more usable form, and so another opportunity for innovation. The changes in the context of the university and of the researcher lead to a need for a more comprehensive understanding of the complexity of the university’s universe. To answer this need, a systematic literature review was conducted. From 5,463 articles, 98 were selected that identified four different roles of the researcher (research, teaching, entrepreneurialism, and services), and four levels of variables that influence them: the researcher’s characteristics (gender, ethnicity, network, e.g.), the departmental level, the university’s characteristics (type, structure, policies, e.g.), and the university’s location (city characteristics, entrepreneurial climate, regional policies, e.g.). A contextually sensitive understanding of these variables could provide a more nuanced and creative approach to manage research and entrepreneurial activities, and would provide opportunities to generate best practices to support the researcher.

Keywords: triple helix, university, researcher’s activities, researcher’s roles

Introduction
In some Organisation for Economic Co-operation and Development (OECD) countries, the interactions of the economic actors are in transition (Inzelt, 2004). A triple helix model of these interactions is emerging, based on a spiral pattern of relations among three meta-actors in a society: Industry, University and Government (Etzkowitz & Klofsten, 2005; Marques, Caraca, & Diz, 2006). None of these three meta-actors prevails on the others; each influences its
**Articles**

own trajectory of actions while every trajectory is influenced by the others (Leydesdorff & Meyer, 2006). Their roles and interests are “intimately intertwined in a complex combination of financial, intellectual, personal and legal relationships” (Campbell, Koski, & Blumenthal, 2004a, p. 4).

Never has the university had such a place. It has been motivated by external pressures such as the emergence of the knowledge economy within which the university, as a knowledge-producing and disseminating institution, plays a larger role in industrial innovation (Meyer, Sinilainen, & Utecht, 2003; Cooke, 2005; Landry, Amara, & Saihi, 2005); and the steady decline of public funding of research, which increases the competition for public funds (Etzkowitz & Brisolla, 1999). In this context, the university is experiencing its second academic revolution (Jacob, 2000), which leads to the emergence of a third role, beyond teaching and research: the entrepreneurial role (Etzkowitz et al., 2000). The entrepreneurial university is a “key instrument of technology innovation” (Degroof & Roberts, 2004, p. 327).

Two trends in the scientific literature have focused on this new academic environment (Marques et al., 2006). The first is focused on the study of the university's three roles, particularly the horizontal relations among the three meta-actors (Gunasekara, 2005). The second is focused on the institution's internal environment (Kirkland, 2005). In this trend, two orientations were considered: the first is an institutional perspective focused on structure, as implicit and explicit rules of play that define specific constraints and opportunities for actors (Kleinman, 1998). The new academic environment has increased the need for the institutional management of public higher education organisations (Hemlin, 2006b). The university faces formidable legitimacy challenges (Gumport, 2000). Attaining financial freedom will increasingly depend upon the university's willingness and capacity to collaborate with industries and other organisations (Landry, Traore, & Godin, 1996). Consequently, research and entrepreneurial activities, which were until recently seen as quasi-completely individualistic activities, have been increasingly considered as an organisational objective that should be managed accordingly (Fisher & Atkinson-Grosjean, 2002).

There is a growing interest in the way researchers assume their responsibility in terms of research, entrepreneurial and teaching activities (Kreber, 2000; Porter & Umbach, 2001). Consequently, the second orientation is an agent-centered analysis of faculty members' activities — particularly those of researchers, as operators in a highly manipulable environment and subjected to minimal constraint (Landry, Amara, & Rherrad, 2006). However, this orientation seems to correspond only to ivory tower institutions (Etzkowitz & Klofsten, 2005). In an increasing number of other institutions, this orientation does not take into account the growing pressures to which researchers are increasingly subjected (Meyer, Du Plessis, Tukeva, & Utecht, 2005), and prevents them from self-managing in a “completely free environment” (Laperche, 2002).

Each orientation gives only a partial view of the university's complex mechanisms. A more comprehensive understanding of the internal academic environment reveals the need for integration of the different orientations of the literature in a unique conceptual framework (Audretsch & Lehmann, 2005) that encompasses all the determinants of the researcher's activities and the relation between them. As the literature is disparate, concentrated on different levels of analysis, a complete development of this framework should allow both the mapping and assessment of the existing intellectual territory. A systematic review appears to be the more useful method to manage the diversity of knowledge on a specific academic inquiry (Tranfield, Denyer, & Smart, 2003). Understanding the determinants of the researcher's role has numerous implications both in identifying gaps that can be filled by future research, and in terms of university management (Hemlin, 2006a).
The article begins with a review of the protocols used and the reasoning behind them. A map is then introduced by considering six trends that characterize the field. Researcher activities and the relations between them follow, and a conceptual framework and synthesis of the evidence on the researcher’s activities are then presented. The article concludes with an identification of gaps and implications for future research and policy.

**Methodology**

A systematic review is a methodological process that identifies, evaluates and analyzes research evidence to synthesize and map it (Kitchenham, 2004; Staples & Niazi, 2007). The systematic review is a defined, methodical way of identifying, assessing, and analyzing published primary studies to investigate a specific research question (Staples & Niazi, 2007). It is based on a rigorous, transparent and reproducible process allowing development of the most complete view of the literature for researchers and policy-makers (Tranfield et al., 2003; Kitchenham, 2004). Undertaking a systematic review is increasingly regarded as a fundamental scientific activity, and its frequency in management is growing (Tranfield et al., 2003).

The basic steps of a systematic review include: 1) identifying the need for a review, 2) developing a research protocol (formulating an explicit research question, fixing inclusion and exclusion criteria), 3) identifying relevant studies, 4) selecting the studies according to the inclusion and exclusion criteria, 5) assessing the quality of retained studies, and 6) summarizing and synthesizing study results (Kitchenham, 2004; Staples & Niazi, 2007; Tranfield et al., 2003).

**Inclusion and Exclusion Criteria**

This systematic review sets out to answer the following three questions: 1) what are the activities related to the researcher’s roles, as well as their conceptual and operational definitions? 2) what are the institutional determinants of these activities? And 3) what are the other determinants of these activities?

Articles were selected if they considered one of the researcher’s roles as the primary concept and if they answered one of the three questions. Preliminary research identified other inclusion and exclusion criteria. First, the new environment of universities described seems to specifically characterize the OECD countries (Lach & Schankerman, 2003). In these countries, there is a growing trend of links between science and education policies on the one hand, and economic policies on the other (Laperche, 2002; Pilbeam, 2006). Moreover, according to Teodorescu (2001), a common structure of the determinants of the researcher’s role in OECD countries would be applied with difficulty to other countries. This leads to the conclusion that the systematic review should consider only articles based on OECD countries. Furthermore, according to Meyer et al. (2005), Lee and Rhoads (2004), and Baldini (2006), in the mid-1990s and particularly since 1995, there has been a shift toward rapid expansion of university commercialization. This leads to the conclusion that the systematic review should consider only documents studying post-1995 situations. As the systematic review process started in 2007, the review was limited to documents that had been published or available by the end of 2006.

Published, peer-reviewed papers and research reports were considered. Books, dissertations and book reviews were excluded, due to time and resource limitations.
Strategy of Localization

The strategy of paper localization included two subsequent phases. The first phase contained three steps: 1) a systematic computerized search within multidisciplinary (ISI Web of Science) and specialized databases (Academic Search Premier, ERIC, CBCA Complete, Current Contents, Francis, Education abstracts), as advised by an expert librarian; 2) a web electronic search using Google and Google Scholar; and 3) sorting documents extracted from the retrieval system according to explicit inclusion and exclusion criteria.

At the end of this phase, 5,463 documents were identified and reviewed, based on the inclusion and exclusion criteria. After initial sorting based on the documents’ titles and abstracts, 5,129 documents that did not meet the inclusion and exclusion criteria were excluded. A thorough reading of the full text of the remaining 334 documents excluded an additional 250. Hence, 84 documents survived the double sorting to be included in the first phase of the systematic review. Eighty-eight percent of these came from three electronic databases: ISI Web of Science, Academic Search Premier, and ERIC.

The second phase also included three steps: 1) the most important journals were selected according to the results of the first phase (Higher Education, Research in Higher Education, Research Policy, Review of Higher Education, Scientometrics), and a manual search made within volumes published between January 1995 and December 2006; 2) the most prominent authors of the literature selected in the first phase were contacted by email (of 12 authors selected, four responded); and 3) 14 documents were subsequently added. All the identified documents were run through EndNote software to identify and eliminate duplicates. Ninety-eight articles were ultimately selected.

General Characteristics of the Literature

The trend of the publications included is shown in Figure 1, which indicates that the number of works on researcher’s activities had remarkably increased, especially at the end of the 1990s. About 95 percent of the reviewed documents are publications from peer-reviewed journals; 5 percent are from research reports. Most of these studies (63.6 percent) are quantitative; 29.9 percent are qualitative, and 6.5 percent are of mixed methods.

Figure 1: General trend of the literature.
The systematic review process has been developed in more positivist and quantitative disciplines than social sciences and can be followed by a meta-analysis (Tranfield et al., 2003). However, to do so, the literature has to achieve a certain level of maturity, or else different kinds of studies (quantitative, qualitative and mixed method works) must be integrated in the systematic review (Tranfield et al., 2003). This is the case for the literature on researcher’s activities. The heterogeneity of the studies prevents the use of a meta-analysis; however, it allows integration of quantitative estimates of effect and a qualitative understanding from researcher’s life.

**Trends of Analysis Levels**

Two levels of analysis were considered in the literature: the institutional (63%) and the individual perspective (37%) (see Figure 2). The two perspectives have grown, but it seems that the individual perspective has grown faster (see Figure 3).

![Figure 2: Two levels of analysis.](image)

![Figure 3: Level of analysis trends.](image)

The institutional perspective is based on the idea that the university is not simply sustained by a series of individual acts, but also by social and cultural structures and by the institution’s practices (Kleinman, 1998). This perspective sheds light on how the university influences the researcher’s activities, and particularly the question of policies (Landry et al., 2005). In quantitative studies of this perspective, data were collected at the institutional level (Ramsden, 1999). Unfortunately, the aggregation of individual input and output at the institutional level led to an ecological fallacy in which aggregate-level results may substantially differ or even be the reverse of individual-level results (Porter & Umbach, 2001). This methodological issue would have motivated scholars to concentrate on the individual perspective, although the desegregation of the institutional characteristics to the individual level leads to poor or even misleading policy analysis (Porter & Umbach, 2001).

*Proposition 1:* Future research should empirically evaluate the membership effect related to the institution affiliation, in other words the assumption that the behaviours of researchers attending the same university are in some respect more alike that of researchers from two different universities. The membership effect is evaluated by considering a multi-level variance analysis, based on hierarchical structures of data (for example, individuals who are affiliated with universities).
Trends of Role Focus

The literature is dominated by a unique research object perspective (see Figure 4); studies are focused on the entrepreneurial role (53%, see for example Atkinson & elGuebaly, 1996; Abbott & Doucouliagos, 2004), on research (39%, see for example Dill, 1995; Azagra Caro et al., 2003), and on teaching (8%, see for example Ediger, 1998; Frost & Teodorescu, 2001). Since 2000, there has been a shift in focus toward entrepreneurialism (see Figure 5). This can be explained by the second academic revolution, which is increasingly felt in the university. Also, there is a decrease in the number of studies focusing on teaching, which are principally considered in the multi-research object perspective. The unique object perspective does not consider the relation between the different roles, particularly when considering the researcher’s time budget.

In the multi-research object perspective, scholars seem more preoccupied by the relationship between research and teaching (44%). This focus reflects a common complaint about higher education—that the emphasis on research detracts from the faculty’s involvement in teaching (Serow, Brawner, & Demery; 1999). The relationship between research and entrepreneurialism (24%), and teaching and entrepreneurialism (4%), also seems to be considered, as scholars want to know if the goal of producing commercially valuable knowledge is congruent with the goal of producing research and with teaching activities. Finally, 28% of the multi-research object perspective articles considered all three roles together.

Proposition 2: Future research should consider the multi-research object perspective, and integrate all of the researcher’s roles to consider the relationships among them. The use of structural equations or multinomial models can be helpful to consider the relation between researcher’s roles.

Trends of Orientation Focus

To study the researcher’s roles, different orientations were considered in the literature (see Figure 6): 1) quality (2%, see for example Harley, 2002), 2) performance (12%, see for example Print & Hattie, 1997; Ramsden, 1999), 3) productivity (18%, see for example Rhoades, 2001), 4) commitment (22%, see for example Serow, 2000), and 5) output, which concerns results, patents, and publications (43%, see for example Langford, Hall, Josty, Matos & Jacobson, 2006).
Since 2002, there has been a shift in focus toward output as the object of research (see Figure 7). There is a parallel between the researcher’s context and the literature orientation. According to Langford et al. (2006), there is a risk of isomorphism in the university. The orientation policies on the researcher’s activities are focused more on the output than on the activities; scholars spoke about patenting for the sake of patenting (Langford et al., 2006) or publish or perish policies (Ross et al., 1995; Conn, Porter, McDaniel, Rantz, & Maas, 2005). Consequently, outputs such as patenting and publications became measures of success that researchers tended to satisfy. This same phenomenon is found in the literature: scholars are increasingly concerned with output as the object of research, with studies generally focused on one or two outputs, the most common being patents and publication (See for example Azagra Caro et al., 2003; Eugenia Garcia & Sanz-Menendez, 2005).

Proposition 3: Future research should consider the researcher’s roles as multi-dimensional concepts to integrate their complexity, instead of working only on a single output such as patent or publication.

Trends of Countries’ Orientation

The single nation, non-comparative empirical literature is the most common perspective used by scholars (see figure 8), who studied data collected at the individual or institutional level in only one country. The most studied countries are (see figure 9) the United States (36%, see for example Dai, Popp, & Bretschneider, 2005; Ding, Murray & Stuart, 2006), the United Kingdom (11%, see for example MacBryde, 1997; Calvert & Patel, 2003; Harley, 2003), Canada (10 %, see for example Hum, 2000; Kreber, 2000; Landry et al., 2005), Australia (9%, see for example Print and Hattie, 1997; McInnis, 2000; Abbott and Doucouliaigos, 2004), and Finland (6%, see for example Korhonen et al., 2001; Snell, 2001; Meyer et al., 2003). The focus on the United States can be explained by its vanguard policies, such as the Bayh-Dole Act of 1980, which has accelerated the patenting and licensing of university-developed technologies (Campbell, Powers, Blumenthal, & Biles, 2004b), and initiated a University commercialization trend in developed countries (Baldini, Grimaldi, & Sobrero, 2006).
Cross-national studies are recent in the literature, and based on national comparisons. Geuna & Martin (2003), for example, conducted a comparison of European countries, and Meyer (2006) studied the differences among Belgium, Germany, and the United Kingdom. Cross-national studies typically compare aggregate data at the national level, so scholars experienced the same problem of "ecological fallacy" seen in the institutional model. Moreover, the diversity of the internal environment of a country's universities is lost in the international comparison.

**Proposition 4:** The single nation, non-comparative perspective seems to be a more congruent way to study a researcher's activities. Even if multi-level modelling treats a hierarchical structure of data at the national level, it requires a high number of countries — and a highly complex data structure — to obtain significant results.

**Trends of Discipline Studied**

The disciplinary norms view posits that there are large differences in publication productivity and commercialization opportunities across disciplines. These are determined primarily by the traditions, methodologies, and reward structures of each discipline (Teodorescu, 2000). A typology was used to differentiate disciplines: Physical sciences and Engineering (Chemical Engineering, Chemistry, Computer Science, Earth and Planetary Sciences, Energy, Engineering, Materials Science, Mathematics, Physics, and Astronomy); Life sciences (Agricultural and Biological Sciences; Biochemistry, Genetics, and Molecular Biology; Environmental Science; Immunology and Microbiology; Neuroscience); Health sciences (Medicine and Dentistry, Nursing and Health Professions, Pharmacology, Toxicology and Pharmaceutical Science, Veterinary Science, and Veterinary Medicine); and Social Sciences and Humanities (Arts and Humanities, Business, Management and Accounting, Decision Sciences, Economics, Econometrics and Finance, Psychology, and Social Sciences). These four sets of disciplines were equally studied in the literature (see Figure 10). However, when considering the differences between the focus, Social Sciences and Humanities were studied more in the case of Research (35%), but less in the case of Entrepreneurialism (13%). Physical Sciences and Engineering were studied more in the case of Entrepreneurialism (35%). One explanation is that researchers in Physical Sciences and Engineering are significantly more involved in knowledge transfer than their colleagues in other research fields (Landry et al., 2006); they obtain substantially more industry funding and thus commercialize more than the other disciplines (Harman, 2001).
Two perspectives were considered in the literature: a single and a multi-disciplinary focus (see Figure 11). In the single disciplinary focus, scholars use more case studies, such as MacBryde (1997), who studied a university’s commercialization in robotics. In the multi-disciplinary focus, there are more quantitative orientations. In quantitative models, the affiliation to the disciplines is treated as an individual variable instead of as a group affiliation, and so the models presented the same problem of ecological fallacy seen in the institutional model. Only one article considered affiliation in a multi-level model (Porter & Umbach, 2001), but it was not selected for the review because it was based on data collected in 1993.

**Proposition 5:** Future research should empirically evaluate the membership effect related to the discipline affiliation, in other words the assumption that researchers’ behaviours related to the same discipline are in some respect more alike than researchers’ behaviours from two different disciplines. The membership effect is evaluated by considering a multi-level variance analysis. One way to do so is through the use of a hierarchical structure of data (for example, individuals affiliated with universities).

**Trends of Methods**

The methodological trends of the literature on the researcher’s role revealed that studies used more quantitative options (see Figure 12). Since the beginning of the 2000s the literature on the researcher’s role is dominated by quantitative methodologies.
Three kinds of quantitative methods can be considered: quantitative I (descriptive statistics), quantitative II (correlation, ANOVA, and khi2), and quantitative III (OLS regression, structural equation models, and logistic regression). Figures 12 and 13 show that the increase in 1999 corresponds to an increase of quantitative II; the increase in quantitative I and II is seen between 2003 and 2006. These shifts in the literature are the signs of maturity in theory construction that has allowed scholars to use more complex statistical tests.

Proposition 6: The literature on the researcher’s roles seems mature enough to follow the quantitative III methods, even on the question of entrepreneurialism, which is the most recent role.

The Researcher’s Activities

**A Typology of the Researcher’s Activities**

Different typologies of the researcher’s activities were identified (Presley & Engelbride, 1998; Kumar, Mwamwenda & Dye, 1999; Harley, 2002, etc.). For Vidal and Quintanilla (2000), the researcher is involved in four kinds of activities: teaching, research, services, and management. A study by Kreber (2000) revealed 17 activities aggregated into five groups: 1) interaction/scholarship; 2) teaching, with some aspects of citizenship; 3) extramural activities; 4) academic work routines; and 5) product research. Hemlin (2006) identified six groups: 1) research activities; 2) research funding activities; 3) management of human resources; 4) teaching activities; 5) participation in the management of research departments; and 6) quality control. None of these studies considered the entrepreneurial activities as a group, in contrast to a growing literature (Etzkowitz, 2003; Lee & Rhoads, 2004; de Zilwa, 2005).

Integration revealed the following seven activities: teaching, research, funding research, administration, internal and external services, scientific interaction, and academic routine (Presley & Engelbride, 1998; Kumar et al., 1999; Kreber, 2000; Vidal & Quintanilla, 2000; Harley, 2002; Hemlin, 2006b). These seven activities can be aggregated into four researcher’s roles: research, teaching, entrepreneurialism, and services (internal and external).

**Research Activities**

Research activities may be defined according to four questions: 1) Who is performing them? 2) How? 3) What product? 4) To whom?

In response:

1) Research was defined as a “closed intellectual endeavour confined to the self-referential world” of the researcher (Smith, 2001, p. 137). Consequently, research activities are related to the researcher’s characteristics, notably his or her competencies. Research is increasingly conducted by teams instead of individuals (Hemlin, 2006b).

2) Research is a systematic investigation performed with the objective of developing generalizable knowledge (Atkinson & elGuebaly, 1996; Hemlin, 2006b).

3) Research involves the development of tacit knowledge (for example, incorporated in the experience of the researcher), and of explicit knowledge codified in different
supports for the purpose of its dissemination (manuscript, conference presentation, or book, e.g.), and for the purpose of creating commercial value (patent or product, e.g.) (Atkinson & elGuebaly, 1996; Kreber, 2000; Menzies, 2000).

4) Research is increasingly related to the users’ context (patricians and clients, e.g.); consequently, it is increasingly oriented on problem resolution (Smith, 2001). Users can thus be involved in the research process, for example, by maintaining communication with the researcher.

In the literature, two kinds of proxies were used: inputs and outputs. In the first category, scholars used the expected workload, the time implications of research activities (Lester, Carter, Dassu & Hobbs, 1998), and funds (the researcher’s total funds and the externally funded projects where he or she serves as principal investigator) (Lee & Rhoads, 2004). In the second category, scholars used different publication supports (Ramsden, 1999; Korhonen, Tainio & Wallenius, 2001; Geuna & Martin, 2003; Carayol & Matt, 2004), and citation impact (Korhonen et al., 2001; Itagaki & Pile-Spellman, 2006). More than 20 different supports were considered in the literature, including: 1) articles in scientific journals; 2) scientific books; 3) presentations in conferences; 4) conference proceedings; 5) articles in other journals; 6) book chapters; 7) research funds; and 8) supervision of doctoral or master’s students. The first four indicators are the most commonly used (Lester et al., 1998; Kumar et al., 1999; Ramsden, 1999; Abbott & Doucouliagos, 2004; Carayol & Matt, 2004; Itagaki & Pile-Spellman, 2006; Landry et al., 2006).

Proposition 7: Publications are acknowledged to be the most valid, fair and direct measure of research among academics (Print & Hattie, 1997). However, scholars must adapt the outputs of research in accordance with the disciplines; for example, Itagaki and Pile-Spellman (2006), studying radiology research, considered different disciplinary specific types of research production: case reports, review articles, and reports of clinical trials.

Teaching Activities

Teaching is a set of activities that characterise university researchers, in contrast to researchers in industry or in research institutes (Hemlin, 2006b). In addition to classroom hours, lecture preparation, paper-grading, office hours, and selecting graduate students for admission, teaching might include leading an international field trip (McInnis, 2000). Teaching therefore means long days working closely with groups of students developing clinical skills (McInnis, 2000). Teaching is sometimes divided into formal and informal activities (McInnis, 2000), also called instructing and advising (Kreber, 2000; Rhoades, 2001). Instructing is related only to the courses, while advising can be related to extra-course subjects (Rhoades, 2001; Print & Hattie, 1997).

One common finding in the literature is that teaching is hard to measure (Serow, 2000); the number of proxies for teaching is smaller than those for research. Of the former, three kinds of proxies were used: inputs and outputs of activities, and an implication proxy. In the first category, scholars used time spent by the researcher on teaching activities (Fox & Milbourne, 1999; Landry et al., 2005; Landry et al., 2006). Some scholars considered only one part of the time, such as the amount of time spent in class (Ross et al., 1995). In the second category, scholars considered the number of students taught (Ross et al., 1995), and self-evaluation and perception of teaching quality (Lester et al., 1998; Ramsden, 1999). Finally, in the last category, scholars used a composite measure that included, for example, the importance of “Being a Good
“Teacher” and the importance of “Opportunity for Teaching” in the choice of career (Lee & Rhoads, 2004). However, Frost & Teodorescu noted that (2001: 402): “faculty generally seemed to view the evaluation of teaching as either a mission impossible”. The most commonly used proxy for teaching is thus an input-based consideration of time spent by the researcher on the teaching activity (Rhoades, 2001; Landry et al., 2005): number of hours (Fox & Milbourne, 1999) or fraction of time for a period (Landry et al., 2006).

Proposition 8: When studying input-based measures of teaching, scholars must consider all the time dedicated to teaching activities: the part spent in a classroom, the part of preparation and also the part spent consulting with students.

Entrepreneurial Activities

Entrepreneurialism is defined as a formal effort of faculty members to generate revenue for themselves or for their institution (Lee & Rhoads, 2004). It concerns the economic mission of the researcher (Fisher & Atkinson-Grosjean, 2002), and particularly the commercialisation of knowledge under different mechanisms (Landry et al., 2006). Entrepreneurialism is thus seen as a capitalisation of knowledge to translate research outputs into revenues of research (Dill, 1995). In the literature, three kinds of entrepreneurial orientations of the researcher were considered: 1) commercialisation by direct mode of knowledge and technology transfer, i.e., a direct relation between the researcher and a research user (research contract with industrial actor, consultation activities, e.g.); 2) commercialisation by indirect and intermediate mode of knowledge and technology transfer, where the knowledge and technology transfer office is involved as the owner (indirect) or as a facilitator (owner) (patent development, license, e.g.); and 3) commercialisation by structure creation (e.g., spin-off creation).

In the literature, two kinds of proxies were used: inputs and outputs. In the first category, scholars used industrial funding (Gulbrandsen & Smeby, 2005) and the time dedicated to entrepreneurial activities, for example, outside consulting or freelance work (Lee & Rhoads, 2004). In the second category, scholars used commercial outputs like patents (Azagra Caro et al., 2003; Meyer et al., 2003; Powers, 2003; Carayol and Matt, 2004; Dai et al., 2005; Meyer et al., 2005; Baldini et al., 2006), the establishment of firms (Pirnay et al., 2003; Degroof & Roberts, 2004; Vanaelst et al., 2006), and license income and outcomes (Lach & Schankerman, 2003; Sine et al., 2003; Siegel, Waldman, Atwater & Link, 2004). Other commercial outputs are products or services that are currently marketed, consulting contracts, software with commercial applications and trade secrets (Harman, 2001; Gulbrandsen & Smeby, 2005). The patent is the most commonly used output by scholars.

Proposition 9: As entrepreneurial activities observed in the universities are multi-fold (Yokoyama, 2006), future research should consider the researcher’s different commercial outputs from the three entrepreneurial orientations considered in the literature (direct mode, indirect and intermediate mode, and by structure creation) to have a complete view of the entrepreneurial researcher.

Internal and External Service Activities

Internal service activities concern the researcher’s participation in the management of research departments, and even in the management of universities (Bernardin, 1996; Hemlin, 2006b). Researchers are implicated in discussions concerning the department’s and the university’s general scientific objectives, economy, and the wider frames of staff and resource
management (Hemlin, 2006b). External service activities concern notably the implication in quality control and discipline development with examination tasks, by participating in large-scale research evaluations for journals or funding agencies (Bernardin, 1996; Hemlin, 2006b). These activities can be informal or formal (Kreber, 2000).

One input proxy of internal and external services, the number of hours of administrative work per week, was used in the literature (Fox & Milbourne, 1999).

**Proposition 10:** The time devoted to internal services appears underestimated. Future research should integrate this researcher’s role. More qualitative research is needed to develop input and output proxies to consider the complexity of this role.

### The Relation between the Different Activities

Three kinds of relations were considered in the literature among the researcher’s four roles: complementarities or transferences, the substitution or interference, and the null relation. As the meta-analysis method is not permitted due to the heterogeneity of the studies, an alternative method was used to draw conclusions. Dominant effects were generated by using a vote-counting method (Littell, Corcoran, & Pillai, 2008), which consists of the count of the significant effect directions by considering the same operational definition of the dependent variable, when the number of counted effects was superior to three. So, some dominant effects were considered in the quantitative literature, and particularly within research and teaching (−) and research and entrepreneurialism (+) (See Table 1). There is no evidence on the relation between services and teaching or entrepreneurialism. Furthermore, there is no dominant effect on the other relation.

In a more qualitative view (see Figure 14), it appears that the relations are also multifaceted, so scholars have explored the relation between the different roles to understand when there is transference and interference. For example, there is transference between research and teaching in accordance with the transfer of concept from the first to the second, but there is interference in accordance with the time dedicated to these activities, particularly considering the time devoted to consulting with students. Between research and entrepreneurialism, there is transference when considering the transfer of concepts from the first to the second, and the influence of industrial funding on research productivity. However, there is interference when considering the time dedicated to these activities and the influence of industrial funding on research, particularly publication delay. More research is needed to understand the transference and interference relations between the services and the other activities.

**Proposition 11:** future research should consider the relations between the different roles as multifaceted. As scholars use different role proxies in terms of inputs and outputs, they can understand this complexity. For example, one common proxy is the time dedicated to the four sets of activities considered in the literature. Studying the relation between the times dedicated can illustrate transference and interference, but it is only one aspect of the relation.

<table>
<thead>
<tr>
<th>Roles/Roles</th>
<th>Research</th>
<th>Teaching</th>
<th>Entrepreneurialism</th>
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<td>Entrepreneurialism</td>
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<td>Internal services</td>
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Towards a Conceptual Framework

In the literature, different typologies of the variables that influence the researcher’s activities were counted. For example, according to Seglen & Aksens (2000), and Johnsrud (2002), there are two groups of determinants — those related to individual variables (such as age, gender, academic background) and those related to structural variables such as the finance structure and the institutional context. Fox (1985, cited by Frost & Teodorescu, 2001) added specificity at the individual level by differentiating variables that belong to the individual background (age, gender, e.g.) and those that belong to individual accomplishment (experience, commitment to certain activities, e.g.). This systematic review revealed that the variables must be considered at a minimum of four levels: the individual, departmental/disciplinary, institutional, and regional (see Figure 15).

The first, or individual level, concerns: 1) the individual social capital (alone or part of a group, e.g., or the networks); 2) the researcher’s financing structure (public/private, for basic research or oriented on an industry problem, e.g.) ; 3) individual identity (gender, ethnicity, age); and 4) individual accomplishment (the background, the mainstream, non-mainstream
orientation, past performance). The second, or departmental/disciplinary level, concerns the characteristics of the disciplines in accordance with the research productivity or entrepreneurial opportunities, and the different aspects of the department, which is the level where institutional policies are administered. The third level is the university; it concerns 1) the institutional characteristics (the size, the number of campuses, the culture); 2) the presence of different institutional structures and their characteristics (the knowledge and technology transfer office, entrepreneurial and research support centre); and 3) the different institutional policies according to the researcher’s roles. Finally, the fourth level is the regional level; it concerns 1) the relation between the university and other actors such as local or federal government and firms, and 2) the characteristics of the university localization (e.g., the regional entrepreneurial climate).

**Proposition 12:** As some authors have pointed out, individual characteristics tend to weigh more in predicting activity proxies than do institutional influences (Serow et al., 1999; 2000; Link & Scott, 2005); however, as no selected article used a multi-level model, this conclusion must be confirmed. Future research should consider determinants at these four different levels, and particularly the researcher’s affiliation to them; however, the proxies of the researcher’s activities should be considered at the individual level.

**Evidence on the Researcher’s Activities**

In the quantitative literature, the study of the determinants of the researcher’s activities identified a dominant effect in the four levels of the conceptual framework (see Table 2). Dominant effects were generated by using a vote-counting method (Littell et al., 2008), by considering the same operational definition of the dependent variable. This means, for example, that evidence on entrepreneurial activities was considered differently if it referred to spin-off creation, patents or consultation.

**At the Individual Level**

**Experience.**

The more experienced the researcher, the more he or she is likely to produce research and undertake entrepreneurial activities. Experienced researchers may have more to sell, and could be less motivated by traditional academic incentives (tenure, disciplinary awards) than by greater financial incentives expected from the commercialization of their results (Landry et al., 2006).

**Status.**

Evidence suggests that full professors are more likely than assistant and associate professors to disclose inventions and patents. As full professors have generally fewer institutional constraints and more freedom than their counterparts, they could be more motivated to consider entrepreneurial activities (Siegel et al., 2004).

**Star scientist.**

Entrepreneurial activities appear concentrated within a minority of researchers who are also more productive in research, and whose research represents an intellectual capital base of extraordinary value and entrepreneurial opportunities (Meyer, 2006).
Career path.

Evidence suggests that senior academics are more likely to consider entrepreneurial activities and to attract industrial funds than junior academics, who often seem confused and ambivalent about how attracting industrial funds might influence their research orientation (Harman, 2001). Moreover, research, and particularly publication performance, is also strongly negatively correlated with junior positions (Carayol & Matt, 2004).

Gender.

Usually used as a control variable; evidence suggests that Male academics appear more likely to consider entrepreneurial activities. For example, Ding (2006) found that female academics in life sciences patent at 0.40 times the rate of equivalent male academics. One explanation for this difference is that female academics are more committed to teaching than their male counterparts (Lee & Rhoads, 2004).

Social capital.

Evidence suggests that a researcher’s networks influence his or her patenting behavior. Collaboration by researchers is conducive to higher productivity, whether it is with universities, industries or institutions. Also, relations with coauthors, colleagues, and industry actors give the researcher opportunities and support for the patent process (Ding et al., 2006).

Financing structure.

Researchers financed by basic research funds appear more likely to patent their findings. According to Dai et al. (2005), basic research can serve as a knowledge base for future applied research and for patents. As federal-applied research funds are intended to produce research oriented on certain technological needs, they lead to commercialization (Dai et al., 2005), but they have a negative impact on the creation of university spin-offs (Landry et al., 2006). Moreover, the financing structure also has an influence on the commitment to teaching; researchers who use funding toward their research are somewhat less committed than faculty who do not (Lee & Rhoads, 2004).

At the Departmental/Disciplinary Level

At the Institutional Level

Researchers appear more likely to consider entrepreneurial activities when their university has adopted IPP. Universities with IPP typically provide two kinds of remuneration to motivate the researcher in the commercialization process: 1) a performance-based payment structure, such as licensing royalties; or 2) an equity compensation (Goldfarb & Henrekson, 2003).

Knowledge and technology transfer office (KTTO).

Evidence suggests that the presence of a KTTO, and some of its characteristics, has a positive effect on a researcher’s commercialization process. The role of the KTTOs is to manage intellectual property and commercialization. For example, KTTOs encourage and solicit research grants from government and industry, identify and protect discoveries (patenting and registering, e.g.), and promote university intellectual property (Hum, 2000). The KTTO’s size and age (number of years since its creation), and the technical orientation of its managers make
a KTTO more effective in realizing the full potential value of inventions (Lach & Schankerman, 2003; Siegel et al., 2004).

**Former university creations and commercialization.**

Evidence suggests that former university activities have an influence on a researcher’s entrepreneurial activities. For example, former start-up creations lead new researchers to believe that firm formation is acceptable and desirable (O’Shea, Allen, Chevalier & Roche, 2005).

**Prestige.**

A university’s prestige appears to have a positive effect on a researcher’s entrepreneurial activities, particularly on licensing. A university’s prestige seems to produce a halo effect on researcher’s creations, thus increasing his or her rate of licensing (Pilbeam, 2006).

**University size.**

Evidence suggests that the larger the size of the university, the more researchers engage in entrepreneurial activities. One explanation is that larger sized universities have a greater reservoir of resources and expertise linked to financial resources, laboratories, and technology transfer offices (Landry et al., 2005).

**At the Regional Level**

**University-industry relation.**

Evidence suggests that university–industry ties and closer partnerships with industry result in greater levels of commercialization. For example, the greater the proportion of industry-funded research received by the university as a proportion of total research and development funding, the greater the propensity to create spin-off firms (O’Shea et al., 2005). It is interesting to note that, at the individual level, industrial funding has an opposite effect on the creation of spin-off firms.

**Entrepreneurial climate.**

The entrepreneurial climate appears to have a positive effect on a researcher’s commercialization. Universities and researchers are more likely to interact with firms located geographically close to each other, and the density of firms in a high-technology sector has a positive influence on the licensing of universities’ and researchers’ patents (Sine, Scott & Di Gregorio, 2003; Baldini et al., 2006).

**Gaps in the Literature**

Finally, in the quantitative literature, the study of the determinants of the researcher’s activities identified some gaps in the four levels of the conceptual framework (see Table 2). The gaps mean the absence of quantitative evidence or dominant effects about the influence of a determinant on the researcher’s entrepreneurial activities. For example, more research is needed on the influence of the intrinsic motivations and the personal goal-settings on the researcher’s entrepreneurial behaviour. This is also the case for the influence of the institutional policies, and notably the question of incentives and support.
<table>
<thead>
<tr>
<th>Level dimension</th>
<th>Variables</th>
<th>Nb of articles where the determinant is cited</th>
<th>Nb of articles where the determinant effect is tested</th>
<th>Effect on the researcher's entrepreneurial activities</th>
<th>Effect on the researcher's research activities</th>
<th>Effect on the researcher's teaching activities</th>
<th>Selected references</th>
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<td>No evd</td>
<td>No evd</td>
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<td>+</td>
<td>+</td>
<td>No evd</td>
<td>(Itagaki and Pine-Spilerman, 2000; Landry et al., 2006; Rosa and Dawson, 2006, etc.)</td>
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<td>6</td>
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<td>+</td>
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<td>(Fox and Milbourne, 1999; Siegel et al., 2004, etc.)</td>
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<tr>
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<td>No evd</td>
<td>No evd</td>
<td>(Harley and Lee, 1997)</td>
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<tr>
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<td>2</td>
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<td>-</td>
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<td>-</td>
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<td>8</td>
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<td>(±/±)</td>
<td>(±/±)</td>
<td>(O’Shea et al., 2005; Pibeam, 2006, etc.)</td>
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<td>No evd</td>
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<td>16</td>
<td>3</td>
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<td>No evd</td>
<td>No evd</td>
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<td>(Bernardin, 1996; McIntire, 2001, etc.)</td>
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<td>audit and assessment policies; policy and goals clarity</td>
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<td>No evd</td>
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<td>No evd</td>
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<td>No evd</td>
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<td>No evd</td>
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<td>No evd</td>
<td>No evd</td>
<td>(Dill, 1995; Fisher and Atkinson-Grojean, 2002, etc.)</td>
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<td>1</td>
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<td>No evd</td>
<td>No evd</td>
<td>(Dill, 1995; Fisher and Atkinson-Grojean, 2002, etc.)</td>
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<td>KTTO: Technical orientation</td>
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<td>1</td>
<td>+</td>
<td>No evd</td>
<td>No evd</td>
<td>(Dill, 1995; Fisher and Atkinson-Grojean, 2002, etc.)</td>
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<td>Past entrepreneurial activities of the University</td>
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<td>No evd</td>
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### Level dimension

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<tr>
<th>Variables</th>
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<th>Effect on the researcher teaching activities</th>
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<td>No evid</td>
<td>No evid</td>
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<td>No evid</td>
<td>(Azagra Caro et al., 2003; Landry et al., 2008, etc.)</td>
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<td>+</td>
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<td>(Jacobson et al., 2004; Rasmussen et al., 2006, etc.)</td>
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<td>No evid</td>
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<td>(Abott and Doucouliagos, 2004)</td>
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<td>No evid</td>
<td>(Meyer et al., 2003; Degroof and Roberts, 2004, etc.)</td>
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<td>No evid</td>
<td>No evid</td>
<td>(Laperche, 2002; O’Shea et al., 2005, etc.)</td>
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<td>(+/-): no dominant effect</td>
<td>(Johnsrud, 2002; Jacobson et al., 2004, etc.)</td>
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<td>No evid</td>
<td>No evid</td>
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<td>No evid</td>
<td>No evid</td>
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<td>Building, classroom, equipment and technology</td>
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<td>No evid</td>
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<td>University Geographic location characteristics</td>
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### Conclusions

This systematic review generated 12 propositions dedicated to the development of future research and identified gaps in the way researcher’s activities are influenced by some determinants. The systematic review conclusions offer insights into the quantitative research perspective that suggest future research should consider a hierarchical data structure and multilevel models to integrate the influence of determinants related to different levels (individual, departmental and institutional). A more direct and fair method seems to be the study of behaviour in large organizations like universities. At the individual level, structural equation multivariate models can be used to study the relations between entrepreneurial activities and others. It is possible to combine the structural equation or multivariate models with a hierarchical structure of data to do a multivariate multi-level model. In accordance with the proxies of the researcher’s activities, future research should adapt research outputs according to disciplines and consider all aspects of teaching activities (time, preparation and consulting). Moreover, future research should consider more than one output of the entrepreneurial activities, such as patents, consultation and spin-offs.
In the qualitative research perspective, more research is needed on the understanding of service activities and on the way they influence the entrepreneurial activities.

This systematic review presents one limitation. Even if vote counting is an alternative method to draw conclusions in a systematic review, it is not as rigorous as the meta-analysis method. For example, the meta-analysis methods take into account the sample size effect, which was not considered in the vote counting method. However, as there is a shift in the literature towards a domination of quantitative III methods (since 2002), the literature is going to achieve a certain level of maturity, allowing the use of meta-analysis methods.

Policy-makers must consider the complexity of the researcher’s roles and activities. Incentive policies could change the behaviour of researchers in an unpredictable way. Moreover, these policies are based on weak empirical evidence; more research is needed to assess the efficiency of university policies rather than assume their effects (Geuna & Nesta, 2006). The use of the conceptual framework can be linked to more sophisticated heuristics to target policy initiatives. In this regard, a contextually sensitive understanding of the individual, departmental and institutional determinants that influence researchers’ activity outputs may be useful. This could provide policy-makers and practitioners with a more nuanced and creative approach to manage research and entrepreneurial activities, and would provide opportunities to generate best practices to support the researcher.

References


Articles


Articles


Articles


Articles


Developing and Managing University-Industry Research Collaborations through a Process Methodology/Industrial Sector Approach

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Authors’ Note
The author acknowledges the support of members of academic faculty from Imperial College London as well as other professional services colleagues. A previous version of this paper was presented at the 2009 SRA International Annual Event and Symposium, Seattle, Washington.

Abstract
A management framework has been successfully utilized at Imperial College London in the United Kingdom to improve the process for developing and managing university-industry research collaborations. The framework has been part of a systematic approach to increase the level of research contracts from industrial sources, to strengthen the university’s academic base, and to diversify the provision of research at the university. This management approach is composed of two main platforms of activity: an industrial sector or channel focus (sector platform) and structured management methodologies to facilitate the research collaboration process (process platform). Application of this combined management framework through an engineering program case study at the university helped to significantly increase the university’s industrially funded research portfolio in the aerospace and defense sector. Evaluation of the framework against comparative models for collaboration revealed that the management system provides a broad coverage of knowledge, social and financial or cost-based factors. The framework has been demonstrated as a suitable tool for research administration staff and those involved with initiating and managing research collaborations.

Keywords: University-industry research collaboration; research development; research management.
Introduction

A large proportion of universities in the United States and Europe have traditionally focused on undergraduate education, with a lesser emphasis on research. This has largely been the case since many of these institutions were founded (Bozeman & Boardman, 2003). There are, however, a smaller but significant number of universities where considerable research is undertaken. Such universities tend to receive research funding from a range of sources, including government organizations, charitable foundations, philanthropic donations, and industry (D’Este & Patel, 2007). This latter source is likely to include industrial funding for contract research, collaborative research projects, consultancy and technical advisory work, as well as the development of intellectual property through licensing of patents and other commercial activities (Perkmann & Walsh, 2007). The ability for universities to develop such commercial activities has a number of benefits; however, competition among academic institutions can be intense (Wimsatt, Trice, & Langley, 2009), and the success rate for proposals submitted to industry is often low.

The benefits for universities in undertaking commercial projects include access to additional financial resources to fund doctoral and post-doctoral positions; the potential to develop intellectual property; the provision of an application context for research (with application-specific data and information provided by the company); as well as the ability to generate research that results in journal publications and conference papers. Therefore, universities are increasingly interested in positioning themselves favourably with potential commercial partners and in converting research opportunities into funded projects that may ultimately lead to long-term, sustainable collaborations.

This paper describes a combined process methodology/industrial sector management framework that has been successfully deployed at Imperial College London in the United Kingdom to improve the research development process and the management of industrially funded research collaborations. This has been part of a systematic approach to increase the financial value of research contracts from industrial sources, to strengthen the academic base, and to diversify the sources of research at the university. The strategy has helped produce collaborative research programs at the university worth approximately £20 million over a five-year period. Although these projects have been funded by companies, and so can be regarded as a form of contract research, the actual funding has largely originated from government sources, and the research involves a significant level of collaboration between the company and the university; therefore, it is appropriate to regard these as collaborative research programs. The programs involve collaborative research with industrial companies in the UK, where the company provided funds to the university and the projects have been focused on the aerospace and defense (A&D) industrial sector.

This combined process methodology/industrial sector management framework is composed of two main platforms of activity (Figure 1): The use of an industrial sector or channel focus (sector platform), and the development and deployment of structured process methodologies to help facilitate research collaboration (process platform).
The studies reported in this paper will not focus on the field of technology transfer (Siegel, Waldman, Atwater & Link, 2003), which more often refers to activities such as licensing agreements, start-ups and joint ventures.

**University-Industry Research Collaboration**

Globally, there is increased competition among academic institutions, as university research groups compete with their peers to receive funding from large industrial companies to undertake research and technology (R&T) studies. This competition for funding and resources is prompting universities to improve their processes for developing and managing research collaborations with industry (Tucker, 2007). Industrial organizations work with universities to gain access to the intellectual knowledge and creative thinking within the academic environment (Sherwood & Covin, 2008). This can be regarded in terms of the open innovation model (Chesbrough, 2006), in which organizations increasingly partner with external sources for innovation. The motivation for companies is that the knowledge and academic thinking within universities can be utilized to deliver R&T, which can then help them improve their competitive positioning from building technology capabilities (Dooley & Kirk, 2007) through developing enhanced products or services. Industrial organizations are, however, required to justify research funding for universities, and so there is a greater need to capture the wider benefits of such collaboration, i.e., improving the skills and knowledge of the company’s staff through knowledge transfer as well as the potential recruitment of technically qualified graduate students as new employees.

The merits of partnering between universities and companies have been explored in the literature. Kleyn, Kitney & Atun (2007) elucidated certain critical factors that contribute to successful university-industry partnerships in the life sciences sector, including leadership, organisational structure and operational management. The premise is that improvement in these factors can enhance the effectiveness of partnering, thereby improving innovation in research. Partnerships may also be regarded in terms of strategic alliances, where organizations cooperatively share knowledge and resources to gain competitive advantage (Ireland, Hitt & Vaidyanath, 2002). Moreover, Hitt, Ireland and Santoro (2004) have proposed a conceptual model, where alliance development and management effectiveness are supported by optimal resource configuration and exploitation mechanisms that allow value to be created by the alliance, and which build on information sharing and trust.
University-industry alliances can also be used to facilitate collaborative research projects, since sharing research can create value for both partners (Jarillo, 1988). Therefore, the development of strategic alliances can be an attractive way for organizations to grow their commercial activities (Sampson, 2007). However, harnessing knowledge from individuals outside an organization can present its own challenges, and a counter argument is that the relationships that support such alliances can sometimes become a liability by decreasing the quality of knowledge provided (Anand, Glick, and Manz, 2002). Nevertheless, many studies identify the benefits to the innovation process derived from the successful management of alliances and partnerships (Walter, Lechner, and Kellermanns, 2007).

A number of studies have highlighted the role that social capital can play in alliances and collaboration (Koka & Prescott, 2002). Social capital, when including information sharing, trust, and regular and open communication, has been shown to promote alliance development (Hitt, Ireland & Santoro, 2004). Moreover, trust, in conjunction with the level of commitment between partners, has also been identified as a significant indicator of whether or not a university-industry collaboration will be renewed (Plewa & Quester, 2007). Furthermore, a lack of social connectedness may inhibit the development of university-industry collaborations. Thune (2007) has employed a network embeddedness approach to investigate the role of social capital in developing university-industry collaborations. This study viewed social capital as an underpinning ingredient that helps facilitate collaborations; where social capital is limited, the new collaborations can be seriously hampered.

The role of knowledge itself is also fundamentally important to the development and management of collaborations, especially in regard to a company’s ability to assimilate knowledge arising from collaborative activities (Barbolla & Corredera, 2009). In this regard, studies have identified the need for more formal mechanisms to enhance knowledge transfer, such as policies for intellectual property rights (IPR) as well as consideration of the relatedness of technology capabilities for the collaborating partners (Santoro & Bierly, 2006).

The effectiveness of knowledge transfer is influenced by its type. Explicit knowledge (e.g., data within a spreadsheet or database, or listed information and reports) is not particularly difficult to transfer; however, tacit knowledge can be more difficult to codify and transfer (Simonin, 1999). Such knowledge may, for example, be lacking when a researcher has not fully recorded all the fine details associated with successfully carrying out a certain materials spectroscopic technique. Consequently, for a collaboration to be effective, mechanisms to transfer tacit knowledge between collaborators need to be considered. Woods, Curran, Raghunathan & McKeever (2004) have identified a number of barriers to the transfer of tacit knowledge arising from university-industry collaborative research projects. These barriers include delays in achieving research objectives as well as differences between the university and the company regarding expectations for project progress; i.e., the company may have a more short-term horizon for fulfilment of the research goals. Therefore, the ability to address these barriers through appropriate mechanisms, such as enhanced communication between collaborators and improved measurement of the research outcomes, can contribute to an enhanced collaboration process.

Specific attributes of university-industry research collaboration have also been explored. Burnside and Witkin (2008) have reported on how IP negotiation can act as a barrier to new collaborations. They have proposed a process-driven approach to help academic faculty and contracts staff resolve negotiation issues. Kenney (1987) has examined the ethical dimensions of university-industry collaboration, and argues that universities should avoid becoming purely
Having highlighted some key features of university-industry collaboration, it is now appropriate to explore the combined process methodology/industrial sector management framework. This framework, produced to facilitate the development and management of university-industry research collaborations, is composed of two 'platforms of activity:' the sector and process platforms.

**Sector Platform**

This platform uses an industrial sector strategy for the management of research opportunities and the delivery of research programs. Such a strategy is based on the premise that a number of benefits can be accrued through building up and then utilizing knowledge of a particular industry to initiate a greater (financial) level of research projects. A sector-based approach has been described as a best practice for channel management by Bellin (2006), who identifies the following successful elements of this structure: a market-driven approach based on customer needs; an overall management framework; an efficient balance of cost, control and coverage; a long-term perspective; a robust and high quality offer that is competitively priced; and the ease of doing business for all parties. These elements indicate there are benefits to be gained from managing the development and delivery of university-industry research collaborations according to an industrial sector (channel) strategy.

The sector approach, first established at Imperial College London in 2003, involved the creation of a new team of professional services staff (business development focused) within the university's Faculty of Engineering that would develop and manage university-industry collaborations according to industrial sectors. The team consisted of three research development executives and an administrator. Each of the executives focused on developing research collaborations in individual sectors, and the author was the executive charged with growing the volume of research projects for the A&D sector.

Previously within the university, business development staff had been based within individual academic departments, such as the Department of Chemical Engineering. This approach was sufficient when academic faculty required business support for small- and medium-sized research projects. However, to develop multidisciplinary and multi-departmental propositions for large and complex industrial programs, this approach was less effective. The new team, with its industrial sector approach, represented a departure from the previous strategy. The A&D sector was selected because a previous review of research strategy by the Faculty of Engineering had identified major funding opportunities in this sector, where the university would be well positioned to secure extensive participation (Philbin, 2004).

A lack of awareness of the key industry drivers for research in the area led to the decision to focus the research development team on to industrial sectors. In this regard, Baba, Shichijo & Sedita (2009) have highlighted how university-industry collaboration performance can be related to the ability of faculty teams to act as “boundary spanners,” (page 759) combining scientific expertise with knowledge of the corporate enterprise. Boundary spanning could render the university more accessible to industry through improved communication of research capabilities and translation of university research into industrial
requirements. Leveraging knowledge of industrial sector applications for research therefore enables universities to improve their positioning with companies with respect to securing new research programs.

The sector platform involved the pursuit of an integrated set of activities to address a number of objectives: to raise awareness of the university’s relevant research areas within the A&D sector; to make contact with key decision-makers in commercial and government organizations; to identify early stage research opportunities so the university could explore partnering approaches with candidate industrial collaborators; and to position the university to submit successful research proposals to companies with a view to undertaking A&D projects.

Table 1 provides details of the main activities of the sector platform. The activities are broken down according to internal or external focus, thus reflecting the dual focus of the sector platform approach. The need to drive the strategy according to external requirements to be industry sector aligned must be accompanied by a corresponding internal alignment that translates external requirements into internal opportunities, which can then be communicated to interested academic faculty members. The research development strategy relies on an ability to gain the support of relevant academic faculty, since it is through their laboratories, researchers and students that research will be undertaken. This internal/external dimension can be extended further in terms of the customer base for research development work. External customers are required to provide the funding opportunities and the industrial collaboration, but the academic faculty members will deliver the research studies. Such faculty can therefore be regarded as internal customers for the research development service, and consequently efforts need to be maintained to ensure that their needs are met.

Table 1. Main Activities Undertaken as Part of the Sector Platform

<table>
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<th>Internal activities</th>
<th>External activities</th>
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<td>1. Identification of A&amp;D research areas across the engineering departments at the university, together with identification of the corresponding members of faculty who either currently worked with the A&amp;D sector or who wished to.</td>
<td>1. Attendance at A&amp;D conferences focused on R&amp;T across the UK, continental Europe and also in USA. Such conferences provided networking opportunities and also helped to identify key industrial and government requirements for A&amp;D research programs.</td>
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<td>2. Development of a database of A&amp;D research areas, where the areas were categorized according to sector-specific themes. The database included key information such as the principal investigator, department, research area description, A&amp;D application area (existing or potential) and details of existing funding.</td>
<td>2. Attendance at government led procurement and research contracting events, where research opportunities as well as potential collaboration partners could be identified.</td>
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<td>3. Presentations to departmental research committees involving senior members of faculty on the A&amp;D research development strategy. These committee meetings allowed key academic stakeholders to be briefed on the overall approach.</td>
<td>3. Articles published on the A&amp;D strategy employed, so as to raise the profile of the university in this area (Philbin, 2004 and 2007).</td>
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<td>4. Formation of application focused teams of faculty staff, which were aligned to specific A&amp;D areas, such as autonomous systems.</td>
<td>4. Presentations given at research conferences and industry meetings on the university’s A&amp;D research capabilities.</td>
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<td>5. Consultation with professional services staff within the university on how the A&amp;D approach related to other corporate development initiatives.</td>
<td>5. Briefings and meetings held individually with prospective industrial collaborators, where research propositions could be presented.</td>
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<td>6. Production and distribution of a research booklet that highlighted the A&amp;D research areas.</td>
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<td></td>
<td>7. Development of website pages as part of the Faculty of Engineering website, which included the material from the research booklet.</td>
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Translating the external A&D requirements into research opportunities was contingent on understanding how the research areas within the university related to the technology applications that both government and industrial stakeholders perceived as investment priorities. Figure 2 provides a schematic view of the research building blocks identified in the Faculty of Engineering, together with the aerospace and defense application areas. This view illustrates the technical areas that were explored and developed as part of the sector platform approach within the research development management framework.

**Figure 2.** View of A&D application areas and university research areas (Philbin, 2007).

**Process Platform**

This platform employs structured process methodologies to help improve university-industry research collaborations. Previous work has identified a lack of process studies, especially in the area of university science parks (McAdam, Galbraith, McAdam & Humphreys, 2006) and technology transfer (Autio & Laamanen, 1995), and so this approach is an attempt to address that shortcoming. To develop a process methodology, a research study was undertaken involving interviews with 32 stakeholders for university-industry collaborations (Philbin, 2008a). Analysis of the interview findings, combined with the results of a literature review, revealed the conceptual model for university-industry research collaboration as a transformation process depicted in Figure 3.

**Figure 3.** Transformation model of research collaboration (Philbin, 2008a).
The interview findings revealed that successful research collaborations are built on a number of process inputs that are technical, project and business, and social in nature. These inputs can be viewed as part of a transformation process that is research collaboration, and which gives rise to the desired process outputs, namely knowledge sharing and improvement, as well as sustainability. Not all research projects need to lead to sustainability, and some may need to cease for a variety of reasons, not least because the original research objectives have been fully met. Nevertheless, achieving a sustainable collaboration that moves forward, which gradually develops and addresses new and more demanding research goals, can be a desired outcome for many academic research teams. Long-term collaboration with industry can provide continued access to funding for doctoral and postdoctoral fellowships, but collaboration also provides a valued context for research and application-specific data that can be used to validate academic research.

Through further analysis of the interview findings, it was possible to build on the simple transformation view of research collaboration to formulate a process-based model for university-industry research collaboration (see Figure 4).

The grounded theory for qualitative analysis (Strauss & Corbin, 1998) was employed to generate the conceptual process model, which related to both the empirical results and the literature on university-industry collaboration. The process model is based on a linear sequence of activities, starting with the terrain mapping stage and moving through proposition, initiation, delivery, and evaluation. The process is supported by four other elements: the technical and business missions, social capital, and the collaboration agent. The process was developed as a guide to help university-industry collaborators develop research collaborations and manage the resulting programs.

The following descriptions of the different components of the process model relate to a case study at the university. The terrain mapping and proposition stages involved broad-based activities, but the other components of the model are described for a particular research program valued at £3 million and delivered to an international engineering company.
Terrain Mapping

This stage, focused on knowledge acquisition of the A&D market for research, involved discussions with industrial stakeholders as well as gathering information on the requirements for long-term fundamental research in this sector. To accompany the external analysis, internal research and technology audits were conducted across the faculty of Engineering, which allowed A&D research areas to be categorized into four main areas: information processing and management, systems research, aeronautics, and structures and materials. These categories were selected to ensure that the research areas could be grouped into sector-specific themes. Once this improved understanding had been established, it was possible to market the research areas through, for example, presentations and exhibitions at industrial events, such as the Farnborough International Air Show and Exhibition in the UK and at National Defense Industrial Association (NDIA) conferences in the US.

Proposition

At this stage, additional marketing-related activities focused on submitting defined research proposals to specific companies. This approach built on the knowledge gained from the terrain mapping stage. Moreover, informal discussions with key companies allowed proposals to be pitched at the right level; i.e. costs were at an appropriate financial level and the research proposals were focused on the most appropriate technology readiness level (TRL) that the industrial program required.

Initiation

Agreement with the company on the program statement of work, undertaken early on, allowed negotiation of the contractual terms and conditions to move ahead. A coordinated approach was used for the contracts negotiation, which involved signing an overall business agreement, as well as individual contracts for each of the nine research projects (which together constituted the research program). These contracts contained specific technical details and supporting costs.

Delivery

The individual research projects were assigned to academic principal investigators who were responsible for delivering the technical milestones to the company. Conversely, the collaboration agent provided overall financial management of the program and also had a customer liaison role with the company’s managers. This liaison helped to ensure a consultative and timely approach to any problems.

Evaluation

Annual reviews of the three-year program were conducted, and there was also a major evaluation at the end that considered whether the research outputs were being incorporated into the company’s technology development plans for future equipment. This approach led to a number of projects being awarded additional funding, which in some cases focused on an examination of the transition of the research findings into existing
and planned equipment systems. This was viewed by the company as being a particularly important outcome for the research, as it justified the research investment by demonstrating the added value to an actual equipment capability.

**Technical Mission**

Only technology areas that provided sufficient intellectual and academic rigour were investigated for possible collaboration with industry. This approach ensured that the research under investigation had the necessary potential to give rise to journal and conference proceeding papers of the required standard. Further, research was pursued that had a clear alignment to the company’s technology requirements, thus maintaining the technical mission for both the company and university. Being able to demonstrate the relevance of the research to the company’s technical objectives is clearly an important criterion for both initially gaining research funding and substantiating the industrial value to the research findings.

**Business Mission**

Careful consideration was applied to the proposal costs, and in a few cases the project scope was modified so more affordable proposals could be submitted. This flexibility helped improve the probability of the project being awarded, and also demonstrated commitment by the university to the research and to working with its industrial partner. Moreover, an alignment of the research areas with the company’s priorities, which were in turn influenced by government procurement directives, allowed for the development of the business case for investment by the company in the research projects.

**Social Capital**

Contact made in the early stages of the process with key technical staff in the prospective collaborator organizations allowed social capital to be established and then nurtured. Furthermore, social capital was built up through regular contact with technical and contracts staff from the company. In fact, at one point, certain issues delaying the contractual negotiations could have resulted in a loss of program funding. However, through regular dialogue with the company’s contracts manager, these issues were resolved quickly, which allowed the program to go ahead.

**Collaboration Agent**

The collaboration agent was the person within the university tasked with ensuring research programs were contractually awarded and then overseeing program delivery to ensure the company’s overall program requirements were met. The author undertook this role, which allowed the academic faculty to concentrate on leading the individual research projects while giving the company a central point of contact to quickly resolve any issues.

**Evaluating the Management Framework**

Adoption of the management framework based on a combined process
methodology/industrial sector approach has resulted in a number of benefits for the university. Nevertheless, to evaluate the effectiveness and identify any limitations of the management framework, it is useful to compare to other approaches reported in the literature. Ireland, Hitt, & Vaidyanath (2002) examine effective alliances according to transaction cost economics (TCE), the resource-based view (RBV) of strategy, and social network (SN) theory. Although research collaborations can be regarded as a simpler version of more extensive strategic alliances, analysis through these three theories still provides an appropriate and broad-based method to consider management frameworks for university-industry collaborations.

TCE (Pessali, 2009) can be viewed in terms of the reduced costs incurred by a company through undertaking a research collaboration with a university. The company is able to utilize the academic resources of the university that it would otherwise not have had access to, and so is able to lower its costs. Collaborations will themselves incur transaction costs that must be accounted for; however, a company will seek to justify investment in university research either through potential future revenues from enhanced products or services to be developed or through the reduced costs from gaining access to the knowledge generated by the university. Moreover, companies may form stronger linkages with universities to reduce both the transaction and production costs of associated manufacturing operations (Barringer & Harrison, 2000).

The RBV theory of strategy (Wernerfelt, 1984) has been widely discussed in the literature across a broad range of management applications (Grant, 1998). Essentially, a firm's competitiveness can be related to its unique combination of organizational resources and assets. Improvements in competitiveness through developing new products or services can therefore be regarded in terms of a company's access to the required resources, e.g., people, infrastructure, and technology, as well as less tangible resources, such as tacit and explicit knowledge. Furthermore, Spender (1996) has extended the RBV paradigm to focus specifically on knowledge, where a firm's level of success can be attributed to its capacity to acquire, integrate and then deploy knowledge in support of technology developments for new products and services (Su, Chen, & Sha, 2007). Applying the RBV theory to research collaboration would essentially suggest that collaborative activities undertaken by companies help generate knowledge to improve a firm's competitiveness.

SN theory suggests that an organization's activities on a strategic level are contingent on the social context within which the organization operates (Gulati, 1999). Furthermore, the social connectedness associated with an organization includes both internal (intra-organizational) and external (inter-organizational) relationships (Madhok & Tallman, 1998). Extending SN theory to collaborations would suggest that university-industry interactions are likely to be linked to the level of social links between them, and that collaboration success will be a function of the extent and quality of social interaction.

It is now appropriate to compare the combined process methodology/industrial sector management framework with other management systems for university-industry collaboration. Two different approaches to collaboration from the literature reflect different perspectives on university-industry relations. Burnside and Witkin's (2008) model for university-industry collaboration is linked to a need to establish a central intellectual property and industrial research alliance office. This department at the university focuses on
certain key objectives: build a team; work from the big picture (model); commit the team to a process (secure buy-in); work the process creatively; and have an escalation path. The model also emphasizes the need for effective negotiation of intellectual property rights (IPR), something that can cause substantial delays in the signing of collaboration agreements and research contracts.

The second comparative model is by Thune (2007), which involves a networkembeddedness approach to university-industry collaboration. This study draws on a social capital perspective to examine how access to an array of embedded resources derived from networks of relationships can have an impact on the formation of new collaborations, with the research indicating that such social interactions are central to both forming and carrying out such collaborations.

Table 2 illustrates how the three collaboration models relate to the aforementioned theoretical underpinnings.

Table 2. Comparison of the Combined Process Methodology/Industrial Sector Management Framework with Collaboration Models from the Literature

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<td>TCE</td>
<td>The framework includes a focus on spanning the university research and industrial sector divide, which has the potential to improve the commercial attractiveness of the university research. The process model includes the ‘business mission’, which is also specifically aligned to emphasizing the commercial viability of the research; these commercial linkages help reinforce the TCE basis.</td>
<td>The model includes a pragmatic view on the negotiation of collaboration agreements with a particular focus on determination of optimal IP conditions. This negotiation framework should help ensure the commercial attractiveness of research propositions and hence be a positive TCE characteristic, although there does not appear to be a specific cost-based attribute to the model.</td>
<td>The approach did highlight the leading role that government agencies can play in stimulating research and this government support can help to reduce transactional costs for industrial sponsored research. There is therefore some coverage of the cost drivers for collaboration.</td>
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<td>RBV</td>
<td>The framework includes a strong focus on the acquisition and deployment of knowledge. This includes sector-specific knowledge through the industrial focus as well as the gathering and utilization of knowledge in various parts of the process model (terrain mapping, proposition, technical mission, etc.).</td>
<td>The structured model includes consideration of knowledge generation, however, there does not appear to be a systemic treatment of the different forms of knowledge and the processes that can be utilized in order to facilitate collaboration as a knowledge driven activity.</td>
<td>Although there was coverage of the nature of knowledge flows as part of university-industry research collaboration, the approach did not have a systematic treatment of how knowledge can be effectively acquired and deployed in a collaboration context.</td>
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<tr>
<td>SN</td>
<td>Social capital as a feature of social networks is a clear component of the process model as well as the transformation process and hence the resulting framework takes account of the social dimensions of collaboration.</td>
<td>The model makes reference to the need to continually emphasize relationships rather than transactions, plus there is a clear development of the role of individuals in the collaboration process; This model therefore has a significant social applicability.</td>
<td>The model includes a clear analysis of the role of relationships across different types of collaborations, which have been developed according to different situations, such as needs-driven or opportunity-driven collaborations. The model therefore has a strong social dimension.</td>
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</table>
An analysis of the approaches to university-industry collaboration across the three supporting theories provides a useful perspective. The model by Burnside and Witkin (2008) offers a sound negotiation approach, whereas Thune’s (2007) approach provides a rigorous treatment of the social dimensions of collaboration. Further analysis highlights how the combined process methodology/industrial sector management framework provides a comprehensive treatment of collaboration factors across a broad, systems-wide context. This spans coverage of the social inputs to collaboration, through considering relationships and key staff, as well as a focus on the economic and cost basis for collaboration and the resources and knowledge that need to be deployed. Both the initiation and delivery of collaborations can be highly contingent on an organization’s ability to utilize its current and acquired knowledge resources; hence in this regard, the development of process and structural management models for collaboration needs to have an adequate consideration of knowledge as a central paradigm.

Conclusions

An innovative management framework was devised and employed at Imperial College London to improve the development and management of collaborative research programs. The combined process methodology/industrial sector management framework focused on the aerospace and defense industrial sector as part of the sector platform, which allowed significant knowledge build-up (both explicit and tacit) of the A&D industry that has traditionally been a strong provider of funding for academic research. This focus has allowed the university to pursue a co-ordinated marketing and bidding campaign with companies from the sector that has resulted in £20 million of research programs being awarded over a five-year period.

The combined process methodology/industrial sector management framework also included a systematic use of structured management methodologies as part of the process platform. This approach was informed by literature depicting research collaboration as a transformation process, which further allowed an overall process to be developed for the management of university-industry research collaborations.

The use of the management framework builds on studies reported in the literature, which highlight the lack of process models in the area of university-industry collaboration. From a broader perspective, companies are increasingly pursuing an agenda of open innovation, and this is leading to greater collaboration with universities. But with this greater opportunity for funded research comes competition between universities, as well as a need to improve the management of research development within universities. Literature studies also point to the role that social capital plays through building trust from open and regular communications between collaborators as well as honesty and so-called “norms of reciprocity” (Yli-Renko, Autio, & Sapienza, 2001, page 591).

Effective knowledge transfer is also a highly important determinant for successful collaborations. The management framework described in this paper is an attempt to tackle some of these issues, and to provide an intellectual foundation for professional services at universities engaged in helping academic faculty establish and manage collaborations with industry. The framework, crucially, is also practitioner focused and can be regarded as a guide to help maximise research opportunities and eventual levels of research contracts that a university may generate. The approaches described in this paper will also provide a useful insight for industrial managers who are involved with contracting university research.
Focusing research development activities according to an industrial sector approach involved the university positioning itself within the aerospace and defense sector as part of a co-ordinated marketing and bidding campaign. This phase of activity was clearly externally focused but it had to be conducted in parallel with communication and team building internally with the academic faculty. Without gaining the firm commitment of the academic faculty there would have been no point in pursuing the external company engagement since members of faculty are of course responsible for leading any resulting research studies.

The use of the process model highlighted that successful collaborations require an adequate focus to be applied to all parts of the model (although this is dependent on the size and scope of collaboration). Many of the model’s elements were found to be inter-dependent, e.g. the collaboration agent required an open and honest relationship with the company, which was built on the required social capital. Moreover, focus needed to be maintained on the technical mission (e.g. through understanding and applying TRLs) as well as the business mission (e.g. understanding the customer’s position on value for money). Throughout the process, social capital was built up steadily and this position helped alleviate a difficult point in the contractual negotiation stage (initiation). A weakness, however, for process models derived from qualitative results is that they can sometimes be normative (Strauss & Corbin, 1998). To address this weakness, the model contained both process components (terrain mapping, proposition, initiation, delivery and evaluation) and structural components (technical mission, business mission, social capital and collaboration agent), as well as being grounded on findings from supporting literature reviews.

Analysis of the combined process methodology/industrial sector management framework has been undertaken through comparison with collaboration models from the literature, including approaches by Burnside and Witkin (2008), and Thune (2007). This analysis has included assessment of the approaches according to three underpinning theoretical frameworks, which had been previously employed as part of an ‘analysis lens’ by Ireland, Hitt & Vaidyanath (2002). The analysis found that whilst the other approaches had distinct features and potential benefits for collaboration management, the combined process methodology/industrial sector management framework reported in this paper provides a comprehensive treatment of collaboration factors across transaction cost economics (TCE), resource-based view (RBV) of strategy, and social network (SN) theories. The management framework is therefore applicable to a range of university-industry collaboration scenarios.

The research and supporting case study investigation reported in this paper have revealed the benefits that can be derived from employing a management framework for research collaborations, based on the sector and process platforms approach. However, it is important that university management systems not become overly burdensome so that the creative aspects of scientific research and collaborative work are hampered or blocked. Ideally, research administration processes will operate alongside and in a supporting capacity to the academic and creative activities that are essential to the exploratory nature of scientific research. Moreover, research administration processes, such as those described in this paper, will complement creative academic work, improve the efficiency of how universities partner with companies, and help ensure that academic faculty are free to devote adequate time and energies to overseeing research activities.

It will not always be appropriate to employ an industrial sector strategy within a university, and such an approach will be contingent both on the university’s current practice and its future aspirations. Where it is possible to manage research development according to industrial
sectors, this initiative may be viewed as a long-term strategy. The strategy will need to be adequately staffed over multiple years, and will require commitment from the university’s senior management. The industrial sector focus will also need the support and engagement of relevant academic faculty, and so communication and team building are crucial, as are relations with key external stakeholders.

The process model described previously is not meant to be overly rigid but ideally can be viewed as a guide to improve the management of research collaborations, from the opportunity stage through delivery. For universities looking to engage further with industrial companies, it is further recommended that efforts are directed towards building appropriate social relations with individuals from these prospective partners, including technical, commercial and business focused staff. There also needs to be careful thought towards enhancing the transfer of knowledge generated by the university to the company, so that collaborations can be developed into sustainable relationships. These activities do, of course, need to occur in addition to the delivery of individual research projects and programs through the key channels for knowledge dissemination (Cohen, Nelson, & Walsh, 2002), such as journal articles, conference papers, reports and patents, and informal information exchange.

There are a variety of reasons why collaborations may or may not be successful (Dodgson, 1992), and the development of major high-value research collaborations can often be a complex process that involves many people from both the university and company. The use of suitable management frameworks does, however, provide a potential guide so that the success rate for research proposals can be maximised and the risks of the resulting research projects mitigated.

Future work is suggested on the application of the management framework to other case studies, particularly those in the healthcare and pharmaceutical sectors. This will allow the merits of the approach to be explored from new perspectives and for its general application to different organizational and operational contexts to be examined in more detail. Future work is also suggested in developing an improved understanding of the value for money attributes for research collaborations, so that companies may justify the case for investment in university research and for universities to improve their ability to commercially engage with industrial organizations. Developing such areas of research will help to strengthen the theoretical basis for collaboration management, thereby contributing to advancement in the research administration profession.

References


Challenges of Implementing the NIH Extramural Associate Research Development Award (EARDA) at a Minority-Serving University

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Author’s Note
Presented at the Symposium of the 2008 Society of Research Administrators International meeting in National Harbor, Maryland, this project was made possible by a grant (#G11HD054970-01) from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD). Its contents are solely the responsibility of the author and do not represent the official views of NICHD.

Abstract
The impacts and challenges of implementing an NIH/NICHD Extramural Associate Research Development Award (EARDA) at a private Minority-Serving-Institution (MSI) are examined. This article outlines efforts to gain institutional buy-in and challenges encountered in creating a functioning Office of Sponsored Research and implementing research policies where none existed previously. The model combines NIH training and pilot research funds with on-campus outreach and professional development, to effect change in the research culture at a primarily undergraduate teaching university. Challenges discussed include how best to engage faculty with heavy teaching loads, managing unrealistic faculty expectations about grants and funding, the need to engage institutional leaders in creating a strategic research development plan, locating researcher-appropriate funding opportunities, and developing partnerships to augment research opportunities at non-research institutions. The successes and challenges that emerged can inform research administrators of the needs of faculty while they act as agents of change at universities seeking to increase faculty-student research and funding.

Keywords: research administration, professional development, minority-serving institutions

Introduction
In fall 2007, a National Institutes of Health (NIH) Extramural Associates Research Development Award (EARDA) was implemented at St. Thomas University in Miami, Florida. The NIH EARDA award was designed to build research infrastructure
and encourage development of externally funded research at minority-serving institutions to encourage more minority students to enter the sciences and pursue biomedical research careers.

St. Thomas University, an undergraduate teaching institution, is a designated Minority Serving Institution (MSI) and Hispanic Serving Institution (HSI). Its enrollment is comprised of 47% Hispanic, 27% African American/Caribbean and 10% International undergraduates. The award helped establish the university’s first Office of Sponsored Research and to initiate a research development program.

The Boyer Commission Report on undergraduate education (1998) recommended providing every undergraduate student with research opportunities beginning in the freshman year. Historically, teaching institutions without strong research components have experienced greater financial risks due to stiff competition from more established research institutions (Kenny, 2003). Research participation has been effective in promoting retention of students at greater risk for college attrition, especially minority students (Nagda, Gregerman, Jonides, VonHippel, & Lerner, 1998). Evidence suggests the need for teaching institutions to expand research opportunities for faculty and students, to enhance both academic quality and financial sustainability (Strassburger, 1995). However, institutions that transition from a teaching to a research focus typically experience difficulties with funding and personnel support (Harman & Selim, 1991). The NIH EARDA grant helps address this challenge by providing infrastructure and support to stimulate research activities at MSIs that historically have not engaged to a great degree in externally funded research.

**What is the NIH EARDA Program?**

The NIH established the Extramural Associates Program in 1978 to produce a cadre of academic research administrators who could promote the participation of institutions with high ethnic minority student enrollments in rigorous biomedical and behavioral research programs. The program is administered within the Division of Special Populations of the National Institute of Child Health and Human Development (NICHD). The EARDA Program was created to develop institutional capacity to support external research grant proposals, provide administrative structure to manage grant awards, and increase biomedical and behavioral research at minority-serving institutions.

As part of the award requirements, the participating institution nominates an Extramural Associate (EA) who is trained in grant processes used by the NIH and other federal agencies to support biomedical and behavioral research and training. The program instructs the EA in the role of academic research administrators in research development. EARDA is designed to stimulate the building of research infrastructure and development, and to facilitate a sustainable capacity in research administration at institutions with limited resources for implementing fundable biomedical and behavioral research.

To strengthen research administration infrastructure at minority-serving and women’s institutions, the EARDA Program trains the EAs to: 1) be leaders for research administration at their institutions; 2) help colleges acquire trained sponsored research staff and establish the infrastructure for grants acquisition and management; 3) identify best practices and encourage the MSI to institutionalize sponsored research practices; 4) establish
a process for evaluating capacity development in research administration; and 5) encourage student participation in faculty research. EAs participate in distance learning and on-site residency training at the NIH in federal grants terminology and funding mechanisms, receipt and referral of applications, peer review, program funding cycles, grants management basics, use of human and animal subjects in research, electronic grant submission, best practices for sponsored research, and development of a network of contacts at federal funding agencies.

This author was the EA for St. Thomas University and was trained in a 10-week residency at NIH in the topics shown in Table 1.

<table>
<thead>
<tr>
<th>Table 1. Components of the Extramural Associates Training</th>
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<tr>
<td>1. The organization and function of the NIH and other federal funding agencies</td>
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<td>2. Common federal grant compliance and regulatory issues</td>
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<td>3. Extramural funding mechanisms and opportunities</td>
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<td>4. Best practices in program administration, evaluation, financial management of grants, subcontract awards, and research project administration in resource-limited settings</td>
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<td>5. Technologies for information and data retrieval, dissemination, and grant applications</td>
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<td>6. Office of Sponsored Research planning and management strategies</td>
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<td>7. Common federal extramural funding program policies and procedures; federal extramural scientific review policies and procedures</td>
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<td>8. Other federal and private or non-profit funding programs and opportunities</td>
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<tr>
<td>9. Grantsmanship – grant writing and budget development skills</td>
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<td>10. Understanding NIH guidelines and protocols on issues in human subject research</td>
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<tr>
<td>11. Institutional review boards, use of laboratory animals, research misconduct, conflicts of interest, and policies on intellectual property management</td>
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Once the NIH residency is complete, EAs possess a working knowledge of federal support for biomedical and behavioral research and training, and skills in preparing research applications and postaward management, and are prepared to expand research infrastructure and development at their MSIs.

Engaging Institutional Leaders

One of the first activities undertaken at St. Thomas University was to establish a committee to advise and oversee the implementation of a new Office of Sponsored Research and to plan research development efforts. The university deans were invited to participate, along with key faculty, business office staff and administrators. The goals of the EARDA program and the EAs implementation plan were shared to gain feedback and foster the support of these key stakeholders and campus leaders. Involving the deans, faculty and staff in the oversight and planning of the new office helped the EA to gain buy-in from key campus stakeholders.

Among the most important individuals to cultivate as allies were the university president and provost. A commitment by these leaders was needed to establish a strategic research vision for the university and to plan development of research infrastructure and resources important to the
overall mission of the institution and its academic programs. These leaders were instrumental in establishing faculty evaluation criteria that reward efforts in research and grant writing, as well as policies to free up faculty from teaching to permit pursuit of research activities without disrupting the university operations and culture. Frequent meetings were held with the president and provost to apprise them of actions taken by the new Office of Sponsored Research. Thus, the university leadership actively supported initial efforts of the EA in confronting the many challenges of redirecting the culture of this teaching institution towards research.

Outreach and Professional Development

Changing the culture at a primarily teaching university is not an easy task, and, as stated earlier, the role of research administrators in such an effort is key. During his training, this EA developed a network of contacts and mentors at the NIH and other federal agencies, many of whom stressed that building trust and reaching out to faculty were crucial to success. Faculty engaged primarily in teaching and advising may not have the skills or interests to pursue funded projects. Therefore, professional development and outreach activities are needed to motivate faculty to explore grants preparation. A series of seminars were offered, including one entitled, “What can the Office of Sponsored Research do for you?” Here, the EA introduced faculty to the functions of the new office and the EARDA implementation plan. Faculty members were surveyed via the seminars, email and attendance at departmental faculty meetings to identify their needs and interests. Professional development training was subsequently planned for faculty, business office and other university staff on a variety of research and pre- and postaward issues. Seminars were offered several times during the semester, often taking place in computer labs so faculty could gain hands-on experience in searching for funding opportunities and working with electronic submission and grant management systems. Seminar topics are listed in Table 2.

Table 2. Faculty Research Development Seminars

<table>
<thead>
<tr>
<th>1. Office of Sponsored Research – What can we do for you?</th>
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<td>2. How to identify funding opportunities using grants.gov and other web resources</td>
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<td>3. How to evaluate and read a funding opportunity announcement</td>
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<td>4. Ethical issues in the use of human participants in research</td>
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<td>5. Ethical issues in the use of animal subjects in research</td>
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<td>6. Grants writing workshop – I Beginners; II Intermediate</td>
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<td>7. Preparing your faculty pilot research award application</td>
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<td>8. Using CRISP/NIH RePORTER to identify funded projects and potential collaborators</td>
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<td>9. Developing your proposal and budget</td>
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<td>10. Partnerships and collaborations – How to form and sustain them</td>
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<tr>
<td>11. Grants for minority serving institutions in STEM and health disciplines</td>
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<tr>
<td>12. Statistics and research design and methods assistance forum</td>
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<tr>
<td>13. Preparing for summer student/faculty research internships</td>
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<tr>
<td>14. Following-up after your faculty pilot research</td>
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Surveys indicated that the faculty needs for training and assistance varied greatly. Thus, both beginning and intermediate grant-writing seminars were offered, during which some faculty for the first time drafted a needs statement, specific aims, and program narrative, while others delved deeper into issues of research design, sampling, human subjects and budget justifications. Many workshops began with a wish list exercise in which participants were asked to envision what resources they hoped to gain as they moved their careers into new directions by conducting funded research projects. In the first year of operating the new Office of Sponsored Research, the EA circulated newsletters to inform faculty about research opportunities, highlighted faculty and student research achievements and announced upcoming seminars and workshops. The Office of Sponsored Research also created a website portal to grant opportunities, new university policies, forms and guidelines needed to initiate grant proposals, institutional review board (IRB) review, and other key resources for research grant development, compliance and reporting. Thus, in its first year, the EARDA award helped stimulate a new, visible research support system at this MSI, and initiated conversation among faculty in conducting research at this teaching institution.

Faculty Pilot Research Awards

It is difficult to engage in research those faculty members with heavy teaching responsibilities. The basic teaching load for faculty at St. Thomas University was four courses (12 credit hours) per semester. At smaller universities, many faculty also assume additional course loads, heavy advising, committee responsibilities, and other duties. In a preliminary survey, lack of time was the most common reason faculty gave for not engaging in grant writing and research. The perception that research activities will only add to an already high teaching load is a barrier to research involvement, and requires a creative, on-going effort to overcome.

Another reason making faculty less inclined to write grant proposals is the perception that this effort would not be recognized for advancement and evaluation. Not all universities recognize grant writing in the same way they recognize publishing or the development of new courses. Grant writing consumes time and is risky because many grants are not funded, especially on the first round. That grant writing may not be explicitly recognized in evaluations makes it more difficult for teaching faculty to pursue funded research projects. Early meetings with faculty therefore stressed that research involving students would complement the teaching mission. It was necessary to reassure the staff at departmental meetings that only some faculty would pursue funded research; the university was not asking all faculty (especially those who were satisfied in their teaching roles) to become externally funded researchers. However, the availability of EARDA pilot research seed money to assist faculty in starting their research programs helped motivate some to make their first forays into grant writing.

The EARDA award includes funding to establish a Faculty Pilot Research Award competition, with small grants that faculty could apply for to jump-start their research programs, typically during the summer months, when teaching loads are reduced. Faculty could propose small-scale projects and receive funding for themselves, student assistants, travel, and supplies and equipment to undertake a research activity of limited scope. Typically, these research projects could be conducted within a year. Faculty were required to submit their proposals on PHS 398 grant application forms and to undergo an NICHD review. Pilot research funding of up to $40,000 per year was built into the EARDA budget. Faculty were encouraged to apply for
awards under $20,000 so that at least two awards per year could be made. The faculty pilot applications were developed in the first year of the EARDA, for funding to begin in the second year of the award. The use of standard grant application forms, with a full review and revision process, encouraged faculty to follow the federal grant application process. In this way, faculty would be more prepared at the end of their pilot research projects to undertake a federal research grant proposal (such as an NIH R03). Thus, these awards required a rigorous application and review process to provide the faculty experience in the effort required to create sustainable, externally funded research programs.

**Challenges**

One of the most interesting challenges in the first year of the EARDA was managing unrealistic faculty expectations about grants and funding. The EA was surprised at how many of the faculty initially visited the Office of Sponsored Research to ask how they could increase their salary through writing grants. Many had no specific ideas about developing a research project, but they had a long wish list of desired equipment, travel money and other resources. Many faculty wanted funds to serve academic needs (classroom computers and new buildings) or for travel, with little consideration of how to justify the need for these resources to an external funding source. Faculty in the humanities and arts were disappointed when they learned from the workshops that much federal funding is geared toward projects concerning public health, security issues, or scientific disciplines. The EA spent considerable time providing faculty with realistic estimates of the most fundable projects and the best funding sources. While the focus of the EARDA program was clearly geared to enlist faculty from the sciences and health disciplines, it was not surprising that interest in seeking funding arose across all disciplines, including the arts, humanities, faith-based initiatives, and community service projects. Therefore, one challenge was coordinating a science- and health-oriented research development program while at the same time managing faculty expectations within the multi-disciplinary context of the university.

A related challenge was convincing the university to create a strategic research development plan. Given that not all disciplines or projects are equally fundable, it was important to prioritize areas that had the greatest potential for scholarship and likelihood of earning external funding. The president, deans and campus leaders collaborated with the EA to identify key areas of scholarship and research that complemented the university’s broader mission. The survey data helped identify some of the stronger researchers and faculty areas of research interest. A strategic plan was developed that emphasized STEM (Science, Technology, Engineering, and Math) disciplines, teacher training, and projects that focused on diversity (e.g., minority health, cross-cultural, and international issues). The university strategic research development plan helped faculty and administrators to focus efforts on areas of expertise and fundability. The EARDA program research development plan emphasized pursuit of funding that best matched existing faculty expertise and talent with current funding trends and climate.

One final challenge was the need for developing partnerships with external agencies. Many grant opportunities and funding proposals are enhanced by the collaboration of different organizations, and each brings its own unique resources and expertise to the proposal. For example, teacher training initiatives benefit from supportive partnerships with local educational agencies and schools. Partnering with other local universities can
extend limited grant budget resources to larger target audiences, and letters of support and memoranda of understanding (MOUs) attesting to their partnerships are a necessary component of many applications for external funding. The challenge was not only in how to form partnerships, but also in how best to institutionalize and document this partnering process. The following questions emerged:

1. Who represents the university with regard to external partnerships?

2. What is the function of Sponsored Research and other university units in developing, authorizing or reviewing letters of support or MOUs related to grant-funded projects?

3. What do university-community partnerships convey in terms of new roles and responsibilities for grant-funded project directors and external partners?

There are other issues in dealing with organizations external to the university. Along with implementing new forms and policies for grant proposals, as well as new practices for managing external funding and dealing with federal grant compliance issues, the university also needs to examine how to deal with external entities in partnerships. The first year of EARDA support for this MSI was an interesting one, both in terms of the EA assuming the role of a change agent to advance the research culture of a teaching university, and in managing the many unanticipated impacts of stimulating more research and external funding proposals.

**Conclusion**

As most members of the profession have acknowledged, the role of research administration exceeds grant oversight, fiscal accountability, and compliance with federal funding policies. Research administrators at smaller academic institutions are often seen as change agents tasked with strengthening the research culture by: 1) encouraging administrative and faculty buy-in to perform research; 2) providing opportunities for training in research policies and grants development; 3) promoting reward systems for faculty engaged in research; 4) providing opportunities for faculty training in compliance and regulatory policies; 5) overseeing sound project management; and 6) serving as an informational and networking resource.

Successful research administrators know how to find information about funding, explain the actions of review panels, and assist in budget development, as well as how to deal with issues of contract negotiation and grants compliance. According to NIH, the EARDA supported EAs in fostering a culture of research at their institutions by bridging science and administration, stimulating development of seed funding for research, providing resources for faculty and students, and influencing institutional research policies. The EARDA model was successful in establishing an office of sponsored research at this MSI, developing new grants policies and procedures, stimulating faculty to apply for pilot research awards, and increasing the level of research and number of grant submissions. Significant challenges remain in sustaining institutional support for research development and encouraging additional faculty to initiate funded research. Despite the challenges of creating a research culture at a teaching-intensive institution, great rewards are possible through activities aimed at increasing faculty research and engaging students in the sciences.
References


Building a Research Administration Infrastructure at the Department Level

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Author’s Note
The author thanks Danny M. Takanishi, Jr., M.D., FACS, chair of the Department of Surgery, for supporting her research interests as well as her professional development in the area of research administration.

Abstract
Due to the current economic crisis, research administrators at public universities are grappling with declining state funding and are faced with identifying other potential sources of revenue to support operations. Research administrators at all levels are forced to do more with less. Department level research administrators must be innovative since they have the least control over distribution of resources, including fiscal, staffing, and space. They must be adequately trained to deal with periodic shifts in the centralization and decentralization of duties that result from fiscal uncertainty and leadership changes. Therefore, strategically planning to accommodate department level assistance for its faculty who are engaged in or are pursuing extramural funding has become imperative. This article discusses a public university department’s initiative to support both its faculty and the central administrative office by attempting to reduce administrative burdens. This was accomplished through increasing self-sufficiency of department-level research administration staff via professional development efforts and engaging in collaborative efforts with other departments and the central administrative office.

Keywords: research administration, departmental research administrator, management
Introduction

Doing more with less has been the norm for research administrators (e.g., Drummond, 2003; Hexter, 1998; Kirby, 1996; Morris & Hess, 1991; Schweri, 1992). Shambrook & Mintzer (2007) noted that given considerable intellectual demands and tight deadlines, 41.3 percent of research administrators (n = 624) who completed the Research Administrator Stress Perception Survey (RASPerS) reported high work-related stress. Sixty-six percent did not have adequate resources to complete their job in a 40-hour work week. These difficulties are further compounded by the global economic crisis where hiring freezes and potential job loss have placed additional burdens on research administrators. Faced with the same concerns as its mainland counterparts, the University of Hawaii’s (UH) medical school has engaged in various strategic planning and prioritization initiatives to determine how to best utilize limited resources.

In its desire to assist both its faculty and the medical school by reducing administrative burdens, the UH Department of Surgery embarked on an initiative to develop a department level research administrative infrastructure. The intent was not to create a fiefdom or duplicate the efforts of the medical school’s central administration. Even if a department attempted such a feat, its lack of control over resource allocation would render the effort moot. The department is aware of its role in the research administration process and how it must integrate and work closely with the larger organization. As Kirby (1996) notes, a unit, such as a department, is part of a larger system and cannot be viewed in isolation. Additionally, Drummond (2003) emphasizes the need for the responsible unit’s mission to be in alignment with the university’s strategic plan.

Within the UH medical school, centralization and decentralization of various research administration tasks have shifted periodically due to changes in available funding, resources, and even leadership. Earlier in this decade, serious concerns about the University of Hawaii’s research infrastructure, or lack thereof, was formally studied through a research infrastructure task force that was derived from an ad hoc committee – University of Hawaii Association of Research Investigators (UHARI). The ad hoc committee met periodically to identify problem areas and brainstorm potential solutions. In the task force’s 2001 report, the committee concluded that the university had not adequately projected the administrative needs required to support the increase in research activity (UHARI, 2001). One of the task force’s recommendations was to hire knowledgeable, well-qualified research administrative staff and seat them in as close physical proximity to the principal investigators (PI) as possible. Related to this was delegating administrative decision-making authority far down the university hierarchy.

The UH medical school conducted its own internal reviews of its research administration needs. For example, in 2006, the central office conducted a needs assessment requesting department chairs to note which research administration duties (grouped under preaward, postaward, closeout, audit requirements) they would recommend or request be delegated to the departments. Information on the number of staff requiring training and the specific training needs was also requested. In 2007, the medical school established a formal policy regarding grant proposals, delegating certain administrative responsibilities to the departments (JABSOM Grants Development Office, 2007). For example, the unit directors/department chairs were delegated fiscal responsibility for grants. Specifically, they
are responsible for reviewing budgets for salary and fringe rates, staffing commitments, other resources, and institutional support for any grant proposals submitted. This policy is still in effect, but hiring freezes have forced the medical school’s central office to provide more direct support to departments that lack research administration staff. Consequently, effects of the hiring freeze have trickled down further, placing more responsibility onto the PIs.

Furthermore, properly trained department level staff can assist in compliance matters according to relevant university guidelines as well as state and federal regulations. Compliance is critical not just to protect the individual investigator, but the department and the medical school as a whole. Otherwise, there is the risk of negative sanctions, including jeopardizing future funding opportunities should any fiscal mismanagement occur. Krauser (2003) notes the importance of research administrators in developing a trusting relationship with PIs as an aid in potential negative encounters, such as having to reject a request. If a PI knows that the research administrator has her best interest in mind, she is likely more open to accepting the bad news.

The remainder of this article discusses the UH Department of Surgery’s research administration project. The first section discusses the initial project, which was initiated in the fall of 2007. The second section presents the project’s outcomes and the current state of affairs.

**Project Initiation: Fall 2007**

In keeping with the Chair of the Department of Surgery’s desire to operate the department on sound business and management principles, an associate chair position was created to assist in the oversight of administrative and fiscal matters. Reporting directly to the chair, the incumbent started in April 2006. The department has a number of funding sources: a little over $1 million in state general funds to cover departmental personnel and operational costs; several million dollars in private funds through various hospital contracts that cover physician salary and fringe; and several hundred thousand dollars in federal and private grant funds. Thus, the area with the most potential for growth, and receiving the highest level of focus, was development of the department’s research enterprise through increased grant funds.

The chair mandated that half of the department’s 46 compensated faculty members submit a competitive grant proposal to contribute to its evolution into a mature academic surgery department, fulfilling the tripartite mission of patient care, education, and research. The department was actively administering three grants for three different PIs by serving as the liaison with oversight entities, processing paperwork, and ensuring compliance with guidelines and deadlines. In addition, there was oversight of three other grants that were nearing completion.

All research projects administratively supported by the department are conducted in Hawaii with the intent of improving the quality of life for Hawaii’s citizens. The department’s draft strategic plan includes a research focus on three major killers – mitigation of Hawaii’s obesity and related diseases (e.g., diabetes, hypertension, heart disease and strokes), trauma (e.g., injury prevention and improving care of the critically ill or injured), and cancer. Current research endeavors include a study of the use of unique ultrasound
techniques in the early detection of breast cancer, an evaluation on the impact of blood volume measurement in the care of critically ill patients, development of a multidisciplinary approach to fall prevention in the elderly, and creation of validated assessment tools to measure cultural competency in surgical resident education. To undertake such critical research, more direct administrative support was needed at the department level.

As part of a needs assessment, the associate chair attempted to collect existing resources on research administration at the University of Hawaii. Particularly, she focused on formal guidelines regarding department level responsibilities. After confirming with the medical school’s central office that it did not have a research administration manual, she contacted the UH’s Office of Research Services (ORS). ORS referred her to a Roles and Responsibilities Matrix for Research Administration (UH ORS, 2007) that lists department level responsibilities such as developing and revising budgets, providing guidance to PIs on proposal preparation, reviewing and approving proposals before sending to ORS, revising and correcting proposals after institutional review, mailing proposals to sponsors, setting up accounts in the financial accounting system, ensuring expenditures/cost transfers have been posted to accounts, resolving issues related to unreconciled accounts, and ensuring compliance with circulars and sponsor conditions at the transaction level. At the medical school, the Grants Development Office handles preaward activities, such as informing faculty of funding announcements via e-mail and assisting with proposal preparation. The central office staff provides oversight of postaward activities and reminds department staff of reporting requirements and deadlines. Department staff serves as the liaison between the PIs and the central office, and have the responsibility of processing paperwork. Additionally, given that accountability is placed at the department and PI levels, the department’s research administration staff must take an active role in oversight as well.

To aid with the development of its research administration infrastructure, the department submitted a grant proposal to a local foundation. As required by the grantor, the project did not directly support a specific research project, but would facilitate organizational change by creating general administrative support for the department’s research endeavors. The funds would be used to hire a part-time student assistant and to cover costs related to the development of a departmental grants administration manual since no official university guidance on grants administration existed. The remainder of the funds would be used for the professional development of staff to attend conferences and purchase educational materials for self-study. At the time, there was limited formal training available on research administration at the medical school and the university. Therefore, the project had two goals: 1) to increase the department’s administrative and fiscal staff’s knowledge of research administration in order to be prepared to assist the department’s current and future PIs; and 2) to develop tools to assist the PIs via the collection, review, and synthesis of information on university, school, and department level policies, as well as review best practices in research administration at other universities. Specific outcomes were: 1) have the associate chair provide an orientation as well as follow-up training of the department’s research administration process to current and new PIs; and 2) have the part-time student assistant develop a departmental grants administration manual for distribution to all PIs and potentially shared with other interested departments at the medical school.

The timeline for the project was as follows:
Year 1 (July 1, 2008 to June 30, 2009)

a. Hiring of a part-time student assistant to help with development and distribution of a department grants administration manual;

b. Group meetings for initial training of current PIs and their respective administrative staff; and

c. At least two grant applications submitted with the department’s assistance.

Year 2 (July 1, 2009 to June 30, 2010)

a. Certification in research administration for the associate chair;

b. Dependent upon availability of university or other grant funds, hire one full-time administrative, professional, and technical (APT) staff member to develop and maintain a departmental grants database to track both preaward and postaward activities, as well assist with the processing of forms and requests;

c. Restructure the research administration process to more accurately reflect departmental oversight to ensure compliance with university, federal, and other relevant guidelines; and

d. Submit at least four grant applications with the department’s assistance.

Year 3 (July 1, 2010 to June 30, 2011)

a. With approval from the dean, initiation of a School of Medicine “support network” of department level research administrators to assist with updating and maintaining the grants manual and looking for possible inter-departmental research collaborations; and

b. Submit at least six grant applications with the department’s assistance.

Unfortunately, the department was not awarded the grant. Although the reviewers felt that the proposal was promising, they felt it was the medical school’s responsibility to find funding to support these efforts. Regardless, the chair firmly believed in the project and allowed the associate chair to continue developing the department’s research administration infrastructure. In the spring of 2007 the associate chair had received certification as a contracts and grants administrator through the UH ORS’s new training program, which provides an overview of the entire research administration process, both generically and specific to UH. In July 2008, a UH Department of Surgery Grants Administration Manual was authored by the associate chair with input from the staff of the medical school’s central office and other academic offices. The manual was distributed to both faculty and staff within the department. During that same month, the medical school granted the department an APT staff person whose duties include processing research administration paperwork in addition to other departmental fiscal transactions. This staff person was immediately enrolled in the same course as the associate chair so that he, too, could be certified. Both staff also received certification as fiscal officers so that administrative and fiscal assistance can be provided beyond contracts and grants (e.g., purchasing and procurement).
Through a combination of department and personal funds, the associate chair attended the Society of Research Administrators (SRA) International’s conference in National Harbor, Maryland, in October 2008. This experience exponentially increased her knowledge of available resources via formal sessions and networking. Atkinson (2002) notes that research administrators are still trying to forge an identity and legitimation as a profession. Therefore, much of the innovations and best practices in the field stem from conversations among research administrators at other institutions. For example, while conducting background research, the associate chair learned of similar projects at other universities. Wiersema (2002) described her project in the Department of Geography at the University of Maryland. The department chair hired a director of administration to alleviate the administrative burden, allowing him to be more engaged in planning for the department’s future rather than responding to daily minor crises. After conducting a needs assessment, the director engaged in a reorganization that involved the modification of job descriptions with the provision of skills training as needed for staff in adjusting to their new job duties. Wiersema (2002) reported that after this restructuring, her department became heavily involved with the university and other research and political communities.

Most recently, the associate chair was surprised at how many research administrators at other institutions across the United States share the same desire for more guidance at the department level. She recently sent an e-mail to a department research administrators’ listserv asking if anyone had any grants administration manuals they could share to obtain feedback on the UH manual. In response, close to 50 research administration staff at various universities and organizations requested a copy of her department’s manual. One institution sent a copy of its preaward manual and several others offered to review hers. Due to the demand, the manual is now posted on the National Council of University Research Administrators’ (NCURA) website in the Department Administration Neighborhood. The associate chair was also invited to join the Departmental Administration Neighborhood Committee.

Additionally, with the department chair’s encouragement, the associate chair anticipates participating in the medical school’s efforts to invite “field level” (i.e., departmental) input regarding how the medical school approaches research administration. This promotes a systemic approach encompassing interactions both within the university and with the federal government with how to best administer NIH grants. At a higher level, the dean and his executive committee are strategically planning the school’s approach to both research and research administration.

The department’s faculty has begun to actively seek extramural funding, with several grant proposals submitted and in preparation. Due to this project, the department is now better prepared to assist faculty with their efforts. Even though the department’s research administration infrastructure is in its infancy as compared to more established institutions, this experience demonstrates that small steps can lead to larger initiatives.
Conclusion

The department’s research administration project demonstrated that, with strong support, desire and dedication can overcome funding constraints. The current economic crisis has led to the tenuous nature of staffing and resources, with departments forced to take on more responsibilities. The commitment to research administration comes in the form of continuing professional development to keep current with the field, keep updated on internal and external policies and procedures, promote positive communication with the central office, and continue development of relationships with other departments. Also critical is the role of networking with other institutions, both nationally and internationally, to obtain both insight and feedback.

References


Tenured and Non-Tenured College of Education Faculty Motivators and Barriers in Grant Writing: A Public University in the South

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Author’s Note
Immense gratitude is expressed to Dr. Patricia Boyer for her help and guidance in conceptualizing and completing this research. Permission for survey use was obtained from Dr. Boyer before completing this project. An earlier version of this paper was presented at Florida Atlantic University’s College of Education Student Research Colloquia. Address correspondence to Dr. Patrick R. Walden.

Abstract
The purpose of this investigation was to identify College of Education (COE) faculty members’ perceptions of motivators and barriers to grant writing at a public university in the South, to compare the university’s COE faculty perceptions to previously published survey results of Colleges of Education at Research I institutions, and to compare tenured and non-tenured faculty’s responses. The survey instrument was adapted, with permission, from the instrument reported by Boyer and Cockriel (1998) for administration online. Several significant motivators were identified for the faculty: opportunity to probe or research new information; personnel support such as graduate assistants and clerical help when proposals are funded; having travel money available for conferences; building my professional reputation as a capable researcher; personnel support such as graduate assistants and clerical help when preparing...
proposals; more flexibility in how time is allocated; and assistance in grant proposal preparation. One important barrier to grant writing was identified: inadequate support available to submit proposals in a timely manner. One significant difference (heavy teaching load) was identified between tenured and non-tenured faculty. Recommendations were suggested to increase the number of grant proposals written and submitted by faculty and to support the overall grant writing process at the institution.

Keywords: Grant writing, education faculty, motivators, barriers, tenured, non-tenured

Introduction

Securing funding to conduct research is increasingly important in today’s higher education environment (Boyer & Cockriel, 1998; Sterner, 1999). Writing research grant proposals is a major means of seeking funding for research at institutions of higher education. For universities to increase research funding and subsequently increase research productivity, it is essential that university faculty members receive adequate support in writing research grant proposals. To provide such support, universities need a clearer understanding of faculty’s perceptions of motivators and barriers in the research grant proposal writing process. While all faculty members have at least some academic writing experience, experience with grant writing may be limited to non-existent for some faculty. Academic and grant writing represent two distinctive genres of writing, each necessitating differing approaches.

Porter (2007) described grant writing as an activity that is geared toward the future, oriented toward service, focused on a single project, written to persuade the reader using a personal and lay tone, team-focused and brief. Academic writing, on the other hand, is geared toward the past, oriented toward individual pursuits, centered on a theme, uses an explanatory discourse genre with an impersonal tone, individual-focused and lengthy. Obviously, writing for academia and writing to obtain grant funds are two very different activities requiring varying skill sets. For many faculty, professional development in grant writing may be both needed and welcomed. These same faculty members may, however, require varying amounts of support from their research organization, which must probe employees regarding their past experiences and future goals for grant writing activities.

Similarly, understanding university faculty’s perceptions of motivators and barriers is important in the development of organizational support to encourage faculty to write grants, subsequently carry out research, and publish. Campbell (1998) reported an increase in both the number of proposals submitted and the level of external funding at a small undergraduate teaching institution following a focused initiative by the university’s Office of Grants and Research to write proposals with faculty. Banta et al. (2004) reported that a fellowship program award created at the University of Northern Colorado to support new faculty in writing grants is actively leading participants in pursuing grant funding as well as enhancing grant writing skills. Focused initiatives such as these may arise out of a greater understanding of what university faculty members deem important in pursuing grants (motivators) and what keeps them from moving forward (barriers) with grant proposals. Efforts to understand faculty perceptions are likely to vary from institution to institution according to variables such as institutional size, resources available, and the institution’s culture regarding the grant-seeking and procurement process.
For instance, Boyer and Cockriel (1998) randomly surveyed 370 faculty members (67% response rate) within Colleges of Education (COE) at American Association of Universities (AAU) Research I institutions and found that consideration in tenure and promotion, building professional research reputations, and a strong commitment from the college president were significant motivators in writing grants. They also found that lack of training in seeking and writing grants, lack of knowledge in the development of budgets, and lack of knowledge regarding potential funding sources were significant barriers to grant writing. These motivators and barriers were more significant for non-tenured faculty than for tenured faculty.

Similarly, Cole (2007) reported that faculty need more administrative assistance with grant proposal preparation, as well as a more streamlined review procedure. Insights into what faculty consider motivators and barriers to grant writing, such as those reported by Cole as well as Boyer and Cockriel (1998), may better inform institutionally sponsored initiatives to increase grant writing activities and, ultimately, the level of funding received. The current study sought to accomplish just that within a Southern university's COE.

The purpose of this investigation was to: (a) identify COE faculty perceptions of successful grant writing motivators and barriers at a public, four-year, coeducational, doctoral-granting university in the South classified as a Research University with high research activity by the Carnegie Foundation for the Advancement of Teaching; (b) compare the university's COE faculty perceptions to previously published survey results of Colleges of Education at Research I institutions; and (c) compare and contrast tenured and non-tenured faculty's responses.

Five research questions guided this study: (1) Which grant writing motivators are perceived as important to the faculty? (2) Which grant writing barriers are perceived as important to the faculty? (3) Is there a difference in tenured and non-tenured faculty in perceived importance of grant-writing motivators? (4) Is there a difference in tenured and non-tenured faculty in perceived importance of barriers to grant writing? (5) Are these survey findings similar to Boyer and Cockriel's (1998)?

These findings bore significance internally for the university in attempting to create programs that encourage, support, and remove barriers to grant writing. Externally, these findings demonstrated successful use of Boyer and Cockriel’s (1998) instrument in surveying perceived importance of motivators and barriers to writing grants in higher education, as well as its utility in guiding recommendations for improvement. The information derived from this study provided the university with a useful perspective from which to begin to understand its COE faculty's perceptions of motivators for and barriers to grant writing. These data also provided insight into a comparison of the university’s COE faculty to other COE faculty at AAU Research I institutions. Further, this information may be used by the university in creating future projects that focus on increasing the quantity and quality of faculty research grant writing activities.

Participant Recruitment, Survey Adaptation and Implementation

Before contacting any potential participants, Institutional Review Board (IRB) approval from the university was granted. Special attention in the IRB process was needed to
Articles

protect the anonymity of the respondents in the online environment. Individual permission was granted through the research office of the college within which the study was conducted. Written permission was also obtained from Dr. Patricia Boyer to use and adapt the survey instrument employed by Boyer and Cockriel (1998).

The survey instrument was then adapted for online use. The survey included 15 motivators and 15 barriers to grant writing and required that participants rate the perceived importance of each as Very Important, Moderately Important, Marginally Important, or Not Important. The only item altered from the original survey was the word “boilerplates,” which, to avoid semantic confusion, was replaced with the term “templates.” In addition to the opportunity to add motivators and barriers, the participants were permitted to add comments at the end of the survey. See Boyer and Cockriel (1998) for the complete survey, including all motivator and barrier items.

The adapted survey was produced online with software provided by an educational grant from the Websurveyor Corporation. Communication with the COE faculty regarding this study was accomplished through a solicitation email in which a hypertext link guided participants to the survey site to read the informed consent document. After agreeing to continue in the study, participants completed the online survey. To obtain the largest sample possible, the entire 131-member COE faculty was solicited via email addresses obtained through the university’s mailing list. Faculty members chose whether or not to participate in the survey.

Data Analysis

Participant responses were coded from 0 to 3 according to perceived level of importance, where 0 represented Not Important; 1, Marginally Important; 2, Moderately Important; and 3, Very Important. Appendix A describes the mean participant responses for both motivators and barriers to grant writing. Results of this study were interpreted with the use of descriptive statistics and a univariate Analysis of Variance (ANOVA) to compare the tenured and non-tenured groups’ perceptions of importance. Appendix A also reports the ANOVA results obtained for both motivators and barriers. The Chi Squared analysis employed by Boyer and Cockriel (1998) was rejected in the current study due to the presence of low raw observed frequencies (less than five) for many items.

Participants were also given the opportunity to add both motivators and barriers to the survey by responding to an open-ended solicitation. The textual data derived from the open-ended solicitation were subjected to thematic analysis (Creswell, 2005). Starting with one document, specific text segments were chosen and coded as they pertained to the segments’ meaning(s). Coding and subsequent thematic analysis were aided through use of the Atlas.ti 5.2 software package. Codes established in the first document were then used with subsequent documents to test fit and to see if any new codes appeared. New codes were added as necessary. After reading and coding all the documents, codes were collapsed into themes or “similar codes aggregated together to form a major idea in the database” (Creswell, p. 239).
Results

Following one email reminder that also included a link to the survey, 35 faculty members of the 131 solicited (26.7%) chose to complete the online survey. Hamilton (2003) reported that the average response to online surveys is 30%. While the actual response rate of 26.7% is slightly lower, the current study's response rate approximates the 30% average closely enough to draw preliminary conclusions regarding the perspectives of the faculty under study. Of the respondents, 15 (42.9%) were male and 20 (57.1%) were female. Fourteen of the faculty (40%) were non-tenured and 21 (60%) were tenured. The faculty ranks were Professor (9 or 25.7%), Associate Professor (15 or 42.9%), Assistant Professor (5 or 14.3%), and Other (6 or 17.1%). Associate Professors made up the highest percentage of participants in the study.

To discern motivators and barriers considered important by all faculty, motivator and barrier items for which the mean value for both the tenured and non-tenured groups was greater than 2 (Moderately Important) were reported. Table 1 lists the motivators and barriers identified as important (greater than 2) for tenured and non-tenured faculty separately, the motivators and barriers considered important for both tenured and non-tenured faculty, as well as the rank of importance between these two groups. Only those motivators and barriers considered important for both tenured and non-tenured faculty were used in generating recommendations to increase the grant writing activities in this COE.

Table 1. Rank of Importance of Motivators and Barriers for Tenured and Non-Tenured Groups

<table>
<thead>
<tr>
<th>Motivator</th>
<th>Tenured Rank</th>
<th>Non-Tenured Rank</th>
<th>Barrier</th>
<th>Tenured Rank</th>
<th>Non-Tenured Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel support such as graduate assistants and clerical help when preparing proposals</td>
<td>6</td>
<td>3</td>
<td>Inadequate support available to submit a proposal in a timely manner</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Personnel support such as graduate assistants and clerical help when proposals are funded</td>
<td>1</td>
<td>2</td>
<td>Heavy teaching load</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Consideration in tenure or promotion decisions</td>
<td>2</td>
<td>4</td>
<td>Too many committee assignments</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>More flexibility in how time is allocated</td>
<td>4: Equal mean</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opportunity to probe or research new information</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Having travel money available for conferences</td>
<td>3</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact with funding sources</td>
<td>-</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assistance in grant proposal preparation</td>
<td>5</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building my professional reputation as a capable researcher</td>
<td>4: Equal mean</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Motivators

The following motivators for writing grants (in rank order with mean importance score for both tenured and non-tenured faculty reported) were identified as important to the faculty in addressing research question (1) Which grant writing motivators are perceived important to the faculty?

1.  *Opportunity to probe or research new information* (mean = 2.61 on 3-point scale of importance for both tenured and non-tenured faculty);

2.  *Personnel support such as graduate assistants and clerical help when proposals are funded* (mean = 2.59 on 3-point scale of importance for both tenured and non-tenured faculty);

3.  *Having travel money available for conferences* (mean 2.26 on 3-point scale of importance for both tenured and non-tenured faculty);

4.  *Building my professional reputation as a capable researcher:* (mean = 2.26 on 3-point scale of importance for both tenured and non-tenured faculty);

5.  *Personnel support such as graduate assistants and clerical help when preparing proposals:* (mean = 2.21 on 3-point scale of importance for both tenured and non-tenured faculty);

6.  *More flexibility in how time is allocated:* (mean = 2.12 on 3-point scale of importance for both tenured and non-tenured faculty);

7.  *Assistance in grant proposal preparation:* (mean = 2.11 on 3-point scale of importance for both tenured and non-tenured faculty).

Barriers

The following barrier item had a mean value greater than 2 (Moderately Important) for both the tenured and non-tenured groups in addressing research question (2) Which grant writing barriers are perceived as important to the faculty?

1.  *Inadequate support available to submit proposals in a timely manner:* (mean = 2.18 on 3-point scale of importance for both tenured and non-tenured faculty).

Tenured Versus Non-Tenured: Motivators and Barriers

Responses to research questions (3) Is there a difference in tenured and non-tenured faculty in perceived importance of grant writing motivators? and (4) Is there a difference in tenured and non-tenured faculty in perceived importance of barriers to grant writing? revealed one statistically significant difference (p<.05) between tenured and non-tenured faculty. Tenured COE faculty at the university found heavy teaching load to be a significantly more important barrier than non-tenured faculty. No statistically significant difference was found
between tenured and non-tenured faculty in perceived importance of the motivators used in the survey. Appendix A reports the results of the univariate ANOVA for both motivators and barriers to grant writing.

**Results of Thematic Analysis**

Of the 35 participants in this study, 22 (62.9%) responded to the open-ended solicitation. Of these 22, 15 (68.1%) were tenured and 7 (31.9%) were non-tenured. Twenty-four codes emerged from the participants’ responses. Of these, 12 dealt with motivators to the grant writing process and 12 dealt with barriers. These codes were collapsed into themes, which were cross-referenced with the topics addressed in the survey (see Boyer & Cockriel, 1998 for full survey). Themes that were adequately described in the survey itself were eliminated and judged to be adequately addressed through use of the quantitative data analysis methods reported above.

**Motivators to Grant Writing**

Two themes emerged from the data analysis that represented the participants’ perception of what motivates them to write grants: more control over resources and innovation. These themes were judged not to be fully addressed in Boyer and Cockriel’s (1998) survey regarding the level of depth in understanding the categories allowed. While surveys provide a relatively quick and efficient way to garner information about a population, they also possess an inherent weakness in discovering matters that are not included or deeply probed. To their credit, Boyer and Cockriel showed foresight in including open-ended response solicitations to collect data not included in the survey’s content areas. Regarding the current study, most faculty who responded to the open-ended solicitations identified barriers versus motivators. The most widely found themes regarding motivators were the two reported here. It is, however, noteworthy that the groundedness of the themes regarding motivators to grant writing is weak.

**More Control over Resources**

Three of the faculty reported that control over resources was a motivator to grant writing. One non-tenured faculty member responded that it was motivating to have the “ability to have and use resources at [name of university] at own discretion rather than at the demands of chair and dean.”

Further, a tenured faculty member responded that it was motivating to “have … equipment or research opportunities for my students as a result of the grant.” It is clear from the participants’ responses that acquisition and control over resources is a motivating factor in writing research grants.
Innovation

Three tenured faculty members reported innovation in their discipline as a motivator to grant writing. A tenured faculty member responded that it is motivating to write a grant “because the proposal will focus on a needed innovation . . . it’s good work!” Another tenured faculty member responded that a perceived motivator was “making a contribution to my field in an area of needed research or service.”

The final tenured faculty member who found innovation to be a particular motivator to grant writing stated that it was motivating to have, “[the] ability to focus research work in particular areas that might have a greater impact and broader dissemination of results -- thus impacting the field.” Interestingly, no non-tenured faculty members reported innovation as a significant motivator. Further, the participants for whom innovation was motivating all found that contributing to their field was more significant than getting published. This finding may be the result of these faculty members having achieved tenure and promotion and, as a result, the pressure or importance of being published has diminished.

Barriers to Grant Writing

One theme emerged from analysis of the textual data collected from participants’ responses to the open-ended solicitation: University culture as a barrier. Of the 22 participants who responded to the solicitation, 14 felt that the university’s culture did not support or reward the writing of grant proposals. These faculty members all felt that the lack of a culture conducive to grant writing was a major barrier in their proposal writing efforts.

In describing how the university’s culture is perceived as a barrier, respondents cited two distinct areas: an inadequate grant process and lack of rewards. Regarding the process for grant writing at the university, a non-tenured faculty member responded, “It is too important to my professional career NOT to pursue a grant ... you just have to limp along with the poor infrastructure.” A tenured faculty member responded, “I have no motivation because there is no REAL support, just MORE work.”

Another tenured faculty member commented:

… de-motivators are a key here. [name of university] does not provide GAs [graduate assistants] for routine faculty work and grants are/can be more of a pain than an asset to a faculty member. Just more work without an infrastructure of support in that administrators take the support systems for themselves-sad. If funds are returned to a department, how does this benefit a faculty member? Benefits the administration, it seems. Loads are not reduced because of grants -- who else will do the work?????

These faculty members clearly felt there was no support system for grant writing and that the process in place at the university did not benefit them. A tenured faculty member summed up the perceived sentiment regarding the university’s process for grant writing by stating, “I had a large Federal grant. The university took all the indirects and gave nothing back to me or my department.”
Lastly, faculty members felt that the lack of rewards for those who write grant proposals was a barrier to their grant writing activities. One tenured faculty member responded that there was a “Lack of recognition for grants through P & T [promotion and tenure].” Further, one non-tenured faculty member felt that

In general, [name of university] does not value research — the rhetoric is great but the culture does not support doing really rigorous scholarship. Rather, the culture of [name of university] is administrative “busywork” that has little impact in advancing scholarship on a national scale.

Support of Boyer and Cockriel’s Findings at Research I Institutions

Participants’ responses to the last question, (5) Are these survey findings similar to Boyer and Cockriel’s (1998) findings? did reveal one motivator to grant writing that corresponded to Boyer and Cockriel’s findings. Building a professional reputation as a capable researcher was of significant importance to faculty, both tenured and non-tenured (mean = 2.26 on 3-point scale). The perceived importance of building a solid research reputation appears to be a common motivator to grant writing regardless of the research standing of the university in which the faculty member works.

Discussion

The authors acknowledge that the sample size achieved in this study is small; thus, based on the response to this study and the non-randomized sampling procedure employed, the results may not be generalized to the larger COE faculty population at the university under study. A larger response to this survey from a randomized sampling of the COE faculty may have resulted in different findings. Based solely on the 26.7% return in this study, however, the findings led to eight conclusions for both tenured and non-tenured faculty respondents:

1. Administrative encouragement of probing or researching new information is motivating;
2. Personnel support of the grant writing process and the faculty when grant proposals are funded is motivating;
3. Travel monies to aid grant procurement are motivating;
4. Building a professional reputation as a capable researcher is motivating;
5. Increased flexibility in time allocation (assignments) is motivating;
6. Increased support to submit proposals in a timely manner is motivating.
7. Control over resources and innovation appear to be motivating (groundedness is weak).
8. Inadequate or poor infrastructure and a culture not geared to grant writing support are barriers.
These findings differ from previous research. Boyer and Cockriel (1998) found the following significant motivators in a study of 248 COE faculty members (67% response rate) at Association of American Universities (AAU) Research I universities:

1. Consideration in tenure or promotion decisions;
2. Building my professional reputation as a capable researcher; and
3. A strong commitment from the college president.

In the same study, Boyer and Cockriel reported the following significant barriers (Each of the significant motivators and barriers was more important for non-tenured faculty than tenured faculty in their study.)

1. Lack of training in grant seeking and grant writing;
2. Lack of knowledge of budget development; and
3. Lack of knowledge of funding sources.

In this study, one difference between tenured and non-tenured faculty was considered statistically significant (p<.05). Heavy teaching load was more important as a barrier to tenured than non-tenured faculty. No other statistically significant differences between tenured and non-tenured faculty were found. Heavy teaching load was not a significant barrier to faculty surveyed by Boyer and Cockriel (1998). The nature of the differing institutions surveyed in these two studies and their support systems for grant research may be a factor in this analysis. Further, use of a self-elected, non-randomized sample in the current research may have further influenced the findings by way of eliciting perceived importance from those who hold the strongest opinions.

Likewise, the population factors in the current study may have also had an impact on the findings. Respondents to the current survey were 21 tenured faculty (60%) and 14 non-tenured faculty (40%). The tenured status of 60% of the respondents may have flavored the results. In Boyer and Cockriel’s sample, 77.6% were tenured and 22.4% were non-tenured. Of interest as well is the fact that the college in the current study has undergone a high turnover of faculty in recent years. This turnover may have had an effect on the responses provided and the significance of grant writing in the professional lives of the respondents. Individuals striving for tenure early in their professional life may be less inclined to address grant writing as a way to express their scholarly works due to the nature of their promotion and tenure guidelines.

Further, a factor that may have had an impact on the return rate of this survey, and therefore its possible conclusion, was timing. The college under study was in the complex situation of going through numerous accrediting and credentialing processes in which all the potential faculty respondents were actively involved, in addition to their normal assignments.

Lastly, this survey was conducted using web-based technology, while Boyer and Cockriel (1998) used hard-copy mailing. The web-based delivery of the survey may have influenced the return rate and responses. In fact, several faculty members were concerned about the anonymity of their responses. Research has suggested that online surveys have a smaller response rate than traditional mail-based surveys, although results are inconclusive (Ilieva, Baron,
and Healey, 2002). These considerations make comparison of findings between the two studies more difficult, as the methods and population used in each study differ greatly.

**Recommendations**

Based on this study and review of the literature, the following recommendations to increase the grant writing activities within this COE have emerged:

1. Provide a campus-wide system for administering grants (grant writing assistance, budgeting assistance, clerical aid for completing procedural functions, such as obtaining signatures, e.g.);

2. Provide incentives for grant writing (travel funds, flexibility in assignments, recognition for grant procurement, graduate assistants, professional development opportunities);

3. Provide instruction to enhance grant writing skills;

4. Include grant writing as part of the criteria for tenure and promotion;

5. Include grant procurement of various levels as significant scholarly work for promotion for tenured faculty;

6. Create a new formula for teaching, service, and research that allows time for grant writing skill development and grant procurement;

7. Further assess the faculty’s perceptions of the university’s culture regarding the writing and procurement of grants. It is clear from the analysis of the qualitative data that the participants in this study overwhelmingly felt that the university’s culture was not conducive to the grant writing process. Aspects of organizational culture may also be included in future versions of Boyer and Cockriel’s (1998) survey.

**Conclusion**

Boyer and Cockriel’s (1998) survey was used to identify COE faculty perceptions of motivators and barriers to the grant writing process at a Southern university. The following motivators were identified as significant for both tenured and non-tenured faculty: (1) Personnel support such as graduate assistants and clerical help when preparing proposals; (2) Personnel support such as graduate assistants and clerical help when proposals are funded; (3) More flexibility in how time is allocated; (4) Opportunity to probe or research new information; (5) Having travel money available to attend conferences; (6) Assistance in grant proposal preparation; and (7) Building my professional reputation as a capable researcher.

Both tenured and non-tenured faculty found inadequate support available to submit a proposal in a timely manner a significant barrier to grant writing. This finding was both supported and further elucidated through analysis of the textual data derived from the survey’s open-ended response solicitation. Faculty participants in this COE perceived the university’s culture as not conducive to grant writing.
One significant difference emerged between tenured and non-tenured faculty members regarding perceptions of barriers to grant writing: Heavy teaching load. In future studies, it would be helpful to collect additional respondent demographic data to determine the impact of factors such as number of courses taught or other assignments. Further, one common motivator was found between the faculty surveyed in the current research and previous findings (Boyer & Cockriel, 1998) reported in the literature: Building a professional reputation as a capable researcher.

The research reported in this article demonstrated the use of Boyer and Cockriel's (1998) survey of faculty perceptions of motivators and barriers to grant writing to identify areas of both perceived strength and weakness regarding grant writing in one institution's COE. The research also highlighted the potential impact faculty perceptions of institutional culture may have on grant-writing activities. If research institutions wish to increase their faculty's grant writing activities, surveying (or otherwise assessing) faculty perceptions of motivators and barriers to the grant writing process lends invaluable information to guide the first steps in that direction. In the case of the university under study, it is likely that concentrating on the support systems would be one part of a multi-step process to increase the faculty's grant writing efforts. Similarly, according to the respondents in the current research, removing barriers such as the number of required signatures for the grant process may not have adequately addressed the faculty's needs. Therefore, it is necessary to measure faculty perceptions of motivators and barriers before efforts to improve or otherwise increase grant writing activities are undertaken.
References


# Appendix A

## Mean Importance and ANOVA results for Motivators and Barriers for Tenured and Non-Tenured Faculty

<table>
<thead>
<tr>
<th>Motivators</th>
<th>Mean Tenured</th>
<th>Mean Non-Tenured</th>
<th>F(df, df) = F</th>
<th>p</th>
<th>Barriers</th>
<th>Mean Tenured</th>
<th>Mean Non-Tenured</th>
<th>F(df, df) = F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indirect Funds</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Tenured</td>
<td>1.57</td>
<td>1.57</td>
<td>F(1,33)=0.00</td>
<td>1.0</td>
<td>Lack of support** Tenured Non-Tenured</td>
<td>2.15</td>
<td>2.21</td>
<td>F(1,32)=0.03</td>
<td>.86</td>
</tr>
<tr>
<td>Non-Tenured</td>
<td>2.05</td>
<td>2.46</td>
<td>F(1,31)=1.14</td>
<td>.29</td>
<td>Lack of training** Tenured Non-Tenured</td>
<td>1.43</td>
<td>1.57</td>
<td>F(1,33)=0.13</td>
<td>.72</td>
</tr>
<tr>
<td><strong>Support when funded</strong></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Tenured</td>
<td>2.55</td>
<td>2.64</td>
<td>F(1,32)=0.094</td>
<td>.76</td>
<td>Heavy teaching load** Tenured Non-Tenured</td>
<td>2.45</td>
<td>1.69</td>
<td>F(1,31)=5.45</td>
<td>.03*</td>
</tr>
<tr>
<td>Non-Tenured</td>
<td>1.75</td>
<td>2.43</td>
<td>F(1,32)=3.45</td>
<td>.07</td>
<td>Committee assignments Tenured Non-Tenured</td>
<td>2.14</td>
<td>1.46</td>
<td>F(1,32)=3.75</td>
<td>.06</td>
</tr>
<tr>
<td><strong>Tenure &amp; Promotion</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Tenured</td>
<td>0.85</td>
<td>1.21</td>
<td>F(1,32)=1.30</td>
<td>.26</td>
<td>Knowledge Tenured Non-Tenured</td>
<td>1.33</td>
<td>1.79</td>
<td>F(1,33)=1.26</td>
<td>.27</td>
</tr>
<tr>
<td>Non-Tenured</td>
<td>2.20</td>
<td>2.00</td>
<td>F(1,32)=.338</td>
<td>.57</td>
<td>Inconvenience Tenured Non-Tenured</td>
<td>1.90</td>
<td>1.29</td>
<td>F(1,33)=2.61</td>
<td>.12</td>
</tr>
<tr>
<td><strong>New information</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Tenured</td>
<td>2.45</td>
<td>2.85</td>
<td>F(1,31)=2.06</td>
<td>.16</td>
<td>Time consuming Tenured Non-Tenured</td>
<td>1.86</td>
<td>1.50</td>
<td>F(1,33)=.767</td>
<td>.39</td>
</tr>
<tr>
<td>Non-Tenured</td>
<td>2.24</td>
<td>2.29</td>
<td>F(1,33)=.022</td>
<td>.88</td>
<td>Collaboration Tenured Non-Tenured</td>
<td>0.95</td>
<td>1.43</td>
<td>F(1,32)=1.66</td>
<td>.21</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Tenured</td>
<td>1.85</td>
<td>1.93</td>
<td>F(1,32)=.060</td>
<td>.81</td>
<td>Advisement Tenured Non-Tenured</td>
<td>1.05</td>
<td>0.93</td>
<td>F(1,32)=.108</td>
<td>.74</td>
</tr>
<tr>
<td>Non-Tenured</td>
<td>1.53</td>
<td>2.07</td>
<td>F(1,31)=2.35</td>
<td>.14</td>
<td>Expectations Tenured Non-Tenured</td>
<td>1.35</td>
<td>1.43</td>
<td>F(1,32)=.035</td>
<td>.85</td>
</tr>
<tr>
<td><strong>Funder contact</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tenured</td>
<td>2.10</td>
<td>2.14</td>
<td>F(1,33)=.016</td>
<td>.90</td>
<td>Budget Tenured Non-Tenured</td>
<td>1.38</td>
<td>1.15</td>
<td>F(1,31)=.282</td>
<td>.60</td>
</tr>
<tr>
<td>Non-Tenured</td>
<td>1.76</td>
<td>1.14</td>
<td>F(1,33)=2.06</td>
<td>.16</td>
<td>Policy Tenured Non-Tenured</td>
<td>0.80</td>
<td>1.50</td>
<td>F(1,32)=2.65</td>
<td>.11</td>
</tr>
<tr>
<td><strong>Grant preparation</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tenured</td>
<td>1.75</td>
<td>1.54</td>
<td>F(1,31)=.233</td>
<td>.63</td>
<td>Getting funded Tenured Non-Tenured</td>
<td>1.62</td>
<td>1.43</td>
<td>F(1,33)=.237</td>
<td>.63</td>
</tr>
<tr>
<td>Non-Tenured</td>
<td>2.20</td>
<td>2.36</td>
<td>F(1,32)=.229</td>
<td>.64</td>
<td>Reduced signatures Tenured Non-Tenured</td>
<td>1.67</td>
<td>1.07</td>
<td>F(1,33)=1.98</td>
<td>.17</td>
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<tr>
<td><strong>Professional reputation</strong></td>
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<td></td>
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<tr>
<td>Tenured</td>
<td>1.43</td>
<td>1.36</td>
<td>F(1,33)=.039</td>
<td>.85</td>
<td>Internet access Tenured Non-Tenured</td>
<td>0.32</td>
<td>0.43</td>
<td>F(1,31)=.181</td>
<td>.67</td>
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<tr>
<td>Non-Tenured</td>
<td>1.75</td>
<td>1.54</td>
<td>F(1,31)=.233</td>
<td>.63</td>
<td>Getting funded Tenured Non-Tenured</td>
<td>1.62</td>
<td>1.43</td>
<td>F(1,33)=.237</td>
<td>.63</td>
</tr>
<tr>
<td><strong>Recognition</strong></td>
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<td>Reduced signatures Tenured Non-Tenured</td>
<td>1.67</td>
<td>1.07</td>
<td>F(1,33)=1.98</td>
<td>.17</td>
</tr>
</tbody>
</table>

Note: Mean based on perceived importance with (0) = Not important, (1) Marginally Important; (2) Moderately Important; and (3) Very Important. *=sig (p.05)
Training the Research Integrity Officers (RIO): The Federally Funded “RIO Boot Camps” Backward Design to Train for the Future

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Author’s Note
Material in this paper is based on the RIO Boot Camp project funded by the Office of Research Integrity (ORI) through a series of contracts from 2006 to the present. Special thanks to Scientist-Investigators from the Division of Investigative Oversight (DIO). Drs. John Dahlberg, Susan Garfinkel, and John Krueger were the principal DIO architects of the RIO Boot Camps, along with a number of other ORI colleagues, and contributed to this article. Thanks, also, to Janyth Sherman of Michigan State University, who provided technical assistance with the RIO Boot Camps and editing of the paper. Please send all correspondence to the first author.

Abstract
Research institutions receiving U. S. Public Health Service (PHS) funding must assure the Office of Research Integrity (ORI/OPHS/DHHS) that policies and procedures are in place conforming to 42 CFR 93 to investigate allegations of Misconduct in Research, defined as fabrication or falsification of research data, or plagiarism. An institutional official known as the Research Integrity Officer (RIO) generally administers these policies and procedures. The role of the RIO is complex, exacting, and unique. There is no closely analogous position...
in the academy of higher education. Some university attorneys refer to the RIO’s role as “quasi-judicial,” but, in fact, the RIO functions variously as prosecutor, judge, mediator, counselor, teacher, and regulatory manager. Institutions rarely train their RIOs, and no professional society has provided training or support for RIOs. Serious errors by RIOs in handling allegations of research misconduct have landed in the press and in the courts and, in the worst cases, have cost their institutions millions of dollars, public embarrassment, and internal upheaval. The RIO Boot Camp project aims to train RIOs and to professionalize their roles. The RIO Boot Camps were developed in collaboration with the ORI Division of Investigative Oversight (DIO). This paper outlines the unique aspects of the curriculum and the pedagogical techniques used. Results of a survey of RIO Boot Camp participants provide a portrait of the roles and responsibilities of RIOs and the challenges they face. The paper concludes by discussing the planned final products of the RIO Boot Camp initiative and future efforts to support the RIOs.

Keywords: research integrity, training, research integrity officers

Introduction

A Scenario: Dr. Green, of Large University, oversees a number of research regulatory areas as Associate Vice President for Research. These roles include serving as the Research Integrity Officer (RIO). Dr. Green regularly reviews Institutional Review Board (IRB) minutes and on this day notices a report of a death of a research subject in a Phase II clinical trial of a new cancer drug Large University has patented. What elevates Dr. Green’s concern is the statement in the IRB minutes that the consent form in the deceased subject’s research file was not signed. The minutes state that the IRB will investigate the matter further. Vice President Green calls the IRB chair and asks to be kept informed. The next day the IRB chair calls Dr. Green to report that there is also a discrepancy between the information in the deceased patient’s clinical file (age, time since original diagnosis, previous therapy) and the information listed on the research intake form for that patient, signed by one of the research nurses for the drug trial. There are also several instances where records completed by the same nurse for follow-up visits to monitor health after conclusion of therapy do not include the subjects’ initials as required by the protocol.

While fictionalized, this scenario is based on an actual case and is representative of complex problems RIOs have to confront. In this case, urgent review is required under both the regulations protecting human research participants (45 CFR 46) and those covering possible misconduct in research (42 CFR 93). How should the institution organize this review so that handling the case in one venue does not compromise the handling of it in the other? Who does what? In what order?

Because RIOs are often at or near the apogee of the research regulatory structure of their institutions (having titles like that of Dr. Green), it often falls to them to conduct the regulatory triage in cases such as this one. Almost none of them has had any prior training in how to do it.
A Short History of the Position of RIO

Since 1989, every research institution that receives U. S. Public Health Service (PHS) funding has had to assure the Office of Research Integrity (ORI/OPHS/DHHS) that it has policies and procedures conforming to 42 CFR 93 for investigating allegations of Misconduct in Research, defined as fabrication or falsification of research data, or plagiarism (Price, 1994). These policies and procedures are generally administered by an institutional official who has become known as the Research Integrity Officer (RIO).

When the federal misconduct regulations were first promulgated, the position of RIO was not defined—or even mentioned—in either the PHS or the parallel National Science Foundation (NSF) regulations. That has not changed in the intervening 20 years. The RIO remains neither defined nor mentioned in the second generation regulations (42 CFR 93 and 45 CFR 689). Rather, the RIO’s position and role have developed and evolved as a matter of necessity. ORI, concerned about the frequent mishandling of cases at research institutions, wanted a single liaison on whom it could rely. As it had already successfully advocated for the creation of similar positions for intramural research at NIH, ORI wanted RIOs at extramural institutions as well. At the research universities and institutes, misconduct allegations were typically handled at first by the vice president or chancellor for research, or a provost. As it became clear that misconduct cases were often highly complex and time-consuming, the administration of institutional misconduct procedures has become a specialized role assigned to one person, the RIO. Today, the RIO is usually a fairly senior official, typically an assistant or associate vice president or provost.

The RIO’s Role and Responsibility

The role of the RIO is complex, exacting, and unique. There is no closely analogous position in the higher education academy. Some university attorneys refer to the RIO’s role as “quasi-judicial,” but, in fact, the RIO functions variously as prosecutor, judge, mediator, counselor, teacher, and regulatory manager. In the course of handling an allegation of misconduct in research, the RIO may be responsible for completing the following duties, among others: providing notice to respondents and providing all those involved in a case with notice of their rights and obligations under the procedures, conducting or participating in investigative interviews, sequestering data, conducting preliminary forensic analysis of questioned data and documents, selecting and training inquiry and investigative panels, drafting or reviewing inquiry or investigative panel reports, negotiating the regulatory matrix within research institutions, and serving as a liaison to federal oversight agencies. The RIO may also be responsible for triaging and managing particularly complex or difficult cases that involve more than one regulatory area (e.g., research misconduct, research involving human participants, and financial conflict of interest), assuring that the right steps are taken in the right order, protecting whistleblowers from retaliation, or addressing other exigent circumstances that require special handling and immediate notification of ORI or other oversight agencies (see 42 CFR 93.318).
A Critical Problem for RIOs: Impetus for the RIO Boot Camps

RIOs are rarely trained by their institutions. There has typically been only one RIO per institution at any given time. The predecessor RIO has sometimes left the position in the aftermath of a case that has gone awry or as the result of cumulative frustration, so there may be no knowledgeable person at the institution left to train the new RIO. Until now, no professional association or government agency has provided any training. Initial survey data, collected through the RIO Boot Camps, suggest that RIOs stay on the job an average of five years. When the small group of RIOs with 10 or more years of service is factored out, the average is about three years. In either case, it is a short time to gain the experience requisite to learn this complex job, particularly because research misconduct occurs with relatively low frequency and, therefore, many RIOs have handled few cases. Further, and partially because of the way the position developed and evolved, institutional policies and procedures do not always provide the RIOs the authority necessary to fulfill their duties optimally.

Because careers are at stake and many allegations of research misconduct grow out of heated disputes among colleagues, misconduct cases are usually tendentious and often litigious. Serious errors by RIOs in handling such cases can and do end up in the press and in the courts, and in the worst cases lead to millions of dollars in costs, public embarrassment and internal upheaval for their institutions. When RIOs seriously mishandle cases, it can lead to the end of their careers. Mishandled cases also create a problem for ORI as well as for the institutions. ORI must rely on the adequacy of the cases made and findings relayed from the institutions for its oversight work and possible additional findings. The initial work done by the RIOs and their institutions makes it possible for PHS to make findings of research misconduct and to sustain those findings if the respondent appeals under 42 CFR 93.

This, in short, is the impetus for the ORI-sponsored in-service training program for RIOs—the RIO Boot Camp. RIOs are thrown into a critical, high-risk job for which they typically have had no training and for which there is no training model, or body of clearly applicable theory or methods. The first goal of the RIO Boot Camp program, then, is to create well-trained RIOs for research institutions. The second goal is to create, through the RIOs, better institutional policies and procedures for handling allegations, including the building of institutional teams supporting the RIO. Consequently, in 2006, ORI launched the RIO Boot Camp program to train RIOs and to professionalize their roles. Over the course of the seven RIO Boot Camps held to date, a third goal has emerged: providing a web resource to give RIOs centralized access to sample documents, policies and procedures, and technical material targeted to their needs (http://rioresource.org/).

Needs Assessment and Backwards Planning for the RIO Boot Camp

Scientist-Investigators from the Division of Investigative Oversight (DIO) at ORI and the first author (a consultant to ORI who served as a university RIO for 11 years) designed the RIO Boot Camp curriculum. Lack of a pre-existing training model or curriculum for training RIOs, and very little information about who the institutional RIOs were in terms of background and experience, posed a challenging problem. A decision was made to design the RIO Boot Camp curriculum backwards from the outcomes desired — a competent and professionalized corps of RIOs — and to determine what kind of program was needed to get there (Wiggins & McTighe, 2005).
An initial, informal needs assessment (conducted by talking with first generation RIO peers) revealed that almost none of the RIOs had any training for the job. They appeared to have inconsistent legal and logistical support at their institutions (in some cases very little). RIOs were also isolated. Discussion with approximately 30 RIOs at the first boot camps revealed that most had never talked with another RIO, much less seen other RIOs’ work, and so they had no opportunity to learn from their peers’ successes and errors. Nor did they usually seek advice from ORI in the handling of cases, sometimes viewing that office as a potentially hostile oversight agency. In short, many were flying blind into the storm with no navigational aids.

To provide the research community information about who RIOs were, and to arm new RIOs with information about “the RIO experience,” a video was created, entitled, The Role of the RIO (September 2006). Nearly 1,700 copies of the video were distributed to research institutions in the U.S. and abroad. The video features approximately 30 minutes of interviews with, and conversation among, four experienced RIOs, augmented by several hours of indexed additional discussions with these RIOs on various aspects of their responsibilities. The Role of the RIO is posted on ORI’s website (http://ori.dhhs.gov/rio/riovideo/).

**A Survey of RIOs, Legal Counsel and Staff Supporting RIOs**

At the same time, information-gathering continued via surveys of and discussion with a broader group of approximately 60 RIOs at the early Boot Camps, with a wider focus on their length of experience as RIO, their administrative location within their institutional research regulatory structures, and the level of support they enjoyed. Information about their perceived needs was important to developing and promoting the curricular material. More recently, the following, more comprehensive survey was conducted of all those who had attended an RIO Boot Camp.

**Tenured Versus Non-Tenured: Motivators and Barriers**

Responses to research questions (3) Is there a difference in tenured and non-tenured faculty in perceived importance of grant writing motivators? and (4) Is there a difference in tenured and non-tenured faculty in perceived importance of barriers to grant writing? revealed one statistically significant difference (p<.05) between tenured and non-tenured faculty. Tenured COE faculty at the university found heavy teaching load to be a significantly more important barrier than non-tenured faculty. No statistically significant difference was found between tenured and non-tenured faculty in perceived importance of the motivators used in the survey. Appendix A reports the results of the univariate ANOVA for both motivators and barriers to grant writing.

**Methodology**

**Research Instrument**

An online questionnaire was designed to explore the role of the RIO and the roles of legal counsel and staff who support the RIO. The questionnaire consisted of three sections. The first section asked about RIO roles and responsibilities at their institutions.
The second section was concerned with information about the institutions’ procedures, accessibility, and support for the role of the RIO. The final section collected information about difficult aspects of cases, including dealing with vulnerable whistleblowers and retaliation. To enhance face validity, the questionnaire was reviewed by several experienced RIOs and ORI officials, followed by pre-tests administered to participants at RIO Boot Camps. Feedback and comments were then integrated into the final online questionnaire.

**Data Collection and Analysis**

**Profile of the Sample**

The majority of respondents were RIOs (68.3%, \( N=56 \)), followed by RIO Support Staff (17.1%, \( N=14 \)) or Counsel (14.6%, \( N=12 \)). Due to the nature of this paper, discussion of the results of the survey focuses primarily on responses by RIOs. A profile of RIOs who participated in the RIO Boot Camps is provided in Table 1.

The average length of service for RIOs was five years (\( M=5.19, \ SD=3.68 \)); however, eight RIOs reported more than 10 years of service, making the mode of two years of service and the median of three years more representative of the population. Including experience as RIO at other institutions, the average length of overall service was also five years (\( M=5.20, \ SD=4.10 \)), with a minimum of one year and a maximum of 15 years. Again, the mode of two years of service and the median of four years of service is more representative of the population.

The average number of research misconduct cases RIOs have handled or been involved in handling was eight (\( M=8.16, \ SD=10.36 \)), with a minimum of zero and a maximum of 50. The most reported number of research misconduct cases was three and the median was four.

Fewer than half (42%) of RIOs indicated they were a member of the tenured faculty and the majority (83%) did not have a fixed-term appointment. Most (92%) had “at will” administrative appointments.

Most RIOs (90%) did not have an independent budget for their duties, and of those who did, the approximate size of their budget ranged from $10,000 to $100,000 per year, with most noting that budgets were determined as needed. Results also showed that RIOs work with little or no support staff, and in most cases, staff work part-time or on misconduct cases on an as-needed basis, “on loan” from their regular staff positions.
### Table 1. Rank of Importance of Motivators and Barriers for Tenured and Non-Tenured Groups

<table>
<thead>
<tr>
<th>RIO Characteristics (n=56)</th>
<th>Mean (Standard Deviation) or %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years at current institution</td>
<td>5.19 (3.68) years (Range 1-16 years)</td>
</tr>
<tr>
<td>Total Years as RIO including other institutions</td>
<td>5.20 (4.10) (Range 1-15 years)</td>
</tr>
<tr>
<td>Hold a title other than RIO</td>
<td>98</td>
</tr>
<tr>
<td>Participate in Drafting/Revising Policy and Procedures</td>
<td>98</td>
</tr>
<tr>
<td>Average Number of Cases Involved/Handled</td>
<td>8.16 (10.36) cases (Range 0-50 cases)</td>
</tr>
<tr>
<td>Member of tenured faculty</td>
<td>42</td>
</tr>
<tr>
<td>Fixed term appointment</td>
<td>17</td>
</tr>
<tr>
<td>Administrative appointment “at will”</td>
<td>92</td>
</tr>
<tr>
<td>Independent budget for duties</td>
<td>10</td>
</tr>
<tr>
<td>Average number of findings of research misconduct (last 2 years)</td>
<td>1.54 (1.83) findings (Range 0-9 findings)</td>
</tr>
<tr>
<td>Average number of findings of research misconduct involving PHS or NSF funding (last 2 years)</td>
<td>1.13 (1.41)</td>
</tr>
<tr>
<td>Liaise with federal oversight agencies (ORI, NSF-OIG)</td>
<td>94</td>
</tr>
</tbody>
</table>

**RIO Roles and Responsibilities**

Almost all RIOs (98%) indicated they participated in drafting or revising their institution's policies and procedures for handling allegations of research misconduct.

Most RIOs (85%) are the individuals designated to receive allegations of misconduct at their institutions. Ninety-one percent inform key officials about receipt of a new allegation of research misconduct, and are responsible for triaging complex cases to decide who handles which part of the problem and in what order.

Almost all RIOs (91%) sequester data relevant to an allegation and protect potentially vulnerable whistleblowers (85%). Eighty-seven percent of RIOs conduct the assessment or “pre-inquiry;” 67 percent usually interview the complainant, and 56% usually interview the respondent. Key witnesses are sometimes interviewed by slightly over half of RIOs (59%).

In almost three-quarters of cases (73%), RIOs determine whether an inquiry is warranted. An ad hoc Inquiry Panel (74%) conducts the inquiry under the RIO institution’s procedures in 74 percent of cases. Standing Inquiry Panels (17%) and in a few cases the RIO (9%) determine whether an Investigation is warranted. Half of the time, Inquiry Panel and Investigative Committee members are selected by the RIO (52%).

More than three-quarters (79%) of RIOs are responsible for informing the university about the research misconduct policy. In their administrative capacity, RIOs indicated they were responsible for the additional duties, mostly regulatory, shown in Table 2. Instruction and management of the Responsible Conduct of Research (RCR) (70%) and financial conflicts of interest (61%) were the top two areas of additional responsibility.
Table 2. Rank of Importance of Motivators and Barriers for Tenured and Non-Tenured Groups

<table>
<thead>
<tr>
<th>Area of Responsibility (n=56)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction and management – RCR</td>
<td>70</td>
</tr>
<tr>
<td>Financial conflicts of interest</td>
<td>61</td>
</tr>
<tr>
<td>Human subjects</td>
<td>48</td>
</tr>
<tr>
<td>Animal subjects</td>
<td>45</td>
</tr>
<tr>
<td>Recombinant DNA</td>
<td>36</td>
</tr>
<tr>
<td>Grants management</td>
<td>23</td>
</tr>
<tr>
<td>Radiation, chemical, biological hazards</td>
<td>23</td>
</tr>
</tbody>
</table>

Organizing Decisions for the RIO Boot Camps

Based on the information gathered, a peer-to-peer education model was designed to build core skills and knowledge among RIOs. To address the issue of RIO isolation, each RIO Boot Camp was limited to 25 or fewer participants so that the RIOs could get to know each other and to begin to build a professional community. RIOs from a list of the top 100 NIH grant recipient institutions were invited, as approximately 75% of the cases of alleged misconduct reported to ORI come from these institutions (Krueger, 2004). Scientist-Investigators from ORI participated, for the following reasons: to illustrate forensic techniques and best practices useful in misconduct cases; to let RIOs get to know them informally, building relationships they could subsequently call on should they need a consult on how to handle a case; and, more immediately, to give RIOs the chance to consult ORI informally while at the camp. It was emphasized that the DIO Scientist-Investigators were not conducting regulatory oversight, but attending the Boot Camp as colleagues. For that reason, the DIO did not attend some of the introductory sessions, by design, so that participants felt free to discuss candidly their reactions (including frustrations and complaints) with the oversight process and to make suggestions for its improvement. Because of the comparative inexperience of most of the participants, there was less peer-to-peer education in the first several RIO Boot Camps than expected. Nevertheless, participating RIOs, staff, and counsel made excellent suggestions about refining the initial curriculum. These suggestions were adopted.

Designing the Curriculum

Data gathered by the beginning of 2006 suggested that most of the RIOs attending the Boot Camps would be comparatively new to their jobs and have little relevant training or experience. Because most RIOs have much to learn about how and why misconduct in research occurs (a problem common to everyone concerned about misconduct in research) a basic approach was adopted: start at the beginning with a list of things an RIO would need to do to prepare to do this job. These things include reviewing institutional and federal misconduct policies and procedures, organizing the RIO office, establishing critical relationships within the institution and with the federal oversight agencies, and building the RIO team. The team is essential. Without it, a difficult job can be nearly impossible. The team the RIO can assemble depends both on budget for direct hires and diplomacy to tap colleagues from across the institution that the RIO can rely on for timely assistance. The RIO needs personal staff gifted in handling people and, ideally, staff with some training in forensics. Legal counsel, academic subject matters experts, IT experts, and a representative...
of institutional police or security are also key team members. The request by many RCOs invited to the first Boot Camps to include their institutional counsel and support staff confirmed the importance of these individuals as team members; the Boot Camp design was expanded to include them.

The next step was to teach the critical tasks that an RIO must accomplish in handling cases and the critical skills that RIOs need to perform those tasks. Tasks and skills were presented in the order an RIO would need them, from the initial receipt of an allegation until the final resolution of a case. Because there are no defined theories or methods for training RIOs, established concepts and techniques from other types of professional training (e.g., criminal justice, medicine, aviation) were used wherever possible. A hybrid, eclectic version of the backward design model, fictionalized versions of actual cases, and anecdotes from cases were used, wherever possible, to illustrate problems an RIO confronts or critical decisions that must be made. Case-based education (i.e., story-telling) is a time-honored technique in professional education in part because, like good novels, it presents reality on a number of levels, developing emotional and intuitional as well as rational intelligence for handling highly complex issues. At its best, use of instructional cases can also provide the look and feel of the actual experience of handling a case. This is particularly important in areas where academic theory and methods are undeveloped or in dispute.

Receiving Allegations and Handling the “Front End” of Cases

The most critical part of an RIO’s job is handling an allegation properly at the beginning. During the initial assessment of an allegation the RIO typically functions alone, with support, perhaps, by staff and counsel, but without the expert peer review committees that come into play later if an allegation warrants further review. Establishing the structure of a case properly is a complex task requiring the RIO to make several important decisions, and perhaps take action, in a context of uncertain information. If the RIO handles a case well at the beginning, it is likely to go smoothly. Conversely, if an RIO mishandles a case at the beginning, it may be irretrievably compromised. The institution may never be able to determine whether or not misconduct occurred. The institution may be liable for compliance actions by oversight agencies, and litigation initiated by respondents or disappointed complainants (whistleblowers) is a more probable outcome.

The problem in training RIOs to handle a case properly from the beginning is that allegations of misconduct may be presented in many ways: in person, by phone or e-mail, anonymously, and indirectly (e.g., by rumor). It is often difficult to distinguish allegations of misconduct that require the RIO’s review under institutional policy from other problems or disputes that do not warrant review. Determining whether an allegation requires further review under the institution’s procedures is called the Assessment, and constitutes the first of three stages (with the Inquiry and Investigation) that could lead to a finding of misconduct in research. The criteria for moving forward from Assessment to Inquiry are that an allegation is not trivial, and, specifically: a) the alleged conduct meets the regulatory definition of misconduct: fabrication, falsification or plagiarism; and b) the allegation(s) is sufficiently credible and specific so that potential evidence of research misconduct may be identified. Allegations that do not warrant further review under the misconduct procedures must likewise be handled with care, because some may require urgent referral to protect persons, research subjects, public safety, research data, funds, and equipment. In addition to any number of decisions the RIO may need to make about the applicability of institutional policies and local, state, and federal law, she or he has to determine whether:
There are any exigent circumstances listed in the PHS regulation at 42 CFR 93.318 (e.g., risk to public health and safety) or in other applicable regulations that require immediate notification of ORI or other oversight agencies.

The research data in question are at risk and need to be protected immediately.

Anyone related to the allegation is at possible risk of retaliation and needs to be protected.

There are other federal research regulations (e.g., those protecting research subjects) that apply and require immediate notice to and collaboration with the institutional officials overseeing those regulations.

Consequently, the RIO Boot Camps was designed to focus intensively on the initiation of cases. Fictionalized versions of actual cases (like that involving Dr. Green at the beginning of this article) were prepared to see whether RIOs believed each scenario contained an allegation of misconduct that required institutional review, and what their decisions were with respect to the four questions above. Anecdotes about other cases, both from presenters and from Boot Camp participants, were also included, particularly about cases where things went wrong.

From other professions that confront complex, uncertain situations (e.g., aviation and emergency medicine) an emphasis was placed on disciplined, routinized behaviors (i.e., standard operating procedures [SOPs]), to be used when confronting critical tasks to assure that the necessary decisions are made and appropriate actions taken. An example would be initiating takeoff without lowering the flaps, which has had catastrophic consequences in aviation, and metaphorically speaking, can also be a fatal error for RIOs handling cases. The list of SOPs taken from the RIO Boot Camp Syllabus provided to RIOs is shown in Table 3.

Table 3. Rank of Importance of Motivators and Barriers for Tenured and Non-Tenured Groups

<table>
<thead>
<tr>
<th>SOPs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. New Allegation Intake Form</td>
</tr>
<tr>
<td>B. Exigent Circumstances</td>
</tr>
<tr>
<td>C. Triage Precedence and Procedures</td>
</tr>
<tr>
<td>D. Retaliation</td>
</tr>
<tr>
<td>E. Good and Bad Faith</td>
</tr>
<tr>
<td>F. Sequestration</td>
</tr>
<tr>
<td>G. Corrections and Retractions</td>
</tr>
<tr>
<td>H. Monitoring Administrative Actions</td>
</tr>
<tr>
<td>I. Retractions</td>
</tr>
</tbody>
</table>

The part of the curriculum to prepare RIOs to do the job and then to handle properly the front end of cases evolved to look like this:
RIO Boot Camp Syllabus
(Excerpts from Initial Handling of Allegations)

Receiving an Allegation
What does an Allegation look like?
 Does it have to be in writing?
How does the allegation reach the RIO? Is it easy or hard for complainants to find the RIO?
How do you know if you have a credible allegation of research misconduct (exercise: evaluating sample allegations)
Documenting the processing of an allegation: best practices/activity logs/file keeping/notice of the allegation on need-to-know-basis
Communicating with other institutional officials about an allegation
Allegation Intake Form - SOP

Stabilizing the Case
Immediate review of possible exigencies
Exigent Circumstances - SOP
Triage, if necessary, to other regulatory committees/officials
Triage - SOP
Internal Notices
External contacts - e.g., with editors - at what stage?
Preventing/Handing Retaliation - SOP

Engaged Learning from Exemplars
Following the development of a typical case, the next sections of the curriculum include recruiting and training Inquiry and Investigative Committees. These committees are the expert peer review panels central to the second (Inquiry) and third (Investigation) stages of review of an allegation. While the first section of the curriculum is substantially knowledge-based (although it also teaches and tests skills such as the ability to conduct an Assessment), this second section, Assisting Panels, involves teaching and practicing critical, complex skills such as interviewing complainants as part of the Assessment, and interviewing respondents, potentially as part of providing notice and sequestering data. Teaching someone to teach others is an excellent pedagogical technique for learning to do the job independently.

The first section begins with the critical intake interview, where a complainant approaches an RIO in person to make an allegation of misconduct. As noted earlier, this is only one way in which allegations may come to RIOs, but it is a common way, and one that allows the RIO both to properly establish the structure of a potential case and to stabilize the situation to protect persons and evidence. The least experienced of the participating RIOs had never received an allegation of research misconduct. Many had relatively little practice in receiving an allegation, and fewer still had codified best practices for receiving one.
The New Allegation Intake SOP emphasizes disciplined, routinized behavior to handle uncertain and potentially volatile situations. Because there is only one “first interview” with a complainant, there may never be another opportunity to interact, as the complainant may subsequently decide not to cooperate. This may occur if the complainant opts to engage legal counsel, retract the claim or not be available for further discussion. It is therefore important to get it right the first time. Portions of the New Allegation SOP are provided in Table 4.

Table 4. RIO Boot Camp Standard Operating Procedures for Receiving an Allegation from a Complainant

<table>
<thead>
<tr>
<th>SOP: Allegation Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the Allegation? (provide as much detail as possible at this stage, e.g.</td>
</tr>
<tr>
<td>fabrication, falsification or plagiarism of)</td>
</tr>
<tr>
<td>2. Who is the Respondent? (name, title, location)</td>
</tr>
<tr>
<td>3. Does the Respondent have collaborators in this research? If so, who are they?</td>
</tr>
<tr>
<td>List:</td>
</tr>
<tr>
<td>4. What evidence does the Complainant have/know about to support the allegation?</td>
</tr>
<tr>
<td>List:</td>
</tr>
<tr>
<td>5. Are there any collaborators at other institutions? If so, list each collaborator</td>
</tr>
<tr>
<td>with his/her institution.</td>
</tr>
<tr>
<td>6. When and where did the alleged misconduct occur?</td>
</tr>
<tr>
<td>7. Is the alleged misconduct still going on? (See Exigencies SOP)</td>
</tr>
<tr>
<td>8. What is the nature of the research in which the misconduct allegedly occurred?</td>
</tr>
<tr>
<td>(See Exigencies SOP and Triage SOP)</td>
</tr>
<tr>
<td>9. Does the research involve human or animal subjects?</td>
</tr>
<tr>
<td>10. Does the research involve hazardous materials or biologics? Select agents?</td>
</tr>
<tr>
<td>11. Is the research extramurally funded? If so, by whom? Identify grant #s when</td>
</tr>
<tr>
<td>possible.</td>
</tr>
<tr>
<td>12. What evidence does the Complainant have/know about to support the allegation?</td>
</tr>
<tr>
<td>Where is that evidence currently? List:</td>
</tr>
<tr>
<td>13. Explain the procedures briefly, especially what will happen next (the assessment</td>
</tr>
<tr>
<td>stage), when the Complainant will be notified of what has happened, and a</td>
</tr>
<tr>
<td>Complainant’s limited role in the procedures.</td>
</tr>
<tr>
<td>14. Explain a Complainant’s (witnesses’) protections from retaliation under the</td>
</tr>
<tr>
<td>procedures along with the obligation for all witnesses to act in good faith.</td>
</tr>
<tr>
<td>15. Invite any questions the Complainant may have.</td>
</tr>
<tr>
<td>16. Provide RIO’s contact information and invite Complainant to contact RIO with</td>
</tr>
<tr>
<td>any subsequent information, questions, or concerns.</td>
</tr>
</tbody>
</table>

As important as a comprehensive list of questions that need to be asked and information that needs to be obtained is, such a list does not provide RIOs with any instruction in how to engage the complainant to elicit as much information as possible and ensure future cooperation. Nor does the list provide guidance on how to assess a complainant’s credibility, whether the complainant is vulnerable to retaliation or needs supportive psychological intervention to deal with stress. Techniques and literature from investigative interviewing can augment that training, but even these do not provide RIOs a direct sense of the actual experience of engaging a complainant for the first time.

RIO Smith’s Interview of Complainant Heesun Chung

A 30-minute video was created to help address the issue of actual experience. The video featured “RIO Smith” interviewing a potentially vulnerable complainant, graduate student Heesun Chung. The video was a joint effort of the first author, experienced RIOs, and ORI staff.
Rather than professional actors, academics familiar with institutional policies and procedures for reviewing allegations of research misconduct were featured in the video. The amateurs were more likely to be recognized by RIO Boot Camp participants and future audiences as authentic academics behaving as they would in real situations. This choice was both cost effective and accurate in conveying the misconduct allegations.

The video was used to initiate an exercise in which Boot Camp participants were asked to interview colleagues who played Heesun Chung. These participants were briefed about Ms. Chung’s background, her research, and the nature of her allegation. The interviewers are video-taped and receive a copy of the video to take home with them to review. This training video is important since, with very rare exceptions, RIOs have never seen another RIO work or had the chance to view themselves in their role as RIO. The Boot Camp participants also watched “RIO Smith” interviewing “Heesun Chung” and compared this to their own performances.

The Vogel Case

Developing the complainant interview video and piloting it, along with the associated training interviewing sessions at the initial RIO Boot Camp, led to a decision to further develop this same fictional case, which became “The Vogel Case” to show RIO Boot Camp participants the look and feel of subsequent stages of institutional review of an allegation. A number of the RIOs, their legal counsel and staff, had had little experience administering these subsequent stages of their institution’s procedures. None had experienced the opportunity of watching other RIOs administer these procedures or to discuss best practices. To date, The Vogel Case videos include: 1) RIO Smith’s intake interview with Heesun Chung; 2) a video on RIO Smith’s carefully planned initial interview with the Respondent, Prof. Richard Vogel, in his lab, initial interviews with other lab members who might be witnesses or even respondents, and the sequestration of the data related to the allegation; 3) the briefing of the Inquiry Panel; 4) the Inquiry Panel’s planning for the interview with a key witness and potential respondent, post-doctoral student Raju Shrestha; and 5) the Inquiry Panel’s interview with Dr. Shrestha. There are three more video chapters of The Vogel Case in the planning stages, all having to do with the Investigation and final resolution of the case.

Development of The Vogel Case provided a number of additional pedagogical benefits, which were not foreseen at the beginning of the project. First, it allowed for the development, in the context of this specific case, of all the standard documents, letters, and forms that RIOs have to draft, participate in drafting, or review in the course of institutional review of an allegation of misconduct in research. These documents include the Assessment Report (prepared by the RIO), the Inquiry Report (prepared by the Inquiry Panel, but often drafted and always reviewed by the RIO), the Investigation Report (prepared by the Investigation Committee, but often drafted and always reviewed by the RIO), written notice to the Respondent of the allegation, itemized receipts for evidence sequestered and explanation of the sequestration process, briefing agendas for initial meetings of Inquiry Panels and Investigative committees, and other documents and forms. Preparing these documents for The Vogel Case brings to life questions of how to present, in official reports, the issues participants have discussed and are engaged in throughout the three-day RIO Boot Camp. In each instance, these documents represent an effort to establish best practices for
documents and forms. This has proved more effective than using template documents and discussing the contents in the abstract.

Second, because these model documents were completed for a case under discussion, participants could be asked to prepare their own reports (e.g., the critical RIO Assessment Report), and compare these to the “best practices” documents. The Assessment Report was a particular focus, because the RIO’s proper framing of the allegation for further review, if warranted, by the peer review panels is critical to a successfully handled case. The correct framing of an allegation is not a trivial task; it is the basis of what will be reviewed in a subsequent inquiry or investigation phase. Using The Vogel Case, RIOs are shown how to identify the specific falsification, fabrication, or plagiarism being alleged, and to amend the allegations as new information is received, just as in a real case.

Third, the documents permitted the instructors to work backwards from the content of the Inquiry Report (which must satisfy the requirements of the PHS regulation) to the planning of the Inquiry. This likewise proved a more productive exercise in the context of The Vogel Case than it would have as an abstract discussion. On several occasions, participants included in their exercises methods of handling issues in ways superior to their instructors, thus advancing by peer-to-peer education the communal effort to refine best practices.

Fourth, the development of The Vogel Case allowed the Scientist-Investigators of DIO, the first author, and other consulting RIOs to combine their experience in handling allegations of misconduct in research, to design a case that includes: the kind of complex allegations and uncertainties that RIOs are likely to encounter; a large cast of investigators, research staff, and colleagues (on and off campus) involved in the case; and individuals with varying degrees of responsibility for or complicity in the misconduct. RIOs, counsel, and staff must stabilize the case to protect evidence, research subjects (whether animal or human), and possible vulnerable witnesses. They must also develop, in concert with the expert panels, strategies to establish the facts relevant to the allegation and to interpret those facts.

Finally, Boot Camp participants were able to develop and discuss the unfortunate instance of a junior co-investigator who is coerced by the respondent into complicity in misconduct. This is an especially troubling problem that RIOs, their counsel, and their institutions sometimes confront: what level of responsibility does one assign to and what level of sanctions, if any, should be imposed on vulnerable, junior investigators who are coerced into complicity in misconduct? The Boot Camp faculty spent many hours over a two-year period around the ORI conference table designing and refining The Vogel Case. As the case proceeded through various stages of development at the RIO Boot Camps, participants were engaged in discussions about how to develop it further, thus providing another mutual learning experience between participants and presenters.

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Forensics

Computing has revolutionized the conduct of science, most dramatically in the digital acquisition of data, its reduction and placement into a presentation, its submission for publication, and its subsequent distribution over the Internet. The time between observation and reporting can be a matter of hours, through a path totally unencumbered from past opportunities for detailed inspection by colleagues. Nowhere has this had more impact than in the manipulation of images and numerical data. Photo-editing software developed in recent years allows researchers to manipulate scientific images for inclusion in journal manuscripts and grant proposals. Spreadsheet technology allows researchers to record, analyze, and present numerical data with similar facility. While these software packages are generally a great boon to researchers, they also enable a range of ethical lapses from enhancing images to outright falsification (Rossner & Yamada, 2004). Simultaneously, software companies and DIO Scientist-Investigators have developed a range of tools and techniques (armamentarium) to detect the questionable manipulation of images and data. Similarly, the community now has access to better images via the Internet, thus increasing the likelihood for detection and for potential challenges to RIOs.

DIO personnel made presentations at the early RIO Boot Camps on tools and techniques for detecting questionable manipulations of images and digital data. As the RIO Boot Camp project continued to develop, this part of the curriculum was expanded and refined in two ways. First, “questioned data” from The Vogel Case were developed and shared with workshop participants through simple analytical techniques to demonstrate that the images had been manipulated. Second, the DIO team has been developing a set of forensic tutorials for use by RIOs. The goal is not to turn RIOs into forensic specialists, as most do not have the disciplinary background, and the detailed forensic analysis in cases is appropriately left to the expert Inquiry and Investigation Committees. However, it is
important for RIOs to achieve basic literacy in these tools and the techniques to make panels aware of them as needed, to be able to use them to assess questioned images and digital data during assessments, and to encourage their application by the expert faculty on the panels. In addition to these forensic tools DIO is also reviewing and demonstrating on-line plagiarism detection software (e.g., eTBLAST and Déjà Vu) (Mounir & Garner, 2008).

**Finishing Up**

The last portion of the RIO Boot Camp is devoted to special issues critical to the handling of cases and to review and discussion of steps that must be taken to conclude a case properly. Attorneys (including an HHS counsel) discuss with both RIOs and institutional counsel issues such as legally sufficient reports to ORI, standards of proof, legal challenges from respondents during institutional procedures, retaliatory and obstructionist tactics by respondents, and settling cases with legally sufficient admissions of misconduct by respondents. As the survey data of RIO Boot Camp participants show, many RIOs and institutional counsel have had to deal with difficult respondents. Consequently, these discussions are popular with participants. In addition, the RIO Boot Camps provide the opportunity for institutional counsel and HHS counsel to meet and talk informally, paving the way for consultation during difficult cases.

Reaching closure in research misconduct cases can be complicated. Most institutions have internal appeals processes for both the finding of misconduct and for any sanctions that may be imposed on respondents found responsible for misconduct. To remain in compliance with the PHS regulation, it is critical for institutions to have substantive appeals handled by panels with the requisite scientific expertise. Many institutions have had, and continue to have, difficulty in this regard. RIO Boot Camp participants focus, at the end of the workshop, on the final stages of a case: the sequencing of internal and external appeals; notice to ORI (in cases with PHS funding) and to other sponsors; determination of sanctions for guilty respondents; handling legal actions by respondents during the final stages of cases; and working with ORI as it considers additional findings in cases where the institution has found misconduct.

Both RIO Boot Camp participants and others recommend institutional post-mortems at the end of difficult cases so that the research community can learn from the case and, hopefully, improve the integrity of the research environment. Finally, participants rate their own institutions in terms of quality of their procedures, the integrity of the institutional research environment (including their RCR program), and support for the RIO.

**The RIO in the Context of Institutional Compliance Programs**

The RIO Boot Camps fill a pressing need for training a unique and critically important official in research institutions’ compliance programs. While there are a number of other critically important research regulatory positions in universities, research hospitals and institutes (e.g., IRB chair, IACUC chair, Conflict of Interest Officer, Radiation Safety Officer), there are none that are closely analogous to the RIO, and such training programs as exist in these other areas are not pertinent to the role of the RIO. Usually working with peer review panels, these other regulatory officials oversee evaluation and approval of research that meets appropriate ethical and safety standards. Their work approximates the RIO’s role.
only when they are investigating potentially serious and deliberate non-compliance with the regulations they oversee. There are no known training programs or materials to investigate serious non-compliance in these areas. On the other hand, RIOs need to be familiar with these other regulatory areas because, more and more frequently, allegations of misconduct in research present issues that must be dealt with in multiple regulatory areas. This is one of the reasons that the cases presented for discussion and analysis at the RIO Boot Camps are complex. Interestingly, the survey results show that most of the RIOs have some responsibility for other regulatory areas (previously shown in Table 2).

It would also be helpful for training programs for chairs and committee members in other regulatory areas to include information on the requirements of the research misconduct regulations, so that these individuals know when they should communicate with the RIO. As noted earlier, RIOs are typically senior administrative officials with titles such as Associate Vice President (or Chancellor) for Research or Associate Provost. They are probably the best-situated people to oversee the triage of complex cases involving multiple research regulations. This happens best in integrated compliance programs.

**Conclusion**

Although curricular materials continue to be improved, the current RIO Boot Camp is now fully developed. There is more material than can be covered in the three-day camp. Among the important topics that remain to be covered is a detailed analysis of why misconduct cases at research institutions sometimes go badly awry, how to prevent that, and what RIOs can do to recover when cases begin to spin out of control.

Among the reasons misconduct cases may be mishandled is the fact that alleged misconduct may be unreported and undiscovered. For example, 4 of 56 (8%) of participants in our survey said they knew of allegations of misconduct at their institution that had not been reported. Further, 7 of 56 (14%) reported that they knew of instances where individuals had been discouraged from filing an allegation. This can be the result of poor institutional policies and procedures or an “institutional culture of non-compliance,” as a colleague once described his institution’s attitude to the regulation. The problem may also be traced to the RIO. There are predictable problems, critical times, and critical decisions that RIOs face in the course of a case, especially a difficult case. If the right decisions are not made, or not made in a timely fashion, the case can be badly jeopardized. These difficult cases are more common than one might think. Characteristics of difficult cases are provided in Table 5. While only two RIOs (4%) reported the catastrophic instance of a misconduct case that cost their institution more than $1 million to resolve, most RIOs reported handling very difficult cases.

**Table 5. RIO Boot Camp Standard Operating Procedures for Receiving an Allegation from a Complainant**

<table>
<thead>
<tr>
<th>Area of Difficulty</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple allegations and counter-allegations</td>
<td>61</td>
</tr>
<tr>
<td>Internal grievances</td>
<td>52</td>
</tr>
<tr>
<td>Extensive obstructive or delaying tactics by respondents</td>
<td>45</td>
</tr>
<tr>
<td>Lawsuits</td>
<td>36</td>
</tr>
<tr>
<td>Allegations/charges against the RIO</td>
<td>20</td>
</tr>
</tbody>
</table>
To address these issues and others, an Advanced Topics RIO Boot Camp is planned that will feature “post-mortem” analyses of actual closed cases in ORI’s files that presented unusual challenges for RIOs and their institutions. Current and former RIOs who handled particularly difficult cases will be invited to discuss those cases, and what they learned from the experience that might change practice. Protocols and best practices for RIOs to handle these critical moments and decisions will be developed. The Boot Camp will also include advanced, hands-on workshops on forensics and the final episodes of The Vogel Case.

Plans are underway to maintain the RIO Boot Camp curricular materials and other resources in a password-protected online manual for RIOs within two years. A professional association might also assist RIOs in sustaining their community and providing training of new members.

References


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Started multi-adder test.

Start relay #701 (soot) in relay.

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closed down.
Book Review:
Grace Hopper and the Invention of the Information Age
Kurt W. Beyer

Darby Chandler BA (MEd candidate)
Executive Director, Palliative Care Program
St. Joseph’s General Hospital
Elliot Lake, Ontario
Email: palliative@sjgh.ca

Kurt Beyer demands our attention when he writes that Grace Hopper “is unquestionably the most numerically popular computer pioneer on the web” (p.1). Known as “Amazing Grace,” or the “Grandmother of Cobol,” her life is chronicled in Grace Hopper and the Invention of the Information Age.

A woman of relative privilege, Hopper grew up in a prosperous northeastern household with accomplished parents who highly valued education. This affluence and parental expectation provided Hopper with the support she needed to become the first woman ever awarded a doctorate in mathematics from Yale University. This achievement was instrumental in her landing an academic position at Vassar, but her life changed dramatically the day Pearl Harbor was bombed and she enrolled in the US Navy. Hopper graduated as a midshipman in 1944, assuming a new a position that would take her into the hidden world of computing and introduce her to the Automatic Sequence Controlled Calculator, or the Mark I. The Mark I was “8 feet high, 3 feet wide, 51 feet long, weighed 9,455 pounds and had 530 miles of wiring” (p. 37).

Not long after this introduction to Mark I, Hopper was moved with her machine to Harvard, where this coupling would signal the beginning of the computer age. This unique combination of brilliant mathematician and machine would create a revolution in the way we problem solve, communicate with others, and conduct business.

During wartime, Hopper was akin to Rosie the Riveter; a woman working in a man’s world showcasing her manual dexterity, intellect, and leadership abilities. Perseverant, obstinate, intelligent, and hard working, she was part of a growing number of females engaged in the industrial work force, but she did not labor in a factory. Instead, she assumed a position in a new discipline that was being defined and developed during and after the war. Her affluence, high level of education, and mathematical abilities were in demand and provided her the tools she needed to enter the “elite male fraternity” (p. 5) of computer programmers.
Hopper is best known for the development of “a portable, common business language” that used basic English to communicate with machines. This program, known as the COmmon Business-Oriented Language, or COBOL, propelled computer programming into “the economic, political and social fabric of society” (p. 318). Hopper’s COBOL, and the innovations that emerged as a result of its creation, enticed Beyer to research her life. His experience as both a naval officer and academic also influenced his decision to discover more about Hopper and the other pioneering men and women who launched the information age.

Divided into 12 chapters, Beyer’s book begins with a review of Hopper’s life, her accomplishments, and her “place in relation to the greater currents of social history” (p. 21). The first chapter ends with Beyer’s note that:

… The career of this influential college professor turned naval officer

turned inventor turned business executive serves as the ideal conduit for

exploring the rise of the computer industry and the invention of computer

programming in what we refer to today as the information age. (p. 22)

The second chapter outlines Hopper’s decision to leave a career in academia at Vassar to join the Navy, where she graduated from Midshipmen’s School in the summer of 1944. At that time, she was assigned to work with an Automatic Sequence Controlled Calculator, Mark I. The machine and the individuals charged with its development and use would initially assist the war effort, but the longer-lasting impact of this engineered hardware and the manual programming needed to run it would metamorphose into the computers we use today.

In Chapter 3, Beyer describes the origins of computer programming and the term “bug,” now immortalized in the ever-growing computer lexicon. This term was first coined by Hopper in her journal when she described the havoc caused by a moth that had infiltrated the Mark II.

Beyer moves from bugs to the trials and tribulations associated with working collaboratively with the overachieving, overworked mathematicians in the Harvard computation laboratory. He describes what it was like to work during wartime within a minute, emergent, and isolated computer community, but one that Harvard decision makers knew would flourish.

Harvard’s administrators knew the university’s association with Hopper and her Navy colleagues would enhance its profile in the sciences; a new building was erected on campus, and the Department of Engineering Sciences and Applied Physics was formed in 1946 to support this new field. In addition, the university sponsored a symposium on large-scale digital calculating machinery, resulting in “the creation of a forum for dispersed people to come together and exchange ideas concerning new technology” (p. 155). This symposium would signal the beginning of collaboration among computer programmers all over the world.
Beyer describes Hopper as a visionary as he chronicles the growth of the computer age, recounting her successes, challenges, and failings as she strives to make it in a man’s world. He notes that Hopper highly valued and practiced collaborative and democratic work environments in a country where rugged individualism reigned supreme. These beliefs, her relentless work ethic and drive, combined with her foray into a male-dominated field, took its toll. Hopper was a smoker, an alcoholic, a divorcee, and a troubled individual who twice attempted suicide. She abandoned a comfortable professorship at Vassar to join the Navy and align herself with the “embryonic computer industry” (p. 175). Such career and personal life decisions were unorthodox for a woman in the 1940s.

In Chapter 8, entitled *Education of a Computer*, Beyer highlights the “underlying milieu in which the inventor works” (p. 214) in order for the reader to understand how and why this technology came into being. He chronicles the growth of IBM and Remington Rand, two companies that rose to prominence as the industry grew. He further discusses this rivalry and describes how IBM managed to dominate the market share in this burgeoning business.

Chapter 10 describes the growing discussion that computers might someday become available to lay people. FORTRAN, developed from 1956-1957, promised that it could solve more than half of all mathematical problems. Its accompanying manuals and coding procedures, largely developed by Hopper, were freely distributed to potential users and other developers who shared her interest in creating computers that were accessible to the general public.

In Chapter 11, Beyer outlines how Hopper “personified the growing bond between industry and the military during the Cold War era,” (p. 278) as well as the importance of collaboration among actual and potential users, programmers, government, academia, and private business. Beyer explains how, by the 1970s, COBOL had become the most used computer language in the world.

Beyer concludes with a chapter describing how Hopper influenced the Information age. He places her career “in the context of the history of programming,” (p. 313) specifically as it relates to how she encouraged collaboration and democracy in a field that did not always respect either approach. It is Hopper’s belief in collaborative knowledge development that Beyer finds particularly endearing, and which is of importance to research administrators, who are involved in complex systems where rules governing intellectual property, patents, and copyright can sometimes overshadow how important it is to share in the development and dissemination of new discoveries.

Beyer cites Hopper’s multi-disciplinary and collaborative approach to knowledge development as her greatest forte. He relates the story of her auditing courses in biology, zoology, and an array of other disciplines while teaching at Vassar so that she could incorporate these disciplines into her classroom, thereby bringing mathematics to life for her students. In spite of the concerns expressed by a number of her academic colleagues that she was not teaching her area of specialization, her courses became extremely popular with students. Also evident during this period was her ability to forge unlikely alliances with people in power who could support her endeavors.
Beyer contends that Hopper’s ability to work organizationally in what he terms *distributed invention or the democratization of innovation*, melded the strengths and expertise of a multitude of inventors. In addition to Hopper’s democratic management style, he credits the Navy’s egalitarian hiring practices, based on achievement and solidarity of purpose, for initial advancements in early computer technology. It was an environment of creative problem solving focused solely on saving the lives of men and women in the war effort.

Beyer’s book is less a discussion of Hopper than of her place in the development of the computer world. He offers only a superficial look at the price she paid for her intelligence, work ethic, education, tenacity, and her distributed invention approach to research and development. In doing so, Beyer misses an opportunity to look inside the world of this remarkable human being and glosses over Hopper’s struggles with divorce, drinking, smoking, and suicide attempts.

The author is obviously enamoured with the technicalities of the computer, its growth and development over the years, and this viewpoint overshadows his consideration of the human behind it all. He briefly discusses Hopper’s sacrifices and acknowledges that “pioneers such as Hopper deal with a variety of social and psychological pressures associated with the very act of exploring uncharted intellectual waters” (p. 5). It is a story not so much of a woman, but of the growth of a multi-billion dollar industry initially managed by a woman who had a vision that was focused not on money, but on eliciting and incorporating input from her peers, youth, and colleagues to create a tool that could make a positive contribution to society.

It is her vision that is perhaps the reason behind Beyer’s obvious admiration for Hopper, and ultimately the strength of this book. He talks about her readiness to accept the input of others, her lack of guile or ego, and her desire to mentor young, inexperienced programmers. She wanted developing professionals to understand what it meant to fail and how adversity in failure could bring tremendous rewards.

Hopper’s mentoring, democratic research development and servant-leader style of leadership are attributes that research administrators can also develop and share as they encourage faculty members to create tools, techniques, art, music, and other products or ideas that make the world a better place. Like Hopper, research administrators should encourage researchers to share their findings and processes and not to confine the knowledge they develop to a particular institution, group of specialized experts, or company.

By combining knowledge and wisdom, Grace Hopper serves as an example to those involved in research, leadership, collaboration, and the dissemination of new knowledge. Research administrators support individuals who, like Hopper, hone their crafts for the betterment of society, so it is incumbent upon those in this field, to work together, share gifts, and follow the lead of trailblazers like Grace Hopper.
VOICE OF EXPERIENCE
Voice of Experience

Women as Senior Research Administration Managers

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A Roundtable Discussion with:

Lynne Chronister, MPA
Assistant Vice Provost for Research, University of Washington

Marcia Landen, MS
Director, Grant Services
Office of Research Administration, Indiana University

Cindy Kiel, JD, CRA
Office of Sponsored Research Services
Washington University in St. Louis

Kate McCormick, BA
Assistant Director of Finance and Administration
Harvard Medical School Pathology Department

Pam Miller, PhD
Director, Sponsored Projects
University of California at Berkeley

Amy Sikalis, MPA
Director, Office of Research
Intermountain Healthcare

Angela Spaulding, EdD
Dean and Professor, Chief Research Officer
West Texas A&M University

Voice of Experience advances the tradition and service of the Journal of Research Administration by fostering consideration of and reflection upon contemporary issues and concerns in research administration. VOE is a celebrated feature column in each edition of the Journal. In this issue a roundtable discussion addresses a continuing issue affecting research administration and management—the developing role of women as senior managers in research and research administration. This roundtable will consider the paths that must be taken and the choices made for women to achieve success for as senior research managers.
Introduction

In a recent research report, Carter and Silva (2010a) write:

When women get the right education, the right training, the right work experience, and the right aspirations—to succeed at the highest levels of business—then we’ll see parity.

So goes the refrain justifying why more women aren’t well-represented at the helm of global companies, in boardrooms, and in C-suites.

The premise of the promise is that the pipeline for women into senior leadership is robust. After all, over the past 15 years, women have been graduating with advanced professional degrees in record numbers often equal to or even surpassing the rates for men, swelling women’s representation in managerial ranks. Concurrently, companies implemented diversity and inclusion programs to eliminate structural biases and foster women’s full participation in leadership.

However, the authors continue:

Given these accomplishments, who would question whether the pipeline for women to senior leadership is lacking? While women represent just 3 percent of Fortune 500 CEOs, 15 percent of board directors at those companies, and less than 14 percent of corporate executives at top publicly-traded companies around the world, overall they represent 40 percent of global workforces, with growth in some parts of the world projected to reach double digits. Surely, with this vigorous pipeline and the competitive focus on talent, women are poised to make rapid gains to the top.

If only that were true.

The Society of Research Administrators has enjoyed a long history of leadership by talented women who have achieved success in their own organizations and in various fields of science and management. One of the first persons I met when I was introduced to the Society was Joanne Treat, president of the Texas A&M Research Foundation. In the many years since meeting Joanne, I have had the pleasure to work with many other accomplished women in research and research administration, from Vice Presidents and Provosts to Chief Grants Management Officers, Legal Counsel, Executive Directors and Chief Executive Officers. My perception has been that individual women have achieved great success in research administration. Carter and Silva, however, have found a different experience. In an article in the Harvard Business review (2010b), they report:

… that among graduates of elite MBA programs around the world—the high potentials on whom companies are counting to navigate the turbulent global economy over the next decade—women continue to lag men at every single career stage, right from their first professional jobs. Reports of progress in advancement, compensation, and career satisfaction are at best overstated, at worst just plain wrong.

…
It’s especially disconcerting that, after a decade of aggressive efforts to create opportunities for women, inequity remains entrenched.

In light of these conflicting data, I decided to ask several senior research managers, who happen to be women, to discuss their own experience and perceptions concerning the future for women in research administration and management.

**Discussion**

**VOE:**

What is your perception concerning the future for women at various stages of their careers in research administration, particularly since many senior women of the “baby boomer” cohort are beginning to consider retirement? Has there been progress? Is that progress accelerating, or are there continuing material obstacles such as those found by Carter and Silva?

**Lynne Chronister:**

I disagree with the premise. Research Administration (RA) is one area where women have been able to excel. We have overcome a lot of the biases and have a majority of both RA positions and leadership roles in pre- and post-award, and compliance. This is spreading not just to the grant life cycle professions but also into the Vice President/Vice Chancellor (VP/VC) research.

I believe it is a mistake to transfer the findings of Carter and Silva to the profession of research administration. In 1984, when I attended my first professional meeting in the field of research administration, I was one of only five women out of slightly more than 100 attendees. If I attended that same meeting in 2010, the numbers would be greatly skewed toward women. In the past 25 years the profession has attracted women in great numbers. I think it is a reflection of a number of factors: more women in the workplace, the many “nurturing components” that RA brings to the core functions, and the growth of RA into a legitimate profession. Initially most of the leaders were reformed faculty who traded the classroom for the office down the hall. Support staff personnel were either accountants (men) or secretaries. As the need grew for more staffing to support the business of research administration and management, more and more women entered the field as research administrators, not just clerical support. For many years the profession was weighed very heavily toward female dominance in the mid- and lower-management levels. Now I believe an accurate survey would show that women are in the majority of leadership positions with concomitantly respectable salaries. This trend is contradictory to the findings in industry.

**Marcia Landen:**

I think research administration has fared better than corporate America in promoting women into senior-level positions. Still, from where I sit, most of the people below me are women, and most of those above are men. But I will say that it’s the men sitting on top of the local food chain who have given enormous and unprecedented opportunities to me and to other women research administrators at my university. That could be due to a generational change at that level. Not that I didn’t learn an awful lot from the previous leadership, but I suspect that opportunities might have been more limited.
Pam Miller:

I think the future of women in research administration is very promising. Over time women have achieved parity with men in numbers and position levels within the field, and this provides younger women with models to emulate and support for their career aspirations. As a member of the baby boomer group, I am very aware of the need to think about our “replacements.” To make this happen I think all of us experienced research administrators — male and female alike — need to begin to step back and let younger folks take the lead. This is hard to do since we baby boomers are used to making things happen and getting things done “our way.” For the field to stay vital and continue to grow we need these new voices and new ideas. I would encourage my fellow baby boomers to talk less and listen more.

Lynne Chronister:

I believe the future is bright for the profession of research administration. As the government institutes more and more regulations and funds remain as competitive as they are today, higher education must rely on trained professionals to manage the business processes. Having said that, I think the profession is regaining popularity among men. Salaries within the higher education community are not large, unless you are at the level of President or Dean, but are respectable. The obstacles I see for reaching leadership positions are no less or greater than for men.

Cindy Kiel:

It is difficult not to notice the apparent disparity between the numbers of men and women in our profession currently. One sure sign is at professional meetings when there are always long lines extending outside the women’s restrooms, but nary a soul outside the men’s restrooms. Nonetheless, at an anecdotal level, I too, have noticed an apparent difference of gender proliferation in the upper echelons of research administration versus those in the trenches. Thus, in an attempt to test my anecdotal perception against the realm of data, I decided to do a mini-study of 15 research Universities with over $300 million in sponsored research funding. As Mark Twain has said, “Get your facts first, then you can distort them as you please.” I looked at organizational charts for central offices reporting to the research lead, including sponsored programs office, compliance/Institutional Review Board, Technology Transfer, and Information Technology. I could not discern gender from about 3% of the staff line names. If a person had multiple titles, I put them in the highest title line. This is not a scientific, randomized (except insofar as I pulled the institutions randomly from my own head), or comprehensive study, mind you, but, I did find my results intriguing and perhaps seed information for a more fully developed scientific study in the future.

<table>
<thead>
<tr>
<th>Nature of Position</th>
<th>%Men</th>
<th>%Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vice President/Provost/Chancellor for Research</td>
<td>85%</td>
<td>15%</td>
</tr>
<tr>
<td>Associate VP/Provost/Chancellor for Research</td>
<td>63%</td>
<td>37%</td>
</tr>
<tr>
<td>Assistant VP/Provost/Chancellor for Research</td>
<td>33%</td>
<td>66%</td>
</tr>
<tr>
<td>Executive Directors and Directors</td>
<td>45%</td>
<td>55%</td>
</tr>
<tr>
<td>Assistant Directors/Managers/Team Leaders/Senior Staff</td>
<td>39%</td>
<td>61%</td>
</tr>
<tr>
<td>Coordinators/Officers/Analysts/Accountants/Specialists</td>
<td>30%</td>
<td>70%</td>
</tr>
<tr>
<td>Administrative Assistants/Clerical/Reception</td>
<td>3%</td>
<td>97%</td>
</tr>
<tr>
<td>All Research Administrative Positions</td>
<td>32%</td>
<td>68%</td>
</tr>
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</table>
To coin a cliché and stir up some controversy, I would argue that, based upon the above sampling, and in spite of women’s gains overall in research administration, it appears that our profession may be suffering from “harem syndrome.” It seems that we have a large majority of individuals of one gender working in research administration — 68% women — led, primarily, by the opposite gender — 85% men (63% at the associate VP/VC levels).

So, perhaps we should ask ourselves, what is the reason for this apparent phenomenon? Is it because men have become such a rarity in research administration, they get more attention when it comes to promotions? Could it be that we recruit senior executive-level leaders from professional pools outside our own staff and management lines, and those external pools have larger percentages of men than women to choose from? Are men simply more aggressive in pursuing leadership roles once they enter the research administration profession? Or, is it simply the time factor, in which the predominance of men in research administration in its early years is still affecting the numbers of men in executive leadership roles today? Should we be encouraging young women to follow parallel professional interests such as medicine or tenure track professorships if their goal is eventually to assume the highest levels of leadership in research administration, as opposed to growing their skills within the research administration offices?

On a positive note, women seem to be thriving in great numbers in middle management levels, the potential recruitment pools for upper administration of the future. Personally, I think diversity at all levels promotes balance, harmony and the fostering of good ideas. Thus, we might also ask ourselves why we don’t have more or stronger male applicants for our staff line positions.

Lynne Chronister:
I think Cindy’s numbers are representative of most universities, but the opportunities for women even in the highest levels of RA are unparalleled. While men still dominate the VP/VC level, I think it may have more to do with the fact that we are in a transition period than from actual barriers. I happen to be at a highly female-dominated institution with mostly women in leadership roles. I think the opportunities in RA are tremendous.

Amy Sikalis:
I don’t think the conclusions of Carter and Silva translate to women in RA. The majority of the field of RA was developed from the necessity to comply and manage regulations and mandates that come with federal funding and that have been ever increasing since the 1960s. For-profit organizations have different challenges and, although they are often sponsors of research and sometimes partners with federal funding agencies, by and large for-profit organizations are not qualified to apply for and receive federal funding. Nonprofit and academic institutions that do apply for and receive federal funding for research and other sponsored activities are rich in opportunities for professional growth for men and women alike. This said, it is my belief that these organizations offer environments of safety, stability and security that may not be so evident in a corporate environment and may just be more attractive to the professional needs of women.
Kate McCormick:
I believe there is a promising future for women in RA. Since I’ve been in the field it has seemed to be a female-dominated career, judging by the makeup of research administrators at Harvard and of people I’ve seen attending professional conferences. I think progress has been made in terms of women’s ability for advancement, but it’s a slow process and advancements are hard won. Having said that, I do see women attaining high positions at Harvard, so that is encouraging. I think as women continue to be seen managing these roles well, it will become easier for others to attain similar positions in the institution.

VOE:
What is the role of higher education in giving women increased opportunities for advancement in research administration? Will graduate education become a necessary hurdle to jump to achieve senior status in research administration? What about a scientific background?

Pam Miller:
Higher education is important in that it gives women a basis from which to grow as individuals and professionals. One of the great things about our field is that it is so diverse. I think it is important to keep that diversity alive by accepting people into the profession from a variety of backgrounds and then augmenting their experience with professional development and training specific to our field. I do not think this necessarily requires a graduate degree or a scientific background to succeed. The desire and ability to learn (formally and informally) are the essentials.

Marcia Landen:
I think there is great value to graduate education for those who aspire to a senior-level position. Most of the senior research administrators I know have an advanced degree of some type — masters, doctorate, law. And I don’t think that will change. A science background is likely a necessity in the path to leadership for some RA roles, such as tech transfer or biosafety.

Lynne Chronister:
In the office that I have the good fortune to lead, about one-third are men, four are PhDs and seven JDs. As RA grows as a legitimate profession, more and more individuals are seeing the benefit of taking a different career track than the sometimes cutthroat environment of private legal practice or even the competitiveness of the university research field. When RA offices can have a balance of gender, scientific, legal, and business and other backgrounds, it is the best possible environment.

Cindy Kiel:
As much as I hate to admit it, I think graduate education is a necessity to remain competitive in RA leadership. I would love to say that only experience on the job is what matters, but my experience is that it is becoming more and more difficult to promote individuals who do not have more advanced degrees. Universities are all about education, the dissemination of knowledge. It is their primary product. Research is all about the creation and dissemination of new knowledge. Thus, it makes sense that, if an institution believes in its own products, it will promote those who have been willing to invest in a higher level
of education. I think having a graduate degree also streamlines the trust process between scientific researchers and administrative teams. For some reason, having letters behind your name, regardless of the field it is in, seems to deliver clout, a presumption that you just might know what you are talking about.

While I agree that having a variety of backgrounds is the key to success in a research organization, I think that if I could go back and “re-do” my past, I would have opted for dual advanced degrees in science and law. I think I would be even further ahead now and I would have struggled less along the way. Many of the higher positions in research administration, particularly in research development, technology transfer, ethical conduct of research, and core facilities really necessitate developing some level of scientific comprehension or, at a minimum, hiring someone who can decipher the science for you. At most institutions, you cannot expect to reach the Office of Vice Provost or Vice Chancellor level without having developed a strong research funding portfolio of your own as a principal investigator. I wish a University would come up with a “Pan-Scientist” Executive track doctoral degree where you would study various fields of science in an interdisciplinary context, learning the lingo and the methods in the various areas, but without all of the lab time, so it could be completed evenings and weekends.

Amy Sikalis:
I do believe that having a degree beyond a bachelor’s is necessary for moving beyond being a manager. A colleague, mentor and friend, Lynne Chronister, said to me, “you could be a great director, but you need to get your master’s.” I listened, received my degree and moved into a Director of Research position. This said, experience and knowledge is also critical. I think a scientific background would be useful, especially if the position requires that the director be responsible for applying for funding.

Kate McCormick:
I think higher education is a huge factor in opening up opportunities for advancement in research education. In the field of academia, degrees and levels of education garner respect more than just about anything else. I think the level of education needed depends on what your aspirations are. I’ve seen people achieve senior/director status at the department level without higher degrees, but as you move into central administration and up to the higher echelons, such as Vice President/Director of Research, higher degrees become more important, as does some type of scientific background. Researchers want to know that the person making important decisions about the future of research at the institution has an understanding of what’s involved in the actual work being done in their labs.

VOE:

What is your perception of the cohort of young women just entering the field of research administration as compared to your peers when you were just starting out? What will it take for them to reach your level of achievement?

Pam Miller:
I think that young women (and men) need mentorship to achieve their true potential. After 20-plus years, I am still learning from others in my field — thank goodness! Otherwise it would be a pretty boring situation. I think the young women entering our
field have great ideas and energy — what they need is guidance in how to move forward to achieve their goals. I encourage all senior research administrators to reach out and bring these young people into our circle and not just hang out with each other, comforting and enjoyable as that may be. It also is fun to see someone “become” a professional right before your eyes. The downside, of course, is that they then try to tell you what to do! But that is okay — they might just be right.

Marcia Landen:
There are certainly more of them. RA has grown tremendously over the last couple of decades. I think women (and men too) in early- or mid-career will have more competition for the senior spots just due to numbers. Those of us in these senior positions have a duty to train and mentor the next generation of leaders by giving them an opportunity to stretch their skills, learn new things, develop new tools, participate in decision making, and see RA at the macro level. This group also brings ideas and skills of their own, and I’d encourage them to make noise about changing things that no longer make sense. Leaders are successful in managing stress, coping with change, and making tough decisions, so we should be giving those coming along behind us those experiences. (I think we’re good on the stress part.) For those who want to be leaders, I’d encourage them to soak up opportunities to participate in projects or committees outside of their daily responsibilities and build a network of colleagues both inside and outside their organizations.

Lynne Chronister:
The women entering the field are much better prepared than I was! Many, if not most, have graduate degrees, some have legal degrees, and some doctorates. The best advice I could give is to become as knowledgeable as possible about all aspects of RA and develop presentation and leadership skills.

Cindy Kiel:
I consider myself blessed to have been recruited by and then promoted by strong leaders in RA who just happened to be women. I credit their mentoring and networking skills for assisting me in moving forward with my professional goals even when I wasn’t certain whether I was ready for the next move. I do not wish these incredibly talented women to remain nameless, so, I will name them: Lynne Chronister, Linda Brinkley, Marsha Reed, and Denise McCartney. There are many other women I admire greatly because I was able to work with them, learn with them, cut my supervisor teeth with them and learn my own way of mentoring others on the leadership path. I would name the up-and-coming women stars that I know of right now too, but then all of you would be recruiting them and I don’t want to lose them just yet.

One of the weaknesses I see in developing talent for leadership positions generally is the growing trend for staff to specialize in one narrow area, especially in large research institutions. As a profession, we have broken ourselves up into pre-award, proposal development, post-award financial, data analyses, contract negotiators, clinical trials, technology transfer, compliance, or by specific agency, and then we build walls around our “turf” to silo ourselves from one another. This prevents us from learning the full spectrum of research administration with all of its complexities. I was really lucky to start out in research administration in an office where I was allowed to see a plethora of sponsors, a variety of funding mechanisms, grants and contracts and clinical trials, and policy development. I followed this experience with working
in a joint pre- and post-award financial office that showed me how and why things on the pre-award side can affect the post-award side of the house and how Facilities and Administrative (F&A) rate negotiations and compliance areas can either complement each other or cause friction. I was able to serve as parliamentarian of the faculty senate, which taught me how what we do on the administrative side of the house really affects the scientists who are vital to the research blood of an institution. Leadership needs breadth, a big picture, an understanding of how the cogs in the wheel fit together and how to solve a problem when the wheels aren’t working the way they should (or to recognize when they have fallen off completely). So, I suggest developing rotational opportunities, cross-training, and team-based problem solving skills to move staff from line level to leadership.

One area of expertise that I think is particularly ripe for people of talent is in international research. It is a particularly complex area requiring knowledge in a variety of areas: contracts, translation services, compliance, taxation, immigration, export and import laws, financial transactions, international laws and patent processes, for example.

Amy Sikalis:
In an age of instant, constant information, there is an expectation to move up quickly. Those entering the field need to allow time for new knowledge to synthesize through experience. I believe that this can happen more quickly if they look for professional development and opportunities (managers can help with this) to be involved in problem solving, special projects, managing processes, doing research, writing, presenting and generally demonstrating learning and capabilities.

Kate McCormick:
Unfortunately, the people I’ve seen entering the field do not seem to have the same level of dedication and professionalism I’ve come to associate with people who advance in this field. It takes a long time and a lot of hard work to move up in this career path, and you really need to know what you’re doing. The people I’ve seen tend to change jobs rapidly, before they really gain a full working knowledge of the tasks in their initial position, and sometimes falter by trying to take on too much too soon. Coming from one of the “large institutions” that Cindy mentions, I agree that there tends to be a great deal of specialization, which limits opportunities for advancement. Sometimes the only way to broaden your knowledge and skill base is to move to a central administration office. I think that mentorship is going to be one of the most important factors in the ability of both men and women to achieve senior status in the field. There seems to be a tendency to see things in terms of “us” and “them” when dealing with faculty, rather than seeing both sides as part of the same team working towards a common goal. Sometimes the faculty don’t see things that way either, but I believe part of our job is getting them to understand that that is, in fact, the case.

VOE:
How should entry- and mid-level women in RA approach the task of reaching senior positions in organizations such as yours? Should such a position be the ultimate goal of today’s young woman, or are there alternative paths to career satisfaction that should be considered by an ambitious and talented young woman? What about the law, medicine, bench science, or a career in private business? Are these viable paths to senior-level positions managing the research process?
Marcia Landen:  
I hope that young women can do whatever it is they aspire to do without having boundaries or ridiculous assumptions about gender or age or race stop them. The business of research is expanding, and research administrators will be needed not only at traditional research organizations in traditional roles, but also in the new economy as entrepreneurs, CFOs for start-ups, program managers, teachers, IT developers, and much more. I’d ask, “What’s your passion?” Then go do that. establishment of sound research, development, and extension, marketing and monitoring units.

Pam Miller:  
I think the most important thing is networking and being open to new opportunities. No one starts out with the idea of being a research administrator, but for those of us fortunate enough to find this career and to discover that they like it, it is an extremely gratifying experience. To achieve a senior position one has to do more than is expected. It is hard work, and the payoff is not always immediate. It is important to say “yes” to new tasks and opportunities that come your way — one never knows where these will lead. My experience is that even what appears to be a mistake at the time can turn out to be an advantage later.

Lynne Chronister:  
Not all women (or men) are interested in reaching senior level positions. One nice trend among younger generations is that they are looking at quality of life balance. Some will decide later on to move into leadership and that is fine. But there is enough growth and change and challenge in research to keep women engaged at all levels.

Angela Spaulding:  
There are multiple paths to senior-level positions managing the research process. My path has moved me through the layers of the faculty tenure process (assistant, associate, and full professor) to academic program chair, department head, associate dean, and, currently, Dean of the Graduate School and Chief Research Officer. While none of these prior positions prepared me for all the specifics of a senior-level research administrator, they have all contributed to the tools I need to be successful in the role. In today’s university market, especially in a regional institution such as where I work, senior leadership must successfully manage a diverse array of responsibilities. In my case, on any given day, those responsibilities span from admitting and recruiting graduate students, promoting federal initiatives, overseeing research labs and facilities, supporting researchers, enforcing research compliance, and/or facilitating patents and commercialization of research. I need to be as comfortable in a congressional office as I am in our university research feedlot. My advice to anyone who seeks senior-level leadership is to: (1) seek and be committed to potential leadership opportunities that are within your current career rank (regardless of the scale); (2) establish yourself as a consistent, reliable “go-to” person; (3) get along with and learn to foster collaboration and consensus among diverse groups of people; (4) be good at what you do (and recognized as such); and, (5) love the adventure of learning in a new context. Success breeds further success. As I look around me, I am surrounded by brilliant young women who can, do, and will succeed at all levels of research administration. As Lynne discussed, these young women are seeking a quality of life balance. My bigger concern is that universities and institutions provide the support needed as they seek that balance.
Cindy Kiel:
I agree that not everyone wants to take on leadership roles within RA and there are multiple career paths that complement and add value either way. If everyone in an organization wanted to move up from their current position, you very well may have a lot of unhappy and unsatisfied people working for you, since many of our institutions are quite flat from an administrative hierarchical perspective. If there is only one ladder and everyone is on the same rung at the same time reaching for the next rung, the whole thing can fall down. It is a good thing to have a variety of people with a variety of professional goals and leadership timelines at play. I think it is important to recognize that some of the greatest leaders I have met in research administration are the quiet, behind-the-scenes individuals who, with a sense of humor, people and purpose, help lead the entire team to better solutions. Being at the top of an organizational chart does not necessarily mean you are the only leader in the house.

However, if someone lets me know that their goal is to move up an organizational chart, I'll try to provide networking, organizational breadth and variety to their experience. I think there are many complementary and viable professional outlets. For example: Learning export trade controls in a University can lead to rewarding industry careers; bench scientists can become great leaders in research development; RA is a great alternate career choice for many lawyers; and working at a research institution can lay the foundation for an alternate career in private consulting.

In the end, I think I have been successful in RA because I wake up in the morning eager to get going on the next professional challenge. I think that if you are miserable in the work that you do, your job becomes only that — a job— something to pay the bills or to get by on. When you see what you do as a career and profession and not just a job, the motivation and energy necessary to really push the boundaries, to accomplish great things and to be a part of something bigger than yourself propel you upward and outward to accomplish even more. When you are in the mode of making a difference in other peoples’ lives, whether it is the ethical dilemma you just resolved, the faculty member you helped today, the patient that benefits from that faculty member's research years from now, or the staff member who wins that Director position, even if it means leaving you; that is where success is. It really has nothing to do with where your name shows up on an organization chart. We can all experience that success, today, in the leadership role we find ourselves in — right this very moment. All it takes is a shift of perspective.

Amy Sikalis:
I think higher education is a huge factor in opening up opportunities for advancement in research education. In the field of academia, degrees and levels of education garner respect more than just about anything else. I think the level of education needed depends on what your aspirations are. I’ve seen people achieve senior/director status at the department level without higher degrees, but as you move into central administration and up to the higher echelons, such as Vice President/Director of Research, higher degrees become more important, as does some type of scientific background. Researchers want to know that the person making important decisions about the future of research at the institution has an understanding of what's involved in the actual work being done in their labs.

Kate McCormick:
I think there are many different paths to career satisfaction in RA, but for me, being at an academic institution, and Harvard in particular, has been extremely rewarding. I think each person's ultimate goal is different, and finding career satisfaction depends upon what you're looking for, but there are many excellent options available in this field.
References


Footnotes


2Catalyst Research (2010).


2010 SRA Salary and Benefits Survey

- How competitive is your organization's salary and benefits package?
- What benefits are your counterparts receiving?
- Are you getting paid what you're worth?

Given the turbulent economy of the past couple of years, a lot of changes have occurred in the workplace - particularly in the area of compensation. Visit www.srainternational.org to get the survey findings for your position at the member discounted rate of only $10.