# WHAT IS THE DIFFERENCE? STAR AND NON-STAR PERFORMERS WHO PURSUE EXTERNAL RESEARCH FUNDING AT A PRIVATE RESEARCH 1 INSTITUTION

by

Denise Yvette Wynn

A dissertation submitted to the faculty of
The University of North Carolina at Charlotte
in partial fulfillment of the requirements
for the degree of Doctor of
Business Administration

Charlotte

2023

Approved by:

______________________________
Dr. Scott Tonidanel

______________________________
Dr. Reginald Silver

______________________________
Dr. Janaki Gooty

______________________________
Dr. Chandrasekar Subramaniam

## ABSTRACT

DENISE YVETTE WYNN. What is the difference? Star and Non-Star performers who Pursue External Research Funding at a Private Research 1 Institution
(Under the direction of DR. SCOTT TONIDANDEL)

This dissertation analyzes performance distribution, the financial impact of star performers, and how the researcher's discipline moderates the relationship between individual performance and the value of external funding at a private R1 institution. While publications have traditionally served as a metric for faculty success at research institutions, there needs to be more knowledge regarding the role of star performers in securing external funding. Data drawn from the institution's internal application system encompassed a sample size of 7,213 proposals submitted by faculty members over five years. Utilizing the Dpit package from the Comprehensive R Archive Network (CRAN), results indicate that a power law distribution offers a better fit than a normal distribution for modeling star performance, with a significant portion of generated value concentrated among a select group of star performers. Furthermore, the research demonstrates that an organization's strategic core competence moderates the individual performance of researchers and the overall value derived from research initiatives.

Keywords: Star Performers, External Funding, Power Law Distribution, Faculty, Universities

## DEDICATION

I dedicate this dissertation to the cherished individuals in my life: my family and my friends. Your unwavering support has been an incredible source of strength throughout this journey, and I am profoundly grateful.

To my beloved wife, your love, encouragement, and support sustained me through every step of this process. I thank you from the bottom of my heart.

To my mother, your steadfast commitment to education and your relentless encouragement to strive for greatness have been instrumental in my success.

To my late father, who couldn't be here to witness this monumental endeavor, I know you are watching over me with pride.

To my remarkable siblings, Deanna, Rhonda, and Ronald, your constant support and encouragement have been a beacon of inspiration. To my nephew Jacob, know that Auntie loves you dearly.

To Dr. Donna Coletrane Battle and Dr. Tracy Foote White, your mentorship and support not only shaped my academic journey but also touched the lives of my loved ones. Thank you from the depths of my heart.

## ACKNOWLEDGEMENTS

I want to extend my heartfelt appreciation to Dr. Scott Tonidandel, my committee chair, for his unwavering patience. Under his expert guidance, I had the privilege of delving into a topic I'm truly passionate about, and his exceptional leadership and support played a pivotal role in the successful completion of this dissertation.

I also want to express my sincere gratitude to the other members of my committee, Dr. Reginald Silver, Dr. Janaki Gooty, and Dr. Chandrasekar Subramaniam. This entire journey has been transformative, and I will forever cherish the support and wisdom you all provided. Your collective presence represents the epitome of faculty members that students admire and aspire to work with.

# TABLE OF CONTENTS

**LIST OF TABLES**

## LIST OF FIGURES

**LIST OF ABBREVIATIONS**

CRAN - Comprehensive R Archive Network

D/PU -Doctoral/Professional

HEIs - Higher Education Institutions

HERD - Higher Education Research & Development Survey

HRM - Human Resource Management

IPEDS - Integrated Postsecondary Education Data System

KPIs - Key Performance Indicators

KSOAs -Knowledge, Skills, Abilities, and Other characteristics

LR - Likelihood Ratio

NCSES - National Center for Science and Engineering Statistics

NIH - National Institutes of Health

NSF - National Science Foundation

OSRD - Office of Scientific Research and Development

R&D - Research and Development

R1 -Research 1

R2 - Research 2

RBV - Resource-Based View

STEM - Science, Technology, Engineering, Mathematics

# CHAPTER 1: RESEARCH OVERVIEW

## *1.1 Introduction*

Discovery in science, breakthrough technology, and inventions are essential for a globally competitive economy. Science exploration helps address societal diversity, public health, and national security. Research and Development (R&D) expenditures in the United States totaled $554 billion in 2017, increasing to $708 billion by 2022. While businesses are R&D's predominant funders of R&D, higher education institutions (HEIs) are the second largest performers (NCSES, 2023). Figure 1 displays the R&D expenditures from 2000 to 2017, with HEIs being the second largest performer.

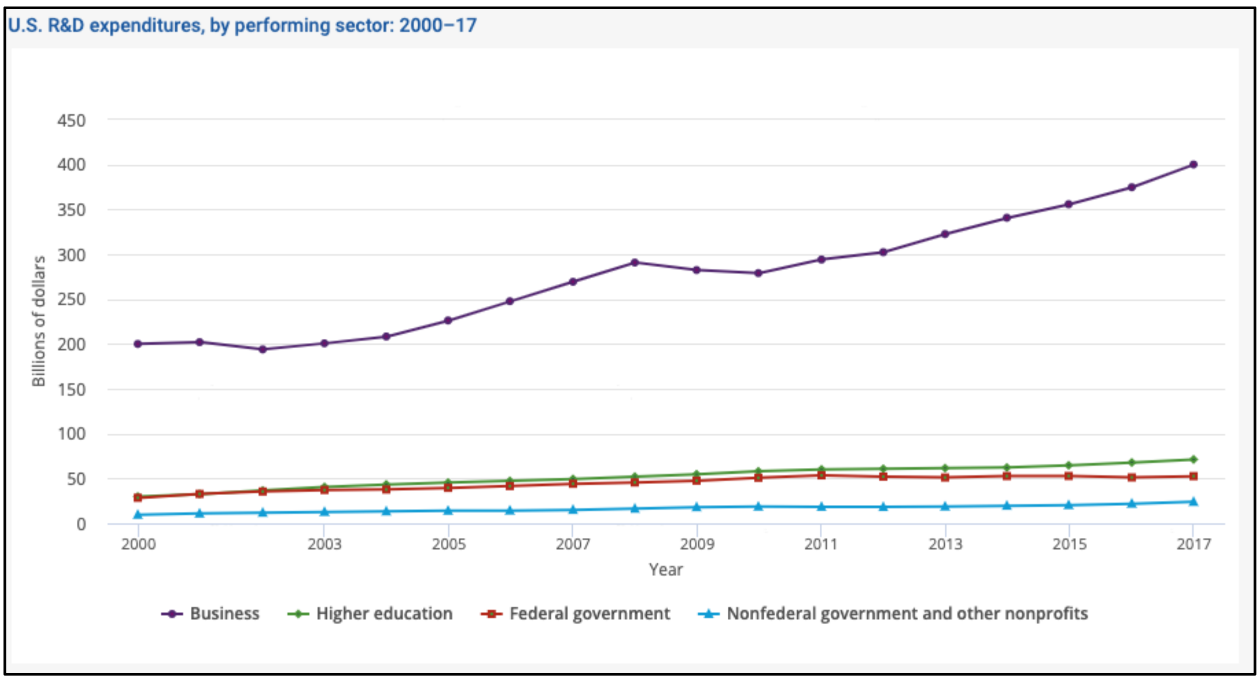


*Figure 1: National Patterns of R&D Resources (NCSES, 2023)*

Higher education institutions "have a responsibility to increase awareness, knowledge, skills, and values needed to create a sustainable future." (Cortese, p 17, 2003). They play an essential role by turning visions into reality and allowing faculty members to train the world's next professionals. A model designed by Anthony Cortese in Figure 2 portrays higher education modeling sustainability when a system is fully integrated with education, university operations, research, and the external community. According to Cortese (2003), "students learn from everything around them," and Figure 2 demonstrates a "complex web of experience and learning." With students able to explore HEIs, they can develop, teach, manage, and influence present and future generations.

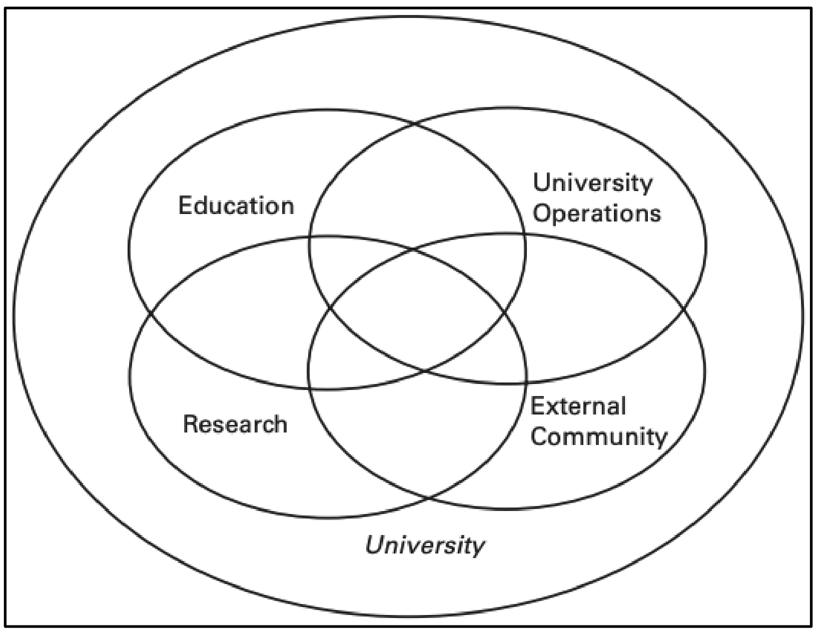


*Figure 2: Higher Education Modeling Sustainability (Cortese, 2003, p. 18)*

Research is a general component supporting the mission of discovery and learning. Some institutions provide opportunities using funding from within the institution to support the research infrastructure. External funding is acquired to support research endeavors to broaden the scope and portfolio of HEIs. Faculty members write proposals to external funders (e.g., federal and state agencies, foundations, private, non-profit) requesting assistance for research. With additional funding, HEIs can increase their research infrastructure by purchasing equipment, researching drugs and devices, conducting clinical research and trials, and providing employment opportunities for personnel.

External funding from the federal government is one of the many ways new ideas are fostered. In fiscal year 2017, the federal government obligated $54 billion in contracts and grants to support research at colleges and universities. By fiscal year 2021, that number had grown to $121 billion, an increase of $67 billion (USA Spending, 2023). Although some of the rise is attributed to COVID-19, the federal government has supported research and development since World War II. In 1945, Vannevar Bush established the framework between science and government under the leadership of President Theodore Roosevelt (Bush & Atkinson, 1980). Bush was an engineer who headed the Office of Scientific Research and Development (OSRD), stressing the importance of scientific research and economic well-being. This office created various funding agencies, such as the National Institutes of Health and the National Science Foundation (Bush & Atkinson, 1980). According to the United States trends in research and development, the federal government is the largest funder of basic research (NCSES, 2023). In the U.S Trends Report, "the strength of a country's overall R&D enterprise—both the public and private sectors—is an important marker of current and future national economic advantage and of the prospects for societal improvements at the national and global levels" (NCSES, 2023).

In 1970, the Carnegie Classifications of Institutions of Higher Education established a framework to categorize institutional diversity in U.S. higher education (Carnegie Classifications, 2023). They developed these classifications of colleges and universities to support research, policy analysis, and institutional differences of students and faculty. Carnegie classifications consist of six universal classifications for all degree-granting universities: Basic, Undergraduate Instructional Program, Graduate Instructional Program, Enrollment Profile, Undergraduate Profile, and Size and Setting. Data is collected annually from the National Center for Education Statistics Integrated Postsecondary Education Data System (IPEDS) and National

Science Foundation (NSF) Higher Education Research & Development Survey (HERD), and the framework is updated every three years to reflect the changes in institutions. For this dissertation, we will use the classifications as of 2021, although the classifications were re-envisioned in 2022.

The Basic Classification Methodology was used to review the three levels of research activity: R1 (Research 1), R2 (Research 2), and D/PU (Doctoral/Professional). Doctoral institutions with very high research activity are classified as R1 and are considered the most complex and prestigious institutions. Doctoral institutions with high research activity are classified as R2. Furthermore, D/PU are doctoral/Professional institutions with some research activity. Institutions are classified as R1 or R2 if awarded at least 20 research/scholarships, doctoral degrees, or 30 professional practice doctorates across at least two programs (Carnegie Classifications, 2023). Based on the NSF HERD, R1 and R2 have at least $5 million annually in total research expenditures in fiscal year 2020.

R1 institutions have the highest research activity, with faculty who have secured external funding from diverse sources to support their research breakthroughs and innovative solutions. Within universities, sustainability is pivotal in both development and enduring existence. Incorporating value, whether financial, educational or through training, via faculty members who actively contribute to the research mission can be instrumental in achieving strategic objectives aimed at pioneering discoveries. While the significance of other factors contributing to competitive success may diminish, the organization's workforce remains a vital component. Pfeffer (1994) contended that human capital represented a pivotal resource within most companies. Human capital is acknowledged as an asset; however, achieving a competitive edge necessitates attracting and retaining the appropriate individuals (Lawler, 2009). The recruitment and long-term retention of the most talented individuals can generate a distinctive competitive advantage within an institution. Individuals possessing exceptional talent can cultivate an atmosphere that nurtures a lasting and sustainable competitive advantage. With universities and colleges being such an integral part of R&D, top-performing faculty conducting research can be vital for the growth of research within an institution. Top performers, also known as stars, superstars, game changers, and star performers, are vital to organizations. Star performers are elite performers who emerge and contribute disproportionately to organizations (Aguinis & Bradley, 2015). Prior research has examined star performers in various roles, including CEOs, athletes, entertainers, politicians, and researchers (Aguinis & O'Boyle, 2014; Aguinis & Bradley, 2015; O'Boyle & Aguinis, 2012). Star performers are not just found in top management or are successful entrepreneurs and athletes; they exist throughout all levels of the organization (Aguinis & Bradley, 2015). They can consistently generate extremely high levels of output that impact the success or failure of the organization (Aguinis & Bradley, 2015).

In order to identify star performers, firms measure performance using metrics, also known as Key Performance Indicators (KPIs). These KPIs help to monitor individual, unit, and firm performance for overall performance and efficiency. Star performers "produce more than other individuals, help increase the productivity of those around them, and have an important impact on the organization's performance" (Aguinis & Bradley, 2015, p. 1). The literature presents star performers being measured using individual performance (O'Boyle & Aguinis, 2012; Aguinis & Bradley, 2015). Preliminary studies assumed that individual performance followed a normal distribution (Hull, 1928; Schmidt & Hunter, 1983; Tiffin, 1947), but for star performers, Aguinis & Bradley (2015) believed Pareto's model or power law distribution should be applied, which states that "20 percent of the known variables will account for 80 percent of the results" (Basile, 1996, p. 53).


*Figure 3: The 80/20 Rule*
*Source: (Holt, Strategyx, LLC, 2021)*

A set of studies conducted by O'Boyle & Aguinis (2012) involved 198 samples, including 633,263 participants. They wanted to look at different types of jobs, different industries, various time frames, and performance measures. Participants included professional athletes, politicians, entertainers, and researchers. Results showed consistently across all studies that performance was not normally distributed for individuals but that the power law distribution yielded a superior fit compared to a normal distribution in every discipline (O'Boyle & Aguinis, 2012). This model produced fatter tails than those seen in a normal curve, allowing more extreme values to be present (O'Boyle & Aguinis, 2012). This study was an influential analysis of power law distribution for star performers.

At most institutions classified as R1, faculty members undergo evaluation based on metrics like publications, which are utilized to determine their career advancement. (Aguinis & Bradley, 2015; Falaster, Ferreira, & Serra, 2016). While publications are an essential source of a faculty member's path to tenure, external funding is one of the financial mechanisms to support publishing research findings. External funding also assists universities in addressing issues for the broader community by uncovering remedies, teaching novel methods, and nurturing the next generation of scientists. As faculty secure funding, some will excel and may be identified as star performers. Nevertheless, little is known about star performers regarding obtaining external funding. For this study, I plan to analyze external funding received at a private R1 institution over five years. The data was obtained from the institution's internal proposal tracking system, which contains details about applications that received external sponsorships. The dataset, consisting of 7,213 applications, encompasses 58 disciplines within the university. An exhaustive roster of these departments is located in Table 1 of Chapter 3.

### *1.2 Research Objectives and Questions*

The main objective of this research is to examine star performers in the context of external funding at a private R1 institution. The specific objectives are:

i. Examine the performance distribution of grant funding to see if it mirrors the distributions found in other domains (e.g., publications).

ii. Examine the financial contribution of star performers based on the grant funding they were awarded, relative to the other faculty members.

iii. Empirically evaluate if the researcher's discipline moderates the relationship between individual performance and value.

For the first objective, I examined the distribution of grant funding to determine if it echoes the findings in a study by O'Boyle and Aguinis (2012). Most performance outcomes are generated by a small group of highly productive employees (O'Boyle & Aguinis, 2012). Five studies by O'Boyle and Aguinis (2012) found that power law distribution better fit individual performance. Individual performance was examined to determine the best distribution for faculty members who submitted proposals during the five years from an R1 institution. Data was collected from the internal application system, with a sample size of 7,213 applications from 20 campus departments, 37 School of Medicine departments, and the School of Nursing.

For the second research objective, because the monetary value to the organization of grant funding is known, I investigated data around star performers that, to date, have been underexplored. Specifically, I examined the financial contribution of star performers based on the grant funding they were awarded relative to the other faculty members. This data was analyzed using the amount awarded per application. Value was assessed based on each faculty member's total number of Awarded Dollars and categorized by department. Each department was considered a specific discipline (e.g., biology, anesthesiology).

For the third and final research objective, I evaluated if the researcher's discipline moderates the relationship between individual performance and value. An untested assumption about star performers is that their exceptional performance has similar outsized contributions to an organization's bottom line and that the relationship between performance and value will depend on the alignment between the performer's functional area and the organization's core competencies (Aguinis & O'Boyle, 2014). Each discipline was ranked based on the U.S. News & World Record Best National University Rankings. I examined disciplines with rankings (i.e., core competency) versus unranked disciplines (i.e., non-core competency) to determine if the relationship between performance and value is moderated. Through the literature review on star performers and using secondary archival data gathered from a private R1 institution, I explored the following research questions:

(1) Does the performance distribution of external funding mirror the distributions found in other domains (e.g., publications)?

(2) What is the financial contribution of star performers relative to the other faculty members?

(3) Does the researcher's discipline moderate the relationship between individual performance and value?

### *1.3 Contributions*

By examining star performers in the context of external funding, this study is uniquely positioned to fill several critical gaps in the existing literature. I will (1) contribute to the literature on star performers, performance management practices, and Resource Based View Theory. (2) From a practitioner perspective, this research will provide practitioners with managerial implications to help identify, utilize, and retain star performers. This research may be a blueprint for recruiting star performers to increase research portfolios within an institution. By hiring star performers, universities can quickly boost their bottom line while gaining research talent. (3) Additionally, as universities work toward moving from a D/PU to an R2 or an R1, this research will help identify star performers and obtain more of a cumulative advantage approach to increase the overall research performance.

This dissertation adds to the existing body of literature on star performers and performance distribution while adding the domain of grant funding. The Resource-Based View theory was used to help practitioners identify star performers within institutions for use individually, by unit, or for the overall institution.

### *1.4 Organization of the Dissertation*

This dissertation contains five chapters. Chapter 1 introduced research at higher education institutions (HEIs), competitive advantage, and star performers. It also described the structure of how HEIs were classified in the Carnegie Classifications and how research is an integral part of the institution's competitive advantage. Finally, it exhibited the research questions for the study.

Chapter 2 contains the literature review and will demonstrate the underexplored topic of star performers and grant funding, with past literature focusing on star performers and publications in the research domain. It contains eight sections. The first section discusses human capital as a source of competitive advantage. It identifies the theoretical framework of the Resource-Based View and the importance of reviewing resources to sustain an organization's competitive advantage. The second section defines performance management and ties the importance of human capital leading to increased performance. The third section details performance distributions and how they can be used to measure performance from an individual, unit, or overall. The fourth section defines star performers and outlines studies on star performers. The fifth section reviews star performer's performance distributions. This section details how power-law distributions have been measured for individual performers in previous studies. Section six focuses on star performers in academia and how knowledge, skills, abilities, and other characteristics (KSOAs) create a competitive advantage. With specific KSOAs, universities can remain competitive and have breakthrough research discoveries. Section seven provides the background and impact of external funding in academia. External funding helps universities solve problems for the general public while discovering cures, teaching new methods, and training the next generation of scientists. Previous studies in star performance and research used publications to measure performance. This study focuses on grant funding as the domain to measure star performers. Finally, section eight discusses the research questions and contains three subsections on (1) the distribution of grant funding, (2) research productivity and performance-value function, and (3) the degree of proximity to strategic core competence.

Chapter 3 of the dissertation consists of the data collection and methodology used to measure the performance of external funding at a private R1 institution. I analyzed three novel questions: (1) Does the performance distribution of external funding mirror the distributions found in other domains (e.g., publications)? (2) What is the financial contribution of star performers relative to the other faculty members? (3) Does the researcher's discipline moderate the relationship between individual performance and value? Chapter 4 presents the results from the research questions and a discussion of the results. Chapter 5 presents the discussion and managerial implications for practitioners.

# CHAPTER 2: LITERATURE REVIEW

## *2.1 Human Capital as a Source of Competitive Advantage*

Firms are created to become profitable while managing their resources strategically. According to Daft (1983), a firm's resources typically include assets, potentiality, organizational processes, firm characteristics, information, and knowledge. Resources are valuable if they enable a firm to conceive or implement strategies to improve efficiency and effectiveness (Barney, 1991). Sustaining a competitive advantage has been a central area of focus in strategic management, with four empirical indicators generating sustained competitive advantage: value, rareness, imitability, and non-substitutability (Barney, 1991).

Firm resources are valuable when they equip a firm to develop strategies for implementation that enhance its efficiency and effectiveness (Barney, 1991). Rareness occurs when the resources help the firm survive (Barney, 1991). Imitability occurs if (a) a firm can obtain a resource under unique historical conditions, (b) there is a causally ambiguous link between the resources possessed and the firm's competitive advantage, or (c) the resource generating a firm's advantage is socially complex (Barney, 1991). Furthermore, resources should be challenging to substitute, allowing competitors to imitate or copy strategies and providing them a competitive advantage. (Barney, 1991). These four constructs led to the birth of firms' Resource-Based Views (RBV). RBV is used to determine the strategic internal resources a firm can utilize to obtain a sustainable competitive advantage. RBV takes the firm's resources and provides a conceptual link between human capital theory and strategic management (Ployhart, 2021). Understanding RBV helps firms see resources as essential to superior performance. However, what does it mean to have a competitive advantage?

Competitive advantage is when a firm is "implementing a value-creating strategy not simultaneously being implemented by current or potential competitors" (Barney, 1991, p. 102) and is a significant construct in the strategy discipline (O'Shannassy, 2008). A firm's success or failure may depend on the competition, the management of resources, or being able to identify which activities will lead to competitive strategy. According to Pfeffer (1994), firms should have something that distinguishes them from competitors, provides positive economic benefits, and is not easily duplicated. A single resource cannot be the sole source of competitive advantage (Enz, 2008). Multiple resources are assembled to create a firm's capabilities. A study on Outback Steakhouse in Korea revealed that the framework of blended financial resources, physical resources, human resources, organizational knowledge, and general resources created a competitive advantage (Enz, 2008). Other capabilities, such as innovation, having a cohesive culture, and successfully implementing processes, are other methods that contribute to performance, leading to competitive strategies (Porter, 1997). Competitive advantages should be created and strategically designed around the organization's resources. It is essential to not only create a competitive advantage but to sustain a competitive advantage.

In order to sustain a competitive advantage, a firm must implement a value-creating strategy that cannot be easily duplicated. Coyne (1986) created a framework that developed a neat, explicit concept of sustained competitive advantage. He noted that there were specific conditions needed: (1) customers perceive a consistent difference in important attributes between the firm's product or service and those of its competitors; (2) that difference is a direct consequence of the capability gap between the firm and its competitors, and (3) both the difference in essential attributes and the capability gap can be expected to endure over time (Coyne, 1986). This framework led to a study by Hall (1993) that identified intangible resources and capabilities of sustaining competitive advantage. Structured interviews were conducted with senior executives who were asked to measure durability and the firm's contribution, assessing each capability's importance and strength. Hall (1993) discovered that all senior executives were enlightened by the results and acquired more insight into their firms to make them more successful.

Firms possess both tangible (i.e., property and finances) and intangible resources (i.e., human capital and intellectual capital) (Hitt, Bierman, Shimizu, Kochhar, 2001; Khan, Yang, & Waheed, 2018). One of the critical sources of competitive advantage is human resources (Berisha Qehaja & Kutllovci, 2015). According to Berisha Qehaja and Kutllovci (2015), human resources are the most important assets because they research, create, and differentiate the firm from other firms. Research describing human capital resources has been done in economics (Becker, 2002), strategy (Coff & Kryscynski, 2011; Crook, Todd, Woehr, and Ketchen, 2011), strategic human resource management (Huselid, Jackson, and Schuler, 1997; Youndt & Snell, 2004), and psychology (Ployhart & Moliterno, 2011). Human capital selection can be crucial in creating and sustaining a competitive advantage. Hatch and Dyer (2004) conducted a questionnaire study to identify the sources of learning performance from twenty-five world-class manufacturers. Findings demonstrated that investments in firm-specific human capital significantly impacted learning and firm performance. Firms using screen tests in the hiring process had higher performance, seemingly because they could identify employees with specific knowledge, skills, and abilities (Hatch & Dyer, 2004). Human capital is considered an asset, but to have a competitive advantage, one must attract and retain the right people (Lawler, 2009). Lawler (2009) outlines three ways to make human capital a resource: (1) create corporate boards with knowledgeable members who are experts to advise, (2) develop executives who practice shared leadership and are committed to developing leaders, and (3) consider human resources as its most important group.

Gary Becker's work (1962, 1964) determined that firms with more human capital (e.g., on-the-job training, formal education) have higher productivity. Grant (1996) suggested that knowledge is a firm's most critical competitive asset. Common knowledge allows individuals to share and integrate aspects of knowledge that are typically not common within a firm (Grant, 1996). However, a firm with an additional specialization of knowledge requires purposefully coordinated actions from individuals within the organization. It is advantageous for a firm to encourage key employees to invest in firm-specific knowledge as an investment in human capital (Wang, He, & Mahoney, 2009).

Becker's (1963) research led to the development of the human capital construct, which focused on the general theory of human capital investment and not just assessing profitability. Pfeffer (1994) argued that human capital was a critical resource in most firms. Although other sources of competitive success may become less important, the organization's employees are a critical component. For example, Southwest Airlines' business strategy includes exceptional service for each passenger. In 1992, they won awards nine times for best on-time performance, fewest lost bags, and fewest passenger complaints (Pfeffer,1994). Employees who interacted with customers made these experiences top-tier, providing a direct connection to the importance of hiring, training, and retaining employees, now referred to as human capital.

Research has identified human capital as the most valuable asset when it is nontradable (Wang et al., 2009). Human capital has been studied at both micro (i.e., individual) and macro (i.e., unit or organizational) levels (Ployhart & Moliterno, 2011). Micro-level human capital is an accumulation of knowledge, skills, abilities, and other characteristics (KSAOs), accessible resources for individuals, unit-level and firm-level. The KSAOs, also referenced as human capital resources, contribute to a firm's capital resources (Ployhart & Moliterno, 2011). Human capital research has been studied more using single-level approval (Hitt et al., 2008; Wright & Boswell, 2002). Organizations would only exist with individuals. Felin and Foss (2005) discussed how individuals matter and the need for micro-foundations in strategic organizations. They wrote their essay in response to organizations lacking focus on individuals and how they were taken for granted (Felin & Foss, 2005). Findings summarized that leadership should focus on skills, capabilities, and collective structures to understand better individuals' underlying actions, choices, abilities, and motivation.

Research has shown that from a macro-level view of human resource management, organizations that implement more generic practices within human resources (i.e., hiring, tests, training) will outperform other organizations (Wright & Boswell, 2002). The macro-level involves the relationship between individual-level phenomena and the KSAOs of an individual (Ployhart & Moliterno, 2011). Some strategic human resource management practices use the resource-based view (Wright & McMahan, 2011; Wright, Dunford, & Snell, 2001), which stems from Penrose (1959) and Barney (1981) outlining the theoretical model and criteria for sustainable competitive advantage. Nevertheless, Ployhart et al. (2011) used the multilevel theory to explain why it was necessary to understand how processes relate across the individual, unit, and firm levels. This approach created a conceptual model to help researchers understand how individual human resources become a unit of human capital resources. Measuring and tracking performance is essential once a firm successfully hires and recruits human capital.

### *2.2 Performance Management*

Given that human capital can be a crucial asset leading to competitive advantage, measuring and managing performance is instrumental in improving the effectiveness of organizations and their employees. Performance is measured individually, by unit, or by the organization as employees grow during their tenure. Performance management has been defined using various definitions (Armstrong & Baron, 1998; Lebas, 1995; Armstrong, 2006; Aguinis, 2009; Aguinis, Joo, Gottfredson, 2013). For this study, I will use Aguinis' (2009) definition of performance management as "a continuous process of identifying, measuring, and developing the performance of individuals and teams and aligning performance with the strategic goals of the organization" (p. 8). Over the years, a considerable body of literature has examined ways to improve individual performance and productivity. Traditionally, efforts with individual-level performance and some team performance have been concerned with improving performance at work (DeNisi & Smith, 2014). Questionnaires were used to help understand areas such as work behavior, task performance, contextual performance (Koopman, Bernards, Hildebrandt, Burren, & van der Beek, 2013), personalities (Hughes & Batey, 2017), and functional outcomes (Massof & Rubin, 2014). Management-by-results on employees were used to measure individuals' productivity based on results and work output, discovering adverse side effects of quantity over quality (Kaillo & Kaillo, 2014). Assumptions have been made that individual performance would improve firm performance, but the most important is establishing meaningful relationships between individual and firm performance (DeNisi & Smith, 2014). A review of the literature by DeNisi and Smith (2014) identified that the traditional methods of human resources practices were related to individual performance. A proposed model on the effects of performance management on firm performance suggests a new approach to analyzing national and corporate culture factors before any system can be designed. DeNisi & Smith (2014) believed culture influenced how performance was defined, determining a firm's success. Overall, measuring performance helps firms to assess if goals and objectives are being met carefully.

### *2.3 Performance Distributions*

Firms measure performance using metrics, sometimes called Key Performance Indicators. These indicators help to monitor individual, unit, and firm performance for overall performance and efficiency. Early studies assumed that individual performance followed a normal distribution (Hull, 1928; Schmidt & Hunter, 1983; Tiffin, 1947), which clusters around the mean and then fans out into symmetrical tails, forming a bell-shaped distribution (O'Boyle & Aguinis, 2012).

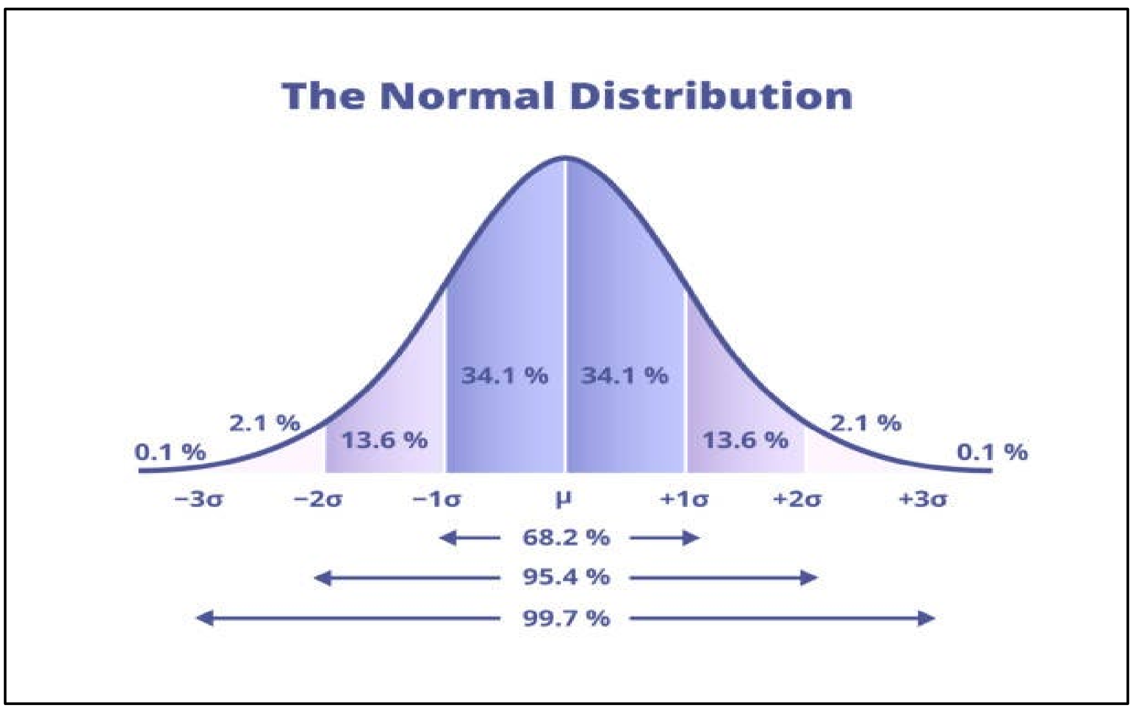


*Figure 4: Normal distribution (Source: Adobe Stock, 2023)*

The bell-shaped curve, also called Gaussian distribution, contains most of the data at the center with the highest point on the arc of the line. More of the sample data is present near the mean value, which decreases as the value moves toward the left and right edges of the curve (Figure 4).

As employees are measured on performance, some will excel beyond the average employee. These employees, sometimes called outliers, can be high or low performers. Outliers usually disproportionately influence substantive conclusions regarding relationships among variables (Aguinis et al., 2013). In other words, they are either too small or too big compared to the rest of the data. A literature review of 46 methodological sources around outliers led to a taxonomy, revealing uncertainty and contradictory information on how researchers should address outliers (Aguinis et al., 2013). According to Aguinis et al. (2013), outliers fall into three categories: error, interesting, and influential. This framework detailed how to define, identify, and handle outliers, revealing the inconsistencies of how outliers are handled and demonstrating the importance of digging deeper when an outlier is involved.

In conclusion, they noticed that researchers often noted practices that were difficult to replicate, not transparent, and unconventional, leading to cynical views and removing outliers to favor their hypothesis (Aguinis et al., 2013). Not all outliers should be removed or be seen as problematic. Most theories on performance target the average worker using appraisal systems and drop the outliers (O'Boyle & Aguinis, 2012). Nevertheless, further research has found that dropping the outliers and forcing normality may be misguided (O'Boyle & Aguinis, 2012).

### *2.4 Star Performers*

Outliers with extreme scores in the performance domain have been examined, and most performance outcomes are generated by a small group of highly productive performers called star performers (O'Boyle & Aguinis, 2012). Star performers are elite performers who emerge and contribute disproportionately to organizations (Aguinis & Bradley, 2015). Star performers have been studied within organizations using various terms such as stars, superstars, and top performers. Its roots began with a scholarly study by William Whyte (1956), who interviewed CEOs from large-scale manufacturing firms and found that stars were more desirable in dynamic environments, while average workers were more desirable in static industries.

Rosen (1981) determined that stars' productivity and output could not be substituted through the work of other employees. This phenomenon led to two common elements: (1) a close connection between personal reward and the size of one's market, and (2) a strong tendency to be skewed toward the most talented people in the activity. Furthermore, Rosen (1981) conceptualized the economy of star performers using income and the "concentration of output among a few individuals."

Star performers within organizations are credited with producing irreplaceable, indispensable, value-enhancing contributions (Asgari, Hunt, Lerner, Townsend, Hayward, & Kiefer, 2021). Research in knowledge-based areas has supported recruiting and hiring star performers as a talent management strategy (Pobst, 2014). Managing the talent of star performers is essential to sustaining a competitive advantage (Asgari et al., 2021; Bish & Kabanoff, 2014). This strategy is created when an organization forecasts the need for human capital and plans to meet it (Cappelli, 2008).

A study by Bish and Kabanoff (2014) surveyed 174 managers in Australian public sectors and found that task and contextual performance were core components of high-level, individual effectiveness. They emphasized the need for a multidimensional approach when measuring performance to unpack key aspects of a star performer (Bish & Kabanoff, 2014). Identifying, measuring, and retaining star performers provides a strategy sustaining competitive advantage. True stars achieve stardom because they have creative ability, are visionaries, possess emotional intelligence, and take calculated risks (Kets de Vries, 2012). They seek out the unfamiliar, producing a wide span of interests and experiences while keeping the mindset of excellence. Star performers can create value that distinguishes them from the average performer, causing a direct impact on organizational performance (Asgari et al., 2021). In order to identify star performers, performance management should (a) include the full range of performance, (b) be time-bound, and (c) focus on comparable jobs (Call, Nyberg, & Thatcher, 2015). Assessing the full range of performance allows leadership to see how employees perform in similar jobs during the same time frame. A star performer's motivation to be known will likely increase negative or positive visibility over an extended period, affecting performance (Call et al., 2015). They must maintain extended and disproportionately high performance with relevant social capital (Asgari et al., 2021). Social capital is obtained through relationships and is essential for star performers (Call et al., 2015; Nyberg, Moliterno, Hale & Lepak, 2014).

Employees who work within organizations increase their knowledge base, creating value. One way to create value is by examining key attributes such as task performance and status. Task performance provides the commonly valued measure of an employee's direct contribution to the organization and is central to classifying stars (Kehoe, Lepak, and Bently, 2018; O'Boyle & Aguinis, 2012). According to Kehoe et al. (2018), task performance is an individual's effectiveness in completing their job or core responsibility. Status brings value to internal and external relationships with other elite employees and builds collaboration. Those relationships connect employees and organizations, which may lead to discoveries and opportunities.

Value increases as performance increases, leading to financial gains (Joo, Aguinis, Lee, Kermer & Villamor, 2021). Only a little research has been conducted analyzing the financial impact of hiring star performers. A recent study examined the financial value that human resource management (HRM) could offer by obtaining more star performers. Joo et al. (2021) reviewed 206 samples of individual performance (i.e., operational output by individual employees) from 824,924 employees from various occupations, performance measures: individual versus team sports, actual versus forced rankings, and one-star versus multiple-star sports. Findings discovered that HRM added greater financial value to organizations by obtaining more stars. Han and Ravid (2020) conducted a study comparing revenues, capacity, and ticket prices before and after the transition of cast members of Broadway Shows. Data from theater performances from 1990 to 2013 were collected from 82 performances, with 498 unique performers. Findings suggested that theater stars with exceptionally talented actors brought more success, increasing the financial value.

### *2.5 Star Performers' Performance Distribution*

Research and practice within fields such as human resource management, organizational behavior and entrepreneurship, and strategic management have built upon the output of an individual worker, revealing that star performers produce the majority of the overall productivity (Ready, Conger, & Hill, 2010; Aguinis & O'Boyle, 2014). While some studies use a normal distribution to measure individual performance, Aguinis and Bradley (2015) believed Pareto's model applied to star performers who "produce more than other individuals, help increase the productivity of those around them, and have an important impact" (p.161) on the organization's performance Pareto's principle, also known as power law distribution, states that "20 percent of the known variables will account for 80 percent of the results" (Basile, 1996, p. 54). Italian economist Vilfredo Pareto is known for one of his first works, Cours d'économie politique (1986-1997). His work took a mathematical formulation and found that the distribution of income and wealth in society was not random but consistent throughout history in all parts of the world and all societies. This model produced fatter tails than those seen in a normal curve, allowing more extreme values to be present (O'Boyle & Aguinis, 2012). Figure 5, as shown by O'Boyle & Aguinis (2012), demonstrates a normal distribution (black) overlaying a Paretian Distribution (grey).

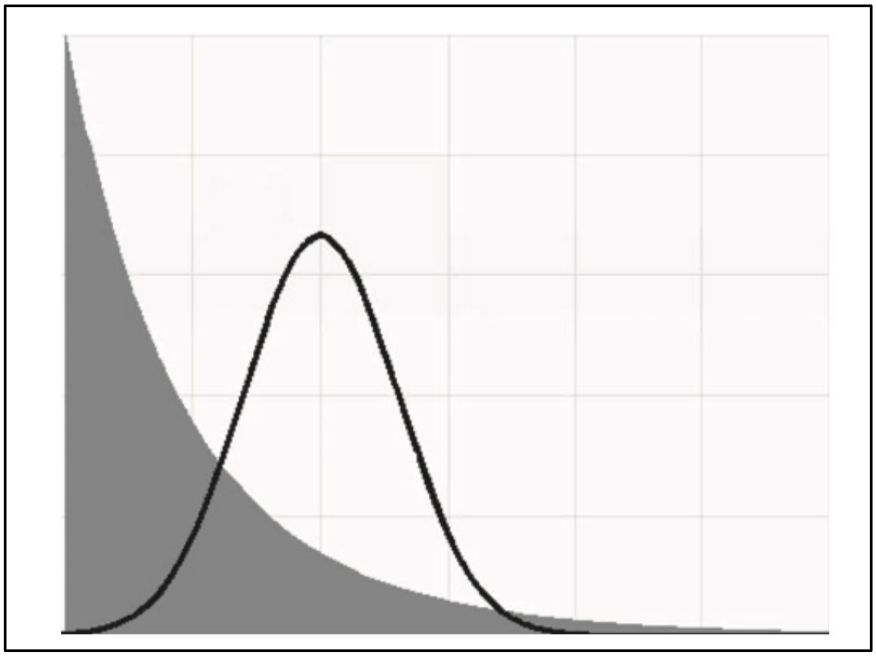

*Figure 5: Normal Distribution Overlaying a Paretian Distribution (Grey)*
*(Source: O'Boyle & Aguinis, 2012, pp. 80)*

Power-law distributions have been studied in financial markets (Gabaix, Parameswaran, Vasilik, & Stanley, 2003), entrepreneurship (Crawford, Aguinis, Liechtenstein, Davidsson, & McKelvey, 2015); software systems (Hatton, 2009), and geosciences (Corral & Gonzalez, 2019). Studies on star performers involving researchers, entertainers, politicians, and amateur and professional athletes have been conducted. A set of studies conducted by O'Boyle and Aguinis (2012) over five years measured more than 600,000 researchers, politicians, entertainers, and athletes. The first study, with a sample size of 25,006, used the number of articles published in the top five journals over 9.5 years over 54 disciplines. Results showed that the power law distribution yielded a superior fit to a normal distribution in every discipline. The normal distribution underestimated the extreme events and could have depicted the actual distribution better. Study 2 expanded on the findings in Study 1 and tested the entertainment industry, using a sample size of 17,750 individual performances and measured the number of times an entertainer received an award, nomination, or another high honor (i.e., New York Times best-selling author). Findings were similar for Study 2 and Study 1, which found that the power law distribution was a better individual performance model. The remaining studies reviewed politicians and athletes in collegiate and professional sports and found a better fit using the power law distribution.

A Goodness-of-fit test compares the observed values to the expected (predicted) values. When referring to a better fit, the goodness-of-fit tests determine how well a model fits a given data set or how well it can predict a future set of observations (Goldstein, Morris, & Yen, 2004). It can also help determine if a sample follows a normal distribution if there are random samples from the same distribution, or if categorical variables are related. Findings in other research indicate consistency across industries, job types, performance measures, and time frames, demonstrating that individual performance best fits the power-law distribution model (O'Boyle & Aguinis, 2012).

### *2.6 Star Performers in Academia*

Science is a fertile ground filled with human capital. Economists believe science captures attention because it is a source of growth and impacts the public with good through problem-solving (Stephen, 1996). Human capital has been studied in several applied fields, such as labor, education, and health, leading to the development of human capital research. The constant development of human capital has become critical as the labor market constantly transforms. In the early years, human capital saw the benefits of education in the labor market (Teixeira, 2014).

Allan Fisher (1946) emphasized the role of education and training throughout his publications. Faculty members must have a college education, knowledge, skills, abilities, and other characteristics (KSAOs) for universities to have and sustain a competitive advantage. As individuals or units increase their KSAOs, the stock of human capital resources increases, creating a competitive advantage. Their KSAOs vary based on their specialization, but a baseline of education is needed for their positions. Each university has a strategic plan based on its collective strategy to create a competitive advantage. Nevertheless, recruitment and the screening process must be strategically designed in the HR department to be unique and set apart from others.

Universities have strategic methods to hire teaching-focused positions, providing novel opportunities to transform undergraduate and graduate disciplines in science, technology, engineering, mathematics (STEM), and other disciplines. Hiring the best and brightest is one of the necessary steps to ensure that universities remain competitive and have breakthrough research discoveries. Strategically hiring faculty within specific disciplines supports the definition of strategic human resource management, which is the "pattern of planned human resource deployments and activities intended to enable an organization to achieve its goals' (Wright & McMahan, 1992, p. 298). Universities are knowledge-based societies (Etzkowitz, Webster, Gebhardt, & Terra, 2000), and faculty members have the intellectual capital to provide learning opportunities for students and other employees. Faculty members teach, train students, and conduct research in specialized areas while playing a pivotal role in creating and disseminating knowledge for society (Gomez-Mejia & Balkan, 1992). Faculty members' performance can be evaluated using various methods, such as teaching effectiveness, scholarly articles, professional achievements, research, advising, and external funding to support research.

Additional evaluations may include service activities on and off-campus community activities. As universities create and implement strategic plans, they achieve superior performance when it aligns with their resources and the environment (Winfrey, 1996). As stated earlier, science is impactful because discoveries are made for the public's good. When discoveries are made at universities, it provides a competitive advantage.

Public sector domains (i.e., government offices and universities) have been studied, measuring performance using output-based results while ignoring outcomes. Employee performance appraisals are the most common measure of individual performance (DeNisi & Smith, 2014). However, outcome-based or results-based is one of the methods used to drive business performance (Armstrong, 2009). According to Rosen (1989), outputs describe what the public sector produces, such as goods and services, but outcomes are the effects caused by the outputs (Talbot, 2010). Universities are rich in knowledge and resources for students, faculty, staff, and the community. Higher education, in general, has to change often to sustain and create a competitive advantage globally to remain relevant. The research focused on performance management at universities has been conducted in various countries, such as Italy (Biondi & Russo, 2022), the United Kingdom (Aboubichr & Conway, 2021), Finland (Kaillo, Kaillo, Tienari & Hyvonen, 2016), and the United States (Bianchi & Caperchione, 2022). Academia is becoming increasingly market-oriented, subjecting it to competition among current and prospective students (Czarniawska & Genell, 2002). Performance management is essential in helping keep up with new systems and metrics, leading to marketing strategies (Kaillo et al., 2016). It is used to demonstrate sustainability challenges, issues, or risks to highlight areas that need improvement. Traditionally, measuring research and teaching performance has played a role in individuals and their performance (Ter Bogt & Scapens, 2012). However, newer methods and systems are more judgmental, looking at past performance to evaluate quantitatively (Ter Bogt & Scapens, 2012). Tracking and reviewing past performance creates a baseline for future goals and strategic planning.

### *2.7 External Funding in Academia*

External university funding has increased to provide opportunities for groundbreaking ideas. According to USA spending, the federal government invested over $149 billion in colleges and universities in 2018 for research grants. In the fiscal year 2022, government funding increased to $193 billion (IBISWorld, 2022), averaging 2.2% over the past five years. Although much funding comes from the federal government, other entities fund research. Current data from the National Center for Science and Engineering Statistics (NCSES) found trends of research and development (R&D) spending of $707.9 billion in 2020 (NCSES, 2022). R&D spending includes funding from private businesses, the federal government, non-federal government, higher education institutions, and nonprofit organizations. Funding is used for basic research, applied research, and experimental development. Basic research is experimental or theoretical work conducted primarily to acquire new knowledge of phenomena using observable facts. Basic research spent $107.9 billion in 2020, or 15.2% of all R&D spending. Applied research occurs when the original study is conducted to acquire new knowledge toward a specific aim or objective. Experimental research occurs when systemic work based on knowledge gained from research or practical experience produces additional knowledge, usually aimed at producing new products or processes. Applied research and experimental research spent $139.5 billion (19.7%) and $460.5 billion (65.1%), respectively. With so much funding being provided and spent on research, we see the investment and the impact and need for research.

External funding helps universities solve problems for the general public while discovering cures, teaching new methods, and training the next generation of scientists. Universities use research productivity to set strategic goals for researchers for promotion, tenure, and retention. Research Institutions with very high research activity are classified as R1 and are considered the most complex and prestigious institutions. At R1 institutions, most faculty and staff are hired to conduct research, with metrics, such as publications, used to calculate their career track (Aguinis & Bradley, 2015; Falaster et al., 2016). Research productivity in business has primarily been based on published scholarly articles (Aguinis & Bradley, 2015; Falaster et al., 2016; Kwiek, 2018). Researchers are encouraged to publish in top-tier journals to receive rewards in salary or tenure (Aguinis & O'Boyle, 2014; Gomez-Mejia & Balkan, 1992). Publishing knowledge brings value to researchers and has been used as a measure of institutional success, especially in doctoral-granting universities (Wellmon & Piper, 2017). However, focusing on publishing counts has been criticized because publishing varies due to disciplines (Toutkoushian et al., 2003). Some disciplines, like physical and biological sciences, produce favorably due to the nature of their work, as opposed to humanities or social science.

While publications are essential to a faculty member's path to tenure, grant funding is a financial mechanism to support publishing research findings. Research publishing is an underlying performance construct (Aguinis, Cummings, Ramani, & Cummings, 2020). Traditional research was found to be an expectation of administrators for promotion and tenure (Schweitzer, 1989) and has included ways to support high and low-performing scholars (Hailiem, Amara, & Landry, 2014). Hailiem et al. (2014) created five scholar profiles based on 1,286 individuals at 35 business schools to determine factors related to publishing articles. This method focused on high-performing researchers and assessed scholarly researchers who have rarely published or have few publications. Findings suggested a positive relationship between high research funding, publications, and public support (Halilem et al., 2014). Another study reviewed university professors in Quebec and measured research funding, publications, and citations (Larivière, Macaluso, Archambault & Gingras, 2010). Using a sample size of 13,479 university researchers and professors in Quebec, Canada, they analyzed research funding, citations, and publications. Findings discovered that funding was highly concentrated using the Pareto distribution, with the 80:20 rule observed in natural sciences, engineering, and social sciences (Larivière et al., 2010). With publications and citations, results displayed a higher concentration for citations in humanities and non-health disciplines. This study will only analyze faculty within the same university on research funding, which differs from Larivière et al., 2010.

With research being a significant part of the university infrastructure, external funding is one of the many facets supporting research endeavors. Jacob and Lefgren (2011) studied the impact of research funding on publications and citations. They reviewed basic science applications to the National Institutes of Health (NIH) from 1980 to 2000 and found that receipt of one grant produced only publication over the subsequent five years. During that time, the average research grant was $1.7 million. Standard NIH grants have a small effect on each applicant's published research. Additional findings demonstrated how applicants who did not get funded would look for other funding sources. At the end of the fiscal year in 2021, NIH awarded research grants with an average budget of $571,561, down from $1.7 million measured in Jacob and Lefgren's (2011) study. Another study involving 68 research universities found that funding of $1 million produced ten more publications (Payne & Siow, 2003).

### *2.8 Research Questions*

#### *2.8.1. Distribution of Grant Funding*

External funding provides funding for various purposes. It builds infrastructure, allowing the purchase of equipment, construction or renovations, supplies, and human capital. Hiring personnel to work on research projects is the most considerable expense on grant funding. NIH suggests 60-80% of expenditures are for personnel and fringe benefits. Since a significant portion of grant funding goes towards personnel and providing jobs, human capital provides a competitive advantage for universities. Each research project is unique, and students and employees are trained to focus on the researcher's specialty. As projects are conducted, human capital and knowledge increase the value of the university. Only a little research has been done on external funding and star performers. With external funding playing a vital role in training people and solving today's problems for the public's good, I will examine star performers in the context of external funding at a private R1 institution. I plan to explore three novel questions: (1) Does the performance distribution of external funding mirror the distributions found in other domains (e.g., publications)? (2) What is the financial contribution of star performers relative to the other faculty members? (3) Does the researcher's discipline moderate the relationship between individual performance and value? These three questions will contribute to star performers and performance management practices literature.

Universities monitor the productivity of employees individually, by unit, and overall. Academic literature has often focused on measuring faculty based on published scholarly articles and citations. Faculty positions are highly complex and require post-secondary education, specialized knowledge, skills, and abilities. With highly skilled faculty, research has shown that a small group of stars will emerge as individuals are measured, dominating through massive performance (Aguinis & O'Boyle, 2014). Measuring individual performance has been conducted using the normal distributions (Hull, 1928; Schmidt & Hunter, 1983; Tiffin, 1947), but the literature has studies supporting the power-law distribution (Aguinis & O'Boyle, 2014; Marsili, 2005; Scherer & Harhoff, 2000). O'Boyle and Aguinis (2012) studied over 490,185 researchers who produced over 943,000 publications across 54 disciplines over ten years. Findings suggested the power-law distribution better fit each discipline, with the normal distribution underestimating the number of extreme events. Also, the normal distribution did not accurately measure the actual distribution (O'Boyle & Aguinis, 2012).

Notably, when measuring the productivity of individuals, Aguinis and O'Boyle (2014) proposed that individual performance would be better modeled by a power-law distribution for organizations that adapt to the 21st-century workplace, with increased job complexity, flexible hierarchies, and reduced situational constraints. The 21st-century working environment has led organizations to change from land and resources to more of a focus on innovation and collaboration (Aguinis & O'Boyle, 2014). Given those findings in the performance domain of publications, I am proposing a similar distribution for external funding at a private R1 institution.

R1: Does the performance distribution of external funding mirror the distributions found in other domains (e.g., publications)?

### *2.8.2. Research Productivity and Performance-Value Function*

Today's workplace creates the potential for stars to distance themselves greatly from the average worker regarding added value (Lepak & Snell, 2002; Oldroyd & Morris, 2012; O'Boyle & Aguinis, 2012). Star performers are considered high-quality colleagues who bring several benefits to an organization, leading to increased value (Groysberg, Lee, & Abrahams, 2010).

When measuring productivity, star performers will dominate production, but the individual output relative to their peers is often tiny compared to the organization's overall value (O'Boyle & Aguinis, 2012). The value placed on performance at the tails of the distribution changes along with the performance distribution (Aguinis & O'Boyle, 2014). Past research on star performers has measured value using compensation (Aguinis & O'Boyle, 2014; Baron & Pfeffer, 1994; Cowherd & Levine, 1992). Compensation is assigned to a position more often than to an individual's level of expertise (Lazear, 1992). Star performers often receive more compensation than the average worker who performs slightly below the stars (Aguinis & O'Boyle, 2014). Kehoe et al. (2018) classified stars into three categories, creating exceptional value for organizations. These three categories - universal stars, performance stars, and status stars - were identified to include stars' contributions, creating a full range of exceptional performers in the organization. Faculty members were categorized as performance stars, or rising stars, who are early in their career in a specific industry (e.g., research) and are given a status without performing (Kehoe et al., 2018). Faculty members are hired into a position with a specific skill set and a post-secondary degree in education. Their positions come with resources (e.g., lab space, start-up funds) to help them become successful and bring a competitive advantage to their university. However, they must perform to be of value to the institution.

Faculty members at R1 institutions are expected to bring in grant funding to support their research. Other literature has focused on the impact of funding on research output (Jacobs & Lefgren, 2011). Adams and Griliches (1998) studied trends in university research teaching and productivity because universities accounted for 50% of basic research in the United States. Still today, higher education institutions are the most prominent contributors to basic research (National Science Foundation, 2022). With research being such a significant factor at R1 universities, research productivity helps current scientists shape the training of graduate students, who may become the next generation of scientists. Kwiek (2018) studied the upper 10% of Polish academics' research productivity with the remaining 90% and found that top performers produced about half of all publications across clusters of academic disciplines. The study also discovered that the average research productivity distribution was highly skewed for top performers, meaning the right tail of the productivity distribution tends to behave as the entire productivity distribution. Similar findings were found by Yair, Guetta, & Davidovitch (2017) and Abramo, D'Angelo, & Soldatenkova (2017), with research productivity being skewed to the right and within the upper tail. O'Boyle and Aguinis (2012) examined multiple industries (e.g., researchers, entertainers, professional athletes) using the performance-value (P-V) function as exponential, finding the top percentage of performers contributing an average of 30.1% of the total production. A simple example of an exponential function f (x) = 2x is shown in Figure 6. Aguinis & O'Boyle (2014) examined an exponential relation, indicating that a CEO making 100 times more than other performers did not have to perform 100 times better. They only needed to perform slightly better than the next closest performer. Aguinis and O'Boyle (2014) proposed that within similar organization positions, the relationship between performance and value would follow an exponential function with approximately 30% of value vested in the top decile of workers and 50% of value vested in the top quartile. Limited research has been conducted on how star performers affect value-creating possibilities (Kehoe et al., 2018). I aim to test the proposition based on grant funding for the second research question. I will use research productivity (individual performance) based on grant applications and value based on grant funding (firm performance).

R2: What is the financial contribution of star performers relative to the other faculty members?

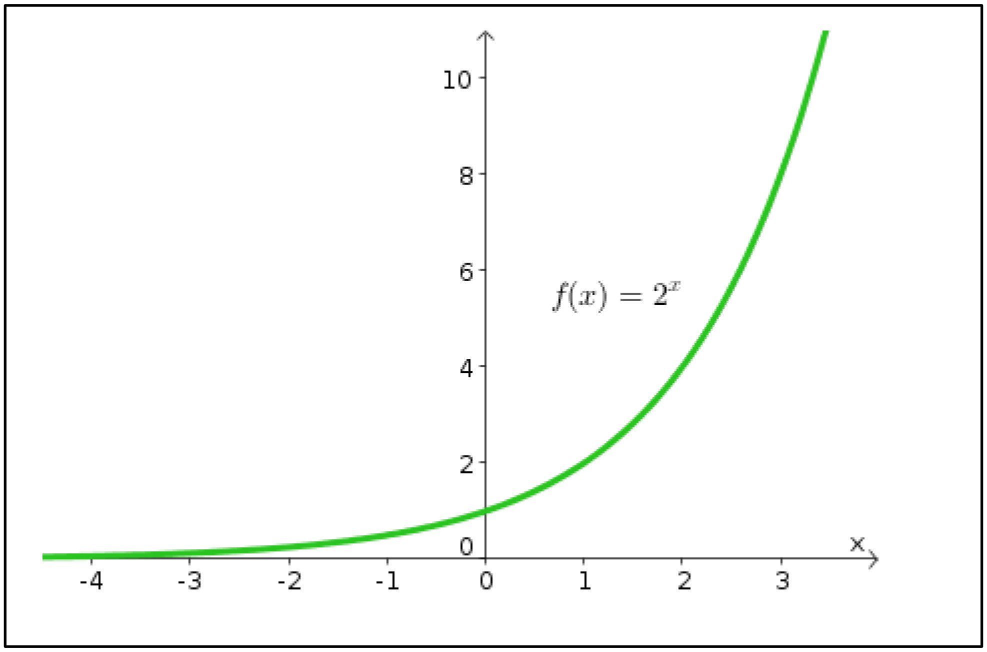


*Figure 6: Graphical representation of the exponential function f(x) =* $2^x$
*(Source: Nykamp, 2023, The Exponential Function, Math Insight.org)*

### *2.8.3 Degree of Proximity to Strategic Core Competence*

The work environment and a star performer's position align with the strategic core theory (Aguinis & O'Boyle, 2012). Humphrey, Morgeson, and Mannor (2009) define strategic core theory as "the role or roles of teams that (a) encounter more of the problems that need to be overcome in the team, (b) have greater exposure to the task that the team is performing, and (c) are more central to the workflow of the team." Teams must overcome adversity to succeed regardless of the problem's source (Humphrey et al., 2009). Faculty work collaboratively in their departments and with their internal and external colleagues. As productivity is measured during a faculty member's tenure, star performers emerge, and a role may be designed with greater responsibility. Those performing more tasks or who complete a large portion of the work will substantially contribute to the team goal (Humphrey et al., 2009). Humphrey et al. (2009) analyzed 778 observations of major league baseball teams and examined core roles by team experience, career experience, job-related skills, core allocation, and team performance. Results confirmed that core role players were more strongly related to performance and that teams who invested more financially in core roles significantly outperformed (Humphrey et al., 2009). Star performers do well if they are engaged in the work that is vital to the organization (Huselid, Beatty, & Becker, 2005). Delivery & Shaw's (2001) model illustrated that knowledge, skills, and abilities directly influenced high workforce productivity, motivation, and empowerment.

The distance, or proximity, between the star's output and organizational output, will be limited when referring to position. For example, a high-performing faculty member at an R1 institution who secures grant funding may be a star performer. However, their impact will be limited to the distance between the individual level and the university's overall grant funding. Distribution of tasks, duties, and responsibilities should be given to star performers who can produce the most based on the firm's goals (Aguinis & O'Boyle, 2014). Research studies of academic researchers have found that employees at the top of the performance distribution are more valuable than their colleagues (Oldroyd & Morris, 2012; Ernst, Leptin & Vitt, 2000). An empirical study analyzed 43 German companies that were critical chemical, electronic, and mechanical engineering inventors. The results showed a high concentration of patent applications and performance of inventors when the number and the quality measured them. A few essential inventors responsible for the technological performance emerged, providing a competitive advantage for the company (Ernst et al., 2000).

Core competence is the knowledge that distinguishes a firm and provides a competitive advantage (Agha, Alrubaiee, & Jamhour, 2012). For universities, core competencies are linked to the strategic plan of the overall university centered around retention and graduating students. As discussed earlier, hiring the best faculty to teach and train students provides a competitive advantage. Strategic core competencies are based on knowledge dissemination at smaller teaching schools rather than knowledge creation (Aguinis & O'Boyle, 2012). Recruiting top researchers for knowledge creation efficiently leverages resources at a research-intensive university (Humphrey et al., 2009). With researchers being hired with core competencies in mind, this study looks to examine if an organization's strategic core competence will moderate the individual performance of the researcher and the value of total research. For the third research question, I look to determine if the relationship is more curved as proximity increases.

R3: Does the researcher's discipline moderate the relationship between individual performance and value?

# CHAPTER 3: METHODOLOGY

This chapter contains three sections. First, I present an overview of the methodological approach to execute the experiment based on the research questions and the study aim. The second section will cover data selection, providing context and rationale for its inclusion in this dissertation. Finally, the third section will expound on the study's methodology and the data analysis.

## *3.1 Overview and Study Aims*

In order to address the research questions, I used a quantitative empirical investigation utilizing archival data. This study aimed to quantify individual research productivity with the research proposals awarded to researchers affiliated with a globally renowned private R1 institution. Four variables were collected and analyzed. Three distinct approaches were used for data analysis:

- Distribution fitting was utilized to find the most suitable distribution.
- An assessment of financial contribution was conducted for each faculty member.
- The correlation between performance and value was examined based on the faculty member's academic discipline.

## *3.2 Data Selection and Sample Size*

The data was extracted from the institution's internal proposal tracking system containing information on applications awarded by external sponsors and downloaded in an Excel spreadsheet. The criteria for the sample data were applications with submission dates between July 1, 2016, and June 30, 2021, from faculty members who applied for funding from an external sponsor in support of their research. Only applications with a decision of funded or unfunded were used. The sample size of 7,213 applications spans the university, including 20 departments from the campus, 37 departments within the School of Medicine, and the School of Nursing. Table 1 provides a comprehensive list of departments used to measure research productivity.

*Table 1: Comprehensive List of Departments*

| **Campus Departments (315 applications)** | |
|---|---|
| 1. African & African American Studies<br>2. Biology<br>3. Campus Administration<br>4. Chemistry<br>5. Computer Science<br>6. Cultural Anthropology<br>7. Economics<br>8. Engineering<br>9. Environment<br>10. Evolutionary Anthropology | 11. Family Policy<br>12. Health Management<br>13. Health Policy<br>14. Marine Laboratory<br>15. Phd Program<br>16. Psychology and Neuroscience<br>17. Public Policy<br>18. Social Science<br>19. Sociology<br>20. Statistical Science |
| **School of Medicine (6,805 applications)** | |
| 1. Administration<br>2. Aging & Human Development<br>3. Anesthesiology<br>4. Basic Research<br>5. Biochemistry<br>6. Biostatistics & Bioinformatics<br>7. Brain Imaging & Analysis<br>8. Cell Biology<br>9. Clinical Research Institute<br>10. Combined Heat and Power<br>11. Community & Family Medicine<br>12. Dermatology<br>13. Genomics and Computational Biology<br>14. Global Health<br>15. Heart Center<br>16. Human Vaccine<br>17. Immunology<br>18. Integrative Genomics<br>19. Medical Education | 20. Medicine<br>21. Molecular Genetics and Microbiology<br>22. Molecular Physiology<br>23. Myeloma Clin Research<br>24. Neurobiology<br>25. Neurology<br>26. Neurosurgery<br>27. Nursing<br>28. OB/GYN<br>29. Ophthalmology<br>30. Orthopedics<br>31. Pediatrics<br>32. Pharmacology & Cancer Biology<br>33. Population Health Sciences<br>34. Psychiatry<br>35. Radiology<br>36. Regulatory<br>37. Surgery |
| **School of Nursing (93 applications)** | |

Campus departments submitted 315 applications, the School of Medicine submitted 6,805 applications, and the School of Nursing submitted 93 applications. Funded applications totaled \$2.889 billion, and unfunded applications totaled \$7.146 billion. Every faculty member was assigned a distinct identifier to facilitate the aggregation of their data points. Pivot tables were utilized to condense the records for each faculty member. A total of 1,144 distinct faculty members were identified in the dataset. From the pivot table, four variables were analyzed for each faculty member over the five years: (1) Number of Proposed Submissions, (2) Proposed Dollars, (3) Number of Awarded Submissions, and (4) Awarded Dollars. The Number of Proposed Submissions represents the cumulative count of proposals submitted by individual faculty members. Proposed Dollars denote the total sum of proposal funding for all submitted applications. Awarded Submissions signify the overall count of proposals that were funded. Awarded Dollars reflect the total sum of funding received for the awarded applications.

### *3.3 Data Analysis*

To analyze the first research question, I utilized the Dpit package, available on the Comprehensive R Archive Network (CRAN), with grant funding as the interest criterion. First introduced by Joo, Aguinis, and Bradley (2017), distribution pitting is a falsification-based method for comparing distributions and examining how well each fits within the given data set. The Dpit package enables users to evaluate the fit of seven distributions: Pure Power Law, LogNormal, Exponential, Power Law with an Exponential Cutoff, Normal, Poisson, and Weibull.

Using the results provided by Dpit, I employed the three decision rules described in Joo et al. (2017) to determine the best-fitting distribution. The first decision rule is to use the distribution pitting statistics generated by the Dpit package. I used each sample's log-likelihood ratio (LR) and associated p-value to determine which distribution fits better. The Dpit package will analyze each distribution to assess the "first" and "second" distributions. For example, a " NormvPL " distribution translates to the normal distribution versus the Pure Power Law and outputs the log-likelihood ratio. A positive LR value means the second distribution fits worse, whereas a negative LR value means the first distribution fits worse. An analysis of the p-value for each LR value will indicate how much a nonzero LR value can be attributed to random chance (Joo et al., 2017). If the p-value is low, the LR value is due to chance. I set the p-value cutoff of 0.10 based on the "Recipe for Analyzing Power-law Distributed Data' (Clauset, Shalizi, & Newman, 2009). This measurement calculates the Goodness-of-Fit between the data and the power law. It measures the distance between the distribution and the hypothesized model. The power law is a valid hypothesis if the p-value exceeds 0.10 (Clauset et al., 2009).

The second decision rule applies the principle of parsimony, which states that a simple model with fewer parameters is favored over a more complex model (Clauset et al., 2009). In other words, although a nested distribution with more parameters is guaranteed a good fit, reduced parsimony increases the risk that the model will be sample-specific and not generalizable. Joo et al. (2017) created a taxonomy with three pairs of nested distributions: (a) power law with an Exponential cutoff (two parameters) and Pure Power Law distribution (one parameter; (b) Power Law with an Exponential Cutoff (two parameters) and Exponential distribution (one parameter); and (c) Weibull distribution (two parameters) and Exponential distribution (one parameter). I measured the first decision rule, and if it does not measure the power law with an exponential cutoff or power law distribution as being the worst fit, I moved on to the second decision rule to identify the former distribution as the worst.

The third decision rule applies the principle of parsimony but focuses on choosing the distribution with fewer possible shapes. Flexible distributions, which are LogNormal, Poisson, and Weibull, represent a wider variety of shapes, capturing the shapes of an inflexible distribution (Joo et al., 2017). Inflexible distributions, which include Pure Power Law, Exponential Power Law with an Exponential Cutoff, and Normal distributions, are nested within a flexible distribution and have symmetric tails (Joo et al., 2017). Once I reviewed the output from the Dpit package, I determined the best fit by using the first decision, the first two decision rules, or all three decision rules (Joo et al., 2017).

To investigate the second research question, I aggregated the total awarded amount for each faculty member and categorized them by disciplines, such as business and nursing. Once I determined how much award dollars have been awarded to each individual, I ran descriptive statistics to determine the mean for the award amount. I also evaluated the performance-value function by examining the amount of grant funding awarded to individuals at different portions of the distribution (e.g., top quartile and top decile).

To test the third research question, I evaluated if the exponential relationship between performance and value is moderated by a position's degree of proximity to an organization's strategic core competence such that the relationship will become more curved as proximity

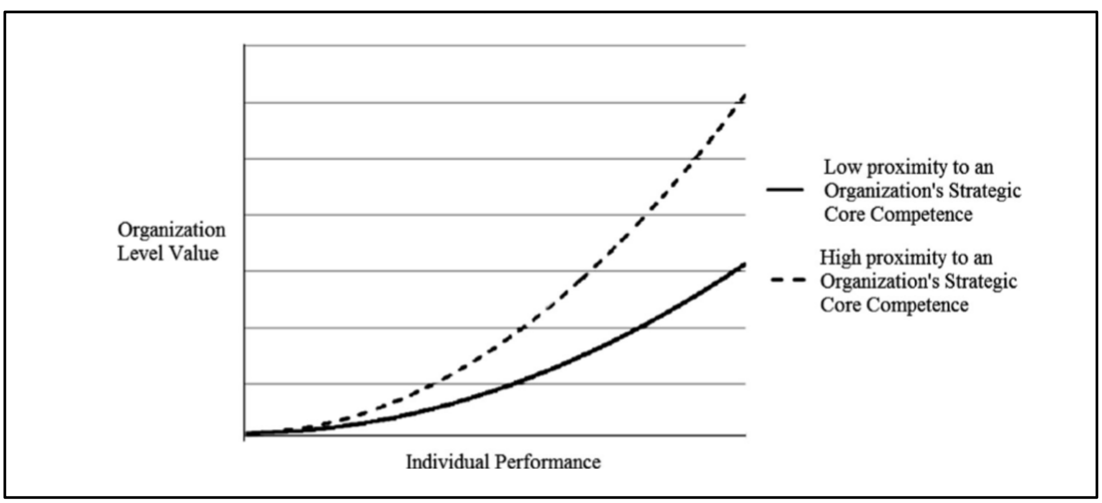


*Figure 7: Graphical representation of performance-value relationship and its moderation by the degree of proximity (Source: Aguinis & O'Boyle, 2014, p. 323)*

increases. I tested the proposition of Aguinis & O'Boyle (2014) based on Figure 7 of the performance-value relationship and its moderation by the degree of proximity. First, I classified each department as core and non-core competencies of the university. I determined if they were ranked according to the U.S. News & World Report based on the National Universities. If a department was ranked, they were categorized as having strategic core competencies that align more with the university. They were categorized as not having a core competency if they did not have a national ranking. Once all the departments were categorized, I examined the performance-value function separately for grant submissions aligned with strategic core competencies and those not. I then compared the values contributed at different percentiles of each distribution (e.g., top 10% or top 20%) using a table to demonstrate the difference in proportions.

# CHAPTER 4: RESULTS

This chapter presents the study's findings and the research questions' results in four sections. Initially, this section provides an overview of the sample and the descriptive statistics of the data. Afterward, I present an exploration of the analysis conducted through distribution pitting. Following that, I will review the results based on Pareto's Principle. The final section will discuss the results of the relationship between performance and value and the degree of proximity to an organization's strategic core competence.

## *4.1 Descriptive Statistics of the Data*

Descriptive outcomes are displayed in Tables 2 and 3 for the four variables examined in this study. For the Number of Proposal Submissions, a total of 7,213 applications were submitted by 1,144 distinct faculty members. The faculty members' submissions ranged from one application to a maximum of 84 applications. The standard deviation suggests considerable variability. The kurtosis value implies a notable presence of outliers or extreme values within the dataset.

*Table 2: Descriptive Statistics for No. of Proposed Submissions and Proposed Dollars*

| *No. of Proposed Submissions* | | *Proposed Dollars* | |
|---|---|---|---|
| Mean | 6.30506993 | Mean | 8,772,220.33 |
| Standard Error | 0.276804328 | Standard Error | 662,985.80 |
| Median | 3 | Median | 2,201,808.50 |
| Mode | 1 | Mode | 442,750.00 |
| Standard Deviation | 9.362371896 | Standard Deviation | 22,424,214.62 |
| Sample Variance | 87.65400752 | Sample Variance | 502,845,401,384,531.00 |
| Kurtosis | 16.15996574 | Kurtosis | 112.04 |
| Skewness | 3.447386322 | Skewness | 8.55 |
| Range | 83 | Range | 410,952,119.00 |
| Minimum | 1 | Minimum | 1,800.00 |
| Maximum | 84 | Maximum | 410,953,919.00 |
| Sum | 7,213 | Sum | 10,035,420,054.00 |
| Count | 1,144 | Count | 1,144 |

For the variable Proposed Dollars, 7,213 applications totaled $10,035,420,054 with a range of $410,952,119. The minimum total of proposal applications was $1,800, and the maximum was $410,953,919. The standard deviation suggests significant variability. The kurtosis value suggests an extremely heavy-tailed distribution with a significant number of outliers, and the skewness indicates a positive skew to the right.

For the variable Number of Awarded Submissions, the descriptive statistics found that out of the 1,144 faculty, 3,381 proposals were awarded to 771 faculty members. The minimum number of awards was one application, while the maximum was 49. The standard deviation suggests moderate variability in the awarded values. The kurtosis value suggests a distribution with relatively heavy tails and a notable presence of outliers. Finally, the skewness value indicates a positive skewness. Outcomes for the Number of Awarded Submission and Awarded Dollars are shown in Table 3.

*Table 3: Descriptive Statistics for No. of Awarded Submissions and Awarded Dollars*

| *No. of Awarded Submissions* | | *Awarded Dollars* | |
|---|---|---|---|
| Mean | 4.385214008 | Mean | 3,747,445.99 |
| Standard Error | 0.227412831 | Standard Error | 499,965.50 |
| Median | 2 | Median | 859,685.00 |
| Mode | 1 | Mode | 100,000.00 |
| Standard Deviation | 6.314546332 | Standard Deviation | 13,882,485.53 |
| Sample Variance | 39.87349538 | Sample Variance | 192,723,404,436,795.00 |
| Kurtosis | 13.91830279 | Kurtosis | 130.61 |
| Skewness | 3.333048797 | Skewness | 10.53 |
| Range | 48 | Range | 208,385,745.00 |
| Minimum | 1 | Minimum | 1,200.00 |
| Maximum | 49 | Maximum | 208,386,945.00 |
| Sum | 3,381 | Sum | 2,889,280,859.00 |
| Count | 771 | Count | 771 |

The final variable, Awarded Dollars, had 771 faculty members with applications totaling $2,889,280,859 in awarded applications. The mean (average) awarded dollar amount is approximately $3,747,445.99. The standard deviation indicates significant variability, with the smallest awarded dollar amount being $1,200.00 and the most significant amount being $208,386,945.00. The kurtosis value is greater than 1.0, which suggests a highly heavy-tailed distribution to the right with a significant number of outliers compared to a normal distribution. The skewness value is a measure of the asymmetry of a distribution. The Awarded Dollars value (10.53) exceeds 1.0, indicating a positive right-skew.

### *4.2 Distribution Pitting*

The distribution of each of the four variables was evaluated using R 4.3.1 (R Core Team, 2023) and the Dpit package (Joo et al., 2017). Three decision rules were used to determine the best fit using a comparative method for each sample. The first decision rule used the distribution pitting statistics generated by the Dpit package. For each variable, the package calculates the log-likelihood ratio (LR) and its associated p-value, comparing every pair of distributions to determine which distribution fits best. A positive or negative LR value indicates which distribution fits better. An analysis of the p-value for each LR value indicated the extent to which a nonzero LR value could be attributed to random chance (Joo et al., 2017). If the p-value was lower than the cutoff, the LR value was assumed not to be due to chance. The p-value cutoff of 0.10 was used based on the recommendations from Clauset, Shalizi, and Newman (2009).

Each distribution was compared to every other distribution for the first decision rule. If only one distribution was never identified as being the worst fitting, then I concluded that the distribution is the likely dominant distribution. If multiple distributions were never identified as the worst fitting, I moved on to the second decision rule. The second decision rule applied the principle of parsimony, which states that a simple model with fewer parameters is favored over a more complex model (Clauset et al., 2009). Several distribution pairs are considered nested in the sense that they describe similar distributions but with differing numbers of parameters. If two distributions fit equally well, but one requires fewer parameters, then the rule of parsimony dictates that the distribution with fewer parameters should be preferred. Joo et al. (2017) created a taxonomy with three pairs of nested distributions: (a) Power Law with an Exponential Cutoff (two parameters) and Pure Power Law distribution (one parameter; (b) Power Law with an Exponential Cutoff (two parameters) and Exponential distribution (one parameter); and (c) Weibull distribution (two parameters) and Exponential distribution (one parameter). This taxonomy can be used to choose between these pairs of distributions when they fit equally well. If a definitive distribution had yet to be identified after applying the first two rules, I next applied the third decision rule. This rule also applied the principle of parsimony but focused on choosing the distribution with fewer possible shapes. Flexible distributions are LogNormal, Poisson, and Weibull and represent a wider variety of shapes, capturing the shapes of an inflexible distribution (Joo et al., 2017). Inflexible distributions include Pure Power Law, Power Law with an Exponential Cutoff, and Normal distributions, and are nested within a flexible distribution and have symmetric tails (Joo et al., 2017).

The distribution pitting methodology was applied to four available variables: Number of Proposed Submissions, Proposed Dollars, Number of Awarded Submission, and Awarded Dollars. I reviewed the first decision rule for each variable and listed them in Tables 4-7. Starred LR had a p-value less than 0.10. The LR results for the number of proposed submissions are contained in Table 4. After analyzing all the comparisons, only two distributions were never significantly worse fitting: LogNormal and Weibull. Since multiple distributions were identified, I moved on to decision rule two to determine the best fit. Since Weibull is less parsimonious, it is identified as a worse distribution, leaving LogNormal as the dominant distribution. In summary, the number of proposed submissions has LogNormal as its dominant distribution after applying decision rules 1 and 2.

*Table 4*: *Dpit Result: Number of Proposed Submissions*  *Table 5: Dpit Result: Proposed Dollars*

*PL w/ Cutoff = Power Law with Exponential Cutoff. Negative of positive likelihood ratio (LR) determines the better fitting distribution. Starred LR means the p-value is less than the 0.10.*

| Number of Proposed Submissions | | |
|---|---|---|
| ***Worse Fit*** | ***Better Fit*** | ***LR*** |
| Normal | Power Law | -5.74* |
| Normal | PL w/ Cutoff | -12.62* |
| Power Law | PL w/ Cutoff | -926.03* |
| Normal | Weibull | -12.14* |
| Power Law | Weibull | -35.73* |
| PL w/ Cutoff | Weibull | -3.83* |
| Normal | LogNormal | -11.73* |
| Power Law | LogNormal | -33.77* |
| PL w/ Cutoff | LogNormal | -2.35* |
| Weibull | LogNormal | -0.71 |
| Normal | Exponential | -12.67* |
| Power Law | Exponential | -6.49* |
| Exponential | PL w/ Cutoff | 8.94* |
| Exponential | Weibull | 8.44* |
| Exponential | LogNormal | 7.65* |
| *N = 1144* | | |
| *Poisson distribution cannot be calculated on continuous data* | | |

| Proposed Dollars | | |
|---|---|---|
| ***Worse Fit*** | ***Better Fit*** | ***LR*** |
| Normal | Power Law | -7.22* |
| Normal | PL w/ Cutoff | -13.14* |
| Power Law | PL w/ Cutoff | -536.45* |
| Normal | Weibull | -12.3* |
| Power Law | Weibull | -24.16* |
| PL w/ Cutoff | Weibull | -3.51* |
| Normal | LogNormal | -11.78* |
| Power Law | LogNormal | -25.2* |
| PL w/ Cutoff | LogNormal | -2.92* |
| Weibull | LogNormal | -2.03* |
| Normal | Exponential | -17.25* |
| Power Law | Exponential | -2.08* |
| Exponential | PL w/ Cutoff | 5.60* |
| Exponential | Weibull | 5.37* |
| Exponential | LogNormal | 5.11* |
| *N = 1144* | | |
| *Poisson distribution cannot be calculated on continuous data* | | |

For the variable Proposed Dollars, the results for the LR comparisons are contained in Table 5. After analyzing all the comparisons, there was only one that was never significantly worse fitting: LogNormal after applying decision rule 1. For Proposed Dollars, the best distribution fit is LogNormal.

For the variable number of awarded proposals, the results for the LR comparisons are contained in Table 6. After analyzing all the comparisons, there was only one that was never significantly worse fitting: Power Law with Exponential Cutoff after applying decision rule 1. worse fitting, which were Weibull and Power Law with Exponential Cutoff. Based on Joo et al. (2017) taxonomy, power law with an exponential cutoff has two parameters and the Weibull distribution has two. Since both have the same number of parameters, we move on to the third decision rule. Since Weibull represents a flexible distribution, this leaves the dominant distribution to a Power Law with an Exponential Cutoff.

*Table 6: Dpit Result: Number of Awarded Submissions* *Table 7: Dpit Result: Awarded Dollars*

*PL w/ Cutoff = Power Law with Exponential Cutoff. Negative of positive likelihood ratio (LR) determines the better fitting distribution. Starred LR means the p-value is less than the 0.10.*

| Number of Awarded Submissions | | | |
|---|---|---|---|
| ***Distribution*** | ***Worse Fit*** | ***Better Fit*** | ***LR*** |
| NormvPL | Normal | Power Law | -15.11* |
| NormvCut | Normal | PL w/ Cutoff | -18.12* |
| PLvCut | Power Law | PL w/ Cutoff | -47.86* |
| NormvWeib | Normal | Weibull | -17.99* |
| PLvWeib | Power Law | Weibull | -5.73* |
| CutvWeib | Weibull | PL w/ Cutoff | 2.62* |
| NormvLogN | Normal | LogNormal | -17.72* |
| PLvLogN | Power Law | LogNormal | -5.98* |
| CutvLogN | LogNormal | PL w/ Cutoff | 3.28* |
| WiebvLogN | LogNormal | Weibull | 1.80* |
| NormvExp | Normal | Exponential | -23.07* |
| PLvExp | Exponential | Power Law | 3.59* |
| CutvExp | Exponential | PL w/ Cutoff | 7.34* |
| WeibvExp | Exponential | Weibull | 7.29* |
| LogNvExp | Exponential | LogNormal | 7.01* |
| NormvPois | Poisson | Normal | 4.86* |
| PLvPois | Poisson | Power Law | 8.48* |
| CutvPois | Poisson | PL w/ Cutoff | 8.90* |
| WeibvPois | Poisson | Weibull | 8.89* |
| LogNvPois | Poisson | LogNormal | 8.87* |
| ExpvPois | Poisson | Exponential | 8.86* |

*N = 1144*

| Awarded Dollars | | | |
|---|---|---|---|
| ***Distribution*** | ***Worse Fit*** | ***Better Fit*** | ***LR*** |
| NormvPL | Normal | Power Law | -15.41* |
| NormvCut | Normal | PL w/ Cutoff | -20.04* |
| PLvCut | Power Law | PL w/ Cutoff | -126.86* |
| NormvWeib | Normal | Weibull | -19.75* |
| PLvWeib | Power Law | Weibull | -10.10* |
| CutvWeib | Weibull | PL w/ Cutoff | 0.74 |
| NormvLogN | Normal | LogNormal | -19.43* |
| PLvLogN | Power Law | LogNormal | -9.96* |
| CutvLogN | LogNormal | PL w/ Cutoff | 1.57 |
| WiebvLogN | LogNormal | Weibull | 3.24* |
| NormvExp | Normal | Exponential | -24.23* |
| PLvExp | Exponential | Power Law | 1.80* |
| CutvExp | Exponential | PL w/ Cutoff | 8.38* |
| WeibvExp | Exponential | Weibull | 8.46* |
| LogNvExp | Exponential | LogNormal | 8.06* |
| NormvPois | Poisson | Normal | 8.52* |
| PLvPois | Poisson | Power Law | 10.61* |
| CutvPois | Poisson | PL w/ Cutoff | 11.15* |
| WeibvPois | Poisson | Weibull | 11.15* |
| LogNvPois | Poisson | LogNormal | 11.13* |
| ExpvPois | Poisson | Exponential | 11.18* |

*N = 1144*

*Table 8: Dpit Summary of Decisions*

| ***Variable*** | **After decision rule # 1** | **After decision rule # 2** | **After decision rule # 3** |
|---|---|---|---|
| No. of Proposed Submissions | LogNormal/Weibull | LogNormal | LogNormal |
| Proposed Dollars | LogNormal | LogNormal | LogNormal |
| No. of Awarded Submissions | PL w/ Cutoff | PL w/ Cutoff | PL w/ Cutoff |
| Awarded Dollars | Weibull, PL w/ Cutoff | Weibull, PL w/ Cutoff | PL w/ Cutoff |

The summary of the decision rules for each variable is displayed in Table 8. As a final observation, the number of proposed submissions and Proposed Dollars were characterized by the same distribution, the LogNormal distribution, and the Number of Awarded Submissions and Awarded Dollars, characterized by the same distribution, the Power Law with Exponential

Cutoff distribution. The variable Number of Proposed Submissions used decision rule 1 and decision rule 2 to determine the dominant distribution. Proposed Dollars and the Number of Awarded Dollars were both decided with just the first decision rule. Awarded Dollars needed all three decision rules to decide.

### *4.3 Pareto's Principle*

Organizations utilize Key Performance Indicators (KPIs) to assess performance and identify standout achievers. As described by Aguinis & Bradley (2015), these high-performing individuals surpass others in output and contribute to elevating overall productivity and significantly influencing the organization's overall performance. Pareto's principle, commonly known as the 80/20 rule, posits that roughly 20 percent of the variables in a given context contribute to around 80 percent of the outcomes (Basile, 1996). I investigated the extent to which Pareto's principle holds in the data by examining the cumulative impact of faculty falling within the top 10%, 20%, 30%, 40%, and 50% brackets across all four variables: Number of Proposed Submissions, Proposed Dollars, Number of Awarded Submissions, and Awarded Dollars.

#### *4.3.1 Number of Proposed Submissions*

Table 9 displays the outcomes regarding the proposed submissions. This table shows the distribution of faculty members and their cumulative contribution to the total Number of Proposed Submissions for different portions of the distribution. In the Top 10% group, 114 faculty members cumulatively contribute to 3,326 proposed submissions, which accounts for 46.11% of the total proposed submissions. The cumulative output produced by the top performers resembled the pattern suggested by the Pareto principle. However, instead of 80% of the output produced by the top 20%, 80% of the output was produced by the top 34%. Since the output of 80% was produced by more than 20%, this can lead to the concept of the vital few versus the trivial many first stated by Joseph Juran (Bajaris, 1998). This concept within the Pareto principle separates high-occurrence outcomes (vital few) from low-occurrence (trivial many) (Bajaris, 1998).

*Table 9: Pareto's Principle: No. of Proposed Submissions*
*The No. of Faculty column indicates the cumulative count of faculty members up to the given percentage group. For example, in the "Top 20%" group, there are 114 faculty members, and when cumulated with the "Top 10%" group, the total becomes 228 faculty members. The No. of Proposed Sub (Cumulative) column shows the cumulative count of proposed submissions up to the given percentage group. The % Proposed Sub (Cumulative) represents the percentage of proposed submissions up to the given percentage group, in relation to the total number of proposed submissions (7,213).*

| | No. of Faculty | No. of Proposed Sub (Cumulative) | % Proposed Sub (Cumulative) |
|---|---|---|---|
| Top 10% | 114 | 3,326 | 46.11% |
| Top 20% | 228 | 4,726 | 65.52% |
| Top 30% | 342 | 5,535 | 76.74% |
| Top 40% | 457 | 6,051 | 83.89% |
| Top 50% | 572 | 6,415 | 88.94% |
| Bottom 50% | 1,144 | 7,213 | 100.00% |

### *4.3.2 Proposed Dollars*

Table 10 presents the results related to the variable Proposed Dollars. The cumulative percentage of Proposed Dollars increases as we move from lower to higher percentage groups, indicating a higher concentration of Proposed Dollars among a smaller number of faculty members. The distribution of Proposed Dollars is heavily skewed towards the higher percentage groups, with a significant portion concentrated in the Top 10% and Top 20% groups. This variable suggests a disparity in the distribution of faculty members and Proposed Dollars, with a relatively small proportion contributing to a substantial portion of the Proposed Dollars. The collective output generated by the top performers displayed a pattern similar to the Pareto principle, with 80% of output originating from the top 20%. However, 80% of the output came from the top 22%.

*Table 10: Pareto's Principle: Proposed Dollars*

| | No. of Faculty | Proposed Dollars (Cumulative) | % Dollars (Cumulative) |
|---|---|---|---|
| Top 10% | 114 | $ 6,074,481,419 | 60.53% |
| Top 20% | 228 | $ 7,793,255,853 | 77.66% |
| Top 30% | 342 | $ 8,721,720,119 | 86.91% |
| Top 40% | 457 | $ 9,278,235,437 | 92.45% |
| Top 50% | 572 | $ 9,606,485,275 | 95.73% |
| Bottom 50% | 1,144 | $ 10,035,420,054 | 100.00% |

### *4.3.3 Number of Awarded Submissions*

Within the Top 10% group, 77 faculty members collectively contribute to 1,538 Awarded Submissions, equivalent to 45.49% of the total proposed submissions. Progressing to the Top 20% group, the count increases, representing 64.15% of the total Awarded Submissions. When viewed through the lens of the Pareto Principle, it becomes apparent that 40% of the awarded faculty members (308 individuals) have a notable impact, generating a substantial 82.08% of the submissions. This achievement aligns with the guideline of the 20% threshold. The cumulative output produced by the top performers resembled the pattern suggested by the Pareto principle. However, instead of 80% of the output produced by the top 20%, 80% of the output was produced by the Top 37%.

*Table 11: Pareto's Principle: Number of Awarded Submissions*

| | No. of Faculty | No. of Awards (Cumulative) | % Awards (Cumulative) |
|---|---|---|---|
| Top 10% | 77 | 1,538 | 45.49% |
| Top 20% | 154 | 2,169 | 64.15% |
| Top 30% | 231 | 2,528 | 74.77% |
| Top 40% | 308 | 2,775 | 82.08% |
| Top 50% | 385 | 2,934 | 86.78% |
| Bottom 50% | 771 | 3,381 | 100.00% |

### *4.3.4 Awarded Dollars*

The results for Awarded Dollars are presented in Table 12. The table provides insights into how the Awarded Dollars are distributed among faculty members. The Awarded Dollars

(Cumulative) displays the cumulative amount awarded to the specified percentile. For example, in the Top 10% row, the Awarded Dollars amount to $1,915,922,402. This distribution is consistent with the Pareto Principle, which illustrates that a small segment of faculty members (20%) is accountable for a substantial share (80%) of the outcomes regarding Awarded Dollars.

*Table 12: Pareto's Principle: Awarded Dollars*

| | No. of Faculty | Awarded Dollars (Cumulative) | | % Dollars (Cumulative) |
|---|---|---|---|---|
| Top 10% | 77 | $ | 1,915,922,402 | 66.31% |
| Top 20% | 154 | $ | 2,305,682,900 | 79.80% |
| Top 30% | 231 | $ | 2,546,327,991 | 88.13% |
| Top 40% | 308 | $ | 2,690,628,896 | 93.12% |
| Top 50% | 385 | $ | 2,776,407,827 | 96.09% |
| Bottom 50% | 771 | $ | 2,889,280,859 | 100.00% |

In summary, 34% of the Number of Proposed Submissions and 22% of Proposed Dollars were required to represent the top 80% of the outcome. Regarding the Number of Awarded Submissions, 37% accounted for 80% of the Awarded Submissions, while 21% sufficed for 80% of Awarded Dollars. Among these variables, Proposed Dollars and Awarded Dollars closely aligned with the expected outcomes. On the other hand, the Number of Proposed Submissions and Number of Awarded Submissions varied significantly from predictions, surpassing a deviation of 14%.

### *4.4 Core Competency*

I classified each department based on its core and non-core competencies to test core competency. Those departments that received rankings following the U.S. News & World Report were designated as possessing strategic core competencies that align more closely with the university's goals. During the analysis of disciplines, it was found that there were 20 departments on campus, 37 departments in the School of Medicine and the School of Nursing. Of the campus departments, 11 were recognized as core, while nine were categorized as non-core. In the School of Medicine and Nursing, 14 departments were labeled as core, whereas 24 were designated as non-core. In summary, 58 total departments were analyzed, and 23 (43.1%) were classified as core, and 35 (56.9%) were classified as non-core.

*Table 13: Core Competencies*

| Rank | Campus | SOM/SON | Total | % |
|---|---|---|---|---|
| Core | 9 | 14 | 23 | 43.10% |
| Non-Core | 11 | 24 | 35 | 56.90% |
| | 20 | 38 | 58 | 100.00% |

The core departments garnered 661 awards, amounting to $2,711,126,949, while non-core departments successfully obtained 110 awards, totaling $178,153,910 in Awarded Submissions. Figures 9-12 illustrate the organizational performance of core and non-core departments, aiming to establish a performance-value function for grant submissions aligned with strategic core competencies. Tables 14-18 display the percentiles of each distribution (e.g., the top 10% or top 20%) to illustrate variations in proportions. Table 14 reveals that the core faculty exhibits minimal variance from the organization, while the non-core departments consistently show lower values in each percentage group.

*Table 14: Performance-Value for No. of Proposed Submissions*

*The No. of Faculty column indicates the cumulative count of faculty members up to the given percentage group. For example, in the "Top 20%" group, there are 114 faculty members, and when cumulated with the "Top 10%" group, the total becomes 228 faculty members. The Organization No. of Proposed Sub (Cumulative) column shows the cumulative count of proposed submissions up to the given percentage group for the entire organization. The Organization % Proposed Sub (Cumulative) represents the (Table 14 continued) percentage of proposed submissions up to the given percentage group, in relation to the total number of proposed submissions (7,213) for the organization. Core Faculty % represents the %*

*of core proposed submission and Non-Core % represents the non-core departments.*

| | No. of Faculty | Organization No. of Proposed Sub (Cumulative) | Organization % Proposed Sub (Cumulative) | Core Faculty % Proposed Sub (Cumulative) | Organization vs Core Difference | Non-Core Faculty % Proposed Sub (Cumulative) | Organization vs Non-Core Difference |
|---|---|---|---|---|---|---|---|
| Top 10% | 114 | 3,326 | 46.11% | 45.47% | -0.64% | 41.72% | -4.39% |
| Top 20% | 228 | 4,726 | 65.52% | 65.50% | -0.02% | 58.76% | -6.76% |
| Top 30% | 342 | 5,535 | 76.74% | 77.10% | 0.36% | 69.27% | -7.47% |
| Top 40% | 457 | 6,051 | 83.89% | 84.34% | 0.45% | 77.39% | -6.50% |
| Top 50% | 572 | 6,415 | 88.94% | 89.26% | 0.33% | 83.44% | -5.50% |
| Bottom 50% | 1,144 | 7,213 | 100.00% | 100.00% | | 100.00% | |

*Table 15: Performance-Value for Proposed Dollars*

| | No. of Faculty | Organization Proposed Dollars (Cumulative) | Organization % Dollars (Cumulative) | Core Faculty % Dollars (Cumulative) | Organization vs Core Difference | Non-Core Faculty % Proposed Dollars (Cumulative) | Organization vs Non-Core Difference |
|---|---|---|---|---|---|---|---|
| Top 10% | 114 | 6,074,481,419 | 60.53% | 61.19% | 0.66% | 51.23% | -9.30% |
| Top 20% | 228 | 7,793,255,853 | 77.66% | 78.31% | 0.65% | 72.96% | -4.70% |
| Top 30% | 342 | 8,721,720,119 | 86.91% | 87.44% | 0.53% | 83.49% | -3.42% |
| Top 40% | 457 | 9,278,235,437 | 92.45% | 92.87% | 0.41% | 89.81% | -2.65% |
| Top 50% | 572 | 9,606,485,275 | 95.73% | 95.97% | 0.24% | 94.03% | -1.69% |
| Bottom 50% | 1,144 | 10,035,420,054 | 100.00% | 100.00% | | 100.00% | |

Regarding No. of Proposed Submissions (Table 14), the core faculty in the top 20% exhibited slightly lower percentages than the overall organization (45.47% and 65.50%) but displayed slightly higher percentages in all other percentile groups. Conversely, non-core faculty members produced lower percentages than the organization across all percentile groups. Table 15 for Proposed Dollars shows that the core faculty displayed slightly higher percentages in all percentile groups. In contrast, faculty members outside the core produced lower percentages than the organization across all percentile categories.

*Table 16: Performance-Value for No. of Awarded Submissions*

| | No. of Faculty | Organization No. of Awards (Cumulative) | Organization % Awards (Cumulative) | Core Faculty % Awards (Cumulative) | Organization vs Core Difference | Non-Core Faculty % Awards (Cumulative) | Organization vs Non-Core Difference |
|---|---|---|---|---|---|---|---|
| Top 10% | 77 | 1,538 | 45.49% | 44.25% | -1.24% | 36.89% | -8.60% |
| Top 20% | 154 | 2,169 | 64.15% | 63.40% | -0.75% | 49.51% | -14.64% |
| Top 30% | 231 | 2,528 | 74.77% | 74.43% | -0.35% | 60.19% | -14.58% |
| Top 40% | 308 | 2,775 | 82.08% | 81.89% | -0.19% | 67.96% | -14.12% |
| Top 50% | 385 | 2,934 | 86.78% | 87.12% | 0.34% | 73.30% | -13.48% |
| Bottom 50% | 771 | 3,381 | 100.00% | 100.00% | | 100.00% | |

*Table 17: Performance-Value for Awarded Dollars*

| | No. of Faculty | Organization Awarded Dollars (Cumulative) | Organization % Dollars (Cumulative) | Core Faculty % Dollars (Cumulative) | Organization vs Core Difference | Non-Core Faculty % Dollars (Cumulative) | Organization vs Non-Core Difference |
|---|---|---|---|---|---|---|---|
| Top 10% | 77 | 1,915,922,402 | 66.31% | 66.68% | 0.37% | 52.96% | -13.36% |
| Top 20% | 154 | 2,305,682,900 | 79.80% | 79.98% | 0.18% | 71.93% | -7.87% |
| Top 30% | 231 | 2,546,327,991 | 88.13% | 88.10% | -0.03% | 82.58% | -5.55% |
| Top 40% | 308 | 2,690,628,896 | 93.12% | 93.22% | 0.10% | 88.52% | -4.61% |
| Top 50% | 385 | 2,776,407,827 | 96.09% | 96.21% | 0.12% | 92.49% | -3.60% |
| Bottom 50% | 771 | 2,889,280,859 | 100.00% | 100.00% | | 100.00% | |

In Table 16 for the number of awards, the core faculty displayed slightly lower percentages in the top 40% but slightly higher in the bottom 60%. On the other hand, faculty members who were categorized as non-core produced lower percentages than the organization in all percentile groups. For the variable Awarded Submissions shown in Table 17, the core faculty displayed marginally higher percentages than the organization, and non-core produced lower percentages than the organization in all percentile groups. In summary, all non-core faculty members had lower percentages than the organization in every percentile category for all four variables.

Aguinis and O'Boyle (2014) introduced the concept of the relationship between performance and value, considering its interaction with the degree of proximity. My evaluation aimed to assess whether the performance-value relationship is influenced by the level of proximity to an organization's strategic core competence. The hypothesis was that this relationship would become more substantial as proximity increases. Figures 8-11 illustrate this relationship, with the core departments' curve showing an extreme slope of the core (orange) plots compared to the non-core (gray) plots. Overall, results in this study reveal that an organization's strategic core competence moderates the individual performance of researchers and the overall value of research endeavors. Notably, core departments exhibit a significant influence on the variables of Proposed Dollars, Awarded Submissions, and Awarded Dollars.

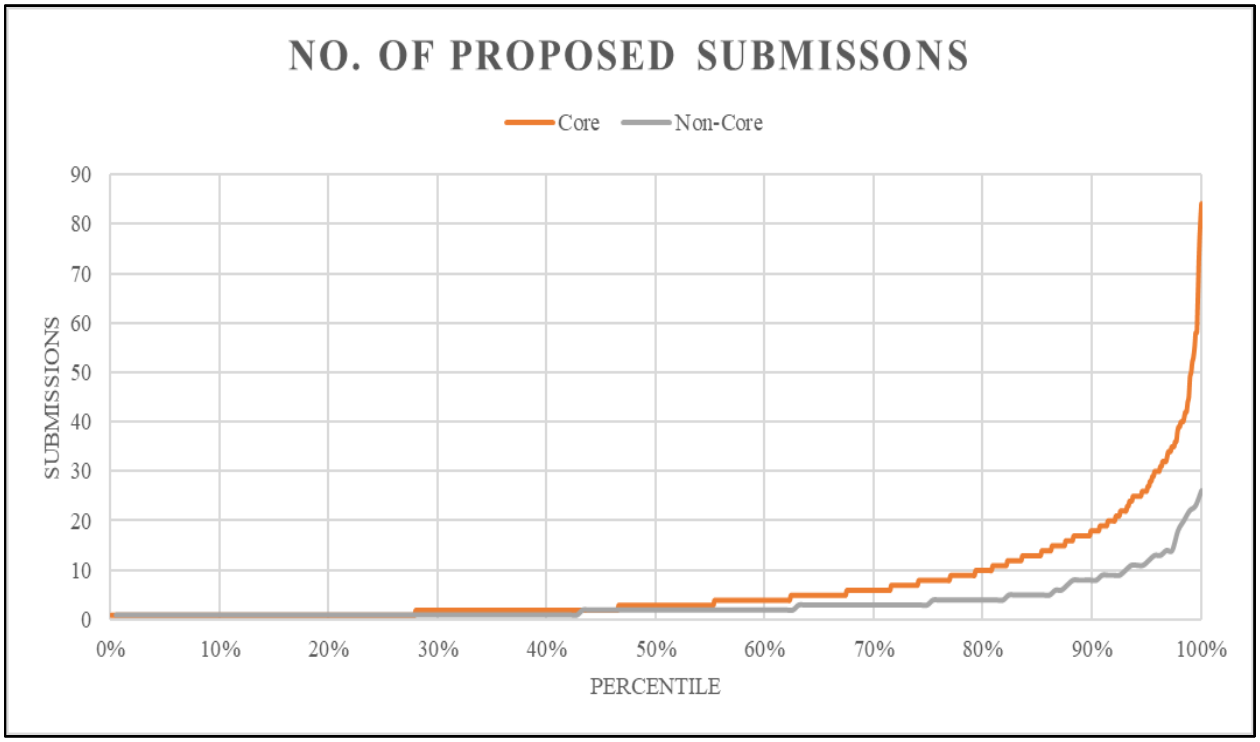


*Figure 8: Performance-value relationship of No. of Proposed Submissions*

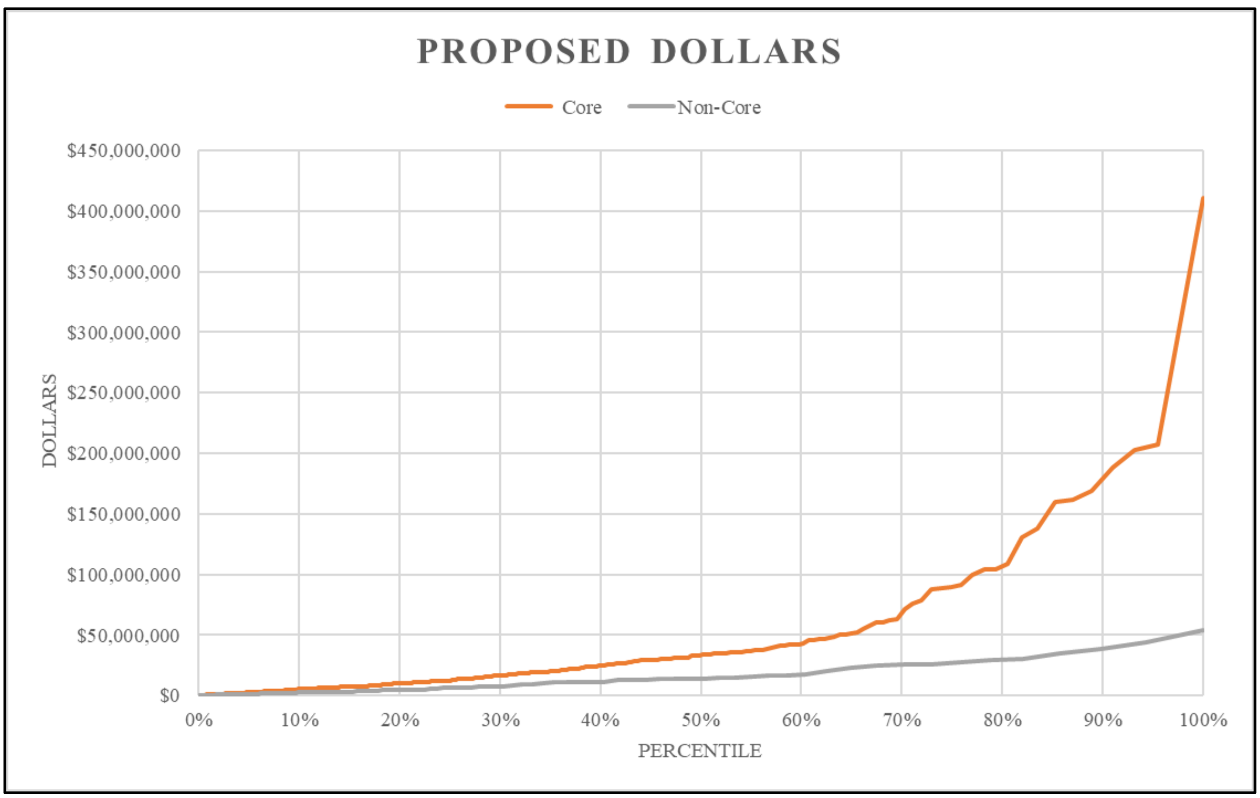


*Figure 9: Performance-value relationship of Proposed Dollars*

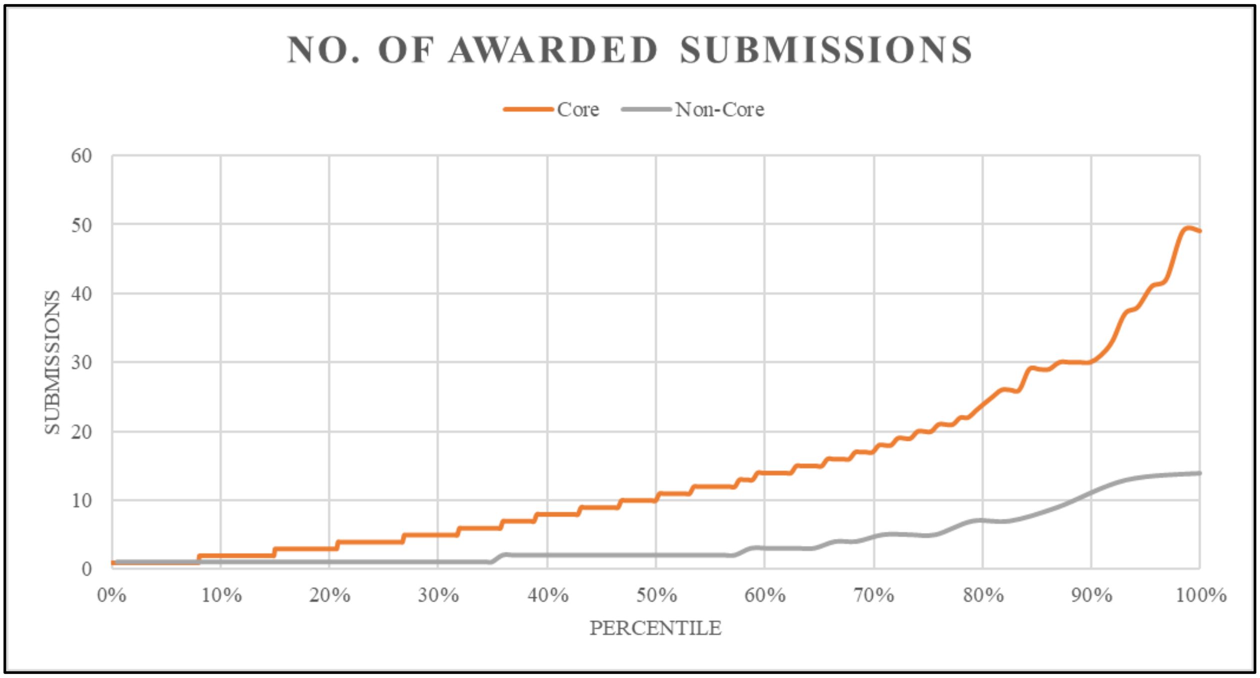


*Figure 10: Performance-value relationship of No. of Awarded Submissions*

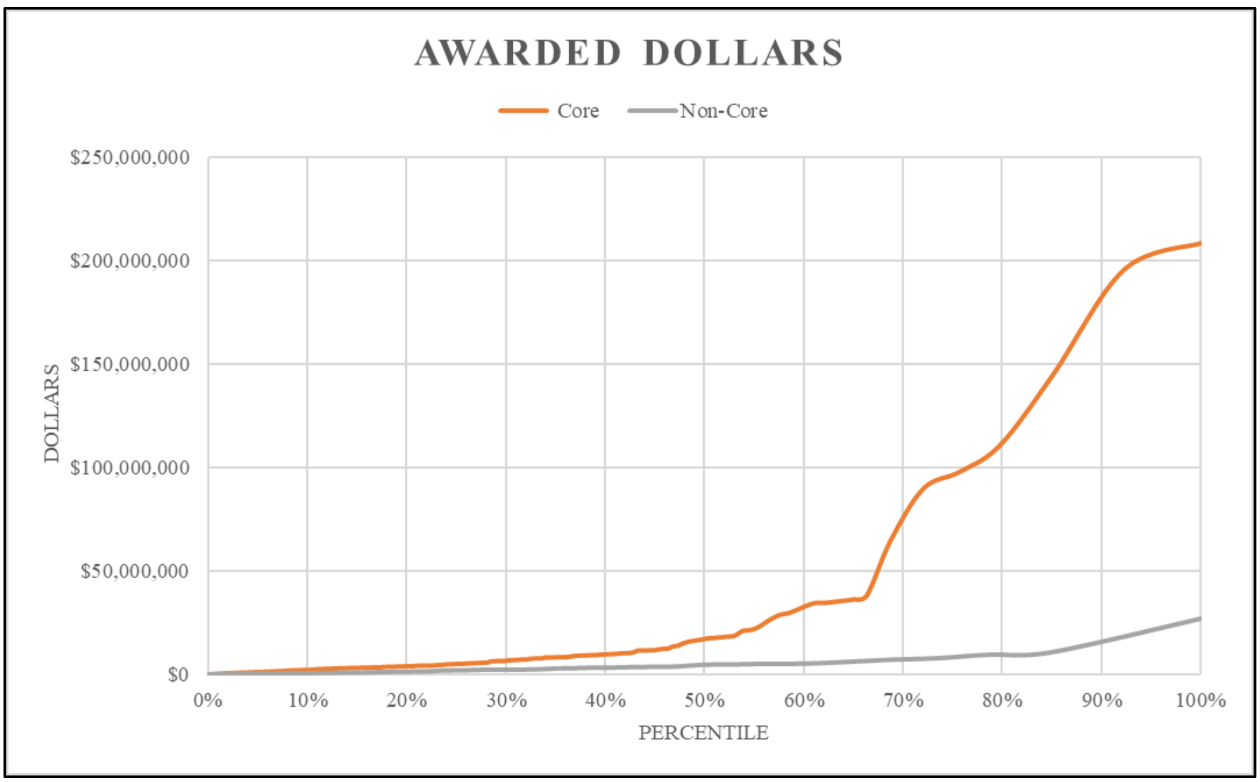


*Figure 11: Performance-value relationship of Awarded Dollars*

# CHAPTER 5: DISCUSSION, IMPLICATIONS, AND CONCLUSION

This chapter consists of seven sections: (1) overview of the study connecting previous research to the current investigation; (2) results of the individual output distributions; (3) research productivity and performance-value function; (4) managerial implications; (5) limitations; (6) future research; and (7) conclusions.

## *5.1. Overview*

While normal distributions (Gaussian) continue to play a role in today's society, the growing importance of nonnormal distributions (Paretian) necessitates organizations to effectively navigate organizational dynamics, especially when dealing with star performers. Nonnormal distributions can help organizations avoid false conclusions by allowing practitioners to see all employees. Aguinis and O'Boyle (2014) offered nine propositions for the 21st-century workplace. Three of the propositions were investigated in this study, which assessed four variables related to external funding from an R1 institution. The first proposition measured if individual performance was a better fit than a normal distribution. The second proposition assessed the performance and value of similar organizational positions to determine if approximately 30% of the value was vested in the top decile of workers and 50% vested in the top quartile. The third proposition assessed the exponential relationship between individual performance and value and analyzed if the core competency and its proximity become more curved as proximity increases. The findings and each generative mechanism are discussed below, along with managerial implications for practitioners.

### *5.2 Individual Output Distributions*

Using the Dpit package in R, I analyzed each variable and determined the best fit. The taxonomy created by Joo et al. (2017) consists of four categories of distributions: (1) Pure Power Law, (2) LogNormal, (3) Exponential tail (including Power Law with an Exponential Cutoff and Exponential), and (4) symmetric or potentially symmetric distributions. Figure 12 provides a generic visual representation of these distribution types. Researchers have discovered the underlying factors or mechanisms responsible for the characteristic patterns observed in power law distributions. Each distribution has a generative mechanism, defined as "a process leading to the existence of focal distributional shape for the phenomenon under investigation" (Joo et al., 2017, p. 1025). In other words, the generative mechanism causes things to happen. Studies have been conducted on generative mechanisms such as entrepreneurship (Crawford et al., 2015) and organizational science (Andriani & McKelvey, 2009).

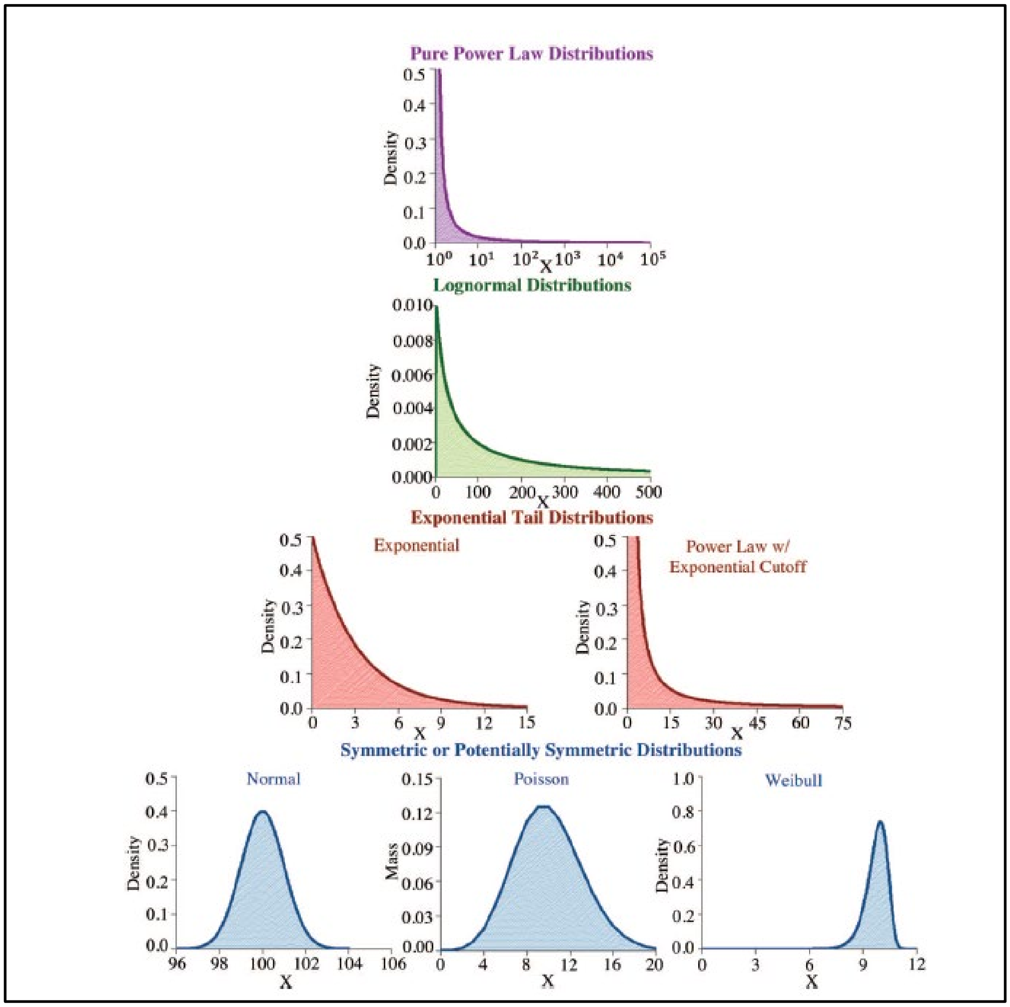


*Figure 12: Generic visual representation of seven types of distributions (Joo et al., 2017)*

The decision rules derived from the distribution analysis revealed that the Number of Proposed Submissions and the proposal dollars followed a LogNormal distribution. Additionally, the Number of Awarded Submissions and Awarded Dollars exhibited a similar fit, conforming to the Power Law with Exponential Cutoff distribution.

### *5.2.1 LogNormal Distribution*

The LogNormal distribution is characterized by a "heavy but ultimately finite right tail and often a bell-shaped head" (Joo et al., 2017, p. 1026). It has a positively skewed tail that falls rapidly but has the second heaviest tail. Notice the graphs, Figures 13 and 14, which exhibit a decreasing right tail and an initially long head. LogNormal distributions fall rapidly at the highest values of observations. The Number of Proposed Submissions (Figure 13) chart shows a similar pattern with a positively skewed distribution.

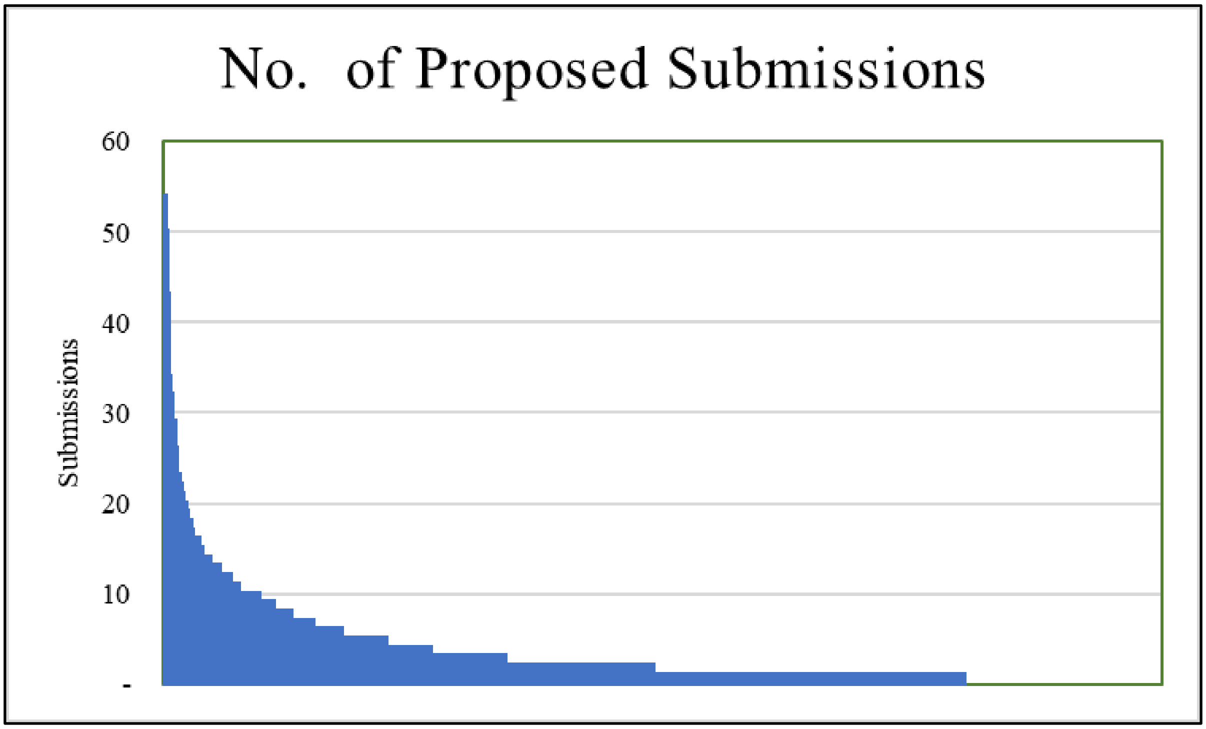


*Figure 13: Visual Distribution Representation of Number of Proposed Submissions*

The top 10% of faculty account for 46.11% of the proposed submissions of the total output, indicating a small group of disproportionately productive individuals. In the Proposed Dollars chart (Figure 14), the distribution is positively skewed, with the standard deviation being much more significant than the average. The most productive individuals, comprising the top 10% of faculty, are responsible for 60.53% of the total proposed submissions, highlighting the significant contribution of a select few exceptionally productive individuals.

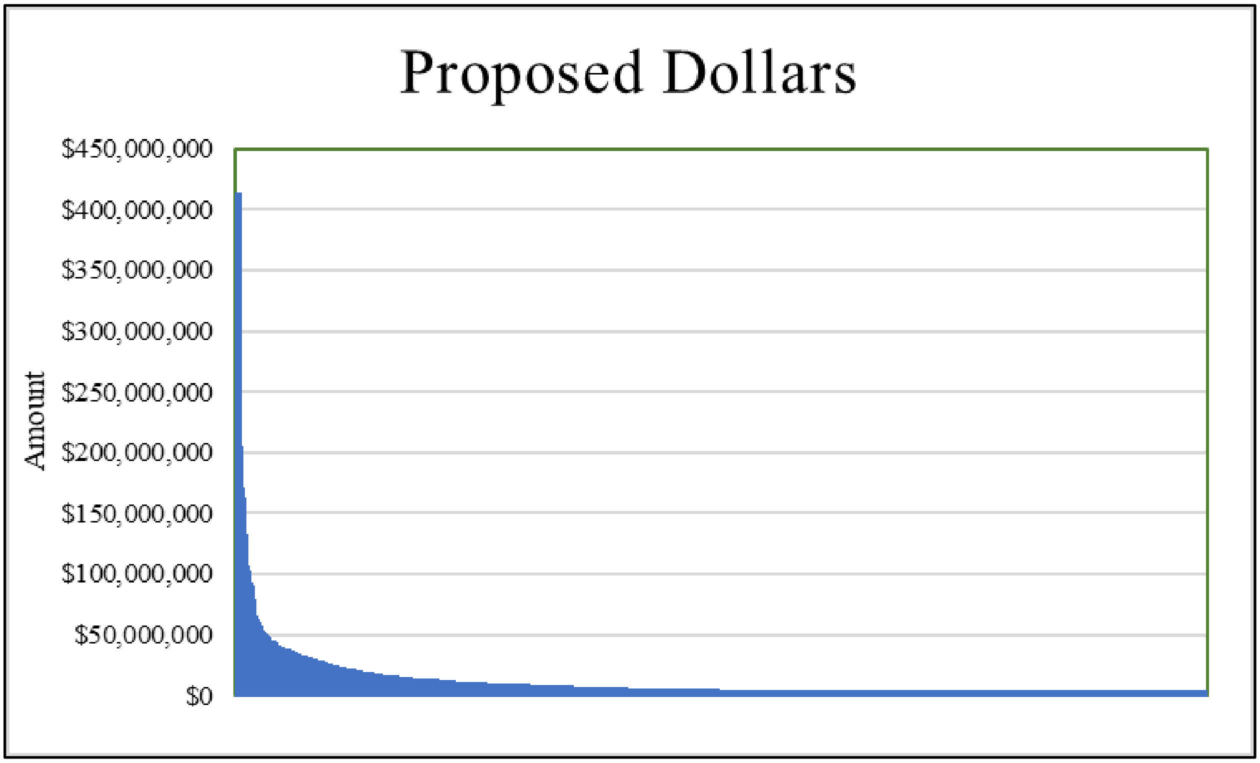


*Figure 14: Visual Distribution Representation Proposed Dollars*

### ***5.2.2 Generative Mechanism: Proportionate Differentiation***

The Number of Proposed Submissions and the Proposed Dollars followed the LogNormal distribution shape, as shown in Figure 8 because it was the best-fitting distribution. The generative mechanism for the LogNormal distribution is proportionate differentiation, which has two key components: (1) initial value and (2) accumulation rate. The initial value is "the amount of a variable that each individual has accumulated during a relatively short period since the beginning of a common baseline" (Joo et al., 2017, p. 1030). The accumulation rate is "the average amount of the variable that an individual produce per period" (Joo et al., 2017, p. 1030). This study collected data over five years, and only cumulative award dollars were analyzed. Individuals vary in proportionate differentiation regarding the overall outcome value due to differences in their accumulation rate and initial value for the outcome (Joo et al., 2017). Future amounts of the outcome would increase by some amounts for faculty, while others may stay low.

The future value is a distinct proportion (i.e., percentage) of the initial value of the outcome (Joo et al., 2017). Proportional differentiation can result in randomly accumulated initial outputs for specific individuals, some of which may be so substantial that others might struggle to catch up over time (Joo et al., 2017). Other times, it may be attributed to luck (Barabasi, 2012, p. 507).

At an R1 institution, faculty members who work in a public health field (i.e., infectious disease) during a pandemic (e.g., Ebola, COVID) may accumulate proposed dollars faster due to the need for a public health solution. On the other hand, certain faculty members might need help securing funding when their research focuses on topics perceived as less urgent or critical by potential sponsors. This barrier can increase future outcomes for some individuals while others stay at lower levels. We know the number of proposed submissions and the cumulative amount of proposed dollars. This reinforces the theoretical implication of proportionate differentiation as it pertains to a small proportion of individuals disproportionately benefiting from "output loops" (Joo et al., 2017). An output loop occurs when "an increasingly more significant output increases based on positive feedback between past and future output (Joo et al., 2017, p. 1031). With Proposed Dollars, a faculty member submitting applications with large amounts over some time decreases the marginal costs of output. In other words, the additional cost incurred for each subsequent application decreases as the faculty member submits more applications and invests more time and effort. This could be due to increased efficiency, familiarity with the application process, or other factors contributing to a more streamlined and cost-effective submission process over time. Practical implications remind us to allocate different resources based on the output of star performers (Joo et al., 2017). Particularly in research, certain faculty members may receive institutional support while seeking additional funding. Others may need institutional support during gap years of funding.

### *5.2.3 Power Law with Exponential Cutoff*

The Power Law with Exponential Cutoff is characterized by a "long head and an initially heavy, but increasingly failing right tail" (Joo et al., 2017, p. 1026). It has a positively skewed tail that falls rapidly. Notice the graphs (Figures 15 and 16), which exhibit a decreasing right tail and an initially long head. The distribution's parameters with a lower lambda($\lambda$), or mean number of events within a given interval, denote how quickly the right tail falls. $\lambda = 1/\text{mean } (\mu) = 1 / 4.386$; $\lambda = 0.23$.

The data analysis regarding the Number of Awarded Submissions (Figure 15) found that four faculty members submitted 181 applications (23.48%) out of 771 submissions. Among these individuals, one was among the top four regarding Awarded Submissions. The distribution for Awarded Dollars (Figure 16) displays that star performers are similar with low variability in either tail. These four faculty members secured $659,403,503 in Awarded Dollars, constituting 23.82% of the total Awarded Dollars, which amounted to $2,889,289,859. These star performers received awards in both quantity and magnitude that were disproportionate.

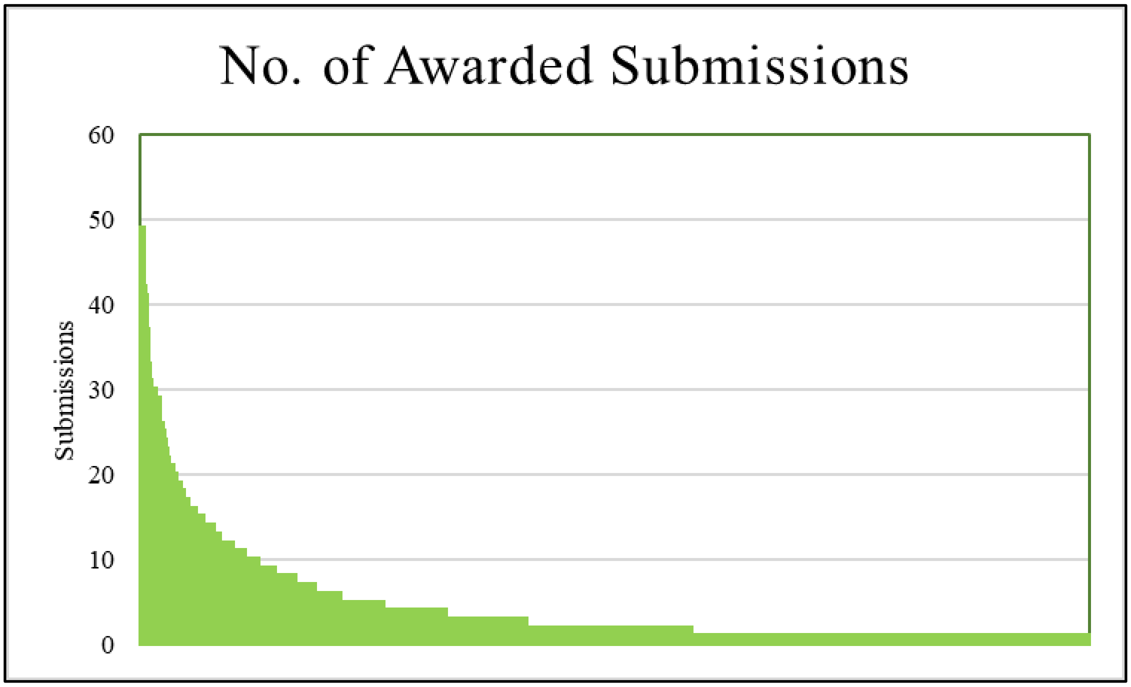


*Figure 15: Visual Distribution Representation of Number of Awarded Submissions*

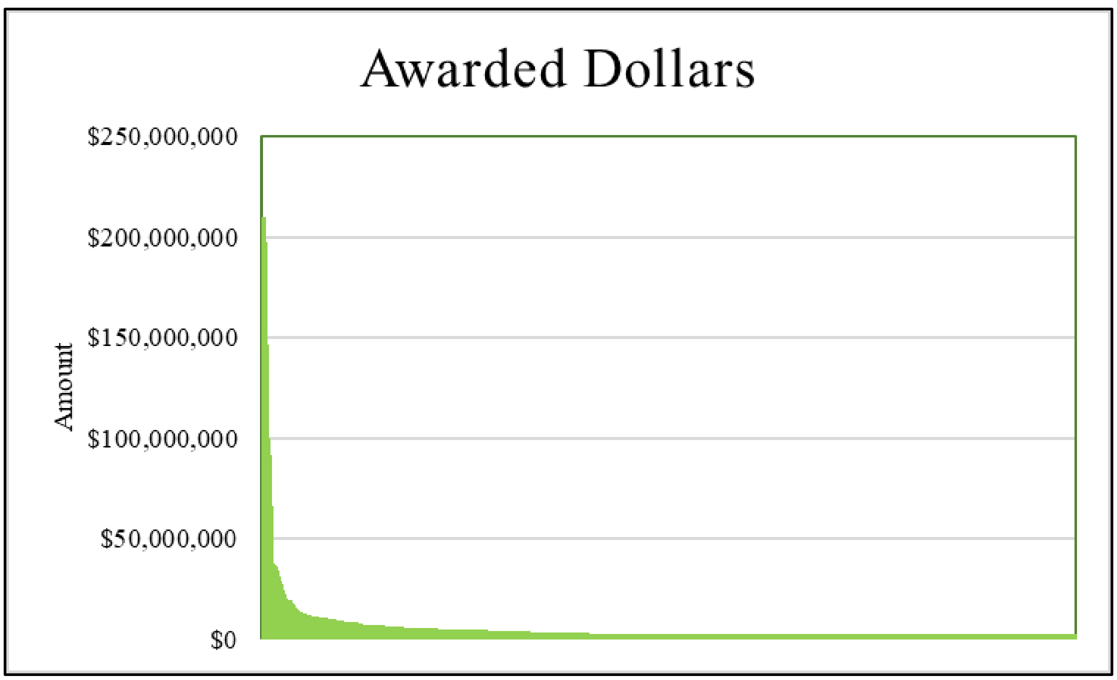


*Figure 16: Visual Distribution Representation Proposed Dollars*

***5.2.4 Generative Mechanism: Incremental Differentiation***

The generative mechanism for Power Law with Exponential Cutoff is incremental differentiation. Incremental differentiation determines "that individuals differ in terms of the total value of an outcome because of their differences to the accumulation rate on the outcome" (Joo et al., 2017, p.1031). It is distinct from proportionate differentiation because the changes occur in small, successive steps or additions. As an individual's accumulation rate increases, the additional benefits or outcomes gained from each additional unit of accumulation might decrease, aligning with the idea that there's a point of diminishing efficiency or effectiveness as one pushes towards the upper limits of accumulation. Individual values on an outcome would differentiate at an incremental rate. For example, a faculty member working on a grant submission will see a substantial increase in the quality and depth of the research strategy initially, as they invest more time and effort into writing. However, the faculty member may find that the marginal improvement in the research strategy is not as significant as it was in the earlier stages. The diminishing returns in this context could be attributed to fatigue, limited additional insights, or a saturation point where the core ideas have already been effectively addressed.

Some individuals enjoy large output increments (e.g., applying for awards over $1 million) compared to others (Joo et al., 2017). The practical implication for incremental differentiation is to invest in individuals with higher output accumulation rates than others to generate greater overall output (Joo et al., 2017). Resources should be allocated based on output for the Number of Awarded Submission and Awarded Dollars. The cumulative output from these star performers from four individuals corresponds to 23.48% of all Awarded Submissions. Additionally, four faculty members collectively secured $659,403,503 in Awarded Dollars, constituting 23.82% of the total Awarded Dollars. These faculty members have dedicated significant time to the process of grant writing and have been successfully awarded. An effective approach to invest in star performers is to acknowledge their commendable efforts and express gratitude for their exceptional work when financial resources are limited (Hills, 2013). The recognition can positively impact their long-term commitment and contributions. Also, star performers can illustrate their successful funding acquisition strategies and mentor junior faculty, guiding them toward success. Past output can predict future output when reviewing someone's accumulation rate. Building on prior achievements, resources can be provided to support grant writing and provide guidance on efficient grant management practices when available.

All in all, power law distributions are often termed heavy-tail distributions (Mitzenmacher, 2004). The LogNormal and Power Law with Exponential Cutoff share similarities but also have distinct characteristics, including extreme values in their distributions. While both distributions exhibit extreme values, LogNormal distributions decline rapidly at the highest observations (Joo et al., 2017; Taleb, 2007, p. 326). Joo et al. (2017) note that proportionate differentiations can be predicted by understanding the accumulation rate and initial value, crucial factors in determining an individual's total value on a specific outcome. In contrast, incremental differentiation acknowledges that individuals with the highest accumulation rates may experience diminishing returns. Proportional differentiations consider both accumulation rate and initial value in explaining an individual's total outcome value, while incremental differentiation emphasizes the accumulation rate's role in determining the outcome's future value, excluding the initial value.

### *5.3 Research Productivity and Performance-Value Function*

Faculty members at R1 universities are anticipated to secure grant funding to bolster their research endeavors. In their 2014 work, Aguinis and O'Boyle introduced the concept that, within equivalent organizational positions, the connection between performance and value can be represented by an exponential function. This model typically allocated around 30% of the total value to the top 10% of employees and 50% to the top 25%. I analyzed individual performance of research productivity and value as an indicator of firm performance. The results indicate that our overall value corresponds to Awarded Dollars totaling $2,889,280,859. Notably, 30% of this value amounts to $866,784,426. The top 10% of faculty members have contributed $1,915,922,402, which accounts for 66.31% of the total value. The star performers have generated half of the total value, equivalent to $1,446,640,429, surpassing the 50% threshold. Notably, the star performers at this R1 institution surpass the expectations outlined by Aguinis and O'Boyle's model. The upper decile (10%) demonstrates exceptional productivity in both proposed submissions, comprising 46.11% of the total, and proposed funding, accounting for 60.53% of our star performers. Additionally, they have received 45.49% of the Proposed Submissions, exceeding the 30% value threshold. The top 20 percent brought in funding to cover the 50% threshold, surpassing the concept model.

Aguinis and O'Boyle (2014) also explored the potential moderation of performance-value (P-V) based on the proximity of a position to an organization's strategic core competence. They outlined how a linear relationship typically characterizes the connection between performance and value; industries demanding substantial innovation, resistant to easy scripting, often exhibit an exponential relationship (Aguinis & O'Boyle, 2014). In knowledge-based environments like universities, duplicating the expertise held by faculty members poses a challenge. It is particularly evident in specialized fields within a medical center (e.g., cell biology) or on a campus (e.g., engineering). Departments were identified as core or non-core according to the national rankings based on the U.S. News & World Report. Results displayed that core departments modified the relationship between P-V functions. Star performers were found in the core competencies, creating a competitive advantage for the university and generating exponential value at higher levels. Star performers, often regarded as top-notch colleagues, bring numerous advantages to an organization, ultimately enhancing its overall value (Groysberg, Lee, & Abrahams, 2010). At this R1 institution, the financial contributions made by star performers are substantial and considerably greater than their peers, making a disproportionate impact. The practical implications for achieving star performance involve forming teams that enable individuals to rotate in and out seamlessly by capitalizing on knowledge transfer. Departments can expand the star's network by encouraging rotation between teams or fostering collaboration with various teams. Simultaneously, establishing high-performance norms and elevating expectations for faculty contribute to this dynamic.

### *5.4 Managerial Implications*

Managerial implications for highly funded star performers can help universities create advanced training programs, identify mentorship opportunities for less funded faculty, and assist with recruiting the next star. This study examined external funding to assess whether research productivity exhibited variations based on distribution, performance, value, and core competencies. The results revealed that star performers outperformed other faculty members in securing external funding. When identifying these top-performing individuals, several important considerations come into play. Exploring the context of R1 institutions as the focal point, I will outline some strategies for recruiting, managing, leveraging, and investing in star performers.

#### *5.4.1 Recruiting and Retaining Star Performers*

Acquiring the appropriate talent for R1 institutions can offer a competitive edge, and this advantage has the potential to yield sustained growth over time. Star performers significantly contribute to enhancing their institutions' reputation, particularly at academic medical centers (Lucey, Sedmak, Notestine, Souba, 2010). A study by Lucey et al. (2010) surveyed deans of 126 United States medical schools and found that most deans were willing to offer great resources to recruit and retain star performers. Resources are seen as an investment and a contribution to the university's prestige. Identifying talent using the talent management approach has been helpful for some institutions. The talent management approach outlined by Moghtadaie and Taji (2016) is a framework designed to identify, recruit, train, advance, and retain individuals receptive to change, enhancing an organization's ability to attain business objectives. The framework summarized that the skills and capabilities of faculty members can significantly enhance their performance within a university, underscoring the significance of talent management. Aguinis and Bradley (2015) discussed how managers could manage star performers through policies, work structure, training, employment decisions, and compensation practices. One recommendation is hiring faculty that "fit" in addition to performance (Aguinis & Bradley, 2015). Attracting faculty members who can easily integrate into the culture while fostering a conducive environment will create a space for star performers to thrive. This, in turn, can lead to significant organizational advantages. Another recommended approach is preserving individuals occupying strategically significant positions when downsizing decisions. Managers and leaders should pinpoint star performers in pivotal roles, preserving the most vital human capital. With this method, organizations can retain the most valuable individuals who align with the strategic core values of the organization.

Obtaining the most talented faculty members can improve the overall organizational performance, but recruiting and retention efforts can be costly if the individual is constantly pursued. In order to ensure a sufficient amount of resources, Lucey et al. (2010) emphasized the importance of ensuring that the faculty package provides adequate time for star performers to nurture their talents and counteract potential recruitment endeavors in the future. Create a plan with goals and expectations for faculty members to review that show the organization's resources, strategies, and values. Research accomplishments are typically measured over years (Lucey et al., 2010). Leadership should plan out the distribution of resources so they will last for the duration of the star performer to achieve success (Lucey et al., 2010).

### *5.4.2 Managing Star Performers*

There has been a debate on whether we should treat the people with the highest potential differently (Ready et al., 2010). Some argue that special treatment gives a disproportionate amount of energy and resources to a select few, neglecting the potential of others (Ready et al., 2010). Effectively managing and overseeing star performers demands both patience and time. It entails creating an environment that fosters their growth throughout their tenure. A culture filled with fairness and openness regarding policies and procedures fosters transparency for these stars, as Aguinis and Bradley (2015) noted. It is essential to ensure that every faculty member has the opportunity to strive for a star performance. By promoting transparency, more faculty members can aspire to attain star status, as it highlights the path and the necessary steps, ultimately cultivating a culture of fairness and nurturing a more professional and productive environment (Aguinis & Bradley, 2015).

In the workplace culture, it is crucial to eliminate situational constraints that hinder performance, as emphasized by Aguinis and Bradley (2015). Faculty members with heavy workloads and tight deadlines may find the administrative burden overwhelming when submitting external proposals and managing awards. To address this, certain institutions offer administrative support or assign dedicated personnel to assist faculty with proposal submissions and day-to-day funding-related tasks, which can reduce some of the stress and provide a more supportive environment to help them secure funding at a faster rate. R1 institutions commonly maintain dedicated administrative grant personnel focused on this aspect and align their strategic objectives with external funding endeavors. Furthermore, adequate support boosts productivity and opens up opportunities for mentoring colleagues. Mentorship and knowledge-sharing can serve as valuable resources for helping others ascend to star performer status, as stated by Aguinis and Bradley (2015). Likewise, specialized training programs can be developed to target enhancing star performers' capabilities beyond standard training approaches. These focused training initiatives can have a more significant impact than attempting to elevate all individuals' performance simultaneously, as Aguinis and Bradley (2015) noted. For instance, once a faculty member secures funding, training others to achieve similar success could represent one focused effort. Concentrating on specific specialties within academia rather than general topics allows more efficient resource utilization.

### *5.4.3 Leveraging and Investing in Star Performers*

Leadership must also consider strategies for leveraging star performers' productivity to enhance their subordinates' performance, which is likely to yield significant benefits, as Aguinis et al. (2014) suggested. Specifically, this research study pinpointed departments and star performers with the potential for high returns. With this knowledge, leadership can pinpoint exceptional performance values situated in the tail end of the distributions, as illustrated in Figures 9 to 12 in the results section. Using the Resource Based View (RBV) Theory, universities can identify resources to sustain an organization's competitive advantage. RBV, as explained by Ployhart in 2021, bridges the gap between human capital theory and strategic management by examining how a firm's resources are interconnected. Understanding RBV helps organizations recognize the essential resources for achieving superior performance. A recent article by Kehoe, Collings, and Cascio (2023) reflected the commonalities between star performers and high-potential employees. Their research confirms that cumulative advantage facilitates the career success of both types of employees. The cumulative advantage in workplaces and organizations is like a snowball effect. If someone starts off doing well in their job – they not only have the knowledge and skills to keep doing great work, but they also start getting more recognition and a higher status. This recognition and status breed more success, creating a cycle where those who do well early get ahead (Kehoe et al., 2023).

By investing in star performers, increased production can generate secondary gains for the manager to reinvest in the star (Aguinis et al., 2014). More star performers through effective human resource management can bring significant value to companies, especially when these stars have predominantly positive effects (Joo et al., 2022). Stars can contribute to a firm's revenue (Han & Ravid, 2020) and increase the likelihood of the firm's survival (Joo et al., 2022; Bedeian & Armenakis, 1998). The greater the diversity and volume of ways in which a star contributes to value, the more enduring and sustainable their capacity to generate value for the company. (Kehoe et al., 2018). In academia, dedicating resources to nurture star performers can propel smaller institutions into higher levels of research productivity. The advantages of successful research studies can be recognized by society when the findings are transformed into products (such as medicines, diagnostic tools, machinery, and devices) or services that can be bought and used (Bornmann, 2013). Bringing faculty members with robust research portfolios and strong mentoring qualities can quickly enhance research funding outcomes.

### *5.5 Limitations*

The faculty members chosen for this study were exclusively drawn from a single R1 institution. As a consequence, the findings of this study may not be readily applicable to other R1 institutions. Furthermore, the data did not include demographic details such as gender or ethnicity. There is some research on gender and star performers, but this could be expanded to include information to get a more in-depth understanding of the faculty population. Further, some faculty are hired for research purposes only, while others spend some time as clinicians. Some institutions have collaborative strategic missions encouraging faculty to submit interdisciplinary studies. Ancillary studies can be conducted on faculty with similar responsibilities and distribution of time in research (e.g., faculty who are committed to research at least 50% or more). The data was also only limited to the principal investigator, who either applied or was awarded external funding. It did not include data on additional staff or faculty listed within each proposal application. Also, most of the data was from the School of Medicine at the university. Reviewing data within the campus separated from the School of Nursing may demonstrate additional outcomes that could be advantageous.

It is worth noting that the research for this study spanned a five-year timeframe, but not all faculty members contributed data for each of these years. To ensure a comprehensive evaluation and assess the consistency of faculty impact, reviewing faculty members' performance over the same five-year period would be valuable. Additionally, it is essential to note that this research did not encompass funding from institutional or in-kind research support. The study specifically concentrated on external funding sources for sponsored research and did not encompass all funding sources (i.e., gifts and institutional support) for each faculty member.

### *5.6 Future Research*

Future research in this study could incorporate an extended time frame involving additional years of investigation. Evaluating each faculty member over a more prolonged duration would facilitate the assessment of their future performance. Moreover, building upon the insights presented in the context of the generative mechanism for incremental differentiation, we can dive deeper into the potential diminishing returns resulting from the accumulation of external funding. Analyzing the diminishing returns, we can review the costs associated with extended hours or work causing burnout and if turnover is an issue. While a faculty member might secure a substantial funding award for several years, it is essential to scrutinize whether the investment in their field continues to grow steadily under constant variables or if it starts to decline after a specific period.

To establish a broader understanding of external funding, further research is required across multiple types of institutions (e.g., R1, R2, D/U). Additional research can be done at Historically Black Colleges and Universities to expand the understanding of underrepresented research areas.

Furthermore, it would be advantageous to explore a faculty member's tenure within the organization, especially compared to peers who began their careers simultaneously. We can pinpoint the commonalities and disparities in individual performance by evaluating faculty members with similar levels of experience and time spent at the institution. Behavioral theories and components can be assessed in addition to productivity to learn the characteristics and attributes of star performers.

Moreover, research has shown some star performers may harm performance. (Harris, 2016; Groysberg, Nanda, & Nohira, 2004). Further research can be expanded to examine the impact of negative star performance. Understanding the positive and negative of star performers will help to create a more sustainable model.

### *5.7 Conclusion*

External funding has the potential to enhance the research infrastructure of both private and public higher education institutions (HEIs). Star performance from faculty members can be vital for growth, leading to a competitive advantage for institutions. Key findings in this study found that the performance distribution for grant funding mirrored those found in other domains (e.g., publications). Four variables were measured, and results illustrated that power law distributions were a better fit than a normal distribution. Another significant finding was that star performers make substantial financial contributions and exert considerably more influence than their peers, causing a disproportionate impact.

Furthermore, the study unveiled that an organization's strategic core competence moderates' researchers' performance and the overall value of research endeavors. Core departments strongly correlate with organizational productivity regarding Proposed Dollars, Awarded Submissions, and Awarded Dollars. Recommendations for practical implications included methods for research institutions to manage, recruit, retain, and leverage star performers. This study addressed a gap in the existing literature by introducing external funding as a metric of individual faculty productivity. This approach can provide valuable insights when assessing resource allocation from the perspective of the Resource-Based View Theory.

# REFERENCES

Aboubichr, B., & Conway, N. (2021). The gaming of performance management systems in British universities. Human Relations, 00187267211052827.

Adams, J. D., & Griliches, Z. (1998). Research Productivity in a System of Universities. Annales d'Économie et de Statistique, 49/50, 127–162.

Adobe Stock (2023). The Normal Distribution. Retrieved from https://stock.adobe.com/search?k=%22normal+distribution%22

Agha, S., Alrubaiee, L., & Jamhour, M. (2012). Effect of core competence on competitive advantage and organizational performance. International Journal of Business and Management, 7(1), 192.

Aguinis, H. (2009). An expanded view of performance management. Performance management: Putting research into action, pp. 1–43.

Aguinis H, Joo H, Gottfredson RK. (2013). What monetary rewards can and cannot do: How to show employees the money. Business Horizons, pp. 56, 241–249.

Aguinis, H., & O'Boyle Jr, E. (2014). Star Performers in Twenty-First Century Organizations. Personnel Psychology, 67(2), 313–350.

Aguinis, H., & Bradley, K. J. (2015). The secret sauce for organizational success: Managing and producing star performers. Organizational Dynamics, 44(3), 161–168.

Aguinis, H., Cummings, C., Ramani, R. S., & Cummings, T. G. (2020). "An A is an A": The new bottom line for valuing academic research. Academy of Management Perspectives, 34(1), 135–154.

American Association for the Advancement of Science (AAAA). (2023).

Armstrong, M. & Baron, A. (1998). Performance Management: The New Realities. London: Institute of Personnel and Development.

Armstrong, M. (2006). A Handbook of Human Resource Management Practice, 10th edition. London: Kogan Page.

Armstrong, M. (2009). Armstrong's handbook of performance management: An evidence-based guide to delivering high performance. Kogan Page Publishers.

Asgari, E., Hunt, R. A., Lerner, D. A., Townsend, D. M., Hayward, M. L., & Kiefer, K. (2021). Red giants or black holes? The antecedent conditions and multilevel impacts of star performers. Academy of Management Annals, 15(1), 223–265.

Aoyama H, Yoshikawa H, Iyetomi H, Fujiwara Y. (2010). Productivity dispersion: Facts, theory, and implications. Journal of Economic Interaction and Coordination, 5, 27–54.

Barabási, A.-L. (2012). Network science: Luck or reason. Nature (London), 489(7417), 507–508.

Bajaria, H. J. (1998). "Vital few, trivial many"--challenged. Quality Congress.ASQ's ...Annual Quality Congress Proceedings, , 474.

Barney JB. (1991). Firm resources and sustained competitive advantage. Journal of Management, 17, 99–120.

Baron JN, Pfeffer J. (1994). The social psychology of organizations and inequality. Social Psychology Quarterly, 57, 190–209.

Basile, F. (1996). Great management ideas can work for you. Indianapolis Business Journal, Vol. 16, pp. 53–4.

Becker, G. S. (1962). Investment in human capital: A theoretical analysis. Journal of political economy, 70(5, Part 2), 9-49. Becker, G. S. (2002). The age of human capital.

Becker, G., & Collins, R. A. (1964). Human capital investment.

Bedeian, A. G., & Armenakis, A. A. (1998). The cesspool syndrome: How dreck floats to the top of declining organizations. Academy of Management Perspectives, 12(1), 58–67

Berisha Qehaja, A., & Kutllovci, E. (2015). The role of human resources in gaining competitive advantage. Journal of Human Resource Management (2015), 18(2), 47-61.

Bianchi, C., & Caperchione, E. (2022). Performance management and governance in public universities: Challenges and opportunities. Governance and performance management in Public Universities, 1-14.

Biondi, L., & Russo, S. (2022). Integrating strategic planning and performance management in universities: a multiple case study analysis. Journal of Management and Governance, 1-32.

Bish, A. J., & Kabanoff, B. (2014). Star performers: task and contextual performance are components, but are they enough? Asia Pacific Journal of Human Resources, 52(1), 110–127.

Bornmann, L. (2013). What is societal impact of research and how can it be assessed? A literature survey. Journal of the American Society for information science and technology, 64(2), 217-233.

Bush, V., & Atkinson, R. C. (1980). Science--the endless frontier: a report to the President on a program for postwar scientific research (Repr. May 1980.). Washington, D.C: National

Science Foundation.

Call, M. L., Nyberg, A. J., & Thatcher, S. M. (2015). Stargazing: An integrative conceptual review, theoretical reconciliation, and extension for star employee research. Journal of Applied Psychology, 100, 623– 640.

Cappelli, P. (2008). Talent management for the twenty-first century. Harvard business review, 86(3), p. 74.

Clauset, A., Shalizi, C. R., & Newman, M. E. J. (2009). Power-Law Distributions in Empirical Data. SIAM Review, 51(4), 661–703.

Coff, R., & Kryscynski, D. (2011). Invited editorial: Drilling for micro-foundations of human capital–based competitive advantages. Journal of Management, 37(5), 1429-1443.

Corral, A., & Gonzalez, A. (2019). Power law size distributions in geoscience revisited. Earth and Space Science (Hoboken, N.J.), 6(5), 673–697.

Cortese, A. D. (2003). The critical role of higher education in creating a sustainable future. Planning for higher education, 31(3), 15-22.

Cowherd DM, Levine DI. (1992). Product quality and pay equity between lower-level employees and top management: An investigation of distributive justice theory. Administrative Science Quarterly, pp. 37, 302–320.

Crawford, G. C., Aguinis, H., Lichtenstein, B., Davidsson, P., & McKelvey, B. (2015). Power law distributions in entrepreneurship: Implications for theory and research. Journal of Business Venturing, 30(5), 696–713.

Crook, T. R., Todd, S. Y., Combs, J. G., Woehr, D. J., & Ketchen Jr, D. J. (2011). Does human capital matter? A meta-analysis of the relationship between human capital and firm performance. Journal of applied psychology, 96(3), 443.

Coyne, K. P. (1986). Sustainable competitive advantage—What it is, what it isn't. Business Horizons, 29(1), 54–61.

Czarniawska, B., & Genell, K. (2002). Gone shopping? Universities on their way to the market. Scandinavian Journal of Management, 18(4), 455-474.

Daft, R. L. (1983). Learning the craft of organizational research. Academy of management review, 8(4), 539–546.

Delivery JE, & Shaw JD. (2001). The strategic management of people in work organizations: Review, synthesis, and extension. Research in Personnel and Human Resources Management, 20, 165–197.

Delello, J. A., McWhorter, R. R., & Marmion, S. L. (2018). Understanding the productivity of faculty members in higher education. International Journal of Management in Education, 12(2), 154-178.

DeNisi, A., & Smith, C. E. (2014). Performance appraisal, performance management, and firm-level performance: A review, a proposed model, and new directions for future research. Academy of Management Annals, 8(1), 127–179.

Enz, C. A. (2008). Creating a Competitive Advantage by Building Resource Capability: The Case of Outback Steakhouse Korea. Cornell Hospitality Quarterly, 49(1), 73–78.

Ernst, H., Leptin, C., & Vitt, J. (2000). Inventors are not alike: The distribution of patenting output among industrial R&D personnel. IEEE Transactions on engineering management, 47(2), 184–199.

Etzkowitz, H., Webster, A., Gebhardt, C., & Terra, B. R. C. (2000). The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm. Research Policy, 29(2), 313–330.

Falaster, C., Ferreira, M. P., & Serra, F. R. (2016). The research productivity of new Brazilian PhDs in management: A few "star" performers outshine a mass of low performers. Management Research, 14(1), 60-84.

Felin, T., & Foss, N. J. (2005). Strategic organization: A field in search of micro-foundations. Strategic Organization, 3(4), 441–455.

Fisher AGB (1946) Education and Economic Change. W. E. A. Press, South Australia

Gabaix X, Gopikrishnan P, Plerou V, Stanley HE. (2003). A theory of power law distributions in financial market fluctuations. Nature, pp. 173, 267–270.

Goldstein, M. L., Morris, S. A., & Yen, G. G. (2004). Problems with fitting to the power-law distribution. The European Physical Journal B-Condensed Matter and Complex Systems, 41(2), 255-258.

Gomez-Mejia L, Balkin D. (1992). The determinants of faculty pay: An agency theory perspective, Academy of Management Journal, 35, 921– 955.

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. Strategic management journal, 17(S2), pp. 109–122.

Groysberg, B., Nanda, A., & Nohira, N. (2004). The risky business of hiring stars. Harvard Business Review, May 2004: 1-9

Groysberg, B., Lee, L., & Abrahams, R. (2010). What it takes to make 'star' hires pay off. MIT Sloan Management Review, 51(2), 57-61.

Hall, R. (1993). A framework linking intangible resources and capabilities to sustainable competitive advantage. Strategic Management Journal, 14(8), 607–618.

Halilem, N., Amara, N., & Landry, R. (2014). Exploring the relationships between innovation and internationalization of small and medium-sized enterprises: A nonrecursive structural equation model. Canadian Journal of Administrative Sciences/Revue Canadienne des Sciences de l'Administration, 31(1), 18-34.

Hamilton, R. (2011). "Does Texas higher education have a morale problem?" The Texas Tribune.

Han, S., & Ravid, S. A. (2020). Star turnover and the value of human capital—Evidence from Broadway shows. Management Science, 66(2), 958-978.

Harris, Christopher M. "The Influence of Star Performers on Coordination and Performance: Does Type of Star Matter." Rev. Contemp. Bus. Res 5 (2016).

Hatch, N. W., & Dyer, J. H. (2004). Human capital and learning as a source of sustainable competitive advantage. Strategic management journal, 25(12), 1155–1178.

Hatton, L. (2009). Power-Law Distributions of Component Size in General Software Systems. IEEE Transactions on Software Engineering, 35(4), 566–572.

Hills, L. (2013). Managing the star performer. The Journal of Medical Practice Management, 28(5), 298–302.

Hitt, M., Bierman, L., Shimizu, K., & Kochhar, R. (2001). Direct and Moderating Effects of Human Capital on Strategy and Performance in Professional Service Firms: A Resource-Based Perspective. Academy of Management Journal, 44(1), 13–28.

Hobfoll SE. (1989). Conservation of resources: A new attempt at conceptualizing stress.

American Psychologist, 44, 513–524.

Hobfoll SE. (2001). The influence of culture, community, and the nested-self in the stress process: Advancing conservation of resources theory. Applied Psychology: An International Review, pp. 50, 337–370.

Holt, Barry. (2021). The 80/20 Rule (Pareto Principle) https://strategex.com/insights/understanding-the-80-20-principle

Hull CL. (1928). Aptitude testing. Chicago, IL: World Book Company.

Hughes, D. J., & Batey, M. (2017). Using personality questionnaires for selection. The Wiley Blackwell handbook of the psychology of recruitment, selection and employee retention, pp. 151–181.

Humphrey, S. E., Morgeson, F. P., & Mannor, M. J. (2009). Developing a theory of the strategic core of teams: A role composition model of team performance. Journal of applied psychology, 94(1), 48.

Hunter, J. E., & Schmidt, F. L. (1983). Quantifying the effects of psychological interventions on employee job performance and workforce productivity. American Psychologist, 38(4), 473.

Huselid, M. A., Jackson, S. E., & Schuler, R. S. (1997). Technical and strategic human resources management effectiveness as determinants of firm performance. Academy of Management Journal, 40(1), 171-188.

Huselid, M. A., Becker, B. E., & Beatty, R. W. (2005). The workforce scorecard: Managing human capital to execute strategy. Harvard Business Press.

Indiana University Center for Postsecondary Research (n.d.). The Carnegie Classification of

Institutions of Higher Education, 2021 edition, Bloomington, IN: Author.

Jacob BA, Lefgren L. The Impact of Research Grant Funding on Scientific Productivity. J Public Econ. 2011 Oct 1;95(9-10):1168-1177.

Joo, H., Aguinis, H., & Bradley, K. J. (2017). Not all nonnormal distributions are created equal: Improved theoretical and measurement precision. Journal of Applied Psychology, 102(7), 1022.

Joo, H., Aguinis, H., Lee, J., Kremer, H., & Villamor, I. (2021). HRM's financial value from obtaining more star performers. The International Journal of Human Resource Management, 1-36.

Lawler, E. (2009). Boards as overseers of human capital. Directors and Boards, 33(3), 56–59.

Lebas, M. J. (1995). Performance measurement and performance management. International Journal of production economics, 41(1-3), pp. 23–35.

Lepak DP, Snell SA. (2002). Examining the human resource architecture: The relationships among human capital, employment, and human resource configurations. Journal of Management, 28, 517–543.

Lucey, Catherine R. MD; Sedmak, Daniel MD; Notestine, Mark PhD; Souba, Wiley MD, ScD, MBA. Rock Stars in Academic Medicine. Academic Medicine 85(8): p 1269-1275, August 2010

Kallio, K. and Kallio TJ. (2014) Management-by-results and performance measurement in universities – implications for work motivation. Studies in Higher Education 39(4): 574–589.

Kallio, K. M., Kallio, T. J., Tienari, J., & Hyvönen, T. (2016). Ethos at stake: Performance management and academic work in universities. Human Relations, 69(3), 685-709.

Kehoe, R. R., Lepak, D. P., & Bentley, F. S. (2018). Let's call a star a star: Task performance, external status, and exceptional contributors in organizations. Journal of Management, 44(5), 1848-1872.

Kehoe, R. R., Collings, D. G., & Cascio, W. F. (2023). Simply the best? Star performers and high-potential employees: Critical reflections and a path forward for research and practice. Personnel Psychology, 76(2), 585–615.

Kets de Vries, Manfred. F. R. (2012). Star Performers: Paradoxes wrapped up in enigmas. Organizational Dynamics, 41(3), 173–182.

Khan, S. Z., Yang, Q., & Waheed, A. (2019). Investment in intangible resources and capabilities spurs sustainable competitive advantage and firm performance.

Koopmans, L., Bernaards, C., Hildebrandt, V., Van Buuren, S., Van der Beek, A. J., & De Vet, H. C. (2013). Development of an individual work performance questionnaire. International journal of productivity and performance management.

Kwiek, M. (2018). High research productivity in vertically undifferentiated higher education systems: Who are the top performers? Scientometrics 115, 415–462.

Larivière, V., Macaluso, B., Archambault, É., & Gingras, Y. (2010). Which scientific elites? On the concentration of research funds, publications and citations. Research evaluation, 19(1), 45-53.

Lazear, E. P. (1992). Compensation, Productivity and. Research frontiers in industrial relations and human resources, p. 341.

Marsili O. (2005). 'Inequality' of innovation: Skewed distributions and the returns to innovation in Dutch manufacturing. Economics of Innovation and New Technology, pp. 14, 83–102.

Massof, R. W., & Rubin, G. S. (2001). Visual Function Assessment Questionnaires. Survey of Ophthal

Mitzenmacher, Michael. (2004) A Brief History of Generative Models for Power Law and Lognormal Distributions, Internet Mathematics, 1:2, 226-251.

Moghtadaie, L., & Taji, M. (2016). Study of the performance of faculty members according to talent management approach in higher education. Educational Research and Reviews, 11(8), 781-790.

Musick, M. A. (2011). An analysis of faculty instructional and grant-based productivity at the University of Texas at Austin. University of Texas at Austin.

National Science Foundation. (2022) Research and Development: US Trends and International Comparisons https://ncses.nsf.gov/pubs/nsb20225

National Science Foundation. (2023) The State of U.S. Science and Engineering 2020 https://ncses.nsf.gov/pubs/nsb20201/u-s-r-d-performance-and-funding#:~:text=Type%20of%20R%26D,-About%2017%25%20of&text=In%20comparison%2C%20nearly%20half%20(48,federal%20government%20(Figure%2018).

Nyberg, A. J., Moliterno, T. P., Hale Jr, D., & Lepak, D. P. (2014). Resource-based perspectives on unit-level human capital: A review and integration. Journal of Management, 40(1), 316-346.

Nykamp, Duane Q. (2023). Exponential Function. Math Insight. Retrieved from https://mathinsight.org/exponential_function.

O'Boyle EH Jr, Aguinis H. (2012). The best and the rest: Revisiting the norm of normality of individual performance. Personnel Psychology, pp. 65, 79–119.

Oldroyd JB, Morris S. (2012). Catching falling stars: A human resource response to social capital's detrimental effect of information overload on star employees. Academy of Management Review, 37, 396–418.

O'Shannassy, T. (2008). Sustainable competitive advantage or temporary competitive advantage: Improving understanding of an important strategy construct. Journal of Strategy and Management, 1(2), 168–180.

Payne, A. A., & Siow, A. (1999). Does federal research funding increase university research output? Institute of Government and Public Affairs, University of Illinois.

Penrose, L. S. (1959). Self-reproducing machines. Scientific American, 200(6), 105-117.

Pfeffer, J., & Baron, J. N. (1988). Taking the workers back out: Recent trends in the structuring of employment. Research in organizational behavior, 10(1988), 257-303.

Pfeffer, J. (1994). Competitive advantage through people. Boston/Mass.

Ployhart, R. E. (2021). Resources for What? Understanding Performance in the Resource-Based View and Strategic Human Capital Resource Literatures. Journal of Management, 47(7), 1771–1786.

Ployhart, R. E., & Moliterno, T. P. (2011). Emergence of the human capital resource: A multilevel model. Academy of management review, 36(1), 127-150.

Porter, M. E. (1997). Competitive Strategy. Measuring Business Excellence, 1(2), 12–17.

Post, G. F. (2014). Meeting the challenge of knowledge worker shortages with strategic talent management. American Journal of Management, 14(1-2), 62-66.

Ready, D. A., Conger, J. A., & Hill, L. A. (2010). Are You a High Potential? Harvard Business Review, 88(6), 78–84.

Rosen, S. (1989). Human Capital. In: Eatwell, J., Milgate, M., Newman, P. (eds) Social Economics. The New Palgrave. Palgrave Macmillan, London

Rosen, S. (1981). The economics of superstars. The American economic review, 71(5), 845–858.

Scherer F, Harhoff D. (2000). Technology policy for a world of skew-distributed outcomes. Research Policy, 29, 559– 566.

Schmidt FL, Hunter JE. (1983). Individual differences in productivity: An empirical test of estimates derived from studies of selection procedure utility. Journal of Applied Psychology, pp. 68, 4

Schweitzer, J. C. (1989). Faculty research expectation varies among universities. The Journalism Educator, 44(2), 45-49.

Stephan, P. E. (1996). The Economics of Science. Journal of Economic Literature, 34(3), 1199–1235.

Talbot, C. (2010). Theories of performance: Organizational and service improvement in the public domain. Oxford University Press.

Taleb, N. N. (2007). The black swan: The impact of the highly improbable (Vol. 2). Random house.

Teixeira, P. N. (2014). Gary Becker's early work on human capital–collaborations and distinctiveness. IZA Journal of Labor Economics, 3(1), 1-20.

Ter Bogt, H. J., & Scapens, R. W. (2012). Performance management in universities: Effects of the transition to more quantitative measurement systems. European accounting review, 21(3), 451-497.

Tiffin J. (1947). Industrial psychology (2nd ed.). New York, NY: Prentice-Hall.

Toutkoushian, R., Porter, Danielson, C., & Hollis, P. (2003). Using Publications Counts to Measure an Institution's Research Productivity. Research in Higher Education, 44(2), 121–148.

USA Spending. (2022, October 1). (https://datalab.usaspending.gov/colleges-and-universities/)

Wang, H. C., He, J., & Mahoney, J. T. (2009). Firm-specific knowledge resources and competitive advantage: the roles of economic-and relationship-based employee governance mechanisms. Strategic management journal, 30(12), 1265–1285.

Wellmon, C., & Piper, A. (2017). Publication, power, and patronage: On inequality and academic publishing. Critical Inquiry, 21.

Wexler, E. (2016). Why Is Tuition So High? Inside Higher Ed.

Whyte, W. H. (1956). The organizational man. New York, NY: Simon and Schuster.

Winfrey, F. L., Michalisin, M. D., & Acar, W. (1996). The paradox of competitive advantage. Strategic Change, 5(4), 199–209.

Wright, P. M., Dunford, B. B., & Snell, S. A. (2001). Human resources and the resource based view of the firm. Journal of Management, 27(6), 701–721.

Wright, P. M., & Boswell, W. R. (2002). Desegregating HRM: A review and synthesis of micro and macro human resource management research. Journal of Management, 28(3), 247–276.

Wright, P. M., & McMahan, G. C. (1992). Theoretical perspectives for strategic human resource management. Journal of Management, 18(2), 295–320.

Wright, P. M., & McMahan, G. C. (2011). Exploring human capital: putting 'human' back into strategic human resource management. Human resource management journal, 21(2), 93–104.

Yair, G., Gueta, N., Davidovitch, N. (2017). The law of limited excellence: Publication productivity of Israel Prize laureates in the life and exact sciences. Scientometrics.

Youndt, M. A., & Snell, S. A. (2004). Human resource configurations, intellectual capital, and organizational performance. Journal of managerial issues, 337-360.