University Researchers' Perceptions and Experiences of the Burdens Entailed in Grant Proposal Preparation and Submission

by

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ABSTRACT

The amount of time and effort that university researchers spend writing grants and executing grant administration responsibilities is one of the biggest challenges for science policy. This study aims to explore the complexity of the phenomenon of burdens in the administrative procedure for principal investigators (PIs) in sponsored research. The findings make a theoretical contribution to the study of burdens and red tape by closely examining the processes in which the burdens emerge, increase, and decrease; in doing so, this research will lay the groundwork for future studies of burdens and sponsored research systems. This study assumes that burdens are embedded in the social process, not merely in the number of required documentation or time spent on the procedure. The two overarching research questions are as follows: (1) What do researchers perceive or experience as a burden in grant proposal preparation and submission in sponsored research? (2) What are the possible factors or hypotheses to explain the generation, increase, and decrease of burdens? This single case study of a large research university examines the burdens faced by university researchers as they prepare and submit grant proposals. Primary data comes from semi-structured interviews with thirty-one PIs in science and engineering schools, and four interviews with research administration staff. Based on the interview data and theoretical arguments, this study illustrates the burdens in two categories: Burdens related to the proposal system, rules, and requirements; and burdens PIs experience with pre-award staff and relations. In addition, this study assesses each PI's burden level in terms of the number of tasks in the proposal process, and the quality of the pre-award staff and services the PI experiences. This study further

examines possible contributing factors and tentative hypotheses of burdens. In the discussion, this study develops theoretical arguments about the nature and consequences of burdens and fundamental issues in the grant system, and discuss prescriptions for PIs, universities, and sponsored research systems.

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1. INTRODUCTION

1-1. Background and Study Aim

This is a single case study of the burdens of university researchers in grant proposal preparation and submission, primarily based on the semi-structured interviews with thirty-one principal investigators (PIs) and four research administration staff. The study addresses the possible theoretical gap of burden-related studies of administrative burdens and red tape by focusing on the process of how individuals complete a specific administrative procedure, namely preparing and submitting a proposal. With the three types of costs in the study of administrative burden (Moynihan et al., 2015) as a starting point, this study examines the burden as embedded in the social process rather than the number of documents to fill in and amount of time needed to complete the procedure. In other words, this study investigates the generation, increase and decrease of burdens through the social and organizational processes.

University researchers in science and engineering disciplines often spend the considerable amount of time and effort writing and submitting grants. The excess of administrative rules and procedures in sponsored research is recognized as one of the challenges in science policy (National Science Board (NSB), 2014; National Academies of Sciences, Engineering, and Medicine, 2016; Government Accountability Office (GAO), 2016). The grant writing itself could be part of the precious research activities to elaborate and plan the research ideas with creativity. However, researchers need to learn and comply with the rules and requirements in each proposal submission although some PIs may have access to administrative assistance at the academic unit or universities. The

burdens of PIs have an impact on the overall efficiency of researchers, as well as the universities and funding system itself, especially when the proposal success rate is low (National Academies of Sciences, Engineering, and Medicine, 2016, pp.60-61).

Given the complexity of the burden-related phenomenon of university researchers in grant preparation and submission in sponsored research, this study explores the complexity in order to identify the contributing factors and generate the possible hypotheses for the study of burden in research administration as well as theories of burdens and red tape. This project addresses two overarching questions: *(1) What do researchers perceive or experience as a burden in grant proposal preparation and submission in sponsored research?* and *(2) What are the possible factors or hypotheses that explain the generation, increase and decrease of burdens?* The project specifically sheds light on the process of proposal preparation and submission as the possible site of burdens emerging, increasing or decreasing, where PIs often interact with pre-award staff to a varying extent.

1-2. The Growth and Significance of Sponsored Research Administration

In response to the growth of government-sponsored research at universities, administrative systems and organizational structures are developed by universities to manage the grants, with a variation in organizational structures, patterns of coordination, and task division (American Council on Education & Committee on Institutional Research Policy, 1954; Kaplan, 1959; Strickland (Eds.), 1968; Steinberg, 1973; Beasley, 1982). Research administration offices at universities, with typical names such as

Research Administration Office (RAO), Office of Sponsored Research (OSR) or Office of Sponsored Programs (OSP), check the compliance of the proposal documents and officially authorize to submit them to the agencies (Misa and Yost, 2016). Research administration was originally performed as a part-time task by a person with other primary tasks, but it has evolved into a full-time profession with occupational identity (Kaplan, 1959; Wile, 2008; Roberts, Sanders and Sharp, 2008).

The focus of this study is the pre-award proposal stage, within the entire life cycle of government research grants as the "pre-award, award, post-award implementation, and closeout" (GAO, 2016, p.7). One of the drastic changes in the proposal system in federally-sponsored research was the introduction of the electronic proposal systems such as FastLane, eRA and grants.gov in the late 1990s and early 2000s. Misa and Yost (2016) argue that the introduction and diffusion of online management systems such as FastLane for National Science Foundation (NSF) is not merely an introduction of technology, but influences the system of research grant management, universities, and the way PIs and staff work. These changes are paralleled with the growth and changes of the rules, requirements, and process of proposal preparation and submission.

The federal funding agencies, specific programs and grants have their own guidelines for grant submission rules and requirements in addition to the government-wide rules, requirements, and legislation. The agency or program-specific rules may be present in various points such as the proposal types, including full proposal and letter of intent, a list of the documents required for the proposal submission, document formats, and method of submission. Some funding agencies explicitly have very high expectations

for strict compliance with the rules and requirements. For instance, the Proposal Preparation and Submission Guidelines of NSF (NSF, 2016, p.11) warns that the proposal may be returned without review if the document formatting is not compliant in order to ensure readability for reviewers and avoid an unfair advantage for proposals which have a smaller type and line spacing, therefore allowing more text in the proposal content. For universities, the proper management of compliance and accountability for research grants is a crucial issue and universities themselves develop their own rules and requirements for grant administration (Bozeman and Anderson, 2016).

The growth of rules, requirements and administrative procedures in sponsored research, even in the proposal stage, is part of the changing relationship between government and science. The well-known report by Vannevar Bush (1945) generally set the social contract of government supports for science after World War II, and the government-science relationship had been in transformation with changing environment (Price, 1965; England, 1983; Guston, 2000a; Guston, 2000b; Demeritt, 2000; Shove, 2003; Hessels, van Lente and Smits, 2009). In the government funding in science as a contractual relation between principal and agent, principals delegate the tasks to the agents to perform, providing resources (Van Der Meulen, 1998; Guston, 2000a) in which the agents have their own objectives; there may be information asymmetry between principal and agent; the principal reserves the right to monitor, and the principal has to trust the agent (Van Der Meulen, 1998, pp. 399–400). The growth of administrative rules and procedures in sponsored research may be partly due to the principals more closely monitoring the activities of agents with growing issues such as accountability and research integrity (Guston 2000a; Guston, 2000b; Braun and Guston, 2003; Shapiro and

Guston, 2006), although Waterman and Meier (1998, p.175) notes that the principals may rationally decide not to monitor the agents' activities because of the costs required for monitoring.

1-3. Why the Burdens Matter in Sponsored Research

The administrative burdens of researchers in sponsored research, especially in the proposal stage, could be problematic with their potential impacts on the overall efficiency of the sponsored research system. The enacted amount of federal R&D funding was more than $146 billion in the FY 2016, with varying amounts in different federal agencies (Sargent et al., 2017), and the indirect cost for the facilities and administration in sponsored research is considerable, too (Goldman et al., 2000). Research activities and research organizations now face the growing task division, administrative procedures, and bureaucratization (Coccia, 2009a; Coccia, 2009b; Walsh and Lee, 2015),

The administrative burden for researchers and universities is increasingly recognized as problematic for optimizing federal research funding system and policy (NSF, 2007; Decker et al., 2007; Ness et al., 2014; NSB, 2014; National Academies of Sciences, Engineering, and Medicine, 2016; GAO, 2016; Bozeman and Jung, 2017). NSF (2007) suggests that the issues in efficiency of the funding system involve not only the success rates of grant proposals, but also the award size and duration, the institutional pressure to grow the funding record, and the potentially negative impacts on the academic research infrastructure, such as the increased workload for grant proposals and administration. The governmental agencies have made efforts to reduce these burdens,

including standardizing the requirements across funding agencies, but results are limited (GAO, 2016). At the level of individual researchers, a survey of the PIs of federally-funded projects in 2012 indicates that the surveyed PIs spent 42.3% of their time on administrative tasks, and only 57.7% on active research (Ness et al., 2014, p.6).

The competitiveness of grant selection may be necessary to fund quality projects with quality outcomes, but the method and purpose of competition, evaluation and its administration may need attention as their potential to shape the practices and norms in research activities (Leopold, 1979; Chubin and Hackett, 1990; Wood, Meek and Harman, 1992; Berezin, 1998; Wessely, 1998; Costello, 2010). Grant writing is often a crucial component of academic life for university researchers in science and engineering disciplines to sustain the funding for their research activities (Laudel, 2006; Anderson et al., 2007; Porter, 2007; Link, Swann and Bozeman 2008). The motivations of the researchers could be both intrinsic and extrinsic, such as expectation that such acquisition would be a consideration for tenure or promotion and scholarly reputation, and the institutional and managerial pressures for the external funding (Boyer and Cockriel, 1997; Boyer and Cockriel, 2001; Anderson and Slade, 2016). Link, Swann and Bozeman (2008) examine the at-work time allocation of science and engineering faculty at top research universities; the data from the Department of Education's National Survey of Postsecondary Faculty shows that the 1,365 faculties in the survey spend 4.58 hours out of 53.96 working hours per week writing grants.

The proposal-stage burdens may be more problematic when the success rate of proposals is lower[1]. Regardless of the ultimate result of success or failure in the funding decision, PIs need to spend a certain amount of time for learning and compliance in administrative components and procedures. The lower the success rate or the greater frequency of proposal submission may mean that PIs spend more time for grant writing and related administrative responsibilities to maintain the same funding level. This study focuses on the proposal process in the institutional context because a former survey suggests that the skilled assistance may save approximately 27% of PI's time to deal with the administrative requirements (Ness et al., 2014, p.25) and also PIs, themselves, do not have the immediate means to change these rules at funding agencies' level.

1-4. Structure of the Dissertation

This single case study investigates the types of burdens of PIs and the process in which the burdens generate, increase and decrease in grant proposal preparation and submission in the social and organizational contexts by combining a set of theories related to burdens and red tape, organization studies, and social capital. Findings will provide an in-depth observation of the burdens in the process and contexts, and insights for the efficiency of the sponsored research systems. While examining the factors of administrative burdens and red tape theories, this study specifically investigates the process of administrative

[1] The success rate varies across funding agencies and programs, and fiscal year. For instance, the total success rate of NIH Research Project Grants in FY2017 is 18.7%, with 54,005 applications and 10,123 awards (NIH, 2017).

procedure which involves the back and forth interactions between PIs and staffs as well as the social relations and errors that could increase or reduce the burdens for PIs.

After the introduction in Chapter One, Chapter Two provides the theoretical framework of the study, incorporating studies of administrative burden and red tape. Chapter Three illustrates the research design as a single case approach with semi-structured interviews with PIs and staff. Chapters Four and Five present the results of the study. Chapter Four focuses on the identification of burdens as system-related burdens and burdens with staff and relations, and assessment of level of experienced burdens and pre-award staffs and services for each PI's interview data. Chapter Five further examines the possible contributing factors to burdens and hypotheses based on the interview results. Chapter Six concludes the study with a summary of findings, theoretical arguments of burdens, fundamental issues in grant system, articulating the limitations of the study and implications for future study, and prescriptions.

2. THEORETICAL FRAMEWORK

This chapter provides an overview of the theoretical framework of this study, articulating the intended contribution. In short, this study addresses one of the theoretical gaps of burden-related studies of administrative burdens and red tape, namely the process in which individual level burdens emerge, increase or decrease in the social and organizational contexts in completing a specific administrative procedure with a case of grant proposal submission.

2-1. Administrative Burden and Red Tape

Administrative burden and red tape, as well as their origin and consequences, are part of major concerns for governments and organizations. Scholars have studied administrative burden from a range of perspectives, generally located around the relatively narrow scope of the phenomenon in government (Burden et al., 2012; Herd et al., 2013; Moynihan, Herd and Harvey, 2015; Moynihan, Herd and Ribgy, 2016; Heinrich, 2016). The administrative burden is primarily studied as a phenomenon at government and public organizations, especially the government-citizen interaction in the government services and administrative burden as the part of policy implementation process.

On one hand, Moynihan et al. (2015) frame administrative burden as costs with three types of costs, namely the learning, psychological, and compliance costs of the citizens who receive the government services. Learning costs are the costs for citizens engaging in an information search and understanding its relevance; psychological costs are involved in the negative perception and stigma of joining a specific government

program and any stress the individuals experience in the administrative process; compliance costs are the burdens which emerge in complying with administrative rules and requirements in the administrative procedure (Moynihan, Herd and Harvey, 2015). Administrative burden is often regarded as part of the political control and policy, with an assumption that an increase in administrative burden discourages and reduces citizen's engagement in the policy programs such as Medicaid (Herd et al., 2013; Moynihan, Herd and Harvey, 2015). In terms of origins and consequences of administrative burdens, Herd et al. (2013) list a set of ways to reduce administrative burden, such as auto-enrolment in the program, employer verification, and online access.

On the other hand, Kahn, Katz and Gutek (1976) provide more attention to the interactive process of transaction process in studying the 'bureaucratic encounters' in the context of evaluating government services. According to Kahn, Katz and Gutek (1976, p. 185), the bureaucratic encounter is the intervention in the causal sequence of the delivery or implementation of the government service for the citizens and they frame it as the interactive product of the service provider agencies and citizens as clients. Their model of bureaucratic encounters involves a set of factors such as agency characteristics, client characteristics, involvement in the service, and outcome evaluation. Kahn, Katz and Gutek (1976) examine a set of factors to influence the dynamics of the process of bureaucratic encounter and properties of episode such as the willingness of staff to help the client, but consider the process more as the one-time experience. Bureaucratic encounter or administrative burden in the repetitive or recurrent procedures in the same organizational and social context, such as proposal submission for PIs at universities,

may entail different sets of burdens and possible origins, compared to the one-time administrative transaction.

Red tape (Kaufman, 1977; Bozeman, 1993; Bozeman, 2000) is another closely related stream in studying burdens. Bozeman (2000) conceptualizes red tape as bureaucratic pathology rather than physiology and explains the broad concept of red tape as "The term red tape has come to be associated with bureaucratic inefficiency, delays, undue paperwork, incompetence, vexing rules and regulations, overcontrol, rigidity, organizational inertia, and unresponsiveness"(p. xii). In organizational physiology, organizations are subject to codified rules, but formalization itself is not necessarily considered as negative. The working definition of red tape as organizational pathology by Bozeman is "Rules, regulations, and procedures that remain in force and entail a compliance burden but do not advance the legitimate purposes the rules were intended to serve" (Bozeman, 2000, p.12). Red tape, in Bozeman's approach, is primarily a rule-based concept of the pathology of the organization, in which burdens may originate from the inception of the rules or emerge through the evolution and processing of rules.

There has been a growth in literature on red tape, especially to study organizations and employees. Bozeman and Scott (1996) articulate the issues and points for future study in red tape theory including its distinction form formalization, good, bad or neutral nature of red tape, objective and perceptual nature, measurements, and internal and external sources of red tape. Pandey and Scott (2002) provide an overview of the efforts in developing the concepts and measures of red tape, where red tape has a range of aspects such as, rules and procedures, constraints on the organization, and administrative

delays that are caused by formalization and stagnation. Studies examined how varying factors are related to red tape, such as hierarchy and positions (Walker and Brewer, 2008), job and careers (Ponomariov and Boardman, 2011), work motivation and network activity (Torenvlied and Akkerman, 2012), work-alienation (Pandey and Kingsley, 2000) of employees, and the impact of red tape on bureaucratic behavior (Scott and Pandey, 2000).

Studies of red tape are oftentimes the rule-based approach. However, rule growth at organizations do not necessarily lead to the growth of burdens or red tape (Zhou, 1993; Bozeman and Scott, 1996; March, Shulz and Zhou, 2000; Kaufmann and Witteloostujin, 2016), and Bozeman (1993) repetitively mentions the need to distinguish formalization and red tape, and DeHart-Davis (2009) labeled the effective rules specifically as green tape. Bozeman (1993, p. 281) asserts that "It is often not the *number* of rules, regulations, and procedures that causes problems," and what matters more are the resources and energy for compliance in red tape concept. Zhou (1993) and March, Shulz and Zhou (2000) conduct the quantitative investigation of rule birth, change, and death with an intensive examination of rules at Stanford University and suggest that rule founding is generally the organizational response to external situations while the rule change is strongly regulated by the internal learning process. Bozeman and Anderson (2016) suggest the growth of rules and the overcompliance issues after the organizational disaster of the Stanford Yacht Scandal in the case of federal research grant management. The origins and intents of rule births, their changes and actual ways and levels of implementation, and compliance may vary in each rule or organizational and other contexts.

The definitions and measurements of burdens and red tape involve both objective and subjective aspects. On one hand, burdens and red tape can be the presence and conduct of a set of rules, documents to prepare, forms to fill in, the number of tasks to process, the amount of time or number of personnel that is required to complete the process. On the other hand, burdens and red tape could be subjective in nature. The issue of subjectivity and objectivity of red tape and its measures has been a long-standing discussion in the existing literature. Gouldner (1952) distinguishes two sets of phenomena that are involved in red tape, namely "(1) the perceiving individual who, with a given frame of reference, comes into some relationship with (2) objective, perhaps bureaucratic, practices or behavior patterns" (Gouldner, 1952, p. 411). Furthermore, measurement of red tape is one of the crucial challenges in red tape studies with red tape as a social science construct (Coursey and Pandey, 2007). The well-used measurements in surveys include the summative indices from Likert-type scales to ask the level of red tape or time spent for specific tasks (Coursey and Pandey, 2007, p. 345), but Feeney (2012) suggests that the wording of red tape definitions in the survey questions influence the responses in the red tape scales. It is necessary to recognize these subjective and objective nature and measurement challenges.

2-2. Theoretical Gap

This current study relies on the perspectives of administrative burden (Moynihan et al., 2015) in a sense that it considers learning, compliance, and psychological costs as part of the primary properties of burdens for PIs. In addition, red tape studies provide the basis

of understanding the burden as both an individual and an organizational-level phenomenon, involving the rules and requirements and their implementation process and resources. This study addresses the possible theoretical gap of burden-related studies, such as administrative burdens and red tape, by examining the process of how individuals complete a specific administrative procedure, namely the proposal preparation and submission. This study thus considers the burden as, and embedded in, the social process in the organizational context rather than the number of documents to fill in and amount of time needed to complete the procedure.

Social capital is one of the concepts which possibly help us understanding the phenomenon, which involves the interactions, communication, and relations between PIs and pre-award staff. Social capital is an umbrella concept (Portes, 1998; Glanville and Bienenstock, 2009), and the focus in this study is on factors such as trust, norms, cooperation, friendship, advice, commitment, goodwill and resources that are embedded in and available through the relationship among individuals and within social unit (Nahapiet and Ghoshal, 1998; Lazega and Pattison, 1999; Adler and Kwon, 2002). On one hand, social capital such as trust and goodwill between PIs and pre-award staff may reduce the burdens for PIs in the proposal process by enabling PIs to rely on the staff to learn and comply with the rules and requirements and prepare administrative documents. On the other hand, lack of social capital, such as distrust, may increase the burdens of PIs by making PIs spend additional time checking the compliance and learning the rules themselves, or even having to check the documents prepared by staff.

2-3. Defining Burden

In this study, the burden is defined as 'Time and effort a person perceives or experiences as unnecessary or problematic in completing the administrative procedure'. While time may represent the devotion of time as the easily countable measure of burden, effort here involves the tasks, process, and related emotional struggles the individual experiences in completing the administrative procedure. This study more specifically investigates the burdens of PIs in the non-scientific components of proposal preparation and submission, chiefly in federal-sponsored research. In other words, the burden in this study is distinct from the burdens of developing and writing the scientific components of a proposal, such as research ideas and research designs. This relatively simple and abstract definition of burden provides a certain level of freedom to explore what individuals actually perceive and experience as burdens in their context, compared to starting with a narrow definition and measurement of burden such as time allocation. In addition, this definition enables us to capture the burdens as both a one-time experience in each transaction, and more longitudinal and embedded perceptions and experiences.

2-4. Research Questions

The theoretical framework leads to two overarching research questions*: (1) What do researchers perceive or experience as a burden in grant proposal preparation and submission in sponsored research?* and *(2) What are the possible factors or hypotheses that explain the generation, increase and decrease of burdens?* Instead of framing or measuring the burdens as the more easily countable elements, such as the amount of time

spent and/or number of documents to fill in, this study starts with exploring the meaning and contents of the burden for PIs. Further, in addition to applying the existing constructs of administrative burden such as learning, compliance, and psychological costs, this qualitative research attempts to provide an in-depth study of the types and contents of the burdens and deep-seated issues in the grant system and its administration system. These research questions enable us to investigate the theoretical gap of burden-related theories by closely examining the burdens in the process and to lay the groundwork for future studies of burdens of PIs in sponsored research who currently have relatively limited knowledge.

In illustrating the literature about the dark side of organizations, Vaughan (1999) describes nonconformity as "how things go wrong in socially organized settings…" (p. 273) in which the nonconformity is recurrent and routine. Although Vaughan (1999) focuses more on the routine nonconformity, such as mistake, misconduct and disaster, the burdens of PIs may emerge in the routine nonconformity that is less explicit and immediate but bring the long-term influence on the efficiency of the PIs, organization and research system. Back in 1981, Herbert Gutowsky, an American chemist, wrote in *Science* about the problems in the federal funding system, labeling it as the 'red tape mill'. He concludes his piece by describing the federal research funding as a wholistic system, as

> 'Federal support of basic research in the universities is a mixed blessing… There is now sand in the machinery, causing unnecessary wear and tear and loss of output. Some of the loss is immediate, visible, and quantifiable. Much is long term, hidden, and qualitative…. (Gutowsky, 1981, p. 640)'

As the issue articulated by this scientist quote, some of the problems in the federal research funding system may be immediate, visible, and quantifiable while others could be more hidden, qualitative and bring long-term development and influences. The burdens for PIs and ultimate influence on the funding system and research system efficiency could be embedded in the recurrent and routine nature of nonconformity at the organization or funding system itself. While studies of administrative burden examine burdens more in one-time transactions (Moynihan et al., 2015), this study intends to explore more accumulative, qualitative, hidden, and long-term understanding of the burdens. The burdens for researchers may not necessarily be a disaster with a specific event, but they can be seen more as routine-based nonconformity that is brought to researchers with varying levels and ways.

3. RESEARCH DESIGN

This study conducted a single case study of Arizona State University (ASU), a large public research university in the United States with the main source of data being thirty-one semi-structured interviews with faculty with PI experience in sponsored research and four interviews with pre-award research administration staff. The interviewees were recruited by purposive sampling, and all the data collected and analyzed from the viewpoint of theoretical and data saturation (Guest, Bunce and Johnson, 2006; O'Reilly and Parker, 2013) with careful triangulation to reach adequate and in-depth information, rather than merely aiming to collect a larger number of cases and interviews.

3-1. Case Study Approach

The case study approach was chosen because it is suitable for answering questions of 'how' and 'why' in contemporary events where the phenomenon and context are not easily distinguishable (Yin, 2002; Marshall and Rossman, 2006). According to Eisenhardt (1989), a case study is "a research strategy which focuses on understanding the dynamics present within single settings"(p. 534) and case study may combine data from multiple sources such as archives, interviews, questionnaires, and observations. In general, a case study is used for a range of purposes, such as to generate or test theories or to provide description (Eisenhardt, 1989, pp.535-536; Gibbert, Ruigrok and Wicki, 2008). The rigorous but reliable case study may consider the issues such as internal validity, construct validity, external validity, and reliability (Yin, 2002, pp.33-39; Gibbert, Ruigrok and Wicki, 2008).

The case study approach has both strengths and weaknesses. Eisenhardt (1998) specifically elaborates the strength of the case study approach for theory-building, including the possibility to generate novel and empirically valid theory and constructs. However, as Eisenhardt (1998) argues the resulting theory from the case study approach may be rich in detail but too complex if the investigator seeks to include every finding from the empirical study, or be narrow and idiosyncratic as the nature of the case study as the bottom-up approach. Acknowledging the strengths and weaknesses of case study approach, this study adopts a single case study approach which enables us to explore the complexity of the phenomenon in depth to reach the deep-seated behaviors and thoughts of the individuals related to burdens in the proposal process and system. One of the rationale for a single case study approach is to have in-depth investigation of the representative or typical case with the objective to "capture the circumstances and conditions of an everyday or commonplace situation" (Yin, 2002, p.41), which is appropriate in this study to investigate the proposal preparation and submission as day-to-day activities of university researchers. In so doing, this study lays the groundwork for future studies, given the relatively limited knowledge on this complexity of the process of burdens in administrative procedure in the social and organizational context.

3-2. Case Description and Justification

Arizona State University (ASU) serves as a case in this study. It is a large-scale, public research university in the United States. This university is one of the R-1 universities, (Doctoral Universities: Highest Research Activity) in the Carnegie Basic Classification

2015, without a medical school. According to the Higher Education Research and Development Survey Fiscal Year 2016, the total R&D expenditure of this institute is US$518,239,000, including US$212,396,000 from federal government and US$31,479,000 from state and local government as the sponsored research, ranked 44th among universities in terms of the total R&D expenditure (NSF, 2017).

While some universities have a centralized system of research administration, ASU has a more localized allocation of pre-award staff. In other words, individual science, engineering schools and departments often have their own pre-award administration staff who help the PIs at the academic unit with proposal preparation, compliance checks, and submission. The staff forward the proposal to the central sponsored research office when it is ready, at which point the central office is in charge of the final authorization and submission. In addition to the pre-award staff in each academic unit, pre-award staff at the central office also help the PIs with preparation and submission if the local staff are not available. At this university, the central research administration office is named the Office of Knowledge Enterprise Development (OKED). The Office of Research and Sponsored Project Administration (ORSPA), as a part of OKED, is primarily responsible for proposal submission. According to the institutional data as provided by the central office, ASU submitted 2,560 research grant proposals in 2017, excluding other types of grants such as scholarships and public service grants[2] (OKED Research Analytics, 2018).

[2] This includes 1,335 proposals for federal research grant, 33 proposals for state government research grant, 301 proposals for industry research grant, and 526 proposals for research grant from nonprofit organizations (OKED Research Analytics, 2018).

3-3. Participants and Recruitment

The target of the interview with PIs was any faculty member with PI experience in sponsored research grants, with an active professorship in the science and engineering schools at ASU. The list of PIs in the awarded grants at ASU were obtained from the funding database of the individual funding agencies, including the list from NSF since January 2000, all the past and current grants for National Institutes of Health (NIH), and all the active grants for Department of Energy (DOE). In selecting participants, faculty rank, academic unit, and gender of each PI were checked against the official faculty website of the institute. The contact information of pre-award staff was obtained from staff information on the official websites of pre-award teams, and by reference from the PIs.

For purposive sampling and recruitment, the PIs in these lists were recruited via email by balancing discipline, rank, and gender. Participant recruitment was done by emailing an interview invitation to each PI, and the recruitment was continued until data saturation. Based on the Organisation for Economic Co-operation and Development (OECD) classification of the field of science and technology (OECD, 2007), the participants were recruited to have at least eight professors in (a) engineering and technology and (b) natural sciences, with at least four faculty with an assistant or associate professor position and four faculty with a senior professor position. The participants were primarily in either (a) engineering and technology, or (b) natural sciences but the participants whose disciplinary backgrounds are not in either of (a) and

(b) were classified as (c) others in Table 1. Total number of the participants in the main interviews with PIs was thirty-one.

Table 1. Participant Distribution

	Assistant or associate professor	Professor	Total
(a) Engineering and technology	4 (1)	5 (0)	9 (1)
(b) Natural sciences	5 (3)	11 (1)	16 (4)
(c) Others	2 (1)	4 (3)	6 (4)
Total	11 (5)	20 (4)	31 (9)

The number in parenthesis indicates the number of females of the total number. Gender is not necessarily equally distributed, but this is justifiable because the gender variation does not have a meaningful influence on the interview results in this study. The number of assistant and associate professors is shown together as the relatively junior faculty, and the two are combined for the purpose of avoiding any deductive identification of the interview participants. Since this project focuses on the burden on the PI's side, four interviews with research administration staff were conducted with the aim of deepening the understanding of the mechanism of research administration at the university. During the recruitment process, an informed consent agreement was obtained by sharing the short consent form in the invitation emails which included a short overview of the research project and use of the data. The interviews were conducted between September 2017 and January 2018.

3-4. Semi-structured Interview

All interviews were conducted as in-person semi-structured interviews. The semi-structured interview enables the investigator to structure the interview to some extent to acquire sufficient data to answer the research question, but leaves open the possibility of reaching interesting points and meaningful facts from the perspective of interviewees. The investigator combined three types of questions: main questions, follow-ups, and probes to structure the interview (Rubin and Rubin, 2005). Although the participants were recruited for a thirty-minute interview, each interview lasted typically thirty to forty minutes, with the longest one being more than sixty minutes. Before the first interview, the investigator conducted pilot interviews with three PIs and two research administration staff in order to check the validity of interview protocol and revise it when it was needed.

The list of questions for the full interview protocol (see Appendix A) was based on the theoretical framework, research questions, and results of the pilot interviews. The questions in the interview protocol primarily aimed at addressing the basic information of the participant, the process of proposal preparation and submission, with a special focus on the interaction and relations between PIs and staff, and problems and strategies they have. In the semi-structured interviews, the interviewer often went through most of the main questions, but deviated from the original protocol to some extent according to the experiences, views and personalities of the participants, and followed the interviewees when their response provided interesting and meaningful data, and viewpoints that were not listed in the original protocol. The interviews concluded with a question asking whether there was anything that was not addressed during the interview but that the participant thought was interesting or important to the research topic. Most of the

participants provided insightful comments at this point. The interviews primarily focused on the proposals in the federally sponsored research, but PIs mentioned the proposal experiences with other funding sources such as foundation and industry funding, too.

All interviews were recorded and transcribed for analysis. The researcher took notes during and immediately after each interview. In the results presentation, the names of academic units, any personal names, position names, and specific research content and grant names were replaced or removed in order to protect the anonymity of the interviewees. For the same purpose, male pronouns were used in the presentation of the interview results, despite the actual gender variation of the interview participants. In addition, the unique episodes which allows the personal identification of participants were not directly used. All the quotes were presented as in the original transcribed interview data, with the supplementary notes in the parenthesis.

3-5. Data Analysis

The aim of the interview data coding was primarily to ascertain what types of burdens the PIs experience, and what the contributing factors and possible hypotheses are to explain the phenomenon around burdens. Text analysis can be used for a range of tasks, such as the discovery of themes and subthemes, identifying important themes, developing hierarchies of themes, and linking these themes into theoretical models (Ryan and Bernard, 2003). Thematic analysis is more than counting the appearance of words and phrases; it also identifies and analyzes the themes in the texts within theoretical and

conceptual frameworks, where theme can be defined as a unit of meaning that a reader observes and notices in the data text (Guest, MacQueen and Namey, 2012).

The study follows one of the text analysis strategies and focuses broadly on the relevant parts and themes in the beginning, and later conducts more focused coding with narrowed themes (Kuckartz, 2014). The interview data were coded both at an interview data text level and the level of each PI interview. First, to understand the types of burdens, the coding identified and classified the burden types in any parts of the interview data, starting by identifying any relevant parts in the data of each interview based on the definition of burden in this study. Then coding both induced and deduced the types of burdens PIs actually perceive and experience, which resulted in generating the typology of burdens with examples described in Chapter Four. The second set of coding was to assess each PI level regarding the experienced burden levels and quality of pre-award staff and services, based on the coding criteria in Appendices B and C, with results presented in Chapter Four. Third, exploratory coding of both PI and staff interview data was conducted to examine the factors and possible hypotheses for burden studies in Chapter Five. The first and second parts involved coding by the investigator and two other coders in order to better interpret the data with the comparison of three coding results and discussion.

4. BURDEN TYPES AND LEVELS

This chapter presents the results of the burden type identification and burden level assessment of each PI. The quotes from interview data are presented in order to provide examples. The listings do not necessarily represent all the relevant quotes, but rather the quotes that were most appropriate or fitted best into the context were selected. In addition, the assessment of the burdens of each PI in terms of the number of tasks the PI needs to complete was conducted, and the relationship between burden level and other possible factors such as the quality of pre-award staff and service was examined.

4-1. Grant Proposal Preparation and Submission Process

Typically, PIs conceptualize the proposal packet as two components, namely the scientific content with project description, and other administrative pieces such as budget and budget justification, data management plan, the list of pending supports and bio-sketches. The number of required documents and sections, page limitations and detailed instructions and rules may vary in each funding agency, program, and proposal call. PIs may prepare documents from scratch but they may simply revise previous versions of documents they submitted before, or use the templates provided by the institute or funding agencies as the proposal preparation and submission recur in academic life.

Most PIs in this study receive assistance from pre-award staff in both the preparation and submission processes, although each PI has different preferences in the way they work with pre-award staff, the service coverage, and time schedules. The PI typically starts the process by notifying the submission intent to the pre-award team, often by submitting the proposal intake form as the internal process at the academic unit. The

following quotes from PI14 and PI20 illustrate the typical submission process among the participants.

> ‘PI4: I'm in the [College name]. We have a pre-awards team, and that team helps you to prepare the application, including budget, any of the necessary forms, if there are subcontracts, they'll request subcontract documents from the participating institutions. We have a pretty good pre-award team here, and they're good with deadlines, and getting the necessary documents. Once they have everything, nothing can be submitted without approval by ORSPA. They get the approval from ORSPA, then ORSPA submits...’

> ‘PI20: … There are staff within the schools who work with faculty to develop a budget, ensure that their proposals is compliant even things like page length or other items more importantly that may not be allowed. Some agencies may not allow you to submit an appendix. They make sure the proposals meet the requirements, fit the criteria and can therefore be submitted, and they build a budget working with the PI, and then that staff member.. (it) is not so simple as if you were…. clicking the button but they actually do the submission to the agency when the proposal goes in of course once the PI has authorized them to do so.’

At the institute studied, the pre-award staff at the local academic unit often help PIs prepare and submit proposals and forward them to the central office. The central sponsored research office authorizes and ultimately submits the proposals to the funding agencies. There are internal deadlines for the PIs to submit the proposal materials to the pre-award team before the very final deadline of funding agencies.

4-2. Burden Types Classification

Given the definition of burden in this study, ‘Time and effort a person perceives or experiences as unnecessary or problematic in completing the administrative procedure’, this study focuses on the burdens that are related to administrative procedures and

administrative staff, and not on the grant writing of scientific content. In order to identify the types of burdens, first, all the interview data parts that fit the definition of the burden were coded. Second, within the coded parts, different types of burdens were observed, and the categories in Table 2 were developed.

Table 2. Burden Classification

Burden type	Burden description
System	Burdens of learning and compliance with the growth, changes and ambiguity of the rules, requirements and system, with the expectation of strict compliance. Psychological cost may or may not be included.
Staff and relations	Burdens because of the limited availability, efficiency and knowledge level of the staff, or the burdens of communication and interaction with staff due to poor communication, or lack of trust and other relations. Psychological cost may or may not be included.
Content and tasks	Burdens as the number of administrative tasks PIs need to complete, based on their descriptions about what they need to do for preparation and submission. Psychological cost is not considered.

The first two types of burdens are largely based on the site of the occurrence of burden, chiefly either of research administration systems such as the rules and requirements in proposal guidelines and actual processing system, and the capacity of staff and relations and interactions between PIs and staff. This distinction of the system-related burdens and burdens with staffs and relations enables us to better understand whether the burden is derived from the relatively fixed forms of system, rules and requirements, or from more amenable social processes and relations, although the system-related burdens themselves may be increased or reduced depending on the capacity of staff or social interaction and relations between PIs and staff, as shown in the rest of the study.

The first two types of burdens consider the psychological costs, as indicated in the overarching definition of the burden, but the third type of burden examines the burden as the sum of tasks the PIs actually need to do, regardless of their psychological cost and feelings. Even if the PIs have to do the same number of tasks in the process, some PIs see it burdensome while others do not. Thus, it is important to consider this third type of burden. As seen in the classification and examples below, burdens in this study have a tautological nature because the articulation and identification of burdens themselves partly illustrate what generates or increases the burdens.

4-3. Burden Examples

This section shows the types of burdens together with examples of quotes from the interview data. The results are presented within a broad framework of system-related burdens, burdens with staff and communication, interactions and relations with staff; more detailed types of burdens are presented in some parts. In the examples below, PIs may directly experience the burdens by themselves, or they describe something as burden but do not experience it by themselves as they avoid it by managing the administrative process and relationships with staff effectively, or by refraining from submitting grant proposals.

4-3-1. System Burden

Throughout the interviews, PIs mentioned their burden perceptions and experiences regarding the proposal administration system, its related rules and requirements,

including those at funding agency level, university level, and smaller academic unit level. Following quote from PI1 illustrates the combination of the growth and changes of rules and requirements, and expectation for the strict compliance, which could be the major types of burdens with learning, compliance, and psychological costs.

> 'PI1:… I think because the faculty don't keep up on it, but the staff really have to. Practical example is we had a PI who had a revision and resubmit. So, he revised it, submitted it, that the staff got it in the online system and it got kicked out. Well, it didn't get kicked out to automatically. But like a month later, the staff at [Funding agency] were looking at the application and it didn't meet the new appendices guidelines of policies. Number of appendices or how you format it or something. They refused to review it. The PI didn't pick up on it, our staff didn't pick up on it. And that's frustrating. So now, it's a very minor revision and formatting, right? … It's hard to keep up, for everyone to keep up on things. And when we try to, staff monitor the new changes and policies from different funding agencies. And they send out notices to the faculty but the PIs don't really pay a lot of attention at times, to things. They don't think it's their responsibility necessarily to keep track of that stuff.'

As the quote example above indicates, PIs often recognize the growing complexity of rules and requirements and perceive the burdens but they may rely on the pre-award staffs to keep PIs away from these burdens. The following part presents the results with three more detailed variations of system-related burdens, namely those where rules and requirements grow and change; ambiguity and confusions; strict compliance.

Rules and requirements that grow and change

Some PIs described their burdens with the general system, specifically with the growth and complexity of the rules and requirements of the bureaucracy. These system-related

burdens include not only the existence and number of rules and regulations, but also as their growth and change. The following quotes describe the PIs' perceptions of the general growth of the rules, requirements and complexity of the system and the seemingly growing learning and compliance costs.

> 'PI11: Make it simpler. It's like tax, it gets more and more complicated with each year. In some ways, I couldn't do a grant submission anymore because is too complicated. There are more mandates all the time. My impression is it grows it never shrinks. … Stuff doesn't appear because it's unimportant. There's a lot of important things. Ultimately, if the system keeps expanding with important things, it becomes unmanageable. Right now, the grant submission business isn't quite there, but I could easily see, in a couple years, continues to grow, get more and more complex all the time. Eventually, you can be defeated by the complexity rather than ideas.'

> 'PI2: Yes, well they just add more and more, don't they? …It just goes on and on and on, but that's fundamentally an American disease because what's lacking in this country is one word, "trust."… There's an essence of trust in other societies which is totally lacking, because in America, everybody is assumed to be a crook. Maybe that's because everybody is….'

Some PIs, like PI2 above, describe their views and experiences in a stronger, critical tone. PI7, below, compares the current situation with the past experiences in the same institute and asserts that it is difficult to compare which is better or worse as they are just different. PI16 sees the growth as an effort of funding agencies to make the proposal review more rigorous and fair, but challenging for PIs in a sense that they need explain how they meet the requirements in the limited pages in the proposal. PI14 perceives the growing overheads and increasing layers of bureaucracy in proposal submission at the institutional level, although the immediate pre-award staff keep the process smooth for him.

> ‘PI7: It's more now. You have to jump a lot of hoops… Back when I started, there was basically one person. You go through one person you give it to one person, you get signatures, and your proposal is out. Now, it has to go through those several different layers, we have our own local admins then they go up to OKED or ORSPA. They got whole day out of it. If you need signature, you have to--. But I don't do big proposals. If you do big proposals, it might be difficult.’

> ‘PI16: … They are making it more complicated. Now you have to add scientific premise, rigor and reproducibility, use of biological things, all of this gender issues and so forth. You have to add all this and they still hold you to 12 pages. That you have to add all this on top of everything else. They've really complicated it and well-intentioned because we should be using high-quality references and that kind of thing. ...’

> ‘PI14:… I feel a lot of that (overhead cost) goes to people's salaries that aren't actually helping anything but are just one more layer of bureaucracy… My proposals have to get reviewed and signed off on by so many people, which adds on a lot of time. [Pre-award staff name] usually keeps those things moving pretty smoothly, so I don't notice, other than having to have everything done three days ahead of time.’

In addition to the growth and complexity of the system and the accompanying learning and compliance costs, some PIs, such as PI14, mentioned their perception of the growing cost for grant administration rather than the cost of research itself.

However, PIs may not necessarily need to deal with all the learning and compliance, and related psychological costs. PI17 explicitly indicated the possibly great psychological costs he may incur if he did all the learning to comply with the detailed rules and requirements, but he felt he was spared from doing them himself, thanks to staff support. PI31 said he read some of the rules in the guidelines for minimum understanding, but the staff are good at telling him what is needed and he trusts the staff. PI23 also describe the

changing forms, rules, and requirements while describing how they get help from the staff in the preparation process.

> PI17:.. As long as I don't have to deal with too many of the little details, like filling out all the forms. If I had to fill out all the forms, I did not have support like I have here…, I would be very frustrated.'

> 'PI31: Yes. At least as much as I can. …I don't read the whole -- I usually just read the parts that look like they're important for me like, that kind of stuff. I just trust that the research administrators and they assume that administration helped if there's something critical that I missed that they'll catch it. The documents are like 40 pages long sometimes, or more. I'll just look at like, "Okay, what's the page count? Let's do this. What's that?" I have a good feel. I haven't skimmed the other sections and then just hope that -- and usually the research people are like, "Oh, you're submitting this proposal? Here's a list of important things you need to know about." Now I'll say, "All that other stuff, don't worry about it, we'll take care of this. It's not important." They'll just give me a list of the ones that are important for that funding agency.'

> 'PI23:… So, National Science Foundation, at least in the time that I've been submitting grants, constantly makes these little, tiny changes. For example, the letter of support.… I had no idea. And if I have submitted my old one, it would have been sent back for those minor details. Them knowing sort of the details of the things that I must do and the documents I need to submit, that is super, super important for them to be able to tell me that, besides, I don't have time to keep reading whatever they call that manual that NSF has now. … I should be reading it more regularly but them knowing that, it saves me a lot of time....'

Thus, many PIs recognize the growth, changes and complexity of proposal preparation and submission, but describe how staff help them with learning and preparing for compliance. In this regard, the administrative assistance by pre-award staff serve as the resource for the PIs rather than the constraints. The growth of rules and requirements and complexity of the proposal system, together with their detailedness and constant changes,

are the major part of the burdens for PIs, which require the PIs or the pre-award staffs to spend learning and compliance costs as well as the related psychological costs.

Ambiguity and confusion

Some of the system-related burdens were due to the ambiguity of the rules and requirements, and the possible room for the interpretation. The ambiguity and confusion may be present in the rules and regulations, or the electronic proposal submission systems, both at funding agency level and at institutional and academic unit levels. PIs may need to spend more time and effort learning and complying and so incur psychological costs due to such ambiguity and confusion. Among the two quotes from PI29, the first quote mentioned the ambiguity of some of the rules of funding agencies and university, expecting the pre-award staff to have the interpretive skills, and the second quote describes the possibility that the interpretation of the rules could be difficult even within the funding agencies which originally formulate the rules. PI28 remarked on the difficulty of learning and understanding the budgeting system, noting that the budgeting spreadsheet is incredibly confusing and not logical in his view, although his direct experience goes back to a few years ago.

> 'PI29:… The very good ones (pre-award staffs) have a good assessment on how to interpret the rules that come down from ORSPA and come down from NSF, because you get written rules and you can-- this is like lawyers. You can interpret them in many different ways. If you happen to interpret them in the wrong way, a worst case scenario is they kick you out. They kick out the proposal.'

> 'PI29: …it's not so clear who you find at NSF that actually is knowledgeable enough…. There are some people who do this

> administrative stuff and they have no clue why this rule has been put in place. They didn't just read. It's like you go somewhere in a store and you ask a technical question, and then the person reads you back what's on the warranty card or on what's on there, right? You can read that yourself. You asked a question because you want an interpretation, and very often you don't get that from NSF either, because the people who actually wrote the rules are not the ones that actually give you the answer.'
>
> 'PI28: … The only the big issue I had was with the spreadsheets and trying to put together a budget. I would prefer to be able to do it myself and just sit down on my desk with a spreadsheet that makes sense and plug in the basic things that I needed two weeks a technician time and one month of my time…. A good example of confusing is what constitutes half-time and what constitutes full-time for some graduate students…. Anyway, the same thing with yours. Some fields like my salary. If I put my salary and you'd expect that to be automatically populated, I shouldn't have to guess. I know what my salary is. The overhead rates change all the time and you got plugged in manually. You had to make sure you had the latest trends. …'

PI28 explicitly noted that he devoted considerable time to learn and use the system.

Some PIs mentioned the learning cost involved in using the electronic submission system of funding agencies such as eRA. These electronic systems may require the PIs to spend some time and effort learning how the system works, especially if the PI is new to the system, or when a new system or revised system is introduced, or the system itself entails the great leaning cost. PI15 described the budgeting in the electronic system in the specific format compelled him to spend more time and effort learning and complying with that specific format. Furthermore, the different electronic systems potentially require different amounts of learning, as PI13 talked in the quote below.

> 'PI15: … I make the budget. They then have to translate into that eRA system, send it back. I double checked the budget. It was wrong. I sent it back. He tries again on eRA, sends it back. It was still not quite right. I

> find that eRA system actually it makes matters worse because when I had complete control over the spreadsheet or the budget, I could just make it and send it to them and say, "This is what I want." Now it has to get translated into eRA system and it never comes back right.'
>
> 'PI13: For the NIH grants, because grants.gov is such a pain in the neck, they (pre-award staffs) will sit with the faculty member and make sure everything gets uploaded, make sure it's all in there. They will download it and make sure that it looks right'

Different PIs may have different experiences and perceptions of the same rules, requirements and systems, such as the eRA submission system mentioned in the case above. However, the ambiguity, confusion, and complexity of the submission system, as well as the rules and requirements, may involve PIs in more learning and compliance cost in the process, especially if PIs get only limited staff support.

Strict compliance

Some PIs mentioned the expectation of strict compliance on the part of some funding agencies, which partly leads to the extra effort to comply by PIs, pre-award staff, and the institute. Certainly, some funding agencies tend to return the proposal without review if the proposal package is not compliant with their rules and requirements, including the very detailed formatting requirements. For the strict compliance, PIs may spend more time and effort learning and complying, incurring possible psychological costs. In the following quote, PI18 mentioned the expectation of very strict compliance and experience of proposal returned without review.

> 'PI18:… NSF Fastlane performs a check for compliance and it will kick back an error message if the project summary, listed at the time, was in

> excess of one page which it obviously was. But that error message was ignored and the proposal was uploaded partly because these things are often finalized on the last day rather than having an opportunity to correct that error the NSF declined it without review. Six months later when we resubmitted it, it was funded. There are issues that crop up sometimes.'

Some PIs recognize the expectations for strict compliance, but do not necessarily require the PIs themselves to worry about them because the staff can take care of those requirements.

> 'PI6: They'll look over your documents to make sure you have all of them because each grant needs about seven different documents. I feel like this is more important when you're doing your first grant of each type. They'll make sure they're compliant too. I think there might be other professors who have got problems like formatting issues. That's not really a problem for me. That's the nice staff. They'll look at those documents to make sure they've put them together. I guess they often need to do changes. ...'

> 'PI5: I've heard stories with things like, "I had the wrong margin in my project description, so it got returned without review". I've certainly heard of those things but largely from our research advancement staff who might just saying that to scare us in to doing a better job. But that's another thing that I depend on the research advancement group to look through is all of the nitpicky compliance thing.'

Thus, PIs may perceive or experience burdens with the proposal system because of the expectation for strict compliance posed by external expectations from funding agencies as well as the expectations of PIs themselves. Strict compliance involves not only the learning and compliance costs but also psychological costs as the funding agencies may return the non-compliant proposals without review.

4-3-2. Staff and Relations Burdens

All the PIs in this study interacted with pre-award staff to a varying extent during the proposal preparation and submission process, in the course of which some PIs experience burdens with staff. The following section presents some of the interview quotes on two more detailed types of burdens, namely those with the quality of staff themselves, and those with communication, interaction, and relations between PI and staff. These two burdens often overlap.

Staff quality

PIs may experience burdens, the extra time and effort, or psychological costs just simply by working with staff of lower competency. All the PI participants in this study indicated that they interact with the pre-award staff to varying extents during the proposal preparation and submission process. Staff quality may involve specifics such as the slowness, lack of knowledge or availability, making errors as indicated by the issue of slowness in the quote from PI10 below.

> 'PI10: … I'm a very action-oriented person. If I ask for it now, I want it now, I don't want to wait. You got to stand in line with all the other people proposing. I asked just this morning, how was the submission going that's due this week? He said he can't call me until tomorrow because he has two proposals that are due today, so I have to wait patiently. What happens is then on the day that he's submitting it, he can't find -- like last week, he put the letters of support in the wrong order. I had emailed him the order. I had to go find the email to get the order, because he couldn't find his that I had already sent him. It's very much dependent on competent administrative staff. We don't always have the most competent administrative staff. …'

The burdens of the PI in this specific experience seem to involve not only the time devoted to the task, but also the psychological costs and frustrations of the process.

The following PI14 describes the limited knowledge of the staff, who were unable to give useful answers when the PI asked questions and the PI had to do the learning and compliance himself. As this quote indicates, the lower quality of the staff may require PIs to engage in the additional learning and compliance, and interaction with staff which did not help the PI in this case.

> 'PI14: I did it all myself. … It's not that he didn't want to help. He just didn't know anything and didn't try to learn anything. … When I said, "Okay, I'm going to submit to this particular call for funding," he would say, "Okay, just send me your 15-page proposal." "It's not a 15-page proposal, it's a four-page proposal." "Okay, just send me your budget." "There's no budget." He didn't know any of those details. It was pretty much up to me to make sure I was in compliance because he didn't-- I don't think he knew where to go find the-- Or didn't bother to go find the information to look it up and didn't know the terminology and things like that. As far as I recall, it was just me figuring it out. I remember him also telling me that nobody at [Academic unit] has ever been a co-PI, which is in no way possible. Because I was co-PI on one that I submitted shortly after I got here and he didn't know what to do with it and told me that nobody had ever been a co-PI. I'm like, "That's probably not true. I doubt that." It was just things like that that it was pretty much all on me. ..'

In addition to the inability to provide the expected level of knowledge, making mistakes is one of the primary factors of bad quality. PI15 describes the staff making mistakes, in which case the PI spent more time and effort on learning and compliance, as well as on interacting with staff. PI21 also describes situations in which he had to spend additional time checking and correcting errors made by staff.

> 'PI15: Mistakes in calculating a budget. Mistakes in terms of getting formatting rules wrong. Not my grant but somebody else's grant got

> rejected because of formatting problem. Just dropping the ball on deadlines and things like that. Most of the time those are caught by people like me. I actually did alright with him because I double-checked everything. I never -- ever since that first mistake that I had, the [A large dollar amount] error, I have never trusted a budget that came out of ORSPA so I always double check it and-- but I caught numerous mistakes, so I did fine.'
>
> 'PI21: Where you have trouble, where you get people that either just simply don't know the system and therefore the worst problem is people that will make errors. Therefore you have to be spending a lot of time going over everything that they do to correct their errors…..'

The quote from PI15 above indicates that, in addition to the burden with on-going mistakes, past experience of mistakes may cause additional burdens for their future submission as PIs may spend time preparing documents by themselves without delegating the tasks to the staffs and double-checking all the documents.

PIs perceive and experience burdens with qualities of pre-award staffs and services which actually involve a lot of different but related aspects. The qualities such as the richness of knowledge and detailed and organized services are related to the accuracy and frequency of mistakes. The burdens with staffs might derive from the quality of staff themselves such as the knowledge level, but these burdens may emerge during the communication and interaction in the proposal process or relationship between PIs and staffs as described in the next section.

Communication and interaction

PIs interact and communicate with staff to prepare and submit proposals and that often help them to do it more efficiently and so reduce burdens. However, for some PIs, this

communication and interaction themselves can be the burdens. The burdens involve a combination of factors such as staff capacity, slowness, inflexibility, mistakes, lack of trust, although the behavior and practice of PIs themselves could be a part of the burden.

PI5 describes a case in which he experienced the slowness in the submission process, potentially due to insufficient communication. The communications and interaction-related burdens may not be simply with slowness, but possibly involve a lack of communication, as indicated by the quote from PI10.

> 'PI5:… It was just taking forever for them to upload it. … I think that was actually the full proposal. It was taking forever. Our research advancement staff had done everything that they could. I had done everything I could. I was traveling for work, so I had turned everything in probably five days before it was due, five calendar days; probably only two business days before everything was due. I had hoped to get everything submitted on the Friday before I traveled, we didn't. It was due I believe on the Monday. It was probably Monday at noon, and it was due Monday at two when it finally went in, so that was frustrating. ….'

> 'PI10: It's required that you do it 10 days early. I'm usually 30 days early. I am not a procrastinator. I don't like to procrastinate. I like to turn in things early. It drives me crazy. Yes, which I can't understand. You have all this time. I don't even know if my NIH grant went in. It's due today. They were still putzing around on Friday. I had turned it in two weeks prior. You're required to do it 10 days before. There's been time where I'm saying, Okay, I'm not going to give it to you except for five days before just because I'm waiting on other team members to get me feedback on something but I usually always am early. My hope is that I don't have to stand in line. If there's any problems, I'll have time before the deadline to get it to them. That doesn't always work in my paper.'

PI10 expressed the trial of waiting in line but said the staff never missed the final submission deadline in the end. Even if the proposal was ultimately submitted on time for the funding agency's deadline, waiting without clear communication about what was

going on could be an additional burden for the PIs, in terms of the psychological burdens as well as the time and effort involved in waiting and checking progress.

PIs experience burdens with challenges in communication and relations, including slow responses and unavailability. The quote from PI15 describes the situation in which the PI visited the pre-award team in person to make sure they worked on his submission because the staff often did not respond to his emails, and the PI further spent time and effort on the back and forth interaction and communication with the staff to make the budget work in the electronic system.

> 'PI15:… I just walk over to [Pre-award staff name]'s office with the flash drive with all the pdf files loaded, word files in case he needs to adjust formatting or something and hand it off to him and then check in with him the next day to ask was everything okay. That's pretty much the submission process is I just walk that flash drive up for [Person name] and say, "Here it is." ...'

Thus, the staff-related burdens involve a range of cases, often in terms of the quality and capacity of staff, as well as the interaction process and relationships between PI and staff. The burdens in the communications and interaction with staff involve not only just the time spent to complete the communication and interaction, but also the psychological costs because of the challenges in the communications, including miscommunication, communication time lag and unavailability of staff.

4-4. Burden Level Assessment

PIs prepare and submit the proposal, oftentimes with the support of the pre-award staff. PI-level assessment of burdens in this section focuses on the actual number of tasks PIs

perform in proposal preparation and submission. As contrasting examples, PI9 responded that he did not worry about the administrative parts and requirements and focused solely on the scientific content. Another, PI15, seems to work on more tasks as he prepares the proposal package by himself and does double-checking by himself.

> 'PI9: Yes, I've very good experiences with the (pre-award) team here. So I know that I can rely on them that. If I want to write a proposal, I can focus on the content, and I know the rest will be going okay.'

> 'PI15: The problem is time, is that due to me needing to double check everything and getting almost 0% proactive help, it just takes me twice as long to write grant proposals as my colleagues at universities like [University names]. ….'

The assessment of the level of the burden here focuses on the number of tasks each PI needs to complete, excluding the factors of psychological costs and frustration, because different PIs may express different perceptions and experiences of psychological costs even when they actually engage in the same number of tasks and processes.

Four factors were considered in assessing the burden level of each PI, namely (1) Learning: Learning rules and requirements for proposal preparation and submission, including the deadlines, the list of documents to submit, document formatting and page limitations, and how to use the electronic submission system; (2) Documents: Preparing documents, which includes drafting and revising documents, and collecting documents from collaborators; (3) Compliance: Checking compliance, including the document list and format, and compliance with the funding agency's rules and with the rules of the specific grant, and (4) Process: Coordination of the process of preparation and submission. All the PIs are responsible for the science part, but the number of tasks

involved in the four tasks above may vary. For the full table of the assessment criteria, please see Appendix B.

The interviews with 17 PIs were coded as having very low to low burden, 9 PIs as having a moderate level of burden, and 4 PIs as having high to very high burdens. One interview was excluded because the PI perceived the burdens with growing administrative procedures but avoided grant submission and did not specifically talk about the submission process and pre-award service in his case or the practice in his academic unit. Table 3 presents the average of PI's annual proposal submission frequency and success rate among in each of three group with different level of burden level assessment results, using the proposal-related data obtained from the institutional database[3].

Table 3. Burden Level Assessment

Burden level	Very low–low (17 PIs)	Moderate (9 PIs)	High–very high (4 PIs)
PI's average proposal submission per year (2014–2017)	3.5	3.0	3.1
PI's average federal proposal submission per year (2014–2017)	2.0	1.7	1.5
PI's average success rate, all proposals (2014-2018)	0.32	0.38	0.35
PI's average success rate, federal proposals (2014-2018)	0.25	0.40	0.26

[3] Each PI's proposal submission and acceptance records were obtained. For the PIs who moved to the current institute after 2014, their year-average submission counts considered only the years after they moved in. The success rate considered all the proposals after 2014 with funding results of acceptance or denial, and excluded those with pending status.

The significant variation was not observable across the three groups. However, this does not indicate the need to exclude proposal-related factors in the future studies of burdens because this observation might be due to the limited number of studied participants.

Table 4 presents the distribution of PIs with different burden content levels according to the level of pre-award staff and service quality each PI interacts with.

Table 4. Pre-award Staff Quality and Burden Level

	Burden very low–low	Burden moderate	Burden high–very high
Poor quality	0	1	2
Fair quality	1	3	0
Good or very good quality	16	5	2

In general, the PIs who have better quality of pre-award staff and services have a lower content burden, although the relationship between the burdens and quality of pre-award staff in this study could be tautological, as better pre-award staff and service may offer greater service coverage which reduce the task amount for PIs and the opposite quality may cause PIs to do additional tasks. Some PIs experience good pre-award service but have higher content burdens partly because of the personal preference to prepare the proposal package by themselves regardless of the quality of pre-award service, or tend to have more hands-on preparation of documents with the administrative assistance rather than completely delegating the tasks.

4-5. Chapter Conclusion

Despite the research design limitation as a single case study, the interview results indicate a recognizable variation in the burden perceptions and experiences by the respondents, illustrating the complexity of phenomenon. The number of resources, here the number of pre-award staff, may reduce the burdens of PIs by providing greater help, but there seem to be many more factors that shape the process and burdens of proposal preparation and submissions, such as the trust relations between PI and staff. The results even indicated a variation in the meaning of 'quality' of pre-award staff.

As shown in the classification of burdens, some of the burdens are experienced with the system, rules and requirements, while PIs also experience burdens with and during interaction with staff. The methods of interaction, and levels and type of supports varied to a large extent. Given that the basic electronic submission system, rules and requirements in the guidelines, and the list of documents for preparation are often the same for all applicants, the interaction process and staff quality may be one of the crucial factors to examine in investigating the content and origin of burdens for PIs. The interview results also illustrated the accumulative nature of burdens: accumulative within the relationship between PI and staff, within the academic unit, and within the PI's own experiences, perceptions and stories they hear from colleagues in and outside the institute. The burdens may be observed and measured in each submission, however, for most PIs, proposal submission is a recurrent practice and PIs submit proposals through the same academic unit with the help of local staff.

When the concept of burden takes account of the psychological costs and the perceptions of burdens, we need to consider that these perceptions are subjective by nature, shaped by the personalities, views and prior experiences of individuals. Some PIs explicitly pointed out that the growth of important rules, requirements, and responsibilities are important in public funding applications, as in the quotes of PI30 and PI9 quote below. Or, in the view of PI9, they are part of the communication between funding agencies and applicants about what the agencies and programs really want. The quotes from PI13 and PI23 indicate that the prior and personal experience and knowledge may shape their expectation and judgment of pre-award staff and services.

> 'PI30: … I mean they don't want to over-require things, but we are spending taxpayer dollars. We should be doing it responsibly.'

> 'PI9: .. I would not necessary say that is more requirement. ….. In that way, yes, there are more requirements, but it's not that is limiting it sometimes, it's more kind of, it's more improving their communication about what is needed…I guess sometimes people don't realize it's tax money that they spend, so you have to talk about why do we do about broader impacts? That's because it's tax money. You have to realize that this is not something you're entitled to.….'

> 'PI13: The one thing that I don't know anything about is anybody else's experience. I'm just sitting here telling you how great [Current pre-award staff names] are, and how our post-awards is a mess. It would be interesting to me to know how are other units working. The reason why I tell you [Current pre-award staff names] are doing so great, is because the previous woman … was the worst. He wouldn't do budgets or anything. You had to do your own budget. It was terrible. He was terrible. To me, having [Current staff name] do a budget, or having [Current staff name] do the budget and having them write the first budget justification, and all of that? To me, that's great, because [Past staff name] did nothing. But if somebody else is like, "Oh hey, they are supposed to be doing that and

these seven other things." I'm like, "Oh, they're not doing so good at all." …'

'PI23:…… And my experiences, overall, have been very positive and have been valuable. Talking to my colleagues who work at places that are smaller, who don't have this type of research admin staff, I realize how lucky I am just to have it. I wouldn't say that all my colleagues are like this, but I know some of them sort over like, "Hey," they have certain expectations that may or may not be met. Me, I'm like, "You should be lucky that we have anyone because there are a lot of our colleagues out there who don't have anyone who's helping them." ...'

The PIs who view the growth of rules and requirements as necessary and important may potentially perceive fewer burdens than those who simply view the growth and complexity as troublesome for the efficiency of the research system. Thus, the perceptions, expectations, experiences, and personality of each PI may need to be considered in a future study.

5. FACTORS AND HYPOTHESES AROUND BURDENS

The interview data suggest a great diversity in the way PIs prepare and submit proposals and how they view and interact with staff for preparation support, compliance checks and the actual submission process. This chapter presents further possible factors that contribute to generate, increase or reduce burdens of PIs, and presents possible future hypotheses, based on the empirical results from the interviews, with reference to the theoretical arguments.

5-1. Contributing Factors

The interview results suggest that the quality of pre-award staff and interaction and relations between PIs and staff are some of the key factors in increasing or reducing burdens. The following experience of PIs illustrates how the burdens of the PIs can be reduced by the staff.

> ‘PI17: Yes, they are growing and more rules, more requirements. Most of it's more administrative stuff. Filing reports, filling forms and stuff like that. We're pretty well protected from the most onerous parts of it. I know there's more way about that.’

> ‘PI11: I think the main thing is that my experience here .. has been very good. They really try hard to lessen the burden on us, to make it as easy as possible for us to get all of our things together and giving us support. I've only got compliments to say about the teams that I work with. I think that's the main thing, is that they're doing a good job. If they were taken away it would be a disaster, I can tell you that.’

On one hand, like these PIs, PIs recognize the growth of rules and requirements in the funding system but that PIs themselves do not have significant burdens because of the staff. On the other hand, as suggested in the previous chapter, many PIs experience burdens as a result of staff quality and interactions and relations with them.

This chapter elicits the pre-award staff as one of the core factors that have potential influence on the burdens of PIs, because interview results generally suggest that the access to quality staff and their relations were key factors in reducing burdens regardless of the actual rules and requirements posed in the proposal. In general, quality, capacity, and motivation of employees could be part of the major determinants of the organizational performance or customer service. According to Gittell, Seider and Wimbush (2010), human capital skills, and motivation and commitment are two dominant approaches to the determinants of performance outcomes, and they further suggest a third approach, namely the relationships among employees. In the study of citizen's bureaucratic encounters in government service, Kahn, Katz and Gutek (1976) examine four points in the properties of episode, namely whether it is hard to find the office or official, levels of staff efforts to help them, availability of appeal, and whether the client has a choice.

This chapter firstly illustrates the potential variables in three broad groups, namely the human resources with staff quality, process and relationship between PIs and staff, and organizational arrangement of staff and services with an emphasis on more academic unit level or pre-award team level issues. Other factors, such as proposal

complexity and PI's practices, are also important in determining the burdens. Table 5 presents the list of the factors.

Table 5. Burden-related Factors

Group	Factor	Description
Human resources	Knowledge	Knowledge level of staffs with attention to detail and accuracy
	Availability	Staff availability
	Anticipatory and proactive	Anticipatory and proactive working habits
	Motivation	Motivation of pre-award staff
	Task coverage	Task coverage of pre-award staff
	Mistakes	Frequency of mistakes by staff
	Compliance mentality	Too much attachment to rigid compliance
Process and relationship	Interaction styles	Face-to-face meeting
	Trust and distrust	Level of trust between PI and staff
	Feedback practice	Feedback practice and culture
Organizational arrangements	Staff workload	Number of proposals per staff, or number of staff per faculty member
	Staff turnover	Average of years of working period
	Staff training	Training and mentoring of staff
	Geographical proximity	Geographical proximity of PI and staff offices
Other factors	Proposal complexity	Proposal complexity with the funding agency, proposals types, inter-organizational team, team size, and research content

Institutional-level system	Institutional system and process for submission
PI's practice and strategies	PI's proposal process management such as last-minute submission
Success rate and submission frequency	Proposal success rate and submission frequency of PI

The relationship between PIs and staff in the proposal preparation and submission process may be conceived in multiple ways. The two groups may work as a team with the same goal of successful, compliant proposal submission in a timely and efficient manner. Or they may see themselves as separate from each other with different views of professionalism or a relationship of customers and service providers in which the service quality and relations are still important in shaping the process (Bove and Johnson, 2001).

5-1-1. Human Resources: Quality of Staff and Services

Under the assumption of the importance of quality staff and services in pre-award, the meaning of 'good' and 'bad' could be multi-faceted. Good qualities may help PIs reducing burdens, while the bad qualities may compel PIs to spend more and unnecessary time and efforts on proposal preparation and submission in various ways. The characteristics of good and bad qualities of staff and services are often pairs of the opposite characteristics. Oftentimes, PIs listed a set of qualities and the combination of qualities is important in increasing or reducing burdens for PIs, as shown in the following quote, as a typical case.

> ‘PI16: I think just like everybody in general, you want them to be detail-oriented, accurate, timely to know the grants process and to know the funding agencies and what their requirements are so they can help you make sure you're meeting all the criteria. You want to make sure that they are available to you. That they have good communication skills and they can work well not only with you but with the other staff to make sure things get out on time.’

Table 6 lists the good and bad qualities of staff that were articulated in the interviews with PIs.

Table 6. Good and Bad Qualities

Good	Bad
Knowledgeable	Limited knowledge
Accessible	Unresponsive
Being detailed and organized	Make mistakes, cover them up
Learn from mistakes	Pretend that s/he knows
Anticipatory and proactive	Only reactive
Flexible work habit	Non-flexible work habit
Understand PI’s preference	Too much compliance mentality
Clear PI-staff task division	Try to help with scientific part

The following section illustrates some of the potential variables, or the content of variables, regarding the quality. Some of the variables are closely related or have overlapping aspects.

Knowledge

Knowledge is a crucial component of human capital in general (Schultz, 1961; Becker, 1962), and one of the primary qualities of staff in the context of proposal preparation and submission support. Here, knowledge involves the amount, depth, level of detailed

knowledge, and accuracy of knowledge of staff about the rules, requirements, and processes of proposal preparation and submission, potentially with the ability to learn and comply with these rules and requirements in proposals to different funding agencies, programs, and each proposal call. With the number, changes and growth of rules and requirements, and increasing complexity and detail, PIs may rely on the knowledge of pre-award staff to some extent. Accuracy of knowledge also matters because of the requirement for strict compliance.

PI17, PI1, PI9, PI11 and PI19 below recognize the growth and changes of rules and requirements as well as the detailed differences between different funding agencies and programs, indicating that staff with good knowledge level and ability enable PIs to avoid the learning and compliance costs that come with the detailed administrative requirements and process. The knowledge of staff covers a range of topics and tasks, such as budgeting knowledge mentioned by PI23 and matching money in PI3.

> ‘PI17: They are all different. We're challenged and that's why we need to have professionals who are experts at this. I'll never be able to know the little differences between DOD and the NIH and NSF. I don't know any of them. We work with all these agencies. We, the big we have to be expert at how to deal with the details of all of them, I can't do that. The university has to have people who are the expert at this. That's really important.’

> ‘PI1:…The pre-award staff were very very knowledgeable particularly about NIH, because many of our investigators in our college use that mechanism, so, they’re very, very up-to-date on all the policies and regulations in from formatting to, budgets to appendices guidelines, etcetera etcetera.’

> ‘PI9: It's important that person knows the rules of the program …..So it's really important that we don't think about font size and the right margins… you want to have somebody who is detail-oriented, and

sometimes they might be "You have to do this, you have to submit," they need to do that because they know what is required....'

'PI11: Advice on everything. Format, length, things to include. Format is a big deal. Every section has its own formatting specialties and they're experts at it, so we can focus on just writing the Word document of what we want in it and they can focus on the formatting. They tell us if we're too long or we're too short. We rely upon them quite a lot.'

'PI19:… A good pre-awards person for me, is who's more familiar than me on the nitty gritty of the submission process and the budget process so that I'm not missing out on things. Because the rules change ….'

'PI23: Knowledge of the system is super, super important. So understanding what the cost is and how much I have to devote, let's say, for graduate student and understanding that a graduate student also needs, say, a stipend plus their tuition remission. Knowing all that and knowing the numbers, that's something that constantly changes. But them being updated and knowing all that, it's super important.'

'PI3:… And he knows the rules, that's the good part. Especially things like, in that proposal we had to have matching money from the department, and so he knew how to do that. I really didn't know. Then, we needed to have some laboratory space, and so he knew how to write that. He gave us good advice. Not in the technical part but in the actual meeting the rules.'

Thus, the knowledge of staff may have to be broad enough to cover the rules in different agencies and proposals, but it also needs to be deep and detailed so that the proposal does not omit important details and requirements. Staff may need to read and learn the detailed rules of each proposal guide, but they are expected to do so in an organized and timely manner as proposals have deadlines.

Detailed and accurate learning and compliance with the requirements could be an important part of knowledge level and ability. PI5 describes a case in which staff found

an error in the compliance element before submission. PI17 mentions the staff being very careful and accurate about rules, requirements, and compliance. PI10 suggests that it is better if attention to detail comes with the organizing capacity to coordinate the entire process in a timely manner. All these abilities of being detailed and organized may be ultimately responsible for error-free and compliant submission of the proposal, as PI27 describes.

> 'PI5: … that's another thing that I depend on the research advancement group to look through is all of the nitpicky compliance thing. For instance, one time I had a proposal that I sent a project description, and it was in a font that wasn't acceptable. They caught it, and they told me. Then I changed it to a font that was acceptable, and it was then too long, so I had to redo it.'
>
> 'PI17: … A good administrator will get in very deep, and make sure we were doing everything exactly correctly. That's good because I hate that. That's the kind of stuff I really detest doing. I love it when I have somebody who works with me who is really good at that, and maybe even likes doing that. We form a good team then.'
>
> 'PI10: Good administrators are detail-oriented, very organized. They pay attention, they thoroughly read emails, they respond to emails with at least timeline, they keep to their commitments, they do things on time.. ...'
>
> 'PI27: .. I think a good administrator is one that is detail-oriented. There's nothing worse than having a proposal rejected for something that is stupid. They forgot to put whatever or they said they didn't have to think. Proposals should be absolutely error free. If it's rejected, it should be rejected because the science is not competitive not because they forgot or they said that there are a lot of things… Detail-oriented is the first.'

Overall, knowledge is the primary capacity of pre-award staff that could reduce burdens of PIs. Rules and requirements are different for each proposal, program and funding agency, and they may change over time. It requires a certain amount of learning,

compliance, and related psychological costs for PIs to keep up with all the details and changes in each proposal. A good level of knowledge and attention to detail, accuracy, and timeliness reduce these burdens of PIs.

Availability

Availability is another primary quality of pre-award staff. Availability of the staff and services may involve availability in terms of the speed and quality of responses to the emails and phone calls from PIs, as well as the availability in terms of openness and readiness of in-person contact, or flexibility. The following quotes illustrate the range of meaning of availability. PI27 suggests that the staff are very responsive. PI13 said one of their staff may respond even during the weekend, although the PI does not expect it. PI1 and PI3 below say that the pre-award team is easily available for in-person meeting. As shown in the quote from PI31, at some academic units, the pre-award team meets with new faculty as a part of the on-board meeting for newly hired faculty, which seems to enhance the visibility and availability of the pre-award team for the PIs and help them build good relationships.

> ‘PI27:… I think somebody who's responsive is very important. If I send something in the 24 hours I need to have an answer.’

> ‘PI13: [Person name] will respond within a few hours. [Person name], usually responds within an hour, unless he's in a meeting. I would never email them at five o'clock on a Friday and expect a response over the weekend. But [Person name] will typically respond over the weekend. I'm not that kind of person. I always try to email them and expect a response by the next day. … But they respond within the day.’

> ‘PI1:…. it’s easy just to walk across the corridor right there of the other building and meet with people.’

> ‘PI3: … He's very good. Very good. Also, he's very available. If I were to call him right now and say, "Could you come here and do this?" he would be here. He's very available.’

> ‘PI31: When I first started, they reached out to me. They set up a meeting right away. Within the first couple of weeks of me being here, I had a meeting with first, [Person name], who was in charge of the whole, and you meet all the individual research administrators, just have a quick meeting. It was very clear that they wanted me to come talk to them. If I have a question, I just go talk to people. I'm not really shy with that. The first couple of weeks, my first proposal, I was probably in their office almost once a day for two weeks. I just built up that relationship, just talking with them face to face. All their offices are right there. When I walk in, I'd say hi to all of them as you walk in. It's very open. They started it. Just by the fact that they're very open, I just took advantage of coming in as often as I could to get all my questions answered.’

In addition to being available for these email, phone and in-person communications, the openness and willingness or even the goodwill to help, could be elements of high availability. As the final quote from PI31 above implies, availability can be enhanced by mutual effort.

Flexible work habits could help PIs experience fewer burdens, by extending the work hours when the pre-award team have a large volume of proposals or have pressing deadlines, or have meetings before or after the typical work hours. PIs like PI1, PI24, PI30 and PI21 said that, before deadlines, the staff in their units sometimes work outside the typical working hours in order to submit the proposals on time. Among those, PI24 explicitly stated that they compensate the extended time at a later date and PI21 noted that the way of communication matters in such working relationship.

‘PI1:… They may be here over a weekend to make sure it meets a Monday deadline, submission deadline on a pre-award side, and faculty don't even know that….’

‘PI24: We need people who are willing to extend their work hours beyond the typical working day. That's really important. It's not something that we expect but it's something that often the research administrators are willing to do. They'll work weekends in order to get a proposal together. Some of the people on the team have stayed up all night working our proposals. Again, that's not a requirement but people who are willing to not be clock watchers. Five o'clock, that's it. I'm done. People are willing to put in the time when it needs to be done. We compensate people for that extra time at a later date. People who can work under pressure, are committed when they can to put in that extra time. That's a really important quality for a successful team.’

‘PI30:… I swear I've had proposals where, because my part was done, the narrative part was done, I was able to go to sleep the night before it was due, but the team, not this team so much but there was an earlier one, the precursor to this team, where they'd stay up all night getting it done for me. Editing it, making sure it was fully compliant, making sure all the pieces of paper were there. They'd be here at 3 O'clock in the morning while I was sleeping soundly in my bed. I thought it was ridiculous.’

‘PI21: Good means somebody that's flexible and the reality is that there seems to always be last minute changes and things like that. A certain amount of flexibility in that regard is extremely helpful. On the other hand, we have to be cognizant to the fact that they have lives and they can't necessarily give them up for everything. It's important to communicate back and forth and to have them say, "Look, I could help you out. I could stay a little extra time this day but I can't on that day and that day." Communication ahead of time I think is particularly important in that regard and both people need to be flexible about how things get done.’

Following quote from RA3 suggests another way in which the staff tries to be available with flexibility by adjusting to the PI’s work habits and preferences.

> ‘RA3:… It all depends on what they like. If they want to set up a time to meet with us, they know they can always do that, but I don't require it. Some of them are so seasoned… they've done it so often. They already know what docs to send us and they just send it and go. They're just like, "Here. You do it. Load it." and that's it. Everyone kind of has their own little way of doing it…. Sometimes we're going back and forth on email. We just have to stop and get on the phone because if we're really miscommunicating enough, I'll just have to go on the phone with it. Again, I have some PIs who'll just send me all the docs at once and say, "Here. Go ahead and submit it." … He doesn't need a lot of hand-holding or interaction, and that's fine. I try to take my cues from them. The newer folks, I will explain more to them either in e-mail or phone, because I can almost tell when they don't know what I'm talking about.’

Thus, the flexibility of work habits, including time flexibility and task content adjustment to each PI, may contribute to reducing the burdens of PIs.

Availability involves not only prompt responses and availability in the office, but also openness and basic ways of interaction and relationships staff develop, such as the mood of openness and willingness to talk to PIs. All the proposals have deadlines, including the funding agencies’ deadlines and internal deadlines at the institutional level, checking and ensuring the compliance on time. The flexibility elements above could be part of the availability in the context of the proposal process because flexibility may enable the PIs actually to access pre-award assistance or to complete the procedure on time.

Anticipatory and proactive

Some PIs mentioned the anticipatory and proactive ability of the staff. Thomas et al. (2010) suggests the emergence of a set of constructs of proactive traits and behaviors of

employees, including a proactive personality and initiatives which may ultimately shape organizational performance. Some of the interview quotes provide examples of exactly what the anticipatory and proactive capacity of staff means for the PIs in terms of potential reduction of burdens.

On one hand, the quotes from PI11, PI19 and RA3 indicate that the staff may be anticipatory and proactive in the identification and expectation of the tasks and problems, in the management of the proposal process, and anticipating PIs' needs. Two quotes from PI15 suggest that the anticipatory and proactive capacity of staff may make the PI's process and tasks easier, with fewer burdens, anticipating what each PI needs. This PI further notes that, in reality, he does not get proactive support and describes how he gets reactive support.

> 'PI11:… They have to be able to see a little bit into the future. You have to be able to anticipate problems quickly. They just can't wait for everything to melt down and then to say, "I knew that would happen." They have to be able to recognize issues as soon as they arise and have the potential for what to do about it.'
>
> 'PI19:… A good pre-award person for me is someone who's on top of things. Who's not waiting for me to say, "Okay, this is what we need to do." I want someone who's going to tell me what I need to do because I'm working on the content right now.
>
> 'RA3: Just thinking ahead usually. "How can I help you?" Or "Do you need this or that?" Or maybe I could -- what we try to do a lot is just reduce as much administrative burden on them so they can concentrate on the science and writing and the proposal writing. That's what we want them to do….'
>
> 'PI15:… I mean a good sponsor projects officer will anticipate what we need and will anticipate when they hear about a call for proposals that they

> think might be in our area that will draw our attention to it…. they anticipate ways that they can make your life easier.… They hear what you're trying to do and they anticipate what you might need and they offer things that might help…. ‘
>
> ‘PI15: [Pre-award staff name] is extremely passive and reactive so he's fine at what he does but I have to send an email which then gets ignored and I call him and say, "[Pre-award staff name], I really need this," and then he'll say, "Oh okay okay. Give it to me." I only get specifically what I ask for. I get no more. He’s not proactive in any way so he doesn’t-- he never anticipates something that I’m going to need and doesn’t ever call anything to my intention and say, "Hey, here's a great, call for proposals that might be interesting to you." I never get that...’

Thus, anticipatory and proactive qualities of staff are part of an important quality of staff in reducing the burdens of PIs. PIs who receive only reactive help may experience more burdens by spending more time and efforts to contact the staffs and face the avoidable administrative problems and spend unnecessary costs in the process.

Motivation

In the studies of employees and organizations, motivation is one of the key factors in determining individual and organizational performance, with either intrinsic or extrinsic motivations (Amabile,1993; Latham and Pinder, 2005; Cerasoli and Ford, 2013). Although it is possible to measure motivation simply with a Likert scale, the level of motivation may be reflected in behavior and practice. For example, the following PI mentioned the case of the personnel he used to work with, who did not have sufficient knowledge and was not motivated to learn.

> ‘PI14:. he didn't know the difference between a pre-proposal and a proposal. He didn't know the details of what might go wrong in a budget. He didn't know how to put any of the documents together. When I first got here, it was pretty much completely up to me to get the grant up correctly because he didn't know anything about what he was doing. That was very unhelpful... It's not that he didn't want to help. He just didn't know anything and didn't try to learn anything.’

Two quotes from a staff member illustrate part of the motivation issue, as a staff who is very motivated to provide as much service as he can because of a set of reasons.

> ‘RA3: I like to provide as much as I can, but we're not scientists so we're limited.... Basically, as much as we can, to just get the proposal in the best quality, meeting all the requirements, we'll write a draft narrative and ask them, just fill in the blanks, fill in what their role is, we'll calculate out everything else and try to write detailed descriptions. I remember in the [Another academic unit], we would put together their bios a lot because that was often out of order. We just try to do as much as we can even if -- I don't know, maybe it's not something we normally do but -- Whatever they ask, if we can do it, we'll do it if we can.’

> ‘[Interviewer: ... I think you are doing much more than minimum. Why? What motivates you to do it?] RA3: I like what I do. … I don't know. I've really liked so much of the faculty. I want the school to be successful. I take pride in my work. Even though I don't really know what they're doing, I take a pride in what they're doing. …. I guess because they make-- they write my paycheck. Just the more successful we make everyone else, everyone's happy. Your job is easier. You get less complaints, you have less errors, people are nicer to you. Just the better you treat others, it comes back. It comes back, it just does. …. I guess it's just that internal intrinsic value. You have that intrinsic desire to want to do well.’

The quote above reveals this respondent’s motivation as a combination of intrinsic desire for good quality service, attachment to the institute, and expectation of better social relations that makes his work easier.

Motivation of the employees could be one of the core factors in shaping the productivity of individuals, as well as organizational performance in general, in the context of the pre-award staff in this study. The motivation of pre-award staff may derive from a set of factors as indicated by the quotes above, but the higher level of motivation results in better quality service which reduces the burdens of PIs. In addition to studying the level of motivation of staff perceived by the staff themselves, their motivation may be reflected in the set of practices and attitudes that are examined in this study, such as the willingness to offer greater service and task coverage, being proactive and anticipatory, or intentionally making themselves open and easily available for PIs to offer better support.

Task coverage

The task coverage of the pre-award staff varies to a large extent, depending on the units of the pre-award team, with some variation among different staff and preference among PIs. The very minimum task of the pre-award staff could be just to hit the 'submit' button in the electronic proposal system, but staff may provide a set of services such as a thorough compliance check, document preparation and formatting, and learning the rules specific to each proposal. Some respondents such as PI30 and PI9 said the pre-award staff help the PIs with great task coverage in which the staffs seem to keep PIs away from detailed learning and compliance in the administrative components such as budgeting, CVs, and every detailed concern in the proposal.

> ‘PI30: Yes, we get huge support here…. Yes. So the only pieces our PIs really have to work on is the project description and the project summary. Our staff will do everything else. Even the budget, right? They'll just say to the PI, "Tell me your wishlist, do you want three graduate students in a post doc, how much travel money do you think you need." Then they'll pull together the budget and then they'll say, "You're over by 200,000 or you still have half a million to spend. What do you want to cut? What else would you like to add?" Then they do all that work.’

> ‘PI9: There are a number of forms that need to be submitted. They know, for each call it can be different but they help me with that, say the conflict of interest. I provide a list of names and they go through it to make sure it's according to all the guidelines. The guidelines are changing every time. This time would cost a lot of additional work because the guidelines were changing again. There are some standard forms in terms of working plan for postdoc facilities, data management plan, so I update the typical plans that we submit, so that’s not-- I have those forms, they keep track whether I’ve submitted all the right forms, and then there's also, they ask for all the other people involved, their CVs, the bios and the conflict of interest. I don't have to worried of dealing with the other people in the project. They work with that. .. When I have my abstracts and proposal, they will proofread it and they often come with some comments about, “Did you make sure you have to put this in the proposal?” There are often a lot of details with NSF that, what can be mentioned or not, what words can be used or not. They read through it and they sometimes say, “Maybe you should rewrite this paragraph because we know from other proposals that this caused problems in the past.”’

Thus, even within the development of budget and the budget justification, some PIs get maximum support where the PIs simply tell the staff what they want and staff prepare the full budget as in the quote from PI30. In these cases, it seems that greater task coverage of the staffs means that PIs can delegate these administrative tasks to staff.

Some PIs think that the task coverage and quality of pre-award staff varies in different academic units within the institute. PI19 thinks that he receives good quality

service in each task but finds that some pre-award services are not available for him. Some PIs like PI30 think that the pre-award service at his academic unit is very efficient, but notices the unequal distribution of these staff and services in different academic units.

> 'PI19: … At pre-award, we're assigned to someone and we work closely with them. They help in the budget and they help with the submission process and all of that. I think some departments have it set up and maybe for some other investigators. I haven't had that level of support. They even coordinate your letters of support and bio sketches and all. I have done those myself more. I write my own letter. I reach out to people who I want the letters of support from so I do that work myself…. That support is not available to me.'

> 'PI30:… There are a lot of units where the research administration team just pushes the button to submit. They hardly do anything else, and that's hard…..'

In addition, PIs might have personal preferences in the pre-award services they want, and how they prepare the proposals. PI30 mentions the flexibility of the task coverage of the pre-award support, depending on the preference of each PI. PI17 explains that he, himself, receives great help from staff, but some PIs may prefer not to use the help.

> 'PI30:…. Because we could just do the budgets for them, we could edit the proposal, we could do graphics for them, we could do the facilities, and the budget justification. We tend to do more than one thing'

> 'PI17: … I have heard that there were some faculty who do not like this kind of help. I've heard this. They resist it. … Well there are some faculty who refuse to relinquish control of anything. They just refuse. They want control of every tiny little detail and they can't work with somebody else who's going to take control of the budgets. Who's going to take control of outlining the proposal and all that kind of stuff. Stuff that I find so valuable, but some people can't give it up until they don't know how to do work with the system. ...'

Some PIs prefer a clear division of tasks between PI and pre-award staff, where pre-award staff prepare a list of the tasks for the PI and the pre-award staff in the case of each proposal submission.

With bigger proposals, PIs may get more support over and above the basic help. Following quotes from four PIs describe the case PIs get greater coverage and intensity of supports typically in the big grants, and in the arrangement of inter-organizational and large team collaborations.

> 'PI17:… This was a big grant, about $2 million, involved a lot of people. There, I had a lot of direct help from research administration, OKED in particular, and also within [Academic unit]. We teamed up. I had a proposal manager who was very good, he works at OKED. I had a budget and form filling person here in [Academic unit], that's his job. Those two people took care of all the details. Everything, from filling out the forms to actually submitting the proposals to scheduling meetings. Making sure the telephone worked. All the really important things that we have to have done well in order to coordinate these large projects. I get a lot of help on the larger ones, and the people are really good.'

> 'PI20: For some big proposals or big projects, we have project managers. They do a lot of things. They all work as a team of faculty and they'll help assemble the proposal, they may help write it, and really, it's an experiment that we started a couple of years ago where we recognized that to create big projects and really assemble a quality proposal, you needed basically project management support and it's worked. … For example, for new faculty, we will provide editing support for their first proposal, and it's a good way to get them thinking the right way...'

> 'PI13: … What he did -- Because it was a five million dollar grant, so there's a floor, like you can't have a $30,000 grant and asked KED to help you. .. We would send him parts and he would help us assemble it into a whole. [Interviewer: In that research content?] Yes. He helped with flow. He helped to make sure if there was a table, it was described. He helped figure out how to make the tables visually appealing and small, so that

> they wouldn't take out too much room….. He helped get the data from the [Other universities] and put it in the charts like it needed to be. He also formatted the entire thing for the references. … He didn't write it. He was more like an editor...'
>
> 'PI23: I've been mentioning that when there's collaborative proposals handling that communication with the other admins, that's something that's nice that it gets taken off of my plate. We're busy putting together the project description and the summary in all these other documents, so them lining up all that stuff is actually super helpful for me. ...'

Thus, some tasks may be seen as more basic, others may require extra service, and PIs have preferences to the extent and type of service they require. Task coverage is not only about the clear-cut of the proposal components such as budget and biosketches but also about how and what extent the staffs help the PIs. For budget, PIs may just give the wishlist of the items they need, or PIs may prepare budget by themselves and get staff supports when they load the budget into the electronic system.

Mistakes

Many PIs articulated that making mistakes is a sort of disqualifier and indicates poor qualities of a person in pre-award team, as shown in the quotes from PI9, PI21 and PI29 below. Mistakes become a significant problem, as the proposal could be returned without review if there are even minor mistakes in some cases, although sometimes mistakes may be corrected before the final submission. The mistakes during the preparation and submission may require additional learning and compliance costs for the PIs, including the time to interact with staffs for additional tasks and related psychological costs. Some PIs, like PI4 and PI25, express their view that the PIs, themselves, are ultimately

responsible for the mistakes in the proposal because the PIs should be responsible for making sure that documents in the proposal are correct and compliant.

> 'PI9:…You don't want to have somebody who is making a mistake.'

> 'PI21: I know of other groups in other areas that have had problems with people making mistakes and that's really where bad things happen. If they make errors and if you don't catch them then sometimes the grant can be refused for that reason.'

> 'PI29: ... The bad one, the really really bad one, forget some important details of the submission process, and NSF rejects your proposal, because some formal nonsense hasn't been taken care of and good ones don't do that. That's the disqualifier.'

> 'PI4:… I can't remember the specifics. But really, it's on me. Because I'm the person that's supposed to approve everything, so the responsibility stops with me. If there's an error, generally, I'm the one to blame, rather than anyone else.'

> 'PI25:… Very, very strong research support. There's a team of people here who are expert at uploading things to NIH. Making sure that all the parts of the grant are assembled. Still, it's important that the scientists review those documents. Things like budget, budget justification, if you don't look at it carefully, you can get hurt…What could be silly mistakes occur all the time.'

It would be ideal to have no errors in the proposal process, but some PIs, such as PI11 and PI1 below, recognize that pre-award staff may make mistakes, but that good staff learn from their mistakes. The opposite is the case when staff try to cover up errors or are less motivated to learn from mistakes, as described in the quotes from PI15. PI10 closely describes how the mistakes, including the past mistakes, could make PIs spend more time and efforts to monitor the proper submission to avoid errors.

> ‘PI11: Have to be smart, have to learn from mistakes in the past because everyone makes mistakes…..’
>
> ‘PI1:… I think everyone does their bests to keep up on these things but you may miss something over there. But I'd say in this case, we know what the mistake was. And it probably won't happen again, right? With anybody but unfortunately it happened with this one. Investigator delays the re-submission by three months or so.’
>
> ‘PI15: I mean the really bad ones just make mistakes and then they try to cover it up. .. he just flat out made mistakes and then would try to cover it up and make it somebody else’s fault. If there's a mistake, you need to admit it and we need to fix it. Preferably, don't make mistakes in the first place but we all know the mistakes happen. … This person made mistakes all the time and they try to cover it up.’
>
> ‘PI10: Every time I want to feel like, "Oh, this person really knows what they're doing." They make a mistake. It's down to little things like the letters of support. Just when you think you don't have the stress that they're going to handle it or whatever, then they send you another thing and the letters of support are out of order. They're missing one. Okay, there were five in that email, not three or four. It's like, okay, I got to put my goggles on and make sure I'm watching person again. You want to trust but then, something happens then you can't. I would love to be able to trust and feel that way about the faculty or the administration, but it doesn't happen that way.’

PIs may experience burdens with the mistakes as PIs possibly need to engage in extra tasks for learning, compliance, and interacting with staffs. The burdens may be greater when the mistakes cause greater costs or the mistakes are frequent or recurrent.

Two respondents mention the ‘invisibility’ or ‘transparency’ of the pre-award team as a desirable quality, which means that pre-award teams handle the proposal supports smoothly and without mistakes.

> ‘PI1: .. So being invisible from the point is that they don't have to always be going back and forth day after day after day. They don't want to be seen

> as pests to the PI, right? … They don't want to seem like they're pesky or annoying. That's why I sort of mean by invisible. ….. They want to work and make our lives as PIs very smooth and efficient and effective. And not be seen as annoying and you know that they don't want to be seen as the hurdle to get over. ….'
>
> 'PI12: … Most faculty who want to write these proposals want research administration to be transparent. They want it to have no impact on what they do. They just want them to make sure that the laws are not broken and make sure that your money is going to continue to come and won't be mismanaged by the university.'

Thus, the frequency of mistakes by staff could be an important factor to study in what generates or increases burdens for PIs. The best situation is not to make mistakes, and to detect errors, but the staff's ability and motivation to learn from mistakes could be also an important element here. Mistakes seem to cause burdens and problems in the proposals the PIs work on at the moment, but past experience of mistakes might make PIs spend more time and effort in future proposal processes in order to avoid the mistakes.

Compliance mentality

Although the compliance assurance is part of the primary role of the pre-award staff, PIs described certain personal characteristics and practices of pre-award staffs as compliance mentality and rigidity which may cause the burdens for PIs, illustrated as the persistence to the strict compliance and specific ways of compliance without consideration of other possible choices. The compliance mentality here may be aligned with the bureaucratic personality (Merton, 1940; Bozeman and Rainey, 1998) or the unbureaucratic personality (DeHart-Davis, 2007) as the opposite. Within the argument of relations between

bureaucratic structure and personality, Merton (1940) asserts that there may be a conflict when the officials are rigid to follow and conduct formal and impersonal treatment even when the client desires more personalized and flexible practice (Merton, 1940, p. 567). The favorability and persistence to rules and rigidity could be due to the formal pressure to hold rigidity within the organizations and task responsibilities of the position, or the personalities (Bozeman and Rainey, 1998).

PI18 mentions that some staff tend to have too strong a compliance mentality, or do only compliance-related works in his view. PI18 thinks that the goal of some staff may be to make sure the proposal is compliant, but too much of it could be problematic for PIs. The following quote from PI26 also indicates that efforts toward strict compliance and the goal of successful and smooth proposal submission may sometimes be in conflict. In addition to the compliance requirements by funding agencies, the academic units and the university assure compliance, which may be very strict in some cases, as PI12 indicates.

> 'PI18:…. Especially when you are stuck in this compliance mentality, the way that people who work in bureaucracies exercise authority and protect their schedule is by saying, no. Hence that doesn't help anybody in any way. Yes, it would be much better to work with staff, people who are trying to find ways to make what you want to do work instead of ways to stop it.'

> 'PI26:… Being focused on the goal which is preparing us with existing proposal as opposed to being focused on enforcing the university's rules and things like that. That may not seem like a conflict because you would think the universities rules are there to help us prepare say these proposals and they are but sometimes you've got to push against those rules a little bit, especially deadlines. That's the toughest one is that most probably would like in a three business days in advance to have it but the reality is it's not always possible. For a bunch of reasons it's not always possible. To have the program office you're working with the administrator you're

> working with understand that, right? Not be somebody who is just a stickler for the rules…'
>
> 'PI12: Here at ASU, they don't want anything that even smells of being a cost share in any proposal. Sometimes, they'll take things that are theoretically a cost share in their mind. That is inappropriate…..'

Although the compliance is important in the proposal, the way and process of assurance of compliance may matter for PIs. PI8 and PI5 provide their views about the good staff, which seem to be the opposite of those with a rigid compliance mentality.

> 'PI8:… But the ones in the research administration floor, are really effective are the ones who start by sitting down and having the discussion and really listening. Understanding what's needed …. The best administrators…..will sit down and listen and figure out, "Okay, what do you need from us? What do you want to see happen? What would be considered successful?" and then help to make that happen...'
>
> 'PI5:… I think my favorite quality in a research advancement person is when they give me options from the beginning. They say things like, "… Here are three different ways that you can get the budget to be where it needs to be". As opposed to, "You're too high. Figure out what you'd like to cut". I like to have people present me with the options. I don't think it's ever happened that I've taken exactly one of the options, but at least I start to see things like if I reduce student time, that would have this impact, or if I took out an hourly student, that would have this-- I can start to see how things go, so that's that. What makes someone bad is just saying, "You're too high", and offering no suggestions as to how to fix it.'

Good staff, in their view, can adjust to what a PI wants and understands as the goal, although the flexibility in the process of compliance and flexibility in the ultimate assurance of compliance could be a separate issue.

While the practice may be seen as compliance mentality, the compliance check is posed by the formal task responsibility of pre-award staff and serve the purpose to make proposals compliant. PI1 expressed the gratitude and understanding for what pre-award

staffs do for the faculty, including the strict compliance checks. The quote from RA4 illustrates the perspectives from staff side.

> 'PI1:… They're doing everything they can to help this job through hurdles. But there are times where they're going to have to push back. They're gonna have to tell a faculty member 'hey you just can't do it that way I'm sorry'… It's not like they're making these things up just to be a pain in the backside.'

> 'RA4:.. The Grant Contract Office (GCO) in Proposal Negotiation Team, their main responsibility is to protect the institution and to make sure we stay compliant and stay eligible for funding. There's a different perspective there and I would have to see specific examples. They're that gateway to go through and I found them to be very responsive. They bend over backwards to get things submitted. The issues can happen if you have a unit staff person like the role my team does and if we don't understand something or we forget about something and then we don't realize it until the GCO points it out to us during that final review, then it can be a hassle to go back and correct it then. Also something we do on our team as well, is people sometimes use ORSPA or OKED to be the bad guy. So, when working with the faculty member, they might use them as the excuse for why we need to follow certain rules rather than just presenting it as this is the rule and this is why we need to follow it. Sometimes, it depends on how comfortable that staff member feels.'

The quote from RA4 above suggests an example of the classical red tape saying, "One person's "red tape" may be another's treasured procedural safeguard" (Kaufman, 1977, p. 4), but further suggests that the greater understanding of the goal of rules and related communication may reduce the burdens, at least the psychological costs, if not the learning and compliance costs.

Although the compliance check and assurance might be expected to be one of the core roles of the staff, too much adherence to the rules and requirements without flexibility and enough communication could increase the burdens for PIs. The interview

results suggest that this compliance-related practice and communication could be one of the contributing factors of burdens, but it is not clear at what point the compliance checks and requirements become burdensome for PIs; whether the PIs are describing the same level of compliance mentality as problematic and helpful; whether the PIs actually experience different levels and ways of compliance mentality, or whether their basic social relations influence these perceptions since the compliance mentality here, seems to be a very subjective phenomenon. There may be a gap between the actual level of compliance mentality and bureaucratic personality of individuals and those perceived by others.

5-1-2. Process and Relationship

Some factors in the interaction, process, and relations between PIs and pre-award staff may influence the burden. In addition to the possible influence of quality of staffs and services on burdens, the burdens are embedded in the process and relationship which is shaped by both PIs and staffs and their interactions. Specifically, the following three factors, face-to-face meeting as the interaction style, trust and distrust, and feedback practices potentially reduce the burdens. These factors possibly foster, embody or exploit social capital such as trust and goodwill, and their feedback and advice may contribute to reduce burdens in each transaction.

Face-to-face meeting

There is a set of purposes for and occasions in which PIs meet with pre-award staff face to face. Some respondents prefer to meet with the pre-award staff at the beginning of the

proposal preparation, others do not meet for every submission, or others meet the staff multiple times throughout the process. The face-to-face meeting might help not only the specific submission in process, but also in building relations. Although the frequency of face-to-face meetings and the reasons vary among the participants, the following PI1 prefers to meet with staffs after submitting the initial proposal intake form and describes multiple aims and effects of face-to-face meetings.

> 'PI1: Yes, definitely, face to face. .. Actually, there's a form that we submit to them when we think we're going to submit a grant. … I think it's a skeleton, amount of information and then they get us in their queue, and then they get back in touch with us, okay, we need to meet. Let's go over some things in person. So, there's understanding about the PI and the pre-award staff of, what needs to be done.… The other thing is you get to know each other. Putting names to faces, building some trust and relationships. So, when you do things then via email or telephone afterwards. There's a sense of connection.'

PI5 has the pre-award team in the same building and finds it very convenient, partly because he does not like email communication. This PI meets with pre-award staff for at least nine proposals out of 10, which helps him to deal better with the process and some of the confusing rules. PI19 also says that emails are fine for some tasks but he personally prefers to meet with staff in person. PI31 notes that the department connects newly hired faculty with the pre-award team, and he has built good relations since he came in.

> 'PI5: Yes, I usually do (meet face-to-face). I will say that even the person I didn't trust, I have to do that way. When I first started, Research Advancement was in a different building than where I was… but it wasn't a bad walk. I still preferred always to meet face-to-face and go through budgets. It was just the easiest way to make sure I understood what exactly was included and I could get questions answered. Oftentimes that academic year, calendar year, salary business got a little confusing, so I liked being able to see it that way.'

> PI19: .. I like face to face meetings a lot, and then we work together. I usually have meetings with them and then it's easier to -- and now I know these people well enough that I think I can. I still like to stop by that office just to--.… they're not in the same building, … but it's walking distance….If I had a question to ask face to face rather than, so we don't have that now, so I miss that….. I could have asked that question in email but I like to do it face to face because I like those people, so I just want to--. I think that helps build a relationship and because it's very stressful when you're writing a grant, right? I get stressed and then I'm not a very nice person. If I know them, then they know me that that's not me all the time, so I think it just helps build a better relationship.'

> 'PI31: I probably bug them a little too much. If I have a question and it's really important, maybe not important but a question that might take four or five rounds of emails to answer, I'll just go over there. If they're there, they're always willing to meet with you if they're there. I'll go there. If they're there, I'll say, "Hey, quick question," We'll just back and forth for five minutes. If they're not there, then I'll send an email and say, "Hey, I have a question. Can we meet some time?" Usually, it's like, "Yes, I'll be back at 2:00 PM." Yes, I meet with them all the time.'

Thus, some PIs explicitly prefer to meet with the staff face to face, not only because of the immediate administrative needs, but also to build relationships. The quote from PI19 above indicates that it is part of his strategy to develop basic social trust and relations so that the process and relation do not go wrong even when the PI behave not nicely in the stressed situation during the proposal process.

However, some PIs do not necessarily meet with staff during the process. PI9 indicates that they may not need to meet in person to complete the process, but see them occasionally or casually drop by the staff team when there is a problem as they are located very close in the building. Some other PIs such as PI4, PI3, PI21 and PI23 also say they do not necessarily meet staff face to face, partly because they already know each

other and have certain expectations, but they may casually visit the team when necessary.

PI10 and PI11 also suggests they can communicate adequately by email.

> ‘PI9: I don't necessarily meet in person. Of course, I see them often. It's not that we make a plan. You submit a request and then you explain what is all involved, because typically, this is not that there are major differences. Sometimes they are very complex proposals, working with people in different parts in the world, then you will meet in person to say, "Well, how should we do that?" … There's often not much to discuss to have the separate meeting. But, of course, because I'm nearby, if there are issues, I can just drop in, and I sometimes hear them talking about the proposal.’

> ‘PI4: Very rarely is it face to face. Most of the things are done via email, unless I happen to be over at that building and I stop by. There's not usually a need to do face to face. Maybe if it's a large complex grant, is that needed. But for mine, not yet.’

> ‘PI3: He would come here and sit right there and we'd talk, but usually by email or telephone… Face to face-- No, if it's a small question I just send an email. …’

> ‘PI21: It depends on the situation. Most things we can do by email and again particularly with people I've worked with a lot that works well because I know what to expect, they know what to expect from me. We can do most of it by email but they're just down the hall so when I have a question I just walk down the hall and ask them.’

> ‘PI23:… They're in two buildings over from me. If anything, I've always actually been able to do most of the stuff over email or on the phone. If anything really need -- If I need to do something, I just have to walk over and sit down with them.’

> ‘PI10: No, I just send everything via email. .. There would really be no reason to go meet with them in person because they are doing all the submitting to the system, not me... I just send the document one at a time. They load them into something that I read, and then I go through it make sure it's correct. I'll find mistakes in the order, or mistakes that they took an old version instead of a new version, or I find mistakes then I fix it.’

> ‘PI11: … Generally, we don't have to (meet face to face). He's very good at telling us, by email, what we need.’

In some cases, PIs may meet with staff in person throughout the proposal. PI16 says that he meets with pre-award staff several times throughout the proposal preparation process. PI17 describes a case of an apparently collaborative proposal which required a set of meetings in the proposal preparation process, but he says he may meet with staff for smaller proposals in addition to email communication. As PI14 indicates, PIs may meet with staff when they prepare a new type of proposal but not in the case of familiar proposals. PI7 says he would need to meet them when there are more complex requests in the proposal.

> ‘PI16: Yes, several times. .. Throughout…Then at the end when it's uploaded, you'll probably meet another couple of times. Then if you work with the editor, you meet with them on a regular basis. I don't usually work with the editor.’

> ‘PI17: Yes, we meet face to face.. We have meetings. To begin, I have to introduce what the proposal is to the proposal managers. We'll have a meeting to go over what I'm doing, who's involved besides me, what's the agency, what's the program, and all that. We'll have a meeting face to face we need to organize. We'll have a number of face to face meetings with all the investigators. Sometimes, the investigators are not here, they're some other place. We connect then by Skype or something like that. That's how we do it. We'll have usually weekly meetings until the proposal's done, whole team meetings. [Interviewer: The smaller grants, do you meet with the administrators?] Occasionally, I'll meet about the budget and filling out forms, but most that can be done by email.’

> ‘PI14:… Sometimes, though at this point, … it's the same process, so I don't necessarily need to meet with them. If there's a new grant call for

> funding that I'm applying to, I might meet with them, but a lot of it's over e-mail.'
>
> 'PI7: The recent one I think is actually quite recent. I don't think I've met her. Only through emails…. I know from a lot of friends of mine who day-in, day-out, they go talk to the administrator, because they have special requests or … they have special needs. When you need to do some type of cost-sharing, then you have to talk to people.'

Thus, a face-to-face meeting may not be a strong requirement to reduce burdens, especially for tasks like minor questions and document exchange, but some PIs still prefer to meet staff face to face to make some of the communications and tasks easier, and to build good relations.

However, there were some cases that PIs visit pre-award staffs' offices to meet face-to-face because of negative reasons. In the following quote, PI15 describes an experience in which the PI visited staff because they were not easily available by phone or email. Another respondent, PI18 suggests some problems in the pre-award service in the unit created a similar reason for visiting.

> 'PI15: … Usually not. Usually I send him emails, he ignores the emails, so I call him. About half the time he ignores the phone calls just because he's busy with somebody else. … Finally, I just end up walking over there and standing at the door right to his office until he gets off the phone… I say, "[Pre-award staff name], I really need this now," and he's, "Well, [Faculty member name] has a grant, too." I'm like, "I don't care. I'm going to stand in your door to your office until you do this for me." He's like, "Okay. Okay." He's a nice guy. ...'
>
> 'PI18: I have a habit of on a deadline day being in their office sometimes for an one hour and a half, going over everything with them, finalizing it, and ensuring that it's sent out. That's the best way to get their attention and best way to communicate.'

In addition to the frequency of face-to-face meeting or any other interactions via emails or phones, the reasons of meeting and what they do in face-to-face meetings matter in understanding the burdens.

Overall, face-to-face meetings helps reduce the burdens in the administrative process for some PIs especially in the cases of complex proposals or proposals with special requests. In addition to the ease of the administrative process by having questions and answers or going through the rules and documents together in face to face communication, some PIs just have personal preference to complete administrative procedures in face-to-face meetings for varying reasons. The face-to-face meeting with positive reasons can enhance the social capital, such as trust and goodwill between PIs and staff, which help them reduce all types of burdens regardless of their intensions.

Trust and distrust

The level of trust or distrust could be one of the primary social capital factors to be considered in studying the process and context of burdens. In general, social capital involve multiple elements such as trust, cooperation, friendship, advice, commitment, and goodwill (Nahapiet and Ghoshal, 1998; Portes 1998; Lazega and Pattison, 1999; Adler and Kwon, 2002; Glanville and Bienenstock 2009). The interview results suggest that, in the proposal process, the better trust relations may reduce the burdens in multiple ways by making the administrative process easier as PIs may delegate the non-scientific parts and administrative components of the proposal to the staff. The lack of trust or distrust may, in fact, generate or increase the burdens of PIs, including not only the learning and

compliance costs and number of tasks, but also the psychological costs, such as emotional exhaustion and skepticism of each other.

PIs and pre-award staff build trust and good working relations, sometimes by knowing each other in person, and these relations facilitate smooth communication processes and task delegation. This trust enables the PIs to focus on the scientific part of the proposal without concerns about other administrative and compliance elements, as PI11 and PI9 suggest. PI16 also describes trust as the fundamental element of their relations. RA3 explains how the staff intentionally try to earn trust from PIs. PI10 talks about how knowing each other in person and socializing helps build the relations and improves work.

> ‘PI11: I'm trust. I've never had any reason to be other than fully trusting. I've never had a problem. They solved a number of problems for us. They anticipated a number of problems before we did. All of my experience with them has been one of trust. Right now, I'm 100% in the trust camp. I've never had any bad experience.’
>
> ‘PI9: Yes, I've very good experiences with the team here. So I know that I can rely on them that. If I want to write a proposal, I can focus on the content, and I know the rest will be going okay.’
>
> ‘PI16: If you can't trust them-- I mean it's too important. It's your career on the line. You have to be able to trust them….. We have really good people. We don't have to worry about that.’
>
> ‘RA3: ..I think they have a lot of trust in us. We haven't had really any bad things happen. I think the trust is there. Again, we've got a lot of positive emails and our bosses hear from them that they are happy, things go well. The proposals get in even though their docs are very late, I think we try to do a good job of knowing that we really care about them being successful and that's really important, is that they know that we're trying to make them successful. If they distrust us, so that's something then we need to

> work on. We need to figure out what's going wrong there. I think some are better -- more trusting of us than others for sure. We just try to be aware of it and earn it. Sometimes it takes time to earn that trust and go to the extra mile. I think we're on the more positive end of the trust.'
>
> 'PI10: Yes, it does help. It does help because they know how I work. Everybody's different. Actually, one time and I went to a party… The faculty and the administrative staff were all socializing together. … That actually might be a good idea in the future for colleges to consider. Helping people get to know each other. ... To intermingle faculty and staff might be better. …'

As shown in the quotes above, trust may reduce the burdens for PIs by enabling them to delegate the tasks such as learning the rules, checking compliance, and preparing some of the documents with confidence. However, some PIs such as PI8 below said that although they trust staff, they double-check the documents regardless of their trust.

> 'PI8:… I mean, we have to trust them because they're between us and the submission process but, trust and verify so we double check everything. For any of our grants, we won't let either our office or the ORSPA people submit before we've been able to double check everything because we found little errors or things that aren't quite right so we all have to trust each other but then, that means you check and be sure it's right as well.'

Some PIs may prefer to carry out the learning, compliance, and preparation themselves, regardless of the trust relations and quality of staff.

While trust may reduce the burdens, distrust or lack of trust may increase burdens for PIs unnecessarily. The following quotes from PI5 and PI15 provide examples of the consequences of lack of trust, confirming similar experiences of standing over staff to oversee what the staff do with their proposals to make sure that the proposal is compliant and properly submitted.

> ‘PI5:… There was one that we had in the past that I didn't have so much trust with, who I was less interested in having him do things without me looking over his shoulder.’
>
> ‘PI15:… I also never trusted they’re going to submit my grant on time unless I'm standing over them waiting, watching them hit the submit button…’
>
> ‘PI15: Completely (distrust). Even with people like [Pre-award staff name] that have never made a mistake. The problem is that there is nothing in his performance of value. If my grant gets submitted and it gets administratively rejected because the formatting was wrong, nothing in his performance evaluation says that he's going to get dinged for my grant getting rejected. Whereas, I just spent two months writing this grant proposal and it's not even getting considered. So no, my experience with my sponsored project officers in general as lead me to—it’s not so much distrust as luck of trust that-- no.’

For PI5, the lack of trust was a result of his experience with the specific staff member in whom he did not have much trust. However, PI15’s case indicates that he did not experience problems with this particular staff member, but his past experience makes him reluctant to trust the staff. The trust relationship may involve an accumulation of interactions and trust, and this PI’s views suggest that distrust could also be accumulative.

Some respondents, such as PI12, emphasize the need for greater interaction and social capital between PIs and staff. PI1 describes the ideal working relations between PIs and pre-award staff, which reflect the organizational-level climate.

> ‘PI12: … I think it would be important for people in research administration to interact more with the people who are actually writing the proposals to understand where they're coming from in these things.. … If these faculty were not out there actually writing the scientific part of the

> proposal, everything they do is worthless. They have no impact at all. In a way, they need to be partnering with the people writing the proposals. Not a gateway that keeps you from the National Science Foundation or from the NASA, something like that. That's one of the things that I would suggest that they do.'
>
> 'PI1:… The faculty would just have much more greater appreciation, if they really understood how hard they worked and all the details that they have to keep track of. ….. I would like the faculty to see them more as colleagues rather than as servants. … Because we all have a place in the whole research enterprise and they're all important. It's not like they're working for us but really they're working with us. ...'

Social capital and better relationships between individual PI and staff and the group of faculty members and pre-award team in each academic unit may contribute to reducing the burdens in the proposal process for both PIs and staffs.

There are a set of factors which potentially shape the level of trust and distrust. The quality of the staffs might be one of the primary factors, as PI's direct experience or the reputation of the pre-award staff and team with good quality of services may increase the PI's trust. As the opposite case, bad qualities such as the frequent mistakes and unresponsiveness may reduce the level of trust. In addition, a quote from PI1 below notes that personality of the PI is one of the important components in shaping the relationship and interaction between PI and staffs, and the same point may apply to the personality of the staffs. Furthermore, PI4 seems to have trust because of the quality of the service he experienced himself, and trust in the institute to hire appropriate personnel.

> 'PI1:… There's always going to be individual PI's that are little more on, more finicky or stubborn or difficult to work with. I think the staff want to work with all of us in a very friendly and helpful way. So it's up to the PIs

> I think--For us to have the right attitudes, the right perspectives, to meet the deadlines, as best as we can, and not wait until last minute to sell.'

> 'PI4: Yes, I trust. I usually trust, unless there's been a bad experience, but I can't remember any. I trust that they're going to get the right forms, get the right information, we meet the deadlines. I start with trust, and then, if there's a lot of screw ups, then you lose the trust. But I start with expecting good. I trust ASU to hire the right people. If they're there, if they're hired, then I trust that they're good. It's everyone's interest for me to get the award, my interest, ASU's interest. I trust that they hire the right people to help with that process.'

Trust could be an important factor in determining the burdens of PIs in this context, especially because the proposal submission is often recurrent in academic life and PIs may need to work with same staffs and pre-award teams in which they accumulate the relationship and experiences.

Feedback practice and cultures

The quality and methods of pre-award services can be good or bad and may not be of a uniform quality throughout the staff or the transactions. Feedback from PIs to staff is one of the major methods of identifying any problems and improving the way they work. London and Smither (2002) view feedback as a part of the long-term performance management cycle in organizations rather than a one-time event. Following quote from PI20 illustrates that communication and feedback are the key to monitor and improve the quality of the pre-award processes in the long-term.

> 'PI20: I would say again zooming out, the biggest challenge is just trying to ensure there is always very good communication and I would imagine you know in the schools we got good feedback, they feel like the

> communication flow was very good and they have confidence…. In schools where they have some concerns, maybe again, communication is a bit of a challenge, and maybe if that identifies where there's some issues on the staff with the faculty, they may not be expressing that... I think some of those might be some of the main challenges.'

If the problem is not articulated, it may persist in the future proposal submissions through the pre-award team or the academic unit.

The PIs reported that both formal and informal feedback exists between PIs and pre-award staff. Formal feedback includes an official survey after each submission as described in a quote from PI1, RA4, and PI6. PI30 describe the opportunities to provide feedbacks including an official evaluation process.

> 'PI1: Yes, faculty will usually talk to the associate dean of research, to make suggestions or to provide the insights out of their experiences. This is working, this isn't working. And the associate dean of research will then work with that office. ...On the pre-award side, actually, not many, if at all. I've had nothing but strong accolades for the pre-award staff, the two that I mentioned that we have right now. The faculty extremely pleased and satisfied, and thankful for what they do…..'

> 'RA4: Yes, so we have in our subject line of every email a link for PIs to be able to email me, the manager and also a link to a survey they can take if they want to and I review those for feedback. It's generally always been good. At the higher level OKED sends out a survey to each PI after every proposal submission and that gives them the opportunity to evaluate their unit RA as well as the GCO that was assigned to that specific action.'

> 'PI6: Yes, I give some every time I submit a proposal, I have to fill out the feedback forms I'll just give them good scores there…. Yes, it's the official feedback form. I think it's generally OKED-level thing. So you input the RA's name and they have five questions. They ask for suggestions of making it better.'

> ‘PI30: .... But he and I talk once a week about the staff and how they're doing, where they need to improve in performance, how we think about getting them to improve in performance. ...’

> ‘PI8: No, they don't do that and that would be a pain in the neck and I wouldn't want to do it. I know from some things, like doing IRB's and things like that, they are always saying, "What the hell is your experience with this?" "Same as usual. You go away." It would be annoying if they ask that. But they do a part of annual review…’

In addition to the formal availability of opportunities, the choice of feedback practice involves personal preferences, as the PI8 above prefers not to give feedback for each submission; it seems to be too much for him. In addition to the direct, informal feedback between each PI and staff member and among faculty members, formal oversight may contribute to maintaining the quality of the staff and system, and ultimately, the levels and content of burdens for PIs in the unit.

Feedback may include not only suggestions for improvement and articulation of problems, but also positive feedback and informal rewards for service. PI25 uses both formal and informal paths of feedback to make suggestions and express gratitude, and PI12 used to communicate feedback to the pre-award team on behalf of the faculty members. Some PIs, like PI9, PI10, PI23 communicate positive feedback and gratitude to staff, too. RA3 indicated that his team often receive the positive feedback, and RA4 described that he received both positive and negative feedback.

> ‘PI25: There's lots of ways they get feedback. Certainly, I often will say things directly to the person that help me with my grants and thank them for what they did and make suggestions about things that could be done differently if they need to be done that way. They also have a reporting structure that works around. They have a supervisor who then reports to

the supervisor of all the administrative team that reports to [Person name]....'

'PI12: When I was director, I gave my feedback directly to OKED, but I did that on behalf of the whole faculty. I didn't do it because of me, I did it on behalf of the whole faculty, but, yes, I used to do that.. ….'

'PI9: Yes. After things are being submitted, we typically say they do a good job, so that's easy to thank them for that..'

'PI10: …. I feel like you should say thank you to people. I know it's their job but you should still say thank you. Thank you's can go a long way. After the grant goes in, I'll send an email saying, "Thank you so much. I appreciate it."'

'PI23: I would say that I occasionally will see them in informal settings like Christmas parties or whatever, things like that. I'll always come up and go, "Hey, that was great. Thank you so much." Anytime they say, "I need this," I send it back. I'm always like, thanks for letting me know. Informally, over email, but I wouldn't say that I've written anything formal. It's all been very informal.'

'RA3: … I don't really get any complaints, usually the opposite.'

'RA4: … I do sometimes get really positive feedback from that link where people can email me and then we almost always hear about if someone has negative feedback so that might go escalate to the director of pre-award services in research operation'

Thus, the PIs give feedback to the pre-award service and staff on various occasions, both positive feedback, reporting problems and suggesting improvements. The development of basic social relations, including mutual trust and an environment where feedback can easily be given, seem to enable the PIs and pre-award staff to solve problems with fewer burdens.

The content type of feedback is important not only for the actual improvement of the system and staffing, but also for the development of cultures and relations. One staff member described his experience in which PIs expressed intense frustrations very directly to the staff, although many of the faculty seemed to be under great stress and came back to the staff to apologize. PI30 noted that PIs at his academic unit often communicate positive feedback to the staffs but it is possible that some PIs report only the negative feedback and the staff do not receive gratitude from PIs when there are no problems at other academic units.

> ‘RA2: Some PIs, their expectation is really arrogant. Sometimes to deal with that, you just have to stay calm and just hear them, hear them out because that's what I do. I just like, "Okay, okay, " and take notes, … make sure you have your checklist. … I think it's just the personality sometime is different. I've had PIs scream at me, you know what I'm saying, like, yes, I've had them lose it but just I make sure I don't get into their energy because if I get myself in their energy, we'll be going back and forth, and what will you get? Really not get anything out that. … I would just like stay calm, “I understand your frustrations." Just bring it back, turn your back around, "Yes, I understand your frustrations, we're going to work this out for you”. Just pass, just stay calm and listen … and majority of them come back and say, "You know what, I'm sorry, I would do all of this and I'm so sorry it should not have to take it out on you." …’

> ‘PI30: We try not to do that. We have a very good team here. We often get people writing us emails saying, "You did such a great job, I'm so grateful." And I do think I try to combine praise with criticism... We try to do both, we really do. I'm sorry that some staff feel that way. Yes, I know (that it was a story at other academic unit). I think faculty do that sometimes though, right? Because when we grade papers, we're used to just grading what's wrong instead of what's right. It doesn't make it okay…’

As this PI pointed out, the PIs may give feedback especially when they experience problems, but feedback may be neglected when the pre-award teams are transparent and cause no problems in compliance checks and in supporting PIs.

Feedback could be important to improve the service and the process of proposal preparation and submission, thus potentially reducing the burdens of PIs, and the feedback seems to involve not only the formal systems, but also the nature of the relationship, and require both the team and academic unit to be open to suggestions and feedback. As the examples above show, feedback practices and cultures involve social capital accumulation, such as basic trust, openness, and advice relationships.

5-1-3. Organizational Arrangements

The interview results indicate that there are a set of organizational arrangements that potentially shape the quality of the pre-award staff and services, and ultimately, the burdens of PIs. This section presents the factors that potentially influence the staff quality, namely the staff workload and staff per capita, staff turnover, staff training and mentoring, and geographical proximity of the office of PIs and pre-award team office.

Staff workload

As many of the PIs in the interviews have good support from the pre-award staff and their support seems to reduce PI burdens, a greater number of staff per proposal or per faculty member may reduce the burden. One of the ways to measure staff workload is the number of proposals per staff, although the proposal size and complexity need to be considered. When the staff are overwhelmed, staff may not be able to spend sufficient

time and care on each proposal submission, and potentially increase the probability of mistakes in the process.

The following two quotes from research administration staff member describe the situation inside the pre-award team in terms of workload and quality.

> 'RA1: I would say the volume of proposals that are pre-award team is quite high, but I am trying to address that. … Now, the numbers do not tell the full story because you can have one proposal that's 20 million dollars and complex. That shouldn't count as one proposal so that's where the managers need to be actively involved in the workload management so that takes time to learn how to do that. …'

> 'RA1: …one of our schools they'll commonly have like 25, 30 even now we've had 40 proposals to do on the same day. Can you imagine trying to manage that? …so one of the things we have to do and this is move the timeline up…. if you have everything to me three days before even if you have -- So if you have 40 proposals it's still physically impossible to -- We just had one of those was the last Wednesday. I think and we had 25 too. That team was really stressed but there's also a management issue there so in that particular school the manager in my opinion didn't plan enough. Had that person planned more in advance we could have given some of those proposals to the other across the team.'

In some academic units, the pre-award team has to deal with dozens of proposals with the same deadline, which makes it more challenging for the staff to provide great quality of service for every proposal. The team may ask for the support of staff from other units when the team expects high workloads, which means that PIs notify pre-award staff of their intention to submit well in advance.

Some PIs said that the quality of pre-award services is sometimes not very high, such as slow responses, but the PIs assume it is because of the workload of the staff rather than the ability of each staff member.

> ‘PI10:… I think that the part of the problem here is that they're overcommitted. There's way too many proposals and not enough people.’
>
> ‘PI23:… As we become more and more research active where I am, … we just need more people to be able to do that. I think the last thing I'd say about negative experience is just them being a little overworked and not being able to spend the time that I would like, but I don't think that's necessarily on them as their ability to do these things, it's just the capacity and what we have. ....’
>
> ‘PI5:… Now, I'm very happy with who we have. I do think that that's really important. The one thing that I wish we had was a slightly larger research advancement staff because I think it would be great to have the research advancement staff actually be able to help to create those supplemental documents for a proposal.’
>
> ‘PI19:… Because we have very little- very few staff and we've got a large number of investigators who they're supporting. I'm not saying that they are not doing their job. I don't think they have the time to do that additional level. I'd much rather they focus on what I can't do as the budget piece. They're just reviewing the technical aspects of the proposal submission that should I rely on them to do it. ….’

In addition to the relationship between the workload and service quality, PI5 and PI19 in the above quotes think the staff may be able to offer greater coverage of tasks if they have more staff and the number of proposals per staff member is smaller.

Staff workload could be measured as the number of proposals taking into consideration the types and size of the proposal, together with the timelines, workload per person per year, and in the busy seasons. The proposal counts as per one full-time pre-award staff, or the number faculty members per one full-time pre-award staff could be a useful measurement, but possibly with some gaps of actual workload per staff because not all the faculty may be active in proposal submission.

Staff turnover

The turnover of staff is another theme that emerged from the interviews. Turnover of the staff are expected to some extent but excessive turnover or turnover without appropriate training and mentoring could be problematic as they reduce the quality of staffs and services PIs receive. Ployhart and Moliterno (2011) suggest that human capital, such as knowledge and skills, can be the unit-level resource that accumulates in the units within the organizations. The following PI describes the general situation of staff turnover at his academic unit, and RA4 described how they try to maintain the quality behind the turnover. PI21 describes the context of turnover, such as the high workload and last-minute submissions by PIs, which make the pre-award work more challenging.

> 'PI8: Of over the last five years through [Academic unit] and through OKED exchange multiple times. .. Over the period I've been here, I remember the change multiple multiple times…. [Interviewer: A few different people means that people quit and new people coming?] Yes, primarily and sometimes so that offices add it. Started with one person and that was two and that was three and that was four, and then one changed, then another one changed, then another one changed. The people we worked within OKED changed, the people we worked within ORSPA changed. People get promoted and that somebody else's is the one you work with.'

> 'PI24: We've had some turnover-- we have some people have been with the team since the very beginning. There are others that have turned over. It's a hard job. There's a lot of wear and tear associated with these positions. Again, because it's just so much activity. They're sitting around half the time just twiddling their thumbs, there's always something going on. They always have work to do. I expect that there will be turnover in these positions. Obviously, we'd like to keep talented people as long as we can. Also, I'm a big believer that when people have new opportunities where they can seek professional promotion then, I support that at the same time.'

> ‘PI17: …. This proposal management thing is expanding. They're hiring new people, so I may get a new person. ...’

> ‘RA4: Yes. on our team it's really important to us that all of our faculty members feel comfortable working with all of us because people move on, things move around, and we want them to not be tied to just one person. We also want to make sure we all giving consistent service, and that helps us to move it around. We do try and share with each other so that we know preferences of those PIs, and we're able to support them best.’

> ‘PI21:… If we are experiencing, February, for example, will a busy month of proposals. If faculty, because, again, they're busy, we understand, but the things are arriving late, then it starts to put stress on the staff, one reason why somebody can become burned out is because again, the pace of the job can be very demanding.’

These PIs and staff anticipate staff turnover and do not necessarily see it as problematic. In addition to replacing existing staff with new staff, the academic unit may add new positions because of the expansion of the staff team.

Turnover could be problematic in some contexts, potentially increasing the burdens for PIs. In the following two quotes, PI18 reports very high turnover at his academic unit and argues that it is difficult to build long-term relationships with the staff.

> ‘PI18:… It's really hard because turnover in our unit is extraordinarily high. .. Whereas right now that position is seen as a stepping stone to other places. Our entire research admin office has turned over several times in the seven years that I've been here. That makes it very difficult to form long-lasting constructive relationships with people……. It's not a very rewarding job. We don't pay very much. There's no way to recognize good work with material rewards. The climate of conflict avoidance actually doesn't foster personal and professional growth, and so, people are in the position until they can get out and find a raise and more responsibility and a different climate.’

> ‘PI18: I work with whomever is assigned from a pool until they leave. Then the pool changes, and then I'll work with. For post-award, there are reliable contacts, for pre-award, I might be assigned to one of three people. But the turnover is so high that it doesn't really matter. The person who we will retain for longest is the person who is least able to find another job. That means that they're the least competent. This is kind of a race to the bottom’

In his view, the team in his unit has problems with high turnover and the low quality of pre-award staff, problems which seem to be embedded in a deeper problem at the academic unit, which he calls the culture of conflict avoidance. One respondent explains that his academic unit has only one pre-award member of staff with high turnover.

> ‘PI15:… he’s the only pre-award person. I have to say, yes. **...** [Person name] is the ninth SPO (Sponsored program officer) we’ve had since I came here. Something like that. I can’t remember all their names. Several of them, they have been good and they’ve gotten promoted to [Other research administration units at ASU]….Then we’ve have a couple that were just terrible.’

The frequent turnover may be more problematic when the academic unit has a limited number of staff because the high turnover may imply fewer mutual learning and training opportunities among the knowledgeable and skilled staff.

Low turnover may imply a longer working relationship between PI and staff, which potentially enables them to know each other better, and come to know each other’s preferences and work styles. PI3 says that he has a continuing work relationship with staff of good quality. PI21 says their pre-award team tends to allocate the same staff to the same PI because it helps them to get to know the work habits of each other, but all staff have worked well with him so far.

> ‘PI3: No. The one that I'm thinking about has been here since I've been here. The other two ladies have been here five years. No high turnover, no. And very knowledgeable, I'm really impressed. And accessible, easily accessible. No problem.’

> ‘PI21: .. I've been working a lot with [Pre-award staff person name] lately, who's very good. I think that they have a tendency to have you work with one person a fair amount because you get to know each other. He knows that he has to bug me all the time for things and he gets used to me. We worked together lots of times before. I think that that's probably how they do it because I tend to end up with the same person for a while and that works out well.’

Thus, turnover or the continuing work relations, may be considered in further studies of burdens, although this factor may require detailed interpretation and surrounding factors such as the quality of the staff and work relations.

Staff training and mentoring

Staff training and mentoring practice within the pre-award staff teams could be an important variable as it shapes the quality of the staff and service as indicated by the general human capital theory (Shultz, 1961; Becker, 1962). This is part of the organizational arrangement because the academic unit or pre-award team may maintain the appropriate quality of staff and service even in the event of staff turnover with a system, practice, and culture of proper staff training and mentoring. PI30 mentions the importance of staff training and motivation.

> ‘PI30: … I think good administrators understand what the aspirations of their staff are. And help them meet those goals and aspirations, that was just having a-- When there's performance problems, I think it's our job to

> say what's the pathway towards improvement. We need you to improve but what are the steps you could take to improve, what's a reasonable time scale for improving rather than just saying, "You're not doing a good job, do better." ….'

In the following two quotes, RA1 specifically describes the training opportunities for the staff in his unit and the expectations of the academic unit with regard to research in coming years of strategically growing the research administration capacity and staff. RA3 also describes one of the ways of training by allocating appropriate proposals to each staff member to foster learning.

> 'RA1: …. ORSPA has a number of classes, but then we also do one on training within. The manager or supervisor, either he or she trains them herself or pairs them with a senior. We also have people across the schools that will come and help and sit and do training. That's we've had people that do that too. I have somebody in [Academic unit] who's really strong with eRA…. He has sat down with people and trained them on eRA. Then the manager maybe sits down and goes through solicitations to make sure people understand that.'

> 'RA1:… They need to make sure that they're developing their people giving them opportunities for leadership …. We also have a budget for professional development. The RAs can go to conferences, take courses, we pay for that, we pay for half of it. We ask the school to pay for the other half. We have a number of people on our team, that are presented at national conferences too really just trying to empower people raise them up, so that they see themselves as professionals and also partners with the faculty members instead of a power hierarchy.'

> 'RA3: .. I assign ones to him that fit his schedule or if I feel he needs to learn a certain one, I'll give it to him. Usually, if it's a brand new one, I'll take it so I can learn it first so I know it and then next time I'll let him take it….I try to make it teaching, widen our experience across for both of us.'

RA4 described the diverse training resources for the pre-award staffs at the institute, including those by the central research administration office and teams at the local

academic unit level. The training resources include both offline workshops and online learning sources. RA4 described details of the training at his team.

> ‘RA4: It depends on the unit. For my team, the way we work it is we have a training agenda, where we have different topics. When we have a new person on boarding, it's usually about three weeks when they would be in formal training. We'll set it up so they get to meet with different members of the team, one member of the team will go through one aspect with them, like how to review a funding announcement and those guidelines. Then we'll give them chances to practice that with real examples we have right now, or with ones, we've done in the past. They do lots of practice work during that three weeks depending on the person usually in that third week we'll start pulling them into actual proposals that are happening. They'll shadow a more experienced RA, and work behind the scenes to help with the different preparing things, but someone else will actually be the point of contact to the PI as well. Then depending on how comfortable they are, and how it's going, then over that four, five, six week period then they'll start taking the lead with someone else shadowing them, and being on point to guide them. From there they typically take off. On our team, we're fortunate where there are experienced administrators here to have support, so if they have questions, and I'm always available for questions, and can help guide them through.’

RA4 talked about the training opportunities outside the institute, chiefly the participation in the certification and training program hosted by the professional associations of research administrators such as the Certified Research Administrator (CRA).

> ‘RA4: The CRA is nice and there are different opinions on it. It's nice because it should make you more marketable if you are looking to go to other institutions because then there's that common foundation that they know you've studied for and looked at a lot of the material for research administration generally.… Earning your CRA does not necessarily factor into getting promoted but we do encourage it especially at the senior levels and RAA level. The main benefit I have found has just been the opportunity to study some of the parallel processes that our team doesn't necessarily do. Like learning more about institutional review board, IRB, and animal topics and then contracting that might not come to us so

becoming a whole administrator and having a broader knowledge is the main benefit.'

Thus, staff training is available both as a formal opportunity and certification in and outside the university, and training in practice within the pre-award team. The training and mentoring of staff primarily enhance the quality of staff and services, which potentially reduces the burdens of PIs. Although the individual staff member's own ability may matter to some extent, the organizational system, practice, and culture of training and mentoring could be important in maintaining quality in the long-term, even when there is staff turnover.

Geographical proximity

Geographical proximity is one of the factors considered in organizational structures. According to Hall (1991), geographical proximity is "the spatial distance between organizations or their subunits" (p.227). Geographical proximity is relevant in this context because some PIs prefer to meet with staff face-to-face for easier administrative processing and relational development. Some PIs noted the submission can be done without meeting and visiting staff, partly because of the electronic submission system and emails, but geographical proximity may influence the burden levels more by enriching basic social relations and trust rather than the mere influence in the readiness to complete the task in a single transaction.

As noted in the factor about face-to-face meeting, the location of staff may help to reduce the burdens because PIs can easily drop by the pre-award team's office to ask

questions and do administrative work that can be done with less effort than by email and phone.

> 'PI1:… I'm down here and so, it's easy just to walk across the corridor right there of the other building and meet with people.'

Staff location, namely in the same floor in the same building as PIs, may shape the ease of communication and social capital such as trust and openness which lead to reduced burdens for some PIs.

In addition to the location of the staff, one PI indicated that it is good to have a one-stop location of staff for proposal preparation and submission, compared to the case in which PIs need to visit staff in multiple locations to complete the process. PI11 says faculty had to visit multiple locations for submission in the institute he previously worked at, although the PI has a one-stop location at the current institute.

> 'PI11: Sometimes you had to go to multiple people to get information… but here, it's one-stop shopping. One office does everything for us. Back in [University name], there were multiple offices, some were better than others.'

Although the electronic submission system and email communication might be increasingly prevalent for proposal preparation and submissions, the greater geographical dispersion may increase the burden if the PIs really need to walk across campus to visit multiple locations in the preparation and submission process.

5-1-4. Other Factors

The interview results suggest other factors are related to burdens of PIs, and this section sheds lights on proposal complexity, institutional-level system and practice, and the practices of PIs including process management, success rate and submission frequency. These factors may be better dealt with as the control or mediating factors rather than the causal factors because it is obvious that varying proposal complexity pre-determine the learning and compliance costs in each proposal, and the question in this study is more on why the PIs experience different levels of burdens in the same proposal submission.

Proposal complexity

The complexity of proposals, such as the list of documents needed for submission and types and levels of rules and requirements, may influence the burdens. Some PIs illustrated the difference of funding agencies, including the variations of both funding goals, proposal styles, selection process, and criteria. One of the differences of funding agencies is the different electronic system. In the following two quotes, PI13 says he meets with staff face-to-face when he submits a proposal in grants.gov, but not with FastLane, and tries to submit early in case the electronic system indicates errors before the submission.

> ‘PI13: For grants.gov, yes. For Fastlane, no, because Fastlane is so much easier. For Fastlane, at least I will submit everything into Fastlane myself…. I upload to Fastlane because it's easier. ... But grants.gov seems like such a pain in the neck that we are always over there, get a face-to-face for those.’

> ‘PI13:… Whatever day it was due, we had it all together and submitted it the day before. Because when you submit to grants.gov then, they'll say whether or not you have an error or whatever. You want to try to get it in

> early. Our research people are always pushing us to get grants.gov in early in case there's an error.'

The variation of complexity and proposal types may involve a single-PI proposal and larger team proposals; proposals with special requests, such as sub-contracts and inter-organizational collaborations; and types of research programs that require additional documentation and certification such as clinical trials, and studies of sensitive subjects. For instance, it is plausible that coordination of a proposal with a large research team may simply require more time and effort on the part of administration, given the number of documents and information they need to collect from each member.

> 'PI4: It takes longer to get all the information from the multi-PI team. The larger the team, the more paperwork, right? That's the difference that I see is. Generally, the administrator's going to do the same. It's going to be the same work, it just requires more follow-up, more paperwork, and sometimes, I have to get on the faculty, if they're not responding to the administrator.'

In studying the burdens, proposal types and complexity could potentially be measured by looking at the required documents, dollar amount of the proposal, the team size, involvement of multiple research institutes, research subjects, and special requirements.

Institutional-level system

As shown throughout this study, the institutional or academic unit-level submission systems and procedures, including the official requirements and tacit cultures, potentially contribute to the burdens. While the funding agencies and universities have formal systems and rules for proposal preparation and submission, there may be room for discretion at academic unit levels to decide how they actually manage the procedure. The

following quote from RA3 describes how the academic unit-level practice, such as budgeting methods, potentially increases the burdens.

> 'RA3:.. The other thing was the budget template, the calculator, the excel. Their version was very difficult to read and lots of colors and big and long. We were spending hours trying to use it, because the PIs were changing formulas in it and not telling us. …. [Pre-award staff name] was able to come up with a great very simple excel. It always ties to eRA so we are much more productive. I had to look for ways to streamline it, because we were just losing so much time with the way ...'

In the case above, his pre-award team changed the budget form for the PIs to make the process easier for both the PIs and staffs. Budgeting is one example, and other interview participants, including RA3, present other potentially burdensome practices at the institutional level and academic unit such as strict compliance for the internal deadlines and the use of PDF format in the initial proposal intake form.

Process management and last-minute submission

PIs may have specific strategies to manage the proposal preparation and submission process, including the timing of initial contact with staff and using the resources of staff. These strategies potentially enable PIs to make the process smoother, more efficient, and avoid unnecessary burdens. One of the strategies to make the submission process smoother is the early submission or early notification of submission intent to the pre-award staff. The following PIs indicate their strategies of early submission.

> 'PI5: I would say that soon as I say I want to do a proposal, I submit a draft summary because that allows us to route the proposal that day and get everyone to say yes pretty quickly, which then means that submitting it

> becomes a faster process. Let's say that I do that usually 10 to 14 days before it's due. Then I like to submit my actual stuff two days to one day early. I don't like to be submitting anywhere later than 24 hours before it's due. I'll shut myself up in here and draft out the proposal as quickly as I can somewhere in the one week early range.'
>
> 'PI27: .. I always submit early. I think it's part of my success. This success we have is because I try to submit early then there's less probability of making simple mistakes.'

A related strategy is to start early by submitting documents one by one, or in a series, as each document may have different progress speeds and require different levels of assistance from pre-award staff.

> 'PI27:… My strategy is to work with all of them simultaneously because some of it have different time lags, so I don't do part A then part B, part C, part D. Part E may require that somebody responds with something and then you are idling there. I start with moving all the balls at the same time and I think it works for me....
>
> 'PI11: Usually in a series. It's not all at once. The documents start coming in, we start submitting them to him, I would say, three to four weeks before the deadline. It usually, then, proceeds up until about a week before.'

PI27 further presented a case in which his proposal was not compliant, but the funding agency allowed him to correct it to make compliant because the original submission was early enough.

The opposite practice could be that PIs regularly or occasionally make last-minute submissions. PI26 describes that sometime PIs may miss an internal deadline, even if they try to be on time. PI7 notes that early submission may enable the PIs to get more assistance from staff to prepare documents and arrange the process, but he is likely to coordinate the proposal himself. PI5 said he actually adjusted the proposal process to

make it easier for staff and to get more help from the pre-award staff. PI24 recognizes that last-minute proposals can cause problems for the pre-award teams.

> ‘PI26: Being focused more on the rules than the goal. Not understanding that if, like three-day thing, for example. Not understanding that if we aren't respecting it, it's not because we don't respect the rules or we don't respect the staff. It's because we're juggling a bunch of priorities and most of us are overloaded and we're always working to deadlines and we're always asking, "Is this a real deadline or is this a fake deadline?" … The deadline that a staff has for submission, that's a real deadline. Internal deadlines we all know are not real deadlines that has been imposed on ourselves as institutions to try to keep things moving rationally. I respect that and we definitely try to meet those deadlines but that doesn't mean we'll meet it by the hour or slide for a day or something like that. We have 90% of documents ready but I was still working at the project description.’

> ‘PI7:… It's usually under my control. There were cases where I've seen a proposal going out to the admins, "Here's a bunch of different documents." Not pages anymore, but just carries a one document and they were asking people for bio sketches. They were putting everything together, which is nice. It can help. It can help, but you have to give them time. A lot of the things that we do, that they are last-minute’

> ‘PI5:… What I think makes someone good is first of all the checklist that very clearly outlines the dates where they need things for them to do their job well and then where I can have more time to do my job well. … I’ve adjusted the way that I work, so I spend a half a day early on in the proposal process just getting all those documents edited and sent over. That's one thing that I think makes someone good is just being clear with, "I can best help you if you do this". Then I as the PI can decide how I want to spend my time and effort, so that's one thing.’

> ‘PI24: The biggest issue that we have with proposal team is probably not a typical one. Faculty's submitting things at the last minute. Not giving the team sufficient amount of time and not only develop the proposal, but to get all the permissions and signatures from everybody else. That's unfortunately probably always going to be the case to a certain degree. But we've been trying to implement some strategies to make sure that it doesn't happen as often as possible.’

Thus, recognizing the back and forth process in preparation and submission, some PIs strategically submit early and make arrangements in order to avoid the unnecessary burdens of last-minute submission and errors.

Some PIs recognize that last-minute submission can increase the probability of mistakes and incomplete compliance, as PI20 states below. Furthermore, the staff in the interview, RA1 and RA3, also attest that last-minute submission is a major problem on the pre-award side. PI3 and PI20 mention that the staff team reaches out to faculty members to start the proposal arrangements with the staff team early.

> 'PI20: … One of the possible challenges, like on the pre-award side, is the faculty member maybe submitting a material quite late, right close to the deadline. That can put a lot of stress on the persons proposing it, or some of the staff putting it together and that can result in mistakes. The fact that you busy and good ideas coming at the last moment, I always try to work with them but getting the balance between, timely submission, enough to leave time to submit the proposal versus, really allowing for the faculty to completely open with their ideas.'

> 'RA1: I think depending on the school but in some schools we need to make more headway with the timing of when we submit the proposals which is mostly based on the timing of when we receive materials from the faculty members. That puts a lot of pressure on the RAs and maybe the staff because I think we have a really diligent team and they get nervous if they get something late, that we're going to miss the submission or they're not going to catch something. Had they had the document three days before and had the time to look at it maybe they would have caught it. Then you get the documents late in the day on deadline day. Typically we have a 5:00 PM deadline, so maybe he doesn't have the time to review the document, it gets uploaded and then the sponsor rejects the proposal because they were non-compliant. …At the university I'm not aware of other positions that are like that where there are such a hard deadline and that if you don't make it you miss this opportunity for 300,000, 500,000, millions of dollars. ….'

> ‘RA3: … so many of them cut it so close. Why? It's just a few weeks ahead of the due date. They come to us and then it's rush, rush, rush. …. They're not planning ahead and far enough. Too close. The window is too short. Then they're rushing. I wonder about the quality of the docs. I can't speak to that. …I think that's why they're emotionally exhausted...’
>
> ‘PI3: …Every month we receive an email from them. They say, "Are you submitting any proposals in the next two months?" They give you a warning. They said, "We believe that next month we're going to have so many proposals. We want we want to see this in advance." They want to be warned about this... That's easy, we can do that.’
>
> ‘PI20: .. The schools, some schools maybe all but at least some, every maybe month or so, or periodically, the research advancement manager maybe she or he will send an email to all the faculty and say, "hey if you going to be submitting a proposal in December or January, let us know as soon as possible, here is your proposal -- there is a form". ..That is based upon the feedback. ..’

The practice of working on grants and submissions at the last minute may increase the PIs’ intensity of work and contribute to emotional exhaustion. Thus, PIs may have competing stakes in the opportunity to elaborate the proposals up to the last minute before the deadline or avoid last-minute submission. The process management strategies may be the timing of the PI’s notification to the staff team of intention to submit, the timing of the document submission, one-time submission, or submission in a series.

Success rate and submission frequency

Finally, the success rate of proposals may influence the perception of the level of burdens, especially when the burden considers psychological costs and accumulative experience. PI15 talked about the success rate as follows:

> ‘PI15: Things were so competitive they’re being really picky on the approach. They are not really trying to help you, they're just trying to find some reason not to fund you because they only got money-- … we're reviewing 42 grants. Two are likely to get funded. That's the norm these days, is that you have to write a top notch grant just to be in the lottery. To may be get that funded.’

PIs may perceive the level of burdens as heavier, although the number of administrative tasks involved in the submission is the same. There may be difficulty in calculating the exact success rate as PIs are typically involved in a number of proposals with varying levels of responsibility and PIs often do re-submission after the rejection of first submission.

Some PIs talked about the greater frequency of proposal submission and greater time allocation on grant writing. PI25 mentioned that he, himself, constantly writes grants and used to do so at a past institute, and described the changing grant practice, although he explicitly said it is not to say which is better or worse. The frequency of submission might involve the disciplinary practice as in the quote from PI5, and personal preferences as shown in the two quotes from PI4 who does not like to miss any opportunities.

> ‘PI25:… You spend far more time writing grants. It used to be that, my PI when I was a graduate student, he had two basic grants that ran his lab. He could cover everybody from those two basic grants. He didn't worry about grant writing, but every three, four years he would be up to have to write grants. Otherwise he was focusing on papers and research. Can't do that anymore. Now, you have to write grants constantly.

> ‘PI5: I generally submit 7 to 10 proposals a year….On [Discipline], I don't think it's that many.’

> ‘PI4: I don't know the exact numbers… but I try to always have three grants submitted at one time... For NIH, there's three cycles a year, so I

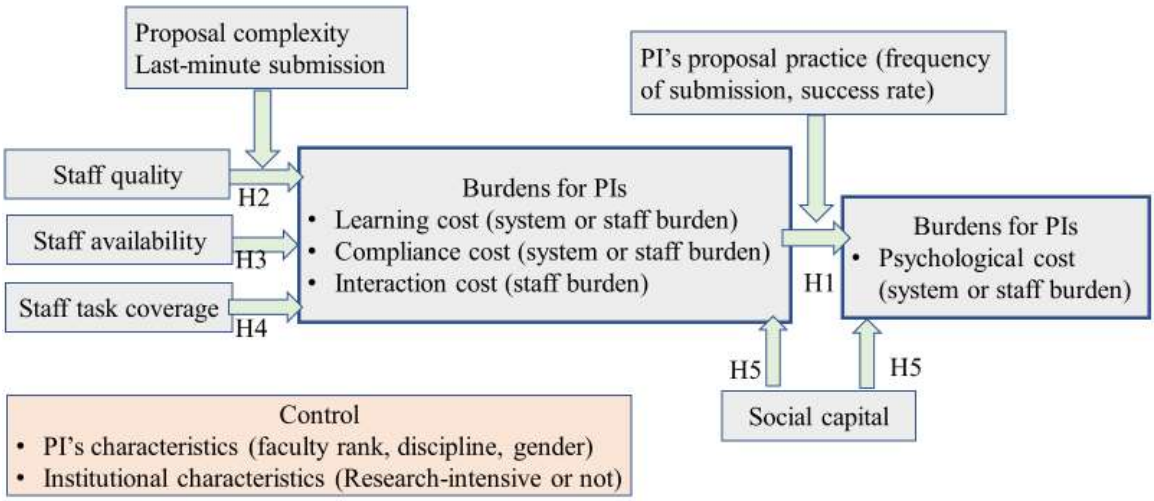
> feel bad if I miss a cycle. I didn't submit this past one, but I would say, probably two of the three cycles, I submit something.'
>
> '[Interviewer: Within this 75% (as the percentage of research time out of total work time), how much time do you spend for the grant writing and grant submission?] PI4: I guess 50%. [Interviewer: Do you think it's reasonable, or do you think you spend too much time, or too little time?] I always think I spend too little time, that I should be doing more. … Yes, I guess. I never like to find that I've missed a good opportunity.'

It would be better to control or consider success rate of each PI, together with the submission frequency, as the basic features of individuals in the proposal practice.

5-2. Tentative Hypotheses Generation

Interview results and factors listed and examined in the previous sections help to generate some tentative hypotheses about burdens. One of the major findings from the interviews is that the burdens of PIs could be reduced, to a large extent, by the quality and interaction with the pre-award staff, regardless of the complexity of proposals and the submission system, and vice versa. Hence, the hypotheses here focus on the factors related to staffs and interaction between PIs and staffs that influence the generation, increase and decrease of burdens for PIs in the processes of proposal preparation, and submission. Instead of incorporating all the richness of the obtained data and observation, the conceptual model and hypotheses in this section intentionally limits its scope because one of the possible weaknesses of case study approach is to be overly complex by incorporating every points from the empirical findings in the hypotheses generation (Eisenhardt, 1998). Figure 1 illustrates the conceptual model, followed by the presentation of hypotheses.

Figure 1. Conceptual Model



It is possible to study the burden as one variable, but burdens themselves could be potentially be separated into detailed variables, as indicated as the cost type in Figure 1. Each element of burdens as a cost type involve either or both of system-related burdens and burdens with staffs and relations as examined in Chapter Four.

Although the model still employs the three costs in the study of administrative burden by Moynihan et al. (2015), interaction cost is added as the component of burdens. The interaction cost here refers to the tasks and processes that are more than minimally required in the learning and compliance process and chiefly in the interactions and relations between PIs and staffs rather than solely based on the PIs. The interaction cost may include, but not limited to, the back and forth interaction between PIs and staffs due to the miscommunication and coordination or the waiting time and additional checking of the progress of the procedure that are perceived as unnecessary or problematic by PIs.

The first hypothesis deals with relationship between the burden-related factors. As noted above, the burdens involve a set of costs, the greater costs in terms of the actual administrative, and any related tasks possibly increase the psychological costs.

> <H1> Learning, compliance and interaction costs of the PI increase his psychological costs. This possible causal relation may be mediated by a set of factors, including PI's proposal practice such as frequency of submission and success rate.

This hypothesis enables us to investigate what the individuals specifically perceive or experience as the burden and partly address the relationship between the subjective and objective components of the burdens. Interview results suggest that PIs, who do not need to spend time for detailed learning and compliance and who see the process and interaction with staffs as smooth, did not express psychological burdens. As the opposite case, those PIs who think they spend a larger amount of time to cope with learning, compliance, and interaction with staffs were more likely to be frustrated or emotionally exhausted.

The second set of hypotheses addresses the capacity of pre-award staff. This study suggests that access to quality pre-award staff and services often reduces the burdens of PIs, indicating the various meanings and dimensions of what means good and bad in the quality of pre-award staff and services.

> <H2> The quality pre-award staff and services reduces the burdens of PIs by enhancing the holistic capacity of PIs to complete the administrative process. This possible causal relation may be mediated by a set of factors, including proposal complexity and the practice and strategies of PIs.

> <H3> The availability of staffs in terms of responsiveness and readiness for communication throughout the proposal preparation and submission process reduce the learning, compliance and interaction costs of PIs.

<H4> Greater task coverage of the pre-award staff and services reduce the learning and compliance costs of PIs.

In addition to the general quality of staffs, the availability and task coverage of the staffs may be examined. The availability in terms of the responsiveness or readiness to communicate matters for burdens because the PIs spend additional time and tasks when the staffs are not responsive. The hypothesis 4 addresses the point of whether the greater task coverage by the staffs means the shift of the tasks from PIs to staffs, which implies the reduction of learning and compliance costs for PIs with task delegation from PIs to the staffs.

The fifth hypothesis refers to the process and relations between PIs and staff, with special focus on social capital between them. Above all, their social capital may reduce burdens during interactions in completing the administrative process by making the process in each transaction easier by knowing and trusting each other.

<H5> Social capital between PI and staff in the form of the PI's trust for staffs reduce the learning, compliance and interaction costs for PIs.

Social capital possibly increases the readiness of each transaction including the procedure PIs actually work on, and trust enable the PIs to delegate the tasks to staffs without concerns. Social capital such as trust, goodwill and familiarity with each other with good knowledge of work styles and personal characteristics may reduce the burdens in both the immediate and future proposal process.

These hypotheses capture the primary factors that generate, increase or reduce burdens for PIs during the administrative procedure in the social and organizational

context. While the influence of staff quality and task coverage on the burdens, as in hypotheses 2, 3 and 4, might be either one-time or accumulative, the influence of social capital might be more accumulative by nature. The costs in the burdens might be largely overlapping and not easily separable in some occasions. However, the amount of time, tasks and effort in learning, compliance, and interactions seem to be closely related with the psychological cost in terms of the stress and frustrations PIs experience in the process, according to the empirical results from this study.

5-3. Chapter Conclusion

Given the complexity of the phenomenon, this study limited its role to exploratory research to better understand the burdens for PIs and the process and interactions from which burdens emerge, increase and decrease; but this chapter examined the possible factors and hypotheses for future studies. Some of the factors, such as the detailed qualities of staff, may overlap to a great extent, and some factors possibly involve both objective and subjective aspects, which require further elaboration in future studies. For example, the compliance mentality may reduce the burdens for PIs by reducing the probability of errors, and some PIs appreciate that their staff do thorough compliance checks and corrections, but other PIs may see it as too stringent a compliance mentality. Similarly, avoidance of last-minute submission and strict compliance with the three-day rule for the internal deadline may reduce the burdens of PIs by avoiding the last-minute scramble and the greater probability of mistakes, whereas some PIs may think it is unreasonable to impose a very strict three-day rule without exception.

6. CONCLUSIONS

Major findings from the interviews include an illustration of burden perceptions and experiences of PIs as the system-related burdens and burdens with staff and relations in the proposal process. System-related burdens primarily exist with the rules and requirements and the proposal systems at funding agencies and institutional levels. However, the costs of learning and compliance, as well as the related psychological costs for PIs, can be increased or reduced during the proposal preparation and submission processes that are embedded in the organizational and social contexts. In other words, the results of this study illustrated how administrative assistance could be either the resource for PIs to reduce burdens or the source of additional burdens. In addition, PIs experience the burdens with communication and interaction between PIs and staffs even when the staffs intend to support PIs by providing administrative assistance or assure the compliance of the proposals. Furthermore, the burdens could be examined either in each transaction of the proposal submission or as the accumulative experiences of PIs.

This study illustrated a set of burden-related issues. One of the issues is the recognized reliance on electronic proposal system and emails in completing the administrative procedure, in which more and more procedures are automated and PIs may complete the submission without meeting with staffs face to face. It is challenging to determine whether the electronic system increases or decreases the overall burdens for PIs as the change is paralleled with the growth of rules and requirements. However, PIs may experience burdens differently in the paper-based system and electronic system. For example, PIs might need to walk across the campus to get signatures or filling in documents with handwriting might be time-consuming. PIs might go through more layers

of approval system in the electronic system but possibly in a less time-consuming way. Or, PIs might spend more time to learn how to use the electronic system itself, while PI just had to submit a paper form in the old days. Again, some PIs get administrative assistance to keep them away from learning every detailed rule and procedure in the electronic proposal system.

6-1. Theoretical Discussion

The burden-related descriptions by PIs involved all the learning, compliance, and psychological costs that are presented as the three types of cost in administrative burden by Moynihan et al. (2015), adding the interaction cost for consideration. This study further examined how these costs and burdens emerge, increase and decrease through the administrative process, which involves social interaction between PIs and staff and is embedded in the social and organizational contexts. Submission of proposals to different agencies and different programs may entail learning and compliance costs to uncover the differences; furthermore, the rules and regulations also change over time. The results of this study indicate that psychological costs cannot be ignored as a part of burdens, especially in the context of grant proposals, because the psychological costs could be the primary burden in reducing the PI's motivation, energy and creativity for proposals and research activities, rather than the mere amount of time spent on a proposal or the number of documents to fill in.

In the interviews, some PIs expressed understanding of having the administrative rules, requirements, and components in the proposals such as data management plan and

broader impacts with a recognition that the need for accountability and integrity in spending the public funding from tax payers. However, some PIs questioned some of the proposal requirements and how they are managed. PI27 suggested that it would be better if the first full proposal require only the science content and not other administrative documents, given the low success rate.

> 'PI27: The peripheral pieces should be requested only when your proposal is in the last stage. Assume that you have hundred proposals, you'll going to find six and then when you try to ask the top 12, ask for all of the pieces.. … I agree that we should have them for each proposal but I don't think that these pieces are necessary to select which one is going to be funded… That's significantly different (from letter of intent) because the letter of intent whether you're shrinking as a core and I think you should have the full 15 pages of proposal. The length of the core proposal, the scientist intact, please give me a break with all the letters and data management, post-doctoral training, budget justification, letters of support. I don't know. There's a long list of things.'

Following two quotes from PI14 describe the issues in the interpretation and implementation of the requirements with a case of the broader impact section in the proposal.

> 'PI14: …. The broader impacts have gotten greater and greater. It used to be that you had to acknowledge that you needed to reach that broader audience, but now, if you're not budgeting funds specifically to do something novel for broader impacts, they don't get viewed as favorably. I've been on several grant panels where that keeps coming up. That just because you're teaching undergrads, that's not broader impacts anymore. You have to be designing museum displays and things like that. There's definitely more expectations to engage the public, which is good, but we're doing it with the same amount of dollars and the same amount of time than people. It's hard. I can end up thinking, a lot of time, into those broader impacts activities that are valuable in their own the way but you're just pulling people in more directions. So much of, it seems like with NSF, of that grant success is just do you have the right review panel that's excited

about it. It's hard to predict and your audience changes every single time. When you're resubmit grants, you can get completely different reviews just based on the people reading it.

'PI14: … It's explicitly stated that you need to have broader impacts acknowledged, but the type of activities and the level of activities that they anticipate isn't explicitly stated…. I think in the NSF grant proposal guide the definition of broader impacts would be reaching underrepresented groups and women and minorities, also, "What does it mean for the general public?"… Then, I'd have reviewers say that women and minorities aren't broader impacts…. I often go to classrooms, … and talk to kids about [Research topic]… One reviewer told me that I am not trained to work with children and I should stay out of the classroom and let the teachers do the teaching.… Things like that… These really off-the-wall questions of what they have decided broader impacts is.'

Part of the problem with non-science part of proposals emerge both in the initial interpretation of the requirements by the PIs and in the review and resubmission process in which PIs may need cope with different review panels. On the grant review practices in Norway, Langfeldt (2001) examines the review process as the social process and illustrates the discretions by panels in which different panels vary in consideration and weigh the factors such as the quality of proposed project and prior merit of applicants. The ambiguity of the rules and discretion by the review panels in interpretation of requirements and proposal evaluation, together with their inherent uncontrollability by the PIs, might magnify the burdens for them.

The focus on the interaction process of the administrative procedure suggested that PI's burdens could be increased or reduced with the support by staff, regardless of the number and complexity of rules, requirements, or system of submission. Furthermore, the interaction process itself could be the origin of burdens or increase burdens. This study added the interaction cost as a part of the burdens in the presentation of the

tentative hypotheses, because the empirical findings suggest that the interaction and relationship between PIs and staffs can be the source of the burdens when the communication costs, additional time, effort, and the interaction process can also generate psychological costs for PIs. These are all accumulative. In the study of red tape, Bozeman (1993, p.281) distinguishes the total resources such as time and people that are formally needed to comply with the rules and procedures (compliance requirement) and those resources that are actually devoted to compliance and procedure (compliance burden). Although the concepts of compliance requirements and compliance burdens are resource-based conceptualization and pre-award staffs could be regarded as the resource in this framework, the same sets of factors, such as pre-award staffs and services and proposal process itself, could be either resources or the origin of the burdens.

In a sense, the increase and decrease of burdens for PIs in this study may be seen as the shift of burdens among pre-award staffs and PIs, as one of the primary factors to reduce burdens of PIs was the administrative assistance by pre-award staffs to take the learning and compliance costs of PIs. As Herd et al. (2013) illustrated in the case of administrative burdens in Medicaid in Wisconsin, burdens can be shifted from the citizens to the state government, or a set of process change such as the auto-enrollment, online access, program and form simplification which helps reduce the burdens such as learning, compliance, and psychological costs. In addition to the shift of burdens from PIs to the staffs, the results included some means to reduce burdens such as the general avoidance of last-minute submission, simplification and improvement of the internal forms and procedures, such as the budgeting spreadsheet and the proposal intake forms,

and better communication between PIs and staffs to avoid the unnecessary back and forth interactions, waiting and checking.

The embeddedness of burdens in the social and organizational contexts is illustrated throughout this study. A quote from PI18 below illustrates the point that organizational cultures seem to be closely related to the burdens of PIs in the absence of good social relations and feedback practices.

> 'PI18: No. No. Giving feedback isn't rewarded. Let me rephrase that. We have a culture that discourages conflict or criticism. Our culture responds defensively to even constructive critique. For the most part at least in our unit, we prioritize conflict avoidance over quality… They prioritize the relationship instead of call it the proposal or whatever it is. I just think that's it's incorrect. But it's typical of people who work together in bureaucratic settings that they avoid challenging one another directly. They avoid constructive critique. They avoid feedback unless it's unquestionably positive. It's okay to give someone a SUN Award (University's award for the recognition to the excellence of employees) but we're discouraged from offering constructive critique. Criticism is often seen or misinterpreted as a temper tantrum. Now, sometimes temper tantrums or complaints are rewarded. It's kind of a weird system.'

This quote implicitly touches on deep-seated issues of burdens at organizations, although this PI had very high level of burdens and represented an extreme in the interviewed participants, most of whom had lower burdens and had pre-award staff and services to help them reduce burdens. This PI said that conflict avoidance is the basic culture among the members of his academic unit and is present in the relations between faculty and the pre-award team. The avoidance of the immediate problems, negative feedback and improvement suggestions or the absence of good social relations as foundations may lead to an accumulation of routinized inefficiency and further burdens.

The level of coordination and communication at the institute level, namely the entire proposal submission and administration system at the university level, may contribute to reducing or increasing the burdens. PI16 and PI8 below think they have good pre-award assistance from the immediate staff, but see some issues in the institute-level pre-award system, seemingly the coordination and communication across different layers and branches.

> ‘PI16: I was educated at the [University]. Everything was pretty much perfect. Everything was done right. It was done on time. Everything through the whole university. That's a big university but everything was just done as it should be done. I think ASU has some problems with communication and timeliness and one hand knowing what the other hand is doing. .. I don't think that ASU is as- well rigorous in making sure that things are done according to procedures in a timely way boom, boom, boom like they were at the [University]. … They're not that, they are much more relaxed here. In some ways, that's good. In other ways, it doesn't get the work done at a really high dependable level always. … I think our associate team for research who is over the research office is very, very competent. When you get above him and you get into the higher university things, there's not the efficiency that there might be.’

> ‘PI8: So it's not rational system, it's a centralized system but then there are these decentralized places to try and make it efficient but the decentralized places don't know enough. ….’

One of the coordination and communication issues at the organizational level could be the unequal distribution of the pre-award staff in different academic units, as PI17 and PI20 mention in the quotes below. Furthermore, PI8, PI11 and PI10 talked that problems in coordination and communication may emerge explicitly as an issue when errors occur, in which people seek to find where the error originated in order to avoid future errors.

> ‘PI17: … The only thing is I suspect that we probably still do not have enough people capacity for these things we're talking about, these

administrative tasks that we have. I can't quantify that. I get good service. I just get the feeling that across the board, not everybody is getting the same kind of good service, many cases because they don't know about it, but if everybody knew about it and try to use it, we wouldn't have capacity. We'd still need to keep building capacity on it.. ...'

'PI20: I'd like to increase the resources available to advance research. That means I'd like to increase our capacity to do research, and that means, fundamentally, add people. Researchers doing research, grant writers helping write grants, project managers working on big projects, expand that.....'

'PI8:… So I don't know, it's here and here's so is it between there, or is it between there and NSF? No way to know. Not quite smooth but, no way to know. And through the [Academic unit] office, there were some problems of being not in compliance with various things which actually, we were in compliance but, it was submitted in a way that wasn't quite right so it made NSF think it was non-compliant which made me have to rush around when I was I was actually in [Country] to try to spend a lot of money on phone calls to try to figure out how to fix it. Those have been little glitches but, again it's not clear where and according to friends of mine that happens in every university, in every institution.'

'PI11: In past (institute PI11 used to work), for example, something not being done according to format and then the office just going home and missing a deadline because their day was over. Ultimately, either you get the grant submitted properly or you don't. If you don't, then-- What's the old expression? "Failure is an orphan, has no parent." I think that's true.'

'PI10: Yes. Everybody blames everybody. In the case of me, it was like, "Oh, oh-oh." [Office name] didn't do this. They're saying this office didn't propose the -- It's like a he said, she said, back and forth. Nobody knows how it happened because nobody wants to take responsibility for dropping the ball.'

Thus, the level of coordination and communication in the entire system, the proposal submission and administration path, as well as staffing, could be factors to examine in studying burdens. While the level of analysis in this study was the individual PIs, studies

of burdens and nonconformity with the levels of analysis of academic units and universities may consider these coordination and communication factors more closely.

6-2. Consequences of Burdens

One of the theoretical insights from this study is the consequences of burdens, or the influence of repetitive, accumulative, and long-lasting occurrence of burdens. The consequences of burdens may go beyond the immediate learning, compliance and psychological costs and these costs and possible impacts accumulate in the long-term. For example, the greater and repetitive burdens of the PIs may influence their psychological energy and frequency of grant writing as well as the content, trajectory, and intensity of research activities. The excess of burdens and complexity may harm the overall efficiency and original purpose of the research system itself.

One of the consequences of burdens in this study are consistent with the possible consequences of administrative burdens articulated by Herd et al. (2013), namely, that the complexity and onerous procedures for application and enrolment to the programs, at least in the case of public programs like Medicaid, results in lower take-up by individuals. The study results of Herd et al. (2013) indicate that the shift of administrative burdens from the individual citizens to the state government significantly increased the Medicaid enrolment. These points apply to the burdens in proposal processes in this study, as the excess of burdens for PIs may discourage them from applying for grants. In contrast, the shift of administrative burdens of PIs to the pre-award staff, academic units or universities may increase the take-up by individual PIs. This point aligns with the

points made by Burden et al. (2012), who indicate the influence of the experience of administrative burdens on the bureaucratic perceptions of policies.

Some PIs such as PI2 and PI15 below, with sarcasm, talked about the balance of time taken up with grant writing and time for doing research, indicating that they reduced the frequency of submissions or shifted their research trajectories. These two PIs noted that they shifted to do more collaborative works with other institutes and students to maintain funding, and PI15 said he shifted the research topic from expensive research to do less expensive research but still maintains the research productivity. PI8 also mentioned the possible influence of the administrative complexity and burdens on the PI's proposal submission frequency in the future.

> 'PI2:… I think to say let's cut some of this time doing an NSF proposal and then go to Las Vegas and put the money on the tables, which has a higher probability of getting funding. I would say go to Vegas.'

> 'PI15: I'm an outlier on that because my attitude is that I didn't get into this because I love writing grants. I didn't get into this because I wanted to spend all my time writing grants. … That's mostly because I feel like it's a pointless endeavor. There's very little chance I'm going to get the grant so I will go through the motions of doing it because ASU expects me to. I don't think that there's any chance I'm getting a grant.'

> 'PI8: … I know there are some people who don't really need grants in order to be able to do their research or they're not need very large grants to be able to do their research who have found the process and the process of navigating the air shoe system of funding and accounting and all that sort of stuff, sufficiently annoying that they set, "I'm never applying again." It's just something to know as part of the process.'

Grant writing and submissions, including all the administrative arrangements and compliance checks, require a considerable amount of time from university researchers.

Some of the PIs interviewed weigh the time and decide not to get too deeply involved, given the low success rate in the overall funding system and skepticism toward the rationality of a large amount of administrative rules and requirements.

In other words, the absence or reduction of these burdens may encourage PIs to submit grant proposals or at least minimize the unnecessary obstacles. PI17 repeatedly said he hates filling in forms and attending to administrative details, and he would not have enough energy for proposal writing if he did not have the administrative support, as shown in the quote below:

> 'PI17:… I hate filling out forms and I hate taking care of little details like that, just bugs me. If I had to do all that, one, I wouldn't do a good job as that would be bad. Two, I'd be frustrated, feeling oppressed. They don't want me to feel oppressed. They want me to feel energized. The fact that I've got these expert people handling all the things I hate to do is so wonderful.'

The influence of burdens is not simply about the burden as the actual number of tasks, but also the burden of psychological costs, balancing time allocation with consideration of institutional and disciplinary expectation and constraints, and the future likelihood of submitting proposals. When the success rate is greater, the psychological costs for the same amount of work may be less, and PIs may experience the fewer learning and compliance costs by getting sufficient funding with smaller number of proposal submission.

6-3. Grant System and the Nature of Scientific Research

The PI's perception and experience of burdens are related to their research-related activities and strategies, and their perception of the grant system itself. As well argued, funding agencies shape the institutional order of academic research, influencing not only structures of organizations such as universities, but also the norms and practices in these organizations and by these researchers (Hackett, 1987; Benner and Sandström, 2000), and researchers may face the institutional pressure to acquire external funding (Anderson and Slade, 2016). Researchers may change their strategies to adapt to the changing funding environment, for example, by producing different knowledge and by changing the research trails, sometimes with risk-averse strategies (Laudel, 2006). Young (2015) examines the transformation of the logic of decision-making by individual researchers in Sweden as a systemic problem, characterizing the emergence and growth of the external, fragmented and competitive funding system as a quasi-market system in which it may be more challenging to pursue risky research.

Some PIs expressed their concerns about the heavy focus on grant acquisition rather than research output at the institutes and academic units and in academia. Some PIs, as PI15 reported, state that grant acquisition is part of the faculty evaluation such as promotion decision in their academic unit, although PI15 has skepticism about getting too much focus on grant acquisition. PI7 mentioned the balance between grant writing and the actual research activities and outputs. Some PIs, as a quote from PI31, have both external and internal pressure to get funding, although this PI, his self, has managed to acquire more funding than expected by the academic unit.

> ‘PI15:… I’d really love to change the metric, is instead of measuring how much money we bring in, measure the productivity. Productivity of terms of knowledge gained, students educated to do PhD work, value to the world. I’d love to change the metric. I think money is a means to an end, it’s an important means to an end….’

> ‘PI7: They do a lot of proposals and then I've seen groups where they only do proposals and basically dump the work. They don't do anything and they don't deliver I think. That's not going to get you very far. No, I'm not talking about that extreme.’

> ‘PI31:… There's always pressure to get funding. I always have more projects I want to get funded, there's always that pressure. I feel that's more internal pressure, myself. As for the pressure from the department in college, I feel like they're happy with where I'm at right now.’

Several PIs suggest that their units consider the disciplines in which certain types of research may require a larger amount of funding, while others do not. PI1 notes variations in the expectations for grant acquisition even within their academic unit, and PI24 mentions that his academic unit expects faculty to acquire funding to do high-quality research, but does not have a specific target amount of funding.

> ‘PI1: … The number of submissions, the number of awards, and what is acceptable or what's good enough for tenure and promotion, that'll also vary between disciplines, even within a college. …’

> ‘PI24: No. I don't do specific targets. Again, it's not the dollar figure. Obviously, we like to bring in large grants. But what I want to see is an ability for faculty to bring in the resources that they need in order to conduct world-class research. That differs by disciplinary fields. … The cost of doing world-class research is going to be different. I recognize that. I don't have a minimum threshold. It wouldn't make any sense. ….’

> ‘PI8: Yes, it's a constant refrain and I happened to be in a position where I ignore it and I tell younger people to ignore it. .. we believe that, you should seek funding in so far as you need it to support your research. In other words don't chase grants just for the sake of it, nobody will be fired

> or denied tenure simply because you don't have a grant if you are able to do your work.… Yes, we have responsibility to get funding in order to able to do research but only in so far as it's necessary and will help each other to make it work and that's kind of an idealistic stigma …. We're forgetting why we are getting the funding and we are forgetting that actually administering grants cost money…..'

PI8 recognizes the institutional pressure for grant acquisition, but expresses the belief that grant acquisition is not the purpose of research.

Some PIs suggested that changing cultures and practices in the research funding system, including the growth of administrative complexity in proposals, reflects the changes in broader society. Following PI26, a senior faculty member also expressed his view about the increasingly grant-driven culture in past decades.

> 'PI26: Yes. Well, it's a little hard for me to say objectively, because my experience is subjective and 30 years ago I was a student. My perception is that we're much more grant-driven now than we were. There is much more of a culture in academia is much more entrepreneurial now, in the sense that scoring a big grants is seen as a really positive thing. Relative to other things, the stature of that has gone up relative to writing some great paper. Whereas when I was a student I certainly didn't perceive it that way. My perception as a student and as a, even a starting faculty was that the balance of valuation between getting big grant and the quality of your research was more towards the quality research than it is now. I think we're mirroring the broader society. The broader society has become more entrepreneurial. I don't mean to say that entrepreneurial as a bad thing. It also means there's a lot more valuation on new ideas and fresh ways of doing things and novelty and innovation all that's great. But it does come at some cost of less valuation of deep expertise and long legacy and experience, right? That manifests in parts in evaluating the splashy grant, the splashy paper, over the deep substance. We've seen publication metrics too, right? We value people have put a lot of papers down. Are they great papers? I like to say, you know about H index? … It's a very common thing and we all joke about it but it's still even we use it. Obviously, there's a way that we know what I have to write a letter about a colleague, there's our H index. It may not be explicitly in the letter but implicitly it does. …'

The quote from the PI above illustrates the grant-driven culture as embedded in the broader context of academic cultures, with prevalence of research evaluation metrics of publications such as h-index and entrepreneurial transition in the society.

However, some PIs emphasized the values of the grant writing process. PI25 mentioned that the grant writing process, including the creative development of ideas, and team building is valuable; PI30 said the research team may take the research idea to a different funder if the proposal is rejected on the first attempt. PI17 also noted, with excitement and energy, that grant writing is a huge effort.

> ‘PI25: … I want to be careful here, because there is a value to grant writing. There is no doubt about it. There is no better way to carefully think through the research you plan to do, than writing a grant. Writing grants it's a very, very good way to be thoughtful about what you do, and to plan your research and to avoid pitfalls. There's definitely value to it, no doubt about it. It has become a bit extreme, in terms of the amount of time we have to spend writing grants because so many of them fail.’

> ‘PI30: If you talk to people with 5% success rates, you have to say, "These were interesting and great ideas, how do we use them in some other context? Do we have other opportunities for this?" … So you don't just let the ideas die.’

> ‘PI17: … It takes a lot of energy to write proposals, and especially since they're not all successful. You know you don't -- maybe get 50% or smaller percent chance of winning. It's a huge effort. People who write proposals have to have a lot of energy. You have to be excited about your ideas, maybe excited about the people you're going to support with this. That's really the key thing to being able to it and keep doing it. It's the energy that's exciting about it. I still have energy, so I'll keep doing it for a while.’

Thus, grant writing and acquisition potentially involve multiple aspects: the instrumental value to find funding to implement research; part of faculty performance evaluation, and the opportunity to breed and develop research ideas creatively.

The balance between risky and conservative research was another issue that emerged through the interview regarding the transformation or issues in the research funding system, although the balance has been one of the fundamental issues in the research itself (Kuhn, 1962; Heinze, 2008; Foster, Rzhetsky and Evans, 2015). PI14 talked about his favorite proposals, and PI27 describes his strategy in maintaining the balance between conservative and risky research. Two quotes from PI2 suggests that, in his view, the nature of scientific activities is not particularly compatible with how the current funding system operates, so he no longer actively submits grants in view of the low success rate and the nature of science.

> 'PI14: …Out of the three grants that I currently have funded, two of them, when I submitted them, … I totally thought that it wasn't going to fly and then they did. It's the ones that surprise you that they get funded…. Because usually the favorites are a little more risky, they're more exciting. The NSF, in this day and age, they're supposed to value risk but they don't actually.'

> 'PI27: Yes. Usually, the very risky research is bootleg under the funding of more conservative research.... You submit proposal for doing something very conservative but the proposal is not a contract. You can do things that are slightly different. I think the reviewers are very conservative. … This is science. It's not a factory that I can make staplers and I have to make them brown. No. This is science… As long as I stay within more or less the scope of what I said I was going to do it's fine. I write a proposal in 2017 for grant that's going to start in 2019 and then I'm going to do it 2021 but science changes. I don't know. As long as I write papers and produce students, I'm okay. Don't need to be exactly-- and there are some agencies who are more lenient than others.'

> ‘PI2:…. The reason I don't do proposals is because science is exploration, not quite sure where you want to go. You know where you want to start, but you're not sure where the path leads from that. You can't write proposals like that. Proposals and everything has to be saying, "In year one, I will do this. In year two, we will do that. In year three, the so and so results will be used to do--" I don't know whether any of that is going to happen. If I knew it to that level by my standards, I already know the answer, so why bother?’

> ‘PI2:… What is the reason? It's because of the desire for accountability. That's what it means that things that are boring and predictable are more likely to be funded than things that are highly speculative. I know they say that we want the big pay off, but they don't mean that. They want things where a congressional staffer comes by, they can say, "Look, this is a respectable person. Look, what they're doing is going to bring all these benefits. Look, they've got a predictable plan and they delivered excellent on paper, so we produce X, Y numbers here."’

The balance between the conservative and risky research in grants is the concern for both PIs and funding agencies, which involves the evaluation metrics. As in the case of research activities in general, a merely large number of publications do not necessarily help the greater creativity and breakthrough with novel and sometimes unexpected contributions (Heinze, 2008; Heinze et al., 2009).

However, the researchers themselves serve in the proposal review panels, and some of the articulated problems seem to be inevitable. PI21, as a senior researcher, described risky research and expressed his view that the scientists themselves serve in grant review panels and the problems in the review culture and practice are their responsibility, too. PI27 talked about the potentially inevitable randomness in the very final phase of the review and selection.

> ‘PI21: … Once again, who's on the panels? It's us. We are our own worst enemy. We get on the panels and suddenly we become very conservative. We only want to fund things that are safe. But then when we are writing the proposals, we want to write things… that are very exciting and risky. It's partly our own thinking that has to change. We have to be more advocates on the panels, but also, I think the different agencies do things better and worse. …’

> ‘PI27: …I've been in many panels and I think that probably of a hundred proposals, there are 70 that are not ready to be funded, and of the 30, they show that the distinction between 70 and 30, it's mostly based on merit. Within the 30, are six that are going to be funded. That is random…. There's not a very clear gradient in quality within the very top. If you submit the same plain proposal, sometimes it's funded, sometimes it’s not. If you are there in the very top in the -- I'm making up the number to 70, 30, but at the very end, I've been in panels they say, "These are all very good. However, we can only support three proposals." How you go from the 30 to 3? There's not a very clear gradient of quality.’

PIs serve in the proposal review panels, but the rules and operation of in the review panels are predetermined by the rules and requirements posed by funding agencies and government to some extent. The issues articulated here such as the balance between the conservative and risky research and randomness in the very final phase of the proposal selection might not be easily avoidable. The role of the review panels and program officers also vary among different funding agencies and programs.

Some PIs do not see the issues in the review process above as problematic, recognizing the need to be strategic and know the tacit, implicit rules. PI6 and PI31 talked about the nature of proposals behind the scenes.

> ‘PI6: … I must immediately deviate. .. I think that's understood. It's very artificial what we're doing… For NSF it's almost you've done all the experiments and you just decide what you want to hold back, so they can

> give me money to justify it. Sometimes you're just missing one component and they reject it because of that even though you just decided not to show it……. It also depends on how, out there, the idea is. I would say I am not the best at getting funding for very regimented ideas. I got most of the funding on things I that are bit more out there. Let's say it's hard to predict. I guess you just lay out the steps that you think will happen and just try to -- you basically run an imaginary experiment in your head. You have to estimate how long it will take and those kinds of stuffs. I guess analyzing your thought process, and whether you thought it through.'
>
> 'PI31: …. you have to tailor your proposals to match … Like I said, I'm not a big believer in just submitting a ton of grants everywhere and trying to get lucky. I feel like a lot of it's luck but you also have to make sure that you're submitting the right proposal to the right place. .. Then you write the proposal for what they want to see. You're selling your ideas, you're not -- Obviously, I'm excited about my ideas. I have to write them so they are excited about it. They want to see A, B, and C. Even if I'm more excited about the other stuff, I need to make sure that I focus on that. To understand that, you have to understand what they're interested in….'

PIs such as PI6 and PI31 described their strategies to strategically adapt to the environment, tailoring the proposals to each submission to increase the probability of success and managing the submission frequency based on the tacit knowledge about the nature of each funding agency and proposals.

This section provided a quick overview of the issues within grant systems that emerged through interviews. Although the focus of this study is the burdens in the administrative procedure, it is embedded in the broader context of changing funding systems, organizational climate, as well as the norms and practices in academia such as the greater reliance of university research on external funding that involves greater competition, the research evaluation and performance management at universities, and sponsored research (Ziman, 1994; Weingart, 2005; Himanen et al., 2009; Auranen and

Nieminen, 2010). The interview results indicate that the administrative and any other grant-related burdens of PIs seem to have both immediate and long-term effects on the practice of PIs, sponsored research system, and academia. There seem to be a balance between the growth of the administrative responsibilities with complexity and the overall efficiency of the research system. Furthermore, another balance lies between the accountability such as research integrity and performance which may favor more conservative and predictable research and the efforts to fund and conduct risky research with lower predictability but entails potential for the unexpected breakthrough. These balances, or dilemmas, might be inherent in the sponsored research funding.

6-4. Limitations and Future Study

The primary limitations of this study arise from the nature of a single case study, which addresses in-depth points in the institute studied but limits generalizability and reflection of the phenomenon in the broader population. The case in this study a research-intensive, large-scale university, and the pre-award staffs are more likely to be located at individual academic units. PIs at the less research-intensive or smaller-scale universities, or those with more centralized pre-award service and staffing, may present different perspectives. Rich empirical findings enabled us to generate the list and descriptions of relevant factors and tentative hypotheses, addressing some broader and embedded issues such as the recognized issues in the grant system itself. However, a future study may firstly need to study a larger population to involve PIs in different types of institutes and disciplines for the hypotheses testing. Furthermore, this study exclusively focused on the burdens for PIs

and indicated a sort of administrative burden shifting from PIs to staffs for some PIs, but future studies may look at the burdens at the institutional level or funding system level, including the burdens of staffs, financial burdens of administrative costs, and the impacts of the electronic proposal systems on the burdens of PIs, staff, and organizations.

6-5. Prescriptions

The results of this study suggest some practical prescriptions for PIs, institutes, and the funding system. At the university and individual PI levels, greater numbers of pre-award staffs may help PIs to reduce burdens, but the financial sources to hire the staffs might be typically limited. One of the practical keys to reduce burdens seem to be the communication and coordination between faculty and pre-award teams within academic units and across different bureaucratic layers. When the PIs reported greater, recurrent or long-standing burdens, the inherent problems involved the insufficient communication and reporting systems either as the structural issue and more cultural and social relational issues. The structural prescription may include the establishment of communication and reporting system with clear oversight responsibility and specific positions who oversee and improve the system, including staff quality and communication between PIs and staffs. The cultural aspects such as the organizational climate and human relations are more incremental, and in-person and social interactions and trust could be one of the keys. The geographical proximity of the PIs and staffs potentially help them cultivate their social capital and relations which enable them to exchange and incorporate feedback for the improvement with fewer obstacles. PIs can strategically reduce the burdens to

some extent, for example, by developing trust, feedback, cooperative cultures between PIs and staff, and avoiding last-minute submissions. PIs may continue to work with the same set of staff members. These efforts may reduce the immediate burdens and the burdens in the long-term future.

One of the major issues PIs mentioned in the interviews was the balance between administrative complexity, responsibility and the original goal, and efficiency of the sponsored research system to produce research outputs with creative and rigorous research. The growth of rules, requirements, and procedures in proposals has been incremental, such as the addition of the broader impact. The introduction of electronic system reduced certain burdens and increase certain burdens for PIs. The fundamental problem or prescription to reduce burdens for PIs is the consideration of the efficiency and optimization of the entire funding and proposal system, rather than focusing on the efficiency and optimization in the fragmented pieces and parts. Sponsored research systems, including the proposal system, entail multiple values that are sometimes competing such as the administrative accountability and scientific efficiency. These values themselves might be important and justifiable, but they may pull the things to different directions, involving the development and changes of rules and requirements here and there in the process. One of the challenges for the funding agencies might be to understand where these values end up increasing the burdens without achieving original goals, where clear communication of the content and goal of the rules and requirements may help reducing the burdens, at least the psychological costs PIs may experience when they think certain rules and requirements are meaningless.

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A
INTERVIEW PROTOCOLS

INTERVIEW PROTOCOLS

RESEARCHERS

<1> Grant experience

- **AGENCY**: What is the major funding source for your research activities?

- **SUBMISSION**: How often do you submit grant proposals for the sponsored research, for example, in the past five years?

- **TIME**: How much time do you spend on research, and how much of the research time do you spend on proposals?

<2> Process and relations

- **PROCESS**: Can you describe your most recent experience in grant preparation and submission in detail?

- **LIST**: Can you list the type of support you get from the research administration service?

- **FAMILIARITY**: Do you have a specific administrator you always work with?
    - At your own school/department, or at the central office?

- **INTERACTION:** Do you meet the research administrators face to face, or via emails, phone calls, or within the online system?
    - Is your office closely located to the research administrators' office?
    - How long does it take to get a response from the administrators?

- **QUALITY**: Can you describe the characteristics of good and bad administrators?
    - Have you given any feedback to the research administration service or staff?

- **PROBLEM**: What is the biggest problem you have had in your grant experience?
    - If you have the authority to change anything in the grant system, what would you like to change?

- **TRUST**: Some PIs told me about the trust and distrust between PI and research administrators. Can you tell me about your experiences?

- **RULES:** The guidebooks at funding agencies are getting thicker, and universities have developed their own system for compliance. Can you tell me about your own experience or impressions as a PI?

- **PRESSURE**: Some universities or departments put institutional pressure on faculty to access external funding. What about your case?

ADMINISTRATORS

<1> Background

- **WORK**: Could you briefly tell me about your position and work responsibility?
    - How long have you worked at your office? How long is the general tenure?

- **TRAINING**: How do the pre-award staff get training or mentoring?

- **COOPERATION**: Do you do your tasks completely independently, or work closely with your colleagues? What types of cooperation?

<2> Service

- **AGENCY**: What are the major funding agencies for grant applications?

- **PROCESS**: Can you list the services you provide in proposal preparation and submission?
    - Could you tell me the details of the typical proposal submission process?
    - Do you meet PIs face to face?
    - When you get emails from PIs, how long does it take for you to respond to them?

- **WORKLOAD**: How many grant proposals do you deal with in one year, on estimate? How many PIs do you work with?

- **RELATIONS**: Do you have a continuing working relationship with the same PIs? How do you build the relationship?

- **GOOD/BAD**: What are the characteristics of good administrators and bad administrators?

- **TRUST**: Some PIs told me about trust and distrust issues between administrators and PIs. Could you tell me your experience or impressions about your case?

<3> Others

- **DIFFICULTY**: Could you tell me about the most difficult case you dealt with?

- **FEEDBACK**: Do you, or your unit, get any feedback from PIs on your work, unit, or the research administration system? Could you tell me in detail?

- **REPORTING**: Can you tell me about the reporting system? Who do you report to, and how do you oversee your team?

B
BURDEN LEVEL ASSESSMENT CODING PROTOCOL

BURDEN LEVEL ASSESSMENT CODING PROTOCOL

This is a coding of interview data at the level of each PI. The burden level of each PI, in terms of the number of tasks the PI needs to complete in the proposal process, based on their descriptions of what they need or do not need to do. Psychological cost is not considered.

Table 7. Content burden level assessment

Burden level	Roles and task contents of PIs	
Very low to low: PIs focus on scientific content only or do very minimum work in non-scientific parts	Science	Scientific project description and related parts
	Learning	No trouble, or minimum learning of rules and requirements such as deadlines and expected tasks
	Documents	No trouble, only very minimum work which requires input from PIs
	Compliance	No trouble, or very minimum check with high reliance on staff
	Process	No trouble
Moderate: PIs focus primarily on scientific content, with moderate administrative works	Science	Scientific project description and related parts
	Learning	Moderate learning of rules and requirements such as deadlines, expected tasks and basic formatting rules
	Documents	Document preparation with moderate staff support with tasks such as collection, drafting, finding templates and formatting
	Compliance	Compliance check with moderate reliance on staff
	Process	PI may arrange the process
High to very high: PIs do most or all of the preparation, including learning and compliance	Science	Scientific project description and related parts
	Learning	Thorough learning of rules and requirements with limited staff help
	Documents	Document preparation with limited help from the staff, such as document collection but not formatting
	Compliance	Check compliance themselves, regardless of staff help
	Process	PI is primarily responsible for arranging the process

C
PRE-AWARD QUALITY ASSESSMENT CODING PROTOCOL

PRE-AWARD QUALITY ASSESSMENT CODING PROTOCOL

This is a coding of interview data at the level of each PI. Pre-award quality here is defined as the combination of the availability and capacity of the staff, service and communication quality, occurrence and resolution of errors.

Table 8. Pre-award staff and service quality criteria

Level	Quality criteria
Poor	PI frequently experiences major problems with staff and services such the low level of knowledge and efficiency, or mistakes by staff, or staff and services are not easily available for PI
Decent	PI describes the staff and services as acceptable and of a fair quality. PI may experience minor problems, but not frequent or major problems
Good	PI describes the staff and services as good, with no major or frequent problems
Very good	PI describes the staff and services as excellent, with great staff capacity and availability, and no experience of significant problems, and errors are easily resolved when they emerge