

ABSTRACT OF CAPSTONE

Derrick C. Gilmore

The Graduate School  
Morehead State University

March 17, 2022

RESEARCH ADMINISTRATION OPEN-SOURCE PLATFORMS: AN  
ASSESSMENT OF INSTITUTIONAL ADMINISTRATORS INTEREST IN  
TECHNOLOGY ADOPTION

---

Abstract of Capstone

---

A capstone submitted in partial fulfillment of the  
Requirements for the degree of Doctor of Education in the  
Ernst and Sara Lane Volgenau College of Education  
At Morehead State University

By

Derrick C. Gilmore

Montevallo, Alabama

Committee Chair: Daryl R. Privott, Associate Professor

Morehead, Kentucky

March 17, 2022

Copyright © Derrick C. Gilmore, March 17, 2022

## ABSTRACT OF CAPSTONE

RESEARCH ADMINISTRATION OPEN-SOURCE PLATFORMS: AN  
ASSESSMENT OF INSTITUTIONAL ADMINISTRATORS INTEREST IN  
TECHNOLOGY ADOPTION

Research administration is a matter of concern for institutions of higher education. While national trends reveal a lack of interest in investing in higher education institutions through federal and state allocations, such institutions have turned to sponsored research as a means of addressing critical issues of instruction, research, and public service through grantsmanship to propel them towards their missions. Smaller institutions of higher education, however, face a more uncertain future in sponsored research administration due to limited resources in the procurement of administrative tools to manage and ensure compliance according to federal, state, and private foundation guidelines. The purpose of this study is to assess institutional interest in technology adoption of open-source software as an administrative tool of sponsored programs at a small college in the Southeastern United States. The findings of this study may support administrators in their understanding of the theories and models of technology adoption and the consideration of open-source platforms as a viable means of increasing efficiency and effectiveness of research administration. This study determined that the primary obstacle of technology adoption rests in the lack of inclusion of information

technology officials in the decision-making processes of technology adoption universally appropriated at the given institution. The study also detected that the communication of adopted technologies was limited to individual departments and/or units. Furthermore, the study found that, while all the administrators supported technology adoption and the use of open-source platforms, security from malware and computer hacks proved to be a major concern. Additionally, the study identified technical support and training as barriers to adopting technologies from open-source platforms.

**KEYWORDS:** Sponsored Research Administration, Technology Adoption, Open-source Software

---

Candidate Signature

---

Date

RESEARCH ADMINISTRATION OPEN-SOURCE PLATFORMS: AN  
ASSESSMENT OF INSTITUTIONAL ADMINISTRATORS INTEREST IN  
TECHNOLOGY ADOPTION

By

Derrick C. Gilmore

Approved by

---

Teresa Merriweather Orok  
Committee Member    Date

---

Lee Nabb  
Committee Member    Date

---

Daryl R. Privott  
Committee Chair      Date

---

Timothy Simpson  
Department Chair     Date



CAPSTONE

Derrick C. Gilmore

The Graduate School

Morehead State University

March 17, 2022

RESEARCH ADMINISTRATION OPEN-SOURCE PLATFORMS: AN  
ASSESSMENT OF INSTITUTIONAL ADMINISTRATORS INTEREST IN  
TECHNOLOGY ADOPTION

---

Capstone

---

A capstone submitted in partial fulfillment of the  
Requirements for the degree of Doctor of Education in the  
Ernst and Sara Lane Volgenau College of Education  
At Morehead State University

By

Derrick C. Gilmore

Montevallo, Alabama

Committee Chair: Daryl R. Privott, Associate Professor

Morehead, Kentucky

March 17, 2022

Copyright © Derrick C. Gilmore, March 17, 2022

## DEDICATION

I dedicate my work to my family and friends. A special note of gratitude is extended to my wife, Karla, whose words of support and encouragement prove to be a calming and soothing note in the winds of turmoil and moments of doubt. To my son Jabbar, you serve as my northstar and drive me to my calling and purpose.

To my wonderful mothers, Jessica Gilmore and Alice Merritt, you are my balance and conscience that keep me focused on the important matters of life and family. For your support and love, I am truly grateful and made whole.

To Dr. Cynthia Warrick, seventh President of Stillman College, thank you for helping me visualize the possibilities of the future and sharpening my skills and resiliency in my labor and love for the work at Historically Black Colleges and Universities (HBCUs). To Drs. Michael and Teresa Merriweather Orok, I dedicate this work to you for your friendship, mentorships, prayers, encouragement, and dedication to my personal and professional growth.

## ACKNOWLEDGEMENTS

I would like to express my deepest appreciation to my committee members, Drs. Daryl R. Privott, Teresa Merriweather-Orok and Lee Nabb. I am indebted to you for your support and encouragement through this process. I extend much gratitude to Dr. Daryl R. Privott for his willingness to serve as the chair of my committee, but also as a voice of reason and guidance throughout my time in the doctoral program at Morehead State University. You have shown a profound belief in my work and career aspirations. I am also grateful to the faculty of the School of Education for their steadfastness in ensuring my understanding of foundations and future needs, trends, and emerging pathways in educational leadership. I would also like to recognize the Platoon cohort of the Adult and Higher Education Leadership program: your helpful advice, unwavering support, and friendship throughout this process has been instrumental in my successful completion of this graduate program.

A Special thank you to the organizations and individuals that participated in this capstone project. You have provided new information to the academy's body of knowledge related to the perceptions of technology adoption and the use of open-source software systems. To the thousands of research administrators of small colleges and universities that do the impossible on a daily basis by cataloging the ideas of faculty, facilitating the grants submission processes, monitoring post award processes, and managing compliance efforts that support stability and growth in knowledge and resources through sponsored programs - your dedication inspired this work.

## TABLE OF CONTENTS

	Page
Chapter 1: Introduction .....	15
Statement of the Problem .....	18
Significance of the Problem .....	20
Local Context .....	21
Purpose Statement .....	22
Research Questions: .....	23
Definition of Terms .....	23
Chapter 2: Review of Literature .....	26
Research Administration Perceptions and Values .....	31
Theoretical Framework for Technology Adoption .....	34
An International Perspective of Technology Adoption .....	40
Financial Allocations and Technology Adoption .....	42
Free and Open Software Systems (FOSS) .....	44
Conclusions .....	51
Chapter 3: Methodology/Procedures .....	54
Introduction .....	54

Research Design.....	54
Site .....	56
Subjects .....	57
Instrumentation .....	58
Procedures.....	59
Data Analysis .....	59
Reliability and Validity.....	60
Reliability.....	60
Validity .....	61
Limitations .....	61
Chapter 4: Findings.....	63
Introduction.....	63
Profile Information.....	64
The Institution.....	64
Study Participants .....	65
Results.....	66
Theme1: Local communication of technology adoption .....	66
Theme 2: Relationship between years of service and perception on technology adoption.....	67

Theme 3: Staffing and resources as a barrier to technology adoption .....	69
Theme 4: The hack of 2017 accelerates data security concerns related to the adoption of technology .....	70
Theme 5: Lack of support and security biggest risks to technology adoption from open-source platforms.....	72
Theme 6: Triggers that support technology adoption .....	74
Theme 7: Limited knowledge of open-source software systems.....	77
Theme 8: Supportive of technology adoption from open-source platforms for sponsored research administration .....	79
Summary of Findings.....	80
Chapter 5: Conclusions, Actions, and Implications .....	82
Introduction.....	82
Conclusions.....	83
Research Question One.....	83
Research Question Two .....	86
Research Question Three .....	88
Implications.....	90
Implications for research on technology adoption .....	90
Implications for practice on technology adoption .....	91

Implication on research/practice for security related to open-source software systems .....	92
Future Actions.....	92
List of Figures .....	94
List of Tables .....	95
References.....	96
Appendix.....	104
Vita.....	107

## **RESEARCH ADMINISTRATION OPEN-SOURCE PLATFORMS: AN ASSESSMENT OF INSTITUTIONAL ADMINISTRATORS INTEREST IN TECHNOLOGY ADOPTION**

### **Chapter 1: Introduction**

In higher education institutions, there are five key areas that determine the academic and financial success, as well as the sustainability of the organization: student outcomes with regard to quality programs and courses; the productivity and impact of scholarship and research; public service and outreach through community service; faculty and staff workplace satisfaction; and financial sustainability and growth (McClellan, 2011) (Ruben, 1999). Research expenditures by colleges and universities have shown continued growth as reported from the National Science Foundation (NSF), Higher Education Research and Development (HERD) survey (Foundation, 2019). Total expenditures increased by 5.7% from FY18 to FY19, totaling over \$83.7 billion (Gibbons, 2021). Additionally, the HERD survey indicates the amount of research expenditures by institutions of higher education has grown continuously since 2015. This figure increased by 13%, with federal sources of funding increasing during that time frame by 10% and nonfederal sources expanding by a total of 18% (Gibbons, 2021). While the NSF HERD survey shows significant growth in research and sponsored programs, many small colleges and universities are showing shrinkage in research expenditures over the past three years (Foundation, 2019). This study seeks to assess institutional interest in technology adoption of open-

source software as an administrative tool in sponsored programs at a small college in the Southeastern United States.

As Mehlinger discussed in (1996), technology is not only a part of the culture from which it arises, it also impacts the very culture that created it. Such is the case with technology adoption. According to Allen & Seaman (2007), some of the barriers to the adoption of technology for distance learning can be attributed to the perceived high costs for program development and maintenance. For this reason, it is critical for institutional leaders to collaborate with research administrators to embrace technology adoption and explore open-source platforms. This concept was examined by Kezar and Lester (2009), who explored the stages of collaboration in higher education. The model included building commitment to collaborate (stage 1); commitment to collaboration (stage 2); and sustainable collaboration (stage 3). In stage one of this model, Kezar and Lester highlight the need for institutional leaders to build a commitment to collaborate by leveraging value systems, external pressure, and learning (Kezar, 2009).

This applies to research administration, as well. Institutional leaders must demonstrate a willingness to collaborate to assess their interest in technology adoption from open-source platforms and, if it is determined to a feasible option, progress to building from commitment to action (stage 2). Stage three subsequently focuses on structures, processes, and systems that sustain these collaborative efforts for technology adoption in research administration. This sentiment was confirmed by Thornton (2008), who found that institutional culture and values provide a vision of

the institution, as well as a framework for understanding the ideology of an institution and its strengths. This can be used to collaborate and show commitment to technology adoption. A similar theme was found by (Atkinson, 2007, p. 208) who reported that research administrators “lack authority” and need support from management and administrators.

While many sectors, including institutions of higher education, have seen growth in technology adoption and the implementation of free and open-source software systems (FOSS), little research has been completed to determine the interest in technology adoption at small colleges and universities. Research by (Boyce, 2003) found that institutions of higher education were quick to make small environmental changes, while Kezar (2009) indicated that strategic change is possible by creating conditions that support continued organizational learning. This denotes the need for research administrators to suggest applicable tools and resources that increase sponsored research projects by serving as agents of change and advocates for the adoption of technology by institutional leaders.

This study seeks to gauge institutional interest in technology adoption of open-source software as an administrative tool in sponsored programs at a small college in the Southeastern United States. This qualitative research study was structured using *The Art of Case Study Research* (Stake, 1995).

The research design for this case study is based on a single institution and engaged a qualitative case study to focus on the pre- and post-award data collection needs of sponsored programs administrators. Compliance reporting requirements for

internal and external stakeholders are also highlighted, as well as the use of results to support the development of performance evaluation measures of research administrators, academic divisions and units, and other non-academic units that participate in grantsmanship. Additionally, the institutional history of sponsored programs as based on annual audits required by the Office of Management and Budget (OMB) Uniform Guidance was reviewed, in addition to the number of staff dedicated to research administration, and the annual institutional budget and fund allocation for sponsored research.

#### Statement of the Problem

The research problem this study seeks to address is/are the perception(s) of open-source technology adoption by university/institutional leadership. According to the National Science Foundation (NSF), Higher Education Research and Development Survey (HERD), of the 915 institutions surveyed, research expenditures climbed at 5.5% (\$4.1 billion) in 2018, growing for the third straight year with a total of \$79 billion (Foundation, 2019). While this data supports the narrative that research is a practical method of support for institutions, faculty, and students, it also indicates that merely a slim 30 of the 915 institutions surveyed account for 42% of all expenditures (Foundation, 2019). The top five institutions were as follows: Johns Hopkins University, University of Michigan-Ann Arbor, University of California-San Francisco, University of Pennsylvania, and the University of Washington-Seattle. Meanwhile, much smaller institutions are tasked with competing for scarce resources with those who utilize integrated data collections systems and analytics that support

mission and goals. Conversely, the NSF HERD revealed that the bottom 30 institutions observed their research expenditures shrink by 21% in 2018. For example, between 2017 and 2018, Morehead State University reported a total reduction of over \$400,000. What's more, many institutions are faced with operating at the pre-recession levels of 2008. This could easily adversely impact the number of staff and technologies incorporated by small colleges and universities to manage the daily functions of research administration. This resource deficiency may also deter administrative investment in software, as some have annual subscription costs of over \$5,000.

Kashorda and Waema (2014) claim that universities are “still not ready to use Information Communication Technology (ICT) to transform learning and research” (p. 36). The researchers reiterate that university leadership dictates the ICT environment. They state, further, the significance of maintaining adequate ICT policies and regulatory framework as well as a plan of implementation for those policies (Kashorda, 2014). Kashorda and Waema (2014) emphasize the importance for administrators to ensure policies and regulatory frameworks are not only implemented, but also detailed. However, what they fail to mention is the need for administrators to aid in the development of disruptive innovations that support enhanced data collection and reporting, as well as the use of results for systems that encourage increased efficiency and effectiveness in sponsored research administration. A lack of financial resources could certainly hamper the efforts by administrators at small colleges and universities to purchase highly specialized

software systems (such as Cayuse, Nature Research, Guidestar, and Streamlyne).

Given that limited financial resources adversely impact researchers at these universities, the ability to purchase proprietary software systems is paramount. There is a definite need to consider technology adoption that supports open-source platforms as a means of research growth and compliance.

National trends in sponsored research reveal that colleges and universities are appropriating all-time high amounts of sponsored research dollars, as indicated in the National Science Foundation, Higher Education Research and Development Survey (Foundation, 2019). These increases, coupled with the overall reductions in the recovery of facilities and administrative costs, smaller institutions are faced with funding positions and procuring the technologies needed in research administration with very limited resources. The perception of technology adoption and open-source platforms as a solution is a vexing hurdle for small colleges and universities, which begets significant inefficiencies within research administration.

#### Significance of the Problem

Free and open-source software (FOSS) systems are becoming more pervasive in business, industry, and education as a cost-saving measure. In higher education, FOSS systems have been primarily explored for the purposes of teaching and instruction. However, there has been little interest in exploring the role FOSS systems could play in improving the administrative functions in sponsored research. Subsequently, minimal research has been completed to ascertain any such effects.

The costs associated with subscription to proprietary software can be prohibitive to small colleges and universities with limited funding, as well as reduced research expenditures. Thus, the development and implementation of FOSS systems have the capacity to save money and support effective research administration.

#### Local Context

The institution is a small, private liberal arts college that is designated as a Historically Black College or University (HBCU) by the Higher Education Act of 1965. The institution currently does not have a Carnegie Classification, but has an enrollment of fewer than 1,000 students, with the Fall 2020 Full-Time Enrollment (FTE) at 709. The institution has a total of 41 full-time faculty and utilizes the services of over 56 part-time and adjunct faculty during the Fall 2020 academic year. Over the past five years, the sponsored research portfolio at the institution has principally encompassed federal financial aid, Title III funding, and the federal TRIO programs (i.e., Upward Bound and the Student Support Services grant). In 2017, the institution's governing board selected their open-source 12<sup>th</sup> President. Since the appointment, the president has pushed a renewed effort to secure sponsored programs from federal agencies, private foundations, and business/industry.

The institution does not have a Carnegie Classification nor an approved Indirect Costs (IDC) rate by any of the recognized agencies, such as Health and Human Services (HHS), IDC is used to determine the facilities and administrative costs (F&A) that the institution can charge on a given federal grant. Thusly, the

institution utilizes the “de minimis” rate of 10% permitted by the Office of Management and Budgets (OMB) that is cataloged in the Uniform Guidance in the Code of Federal Regulations.

A review of institutional policies does not indicate that the policies and procedures from the Business and Finance Division, the Faculty Handbook, or Human Resources, provide any guidance for sponsored research engagement for faculty or staff. In addition, the institution does not have an organized sponsored research administrative office. The rules of engagement are vague and do not support efficiencies in proposal development and submission guidelines that ensure adherence to established institutional policies, nor those mandated by the federal government. There is no centralized or decentralized system to manage the pre- or post-award functions of sponsored programs (i.e., contract review/approval, time and effort reporting, and fiscal reviews of expenditures).

#### Purpose Statement

The purpose of this study is to explore the impact technology adoption has on institutional leadership at a small college/university and their perceptions of open-source software platforms as suitable method of improving sponsored research administrative functions. This study will aid the development of disruptive innovations that prompt enhanced data collection, reporting, and the use of results for systems that reinforce increased efficiency and effectiveness in sponsored research administration.

#### Research Questions:

1. What impact does the perception(s) of open-source software platforms have on technology adoption for sponsored research among administrators at a small college/university?
2. What issues or factors support or deter technology adoption?
3. Do administrative roles and responsibilities affect the perceived usefulness and attitudes towards technology adoption using open-source software platforms for research administration?

#### Definition of Terms

The initial lists (1-7) of terms are derived from the U.S. Office of Management and Budget, under the Administrative Requirements, Cost Principles, and Audit Requirements for federal awards, cataloged in the Uniform Guidance published in December of 2013 (Budget, 2021).

- 1) *Sponsored research- (interchangeable with sponsored programs)* is defined as research and development activities that are sponsored by federal and nonfederal agencies and organizations.
- 2) *Grant agreement* is a legal instrument of financial assistance between a federal awarding agency or pass-through entity and a non-Federal entity that, consistent with 31 U.S.C. 6302, 6304.
- 3) *Indirect (facilities & administrative (F&A)) costs* are those costs incurred for a common or joint purpose benefitting more than one cost objective, and not readily assignable to the cost objectives specifically benefitted, without effort

- disproportionate to the results achieved. To facilitate equitable distribution of indirect expenses to the cost objectives served, it may be necessary to establish several pools of indirect (F&A) costs. Indirect (F&A) cost pools must be distributed to the benefitted cost objectives on a basis that will produce an equitable result in consideration of relative benefits derived.
- 4) *Indirect cost rate proposal* refers to the documentation prepared by a non-Federal entity to substantiate its request for the establishment of an indirect cost rate as described in appendices III through VII and appendix IX until this part.
- 5) *Non-Federal entity (NFE)* denotes a State, local government, Indian tribe, Institution of Higher Education (IHE), or nonprofit organization that carries out a federal award as a recipient or subrecipient.
- (1) Is operated primarily for scientific, educational, service, charitable, or similar purposes in the public interest;
- (2) Is not organized primarily for profit; and
- (3) Uses net proceeds to maintain, improve, or expand the operations of the organization.
- 6) *Office of Management and Budget (OMB)* concerns the Executive Office of the President, Office of Management and Budget.
- 7) *Research and Development (R&D)* are all research activities, both basic and applied, and all development activities that are performed by non-Federal entities. The term research also includes activities involving the training of individuals in research techniques where such activities utilize the same facilities as other

- research and development activities and where such activities are not included in the instruction function. “Research” is defined as a systematic study directed toward fuller scientific knowledge or understanding of the subject studied. “Development” is the systematic use of knowledge and understanding gained from research directed toward the production of useful materials, devices, systems, or methods, including design and development of prototypes and processes.
- 8) *Technology Adoption* is a complex, inherently social, development process; individuals construct unique yet malleable perceptions of technology that influence their adoption decisions (Rogers E. , 1962).
- 9) *Open-source software (OSS)* is a broad software license that makes source code available to the general public with relaxed or non-existent restrictions on the use and modification of the code (Perens, 1999).

The capstone project is divided into five chapters and followed by an appendix. Chapter One provides an introduction, definition and explanation to technology adoption. Chapter One also furnishes an introduction and working definition of open-source software platforms and discusses the administrative functions associated with sponsored research administration. Chapter Two is the literature review and includes an introduction to the global condition of sponsored research and research administration. Additionally, Chapter Two explores the literature review associated with technology adoption, as well as open-source standards.

## Chapter 2: Review of Literature

The purpose of this study is the exploration of the impact technology adoption has on institutional leadership at a small college/university and their perceptions of open-source software platforms as a capable measure to improving sponsored research administrative functions. This study seeks to support the development of disruptive innovations that enable enhanced data collection, reporting, and the use of results for systems that encourage increased efficiency and effectiveness in sponsored research administration.

Sponsored research is ordered by written formal agreements entered with external agencies that direct the programmatic and financial resources of funded research efforts. These agreements may appear in the form of grants, contracts, cooperative agreements, gifts, and other types of financial mechanisms (Budget, 2021). Under the guise of the Office of Management and Budget (OMB), compliance for research administrators is capsulated in the Uniform Guidance (2 CFR 200). Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards governs the budgeting and accounting practices. As funding for higher education diminishes the cycles of cynicism about its aims and purposes, such institutions are tasked with creating so-called revenue streams through sponsored research.

Research administration consists of pre-award, award acceptance, compliance, technology transfer, and post-award, according to the Society for Research Administration ([Society for Research Administrators, Inc.](#)). Pre-award function

encompasses finding funding opportunities, writing proposals, construction of the budget, the development and approval of institutional processes for submission, and final submission to the grantor. Post-award research administration requires professionals to understand the administrative/fiscal principles and regulations related to the sponsored award, including identifying critical information in awards for project setup, monitoring, and reporting. Research administrators are also required to facilitate compliance measures associated with risks assessments, animal subjects, conflict of interest, data management, environmental health and safety, export controls, human subjects, research misconduct, and the responsible conduct of research.

According to the National Science Foundation (NSF), Higher Education Research and Development Survey (HERD), research expenditures at the 915 surveyed institutions climbed at 5.5% (\$4.1 billion) in 2018, growing for the third straight year, with a total of \$79 billion (Foundation, 2019). The report also reveals that federal research support accounted for 53% of all higher education funding. Nevertheless, other funding sources grew at an overall higher rate, totaling \$1.4 billion, thereby eclipsing the \$1.2 billion from federal sources. The federal department of Health and Human Services is the largest supporter of federal research with \$22.9 billion in 2018, which accounted for 76% of the growth rate from 2017. Even so, institutions are contributing roughly the same amount of their funds to support research, with a record \$20.4 billion in 2018, the highest level documented

since the onset of the survey. Nearly \$12.8 billion was reimbursed to institutions for facilities and administrative costs (F&A), otherwise known as indirect costs (IDC).

While the data supports the narrative that research is an apt initiative to support the institutions, faculty, and students, the report also indicates that 30 of the 915 institutions account for 42% of all expenditures (Foundation, 2019). The top five institutions were Johns Hopkins University, University of Michigan-Ann Arbor, University of California-San Francisco, University of Pennsylvania, and the University of Washington-Seattle. Smaller institutions, therefore, are tasked with competing for scarce resources with institutions that utilize integrated data collections systems and analytics that support mission and goals. The NSF HERD showed that, in 2018, the bottom 30 institutions observed their research expenditures shrink by 21%. For example, Morehead State University reported a reduction totaling over \$400,000 between 2017 and 2018.

*Table 1: National Science Foundation, Higher Education Research and Development Survey Comparison of the percentage of change FY-18-19.*

NSF HERD Survey FY19 Research Expenditures-Group Comparison		
Top 50 Institutions		
FY18	FY19	% Of change
\$ 45,166,233.00	\$ 48,499,133.00	7%
Bottom 50 Institutions		
\$ 48,644,000.00	\$ 50,212,000.00	3%
HBCUs		
\$ 534,045,000.00	\$ 508,537,000.00	-5%

In this study, the Carnegie classification system will be used to define small schools. The system catalogs a total of 4,324 institutions that are degree granting facilities and were Title IV eligible in 2018. The Carnegie classification system reports annually on doctoral degree granting institutions that awarded at least 20 research/scholarships, had expenditures of at least \$5 million and were classified as “very high research” during the update year, as reported by the NSF HERD survey (Education, 2019). Four-year institutions that had small enrollment (1,000-2,999) and very small (less than 1,000), total 2,576, accounting for 60% of all institutions (Education, 2019).

Recent trends indicate that federal agencies are increasingly investing in research through grants and contracts. States, however, have not kept pace with this shift. The Center on Budget and Policy Priorities maintains that, following the great

recession of 2008, funding for public two-and four-year colleges in 2017 was \$9 billion below the 2008 funding level (Mitchell, 2017). With the states accounting for roughly 53% of funding for teaching and instruction, institutions have taken the approach of raising tuition. They have also made cuts to faculty, closed research labs, and reduced their investments in software and technology. Reduced funding from the states, increased competitiveness among institutions, and larger investments from the institutions in covering the F&A costs associated with grants and contracts have led to an alarming disparity. The average nationally negotiated indirect cost rate (primarily cognizant agencies: the U.S. Department of Health and Human Services or the Department of Defense) at a public research university is 52%; the average effective (actual) rate of recovery (reimbursement) for these same institutions is 27% (COGR, 2014).

The following literature review supports the assertion that small institutions that have extremely limited revenue from tuition and research are charged with increasing the representation of their faculty and staff's engagement in grantsmanship. A partial solution rests in institutions participating in the development, implementation, and evaluation of free and open-source software systems. This review of literature will catalog studies that provide insight into the institutional administrators' interest in technology adoption. This will include a review of the theoretical frameworks, international perspectives of technology adoption, free and open-source software, and the impact of financial allocations to research administration for technology adoption.

### Research Administration Perceptions and Values

To better understand the needs of research administrators, it is important to enumerate the values associated with the profession. Schein (2010) held that accuracy, timeliness, communication, reporting, training, ease of access to information, relationships, tolerance, and humor are the values that drive research administrators and their goals and aspirations. This study seeks to understand how the perceptions of technology adoption and open-source software systems can support training and comprehension of institutional policies and procedures, both federal and state compliance reporting, and grant awarding agencies principles and guidelines. What's more, technology adoption and the use of open-source software systems for research administration, may be an opportunity for improving access to information through standardized data collection processes and systems, and tools for reporting the pre- and post- award functions to both internal and external constituent groups.

Kemp and Sass (2017) explored the expression of those values related to compliance in research administration by assessing how Higher Education Institutions (HEI) lack of infrastructure impacts the pre- and post- administration efficiencies in research administration. The authors used data collected from websites and other sources to determine the pre/post award administrative technologies implemented to administer grants and contracts. One hundred and fifty-nine HEIs were selected for participation, with 61% using systems such as Cayuse, InfoEd, and Oracle, while a significant portion used manual or homegrown systems for pre-award functions of research administration. Results indicate that 64% used the same pre-

award system as they did for post-award administrative functions. The range of funding for those who were selected as subjects (as reported to the NSF HERD survey) was between \$24 million and \$2.2 billion in annual expenditures. While the type of systems and the perception of those systems by research administrators are important, the culture of an organization related to compliance is equally important.

Bailey (2011) examined how the organizational culture affects institutional effectiveness in the administration of research and sponsored programs at Historically Black Colleges and Universities (HBCUs). The areas of culture that Bailey identified as key elements of institutional effectiveness were environment, mission, strategy, information, socialization, and leadership. Since tuition is often the driving force behind the viability of HBCUs, Bailey asserts that the culture of the research infrastructure must be examined, as well, to ensure additional revenue streams are nurtured. The findings of the study suggests that organizational leaders must create a culture for research by ensuring it is reflected in the mission of the institution. More than that, the results indicate that infrastructure for research must be supported by developing designated staff, with access to the president and institutional leadership to share challenges and successes, as well as expansion plans.

Likewise, researchers found that universities were primarily concerned with the development of a research administrative unit/department that included the functions and purposes espoused by Bailey (2011). What's more, the author surmised the difficulty in developing a metric with which to measure success in universities' perception of administration. There is such variance in marks of success at each

institution that standardizing such an experience becomes burdensome and onerous. While institutional leadership is critical in assessing and determining the improvement required for efficient and effective research administration, faculty perceptions must be categorized to meet the institutions goals and objectives of faculty engagement in research. With little concern for the administrative functions of research administration, faculty present a different set of values that impact their interest in preparing proposals for submission and, upon award, increase their capacity to facilitate grants and contracts. Grossman (2015) sought to examine the perceptions of tenured and tenure track faculty, who were successful in grantsmanship on the use of indirect costs and the conflicts that ensue between researchers and university administrators. Several themes resonated from the interviews with the faculty members who served as subjects in the study. The themes included faculty socialization, which denotes the larger role faculty are required to play in supporting the institutional enterprise. The second theme was culture, specifically faculty perception of the recovery of indirect costs as validating the institutions' commitment to research and, in turn, their work was also a factor in faculty interest. Another theme entrenched in faculty interest was political bargaining, the ability to exert power and influence over and between participating parties. Key variables were also identified for each of the themes, which included knowledge, resource values and needs, and internal environments.

### Theoretical Framework for Technology Adoption

This study will utilize the Unified Theory of Acceptance and Use of Technology (UTAUT) model as a basis for understanding technology adoption in research administration. The UTAUT concept results from combining and integrating components of several models that include: The Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Innovation Diffusion Theory (IDT), and the Social Cognitive Theory (SCT), among others. The model by Venkatesh, et al. (2003) details four main factors that influence the intent and use of information technology. They include: performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC), (Venkatesh V. M., 2003).

Below is a representation of the UTAUT model. Be mindful that age, gender, experience, and voluntariness of use are all factors that contribute to the behavioral intention and subsequent usage behaviors.

Ken Krechmer (2006) sought to develop a universal definition of open standards that encompassed the views of creators, implementers, and end users.

Below are the ten requirements as identified by Krechmer that support open standards:

1. Open Meeting - all may participate in the standards development process.
2. Consensus - all interests are discussed and agreement found, no domination.
3. Due Process - balloting and an appeals process may be used to find resolution.

4. Open IPR - how holders of IPR related to the standard make available their IPR.
5. One World - same standard for the same capability, world-wide.
6. Open Change - all changes are presented and agreed in a forum supporting the five requirements above.
7. Open Documents - committee drafts and completed standards documents are easily available for implementation and use.
8. Open Interface - supports proprietary advantage (implementation); each interface is not hidden or controlled (implementation); each interface of the implementation supports migration (use).
9. Open Access - objective conformance mechanisms for implementation testing and user evaluation.
10. On-going Support - standards are supported until user interest ceases rather than when implementer interest declines.

*Figure 1: Reimagining of the UTAUT Model*

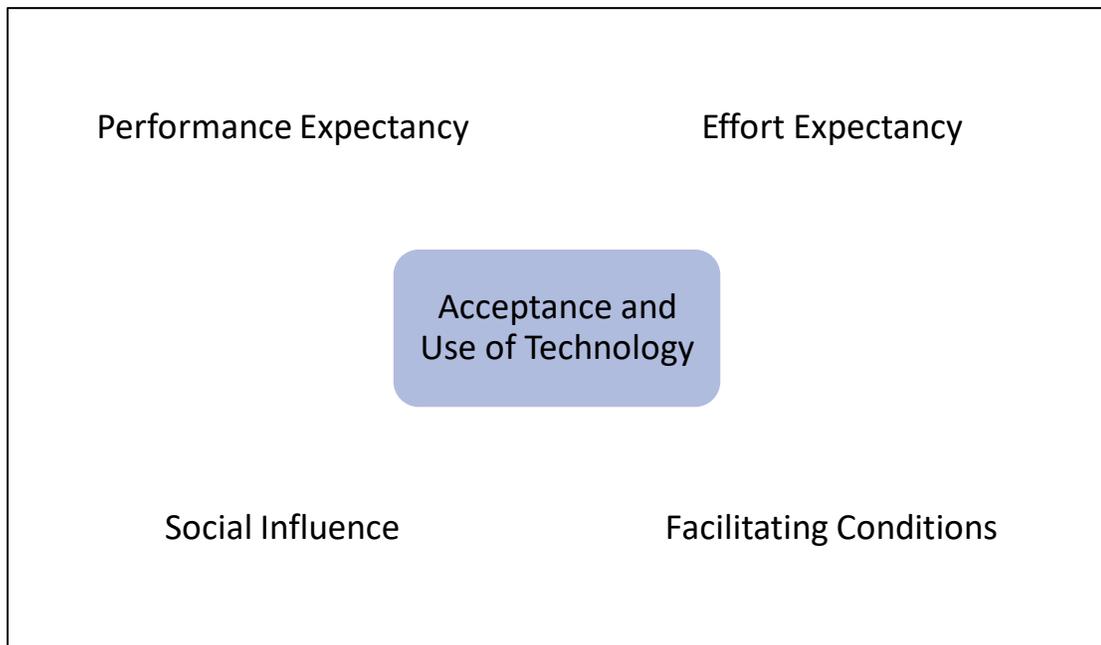
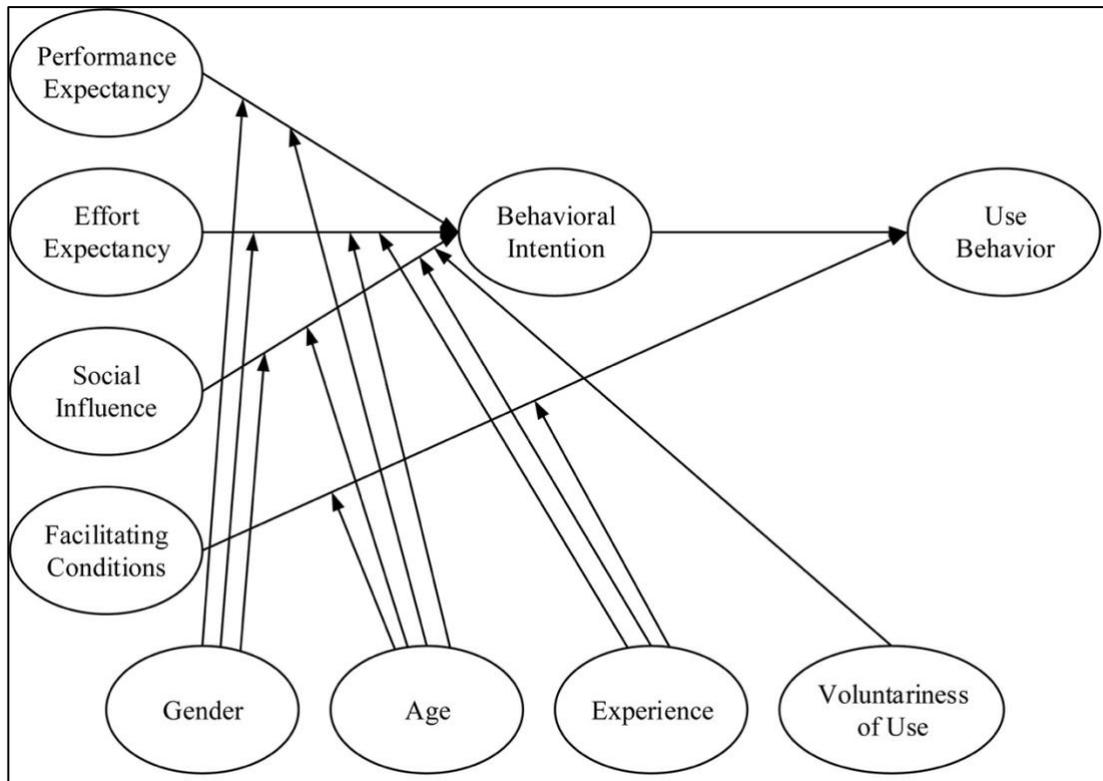


Figure 2: UTAUT Model



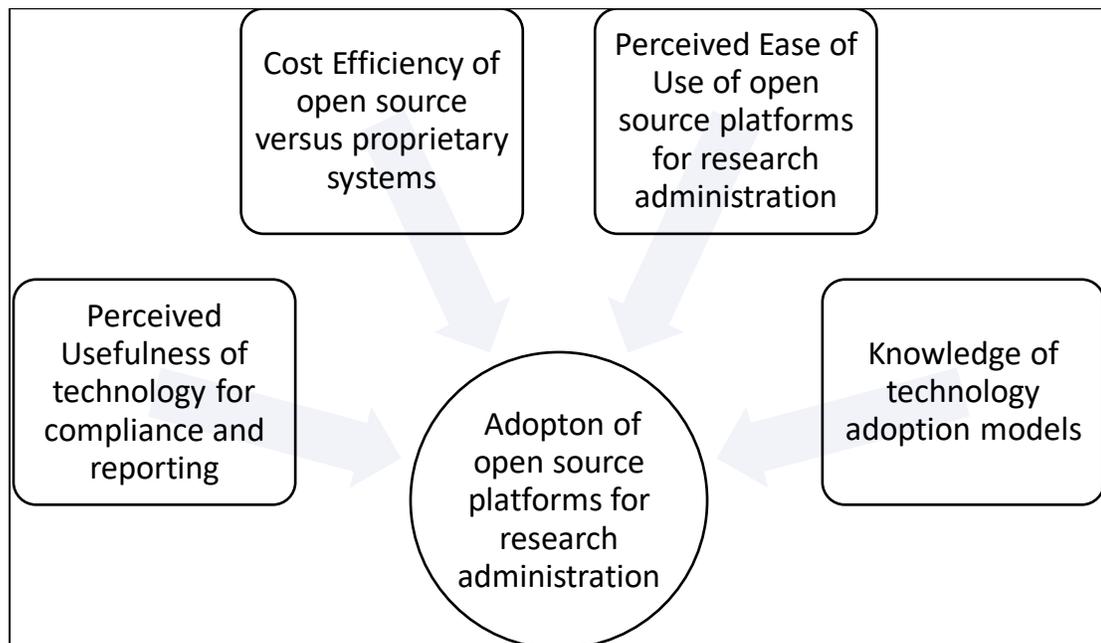
Venkatesh, et al. defined the four elements of the UTAUT model as follows:

- Performance expectancy is explained as “the degree to which an individual believes that using the system will help him or her to attain gains in job performance” (Venkatesh V. M., 2003, p. 447).
- Effort expectancy is specified as “the degree of ease associated with the use of the system” (Venkatesh V. M., 2003, p. 450).
- Social influence is described as “the degree to which an individual perceives that important others believe he or she should use the new system” (Venkatesh V. M., 2003, p. 451).

- The facilitating conditions construct determines “the degree to which an individual believes that organizational and technical infrastructure exists to support the use of the system” (Venkatesh V. M., 2003, p. 453).

In addition to the variables indicated in the TAM and UTAUT models, Venkatesh (2008) and (Wallance, 2014) indicate that hedonic motivation, habit, and price value affect the perceived usefulness of technology, as well as the relevance of the technology to the individual’s work, and the quality of the results that adoption of the technology may generate.

*Figure 3: Proposed Technology Adoption for Research Administration*



The problem of technology integration, along with free and open-source software systems in higher education, is not isolated to institutions or research administration units within the United States. International institutions of higher education have limited resources akin to small counterparts in the U.S. They are also assessing Information Communication Technologies (ICT), in addition to how free and open-source software systems can aid them in increasing organizational efficiency and support the engagement of faculty and external collaborators. The adoption of ICT and the cost benefits of outsourcing the development of software and/or technology in higher education is a global quagmire.

Internationally, Allen, Kern, and Mattison (Allen D. K., 2002) reviewed outsourcing practices in higher education institutions (HEIs) in the United Kingdom by analyzing research and data collection techniques. The authors used a case study of 15 interviews conducted over a period of several months at HEIs classified as old, new, and young universities. The results indicate that outsourcing practices at HEIs were more likely to accept ICT systems if they understood that, culturally, they would have to adjust to the engagement of the private sector in their ICT decision-making processes. The authors noted that ICT power plays by university IT staff deserved examination as well, to ensure that their roles and responsibilities were clearly defined so that academics and administrators could exhibit more control over the functions of ICT systems. Lastly, the authors advised ICT system adopters to be mindful of the politics by acquiring carefully crafted communications and developing

techniques of adjusting and resolving the concerns of both internal and external constituencies.

#### An International Perspective of Technology Adoption

Another international study conducted in Kenya by Muriithi, Horner, and Pemberton (2016) explored the impact of ICT and its capacity to support collaborative research projects. The authors applied a mixed method research model to examine if ICT in Kenya, where infrastructure systems such as the internet were lacking, had an impact on research collaborations. The authors further assessed academic disciplines (agriculture, engineering, public health, and computing) at four institutions regarding their ICT infrastructure as though they were being used for collaborative research. The authors also evaluated the productivity of the research collaborations. Of the 248 respondents, 58% had basic computer skills with over 80% indicating that they had access to a desktop or laptop computer. Overall, the results showed the lack of internet and limited ICT use had an impact on collaborative efforts. These, as well as other, cultural factors, influenced the level of adoption and use of technologies for increased collaborative research deemed productive by the number of publications over a span of time.

The concerns of internal constituencies were examined by Adam and Boateng (2017) concerning how institutions of higher education in developing countries adopt information systems and information technology to virtualize their work environment to improve information management. The activity and agency theories were utilized to assess human interactions using artifacts and relationships between two parties and

the associated bonds. A qualitative interpretive case study was employed by collecting interviews, documents, and participant observation of 20 representatives from various areas at Ghanaian University (Adam, 2017). Results indicated work environments that were physical in nature created duplications in processes, with many staff expressing fears that automation would lead to job loss (Adam, 2017). Moreover, the research team found that conflict existed between the virtual work environment (VWE) development team and administrative staff due to a lack of understanding the rules and processes used in a traditional setting.

Dutse (2015) reviewed information technology adoption (ITA) and its capacity to inspire innovation research and administrative information technologies. The author investigated if ITA could aid Nigerian universities in promoting innovative behaviors and increases in staff knowledge capabilities. Over 300 questionnaires were administered to staff at public and private institutions within various sectors and geopolitical zones of the country. The returned surveys revealed institutions that adopted technology were more likely to be innovative. Additionally, results demonstrated a positive relationship exists between the increased knowledge capabilities of staff and innovation in Northern Nigeria (Dutse, 2015). The study affirms ITA, coupled with staff knowledge capability, can spur innovations in research and technology development that aide the Nigerian national governments innovation and development goals.

Flavin (2016) examined how disruptive technologies affected subjects at a United Kingdom institution of higher education. He further reviewed perceptions of its usage to support teaching and learning. The survey and questionnaire pursued the question of whether the infusion of technology alone was disruptive in nature, based on definitions of disruptive technology by Clayton Christensen in his 1997 publication titled: *The innovator's dilemma: When new technologies cause great firms to fail*. Questionnaire and interview data noted a common thread in the simplicity of technologies (i.e., Facebook, Twitter, Wikipedia, etc.) and ease of use in determining the frequency with which the platforms are used (Flavin, 2016). Results indicate that emphasis should be placed on the methods in which institutions of higher education assess the quality of disruptive innovations. The lack of such evidence is needed by institutions so they might serve as advocates for such technologies (Flavin, 2016). Ergo, these international studies show that global institutions of higher education are, indeed, grappling with understanding that ICT systems require a high quotient of support from institutional administrators. Continuous discussion with faculty and staff regarding the elements of ICT are needful, as well, and will likely lead to increase efficiencies in administrative tasks associated with research.

#### Financial Allocations and Technology Adoption

Domestically, Thomas (2014) examined Transaction Cost Economics (TCE) to ascertain what factors weigh in the decision of institutional administrators to integrate technology via proprietary vendors, outsourcing or building their systems.

The varied audiences of higher education present an interesting dynamic regarding their adoption of technologies and the perceived cost benefits. The study examined the factors and values of the organization that led to the facilitation of their technological needs, either internally or externally. They further assessed terms of those contracted services to outside vendors (Thomas, 2014). The study found the most important factor was identifying the critical team members who aid in establishing the timeframes associated with selecting a vendor and product.

More than that, the results stipulated one of the most significant and prevalent comments of interviewees related to the selection and implementation of learning management systems at Western Global University, differed according to stakeholder groups. Administrators were concerned with pricing and implementation schedules; faculty were only concerned with the reliability of the software platform Siegel (2017) found that, given the rapidity of changing technology, university employees are faced with the arduous task of keeping pace with the knowledge and skill required for these emerging technologies. Resistance and low motivation to use new technology is an obstacle that continues to plague business and educational organizations throughout the world. Technology adoption is not only a hurdle for institutions of higher education. Indeed, leaders at all levels in education must manage the expeditiously evolving dynamics of data collection and analytics methods that necessitate new approaches to resource management and the skill sets needed by technology coordinators.

Sugar and Holloman (2009) conducted a study examining the role of 37 technology coordinators in middle schools in the southeastern U.S. The authors asserted that technology coordinators should have the technical expertise, be able to analyze policies and procedures, and exhibit leadership (Sugar, 2009). These skill sets, specifically leadership and its corresponding characteristics (e.g., problem-solving, resource management, student-centeredness, and servant leadership) were critical in determining if technology coordinators were effective in reflecting the intended, broader impacts of technology in their schools' technology ecosystem (Sugar, 2009). The results showed that over 90% of the technology coordinators were viewed as successful leaders in problem-solving and over 88% were deemed effective in areas such as resource management.

Both internationally and domestically, educators must examine and construct models to implement ICT systems and ensure IT personnel are equipped to assess organizational needs and identify systems that provide a holistic approach to data collection and analysis. Those responsible for navigating today's market for FOSS and ICT adoption must also build consensus and confidence among all stakeholder groups to aid in reliable and sustainable systems using proprietary or community developed software systems.

#### Free and Open Software Systems (FOSS)

FOSS is a form of software that is primarily produced by voluntary, decentralized communities whose members meet virtually over the Internet (Sager, 2017). FOSS is changing the software-writing business, but, more importantly,

higher education and industry concepts of intellectual property. Within the realm of open-source software (OSS), the individuals and teams involved in development include anyone in the software development community allowed unfettered access to the binary and source code. In OSS environments, the developer encourages and supports the use and improvement of the platform, with no consideration for financial compensation (Sagers, 2007). The development and implementation of OSS systems for research administration has the potential to increase efficiencies and effectiveness in sponsored research administration at a minimal cost.

In examining OSS systems Sagers (2007) utilized an adapted theoretical model to assess the developmental community of open software systems (OSS). The author was interested in how these communities sustain themselves, despite their operational disregard to financial interest. By examining a model of community success, Sager scrutinized the resources (or increases in the system of the community of people) needed to sustain itself in the development and maintenance of OSS for the public good. The study was conducted in a longitudinal manner, consisting of 335 useable web-based surveys from an originally dispersed pool of 1,724. The hypothesized model results indicate that larger OSS communities are needed to sustain these platforms with technical support and improvements. With expanded communication among these communities, the vitality of OSS is increased through the time and effort of its members.

Morgan, Feller, and Finnegan (2013) proclaimed that open-source software has evolved from a community-based development organism to one that is used by businesses and industry to create and capture value. The authors focused on the quality and utility of open-source software code, as well as who maintains control upon the invention and what governance structures exist and/or need development to ensure the platform is true to its nature: free and open-source (Morgan, 2013). Erdogmus and Williams (2003) assessed whether paired programming is more efficient and economical as compared to single programmers. Both, personal software processes and collaborative software processes, were examined for single and dual programmers, accordingly, with time and effort the primary factors in determining the cost efficiencies and the quality/defect rate of the program. Results indicate there were substantial benefits to paired effort, with 100% improvement in efficiency. Indeed, such pairing elicited an effort reduction of over 40% t, and a 70% curtailment in time usage (Erdogmus, 2003). Thusly, the authors found there is considerable benefit to pairing programming economically (Erdogmus, 2003).

Contrary to OSS systems, proprietary software is typically developed by teams of individuals working within a firm. Proprietary software is usually designed in a “top-down” mode, wherein programmers write code implementing this design (Neus, 2015). The goal of this type of development is the completion of a project viably and profitably for the company owning the source code. In organizations that develop proprietary software, the individual developers do not profit from their creations.

The matter of profit was explored by (Aldama, 2010) who compared costs associated with open software systems (OSS) versus proprietary systems, specifically within the maintenance of network servers and operating systems. Employing surveys of administrators using Microsoft as compared to Linux, Aldama found that the cost of ownership of OSS and proprietary operating systems over their lifecycle included such factors as maintenance and administration, labor cost, and personnel training. The findings indicate that IT professionals spent less time, on average, servicing Linux versus Windows systems (Aldama, 2010).

Annand (2015) examined an online course and its promulgation of learning content to gauge open educational resources (OER) and their importance as a cost-effective measure for 21<sup>st</sup> century teaching. Annand argued there are financial advantages to utilizing OERs, such as cost-efficient virtual learning environments, which reduces textbook costs to students. The author notes that of the institutions that have adopted OER systems, federal grants are the primary financing tool in the development of such systems. Institutional support also figures into development, but to a much lesser degree and is limited to institutions, such as MIT, which use these innovative approaches as a means of recruitment (Annand, 2015). Annand revealed that many OER systems suffer from a "sustainability crunch" after two years of existence due to the cessation of funding. Thus, the OER systems never mature enough to determine if they can become practical models of financial sustainability. Research conducted by Allen and Seaman (2014), indicate that OER systems are perceived as good or better than proprietary systems, but state perceived lack of

political and institutional will, as well as resource allocation, contribute to OER resistance.

With the increasing appetite for open-source software, Guimarães, et.al. (2013) observed development patterns in such systems by inspecting their effectiveness and activity levels of usage. This examination of life cycles of the growth of online open-source software systems and their impact on organizational development was an added aim of the researchers. Employing quantitative longitudinal data, (Guimaraes, 2013) the author inspected SourceForge, with over 100,000 projects, a million-plus registered users, and the key number of participants to develop a dataset of 1,030 projects and over 24,000 monthly observations. The effectiveness levels were determined by the number of downloads in a month and activity was measured by the number of monthly actions (e.g., bugs opened/closed). The authors concluded while effectiveness grew sharply, activity slowly declines. If interest wanes among its members, both activity and effectiveness will decline (Guimaraes, 2013).

Lee and Davis (2003) found similar results in their examination of the Samba projects evolution as compared to the laws of software development. The Samba project is an open software system that enables UNIX applications to communicate with Windows operating systems for matters such as file sharing and printing. The study utilized both quantitative and qualitative methods to measure the growth of Samba versions released with bug fixes and other updates, as well as feedback from the Samba community via emails, chats, and discussion boards (Lee, 2003). Results

indicated that the drivers of Samba's continued growth and evolution from 1995 to 2002 consisted of community dedication, community and/or commercial use, and the low cost of effectiveness in operations (Lee, 2003).

Open-source software systems have grown in number and variety and data supports their efficiency and effectiveness. Aksulu and Wade (2010) built a taxonomy of open-source research with exploration across various academic areas. Those areas included information systems, operations, and supply chain management research (Aksulu, 2010). Employing a qualitative analysis methodology of 618 peer-reviewed articles, the authors used ProQuest and Google Scholar as search tools for open-source research and refined the data using a multi-stage process of coding to determine the emerging categories (Aksulu, 2010). The findings hold that 88 code categories or patterns (e.g., content management, programming, and software development) could be consolidated into 57 grouped codes (Aksulu, 2010). This effort to standardize the classification of open-source research will allow its proliferation to support its adoption across a variety of domains in higher education. Reporting requirements are increasingly complex and extensive in sponsored research administration. Nevertheless, developers and research administrators can support the effectiveness, growth and activity through concerted efforts to communicate, as well as share ideas and concept improvements.

(William van Rooij, 2009) found the increased demand for support systems in higher education to reinforce instructional pedagogy for faculty and learning outcomes for students. More institutions of higher education are exploring open-

source software systems that will allow them to conserve meager resources by increasing innovative approaches to the institution's technical capacities. Van Rooij discovered that many of the CFOs (58%) surveyed stated the ability to customize software source code was an attractive feature in determining if implementation of such software. Institution infrastructure needs, as assessed by software developers and IT staff, are a significant motivating factor in considering FOSS; there must be a perceived financial benefit, such as cost savings on licenses and training.

Otto (2019) examined the understood differences between open educational resources (OER) and other forms of open access platforms, such as science and instructional pedagogy. The author identified barriers in the adoption of OER in education across multiple platforms, despite the exponential increase in OERs. Otto examined the lessons learned from the adoption and implementation of OERs and design recommendations from participants. The author concluded there was substantial interest in OER and the legal implications of integrating teaching and instructional tools for OER (Otto, 2019). Finally, the results advocated for more training and workshops that should facilitate OER. Such training, it is surmised, would be most effective when inclusive with broader conversations related to teaching and learning.

With growth of the popularity of OSS systems among institutions of higher education, continued research must be conducted to assess its application beyond teaching and instruction. Strict attention must be directed towards administrative tools/software in research administration that supports the litany of compliance

checkpoints. In that vein, (House, 2009) studied the levels and extent to which institutions of higher education utilize OSS. The study found that both domestic and international institutions increasingly used OSS systems as opposed to fee-based proprietary software. Numerous platforms (i.e., Kuali, Moodle, and OpenOffice) allow institutions to extricate resources, including personnel and software purchases with OSS integration.

The approach used by House included the development of a survey to assess factors that institutions used in selecting OSS systems. A model was incorporated to determine critical performance factors in non-OSS versus OSS platforms regarding design and implementation. These types of investigative research efforts should aid leaders of small institutions of higher education and sponsored research administrators to consider actively engaging in the development of administrative tools that support research compliance. Further benefit would emanate from attractive cost savings for institutions already stretched and stressed by limited resources. Proprietary software purchasing can be fiscally sustainable through a process of planning and budgeting.

### Conclusions

The literature review reinforces the assertion that small institutions have difficulty with extremely limited revenue from tuition and research. Not only that, they are tasked with strengthening the representation of faculty and staff engagement in grantsmanship (Foundation, 2019), (Bailey, 2011), (Kemp, 2017). Part of the solution could consist of their participation in the development, implementation, and

evaluation of free and open-source software systems that support efficiencies and effectiveness in sponsored research administration.

The success factors of effective research administration were explored by (Leman, 2016). In this study, Leman utilized the Delphi research method, which leverages the knowledge and experiences of a select group of experts or qualified professionals to obtain a consensus of multifaceted issues through an iterative process. His research found that 50% of those surveyed used organization-created information systems to manage sponsored research, with 37% engaging Microsoft Excel (Leman, 2016). Of the 22 critical success factors of effective sponsored research administration, the majority of participants believed that the information system must be accessible through the internet/intranet, have leadership support and be easy to use. Furthermore, they should integrate across existing institutional information systems and platforms and be able to provide data analytics for robust and flexible reports to all levels across the organization (Leman, 2016).

Eisenhower (2018) concluded the viability of institutions of higher education depends on several factors. They include the support of the infrastructure for research engagement through the allocation of physical space, training in grantsmanship for faculty, dedicated research administrative staff, and policies that support financial incentives and teaching release time for faculty. Allen, Kern and Mattison (2002) concluded that outsourcing practices at HEIs were more likely to accept ICT systems if they understood that, culturally, they must adjust to the engagement of the private sector in their ICT decision-making processes. Allen, et.al, advised that adopters of

ICT systems should be mindful of the politics by adopting very carefully crafted communications and develop means of adjusting and resolving the concerns of internal constituencies.

Adoption of FOSS systems must be mindful of the cultural and political landscape of the institution. Because there is a lack of access to software at smaller institutions, software tools need to be developed to support forecasting analytics tools, budget development, and automated certification/reporting tools that support compliance at the federal, state (if applicable), and institutional levels.

Chapter three of this capstone will provide insight into the research design for this qualitative case study. It will discuss and elucidate the site/location of the study, as well as provide a profile of the subjects/participants. It will further discuss the instrumentation used to collect data and information, research procedures and methods of data analysis. Finally, chapter three will render a discussion of the validity and reliability of the study, as well as study limitations.

### **Chapter 3: Methodology/Procedures**

#### Introduction

This study seeks to gain insight into the perspective of administrators at a small college regarding technology adoption of open-source platforms for research administration. The research questions identified are as follows: (1) What impact does the perception(s) of open-source software platforms have on technology adoption for sponsored research among administrators at a small college/university? (2) What issues or factors support or deter technology adoption? and (3) Do administrative roles and responsibilities affect the perceived usefulness and attitudes towards technology adoption using open-source software platforms for research administration?

#### Research Design

This study seeks to understand the perspectives of administrators at a small, private institution of higher education, as related to technology adoption of open-source platforms for research administration. According to Merriam, “a case study design is employed to gain an in-depth understanding of the situation and meaning for those involved” (Merriam, 1998, p. 19). By using this qualitative approach via interviews, the research will be able to gain a deeper, fuller understanding of the perceptions of technology adoption and the perceived viability of open-source platforms as a means of efficiency and effectiveness in sponsored research administration. The research questions for this study seek to answer the following questions: 1) Do administrators support the adoption of technology aimed at

improving efficiency and effectiveness in research administration? 2) Do administrators support the creation and adoption of free and open-source software systems in research administration? 3) What are their perceptions of the essential elements of a free and open-source software system that supports sponsored research administration at small colleges and universities? 4) Are there triggers (i.e., proposal submissions, sponsored programs awards, and levels of funding) in sponsored research administration that support the need for its existence? 5) Are free and open-source software systems a viable and cost-efficient means of addressing the needs of administrators? 6) Can the creation and adoption of free and open-source software systems aid small colleges and universities in increasing their efficiency (compliance) and effectiveness (i.e., faculty participation and annual funding) in sponsored research administration?

This qualitative case study adheres to the five “traditions” identified by Creswell (1998) which include the biography, phenomenology, grounded theory, ethnography, and the case study. Utilizing a case study model supports the understanding of how the participants forge meaning from a situation or phenomenon (Creswell, 1998, p. 8). This model is also supported by (Stake, 1995), (Merriman, 2002), and (Yin R. , 2003) as an operable means to gain insight into administrator motivations, perceptions, attitudes, and interest in adopting technology for research administration using open-source platforms at a small, private institution of higher education.

## Site

Due to the limited number of studies that assess technology adoption at small colleges and universities, the selection of the site for this research study is based on the size of the institution, the sponsored research funding level, and the absence of a proprietary or localized administrative software system for research administration.

The institution is a small, private liberal arts college that is designated as a Historically Black College or University (HBCU) by the Higher Education Act of 1965. The institution currently does not have a Carnegie Classification but has an enrollment of fewer than 1,000 students. The Fall 2020 Full-Time Enrollment (FTE) is 709. The institution has a total of 41 full-time faculty, 150 administrative staff, and employs the services of over 56 part-time and adjunct faculty during the Fall 2020 academic year. The sponsored research portfolio at the institution over the past five years has primarily encompassed federal financial aid, Title III funding, and the federal TRIO programs (i.e., Upward Bound and the Student Support Services grant). In 2017, its governing board selected the institution's 12<sup>th</sup> President.

The institution does not have a Carnegie Classification nor an approved Indirect Costs (IDC) rate by any of the recognized agencies such as Health and Human Services (HHS). IDC is used to determine the facilities and administrative costs (F&A) the institution can charge on a given federal grant. Thus, the institution utilizes the "de minimis" rate of 10% permitted by the Office of Management and Budgets (OMB) that is cataloged in the Uniform Guidance in the Code of Federal Regulations.

A review of institutional policies does not indicate that the policies and procedures from the Business and Finance Division, the Faculty Handbook, or Human Resources, provide any guidance for sponsored research engagement for faculty or staff. What's more, the institution does not have an organized sponsored research administrative office. The rules of engagement are vague and do not support efficiencies in proposal development and submission guidelines that ensure adherence to established institutional policies or those mandated by the federal government. There is neither a centralized nor decentralized system to manage the post-award functions of sponsored programs (i.e., contract review/approval, time and effort reporting, and fiscal reviews of expenditures).

#### Subjects

The population selected for this study (N=5) is comprised of administrators at the small, private institution of higher education. In total, the institution has 150 administrative staff, comprised of seven vice presidents, four academic deans, and multiple persons who serve at the director and coordinator level. The subjects were selected based on their administrative role, as related to sponsored research administration. The functions and roles of the individuals invited to participate were selected for the following reasons: administrative responsibilities for research administration, fiscal accountability for research expenditures and compliance to the Uniform Guidance (Budget, 2021), and the use of data and reporting for faculty engagement sponsored research for promotion and tenure purposes. Those interviewed included: the Provost/Vice President for Academic Affairs, Vice

President for Business and Finance Administration, the Director of Sponsored Programs, the Vice President for Institutional Advancement/Director of Title III Programs, and the Director of Information Technology.

Confidentiality is critical for interviewee anonymity and privacy. Informed consent was obtained before conducting each interview wherein interviewees were provided the opportunity to decline/withdraw from the study and have their information/data removed from the transcripts. All the interview transcripts have been securely maintained by the researcher and stored on digitally encrypted files.

#### Instrumentation

This qualitative case study followed the guidance of Yin (2014, p. 114) who identifies six sources of evidence for case study research: documents, archival records, interviews, direct observation, participant observation, and physical artifacts. This grounded theory methodology case study utilized interviews to ascertain the perception of administrators in adopting technology for sponsored research administration. The interviews consisted of an unstructured exchange that allows the researcher to modify the sequence of the questions and wording used. The interview consisted of ten questions and allowed for follow-up questions based on participant responses. The interview questions were derived from a research related to technology adoption and the TAM and UTUAT models. Additionally, questions were developed based on my 18 years in research administration and the studies in the review of literature that examined the values and perspectives of research administrators. A copy of the interview questions is provided in appendix two.

### Procedures

The face-to-face and phone interviews were scheduled with the five identified subjects. If the interviewees agree to participate, the interviews will be scheduled via and cataloged using the Gmail calendar system. Once the agreed-upon date for the interviews arrives, the interviewees will be provided an informed consent letter, (see the appendix). Following review and signing of the informed consent form by the interviewees, the following procedures will be facilitated:

Step 1: Inform the interviewee of the purpose and goals of the research study;

Step 2: Inform the interviewee that the interview is being recorded;

Step 3: Inform the interviewee of the confidentiality of his/her responses;

Step 4: Allow questions from the interviewee

Step 5: Obtain signatures of the informed consent

Step 6: Ask interviewee name, title, daily tasks, role and responsibilities;

Step 7: Ask interview questions;

Step 8: Allow the interviewee to ask questions or elaborate on the interview questions;

Step 9: Follow up to responses from the interviewee;

Step 10: Allow the interviewee to make final remarks to follow up questions;

Step 11: Thank the interviewee for participating and end the interview; and

Step 12: The researcher will transcribe the notes and audio recordings for documentation purposes.

### Data Analysis

An analysis of the interviews was coded manually during open coding. The researcher coded all the interviews simultaneously using this method. The transcripts of the interviews were uploaded into computer software, Otter.ai, for further analysis. The transcribing process is useful because it produces a verbatim narrative readout of the interviews. The researcher reviewed the audio files and transcriptions from Otter.ai, to ensure their accuracy and, when needed, updated/revised/modified the final transcripts. Additionally, the Otter.ai, transcription system provides frequency numbers which supports the organization of themes related to the topic of this capstone.

#### Reliability and Validity

The “logical model of proof” as described by (Yin R. , 2003, p. 34), supports the trustworthiness of the case study design and addresses the reliability and validity of the data propositions, as well as the logic of the analysis of data.

#### Reliability

Replication is a sure means of addressing external reliability. The scientific community should be able to replicate this study, which would be most applicable to those who have a vested interest in technology adoption for sponsored research administration using open-source platforms. Further external validity is the identification of the researcher as a member of the group being studied. This supports the disciplined subjectivity and provides clarity to my experiences and interest in research administration. I have served as a sponsored research administrator for the

past 18 years. Another measure taken to ensure external reliability are the data collection techniques, which was detailed earlier in this chapter.

Internal reliability concerns were addressed through a collection of the data and ensuring that the interviews were transcribed verbatim. The maintenance and documentation procedures of the data collected also support the reliability of the study.

#### Validity

To support the construct validity, the researcher demonstrated the research measures reflected the linkages between the conceptual framework and the objectives of the study as identified by (Yin R. , 2003, p. 35). Incorporating multiple sources of evidence proved another means of supporting the internal validity of the study. The researcher used data sources, participant interviews, documents from the organization, and a continuous review of related literature to support the internal validity of the study.

#### Limitations

This qualitative case study concentrated on the perceptions of institutional interest in technology adoption of open-source software as an administrative tool in sponsored programs at a small college in the Southeastern United States.

Accordingly, this study does not cover the spectrum of research related to the adoption of technology, nor does it address all matters and aspects related to open-source software systems. Indeed, this study is exclusively focused on a small, private institution and does not include an analysis of research administrative tools or

frequency of use of proprietary or open-source software systems on a regional, national, or global scale. The small sample size of this study limits the transferability of the findings to the comprehensive analytical output related to technology adoption and open-source software perceptions.

By employing a case study approach, there are inherent limitations, as well. These limitations are associated with the lack of investigation of more sites to further bolster the argument of the perceptions of technology adoption concerning research administration. There may be subsequent researcher biases, based on former and current roles within research administration and the organization.

#### Conclusion

This chapter provides a discussion of the case study approach used in this capstone project to examine perceptions of technology adoption and the viability of open-source platforms for research administration at a small college in the southeastern US. This methods section provided the approach to this qualitative study, which included a detailed account of the site, the interview procedures with which to collect information from participants, the data analysis techniques used to compile responses to interview question, a summary of the potential reliability and validity issues, as well as discussions on the limitations of the study being conducted at a singular site.

Chapter four will provide a restatement of the research questions and provide a profile of the site of the study, while also imparting a detailed description of the study participants. The most critical part of chapter four will be the discussion of

themes from the interviews with the study participants. Finally, a narrative dialogue will be provided on the findings and results from the study.

## **Chapter 4: Findings**

### **Introduction**

This chapter provides the results of the qualitative case study method and adheres to the five “traditions” identified by Creswell (1998), using the grounded theory methodology to answer the following research questions:

**RQ1:** What impact does the perception(s) of open-source software platforms have on technology adoption for sponsored research among administrators at a small college/university?

**RQ2:** What issues or factors support or deter technology adoption?

**RQ3:** Do administrative roles and responsibilities affect the perceived usefulness and attitudes towards technology adoption using open-source software platforms for research administration?

This chapter also discusses the process of analyzation of the interview data collected, which were based on the grounded theory methodology in relation to the research questions. The purpose of this study was to explore the impact technology adoption has on institutional leadership at a small college/university and their perceptions of open-source software platforms as tenable means of ameliorating sponsored research administrative functions. This study will support the development of disruptive innovations that maintain enhanced data collection, reporting, as well as

the use of results for systems that sustain increased efficiency and effectiveness in sponsored research administration.

#### Profile Information

##### The Institution

The four-year institution awards degrees from 17 majors with a liberal arts foundation. According to the Integrated Postsecondary Education Data System (IPEDS), (U.S. Department of Education. Institute of Education Statistic, 2021), the institution has a total enrollment in the Fall of 2020 of 712 students, of which 95% identify as Black or African American. The institution also has a total of 43 instructional, full-time faculty and was reaffirmed by the Southern Association of Colleges and Schools, Commission on Colleges (SACSCOC) in 2020 for an additional 10 years. The institution does not have a Carnegie classification, which represents the level of research facilitated at the institution, nor does the institution participate in the Higher Education Research and Development survey, published annually by the National Science Foundation. According to the annual audited financials of the institution, over \$15 million were expended in federal grants and contracts during the 2020 fiscal year. These grants and contracts expenditures include the federal PELL grant program, TRIO cluster (Upward Bound and Student Support Services grants), institutional aid from the Title III grants, CARES Act funds, and other competitive grant programs.

### Study Participants

Five participants were interviewed for this study. All study participants were employees of the institution, with 60% being employed three years or less. Two of the participants had an average of 24 years of service at the institution. The gender of the participant population was 40% female and 60%, male. Related to roles and responsibilities of the participants, 60% served as senior administrators, while the remaining 40% served at the Directors' level.

*Table 2: Profile of Participants*

<b>Interviewees</b>	<b>Institutional Role</b>	<b>Years at the Institution</b>	<b>Gender</b>
Interviewee 1	Provost/VP for Academic Affairs	21	Male
Interviewee 2	VP for Advancement and Director of Title III Programs	28	Female
Interviewee 3	VP for Business and Finance Administration	11 months	Male
Interviewee 4	Director of Information Technology	3	Male
Interviewee 5	Director of Sponsored Programs	6 months	Female

The functions and roles of the individuals at the institution invited to participate were selected for the following reasons: administrative responsibilities for research administration, fiscal accountability for research expenditures and compliance to the Uniform Guidance (Budget, 2021), and the use of data and reporting for faculty engagement sponsored research for promotion and tenure purposes. Those interviewed included: the Provost/Vice President for Academic Affairs, Vice President for Business and Finance Administration, the Director of

Sponsored Programs, the Vice President for Institutional Advancement/Director of Title III Programs, and the Director of Information Technology.

## Results

This section will describe the results derived from the participant interviews and catalog those findings based on distinct themes, as related to the perceptions of institutional interest in technology adoption of open-source software. The research design for this case study is based on a single institution and engaged qualitative methods. This design focused on the pre- and post-award data collection needs of sponsored programs administrators and compliance reporting requirements for internal and external stakeholders. The use of results to support the development of performance evaluation measures of research administrators, academic divisions and units, and other non-academic units that participate in grantsmanship was central to the design.

The major emerging themes are presented and provided in the order of importance based on the frequency in response to the interview questions. They were identified, coded, and analyzed in relation to the research framework, the research questions and the interview data.

### Theme1: Local communication of technology adoption

When the interviewees were asked about the perception of the institution's response to emerging technologies, they overwhelmingly indicated communications regarding emerging technology were facilitated at the individuals' level/department of the institution. The responses included the following:

Interviewee 2: It depends on what area you're in, it is more departmentalized than maybe institutionalized. But I think within individual areas, it may be, you know, regular.

Interviewee 3: So almost a siloed approach, per function areas, where we may be strong in some areas and moderate in some areas, such as finance, you may be relatively moderate.

Interviewee 1: I think our communication is, is fairly efficient, but limited to the areas that need or that that will be required to use that technology. We engaged a fairly robust process of accessing and utilizing technology, particularly to automate and create more efficiencies in our administrative systems, particularly with the instructional technology.

Interviewee 5: I have not been made aware of any new advances in technology that have been made available to staff. I'm not aware of any publication or announcement regarding that.

Theme 2: Relationship between years of service and perception on technology adoption

The interviewees demonstrated a difference of perception of the institutions' efforts to adopt and communicate emerging technology. Interviewees who have served longer: interviewee 1 (21 years), interviewee 2 (28 years), and interviewee 4 (3 years) held that the institution was astute at adopting and communicating emerging technologies.

Interviewee 1: I would say overall that the college is exhibiting, really robust utilization of available technology.

Interviewee 2: The college has always sought to be at the cutting-edge of technology, and throughout the years have been seen as leaders in technology adoption and the use of open-source systems, particularly as an instructional method. The institution allows faculty to use open-source educational resources for instruction.

Interviewee 4: Yes, we are paying attention to all things IT.

Those who had served shorter lengths at the institution, interviewee 3 (11 months), and interviewee 5 (6 months), held the perception that the institution exhibited limited efforts to adopt or communicate emerging technologies.

Interviewee 3: I'm Teetering on either saying just does not applicable because I don't think people even know what emerging technology are, so I don't think isn't a negative perception, or is there a positive one. When you talk in terms of, I think analytic capacity, I don't think they really know what exists. If we could do a scale of one to 10, one to five, I would say a one.

Interviewee 5: I have not been made aware of any new advances in technology that have been made available to staff. I'm not aware of any publication or announcement regarding that.

### Theme 3: Staffing and resources as a barrier to technology adoption

Interviewee 4, who serves as the Director of Information Technology, indicated that limited staffing and decision-making were a hindrance to the adoption and successful implementation of technology.

Interviewee 4: Economics have always been a hindrance, where economics has not been a hindrance, we've been playing catch up...you got to have all the foundational pieces in place, and they have to be functional before all of them can work. And you can move to a faster pace. So often, we try to, to jump and jump over some things that we later find out are integral parts of the puzzle. And in things, they're hindered from working because everything isn't in place. So, the foundational internet, we've been working on that the equipment that we're using to relay transmit, to carry information from building to building has been reviewed.

-Overseeing and make sure that everybody's doing it the right way, and then who's enforcing it having the power to enforce it. Sometimes by the time it finds out that there's a Database or Software, whatever someone's already agreed and wrote, check. Didn't come through us, you know, and then we go into like, oh, we need to see if it's compatible.

-I don't know if this is even possible, because of the finances at HBCUs. We have one person doing too many jobs.

These responses from the individual in the administrative unit responsible for procuring, implementing, and troubleshooting software systems and technology at the institution held the perspective that the department was not included in the decision-making process when proprietary or open-source systems were procured. The information technology department was not consulted regarding compatibilities with existing systems. This was validated by other interviewees who indicated that technology adoption was localized, (see theme one).

Theme 4: The hack of 2017 accelerates data security concerns related to the adoption of technology

It should be noted that the institution had a ransomware attack in 2017. Interviewees employed at the institution during this crippling breach indubitably answered questions with this in mind; data security is certainly of the utmost importance in their decision-making, as related to technology adoption for both proprietary and open-source systems. This ransomware attack incapacitated enterprise resource planning (ERP) systems for business and finance, financial aid, in addition to the learning management system, which aided the monitoring of student success measures. In response to the ransomware hack in 2017, the institution utilized a system of “smartsheets” to manage the ERP functions of the institution.

The smartsheet system (<https://open-source.smartsheet.com/solutions/education>) allowed the institution and its officials to manage the daily operations of the institution. This system was used in tandem with MS Excel, as preparation for annual audit documents and reports. Since the

ransomware hacks, the institution decided to join a consortium of private institutions to purchase the Ellucian Colleague system. The rationale for joining the consortium was cost-based. The costs associated with becoming a member of the consortium (and recognizing the costs saving associated with the collective), they decided, far outweighed independently procuring an ERP such as Colleague or Banner, through Ellucian, or Peoplesoft. Nevertheless, the institution has not been able to regain access to the data and information encrypted during the ransomware attack. Most assuredly, these factors forecast the reservations of administrators who were employed at the institution and endured the aftermath of the ransomware attack.

Interviewee 1: it's only recently, within the last four years, maybe three and a half years that faculty have come to the kind of awareness that they have of Colleague and its capacities. You know, before we had the ransomware, attack, faculty only engaged colleague to report final grades.

-All the cyber protections, all the things that you need the things that you think about for handling your data, and that you then have access to your data with no strings attached or whatever, it's just out there.

- By the same token, it's only recently, within the last four years, maybe three and a half years that faculty have come to as the kind of awareness that they have of Colleague and its capacities. You know, before we had the ransomware, attack, faculty only engaged colleague to report final grades.

Interviewee 2: Because you know, we know a lot of pirating goes on, we know that there are a lot of cyber thieves who can look one way and be

something else. And if you've got mechanisms in place, that help thwart that, because I don't think you can ever get rid of it completely, but at least help through it that and, and really kind of decrease the chance of that because you want to feel like it's a safe space.

Theme 5: Lack of support and security biggest risks to technology adoption from open-source platforms

As previously mentioned in theme four, security was a major consideration concerning technology adoption using open-source systems. However, when asked the question, “What are the benefits and risks when considering adopting technology from open-source platforms?” the interviewees shared some similar security concerns. They also appraised other risks, as well, such as compatibility, support systems, and desirability of use/continuous updates as some of the pronounced risks.

Reflections are provided below on the benefits and risks, as supplicated by the interviewees. It is interesting to note the perspectives of interviewee 3, regarding these benefits and risks associated with technology adoption and open-source systems. Interviewee 3 serves as the Chief Finance Officer (CFO) and has maintained this role for eleven months. Prior to the appointment as CFO, interviewee 3 served in high levels of state government as the chief official for the data analytics unit. Interviewee 3 presented a candid perspective on the institutions' readiness for technology adoption, stating, “I'm teetering on either saying just does not applicable because I don't think people even know what emerging technology are [...]”.

Interviewee 4 also provided some compelling insights of the benefits and risks associated with technology adoption and open-source software systems. They indicated the lack of procedures for data entry and the impact on data integrity and reporting is most damning. Other perspectives and accounts are provided below.

Interviewee 3: The risks of open-source technologies that are initially established with in-house expertise, and there's always error, most open source platform, there isn't support. They don't have a formal level of support where you can submit a help desk ticket.

-Some of the risks associated with it (open-source systems) is someone else manages it offsite unless you have it on-premises, then because if you have a cloud environment, then you have a data security risk.

Interviewee 5: I think it disadvantages is being able to link them with other departments that might use itself use that information like your business office or your finance area.

Interviewee 1: I think the risk really is more associated with not so much as risk as it is the desirability of use...and that's besides, it's the how up to date is the content, and how much is maintained in that way.

Interviewee 4: The big question always comes up with open-source is security. So, if you're able to answer the security question, if people can feel

comfortable that their information isn't out for everyone else, then you probably can move forward with that.

#### Theme 6: Triggers that support technology adoption

When asked about the triggers that support the need for sponsored research administration software, interviewees imparted a range of factors. Interviewees stipulated the need for software to support growth, efficiency, and effectiveness in sponsored research administration. Interviewee 3 provided insight from the stance of the CFO, indicating that the time and effort associated with the financial management of grants is a consideration based on the number of grant awards and amounts:

Interviewee 3: I think you will have to establish a substantial ratio, and that ratio will be the number of grants awarded in relation to the amounts, right. Don't do me no good, If I got 500 awards, I only got \$1,000. I would rather have two awards and get a million dollars.

- I think you've got to have some kind of KPI (Key performance indicators) that are measurable, to determine whether us filling out all these applications is efficiently. Is there a return on investment?

- What's the hit rate, but what money is coming in, and the award associated with it. Well, I filled out 500 grand proposals and I got 400, but you only got \$50,000. Versus that one department that filled out three and they got three million. So why do I need software?

- What was the time and effort it took to write the grant in correlation to how much you were awarded? So, if you're at \$20,000, and your time the effort was \$40,000. Essentially the school lost money.

The other interviewees advised having support systems in place for tracking the current sponsored programs portfolio and preparing for future growth were the triggers that would support the need for sponsored research administrative software. Moreover, Interviewees two and four, whom both have a history and are currently responsible for managing grants and contracts, were concerned with the institution's capacity to monitor and report deliverables to the awarding agency or organization.

Interviewee 2: You've got to have the supports in place, you got to operate, have the processes and operations in place, if that software, whatever type of infrastructure, you need, to be able to set the area up for success... You've got budgets, you've got all these things that come into play with other folks' money. Basically, what you're doing via the federal government, another agency, a person, a private, whomever it is, who said, you said in your application, you would deliver or do this thing, in this amount of time for this, you got to have work product, you've got to be able to manage and track that.

Interviewee 4: From my time working as a compliance officer, the one thing, especially with HBCUs we had to deal with was, period performance. If you don't understand the period of performance, then you can't get anything else straight. What are your start dates, what are your end dates? What are all the milestones in between?

Interviewee 1, who served as the chief academic officer, relayed policies supporting financial incentives, release time, promotion and tenure as triggers for sponsored research administration. These policies, the Interviewee claims, are related to the strategic goals for growth in research engagement by faculty.

Interviewee 1: If we start on the front end and say, look, we have a goal that in the next five years, we're going to increase the amount of grant applications that are completed and submitted ahead of the deadline as opposed to at the deadline, then what we would need to know is what's the digital tool that's going to help us reach that? Or do we have on the backside... a certain dollar amount, that's when then we invest, because we need to be more efficient. I would lean toward the front side, but if we want to say make a strategic plan, that we're going to increase the number of faculty involved in submitting grants to X percent, then then we need a digital way to identify who they are and a digital tool. I guess I should say it's going to help us vet out those research projects that are out there. And we can actually say, oh, we've got faculty who could do this research. And then on my side, you know, I wouldn't be able to say, okay, if we're focused on social science faculty, then I need to be thinking in terms of what kind of course releases is necessary. What are the ways that that's going to impact instructional delivery or the need for adjuncts? Those kinds of things. And of course, if we had a digital tool, it's helping us see on a dashboard, we would be way more efficient at accomplishing that. Certainly, at reaching that kind of a

benchmark, where you say, we want to increase faculty participation in grant research by 20% in five years. But I think, you know, we've got faculty who do research who are publishing, and they're doing it by squeezing it in on their own time here and there. If we can help them find support dollars, then they could be doing that and teaching a lighter load and paying for an adjunct to teach.

#### Theme 7: Limited knowledge of open-source software systems

While some interviewees maintained (as indicated with Themes One and Two) a deficiency of global or institution-wide communication regarding emerging technologies exists, they continued to credit the members of their departments as astute and on “the cutting-edge of technology and throughout the years has been seen as a leader in technology adoption and the use of open-source systems”, (2, 2021). The interviewees, however, were not very commendable towards their own understanding of open-source systems. With good reason, too. They simply lacked mastery of that skill. Indeed, many had limited knowledge of open-source software systems for database management systems or enterprise resource planning (ERP) systems.

The table below provides a listing of the most popular open-source ERP systems, according to (The Best Open Source ERP Software of 2021). A listing of the most popular enterprise grade-Database Management Systems (DBMS) (Top 8 Most

Popular Enterprise Grade Open Source DBMS Software, 2021) is also provided in comparison to the responses of the interviewees.

*Table 3: Popularity and Knowledge of Software Systems*

<b>Open-source Enterprise Resource Planning (ERP) systems</b>	<b>Enterprise Grade Open-source Database Management Systems</b>	<b>Proprietary Sponsored Research Administration Software Systems</b>	<b>Open-source Sponsored Research Administration Software Systems</b>	<b>Interviewee Responses</b>
Apache ofbiz	Altibase	Infoedglobal	Kuali	Interviewee 1: Open Stax, Alabama Virtual Library
Compiere	MySQL	Cayuse		Interviewee 2: None
Dolibarr	PostgreSQL	Streamlyne Research		Interviewee 3: R, Python
ERP5	Maria DB	Huron		Interviewee 4: Linux
ERPNext	MongoDB			Interviewee 5: None
Flectra	Cassandra			
iDempiere	SQLite			
Metasfresh	Cubrid			
ODOO				

The interviews also revealed a lack of knowledge of proprietary systems associated with sponsored research administration. These systems include Infoedglobal., Cayuse, Streamlyne Research, and Huron. Kuali is currently the only open-source platform for sponsored research administration (<https://www.kuali.co/>, n.d.).

Theme 8: Supportive of technology adoption from open-source platforms for sponsored research administration

The interviews revealed a supportive inclination toward technology adoption from open-source platforms for research administration by all the participants. The rationale for each interviewee varied. Their support hinged on such matters as the volume of grant applications and awards, pricing, controls, developer interests, and training.

Interviewee 3: Yeah, because we don't have the volume...you can take something that was built in MS Access, and it basically gives you all the outputs that you need to facilitate reporting. That's absolutely free.

- I think value dictates the level of specificity that you need in a software, right? If the volume doesn't exist, then it makes no sense to go out and get a Peoplesoft grants and contracts module at \$200,000. You ain't going to never get \$200,000 in indirect in a year. It ain't even worth it.

Interviewee 1: Yes, because that's the argument that I've been making to faculty with regard to open-source materials for their courses. I do think it's a cost-effective tool to be used, simply because it requires less investment across the board.

- We would need some controls.

Interviewee 4: I do with the understanding that if security is not an issue... If you do have someone on staff that can program or tweak it, it gives you so much more flexibility.

- Now, the only question is the person developing it if their allegiance is to you or are they selling to you?

### Summary of Findings

This chapter provides the key themes derived from the primary data collected through participant interviews. Each interview was approximately 45 minutes in length and conducted in a face-to-face format. Eight major themes emerged from the participant interviews, which totaled approximately four hours and 26 minutes in duration. Themes were cataloged based on the frequency of discussion and are provided in the following ranked order: local communication of technology adoption; the relationship between years of service and perception of technology adoption; staffing; and resources as a barrier to technology adoption. The hack of 2017 propels data security concerns related to the adoption of technology; lack of support and security are the biggest risks to technology adoption from open-source platforms; triggers that support technology adoption; limited knowledge of open-source software systems; and support for technology adoption from open-source platforms for sponsored research administration were all also emerging themes from the study data.

The final chapter (five) of this capstone project will interpret the findings from this chapter and answer the research questions posed in this study, based on the themes derived from the interviewees. Chapter five will also impart a discussion of

future actions for the researcher, as related to this capstone project. Finally, chapter five will provide a discourse of the implications of this research project for sponsored research administration and technology adoption for small colleges and universities considering open-source software systems.

## Chapter 5: Conclusions, Actions, and Implications

### Introduction

This study seeks to assess the perceptions of institutional interest in technology adoption of open-source software as an administrative tool in sponsored programs at a small college in the Southeastern United States. The conceptual framework for this qualitative study was provided in chapter three, which adheres to the five “traditions” identified by Creswell (1998). These “traditions” include the biography, phenomenology, grounded theory, ethnography, and the case study. Employing a case study model supports the understanding of how the participants make meaning of a situation, or phenomenon (Creswell, 1998, p. 8). The themes identified in chapter four were centered on the following research questions:

**RQ1:** What impact does the perception(s) of open-source software platforms have on technology adoption for sponsored research among administrators at a small college/university?

**RQ2:** What issues or factors support or deter technology adoption?

**RQ3:** Do administrative roles and responsibilities affect the perceived usefulness and attitudes towards technology adoption using open-source software platforms for research administration?

This chapter utilizes the emerging themes from chapter four to analyze the findings and conclude the research questions. Additionally, this chapter will provide implications for small institutions of higher education, as related to technology adoption and open-source software systems for sponsored research administration.

Lastly, recommendations will be supplied for further research on the matter of technology adoption.

## Conclusions

### Research Question One

What impact does the perception(s) of open-source software platforms have on technology adoption for sponsored research among administrators at a small college/university?

Themes two, four, five, seven, and eight became evident in answering research question one. The results indicated in theme eight that interviewees were overwhelmingly supportive of technology adoption from open-source platforms for sponsored research administration. This support is based on the perceived value, pricing, controls, developer interests, and training, which is consistent with the findings of Rogers (1995), who published his diffusion of innovations theory in 1962. Rogers held that adopters of innovations could be grouped into the categories of innovators, early adopters, early majority, late majority, and laggards. These perspectives on the adoption of technology and open-source software systems are also consistent with the findings of Burdt and Bassett (2005). They maintained information technology administrators viewed open-source technology as a social movement in higher education, thus the attraction to the concept.

The findings from this qualitative research effort indicate that the interviewees believed as much, too. “Yes, because that's the argument that I've been making to faculty with regard to open-source materials for their courses, I do think it's a cost-

effective tool to be used...we would need some controls” as indicated by (Interviewee 1, 2021), and Interviewee 4 concurred, stating: “I do with the understanding that if security is not an issue...If you do have someone on staff that can program or tweak it, it gives you so much more flexibility” (Interviewee 4, 2021). These findings are also consistent with the work of Stewart and Gosain (2004), who developed a framework to examine the ideology of open-source development teams. They asserted that “clan control” is critical in open-source development because they lack formal behavioral and outcome controls. Participants’ limited knowledge of open-source software systems is discussed in theme seven. The results from (Aldama, 2010) examined the cost of ownership of open-source software and proprietary operating systems during their lifecycle. Administrator surveys who used systems such as Microsoft and Linux, revealed IT professionals spent less time, on average, servicing Linux versus Windows systems (Aldama, 2010).

The impact “security” had on the findings from research question one, as based on participant perspectives, are discussed in themes four and five. The participants recalled a 2017 security hack, which crippled the institutions’ ERP systems and directed their approaches to open-source systems and the adoption of technology. Understandably so, control, support, and security are matters of great apprehension for participants. The interviewees overwhelmingly indicated that the “hack of 2017” presented deep concerns about open-source platforms for sponsored research administration. Interviewee 2 provided some insight into this area and stated:

Because you know, we know a lot of pirating goes on, we know that there are a lot of cyber thieves who can look one way and be something else. And if you've got mechanisms in place, that help thwart that, because I don't think you can ever get rid of it completely, but at least help through it that and, and really kind of decrease the chance of that because you want to feel like it's a safe space.

This issue of security is consistent with Lawton (2002) who declared security as the main barrier to the adoption of open-source software. The false perceptions of security related to open-source systems were affirmed by John Reinke and Hossein Saiedian (2003). Emergency response teams at Carnegie Mellon found security vulnerabilities to open-source systems were fixed at a higher rate and with a quicker response time than proprietary systems. This notion of fear and mistrust was more acutely explored by Slovic (2000), who noted that the management of fears from technological hazards is related to a lack of trust and the acceptance of risks among those we entrust to manage those systems.

The results also specify a relationship between years of service and interviewee perception of technology adoption as discussed in theme two, chapter four. Interviewees 1, 2, and 4 held that "the college has always sought to be at the cutting-edge of technology, and throughout the years have been seen as leaders in technology adoption and the use of open-source systems, particularly as an instructional method" (Interviewee 2, 2021). This cohort maintained an average span of service at the institution of over 17 years. Their roles included the Chief Academic

Officer, the Vice President for Advancement and federal Title III programs, and the Director of Information Technology. This compared markedly with those interviewees who had served shorter lengths at the institution. Interviewee three (11 months), and interviewee five (6 months), all held the position the institution exhibited limited efforts to adopt or communicate emerging technologies. I Interviewee 3 stating, “I’m Teetering on either saying just does not applicable because I don’t think people even know what emerging technology are...”. This is significant, given the work history of this interviewee, who served as the chief data integrity and analyst for a state system before he was appointed as the Chief Financial Officer at the institution. It is also important to note that Interviewee five has served in the roles of Director of Institutional Effectiveness and Director of Sponsored Programs at other colleges and universities prior to her appointment at the institution.

Participant perception of technology adoption was consistent with the motivators of usefulness, price value, relevance to the individual’s work and quality of results as discussed in the review of literature in the TAM and UTAUT models, Venkatesh (2008) and (Wallance, 2014).

#### Research Question Two

What issues or factors support or deter technology adoption?

Interviewees communicated in themes one and three through five, the factors that support or deter technology adoption. The themes resonated with the institution’s capacity to communicate globally the technologies adopted at the local/administrative levels. The impact of staffing and limited resources to purchase proprietary systems,

security., and the lack of support are also factors that deter the institution from technology adoption. The sentiments expressed by the interviewees indicated that communication is “limited to the areas that need or that will be required to use that technology”, (Interviewee 2, 2021), to “economics being a hindrance”, (Interviewee 1, 2021). Interviewee four stipulated that, in addition to finances, staffing at small colleges, particularly at HBCUs’, play a major role in their support of technology. Interviewee two goes on to discuss the issue of security, by stipulating that the “if you’ve got mechanisms in place, that help thwart piracy/security threats because I don’t think you can ever get rid of it completely, but at least help through it that and, and really kind of decrease the chance of that because you want to feel like it’s a safe space”.

According to the interviewees, administrative efforts supporting technology consist of substantial increases in the number of submitted grant proposals; additional faculty involved in grantsmanship to strengthen efficiency in grants identification, as well as the timeliness of grants submissions. These factors illuminate the need for efficient, effective tools to support stabilization and growth in research administration. This goal could become fully realized with the adoption of technology using open-source software systems. These conclusions are consistent with the body of research regarding the success factors of effective research administration, as discussed by (Leman, 2016). The author asserted the information system must be accessible through the internet/intranet, have leadership support, be easy to use, integrate across existing institutional information systems and platforms, and be able

to provide data analytics for robust and flexible reports to all levels across the organization. These findings also adhere to similar conclusions reached by Eisenhower (2018), who stated the viability of institutions of higher education depends on the support of the infrastructure for research engagement through the allocation of physical space, training in grantsmanship for faculty, dedicated research administrative staff, and policies that support financial incentives and teaching release time for faculty. The findings from Morgan, Feller, and Finnegan (2013) also support the notion that open-source software must be focused on the quality and utility of open-source software code. They contend an institution must be mindful of who maintains control upon the invention and what governance structures exist and/or need development to ensure the platform is true to their nature free and open-source (Morgan, 2013).

### Research Question Three

Do administrative roles and responsibilities affect the perceived usefulness and attitudes towards technology adoption using open-source software platforms for research administration?

Themes two, four, seven, and eight serve as the basis for the researchers' understanding of the perceived usefulness and attitudes towards technology adoption using open-source software and platforms for research administration. Results indicate that all interviewees believe that open-source software systems are an operable tool for research administration. This notion was confirmed in theme eight;

interviewees were supportive of such technology adoption based on the perceived value, pricing, controls, developer interests, and training involved with the adoption.

The perspective of the administrative staff (i.e., the study participants) concur with the findings of Burdt and Bassett (2005). They contend acceptance and support of technology adoption are viewed as an attempt by the academy to further the knowledge base regarding the value, performance, and availability of open-source software systems. This, in turn, enhances efficiencies and effectiveness in administrative functions of both private and not-for-profit organizations.

Interviewees imparted valuable insight into whether administrative roles affect the perceived usefulness and attitudes towards technology adoption using open-source platforms for research administration. They substantiated the work of (Lane, 2007), who found that administrators of sponsored research work in an arena where oversight is prevalent, thus affecting their interest and consideration of open-source platforms as a means of research growth and compliance. Interviewee five confirmed this, stating, “it all boils down to effectiveness and not having to start behind the eight ball, but to be ahead of what’s being expected.” This conclusion was affirmed by Schein (2010), who found that accuracy, timeliness, communication, reporting, training and ease of access to information are values of research administrators that propel their goals and aspirations.

It should be noted that all the interviewees had served as the principal investigator of a grant program. Three of the interviewees (two, four, and five) have or currently serve in a management capacity for sponsored research. The perspectives of the Provost/Chief Academic Officer were specifically centered around instructional delivery methods within sponsored programs. In contrast, the Director of Information Technology engaged a different perception, one relegated to inclusive, effective communications to ensure continuity and compatibility with existing technology infrastructure and systems. Similarly, the Chief Financial Officer's perceptions were based on value, volume and the costs associated with proprietary systems. The Advancement Official held that, "tracking where you've been successful...better positions the institution for opportunities...and provide services and programs to your student body, community, faculty, staff, and other constituents".

### Implications

The results presented in this study address the perceptions of technology adoption utilizing open-source software systems for research administration. This qualitative study may have implications for both research and practice at higher education institutions, particularly small institutions.

#### Implications for research on technology adoption

One of the most important implications of this study is future research. This study found administrators overwhelmingly supported technology adoption.

Nevertheless, the results also indicate that the participants viewed the institutions' communication strategies/methods as limited and directed only to the departmental/unit concerned. Further research is needed to assess communication behaviors and patterns that encompass globally communicating technology adoption at institutions of higher education. Another implication from this study is related to the engagement of the information. Participation and input from IT departments and other stakeholders is critical in the decision-making processes related to technologies/software systems that the institution or its officials are inclined to adopt. Future research can add clarification of the relevant stakeholders who should participate in the decision-making hierarchy when considering technology adoption and how it impacts training, security, data collection, entry, and utilization, and other cloud-based or on-premise systems.

#### Implications for practice on technology adoption

The implications from the findings of the research also indicate that the participants were amenable to adopting open-source software systems as a means of supporting the functions of sponsored research administration. Participants specify, nonetheless, their limited exposure to open-source software systems. Implications for future research should include an examination of open-source software systems utilized by frequency and function at institutions of higher education. Additionally, implications for future research could include a review of institutions that use Quali, an open-source software system for research administration. Overall satisfaction level

and contentment with tech support for updates and revisions are two of many factors that can benefit from future research.

Implication on research/practice for security related to open-source software systems

The results of this study disclose a participant concern regarding the security of open-source software systems. The implications for future research related to these concerns may be facilitated by examining security breaches at institutions of higher education. Analyzing institutions' responses to security breaches from the perspective of various stakeholder groups would be a great means of gauging OSS security. This study and subsequent findings may inform research administrators to examine the security concerns when considering adopting technologies for sponsored research administration. Further, it may promote research administrators to engage the information technology department before procuring software systems.

#### Future Actions

Future actions for research of technology adoption and open-source software systems for research administration will include qualitative methods by collecting additional interview information from open-source software system developers. This will be a means of assessing their interest in developing systems for research administration. Moreover, future actions will include expanding the study population to additional institutions of higher education, thus procuring a broader perspective of technology adoption at small colleges and universities. Future actions may also incorporate the development of a survey instrument to collect quantitative data on

technology adoption and open-source software systems. Lastly, future actions may provide opportunities to engage institutions of varying size, mission, and research classifications to determine if those qualifiers affect technology adoption of open-source software.

**List of Figures**

FIGURE 1: REIMAGINING OF THE UTAUT MODEL .....	36
FIGURE 2: UTAUT MODEL .....	37
FIGURE 3: PROPOSED TECHNOLOGY ADOPTION FOR RESEARCH ADMINISTRATION .....	38

**List of Tables**

TABLE 1: NATIONAL SCIENCE FOUNDATION, HIGHER EDUCATION RESEARCH AND DEVELOPMENT SURVEY COMPARISON OF THE PERCENTAGE OF CHANGE FY-18-19.....	29
TABLE 2: PROFILE OF PARTICIPANTS .....	65
TABLE 3: POPULARITY AND KNOWLEDGE OF SOFTWARE SYSTEMS .....	78

### References

- Adam, I. E. (2017). Virtualisation on an administrative work environment in higher education: Managing information in a developing country university. *Journal of Enterprise Information Management*, 30(5), 723-747.
- Aksulu, A. &. (2010). A comprehensive review and synthesis of open-source research. *Journal of the Association for information systems*, 11(11), 576-656.
- Aldama, D. (2010). A study of the total cost of ownership between server operating systems-open-source versus proprietary. *Doctoral Dissertation*.
- Allen, D. K. (2002). Culture, power, and politics in ICT outsourcing in higher education institutions. *European Journal of Information Systems*, 11, 1259-173.
- Allen, E. &. (2014). *Opening the curriculum: Open educational resources in the U.S. Higher Education*. Babson Survey Research Group.
- Allen, I. &. (2007). Online nation: Five years of growth in online learning. *Sloan Consortium*. Retrieved from Sloan Consortium: open-source.sloanconsortium.org
- Annand, D. (2015). Developing a sustainable financial model in higher education for open educational resources. *International Review of Research in Open & Distance Learning*, 16(5), 1-15.

- Atkinson, A. &. (2007). Virtue blindness hegemony: Quality evidence of negotiated ethical frameworks in the social language of university research administration. *Science & Engineering Ethics* 13(2), 195-220.
- Bailey, T. (2011). Organizational culture's impact on the effectiveness of research administration units: A multicase study of historically black doctoral degree granting institutions. *ProQuest Dissertations and Theses Global*.
- Boyce, M. (2003). Organizational learning in essential achieving and sustaining change in higher education. *Innovative Higher Education* 28(2), 119-136.
- Budget, U. O. (2021, August 29). *Electronic Code of Federal Regulations*. Retrieved from [https://open-source.ecfr.gov/cgi-bin/text-idx?SID=61a0acd5c96938406659dd36688f31ef&mc=true&node=se2.1.200\\_11&rgn=div8](https://open-source.ecfr.gov/cgi-bin/text-idx?SID=61a0acd5c96938406659dd36688f31ef&mc=true&node=se2.1.200_11&rgn=div8)
- Burdtt, C. &. (2005). Open-source in higher education: Decision-making for open-source adoption. *Eduventures*.
- COGR. (2014). *Finances of Research Universities*. Council on Government Relations.
- Creswell, J. (1998). *Qualitative Inquiry and Research Design*. Thousand Oaks, CA: SAGE.
- Creswell, J. (2018). *Qualitative inquiry & research design: Choosing among five approaches*. 4th ed. Los Angeles, CA: SAGE.
- Droegemeier, K. K. (2017). *The Role of Facilities and Administrative Costs in Supporting NIH Funded Research*. Submitted to the Appropriations Sub-

Committee on Labor, Health and Human Services, Education and Related Agencies.

Dutse, A. (2015). An Analysis of the effect of information technology (IT) adoption and staff knowledge capabilities on the innovative behaviour of universities in Northern Nigeria. *International Journal of Technology Management & Sustainable Development*, 14(1), 49-62.

Education, n. U. (2019). *Carnegie Classification of Institutions of Higher Education*. Bloomington, IN: Center for Postsecondary Research.

Eisenhower, T. (2018). Best practices in grantsmanship: A case study of a high predominantly undergraduate institution. *Doctoral Dissertation*.

Erdogmus, OPEN-SOURCE. &. (2003). The economics of software development by pair programmers. *Engineering Economist*, 48(4), 283-319.

Flavin, M. (2016). Disruptive conduct: the impact of disruptive technologies on social relations in higher education. *Innovations in Education & Teaching International*, 53(1), 3-15.

Foundation, N. S. (2019). *National Center for Science and Engineering Statistics*. National Science Foundation.

Gibbons, M. (2021). *National Center for Science and Engineering Statistics (NCSES): Universities Report 5.7% Growth in R&D Spending in FY 2019, Reaching \$84 Billion*. Alexandria, VA: National Science Foundation.

- Grossman, S. (2015). The title: Public research university STEM faculty perspectives on sponsored research indirect costs. *ProQuest Dissertations and Theses Global*, UMI No. 1001152.
- Guimaraes, A. K. (2013). The life cycle of open-source software development communities. *Journal of Electronic Commerce Research*, 14(2), 167-182.
- House, T. (2009). A model and intelligent software agent for the selection and implementation of open-source software. *Doctoral Dissertation*.
- Kashorda, M. &. (2014). E Readiness survey of Kenyan Universities. *KENET*, 36.
- Kemp, J. &. (2017). It takes an eco-system: Review of the research administration technology landscape. *Research Management Review*, 1-13.
- Kemp, J. &. (2017). It takes an ecosystem: Review of the research administration technology landscape. *Research Management Review*, 22(1), 1-13.
- Kezar, A. &. (2009). *Organizing higher education for collaboration: A guide for campus leaders*. San Francisco, CA: Jossey-Bass.
- Krechmer, K. (2006). Open Standards Requirements. *The International Journal of IT Standards and Standardization Research*, Vol. 4, No. 1.
- Lane, J. (2007). The spider web of oversight: An analysis of external oversight of higher education. *Journal of Higher Education* 78(6), 615-644.
- Lawton, G. (2002). Open-source security: Opportunity or oxymoron? *Computer*, 18-21.
- Lee, M. &. (2003). Evolution of open-source software: A study of the samba project. *Systemes d'Information Et Management*, 8(1), 43-62.

- Lehman, D. (2016). Identifying the critical success factors for information systems to manage sponsored research activities at institutions of Higher Education.
- Leman, D. (2016). Identifying the critical success factors for information systems to manage sponsored research activities at institutions of higher education. *Doctoral Dissertation*.
- Lintz, E. M. (2008). A conceptual framework for the future of successful research administration. *The Journal of Research Administration*, 68-80.
- McClellan, J. (2011). Beyond student learning outcomes: Developing comprehensive, strategic assessment plans for advising programs. *Journal of Higher Education Policy and Management* 33(6), 641-652.
- Mehlinger, OPEN-SOURCE. (1996). School reform in the information age. *Phi Delta Kappan* 77(6), 400-407.
- Merriam, S. (1998). *Qualitative research and case study application in education*. San Francisco : Jossey-Bass Publishers.
- Merriman, S. B. (2002). *Qualitative Research in Practice: Examples for discussion and Analysis*. San Francisco, CA: Jossey-Bass.
- Mitchell, M. L. (2017). *A lost decade in higher education funding: State cuts have driven up tuition and reduced quality*. Washington, DC: Center on Budget and Policy Priorities.
- Morgan, L. F. (2013). Exploring value networks: Theorising the creation and capture of value with open-source software. *European Journal of Information Systems*, 22(5), 569-588.

- Muriithi, P. OPEN-SOURCE. (2016). Factors contributing to adoption and use of information and communication technologies within research collaborations in Kenya. *Information Technology Development*, 22, 84-100.
- Neus, A. &. (2015). Opening minds: Cultural change with the introduction of open-source collaboration methods. *IBM Systems Journal* 44(2), 215-225.
- Otto, D. (2019). Adoption and diffusion of open educational resources (OER) in education: A meta-analysis of 35 OER-projects. *International Review of Research in Open & Distance Learning*, 20(5), 122-140.
- Perens, B. (1999). *Open Sources: Voices from the Open-source Revolution*. O'Reilly Media.
- Reinke, J. &. (2003). The availability of source code in relations to timely response to security vulnerabilities. *Computers & Security*, 707-724.
- Rogers, E. (1962). *Diffusion of Innovations*. New York: Press of Glencoe.
- Rogers, E. (1995). *Diffusion of Innovations (4th ed)*. New York: Free Press.
- Ross, R. (2017). University research development offices: Perceptions and experiences of research university administrators. *ProQuest Dissertations and Theses Global*.
- Ruben, B. (1999). Toward a balanced scoreboard for higher education: rethinking the college and university excellence indicators framework. *Higher Education Forum QCI Center of Organizational Development*, , 1-10.
- Sagers, G. (2007). Is bigger always better? Toward a resource-based model of open-source software development communities. *Doctoral Dissertation*.

- Schein, E. (2010). *Organizational culture and leadership*. San Francisco: Jossey-Bass.
- Siegel, D. A. (2017). Extending the technology acceptance model to improve usage & decrease resistance toward a new technology by faculty in higher education. *Journal of Technology Studies* 32(2), 58-69.
- Slovic, P. (2000). Perceived risk, trust an democracy, The Perception of Risk. *Earthscan*, 316-326.
- Stake, R. (1995). *The art of case study research*. Sage Publication, Inc.
- Statistics, N. C. (2020). *Universities Report 5.7% Growth in R&D Spending in FY 2019, Reaching \$84 Billion*. National Science Foundation.
- Stewart, K. &. (2004). *The impact of ideology on effectiveness in open-source software development teams*. Retrieved from <http://open-source.mit.edu/papers/stewartgosain.pdf>
- Sugar, OPEN-SOURCE. &. (2009). Technology leaders wanted: Acknowledging the leadership role of a technology coordinator. . *Tech-Trends: Linking research & practice to improve learning*, 53(6), 66-75.
- The Best Open-source ERP Software of 2021*. (2021). Retrieved from [digital: open-source.digital.com](https://digital.open-source.digital.com)
- Thomas, M. (2014). Outsourcing technology support in higher education. *Doctoral Dissertation*.

- Thornton, C. &. (2008). The role of culture in institutional and individual approaches to civic responsibility at research universities. *Journal of Higher Education* 79(2), 160-182.
- Top 8 Most Popular Enterprise Grade Open-source DBMS Software.* (2021, 11 1). Retrieved from Software Testing Help: [open-source.softwaretestinghelp.com](https://open-source.softwaretestinghelp.com)
- U.S. Department of Education. Institute of Education Statistic, N. C. (2021).
- Venkatesh, V. a. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Sciences* 39 (2), 273-315.
- Venkatesh, V. M. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly* 27(3), 425-478.
- Wallance, L. &. (2014). The adoption of software measures: A technology acceptance model (TAM) perspective. *Information Management*, 41-51.
- William van Rooij, S. (2009). Adopting open-source software application in U.S. higher education: A cross-disciplinary review of literature. *Review of Educational Research*, 79(2), 682-701.
- Yin, R. (2003). *Case study research: Design and methods*. Thousand Oaks: Sage.
- Yin, R. (2014). *Case study research: design and methods*. Thousand Oaks, CA: SAGE Publications Inc.

**Appendix**

**Appendix A:  
IRB Approval**

**MSU Institutional Review Board for the Protection of Human Subjects in Research  
NOTIFICATION OF EXEMPT PROTOCOL REVIEW**

**Principal Investigator/Researcher**

First Name  Last Name  Title:   
 Campus Address  Campus Phone:   
 E-Mail:   
 Department:   
 CITI Trainin  Date Completed

Other Personnel  Other Personn

**Purpose:**

Title of Project/Course:   
 Funding Source/Agenc

**Protocol Review Num**

The human subject use protocol described above has been reviewed by the MSU Institutional Review Board for the Protection of Human Subjects in Research with the following results:

The IRB determined the project, as stated, is exempt based on federal regula   
 Federal regulations require that the IRB be notified if anything in the research changes, as additional review may be necessary.

Approved, may proceed as writte

Begin Dat  End Dat

In accordance with new procedures instituted by the IRB, and because your study is exempt, you are not required to complete continuation or final review reports. However, it is your responsibility to notify the IRB prior to making any changes to the study. Please note that changes made to an exempt protocol may disqualify it from exempt status and may require an expedited or convened review. Your exempt protocol is approved for six years. At the end of six years the protocol will close and interaction with human subjects must cease. If you would like to continue your project, you must submit a new exemption application and have it approved before the project can continue.

Regulatory requirements have been met for the waiver of documentation of cons  
 Regulatory requirements have been met for the waiver of informed consent  
 Criteria for use of children has been met

Signed: Elizabeth B. Perkins Date: 10/13/2021

Chair, Institutional Review Board for the Protection of Human Subjects in Resear

**Please refer to the protocol review number in any future references to this protocol. If any revisions are made to a project or if any unforeseen risks arise during an investigation, the principal investigator must submit Form H to the IRB, fully explaining all changes or unexpected risks.**

pc: Protocol Fi

## **Appendix B: Research Procedures**

### **RESEARCH ADMINISTRATION OPEN-SOURCE PLATFORMS: AN ASSESSMENT OF INSTITUTIONAL ADMINISTRATORS INTEREST IN TECHNOLOGY ADOPTION**

**Purpose Statement:**

The purpose of this study is to explore the perceptions of technology adoption by institutional leadership at a small college/university and their views on open source software platforms as a viable means of improving sponsored research administrative functions.

**Research Questions:**

What impact does the perception(s) of open source software platforms have on technology adoption for sponsored research among administrators at a small college/university?

What issues or factors support or deter technology adoption?

Do administrative roles and responsibilities affect the perceived usefulness and attitudes towards technology adoption using open source software platforms for research administration?

**Interview Procedures:****Part A.** Explanation of the consent form: (2-3 mins)

An explanation of the consent will be discussed with the research participant. Particularly, the data acquired through the interview will be confidential and not drawn back to the research participant or the institution. The information provided will be used for the research report of this study and may be used for academic dissemination in scientific articles and/or conference papers.

**Part B.** Introduction: (3 mins). The purpose of the study (as outlined in the consent letter), will be communicated when setting up an appointment for the interview. This will also allow introductions to be capped at 3mins.

**Part C.** Discussion and in-depth interview: (30 mins)

This section forms the basis of the interview and will be guided by the interview questions outlined below. Further to this, additional insights provided by the research participant will be taken into consideration for data analysis.

**Part D.** Conclude by asking the researching participant if there is anything further that may be insightful into this research. Thank the research participant for input into the research study (5mins)

## Appendix C: Interview Questions

### Part E: INTERVIEW QUESTIONS

- 1) What is your role at the institution?
- 2) How long have you been employed at the institution?
- 3) What is your perception of the organizations response to emerging technology?
- 4) How often are the adoption of new technologies communicated at the institution?
- 5) What are benefits and risks (if any) when considering adopting technology from open source platforms? What open source platforms are you familiar with?
- 6) What is your perception of a free and open-source software system that supports sponsored research administration? Do have knowledge and/or experiences with open-source software?
- 7) What can the organization do from your perspective to ensure technology related to research administration is considered?
- 8) Do you support the adoption of technology aimed at improving efficiency and effectiveness in research administration? Why? ( consider asking “how” they would support the adoption)
- 9) Are there actions or triggers (i.e., proposal submissions, sponsored programs awards, and levels of funding) that support the need for sponsored research administrative software?
- 10) Do you believe free and open-source software systems are a viable and cost-efficient means of addressing the needs? Why?

## VITA

DERRICK C. GILMORE

EDUCATION

May, 1994	Bachelor of Science Albany State College Albany, Georgia
May, 1996	Master of Science Albany State University Albany, Georgia
Pending	Doctor of Education Morehead State University Morehead, Kentucky

PROFESSIONAL EXPERIENCES

January 1, 2020	Executive Vice President Stillman College Tuscaloosa, Alabama
January 1, 2013	Deputy Provost for Research and Sponsored Programs Kentucky State University Frankfort, Kentucky

ProQuest Number: 29166491

INFORMATION TO ALL USERS

The quality and completeness of this reproduction is dependent on the quality and completeness of the copy made available to ProQuest.



Distributed by ProQuest LLC (2022).

Copyright of the Dissertation is held by the Author unless otherwise noted.

This work may be used in accordance with the terms of the Creative Commons license or other rights statement, as indicated in the copyright statement or in the metadata associated with this work. Unless otherwise specified in the copyright statement or the metadata, all rights are reserved by the copyright holder.

This work is protected against unauthorized copying under Title 17, United States Code and other applicable copyright laws.

Microform Edition where available © ProQuest LLC. No reproduction or digitization of the Microform Edition is authorized without permission of ProQuest LLC.

ProQuest LLC  
789 East Eisenhower Parkway  
P.O. Box 1346  
Ann Arbor, MI 48106 - 1346 USA