The Curious Case of Alternate Sourcing: Studies on the Impact of Alternative Supply Chain Approaches

by

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ABSTRACT

The phenomenon of using alternative sourcing has attracted the attention of researchers in the field of supply chain and operations management. Alternative sourcing refers to any method other than the status quo. When competition arises in the marketplace, firms tend to innovate by deviating from status quo approaches and take risks to gain advantages throughout their supply chains. One such alternative sourcing risk is using soft criteria primarily in the supplier selection process. While anecdotal evidence exists, the supplier selection literature stream fails to explain how alternative sourcing might impact operational performance. Such alternative approaches- evaluating tangibles versus intangibles- have come under scrutiny. Firms have used soft criteria, considered more difficult to quantify, mainly as a supplement to hard criteria- those status quo criteria based on operational performance metrics of cost, quality, timeliness of delivery, service level, etc. Researchers and practitioners alike have found empirical evidence to support a plethora of theories regarding the impact of hard criteria in supplier selection on the operational impact of buyer-supplier relationships. This research examines alternative sourcing by studying alternative supplier selection criteria, simulating the status quo versus alternative supplier selection methodologies, and studying alternative supplier evaluation techniques. First, the qualitative examination of sourcing teams provides case studies in private and public sector organizations to abductively establish boundaries of alternative supplier selection approaches. Second, a numerical experiment compares status quo supplier selection versus alternative methodologies to ultimately test long-held supplier selection assumptions. Lastly, a qualitative study of alternative supplier evaluation techniques establishes boundaries of alternative supplier evaluation approaches. This research makes theoretical contributions to sourcing and organization behavior literature streams.

DEDICATION

This dissertation is dedicated to the most important people in my life, namely my family- both immediate and extended, my very close friends and colleagues, and my gracious and kind advising professors: Prof. Thomas Kull, Prof. John Fowler, Prof. Craig Carter, and Prof. Tingting Yan. I will acknowledge my advising professors in the Acknowledgment section but I would be remiss if I did not dedicate this to them as well. Each of you has played a tremendous role in my life, especially over the past five years and I am eternally grateful for everything. To my wife and children (Erin, Elder Landon Hatton, Hannah, Emily, Chocko, and Coco)- I love you with all of my heart and am so happy I can now dedicate time to each of you and enjoy the rest of our lives together. Thank you for putting up with me, or better said, putting up without me for so many days and nights. To my dad and mom, Dr. Lindle and Louise Hatton- thank you for loving me and inspiring me to reach farther and stand taller. To my deceased mother, Beverly Hatton- rest well Mommy, I hope you're smiling big now. To my parents-in-law, Donald and Janet Chandler, I am so grateful you were there when I couldn't be. To my close friends and colleagues both in and out of Arizona State University- there are too many to count but you all have been so kind and supportive. I am so grateful to you all. To my close friends, Jared and Anna Watts and family- thank you for always being the friends we needed and wanted for so many decades. To my Warrior Sons of Snow Canyon- not a day goes by where I don't think about you and think about the motivation I once tried to provide you on the court but in turn, you all provided me with much greater motivation. You inspired- and currently inspire- me to be better every day. To all of you, I dedicate my dissertation and my research and hope that it can provide just a small bit of improvement to the world of supply chain management.

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CHAPTER 1

INTRODUCTION

The phenomenon of using alternative sourcing has attracted the attention of researchers in the field of supply chain and operations management. Firms have used interesting approaches in alternative sourcing, some of which include various criteria to evaluate suppliers during the supplier selection process. This chapter explores the phenomena of alternative sourcing and introduces the overarching research questions that we explore throughout the three studies we conducted to fill the literature gaps on alternative sourcing. We also present the flow of chapters for the remainder of this dissertation in the concluding paragraph of this chapter.

As we consider supplier selection criteria on a continuum, on one end of the continuum is hard criteria, which are defined as easy to quantify, objective, and noncomplex criteria such as price, quality, and on-time delivery. On the other end of the continuum is soft criteria, defined as hard to quantify, subjective to human judgement, and more complex, such as supplier commitment to buyer, good management attitude, organizational ability to learn, and future potential. The use of soft criteria has been called upon for research as an approach in alternative sourcing, but to no avail. Soft criteria have been found in literature as a supplement to hard criteria – those criteria based on operational performance metrics of cost, quality, timeliness of delivery, service level, etc. Researchers and practitioners have found empirical evidence to support a plethora of theories regarding the impact of hard criteria in supplier selection on the operational impact of buyer-supplier relationships. As competition has arisen in the marketplace, firms have had to innovate and take risks to gain

advantages throughout their supply chains. One such risk is using soft criteria as primary criteria in the supplier selection process. In initial interviews, we found one large semi-conductor firm quoted as saying, "We have selected suppliers based on future potential – which isn't a quantifiable criterion – and the partnership turned out to be very lucrative." Another informant with first-hand experience stated that Honda selected suppliers primarily based on a "good management attitude." A third informant with first-hand supplier selection soft criteria experience stated, "We have selected small business suppliers, who compete with large corporations, because of the management dynamics between their top management and our purchasing managers, and the suppliers were able to grow their orders substantially over a short time." While anecdotal evidence exists, the supplier selection literature stream fails to explain how using primarily soft criteria or what the impact of using soft criteria in the supplier selection process might have on operational performance. If anything, extant literature theorizes that the primary use of soft criteria is detrimental and should not be attempted. Nevertheless, the supplier selection literature maintains an abundance of theory on supplier selection with hard criteria, with limited literature on soft criteria supplementing hard criteria, as well as how both supplier selection processes intersect with operational performance in buyer-supplier relationships. There is a gap in the literature concerning the primary use of soft criteria in the supplier selection process and firms gaining competitive advantage while on their way toward operational performance with such. This dissertation attempts to fill the gap by focusing on the supplier selection process with soft criteria in supply chains and its primary role in sourcing.

As companies have sought to gain a competitive advantage and increase operational performance, firms have taken long, hard looks across their buyer-supplier relationships. Firms have tried vertical integration toward smaller, leaner operations (Kannan and Tan, 2001; Prahalad and Hamel, 1990) and developed cooperative, mutually beneficial relationships with all suppliers (Mason, 1996; Copacino, 1996). Firms have leveraged their supplier bases to manage relationships more effectively with strategic suppliers (Kannan and Tan, 2001; Tully, 1995). Further, firms have involves suppliers in product design at earlier stages, and in doing so, generated more cost-effective design choices, developed alternative conceptual solutions, selected best components and technologies, and assisted in design assessment (Kannan and Tan, 2001; Monczka et al., 1994; Burt and Soukup, 1985). Firms have even sought alternative sourcing that has emerged in a prominent role in buyer-supplier relationships (Ellegaard et al., 2022). In all their efforts to effectively manage suppliers, organizations have developed greater dependence on their supply bases.

While many firms may differ in their approaches to managing suppliers, there are key trends that have emerged. First, effective supplier selection with quantifiable criteria (Ellram, 1990) such as price, delivery, quality, and service, are routinely used for supplier selection and assessment (Hahn et al., 1990). Second, supplier development activities such as site visits, training, and employing alternate suppliers are frequently used (Krause 1997). Third, meaningful supplier performance mechanisms have been deployed so that firms may manage their supplier bases as extensions of their own systems (Vonderembse and Tracey, 1999; Carter, 1996; Cooper and Ellram, 1993; Ettlie, 1995; Fawcett and Fawcett, 1995). Each trend

has focused on the aspect of hard criteria as the critical role in managing and evaluating suppliers.

Firms have long focused on the aspect of quantifiable criteria in both the supplier selection and supplier development processes. When a firm selects a supplier based on hard criteria, the outlook is always toward continuous operational performance in the firm's supply chain. When the supplier happens to come up short in its performance, firms look to step in and address the shortcomings. Firms have addressed supplier shortcomings in various ways and have become creative over time with their efforts (Bai and Sarkis, 2014; Govindan et al., 2010; Li et al., 2007; Krause and Ellram, 1997). In both practice and research, firms that specialize in supplier development in the quantifiable metrics of price, quality, delivery, and service level have gained a clear competitive advantage while operating a robust supplier development program.

Seeking new ways to increase operational performance while effectively managing their supplier bases has driven firms to seek alternative sourcing methods, focusing on criteria other than that of the hard, quantifiable nature. When firms seek alternative criteria in a supplier, they seek a complement to their supplier base and to their operations that doesn't currently exist. If firms can select a supplier based on attributes or characteristics that do not exist in their supplier bases, such buyer firms have the ability to add value in their supply chains. With anecdotal evidence in practice and limited literature on alternative sourcing, firms have no meaningful place to turn to find support for this method and practice. This dissertation thus attempts to address this research gap by asking the following grand research question:

How do organizations gain operational performance through alternative sourcing?

To answer the grand research question, this dissertation is broken into three closely related sections. Using an abductive approach, this dissertation seeks to use both the inductive power of empirical data along with the deductive power of theory to explore the primary use of soft criteria within the supplier selection process (Mantere and Ketokivi, 2013). The first study, starting in chapter three, is a qualitative study theorizing the use of alternative sourcing approaches, including the use of soft criteria in the supplier selection process. This qualitative study explores supply chain firms that use soft criteria in their supplier selection processes and uncovers the elements of soft criteria sourcing across organizations in public and private sectors, including: Why and how do organizations use primarily soft criteria, which soft criteria are most important, and why are they used through the supplier selection process? The first study aims to establish boundaries of the alternative sourcing process and to provide archetypes of the soft criteria supplier selection while providing propositions therein. Thus, this first study provides initial steps toward soft criteria sourcing theory, an understudied – if not neglected – supplier selection literature stream.

The second study, starting in chapter four, is a numerical experiment on the impact of supply chain conditions on the effectiveness of status quo sourcing compared to alternative sourcing. The motivation of this experiment arises from the need to clarify why alternative sourcing would be considered and to question status quo sourcing approaches such as the use of hard criteria in the supplier selection process. While status quo sourcing has focused primarily on the use of hard criteria, we introduce the use of soft criteria in chapter three with our first study. Some scholars have found alternative criteria, such as soft

criteria, more impactful than hard criteria (Kannan and Tan, 2001), while others have found the need for both supplier selection and supplier development (Vonderembse and Tracey, 1999). However, even though there have been repeated calls for such, literature still does not exist regarding the (1) justification of alternative approaches to the use of hard criteria, (2) the impact of alternative sourcing on operational performance, and (3) the ramifications on buyer supply chain design given operational performance through alternative methods. We propose that buyers use a status quo method – the use of hard criteria –to gain competitive advantage and operational performance in their supply chain operations. We present an alternative to the status quo – a random supplier selection method – for comparison to the hard criteria method. We relax assumptions regarding this status quo approach with hard criteria to examine the impact of mean price and mean delivery times of a diverse supply base community under differing market conditions. To numerically experiment with this proposed model, we propose a discrete event model simulation that is well suited to track flows of information, products, and attributes throughout a system or a supply chain (Sargent, 2000). As such, this study can generate managerial implications to assist supply chain managers in effective sourcing and managing their supplier bases.

The third study, starting in chapter five, is a qualitative case study that examines how sourcing teams interact with alternative, innovative supplier selection methods. We present alternative sourcing methods that have indications of soft criteria such as that of culture, namely organizational culture. This study builds on Shook's (2010) argument that organizations can act their way into thinking differently and thus change their organizational culture. This study expands on socio-technical system and provides hard evidence of

individuals' behavioral constraints that facilitate upstream, inter-organizational initiatives. Further, our third study recognizes that changing a supplier selection technique (such as procurement) will interact with social systems in a buyer organization. This section aims to establish boundaries of innovative sourcing techniques and to provide archetypes of the procurement process innovation while providing propositions therein. Thus, the third study provides initial steps toward upstream process innovation theory, an understudied – if not neglected – sourcing literature stream.

This dissertation contributes to the supplier selection literature in several ways. First, this paper fills a gap in the extant literature regarding the use of soft criteria in the supplier selection process while gaining successful operational performance. More specifically, this dissertation fills gaps in the descriptive as well as the prescriptive categories in the supplier selection literature stream. Second, there is a dearth of literature on the intersection of alternative sourcing and operational performance. However, there were gaps found in explaining operational performance and alternative methods such as soft criteria, as well as gaps in the resource-based view theory pertaining to the alternative sourcing methods, and this dissertation contributes additional research on this ntersection. Lastly, this dissertation contributes to a fledgling field of research in supplier selection focusing on diversity, equity, and inclusion. The use of alternative sourcing provides buyer organizations opportunities to augment and enhance their supplier ecosystems with a more diverse supplier base while including suppliers they may not have considered through status quo methods, such as the use of hard criteria. Further, buyer organizations that build out their supplier bases through

the use of hard and soft criteria are able to balance a supplier base that may be perceived as more equitable among suppliers in the supplier base.

This dissertation proposal is organized as follows. Chapter two is an extensive literature review on supplier selection criteria. Chapter three is an abductive case study of the existence of soft criteria in the supplier selection process that lays a theoretical foundation for the whole dissertation. Chapter four is s a numerical experiment on the impact of alternative sourcing in supplier selection processes. Chapter five is a qualitative case study on the impact of innovation on public procurement culture. Each section provides its own discussion and conclusion regarding the theories and concepts explored therein.

CHAPTER 2

LITERATURE REVIEW

2.1 Sourcing: Establishing Buyer-Supplier Relationships

The criticality and cooperative nature of buyer-supplier relationships (Kim and Choi, 2015) has been the focus of strategic sourcing literature through the past several years with a great deal of focus on purchasing's strategic importance (Spekman and Hill, 1980; Reck and Long, 1988; Spekman et al., 1994; Dyer, 1996; Carter and Narasimhan, 1996; Narasimhan and Das, 1999; Krause et al., 2000). Changes caused by competition and the overall global nature of markets have caused organizations to concentrate on their core competencies and downsize non-core areas, ultimately leading to increased outsourcing of parts and services (Krause et al. 2000). This increased effort to source parts and services from external organizations or partners has necessitated alignment of competitive priorities between operations and purchasing (Krause et al., 2000; Spekman et al., 1994; Ennis, 1905). As part of the competitive priorities, operations and manufacturing have long maintained a list of criteria of cost, quality, delivery, and flexibility (Ritzman et al., 1984; Swamidass and Newell, 1987; Adam and Swamidass, 1989; Cleveland et al., 1989; Ferdows and De Meyer, 1990; Roth and Van Der Velde, 1991; Kim and Lee, 1993; Vickery et al., 1993; Ellram, 1990; Miller and Roth, 1994; Noble, 1995; Ward et al., 1995; Safizadeh et al., 1996; Dean and Snell, 1996; White, 1996; Krause et al., 2000). Further, to ensure that such criteria are maintained as priorities in the buyer-supplier relationship, purchasing plays a key role in corporate strategies through the selection and development of suppliers that can support the firm's (buyer) long-term strategy and competitive positioning (Ellram and Carr, 1994). As part of

maintaining these competitive priorities, purchasing is tasked with creating a successful alliance and as such must weigh the associated costs (Lee, 2009). For purposes of this dissertation, the costs of creating a buyer-supplier relationship are referred to hereafter as costs of relationship. The costs of the relationship are simplified to costs of forming the relationship including financial cost, human resources, and coordinating and controlling costs. These costs are summarized in the form of labor costs. Also included in the costs of relationships is the time to form the relationship. Lastly, there is a cost of missing other opportunities that could have been investments of resources. This cost is referred to as the opportunity cost of the relationship. Thus, the costs of relationships are labor, time, and opportunity costs.

Buying organizations offer a key role in addressing some of the most critical aspects of the buyer-supplier relationship: (1) selecting suppliers, (2) managing costs of the buyer-supplier relationships, and (3) conducting supplier evaluation for operational performance. These three elements provide the foundation for this dissertation regarding operational performance in buyer-supplier relationships. The remainder of this literature review summarizes the extant literature on sourcing approaches toward operational performance.

2.2. Supplier Selection

Supplier selection has played an integral role in the forming of buyer-supplier-relationships. By using a supplier selection process, buying organizations are better equipped to assess supplier performance capabilities (Şen et al.,2008). With a strong supplier assessment, organizations can analyze suppliers who have resources and capabilities crucial to their supply chain (Badorf et al., 2019). For example, buying firms can benefit from a

supplier's time, cost, quality, flexibility, delivery, innovation, or technology capabilities (Ward et al., 1998). Hence, buying firms are likely to consider supplier resources and capabilities in their decisions to select suppliers (Krause et al., 2001). Consequently, strategic supplier selection decisions are important sources of competitive advantage for a buyer (Barney, 2012; Koufteros et al., 2012). Further research on supplier selection for competitive advantage has revealed supplier selection impacting operational performance (Kannan and Tan, 2001). Kannan and Tan (2001) argued that soft, difficult-to-quantify selection criteria such as a supplier's strategic commitment to a buyer, have a greater impact on performance than hard, more quantifiable criteria such as supplier capability, yet are considered less important. Kannan and Tan may have hypothesized boldly; however, they were not the first to pontificate on such soft factors.

In her seminal research, Ellram (1990) established defining categories (descriptive and prescriptive) for extant literature but argued that soft factors were to be considered in the supplier selection process, which includes the integration of balanced scorecards that buyers could use to score suppliers based on selection criteria. While Kannan and Tan may have initially heeded the call for a focus on supplier selection soft criteria, the literature is still lacking more refined definition and clarity. This literature review builds on Ellram's categorization (1990) and further clarifies the distinction between hard and soft criteria that Ellram, Kannan and Tan previously contended. With the categorization as part of the foundation of supplier selection literature, this dissertation holds the overall supplier selection literature to account for the lack of literature on supplier selection soft criteria. Further, this dissertation highlights the mandate for supplier selection soft criteria literature

given the need to explain the experience of firms that use primarily soft criteria for supplier selection yet experience superior operational performance.

2.2.1 Hard criteria

As a basis for this dissertation, we define hard criteria as the set of quantitative factors used to rank suppliers during the selection process (Ellram, 1990). Quantitative factors such as price, quality, timeliness of delivery (in terms of days/time "on-schedule"), and service level (in terms of quantity delivered and "on-schedule") are all attributes of a supplier that a buyer may deem important (White, 1987). Further, for analysis purposes, these attributes may be reviewed through a report or financial statement (White, 1987). The buyer organization will thus use a scorecard with each of these quantitative attributes to rank suppliers to determine which supplier or set of suppliers provides the optimal supplier or set of suppliers (Ellram, 1990).

The category of supplier selection hard criteria has been used under different names in various literature. Ellram (1990) originally referred to hard criteria as traditional supplier selection criteria that focus on quantifiable aspects, such as cost, quality, delivery reliability. Kannan and Tan (2001) referred to such criteria as quantifiable criteria. Sarkis and Talluri (2002) referred to these criteria as tangible factors. Carter et al. (2010) used the term quantitative factors when referencing supplier measures frequently compiled from objective reports and comparison. For purposes of this dissertation, the term "hard criteria" will be used to reference such criteria.

Research in the supplier selection hard criteria category includes prescriptive analytical ANH and analytical network process (ANP) models (Sarkis and Talluri, 2002; Sen

et al., 2008; Sharma and Yu, 2013). Other models such as DEA (Seydel, 2006), conditional logit (CLM) (Scott et al., 2018), and LOGIT regression (Badorf et al., 2019) have been presented. Further, multi-criteria decision making models have been applied to the supplier selection problem (Dulmin and Mininno, 2003; Chen et al., 2006; Ho et al., 2010; Rezaei et al., 2016; Chen et al., 2021). In addition to the above prescriptive literature, there have been systematic literature reviews conducted (de Boer et al., 2001; Rashidi et al., 2020). There have been sustainable supplier selection research studies conducted that have mostly focused on prescriptive models (Yu and Hou, 2015; Govindan et al., 2015; Awasthi et al., 2018). There has been a systematic literature review (Konys, 2019) and a descriptive vignette-based study (Thomas et al., 2021).

Hard criteria used in the supplier selection criteria have focused on strategic and operational factors such as cost, quality, delivery, flexibility (Sarkis and Talluri, 2002). Barb and Yazgac (1997) researched factors of low initial price (LP), compliance with cost analysis (CCA), cost reduction activities (CRA), and compliance with sectoral price behavior (CSP). Choi and Hartley (1996) studied factors of quality (conformance quality, CQ; consistent delivery, CD; quality philosophy, QP; and prompt response, PR), time (delivery speed, DS; product development time, PDT; partnership formation time, PFT), and flexibility (product volume changes, PVC; short setup time, SST; conflict resolution, CR; and service capability, SCAP). For the above factors, Sarkis and Talluri (2002) used an ANP approach and found that each of the hard criteria (tangible) used were included with intangible criteria to consider the dynamic aspects of the competitive environment in evaluating suppliers. While Sarkis and Talluri's model provided major advantage to decision makers by helping them think in a

comprehensive and detailed manner, the model did not provide implications for operational performance.

Kannan and Tan (2001) argued that hard and soft criteria may be deemed important but that each may impact a buying firm's business performance. Kannan and Tan's results showed that although hard criteria were common and integral to the supplier selection process, the soft and difficult-to-quantify criteria such as a supplier's strategic commitment to a buyer, have greater impact on operational performance than hard criteria. While Kannan and Tan's study provided an empirical breakthrough regarding the level of importance and impact of soft criteria for supplier selection and operational performance, their study did not explain the use of strictly soft criteria, but it did further underscore the importance of using both hard and soft criteria.

Carter et al. (2010) provided more clarity on hard criteria defining examples of labor cost, projected growth rate, transportation reliability, transportation costs, and border clearance times. They studied the influences of culture on supplier selection decisions and found that although hard criteria (such as low cost) and soft criteria (such as work ethic) are key to supplier selection, the location and cultural perception of the procurement manager also weighed heavily on the selection decision. Carter et al.'s study provided a thorough review of the supplementary qualities of soft criteria to hard criteria in the supplier selection process; however, it did not provide results of impact on operational performance, nor did it highlight relevance of any single soft criteria that could be evaluated as a singular criterion used in the supplier selection process.

2.2.2 Soft criteria

As a basis for this dissertation, we define soft criteria as the set of qualitative factors used to rank suppliers during the selection process (Ellram, 1990). Qualitative factors such as a supplier's strategic commitment to a buyer, supplier good management attitude, supplier future potential, and a buyer's intuition of a supplier are all attributes of a supplier that a buyer may deem important (White, 1987). Intuition, per Carter et al. (2017), was operationalized into three dimensions: experience-based, emotional, and automatic. Experience-based intuition revealed how decision makers recognized parallels to past decisions in making a current decision (Simon, 1992). Emotional intuition revealed a "gut feeling" or a "gut instinct" when a decision-maker was presented with uncertain situations (Sinclair and Ashkanasy, 2005). Lastly, automatic intuition is described as "direct knowing," and intuitive judgements are made rapidly, automatically, and almost effortlessly without conscious awareness and rational thought or reasoning (Sinclair, 2011). Kaufman et al. (2017) further clarify that the highest performance values are found when decision-makers successfully combine high degrees of rational processing and medium degrees of experienced-based and emotional intuition.

Ellram's (1990) initial research on soft criteria, or factors, was the start of a research stream in which others have made a similar call for research; however, the field remains understudied. Sarkis and Talluri (2002) referred to soft criteria as organizational factors like culture, technology, and relationships. Kannan and Tan (2001; 2006) and Polyviou et al. (2022) have called soft criteria the subjective criteria; however, soft criteria does not necessarily mean it can't be quantified. Carter et al. (2010) provided examples of soft criteria

as measures based on oral accounts, incident experiences, and subjective perception. Badorf et al. (2019) argued contextual factors such as economic, buyer, and relationship characteristics influence a buying firms' supplier selection decisions. For purposes of this dissertation, the term "soft criteria" will be used to reference such criteria.

Research in the supplier selection soft criteria category includes prescriptive analytical MCDAM (Dulmin and Mininno, 2003), DEA (Saen 2006) and AHP (Calvi et al., 2010) models. There is descriptive research using case studies (Like and Choi, 2004), survey instruments (Carter et al., 2010; Riedl et al., 2013), and scenario based experiments (Polyviou et al., 2018, 2022; Yan et al., 2018). Kannan and Tan (2001) used a survey instrument to compose the construct of soft criteria, while other research suggested that soft criteria may be composed by the use of a survey instrument (Carter et al., 2010). Other research includes descriptive studies such as Kull et al. (2014) who researched supplier selection behavior under conditions of uncertainly. They found that when contextual effects such as importance and difficulty of a sourcing category exist, higher risk perceptions increase preference for a supplier with more certain outcomes. However, cognitive effects, such as the presence of contingent pay, decrease risk perceptions through higher perceived control.

Soft criteria have spanned a wide range of non-quantifiable and subjective constructs in the supplier selection literature stream. Ellram (1990) researched culture factors such as feeling of trust (FOT), management attitude or outlook for the future (ATT), strategic fit (SF), top management compatibility (TMC), compatibility among levels and functions (CALF), and suppliers' organizational structure and personnel (SOSP). Technology factors (Ellram, 1990; Barb and Yazgac, 1997) were studied, such as technological compatibility

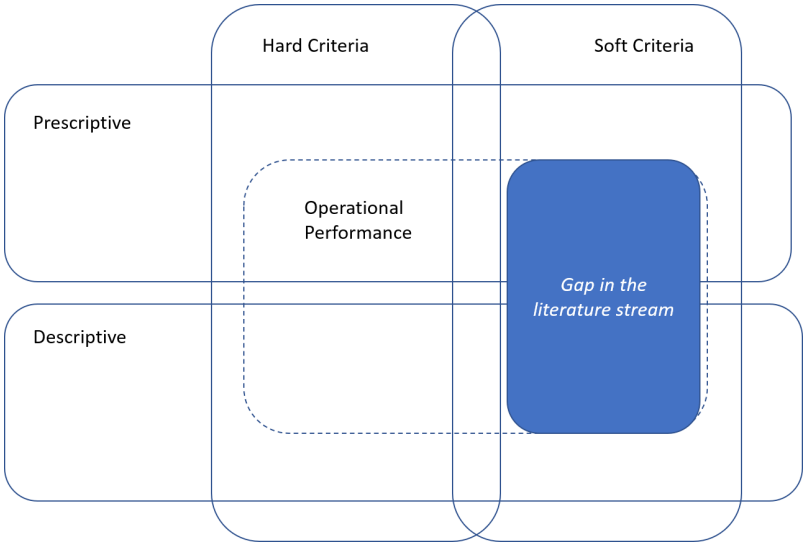
(TCOMP), assessment of future manufacturing (FMC), suppliers' speed in development (SSD), suppliers' design capability (SDC), technical capability (TCAP), and current manufacturing facilities/capabilities (CFC). Choi (1996) studied relationship factors, such as long-term relationship (LTR), relationship closeness (RC), communication openness (CO), and reputation for integrity (RFI).

The research on non-quantifiable criteria reveals works done by Kannan and Tan (2001, 2006) that highlight criteria not given as much importance as hard criteria yet prove to be more impactful than such hard criteria. Kannan and Tan's research was mostly dedicated to the impact of supplier selection and assessment on relationship and business performance in buyer-supplier relationships. Their findings have proved valuable to supplier selection literature, and their study found significance with correlation between a supplier selection soft criteria construct (supplier's strategic commitment to a buyer) and performance measures (market share, return on assets, product quality, and competitive position). They researched the impact of supplier assessment, and the results showed significant correlation between information sharing and the same performance measures (market share, return on assets, etc.). This dissertation builds on the research by Kannan and Tan to explore the hard-to-quantify, soft criteria used in the supplier selection process while expanding the literature stream to include criteria not yet explored in the supplier selection literature.

Figure 2.1 (Appendix A) reflects the typology of descriptive and prescriptive soft criteria research in supplier selection literature. Figure 2.2 below clarifies the categories as a two-by-two matrix of the supplier selection literature and further categorizes the literature into hard versus soft criteria. As shown in Figure 2.2, the research stream for both

prescriptive and descriptive soft criteria in supplier selection literature is lacking, and this dissertation will begin to empirically fill this gap.

Figure 2.2 Supplier Selection Literature Stream



2.2.3 Categorization

Ellram (1990) argued that buyer-supplier partnerships are different in nature as firms become more involved in strategic partnerships. Building on the reverse marketing concepts of Leenders and Blenkhorn (1988), Ellram created categories for supplier selection literature and later established a supplier selection normative guide (Ellram, 1995) while arguing that successful buyer-supplier partnerships can complement Hahn et al.'s (1990) concept of supplier development. The categorization provided a framework that Landeros and Monczka (1989) followed, presented general descriptions of buyer/supplier relationships, and contrasted the attributes of such relationships with traditional approaches. Further, Ellram stated that supplier selection models may be based on the way in which model proponents believe a decision should be made (prescriptive/normative) or the way they

believe decisions are actually made (descriptive). The following sections explore the categories and further clarify the distinction within the categories for supplier selection criteria.

2.2.3.1 Descriptive supplier selection

Research on supplier selection in the descriptive category has been focused on three sub-categories: supplier selection criteria identification, supplier selection under specific buying conditions, and supplier selection under business pressures. Literature on supplier selection criteria identification used by buyers to select supplier partners includes research by Dickson (1966), who argued that supplier selection systems may vary depending on the buyer organizations products. They argued that factors within such a selection system should be weighted relative to one another. Similarly, Lehman and O'Shaughnessy (1982) furthered the supplier selection criteria to expand to a theoretical taxonomy of buyer choice criteria and categories. Both studies focused on the supplier selection criteria yet did not expand their research to consider operational performance.

In more contemporary research, Carter et al. (2010) researched the influences of Western (European) and Eastern (China) cultures on supplier selection criteria. They found that procurement managers select regions for low-cost sourcing based on specific measures and individual and/or group perceptions of the region, whether these perceptions are correct or not. Koufteros et al. (2012) examined whether the strategic selection of suppliers based on suppliers' new product development capabilities, supplier quality capabilities, and supplier cost capabilities directly and/or indirectly enhance the buyer's competitive performance capabilities in the matched domains of buyer product innovation, buyer quality,

and buyer competitive pricing, respectively. Nair et al. (2015) researched supplier selection criteria with a focus on strategic and operational supplier selection criteria. Nair et al.'s research found that purchasing's participation in strategic activities positively influenced supplier selection criteria, both from a strategic and an operational perspective. Kurpjuweit et al.'s (2021) research on selecting startup companies as suppliers expanded the supplier selection criteria identification to include startups such that organizations may be more likely to select a suitable startup as a supplier. They developed five supplier selection themes pertaining to a buying firm's (1) strategic focus, (2) type of selected startup, (3) organizational approach, (4) identification efforts, and (5) evaluation approach, and they assigned all sample firms to three archetypes: skeptical buyers, opportunistic buyers, and systematic buyers. Lou et al. (2022) incorporated supplier selection into a framework of interorganizational control systems. Straddling Ellram's descriptive and prescriptive categories, Lou et al.'s research used the fsQCA (fuzzy set qualitative comparative analysis) methodology and found that the combination of innovation-oriented supplier selection and trust can promote radical innovation while combining efficiency-oriented supplier selection with three kinds of control (outcome controls, behavior controls, and trust) can promote incremental innovation.

Other contemporary literature by Kannan and Tan (2001; 2005) provide unique insight into the impact of supplier selection and assessment on the buying firm's business performance. Kannan and Tan (2001) found that soft criteria such as strategic commitment, honesty, and integrity correlated more broadly with operational performance than hard criteria such as price, quality, and on-time delivery. Kannan and Tan (2005) further investigated buyer-supplier relationships and found a positive relationship between supplier

selection, buyer-supplier engagement, and firm performance. While Kannan and Tan's research is uniquely positioned between descriptive and prescriptive categories, it focuses mainly on what Ellram would describe as "hard" supplier selection criteria while calling on firms to pay more attention to "soft" criteria; their study did not specifically research the soft criteria as a primary component of supplier selection.

Additional descriptive supplier selection research focused on supplier selection under specific buying conditions. For example, Swift (1995) researched the differences in supplier selection criteria among organizations that prefer single sourcing products compared to organizations that prefer multiple sourcing products. They found that buyers' sourcing preference (single versus multiple) was a determinant of choosing between suppliers with total cost of the product rather than price. Dempsey (1978) and White (1978) researched purchases of routine (new task purchase) and non-routine (modified rebuy purchase). Dempsey found relative importance of vendor attributes and buyer information sources depended on the type of buying task performed. Similarly, White's (1978) research focused on understanding the relationship between product categories and buying situations. Furthermore, Verma and Pullman (1998) researched the alignment between purchasing managers' perceived importance of supplier attributes and their actual choices of suppliers.

More contemporary literature conducted by Harland et al. (2008) takes on a network perspective and develops a conceptual model to compare networking activities across eight cases. Their conceptual model provides a taxonomy of supply networks while providing managerial guidance on how to create and operate different types of supply networks in different circumstances while further providing a basis for partner (supplier) selection within

the proposed network. Yan et al. (2020) researched how the information about supplier ties (external innovation partners, other-industry customers, buying firm's competitors) affect a purchasing manager's perception about the supplier's potential contributions to innovation novelty and information protection in a buying firm's new product development (NPD) project. Yan et al. found that – when innovation novelty is the goal – managers perceive other industry customer ties and external innovation ties as positive signals and competitor ties as a negative signal. When information protection is the goal, all three types of ties are perceived negatively. Thomas et al. 2021 researched the impact of social sustainability criteria, such as supplier investments in their own employee welfare and philanthropic efforts, on supplier selection. They found that social sustainability signals (such as an organization's employee welfare or philanthropy) impact supplier selection decisions, but their impacts are varied and nuanced depending on the presence of other signals such as the increase or decrease of price.

Lastly, descriptive supplier selection research has focused on supplier selection under business pressures. Choi and Hartley (1996) conducted research on supplier selection at different points in the automotive supply chain and found that no differences among the auto assemblers, direct suppliers, and indirect suppliers were found regarding the importance placed on consistency (quality and delivery), reliability, relationship, flexibility, price, and service. There were, however, statistically significant differences between the auto assemblers and indirect suppliers on the importance placed on technological capability and financial issues. Other business pressures spanned into global markets, as Min et al. (1994) researched global sourcing activities and argued that multiple attribute utility theory (MAUT) can

effectively deal with the conflicting qualitative and quantitative factors in multiple criteria and uncertain decision environments. Piercy et al. (1997) researched global markets with buyer-supplier relationships in export performance and found that supplier selection criteria impacted export performance; however, customer criteria alignment with supply criteria and a growing need for focus on soft criteria were key findings from their research.

More contemporary literature done by Sen et al. (2008) presents a framework for defining the supplier selection criteria – given the company's competitive situation – by investigating possible quantitative and qualitative criteria (reported by earlier studies) according to the levels of the buyer–supplier relationship and its corporate strategies, rather than investigating these criteria in respect of product category. Riedl et al.'s (2013) research examined antecedents and outcomes of procedural rationality and developed a comprehensive model of factors including organizational characteristics (accountability and incentives), situational characteristics (product dynamism and time pressure), and personal characteristics (product familiarity and work experience). They found that managers rely on procedural rationality to reduce uncertainty in supplier selection decisions while researching cross-country (U.S. and China) effects. Kull et al. 2014 researched supplier selection behavior under uncertainty. Their study examined contextual and cognitive effects – experienced by supply managers – on risk perception and choice. They found that there may be general risk-aversion in managers selecting supply partners based on sourcing category importance, contingency pay, and perceived supplier control. Badorf et al. 2019 investigated how suppliers' economies of scale influenced the buyer's selection decision, and illustrated how the influence of scale is contingent upon important economic, buyer, and relationship

characteristics. Badorf et al. argued that economies of scale have a strongly positive but diminishing effect on the buying firm's supplier selection decision. Polyviou et al. 2022 examined how prior supplier selection decisions gone awry influence future supplier selection decisions through the emotion of guilt. Their study demonstrated that supply disruptions in one context have carryover effects on future sourcing decisions in unrelated contexts.

2.2.3.2 Prescriptive supplier selection

Research on supplier selection in the prescriptive category has focused on two sub-categories: (1) variety of methods and (2) assessment criteria. First, the literature on the variety of methods includes mathematical programming (Turner, 1988; Pan, 1989), weighted average methods (Timmerman, 1986; Thompson, 1990), payoff matrices (Soukup, 1987), and analytical hierarchy processes (Narasimhan, 1983; Nydick and Hill, 1992; Babarsoglu and Yazgac, 1997). Research done by de Boer et al. (2001) presents a review of methods supporting supplier selection, many of which are presented in the following paragraphs.

More contemporary literature includes research by Sarkis and Talluri (2002), who present a strategic decision model using the analytical network process (ANP), which allows inputs from a variety of managerial decision-making levels (strategic to operational) while considering the dynamic competitive environment. Their work advances the use of ANP as an effective and more realistic modeling approach for supplier selection compared to the more popular (at the time) multi-attribute decision-making tool, the analytical hierarchy process (AHP) (Saaty, 1980). Chen et al. (2006) present an approach for supplier evaluation and selection while proposing a hierarchy multiple criteria decision-making (MCDM) model

based on fuzzy-sets theory. Calvi et al. 2010 developed a decision model for supplier selection using an analytic hierarchy process (AHP) based on relevant criteria including supplier improvement potential through buyer involvement, strategic factors of the supplier development program, and strategic importance of the supplier. Their study confirmed the importance of supplier criteria, such as supplier commitment and capabilities, are essential for successful completion of a supplier development project.

Further, Saen (2006) and Seydel (2006) advance the use of data envelopment analysis (DEA) as a prescriptive tool for supplier selection. Saen (2006) proposed an innovative method for selecting technology suppliers in the presence of nondiscretionary factors (political, economic, and military considerations, for example) from a supplier's perspective. Seydel (2006) proposed a DEA approach for decision-makers faced with the complexity of a multi-criteria supplier selection problem involving difficult or impossible criterion weighting.

Other methods of supplier selection modeling include best worth method (BWM) which Rezaei et al. (2016) proposed with an innovative three-phase supplier selection methodology including pre-selection, selection, and aggregation. Scott et al. (2018) examined price-oriented maverick buying (MB) during supplier selection. They used a discrete choice experiment – designed to simulate a TCO-based supplier selection process – in which an established purchasing framework agreement stipulates purchasing managers not necessarily be price-oriented (i.e., select suppliers primarily based on lowest price). They then modeled purchasing managers' choice behavior in the supplier selection process (SSP), using a conditional logit model (CLM) to determine purchasing manager compliance to the established purchasing framework agreement and identified if price-oriented MB exists. Yu

and Hou (2016) studied a modified multiplicative analytical hierarchy process (MMAHP) that was combined with multi-criteria decision making (MCDM) and applied to a sustainable supplier selection problem where both quantitative and qualitative factors had to be considered. Awashti et al. (2018) address the sustainable supplier selection problem with a two-stage model. In the first stage, fuzzy AHP is used to generate criteria weights for sustainable global supplier selection, and in the second stage, fuzzy VIKOR (in Serbian: VlseKriterijumska Optimizacija I Kompromisno Resenje) is used to rate supplier performances against the evaluation criteria. Chen et al. 2021 built a multi-perspective MADM (MPMADM) framework to offer systematic decision support for enterprises to select the optimal third-party revere logistics providers. The findings of their model were such that it eliminated distortion and loss of information and provided decision makers with the capability to control the outcome's precision.

Additional prescriptive supplier selection literature includes the criteria used by buying firms to assess supplier performance (cost, quality, delivery, and service) including research by Monczka and Trecha (1988), who presented a cost-based supplier evaluation system predicated on the recognition that material price is only a fraction of the cost of the purchased material. Further, their system – used to improve the buyer-supplier relationship – identified supplier non-performance costs that accurately reflected the actual cost of doing business with suppliers. Giunipero and Brewer (1993) researched supplier evaluation systems as a means to validate supplier selection. Their research focused on a case study with a firm that implemented TQM/JIT to evaluate their supplier base and found that improvements

were gained in customer satisfaction and lower costs while improving both supplier performance and selection process.

More contemporary literature has provided reviews by Ho et al. (2010) and Rashidi et al. (2020) to assess supplier performance. Sharma and Yu (2013) use an AHP to analyze supplier performance using multi-criteria decision procedures along with Pareto analysis in identifying sub-optimal suppliers to be included in the supplier development to optimize the supply chain performance. Konys (2019) provides meta-analysis to reveal a collection of key data supported by a formal and trustworthy bibliometric analysis. Konys captured knowledge in one place in the form of ontology for enabling selection and evaluation criteria of green suppliers.

While the categories that Ellram established in her seminal citation have been helpful and guiding, literature has emerged to further sub-categorize and further clarify the supplier selection approach in research and practice. This dissertation further clarifies these sub-categories into "hard" and "soft" criteria categories in the paragraphs that follow.

2.3 Operational Performance with Supplier Selection

The supplier selection literature examines the impacts of both hard and soft criteria on operational performance. The research stream has focused on either the impacts of strictly hard criteria of supplier selection on operational performance (Vonderembse and Tracy, 1999) or the impact of soft criteria supplementing hard criteria on operational performance (Kannan and Tan, 2001,2006). Other research includes the impact of strategic and operational supplier selection on purchasing performance (Nair et al., 2015). In the

following sections, this dissertation proposal reviews the literature pertinent to the impact of supplier selection criteria on operational performance.

2.3.1 Operational performance through hard criteria of supplier selection

As part of their research on effective buyer-supplier relationships, Vonderembse and Tracy (1999) found that high performing manufacturing organizations had all elements of supplier performance and supplier involvement and all but one the four supplier selection criteria (of their study, including product quality, product availability, delivery reliability, and product performance) when compared with a low performing group. They operationalized supplier performance by surveying practitioners and asking them to rate the importance of dimensions like raw material availability, timeliness, in-transit damage, and incoming quality. Further, they operationalized manufacturing performance with indicators such as rework costs, unit costs of finished products, quality of outgoing products, level of work-in-process inventory, on-time delivery of outgoing products, and material handling costs. While Vonderembse and Tracy found significant positive correlations between supplier selection criteria, supplier involvement (with the buyer), and supplier performance, there was not as strong significance between supplier selection and manufacturing performance. Also, they did not find that buyers' widespread use of supplier selection carried over as much into buyers' use of supplier involvement. Their research did not focus on soft criteria in the supplier selection process.

Nair et al.'s (2015) research focused on operational and strategic criteria in supplier selection and supplier performance evaluation. Their study centered more on the role of strategic purchasing participation and found that purchasing's participation in strategic

planning influences purchasing performance directly (cost, quality, delivery, flexibility, and innovation) as well as through the mediating effects of supplier selection criteria and supplier performance evaluation. While helpful in expanding the literature, Nair et al.'s study did not focus on any impact of soft criteria on supplier selection, nor on impacting buyer and supplier performance.

While studies conducted by Vonderembse and Tracy (1999) and Nair et al. (2015) maintained a central focus on core criteria considered to be hard criteria, their studies did not focus on the conceptualization of soft criteria impacting supplier selection as well as impacting objective operational performance measures from both buyers' and suppliers' perspectives.

2.3.2 Soft criteria supplement hard criteria for operational performance

Kannan and Tan (2001, 2006) expanded Vonderembse and Tracy's research not only to focus on supplier selection and involvement but also to include broader measures of business performance impact on the buyer, as well as supplier management tactics for supplier assessment. Their first study (2001) focused on the buyer's business performance and found that although soft criteria were considered less important, they were more impactful on the buying firm's business performance; however, the hard criteria within their study still played an integral role within each of the constructs used for supplier selection criteria. To operationalize soft criteria, Kannan and Tan (2001) used a questionnaire with various questions on how important respondents deemed various soft criteria such as suppliers' strategic commitment to a buyer organization. Criteria such as the existence of a supplier invoicing system, supplier use of just-in-time (JIT) principles, buyer's annual orders,

and supplier's profit from supplying to the buyer were all used within the construct of "strategic commitment of supplier to buyer." Kannan and Tan (2006) conducted research on the impact of supplier selection and buyer-supplier engagement on relationship and firm performance. Their follow up study (2006) maintained components of hard criteria yet revealed the importance of selection factors outside of operational selection criteria to be considered when exploring strategic partnerships in buyer-supplier relationships. Both of these studies reflect the combination of hard and soft criteria with the focus on soft criteria as a supplement to hard criteria in the supplier selection process.

Koufteros et al. (2012) examined whether strategic supplier selection based on suppliers' capabilities (new production development, quality, and cost) either directly or indirectly enhance a buyer's competitive performance capabilities in the buyer's corresponding matched domains (buyer production innovation, buyer quality, and buyer competitive pricing). They found direct effects of the strategic supplier selection capability on the buyer's competitive capability. For instance, if a buyer selected a supplier based on the supplier's new product development capability, the buyer then gained a competitive advantage in product innovation. However, they did not find indirect effects – through integration mechanisms of supplier partnerships and supplier development – nor did they find direct effects of supplier selection capability on unmatched domains (for instance, selecting a supplier based on the supplier's new product development capability and the buyer gaining a competitive advantage in quality or cost capability). While Koufteros et al.'s research underscored the criticality of supplier selection for competitive buyer performance,

it further highlighted how hard criteria in the supplier selection process was supplemented by soft criteria.

Kurpjuweit et al. (2021) studied the selection of startup companies as supplier partners. They found that four dimensions of suitable new venture suppliers (resource and capability, strategic, technological, and market fit) applied to two performance indicators (identification and evaluation), creating three startup supplier selection archetypes. Kurpjuweit et al.'s study highlighted the less formalized, less deterministic, and even perhaps less objective selection process of selecting startups compared with established suppliers while highlighting a greater weight on soft criteria. However, there was no complete separation from hard criteria as the dimensions above highlight.

Lou et al. (2022) researched the impact of different combinations of supplier selection (efficiency-oriented and innovation-oriented) and control mechanisms (outcome controls, behavior controls, and trust). Using a combination of qualitative and quantitative analysis (fsQCA – fuzzy set qualitative comparative analysis), they combined supplier selection (efficiency-oriented and innovation-oriented selections), formal controls (outcome and behavior controls), and informal controls (trust). Their main findings – that hard (technical characteristics) criteria combined with soft (trust) criteria) – highlight the supplier selection tenet that soft criteria supplements hard criteria in the supplier selection process.

2.4 Phenomena of Primary Use of Soft Criteria

The supplier selection literature thoroughly reviews the use of hard criteria for improved operational performance. Further, literature shows that soft criteria is used in tandem with or even as supplementary criteria to that of hard criteria in the supplier selection process.

However, more firms have shown the use of strictly soft criteria to improve operational performance. Case studies done with Honda and Toyota (Liker and Choi, 1996; Choi and Liker, 2004) have shown that Honda selects suppliers based on a "good management attitude." Knowledgeable informants and researchers alike have shared that Honda does not select suppliers based on hard criteria. Practitioners at other large firms, such as Dupont and TSCM, have shown to select suppliers with criteria other than hard criteria. Dupont shared that they have the need for flexibility within the management structure, and TSCM revealed that their selection criteria was many times based on technological growth potential. This phenomenon is found in sports; many professional basketball and football teams will choose and put on the field of play players who are not the fastest nor strongest, nor do they have the best technical capabilities, and many times have qualities that are not tangible, yet those qualities are their best qualities – and the qualities that have earned them playing time on the field – are labeled intangible.

The use of primarily soft criteria in the supplier selection process is a phenomenon that lacks explanation in extant literature as is evidence by the current literature review, which includes literature well over twenty years old. Further, based on extant literature, it follows that supplier selection with strictly soft criteria (and no hard criteria) would not positively impact operational performance. This paper argues that supplier selection with primarily soft criteria will not only positively impact operational performance but will provide new insights on costs and benefits of supplier selection and supplier involvement (in the form of supplier development) leading to operational performance in the buyer-supplier relationship. Given the current landscape of supplier selection literature focusing on operational performance,

no such theory or research exists that can explain the strictly soft criteria supplier selection process leading to operational performance. This dissertation aims to fill this gap and provides a novel approach to supplier selection where supply chain managers may analyze costs and benefits of both quantifiable, known suppliers and hard-to-quantify, unknown suppliers and decide how to better invest their resources into a potential buyer-supplier relationship. The supplier selection literature alone is not able to explain operational performance in buyer-supplier relationships. A literature stream that has contributed theory and provides a vast array of support for buyer-supplier operational performance is the supplier development literature stream.

2.5 Resource-based View (RBV) Theory

A firm's competitive advantage is an outcome of efficient management of supply chain resources and requires high coordination between the firm's activities, information sharing capability, and its stakeholders. Managing the supply chain resources is a complex activity and involves decision-making processes at various levels (Reefke et al., 2014; Correia et al., 2017). As per the resource-based view (RBV), the sustainable competitive advantage can be achieved through the acquisition of, and control over, supply chain resources. The RBV further explains that the supply chain resources and capabilities are associated with a competitive advantage (Wernerfelt, 1984; Barney, 1991; Peteraf, 1993). The supply chain resources can be categorized into tangible (e.g., physical) and intangible (e.g., organizational knowledge) assets that support the activities related to production and delivery of goods and services (Penrose, 1959; Grant, 1991; Amit and Schoemaker, 1993; Gupta and George, 2016). However, the achievement of such an advantage is determined by the extent to which

the organization has acquired and developed these resources and capabilities (Barney, 1991). Barney (1991), Peteraf (1993), and Rungtusanatham et al. (2003) identified five characteristics of resources, referred VRINN (valuable, rare, not imitable, imperfectly mobile, and not substitutable), these resources support the firms in achieving a sustainable competitive advantage. In the supply chain management literature these resources are classified in six types: financial, physical, human (managerial and technical skills), organizational, technological, and intangible (reputation, brand recognition, data-driven culture, and organizational learning) (Braganza et al., 2017).

Wernerfelt (1984) argues organizations overlook the effects internal resources have on competitive advantage, in favor of industry, market, and product related factors. Barney (1986b) suggests internal resources are greater determinants of strategic advantage than external factors. Dierickx and Cool (1989) recognize the importance of internal resources; they posit resources deployed to achieve competitive advantage must be developed and accumulated within organizations and cannot be bought or obtained from markets. They distinguish between strategic non-tradable assets, which they describe as asset stocks and asset flows, which can be purchased externally. Barney (1986a) identifies resources that form sources of competitive advantage. He suggests strategic resources have four attributes: value, rarity, imperfect imitability and non-substitutability. The degree of heterogeneity of resources influences the potential for sustainable competitive advantage (Conner, 1991). The suggestion is the first two attributes of VRIN, value and rarity, confer competitive advantage, whereas, inimitability and non-substitutability, when present in conjunction with the other two, confer sustainability. Conner (1991) stresses entrepreneurial vision and

intuition are required to determine which resources contribute to sustainable competitive advantage. Mahoney and Pandian (1992) (citing Hofer and Schendel, 1980), suggest the following resource types: (1) financial resources, (2) physical resources, (3) human resources, (4) organizational resources (quality control systems, corporate culture, relationships), and (5) technological capabilities. To Hofer and Schendel's list they add a sixth category of intangible resources (e.g., reputation, brand recognition, goodwill), citing Grant (1991). The influence of internal factors such as conflict, cognitive biases of managers, and inertia, on the deployment of strategic resources, is highlighted by Amit and Schoemaker (1993). When making deployment decisions, managers contend with (1) uncertainty, (2) complexity, and (3) intra-organizational conflict. They suggest new firms challenge their own beliefs, approach the future more imaginatively and are better able to handle complexity. An approach to strategy development that starts with resources, rather than industry analysis, is proposed by Grant (1991), who describes capabilities as "teams of resources" (p.110) and mentions their similarity to "organizational routines" (p.122). In relating resources, capabilities, and organizational routines, together with factors of coordination, configuration and renewal, the general outline of dynamic capabilities emerges, which is discussed next.

2.8 Summary

This literature review has revealed a number of gaps in the extant literature regarding alternative sourcing – particularly the use of soft criteria – in the supplier selection process and gaining successful operational performance. First, the literature cited is well over twenty years old or older and shows that researchers have either chosen to not study such sourcing or that they may have found evidence in their studies to reveal a deeper study of hard criteria

as a more viable research strategy. In either case, the lack of research in the alternative sourcing research stream provides ample opportunity to research the impact of alternative sourcing approaches. This dissertation will fill gaps in the descriptive as well as the prescriptive categories in the supplier selection literature stream. In addition, there were gaps found in the sourcing literature that explain operational performance through alternative sourcing in theories such as resource-based views and socio-technical systems. There is an abundance of literature on the intersection of supplier selection and supplier development; there is vast research on resource-based view and how organizations are able to combine resources with suppliers. Within the RBV literature stream, there have been calls for more literature on how supply chain practices depend on external environments (Zhou et al., 2014; Patel, 2012; Sousa and Voss, 2008). This dissertation fills the gaps in the following three papers.

CHAPTER 3

STUDY 1 QUALITATIVE CASES IN SOFT CRITERIA SOURCING

3.1 Introduction

Organizations face alarming costs in buyer-supplier relationships particularly with respect to supplier selection. Such costs arise from having to invest in supplier selection processes involving hard criteria such as cost, quality control, delivery audits, product development review and integration. Buyer organizations search for ways to reduce costs in the supplier selection process. One such way exists, however, there is no extant literature to currently support such a supplier selection process. This paper establishes a literature stream of soft criteria used in the supplier selection process to help firms to reduce costs during the selection process.

The concept of using soft criteria in the supplier selection process, i.e., assessing intangible resources like the suppliers' culture, is not new, nor is it rare. Organizations have used soft criteria as a supplement to hard criteria (i.e., tangible resources like lead time and price) in the supplier selection process and have gained operational performance. Operational performance in both buyer and supplier organizations has manifested through improved costs, quality improvements, increased timeliness of delivery, and innovative customer products. Other operational performances include outcomes such as efficiency in information sharing, highly integrated new product development initiatives, and operational performance initiatives like supplier development. However, these outcomes, as have been documented in the supplier selection literature, have resulted from primarily hard criteria and secondarily soft criteria during supplier selection processes. The supplier selection literature

does not reveal any studies with primarily soft criteria used in the supplier selection process. However, there is practitioner phenomena that reflect such a supplier selection process exists.

Informants from various firms have revealed varying supplier selection processes and techniques particularly with respect to the use of only soft criteria. One such process is that of the primary use of soft criteria for supplier selection to gain operational performance. Informants from three large supply chain organizations (automotive, technology, and consumer durable goods) shared that their organizations selected suppliers strictly based on soft criteria, or hard-to-quantify criteria. Additionally, each informant shared that these supplier selections involved some form of immediate supplier development due to the selected suppliers' ability to gain and use knowledge from the buyer and the market or environment (absorptive capacity). Further, other informants have shared that their organizations have create a diversity, equity, and inclusion program which allows the buyer organization to search for and select suppliers based on criteria that do not typically follow the hard criteria approach. This raises the research question: *How do buying organizations conduct the supplier selection process primarily using soft criteria yet gain operational performance?* This paper examines the theory of soft criteria in supplier selection processes. Since this theory is new and not explained by extant literature, this research uses an abductive approach through qualitative methods to propose that using soft criteria in the supplier selection process is possible for improved operational performance. We will use the existing theoretical background (deduction) along with our observations (induction) along with other questions to drive our qualitative investigation. The focus of this research is on elements such as when

and under what conditions are primarily soft criteria used, and which soft criteria are the most important through the supplier selection process. Further, are there specific industries that may use soft criteria more or less frequently? In the following sections, this paper proposes theoretical background regarding the use of soft criteria, proposed methodology to answer this paper's research question, and expected outcomes from the proposed methodology.

3.2 Theoretical Background

Literature on the intersection of supplier selection and supplier development was originally conducted by Vonderembse and Tracy (1999). Their study found that high performing manufacturing organizations had all elements of supplier performance and supplier involvement (development) and all but one the four supplier selection criteria (product quality, product availability, delivery reliability, and product performance) when compared with a low performing group. Kannan and Tan (2001, 2006) expanded Vonderembse and Tracy's research not only to focus on supplier selection and involvement but also to include broader measures of business performance impacts on the buyer and supplier management tactics for supplier assessment. Their first study (2001) focused on the buyer's business performance and found that although soft criteria were considered less important, they were more impactful on the buying firm's business performance; the hard criteria still played an integral role within each of the constructs used for supplier selection criteria. Criteria such as the existence of a supplier invoicing system, supplier use of just-in-time (JIT) principles, buyers' annual orders, and suppliers' profits from supplying to the buyer were all hard criteria used within Kannan and Tan's (2001) construct of "strategic

commitment of supplier to buyer." Kannan and Tan (2006) also conducted research on the impact of supplier selection and buyer-supplier engagement on relationships and firm performance. Their follow up study maintained components of hard criteria yet revealed the importance of selection factors outside of operational selection criteria when exploring strategic partnerships in buyer-supplier relationships. Both studies reflect the combination of hard and soft criteria with the focus on soft criteria as a supplement to hard criteria in the supplier selection process.

Koufteros et al. (2012) examined whether strategic supplier selection based on suppliers' capabilities (new product development, quality, and cost) either directly or indirectly enhance a buyer's competitive performance capabilities in the buyer's corresponding matched domains (buyer production innovation, buyer quality, and buyer competitive pricing). Koufteros et al. found direct effects of the strategic supplier selection capability on the buyer's competitive capability. For instance, if a buyer selected a supplier based on the supplier's new product development capability, the buyer then gained a competitive advantage in product innovation. However, Koufteros et al. did not find indirect effects through integration mechanisms of supplier partnerships and supplier development, nor did they find direct effects of supplier selection capability on unmatched domains (for instance, selecting a supplier based on the supplier's new product development capability and the buyer gaining a competitive advantage in quality or cost capability). While the research of Koufteros et al underscored the criticality of supplier selection for competitive buyer performance, it further highlighted how hard criteria in the supplier selection process were supplemented by soft criteria.

Kurpjuweit et al. (2021) studied the selection of startup companies as supplier partners. They found that four dimensions of suitable new venture suppliers (resource and capability, strategic, technological, and market fit) applied to two performance indicators (identification and evaluation) and created three startup supplier selection archetypes. Their study highlighted the less formalized, less deterministic, and even perhaps less objective selection process of startups compared with established suppliers, while highlighting a greater weight on soft criteria. However, there was no complete separation from hard criteria.

Lou et al. (2022) researched the impact of different combinations of supplier selection (efficiency-oriented and innovation-oriented) and control mechanisms (outcome controls, behavior controls, and trust). Using a combination of qualitative and quantitative analysis (fsQCA- fuzzy set qualitative comparative analysis), Lou et al. combined supplier selection, formal controls (outcome and behavior controls), and informal controls (trust). Their main findings – that hard criteria (technical characteristics) combined with soft criteria (trust) –highlight the supplier selection tenet that soft criteria supplement hard criteria in the supplier selection process.

One path to explain how soft criteria may play an impactful role in sourcing may be found in resource-based view (RBV) theory. As per the RBV, the sustainable competitive advantage can be achieved through the acquisition of and control over supply chain resources. The RBV further explains that the supply chain resources and capabilities are associated with a competitive advantage (Wernerfelt, 1984; Barney, 1991; Peteraf, 1993). The supply chain resources can be categorized into tangible (e.g., physical) and intangible (e.g.,

organizational knowledge) assets that support the activities related to production and delivery of goods and services (Penrose, 1959; Grant, 1991; Amit and Schoemaker, 1993; Gupta and George, 2016.). However, the achievement of such an advantage is determined by the extent to which the organization has acquired and developed these resources and capabilities (Barney, 1991). Barney (1991), Peteraf (1993) and Rungtusanatham et al. (2003) identified five characteristics of resources, referred to as VRINN (valuable, rare, not imitable, imperfectly mobile, and not substitutable), these resources support the firms in achieving a sustainable competitive advantage. In the supply chain management literature these resources are classified in six types: financial, physical, human (managerial and technical skills), organizational, technological, and intangible (reputation, brand recognition, data-driven culture, and organizational learning) (Braganza et al., 2017).

The literature stream on the intersection of supplier selection and supplier development clearly maintains the necessity of hard criteria, yet also calls for research with a focus on soft criteria (Kannan and Tan, 2001, 2006), harkening back to Ellram's (1990) original call for the need of supplier selection criteria focused on the soft, and difficult to quantify, criteria. This paper expands the literature stream on the intersection of supplier selection and supplier development to include soft criteria while including the use of primarily soft criteria to gain operational performance. The following section defines key terms and provides further clarity on the continuum of criteria used in supplier evaluation throughout the sourcing system.

3.2.1 Definition of Terms

When discussing criteria that buyers use to evaluate suppliers for buyer-supplier partnerships, we discuss the various factors involved. Hard criteria are defined as "critical factors" in supplier selection situations and include: (1) price, (2) quality, (3) on-time delivery, and (4) performance history (Kannan and Tan, 2002; Ellram, 1990). *Price* is defined as price of the supplier's product as quoted without discount considerations (Hahn et al., 1990). *Quality* means the quality of the components or raw materials – without defect –delivered from the supplier to the buyer (Rashidi et al., 2020; Verma and Pullman, 1998) ranked in relation to supplier competitors. *On-time delivery* means delivery of products or materials in the supply chain as promised by the delivering organization (typically the supplier) to the receiving organization (typically the buyer) (Dolgui et al., 2020; Burgos and Ivanov, 2021). Sila (2006) defines quality as the production of defect-free components and parts that meet the requirements of customers along the supply chain. Sila (2006) stated this production quality as critical for the quality of the final product. Shifts in supply chains such as downsized organizations, supply base reduction, and organizations focusing strictly on their core competencies have led organizations to leverage their supplier's capabilities for competitive advantage. In doing so, organizations have looked beyond the hard criteria provided above to review other factors which are more difficult to quantify. The following paragraph provides definitions for such factors used in supplier evaluation.

We further clarify soft criteria terminology as those criteria which are quantifiable but much more subjective to human judgement and require experience, perception, and data. Soft criteria are consider more difficult to quantify (Kannan and Tan, 2002) compared to hard criteria. These criteria are more subjective and typically are defined based on a

construct built with surveys (Kannan and Tan, 2002). Kannan and Tan (2002) provide soft criteria as supplier commitment to buyer meaning the level of commitment that the supplier dedicates to the buyer in the buyer-supplier relationship. Both soft and hard criteria may be used by buyers to evaluate suppliers for involvement in a buyer-supplier relationship.

We classify the criteria used for supplier evaluations on a continuum that spans from hard criteria to soft criteria. We define hard criteria as criteria that are easily quantifiable and objective in nature, assessing a specific element or factor of the supplier. We further define soft criteria as more difficult to quantify and more subjective in nature, assessing a set of elements that may or may not directly relate to one element of the supplier. Figure 3.2 below shows the continuum of criteria spanning from "hard" to "soft" criteria.

<Appendix B insert Figure 3.2 Supplier evaluation: Continuum of Criteria (Ellram, 1990; Kannan and Tan, 2002)>

Through our extensive research with knowledgeable informants, we've discovered how supplier evaluations are applied in practice for both public and private sectors. In practice, organizations evaluate suppliers during the sourcing process through various means. One approach is to issue a request for proposals (RFP) to the network of suppliers to gauge interest in the buyer's sourcing needs. An RFP is a document that outlines the firm's sourcing needs. The buyer's sourcing needs may be either commodities (ranging from small components to large machinery equipment) or services (ranging from legal to software development). After receiving responses to RFPs from suppliers, firms may choose to conduct further supplier evaluation, such as supplier site visits (facility, office, or manufacturing plant), as well as interviews with supplier executives, supplier managers, and

other supplier team members. Firms use site visits, interviews, and other in-person interactions with suppliers to assess factors outside of those discussed within written content submitted in an RFP. Firms may use other means of interaction with suppliers to perform evaluations, including virtual interviews or digital visits such as meetings through Zoom and/or Microsoft Teams platforms. Such interactions provide firms with the opportunity to meet, albeit virtually, with individuals and groups who represent supplier organizations. Throughout this paper we refer to the criteria (both hard and soft) as well as the methods of evaluating a supplier with criteria given the above definition of key terms. We discuss these key terms through our methodology and results sections. The following sections present the methodology we use to examine these elements and complexities within these processes.

3.3 Methodology

Within this study, we seek to understand how buyer organizations use primarily soft criteria when selecting suppliers. Additionally, we seek to understand how buyers gain operational performance with the use of only supplier selection soft criteria. These dynamics present unexplored mechanisms such as the role of upstream supply chain members and functional collaboration between acquisition team members and participating suppliers. In accordance with the purpose and research questions posed in this paper, a case study approach investigating the unit of analysis of the sourcing system is most suitable, as research on how buyers select suppliers with primarily soft criteria while leveraging supplier development is complex (Eisenhardt, 1989b; Ellram, 1996; Meredith, 1998; Wacker, 1998; Gibbert et al., 2008; Yin, 2009; Barratt et al., 2011).

Our case study adopted the grounded theory building approach (e.g. Glaser and Strauss, 1967; Strauss and Corbin, 1990), specifically adopting the principles of theory building based on case studies (Eisenhardt, 1989; McCutcheon and Meridith, 1993; Miles and Huberman, 1994; Yin,1994). A Glaserian approach would suggest we approach qualitative interviews as an "empty vessel just going to observe" (Glaser and Strauss, 1967), while a Straussian approach recommends that we have some idea of what is happening in the respondent organizations from informants and other readings and observations (Strauss and Corbin, 1990). Our approach is informed from both approaches as we have some idea of what is happening (Straussian approach), but we sought to observe and gain as much knowledge, information, and data as possible through each of our qualitative interviews and case studies (Glaserian approach). Researchers in supply chain and operations management have begun using such methods to understand complex organizational phenomena (e.g. Boyer et al., 2000; Bozarth and McDermott, 1998). Further, the propositions we derive will be grounded in empirical evidence and show relationships among the emergent constructs.

Following the advice of Gibbert et al. (2008) and Yin (2009) we account for construct validity, internal validity, external validity, and reliability throughout our research. For instance, initially we interviewed key informants from supply chain networks, purchasing managers from large buying firms within supply chains, and other key supplier selection informants from buyer and supplier organizations. The use of soft criteria in the supplier selection process involves cross-functional teams consisting of those functions. Interview subjects come from large buying organizations, supplier-partner firms, and purchasing team members. Obtaining data from multiple sources provides an opportunity to triangulate the

information collected (Eisenhardt, 1989; Miles and Huberman, 1994). To address validity issues from sample size, we adopted an imbedded case study approach, which provides for multiple respondents of different positions or from different perspectives within the unit of analysis within a case. However, additional interviews within the unit of analysis (the sourcing system) were difficult to obtain. Interviews were conducted through in-person meetings, Zoom meetings, and phone calls. The time it took for one interview ranged from 45 minutes to 90 minutes. Unclear answers were clarified through email and follow-up questions. Figure 3.3.2 reflects our research framework.

<Appendix B insert Figure 3.3.2 Research Framework >

3.3.1 Sampling and Data Collection

To better understand and account for validity and reliability for the construct of supplier selection soft criteria, a combination of a theoretical and phenomenological sampling approach will be used. We use a theoretical approach by collecting data thru qualitative interviews and then analyzing transcripts from interviews to establish codes. Simultaneously, we use a phenomenological approach as we collected data by qualitative interviews from individuals who participate or who have participated in the supplier selection and development processes where primarily soft criteria have been applied. First, we use a theoretical sampling approach by selecting cases that predict similar results (cases within the public sector and cases within the private sector) as well as cases that predict contrary results (cases in public sector versus private sector). Also, we use phenomenological sampling based on cases where we discovered the phenomena of soft criteria is occurring. This was done by surveying two organizations, CAPS and NASPO. CAPS stands for Center

for Advanced Procurement Strategy and is a business-to-business nonprofit research center serving supply management leaders at Fortune 1000 companies. Members of CAPS are located in 120 countries and total over $3.2 trillion in annual revenue. NASPO stands for the National Association of State Procurement Officials. Members of NASPO include chief procurement officers of all fifty states and territories of the United States. CAPS member respondents constitute the private sector sample and NASPO member respondents constitute the public sector. Each organization was surveyed to discover the phenomena and if organizations would participate in qualitative interviews. Organizations responded in the affirmative if they (1) participated in such sourcing methods and (2) if they agreed to participate in our qualitative interviews.

To establish the construct, we conducted initial interviews with key informants from large supply chain buyer organizations. These key informants provided valuable information on the soft criteria-primary supplier selection process used in their buyer-supplier-relationships. Figure 3.3.1, Interview protocol, is found in Appendix B. During this process, key informants provided insights into the process as well as into some of the soft criteria used in supplier selection where the primary usage of soft criteria occurs. Based on these interactions, the construct of the supplier selection process with primarily soft criteria progressed into better focus. The data collection process proceeded with more qualitative interviews in order to populate the quadrants of the Kraljic Purchasing Matrix (1983) in Figure 3.3.3 below. By using the purchasing matrix, we can include a wide spectrum of product purchases in our study (Wu and Choi, 2005) and, thus, increase the external validity that case studies usually lack.

<Appendix B insert Figure 3.3.3 Kraljic Purchasing Matrix (1983)>

While we understand that these cases can't necessarily be forced into a quadrant, we start with the Kraljic matrix to increase our external validity. However, we know that some organizations that produce goods or commodities from one quadrant may move or may have moved from one quadrant to another after a supply chain disruption or other exogenous shocks. In addition to interviews, the collection of data included documents and observations that fully informed and improved the supplier selection soft criteria (primarily) process while providing information about successful operational performance. In addition to collecting data from qualitative interviews, archival data was requested. We were unable to collect archival data from any organization as of the date of this manuscript.

3.3.2 Coding

Researchers who performed the coding have experience conducting qualitative research and interviews. One researcher is an academic faculty with a PhD in supply chain management; the other is in the process of finishing their PhD in supply chain management. We based our data analysis approach on Strauss and Corbin (1990), as we used codes grounded in data. In this step, we obtained and integrated data from all sources discussed above (Moran-Ellis et al., 2006). However, as concepts from related research emerged, these concepts were adapted to relate our findings with previous research (Eisenhardt, 1989b; Mello and Flint, 2009; Yin, 2009). We then pursued selective (Strauss and Corbin, 1990) and theoretical coding (Glaser, 1978, 1992) by systematically relating the core category to other categories as well as reviewing each interview. The researchers conducted a coding session

together using the same transcript and set of selective codes from resource-based view theory. Next, each researcher coded an additional transcript separately with the set of codes. After each researcher coded the same transcript separately, both researchers met again to discuss coding and differences in coding. This exercise was performed with multiple transcripts before researchers coded the remaining transcripts separately. Table 3.3.2 found in Appendix B reflects the table of codes we applied.

3.3.3 Data Analysis

After data collection, transcripts were coded and compared for commonalities and differences. Data collection stopped when additional data did not provide new information to our understanding of the research question; this was marked as the theoretical saturation point (Eisenhardt, 1989; Glaser and Strauss, 1967). For data analysis, we followed the procedure by Miles and Huberman (1994), we first conduct within-case analysis, where the case studies are built based on data and key constructs. We identified the appropriate informants from the buyer-supplier relationships and requested more information from informants. Next, we conducted a cross-case analysis. The cross-case analyses, combined with the within case analyses, provide the basis for establishing archetypes.

Having established the specificities of alternative sourcing and resource-based view theory in the literature review, we will now outline the RBV-alternative sourcing particularities of our cases along framework articulated by previous research (Braganza et al., 2017; Kamble et al., 2020; and Rungtusanatham et al., 2003). After data were collected, we coded the transcripts and compared coding. Data collection stopped when additional data would not provide new information to our understanding of the research questions; this

marked the theoretical saturation point (Eisenhardt, 1989; Glaser and Strauss, 1967). For data analysis, we followed the procedure by Miles and Huberman (1994), and we first conducted within-case analysis, where the case studies were built based on data and key constructs were derived. We identified the sourcing system and soft criteria within such. Next, we conducted a cross-case analysis. We show the results of within-case in the next section.

3.4 Within-Case Analysis

Our within-case analysis is presented in this section which includes cases from the private sector as well as cases from the public sector. The private sector cases resulted from examination of member organizations from CAPS; the public sector cases resulted from examination of member organizations from NASPO.

3.4.1 Private Sector Cases

Case 1

Case 1 was a company that manufactures large equipment from various industries. Representatives from Case 1 agreed to qualitative interviews and shared their thoughts on sourcing systems and the role of soft criteria within such. One of the representatives from Case 1 was a senior purchasing official who led sourcing teams for over 25 years. The other representative was a junior purchasing official who worked at one of the suppliers that was selected for one of the projects that the senior purchasing official led. Case 1 senior purchasing official's primary role was to lead supplier selection projects to assess the potential relationship of the buyer-supplier. They mentioned the use of a balanced scorecard and the use of hard criteria such as price, quality, service level, and timeliness of delivery. While these criteria are important, they are not the only criteria used for supplier selection.

Case 1 shared that soft criteria play a very important role in the supplier selection process and throughout the entire sourcing system and buyer-supplier relationships. While hard criteria provided a solid argument in favor of the supplier, they use the soft criteria to make final decisions on completing the buyer-supplier relationship. If a supplier met all of the hard criteria but did meet the soft criteria, that particular supplier would not be chosen. Soft criteria alone could not fail a supplier from the supplier selection process, meaning that Case 1 sourcing team would review the hard criteria as well if not first thing to establish a solid base line of criteria for any particular supplier.

Primarily, Case 1 shared that using soft criteria is referred to as "soft science." Soft criteria used by Case 1 were supplier attitude, supplier willingness to work through difficult issues with the buyer, and supplier organizational ability to learn (absorptive capacity). Additionally, the senior purchasing official shared that the "soft science" is an important attribute for the supplier that will show how the supplier will handle any difficult issues with the buyer.

> "Yeah we will have to work with the supplier on a long-term basis and if they can't get the soft science right then we won't be able to work through difficult issues with them. If we need to be able to instruct them on doing things in the factory that are serious, we need to know that they can handle the instruction – or almost discipline – and be able to work through these difficult issues and carry on as a supplier."

Case 1's quote above reflects how they selected their supplier based on valuable intangible resources (VI) as well as valuable human (VH) resources, both of which represent intangible categories.

Providing support for soft criteria's importance in supplier development processes, Case 1 describes the supplier's ability to complete the work for the buyer given the current buyer-supplier agreement as an important step that could show the buyer further capabilities for production on future agreements.

> "…if we saw the supplier did a good job on the current work for which we (the buyer) had partnered with them, we could feel good about giving them future or work on future projects that they may not have been originally staffed or equipped to complete. Because we saw how they could learn and complete the current agreement, we were confident in their abilities for future work."

Case 1's quote above reflects how they monitored and reviewed the supplier's ability to complete the work based on valuable organizational learning (VI) as well as valuable human (VH) resources which both represent intangible categories.

Case 1 shared that they used soft criteria, or "soft science" as they describe it in their own words, as important criteria, which shows the potential supplier's current capability (VI) to continue on a long-term basis as well as important criteria to show the supplier's capability to work on a new project or complete new work (VH). The relationship provided operational performance as the buyer was able to use the supplier to produce machinery for the buyer over the course of many years and the buyer profited in their supply chain (VF). Further, costs fluctuated over the years; however, the suppliers with whom Case 1 worked reduced costs over the long term as the suppliers became proficient at manufacturing and cut costs, reflecting a mutually beneficial financial resource (VF). These two instances show how Case 1 uses soft criteria throughout the sourcing system, including the supplier selection and supplier development processes.

Case 2

Case 2 was the case with the most interview respondents (5) spanning across most companies (2) with the largest size (both companies were large cap companies). Case 2 respondents included the regional director of supply management, two supply managers, a director of supplier diversity, and a supply chain analyst. Representatives from both companies shared that the most similar approach to using soft criteria, or better said, criteria that did not focus on hard criteria, which is their diversity, equity, and inclusion (DEI) program. In this program, the buying organizations reviewed only suppliers who were small, minority-owned businesses. Each of the respondents defined a minority-owned business as a business owned by individuals or groups of individuals who were not Caucasian, namely African-American, Latino, women, or all of the above. Case 2 respondents shared why this program was important to operate for their perspective organizations.

> "Suppliers want an opportunity to partner with us and we feel like this approach will allow a different background of organizations to partner with us."

Case 2's quote above reflects a non-imitable human (NIH) resource, which they explain was a focus in their DEI sourcing system. They shared that suppliers that were selected as part of the DEI program start off in a conditional status, which they described as probationary period for the suppliers to prove themselves. Case 2 further described the opportunity for the DEI-selected suppliers to move from this conditional status to a more stable status.

> "…if a supplier performs well while in the conditional status – particularly that of a supplier that we select in the DEI program –then we can move them into a preferred status as a supplier, which will provide them an even greater opportunity to operate and perform as one of our suppliers."

The quote above reflects the mutually beneficial resource (VF) that they promoted as the supplier performed well. Operating the DEI program provided a different approach in their sourcing system, which impacted their operational performance for better (as suppliers performed well and advanced to preferred status) and for worse (as suppliers did not perform well and never advanced out of conditional status after being initially selected). Case 2's approach to sourcing using the DEI program provided more insight into an alternate approach to soft-criteria use, or an alternate soft-criteria used in sourcing systems.

Case 3

Case 3 was a company that supplied consumer durable goods. One representative – a supplier manager – agreed to an interview. The supplier manager has over ten years of experience in the position. The supplier manager's main focus was to work with the lead contacts of the supplier to establish relationships and onboard new suppliers. Case 3 said their company used a balanced scorecard when selecting suppliers and that hard criteria such as price and timeliness of delivery were important but not the most important. Also, some hard criteria serve as a qualifier in their approach to supplier selection. They maintained a program for diversity, equity, and inclusion (DEI) where minority-owned, small business owners are the focus of supplier selection and growing supplier relationships. Case 3 mentioned that as part of this program – not focused on the DEI aspect but separate from such – they had a supplier selection program that focused on suppliers that had "fewer layers of senior management; in fact, companies which could provide a direct conversation to the

CEO or chief officers and decision-makers." Case 3 explained why this approach was important:

> "… if we need to make changes to the orders for whatever reason, quantity or price or other specifications of the order -- we needed to be able to speak to those with the power to make that quick decision."

Case 3's quote reflects their desire to source for valuable managerial and technical skills (VH), valuable information sharing resources (VO), valuable organizational learning (VI), and non-substitutable organizational learning (NSI). Their desire to select suppliers according to these resources reflects their approach of sourcing using soft criteria in order to obtain and combine the resources discussed above. Their experience over the years with this approach has provided the opportunity to increase a supplier's orders and provide supplier development to the supplier as well.

> "… we have worked with many suppliers (with this approach). We have started with small orders and increased them gradually over time to much larger orders."

Case 3's quote above reflects their desire to select suppliers to combine resources that are mutually beneficial (VF). The above quote also reflects Case 3's sourcing approach to select suppliers to acquire valuable organizational resources (VO) for information sharing.

Case 3 said that while this supplier selection approach – direct lines of communication to decision makers –is not the only approach they use for selecting suppliers, it is an approach they've used many times over the years. This is an alternate approach to traditional sourcing where the focus is strictly on hard criteria (price, quality, service level, timeliness of delivery, etc.). Case 3 said this approach is also an alternative that

is similar to but still separate from the DEI program they run, but it is an approach that has shown operational performance results as reflected in the quotes above (orders increasing over time while maintaining the buyer-supplier relationship in the supply chain). Case 3's quotes reflect their sourcing approach using soft criteria to gain resources that are tangible, such as valuable financial resources (VF), as well as intangible, such as valuable information sharing resources (VO), valuable organizational learning (VI), and non-substitutable organizational learning (NSI).

Case 4

Case 4 is an automotive parts manufacturer, and the COO agreed to be interviewed to discuss the soft criteria approach they maintained in their sourcing system. Case 4 did not speak of a specific DEI program in their sourcing system, particularly concerning supplier selection and development processes. They did speak of a soft-criteria program in which they maintained an equity-type focus under a theme of "haves and have-nots," as Case 4 described it. Case 4 shared an integral part of their supplier selection process as a visit to the supplier's facility. They described the main elements they focus on when arriving at the supplier's facility.

> "When we arrive at the supplier's facility, we scan the parking lot to see if there are any really nice, expensive cars or if there are cheaper, beat-up cars. Particularly, we look to see if the really nice, expensive cars are parked at the front of the parking lot or if the cheaper, beat-up cars are parked toward the back of the parking. This will initially reveal to us that there is possibly an equity problem between executive management and the line-level employees."

Case 4's quote above reflects their focus of valuable human resources (VH) such as managerial skills, culture, and social contributions to the organization. They explained this

initial approach as a form of identifying any "haves vs. have-nots" – issues that might exist in a supplier. They further explain the next steps that they take after reviewing the supplier's parking lot.

> "…after we enter the supplier's front office or reception area, we ask for a cup of coffee and watch if they bring us coffee from an executive lounge or if they simply tell us to get coffee from a break room area."

The above quote reflects Case 4's continued focus on valuable human resources (VH) particular culture in the supplier selection process. Further, it reflects how Case 4 looks at a supplier's management of valuable financial resources (VF), as well as valuable human resources (VH, culture and social influences)

Case 4 focused on how candidate suppliers managed valuable financial resources in terms of how they related to organizational culture, such that this financial resource management appeared to create an organizational culture within the candidate supplier. Thus, Case 4 focuses on tangible and intangible resource categories when using soft criteria in its sourcing system.

The interviewees from Case 4 said that while this approach may seem a little unconventional, it has served their company well in finding the right supplier partners who will be trusted with a buyer's investments and resources to create an effective partnership. Case 4 shared that while they don't maintain a DEI program to select and develop suppliers, they do look for potential supplier partners who can be trusted to treat their own employees and members of their organization with equity. This approach reveals to Case 4 that they can

trust such a supplier to help create equity and eliminate a "have vs. have-nots" situation within the supplier's organization and that the supplier can operate as an effective supplier partner and gain operational performance.

Case 5

Case 5 is a company in the mechanical and electronics industry. They presented a project manager who participated on supplier selection and supplier development projects through Case 5's sourcing system. Case 5 shared that they use a scorecard to evaluate potential suppliers. Further, they described an approach that focuses on more of the non-quantitative criteria to gain unique insight into the supplier's moral character. Case 5 described that this approach begins the minute they arrive at an on-site visit to the supplier's facility. Case 5 shared the primary criteria on which they focus when selecting a supplier:

> "We look at two big things: communication and ethics. We want to evaluate the sales and marketing departments based on their communication. We score them with a pictograph, or a smiley face, if we want to score them well and a frowny face if we want to score them poorly. The sales and marketing department need to give unbiased information and we can feel them out based on how they are communicating with us – if they are telling us the truth."

Case 5 focuses on valuable human resources (VH) such as communication and ethics and intangible resources during their supplier selection process. Further, as the above quote reflects, Case 5 selects suppliers using a combination of soft criteria resources such as information sharing (VO), valuable reputation and organizational learning (VI) and non-substitutable reputation and organizational learning (NSI)

Case 5 elaborated on how they evaluate the ethics of a potential supplier when discussing a potential relationship with the legal and management teams.

> "… we place a lot of emphasis on ethics, and if they buyer can provide us references, we will value those very highly. We simply ask them for references and if they can provide them- and we can confirm the reference – then the supplier will score very well."

The above quote reflects Case 5's supplier selection using soft criteria and focusing on valuable intangible resources like reputation (VI) and valuable human resources like culture (VH).

Case 5 evaluates a potential buyer-supplier relationship with a non-quantitative approach when exploring how the supplier would work with Case 5 as the buyer with respect to pricing.

> "If the supplier simply says they want the lowest price, we know they aren't interested in maintaining a long-term relationship. But if a supplier tells us they are interested in a long-term relationship, we know we can work with them and price isn't the only thing they are focused on."

Case 5's quote above reflects their sourcing approach by using soft criteria to find suppliers with whom they can combine resources that are mutually beneficial (VF) and provide information sharing for designing and planning throughout the buyer-supplier relationship (VO).

As they discuss a potential relationship with the legal and management departments, they can score the ethics criteria and gain insight into a potential long-term relationship. This approach has helped them focus on suppliers which will provide operational performance in the long-term.

> "…we envision them to become successful and envision us to become successful as well."

The above quote reflects Case 5's long-term goal of the buyer-supplier relationship to be successful for both (VF) which also reflects valuable reputation and organizational learning (VI). This approach works best to learn what the supplier knows and to ultimately see if the supplier's vision aligns with their own. Case 5 shows that their supplier selection process uses soft criteria to evaluate candidate suppliers to acquire resources which are both tangible (VF, VH) and intangible (VO, VI, and VH)

3.4.2 Public Sector Cases

Case A

Representatives from Case A agreed to an interview on the sourcing system where soft criteria was concerned and agreed to shed light on the role soft criteria played throughout the whole sourcing system. Representatives from Case A were a (1) state chief purchasing officer (CPO) from a decentralized procurement office at the state level and (2) legal counsel from a centralized procurement office. The state CPO shared that their office managed many sourcing projects. Namely, there are information technology (IT) and services projects that their central procurement office will conduct. While the IT procurement projects were sourced using hard criteria, or more quantitative criteria, the services projects that were sourced focused on soft criteria such as supplier strategy to complete the work. Case A's representative shared below what those criteria meant in the sourcing system.

> "I think it is largely quality of the product experiencing qualifications to the vendor so moving on to services so depending on what the services for more. It is largely what is like a most service criteria. It's more what is the vendors strategy for accomplishing the work. The evaluation approach is still very subjective …that's a typical RFP."

Case A's quote above reflects their approach to select suppliers to acquire valuable information sharing resources for designing, planning, and scheduling (VO) as well as valuable managerial skills (VH). Case A further explained that by knowing the supplier's strategy to accomplish the work, the importance of this criteria assisted Case A's procurement office in supplier selection by showing how the supplier would stay current in the marketplace.

> "They could be a 100 million (dollar project) … how is this investment going to be kept current by the company is one example of a soft criteria we're going to use."

The above quote reflects Case A's use of information sharing resources for designing and planning (VO), as well as valuable reputation and organizational learning (VI), as soft criteria for supplier selection.

When using these soft criteria (strategy to accomplish the work), the buyer organization gained better insight into a proposed supplier's (sole proprietor) thinking and planning process while then comparing with other proposed suppliers. Case A explains the comparison below.

> "One vendor was just like a sole proprietor, and they gave us a proposal and they were the only one to do the work themselves. This was 3 months period. They were going to perform all these different services, you know, and then but with regard to their strategy this person is going to have to put in an awful lot of hours to get this done by themselves versus another company that was bringing in a team with a a project manager, type person, a legal and then procurement practitioners, and then an admin support person. So it was a slightly bigger team. It was probably a team of like 5 people and then they were going to really do the same work, but they had a better strategy for how they were gonna divide and conquer the work and the number of hours was more reasonable. … and they'll have some more (individuals working) and then the cost proposal, or the hours break-down about who's doing

> what work, so work that could be done by an admin at a lower hourly rate, was going to be done here and you've got a legal person. The first person was an attorney who was also a procurement person with a juris doctorate degree who is just going to work like a banshee and get it done on time versus this other strategy."

Case A's quote above explains how they reviewed a supplier based on valuable physical (VP) and human (VH) resources where managerial skills were needed for the awarded contract. Because they ask soft-criteria questions, they received details of the proposed suppliers' strategy, which ultimately shed light on how the winning supplier would strategize to complete the work with who is going to do the work, which team members take which assignments, and how many hours they all will work. These are valuable organizational resources (VO). Case A explained that the answers these suppliers provided revealed who could realistically complete the work as presented below.

> "… there was, there was more viability with that one that they could realistically get the work done on time."

Case A's quote above explains mutually beneficial resources (VF) as well as valuable organizational (VO) resources. Their procurement office did not work with any of the suppliers for supplier development, therefore they could not recall specific instances where soft criteria was used for supplier development or even the suppliers' contract compliance. Case A's quotes reflect a sourcing system where soft criteria was used to combine resources that are both tangible and intangible.

Case B

Case B was a purchasing official from a centralized procurement office. Case B's representative had spent ten years in the purchasing office and had operated on many sourcing teams for procurement projects. Case B shared that they use hard criteria extensively, but the unique soft criteria that they use is a deciding factor in determining to whom to award a contract.. Many sourcing projects that they have participated on have been similar to an employment interview.

> "…something we've recently started … it's worked out very well, because if you think about it, you're hiring these people (the suppliers) to do a job for you just like you are with … your own staff that you're hiring and just for the same reasons. Why you don't just look at somebody's application and decide to hire them? You want to get with them and talk to them because … the written doesn't always match what actually shows up."

Case B's quote above reflects their approach to selecting suppliers to combine resources such as valuable human resources like managerial and technical skills (VH). This approach is important because, many times individuals who are listed in the response to the request for proposal (RFP) are not the ones who are actually doing the work. The supplier lists them in the contract proposal so that the response has the appearance of competitiveness with other proposing suppliers in the solicitation process. Case B shares below.

> "We found … structuring it with even asking things such as 'are you actually going to be assigned to this project?' Because a lot of times companies will just say this person's resume is really good, so we'll put them in every single proposal that we have, and that's not the person who actually shows up to do the work because they're booked doing all sorts of other things. So yeah, that's … been good."

The above quote reflects Case B's sourcing approach to find resources such as valuable physical resources (VP) and valuable human resources (VH) in making sure the individuals at the interview are the individuals who will complete the actual work on the awarded contract. Case B also explained how this soliciting supplier presented their organization best during the interview and why the evaluators valued the supplier's presentation.

> "the company that ended up getting the award had none of the things we'd asked for. Where was this giant list of key staff, and they come in and just said we can't give that to you, because we don't have them hired right now. But they started talking about their hiring practices, and … how they work as a company and what were their kind of goals or mottos … as a company, how they operate…"

Case B's quote above reflects a sourcing approach using soft criteria to find valuable organizational resources (VO) for designing, planning, scheduling, and evaluation. Further, the above quote reflects finding valuable reputation and organizational learning resources (VI). Case B further explained additional soft criteria they used while reviewing the soliciting suppliers during the interviews. Case B took note of and heavily weighed the social dynamic between individuals in the interview.

> "… the evaluators are always considering the soft criteria, and I'll point back specifically when you get to oral presentations and interviews, because I think of reasons for that probably is going to be that or why they're not doing it with the initial proposals. It's hard to see some of that stuff in writing versus kind of meeting the people. One specific example: we had a big procurement like 5 years ago now or like a big call center and bringing the people in for presentations. Some of these companies are bringing in 20 people, and some are bringing just 4. But the the Evaluation Committee was really kind of focusing on the dynamic between the different people, how they work together or appeared to work together looking at some of their management practices like you had mentioned."

The above quote reflects Case B's soft criteria during the supplier selection process to find valuable human resources (VH) to uncover inter-personal dynamics and as well as valuable organizational learning resources (VI) to reflect chemistry between team members. Case B shared that by using the soft criteria of interpersonal dynamics during interviews, Case B evaluators were able to gauge how cohesive the soliciting supplier's staff were with each other.

> "But then they find others seamlessly going in. There was one company where they remarked about their management and teamwork must be really good, because there wasn't ever for really like a break in the conversation station, or awkward pauses like they were, and and you could tell it wasn't rehearsed because it'd be impossible to do this. But it's like you know, picking up where other ones left off, and you could tell that they kind of had a very good team dynamic there."

The above quote reinforces the valuable human (VH) and valuable organizational learning (VI) resources criteria that Case B used to select suppliers during their sourcing approach. By using these soft criteria (interviewing and interpersonal dynamics), Case B evaluators saw which suppliers were not cohesive and did not show strong interpersonal dynamics.

> "a recent one I sat in. .. where the we brought them in for the interviews and the committee was using a lot of body language between the different feeling. There's one company who came in, and you're like, do these people even know each other? So the committee was kind of really pointing out how 2 of the 4 people were very closed off, and it's like they. They seem like they wanted to just like Tell the one person who was talking most of the time to shut up."

Ultimately, Case B found that using these soft criteria (interviewing and interpersonal dynamics) provided their organization with confidence to award the contract to suppliers who showed strong interviewing and interpersonal dynamics. Case B shares concisely:

> "… that (interviewing and interpersonal dynamics) really won the (evaluating) committee over."

The above quotes reflect Case B's supplier selection approach in using soft criteria to find suppliers who could provide more intangible resources such as human, organizational, and reputation and organizational learning.

Case C

Case C was a representative who had spent nine years in state public procurement in multiple roles: several years as a contract analyst and the other years – including recently – as a state procurement manager. Case C's representative was an individual who spent considerable time reviewing and assessing the criteria that would be used during the supplier selection process. Further, they played a leadership role on many of the procurement team projects to ensure that all team members understood what and how they were going to score candidate suppliers. Case C explained that their procurement office used soft criteria for procurements on professional services of the non-technology nature. For instance, they mentioned legal services as a procurement project in which they used soft criteria.

> "We also have professional services which are a step below in terms of complexity and we do still ask for a scope of work (instead of RFP), so we still ask them to notify the vendors what they're going to be looking at before they give a score. We're kind of cut out of that process a little bit more so it has a lower cost threshold as well. It's how can we still be competitive for something that isn't as expensive. It's usually like a professional services . . . you know it's not like technology. You can't use it for technology, but for a like an attorney would work for it.....that's the main thing that I purchase like legal services. But you know, attorneys, auditors, consultants things like that kind of fall into that professional service."

Case C's quote above reflects their supplier selection approach using soft criteria to find suppliers with valuable managerial and technical skills (VH). They described the soft criteria they used during supplier selection processes that involve demos:

> "The only criteria we have is that they're giving a demo like we and it's it, you know what am I scoring? And it's like, What did you think? What did you think of their demo?"

The above quote reflects Case C's supplier selection approach to find valuable intangible resources (VI) such as organizational learning. The reason they used the demo as a requirement was to allow for the individuals from the supplier presenting in the demo to show how they could best assist Case C in their procurement of services. Case C explains what they reviewed in the suppliers' demo presentations

> "But there's also … you're talking to the person you're going to be working with. What . . . how did they come across to? They come across to someone that would be easy to work with. Did they come across to someone that would be … did they get really defensive when you asked a question? Or did they . . . not?. You know we're working on it, or, you know have a good answer for you, kind of thing. So when you ask a question like "was the person easy to work with?" did you think it (the suppliers' professional services demo) was easy to use? Do you think that you could defend it to our constituents?"

Case C's quote above reflects their sourcing approach to find valuable human resources (VH), which reflect the suppliers' managerial skills along with social aspects like thoughts, opinions, and candor. Case C enlightened the reasoning of why using this demo criteria was an important method to differentiate suppliers from each other in the supplier selection process.

> "It had to do with the reason. The reason I asked if they were defensive is because we interviewed multiple companies, and one of them got very defensive when we started asking questions. They were unhappy and I do think that that was- if I look at the scores that have come out of it- they got scored negatively. I don't think their product was any different from the other two -there are 3 total vendors. I think it was the presenter did not come across as somebody they wanted to work with."

The above quote reflects Case C's focus on the valuable human resources (VH) during the supplier selection process, which may lead them to provide negative feedback for the

potential supplier based on the supplier's thoughts, opinions, and candor. Further, the negativity detracted from their score even though the supplier's product was not different from other suppliers –this reflects valuable reputation and organizational learning resources (VI). Case C representative further clarified the importance of this soft criteria (during a voting system procurement project) as a means to find what truly separates suppliers from each other to determine a winner.

> "if you look at these systems, the security is almost identical between every system. So how do you judge? Is there a difference in the security between 'A,' 'B,' and 'C'? Technically, you look at … what they're saying when we ran the demo phase of that one, our IT person was like 'actually what they all submitted was the same.' But one particular company then went on in the demo to show us how they've gone above and beyond that system, and even though maybe that wouldn't have come across in the technical because he's like I don't know if I would have considered it. They kind of went into some of the history of the staff, and he was like they showed me Why there's a chance that that one is going to be safer. (IT person) was like 'I can't tell you it is or not, but they have the team to make a very safe system, and no one else kind of touched on the safety of their system.' So for the demo that became very important to our IT person you know and so one of the things that is great, for I've seen it work really well for our agencies."

The above quote reflects Case C's approach to evaluating suppliers in the selection process and uncovering valuable human (VH) resources as well as mutually beneficial resources (VF), as the supplier remarked about the security or safe product in the demonstration. Further, the technical evaluator remarked how the awarded supplier stood out from the other suppliers. They used soft criteria as an "order winner" set of criteria, which allowed the procurement team to learn how well the supplier could provide the services they were procuring in a way that the hard criteria alone could not provide. They did not have any information or knowledge of additional soft criteria – those shared or otherwise –used for

supplier development nor did they share information on supplier development activities in which they were engaged. The above quotes reflect Case C's supplier selection process using soft criteria in their sourcing system to find suppliers who could provide mostly intangible resources such as managerial and technical skills (VH), organizational learning and reputation resources (VI), and mutually beneficial resources (VF)

Case D

The Case D representative is the CPO of a state, but had spent several years as a purchasing agent on sourcing teams within their state. They shared that soft criteria was used in several procurement projects, and they had been on various sourcing teams that had mainly used hard criteria for supplier selection. Case D explained that the last several years, there had been a shift in focus to include soft criteria, which ultimately became the "winning criteria" for awarded suppliers. Case D shared on one particular procurement project – lodging services – that soft criteria was the most crucial in supplier selection.

> "So we had the hotel contract and we reviewed suppliers (hotels) in the particular area who would be fulfilling on the contract after awards. We heavily scrutinized how well the hotel staff and management interacted with homeless people … We also reviewed how well they were staffed – how many workers displayed this same service skill- to be able to provide this level of service."

Case D's quote reflects their sourcing approach, particularly during the supplier selection process, to uncover valuable human (VH) resources (managerial skills and social aspects like working with others) as well as valuable organizational resources (VO), such as planning and scheduling according to staff needs with particular staff skill sets. They explained why this service skill was critical to awarding the lodging services contract:

> "…the hotel staff had to be able to communicate with respect and dignity to the particular client base that would be frequenting the hotel. The client base (homeless and displaced individuals and families) would not be the same client base that these hotels would normally be expecting in terms of appearance and speech. We needed to see that the hotel staff could treat this particular type of client with the same level of courtesy as any of the average clients that walked through the front door."

The above quote reflects Case D's soft criteria from the candidate supplier to show communication skills (VH) as well as these skills are not substitutable (NSH) – they cannot be replaced by any resource at the supplier level. By focusing on the customer service skills of courtesy and respect, Case D's sourcing teams selected the supplier(s) who were best suited to fulfill on the lodging services contract. By focusing on these skills during site visits, which were not reviewable in a spreadsheet or report by number score representation, the Case D representative and the sourcing team members saw the skills in real-time (in "live action"), which provided an understanding of the experience the proposed clientele who would receive.

Case D mentioned that there were some unexpected or even unintended consequences that they discovered while using the soft criteria of customer service skills during the supplier selection process.

> "We found a unique solution to a difficult problem … and this solution ended up providing insights on other procurements, which helped us to decide contract award winner(s) … we weren't looking beyond this sourcing project but what we found by using this criteria showed us a way to find separation amongst suppliers in a straightforward fashion."

The above quote reflects Case D's sourcing approach with soft criteria to find valuable intangible resources. Such resources cannot be exploited and thus are rare, such as rate human resources (RH) and rare intangible resources (RI). They were aware of supplier

development resources and programs that could assist awarded suppliers on the lodging services contract; however, Case D was unaware of any other supplier development programs that would assist their other awarded contracts or other contracts where soft criteria were used for supplier selection purposes. The above quotes by Case D reflect their sourcing approach using soft criteria to discover resources in suppliers that are mostly intangible resources. Given the nature of Case D using soft criteria as a "supplier winner" set of criteria and the hard criteria (the physical hotel facility, namely) as the "supplier qualifier," Case D's sourcing approach reflects one searching for tangible and intangible resources. The cross-case analyses are discussed in the next section.

3.5 Cross-Case Comparisons

Given the nine within-case analyses, we implemented a cross-case analysis to find similar patterns across the case studies available (Yin, 2009; Wu and Choi, 2005)). Our analysis reveals that changes in the technical systems of the focal acquisition project teams induced changes in the social systems that have been historically maintained. The characteristics of each acquisition project case are captured in Table 3.5.1 displayed below. The table lists and compares across all nine cases the results from alternative sourcing using soft criteria, sourcing team members, operational performance gained by the buyer, and resources (tangible and intangible) buyers uncovered from the candidate suppliers. Next is the discussion of each of these areas of comparison.

<Appendex B insert Table 3.5.1 Cross-case Analyses*Sourcing systems use of soft criteria*

Sourcing team members and purchasing officials participating in the supplier selection process reveal the soft criteria that is used during the supplier selection process. In

addition, the soft criteria provides sourcing teams the opportunity to find resources within candidate suppliers that are both tangible and intangible.

There were many commonalities among the nine cases of soft criteria used in public and private sector sourcing systems. First, in-person visits and interviews were conducted by firms to gain knowledge from the suppliers. These in-person visits and interviews allowed firms to evaluate supplier management teams and labor forces as well as the dynamic that takes place between the two.

Second, some firms in public and private sector organizations used a scorecard to evaluate suppliers to quantify the soft criteria in a way that allows the buying organization to compare soft criteria among suppliers. Case 5 used emojis (smiley-faces) to score suppliers on ethics, while Case 1 used a scorecard and rating systems to evaluate suppliers' ability to learn and work through difficult issues.

Finally, public sector organizations relied heavily on the use of a supplier's strategy, planning, and organizational skills during presentations or demonstrations. Cases A, B, C, and D all found interesting and surprising results when engaging suppliers during demonstrations, answering questions about how the supplier might complete the work (Cases A, B, and C) or the manner in which the supplier (in Case D) completed the work.

Overall, sourcing teams expressed the use of soft criteria as a new set of evaluating suppliers in a way that allows the sourcing teams to see suppliers from a different perspective outside of what is written on paper and is much more engaging as well.

Sourcing systems uncovering VRINN Resources

Sourcing teams use soft criteria during the supplier selection process to uncover resources in the supplier (valuable, rare, imperfect mobile, not imitable, and not substitutable). There are several commonalities in the VRINN resources uncovered across the cases in this study. First, Case 1 found valuable human and organizational resources in the candidate suppliers they found. The suppliers communicated effectively during difficult manufacturing issues and learned new manufacturing techniques.

Second, Cases 2 and 3 found rare and non-imitable resources as they used DEI criteria to evaluate candidate suppliers. Cases 2 and 3 specifically searched for unique ownership scenarios with either women- or minority-owned businesses, as well as direct channels to small business ownership. Cases 2 and 3 found these resources to create a unique partnership for their supply chain networks.

Third, Cases A, B, C, and D all used soft criteria to uncover valuable intangible resources – such as organizational learning – as well as valuable human resources, such as managerial skills.

Sourcing systems gaining competitive advantage through supplier VRINN resources

Sourcing teams used soft criteria as a primary component to decide which candidate supplier would be awarded a contract (public sector) or become a supplier partner within the buyer-supplier relationship (private sector). Each buying organization used the soft criteria that to gain unique perspective on the candidate suppliers and uncover resources, both tangible and intangible, in the candidate suppliers. These resources – referred to as VRINN –- when combined with buying organizations resources, present the buying organization opportunity to gain competitive advantage. First, Case 1 uncovered valuable human and

intangible resources in candidate suppliers, which provided Case 1 a long-term supplier partnership that they sought diligently.

Additionally, Case 5 uncovered valuable human and intangible resources in candidate suppliers, which revealed communication style and ethics. Case 5 considered these resources important and found that candidate suppliers who revealed such resources were candidate suppliers that had aligned goals with Case 5 and thus would seek to obtain a long-term partnership.

Finally, Cases A, B, and C uncovered valuable human and organizational resources that revealed social aspects of the human labor of candidate suppliers as well as information sharing for planning, designing scheduling. Cases A, B, and C found these resources critical to completing the work on their contracts for the next several years and thus gain a competitive advantage through the combination of these resources with their own. Further, Case D uncovered valuable intangible resources with candidate suppliers who interacted with unique clientele. Case D found these resources paramount and thus evaluated candidate suppliers with these soft criteria (customer service skills with unique clientele) as the deciding factor in their supplier selection process. Case D found these resources critical to competitive advantage in their supply network.

3.6 Results

Five archetypes have been identified and are listed in Table 3.6. The applicable cases listed in the second column categorize the acquisition project into the appropriate archetype based on our analysis.

<Appendix B insert Table 3.6 Summary of Soft Criteria Sourcing Archetypes>

Following the case study method of Wu and Choi (2005), we offer definitions along with descriptions from cases are listed for further explanatory purposes. Our empirical archetypes are intended as a classification scheme that simplifies the complex dynamics embedded in the phenomena of sourcing with soft criteria in our case analyses. First, the *long-term partners archetype* refers to sourcing systems where the buyer focused their supplier selection process on candidate suppliers with whom they could work in a long-term buyer-supplier relationship. The *stewards archetype* refers to sourcing teams that focus on what type of steward the candidate suppliers were with the extant financial and physical resources of the candidate supplier. The *unique opportunity archetype* refers to sourcing systems that focused on unique supplier ownership structure. The *presenters archetype* refers to sourcing systems that focus their supplier selection process on the candidate suppliers' presentations according to soft criteria. The *customer service providers archetype* refers to a sourcing team focused on suppliers who had met hard criteria (owned a hotel) as a qualifier but then focused on soft criteria (personal respect, courtesy, and managerial skills) as the supplier winner criteria.

Propositions

For alternative sourcing systems, there are soft criteria that the sourcing team focuses on during supplier selection processes that reveal candidate suppliers' tangible and intangible resources. Sourcing systems exist to seek out and gain buyer-supplier relationships that provide competitive advantages. As teams evaluated suppliers using soft criteria and, by doing so, uncovered resources that were valuable, rare, non-imitable, and non-substitutable,

the buyer-supplier relationships gained competitive advantages. Further, we argue these propositions explain how sourcing teams use soft criteria in the supplier selection process toward gaining operational performance. Long-term partners focused their supplier selection efforts on candidate suppliers who also wanted to participate in a long-term partnership thus the long-term partners archetype was created. Also, presenters focused their supplier selection process on the candidate suppliers' presentations and presentation dynamics, which created the presenters archetype.

Therefore, when we develop propositions, we move beyond the archetypes of sourcing system characteristics to the intricate dynamics that unfold between the sourcing team and candidate suppliers as well as among candidate supplier team members. Our propositions cut across archetypes. We offer propositions pertaining to the dynamics among sourcing teams and candidate suppliers. Further, our propositions provide evidence of alternative sourcing teams using soft criteria to find suppliers to provide competitive advantage toward operational performance.

Hard criteria-qualifiers, soft-criteria-deciders for tangible and intangible resources

First, sourcing teams in private and public sector firms use hard criteria to qualify suppliers as candidate suppliers in a final selection pool. Private and public firms use hard criteria to uncover candidate supplier tangible resources, which could be combined for competitive advantage in the buyer's supply chain. Further, public and private sector firms use soft criteria to select from the pool of candidate suppliers a winning supplier or a group of winning suppliers such that the soft criteria serves as the deciding factor. As part of the

candidate supplier evaluation, public and private sector firms use soft criteria to uncover candidate supplier intangible resources. The candidate supplier resources are both tangible (established by hard criteria evaluation) and intangible (established by soft criteria evaluation).

For instance, private sector Cases 1, 3, 4, 5 and public sector Cases A, C, and D used hard criteria such as the supplier's owned facility. location, or physical assets to evaluate the supplier, but then they evaluated the supplier at their facility using soft criteria for final decisions. If the supplier met the soft criteria requirements, such as communication and managerial skills as well as fair and equitable treatment of individuals, they were more likely to be awarded contracts. In each instance, the buyer organizations uncovered resources such as human, organizational, and intangible that the buyer found valuable, rare, and non-imitable. Thus, these resources revealed the potential to provide the buyer – after combining resources with the supplier – with competitive advantage.

Proposition 1. Alternative sourcing requires hard criteria (qualifying criteria for candidate suppliers) and soft criteria (winning criteria for awarded suppliers) when selecting suppliers to combine tangible and intangible resources.

Soft-criteria sourcing for tangible resources

Alternative sourcing in this context is specifically referencing the use of soft criteria in both public and private sector firms. In this alternative approach, firms have been able to discover tangible resources in candidate suppliers. For instance, Case 1 used soft criteria to source for heavy equipment manufacturing supplier partners and found candidate suppliers who could fulfill the long-term partnership and provide mutually beneficial resources (VF) in the form of reduced costs over the long-term. Also, Case 3 selected suppliers based on a

direct relationship with executive management and reached decision makers more immediately to make changes to supplier orders in a time-condensed fashion. Case 3 found these tangible resources of various order amounts to be mutually beneficial, tangible resources for their supply chain. Lastly, Case A sourced for suppliers by evaluating candidate suppliers' strategy for completing the work for the requested contract. They found suppliers more than capable of completing the work, which is a mutually beneficial resource. Case A found these tangible resources (VF) beneficial to fulfilling their contract and thus the buyer-supplier relationship.

Proposition 2a. Alternative sourcing uncovers tangible resources – such as mutually beneficial (VF) resources- for buyer-supplier relationships.

Other tangible resources uncovered through alternative sourcing with soft criteria are human resources –human resources can be both tangible and intangible, but in this context, we reference the tangible aspect because the buyer organization requires human labor in the services sourced. For instance, Case A sourced for candidate suppliers' strategies to complete the work of the proposed contract and in doing so found suppliers with capable human beings (physical persons) to complete the work. Also, Case D sourced for hotel and lodging facilities with sufficient number of employees possessing the right customer service skills and uncovered these tangible human resources by evaluating candidate suppliers with soft criteria.

Proposition 2b. Alternative sourcing uncovers tangible resources- such as human (VH) resources to complete the proposed work- for buyer-supplier relationships.

Soft-criteria sourcing for intangible resources

Firms have been able to discover intangible resources in candidate suppliers. For instance, Case 3 found candidate suppliers who could share information (VO) in the form of order data for future planning. Also, Case B selected suppliers based on an in-person interview and presentation from the candidate supplier, which uncovered organizational resources for designing and planning. Lastly, Case D sourced for suppliers by evaluating candidate suppliers customer service skills in providing courteous communication to a unique clientele. In doing so, Case D found suppliers capable of staffing the needs to fulfill the contract with valuable organizational resources. Case A found these intangible resources (VO) vital to fulfilling their contract and thus the buyer-supplier relationship.

Proposition 3a. Alternative sourcing uncovers intangible resources- such as organizational (VO) resources- for buyer-supplier relationships.

Other intangible resources uncovered through alternative sourcing are intangible resources such as reputation, brand, and organizational learning. For instance, Case 1 sourced for candidate suppliers' ability to complete difficult manufacturing tasks (organizational learning, VO). Also, Case 3 sourced for suppliers with unique ownership structure to communicate order information quickly over time. Case 3 uncovered these intangible organizational learning resources by evaluating candidate suppliers with soft criteria.

Proposition 3b. Alternative sourcing uncovers intangible resources –such as valuable reputation and organizational learning (VI) resources to complete the proposed work- for buyer-supplier relationships.

Soft-criteria sourcing for competitive advantage

Private sector companies are constantly vying for competitive advantage in the marketplace. Firms have sought to find competitive advantage with suppliers who possess

and maintain resources that uniquely position those suppliers in the marketplace. Firms seeking to combine resources with such suppliers will conducti sourcing activities such as supplier selection to discover such resources. More specifically, firms use soft criteria in their sourcing activities to gain a clearer picture of the resources suppliers may provide. Case 1 sourced valuable intangible and human resources such as the supplier's capability to learn new tasks as well as ability to work through difficult issues with a good attitude. Before arriving at the final list of candidate suppliers, Case 1 used hard criteria such as supplier plant and machinery available as a means to qualify suppliers. Case 1 revealed how it uses hard criteria as a qualifying criteria and soft criteria to uncover valuable human resources such as managerial and communication skills. Case 2 also sourced for suppliers using hard criteria – such as supplier facility and minimum capabilities – as a qualifier and soft criteria to uncover rare and non-imitable human resources such as the unique ownership of the company.

Proposition 4a. private sector sourcing with soft criteria requires hard criteria as a qualifier but the soft criteria uncover valuable, rare, and non-imitable human resources.

Case 1 and Case 4 both conducted sourcing activities using soft criteria that enabled each of them to uncover resources in suppliers that hard criteria did not. Case 1 discovered valuable human and organizational learning resources from suppliers who had viable communication skills and the ability to learn new tasks on the job. These intangible resources allow Case 1 to gain long-term relationships and thus gain competitive advantages in the marketplace because of longevity in the buyer-supplier relationship. Case 4 sourced for suppliers using DEI-criteria to find women- and minority-owned businesses, which provided rare and non-imitable human resources from suppliers. Case 4 found a unique

market position as they partnered with these suppliers and few companies were conducting such sourcing activities. This unique buyer-supplier relationship provided competitive advantage compared to other firms in their industry.

Proposition 4b. private sector sourcing with soft criteria uncovers candidate supplier human resources that are valuable, rare, and non-imitable for the buyer to gain competitive advantage.

Public sector organizations are vying for competitive advantage for the constituents whom they serve. While the focus of public sector organizations may not be the same as their private sector counterparts, public sector organizations seek to uncover resources from candidate suppliers. Public sector organizations seek to combine resources with suppliers in a buyer-supplier relationship to provide value to the constituents in their jurisdiction. Cases A, B, C, and D all used soft criteria to source for candidate suppliers and in doing so uncovered: valuable human resources, such as managerial and technical skills; valuable organizational resources, such as designing, planning, and evaluating projects; and valuable intangible resources such as organizational learning.

Proposition 4c. public sector sourcing with soft criteria uncovers candidate supplier human resources, which are valuable human, organizational, and intangible resources for the buyer to gain a competitive advantage.

Alternative sourcing to uncover resources for competitive advantage

Alternative sourcing provides the opportunity for the buyer to view suppliers from a different perspective from just the hard criteria-only perspective. In doing so, additional skills, traits, and, ultimately, resources that the candidate supplier possesses are uncovered. By uncovering these resources through soft criteria, alternative sourcing practices provide buyers the opportunity to gain a competitive advantage (after combining resources with soft-

criteria-sourced suppliers). Alternative sourcing allows buyers to uncover intangible as well as tangible resources otherwise not uncovered by a hard criteria-only approach.

Cases 1 and 5 took on a perspective of evaluating suppliers through a perspective of how the suppliers could learn and what type of relationships the suppliers wanted to maintain. In doing so, Cases 1 and 5 found suppliers who possessed resources that Cases 1 and 5 may not have found had they sourced using a hard-criteria only approach. For instance, in meeting the suppliers in person and getting to know them by asking questions centered on attitude, ethics, communications, and problem-resolution, Cases 1 and 5 were able to see beyond any numbers on a score card. Further, Cases 1 and 5 found tangible resources that made the buyer-supplier relationship mutually beneficial in the future. Cases 3 and 4 were sourced for suppliers with a unique approach that allowed them to uncover tangible resources in the supplier such as order flow information and use of company resources. Cases 3 and 4 gained perspective on tangible resources through their soft criteria sourcing approach and thus gain competitive advantage from these tangible resources.

Proposition 5a. Alternative sourcing (using soft criteria) provides opportunity for buyers to combine tangible resources with suppliers to gain competitive advantage.

Each organization shared that their sourcing activities using soft criteria allowed them to uncover supplier intangible resources in the supplier selection process. In doing so, buyers gained perspective beyond that of a hard-criteria-only approach. This perspective includes that of the candidate supplier, the industry in which the candidate supplier is being sourced, and that of the overall supplier chain as well. Case C shared how their unique sourcing approach with suppliers was a demonstration for professional service revealed

supplier intangible resources such as valuable human and organizational resources. Further, Case C revealed how their evaluation provided perspective on the overall industry of professional services and how their constituents would perceive the candidate suppliers that were evaluated.

Proposition 5b. Alternative sourcing (using soft criteria) provides opportunity for buyers to combine intangible resources with suppliers to gain additional perspective on suppliers, marketplace, and supply chain resulting in a more robust competitive advantage.

3.7 Discussion

With nine cases, we have identified five archetypes of alternative sourcing with soft criteria. These archetypes capture the complex details of the dynamics between acquisition team members. This study offers ten propositions that examine the intangible and tangible resources buyers uncover when evaluating candidate suppliers for a buyer-supplier relationship, thus revealing competitive advantage for operational performance. The study has both theoretical and managerial implications which are discussed below.

Theoretical Contributions

This study contributes to theory development in the supplier selection criteria in three ways. First, we contribute to the resource-based view (RBV) theory in providing a codification for qualitative research in describing how buyers in private and public sectors source using soft criteria to partner with suppliers and thus combine resources that are both tangible and intangible. Our set of codes reveals the set of valuable, rare, imperfectly mobile, non-imitable, and not substitutable, that exist within the tangible and intangible categories while further exploring their application in soft criteria sourcing.

Second, we contribute to the RBV theory on sourcing using soft criteria to gain competitive advantage toward operational performance. Even though the data to support what is and is not operational performance was limited, we found hard evidence to support the "order qualifier/order winner" approach with hard and soft criteria. This research shows that buyer-supplier partnerships were created with the winning candidate suppliers using soft criteria for the "order winner"-criteria. This represents a very important step in the alternate sourcing approach as we uncover more of the black box. We further show the importance of resource-based view theory in revealing the details of the black box of soft criteria sourcing. Further, this research contributes to the body of literature previously explored by Kannan and Tan (2001 and 2005) toward the importance of soft criteria in supplier selection and involvement.

Third, we present hard evidence that sourcing with soft criteria exists and highlight the process soft criteria sourcing, which expands well beyond the anecdotal evidence provided from Honda and TSCM. While Ellram's (1990) call for more research on soft criteria has gone unanswered, this research answers the call directly to uncover more specifics of the role of soft criteria in sourcing while enlightening the dynamics of the resources uncovered in suppliers while using soft criteria sourcing.

Managerial implications

This research offers productive and cautionary tales for practitioners irrespective of sector, public or private. First, we can approach organizations in both spheres to offer general recommendations on the soft criteria approach with a general model of what to look

for in terms of tangible and intangible resources. Further, we can offer a general process of how to initiate interactions with supplier organizations such that tangible and intangible resources may be revealed and thus uncover competitive advantage opportunities.

Additionally, we can offer suggestions regarding DEI as stand-alone criteria for supplier selection. We can offer an alternative approach to review VRINN resources to be evaluated as part of the program to initiate, develop and continue buyer-supplier relationships in the DEI program. Firms considering the implementation of DEI may review our case studies to uncover additional aspects of a DEI program that provide a qualifier criteria – such as hard criteria – to the approach and thus create a unique relationship with a DEI-criteria-selected-supplier, which may defer from other buyer-supplier relationships in the market place (hard-criteria-only and DEI-only-sourced organizations).

Limitations and future research

This study is not without limitations. First, the primary disadvantage of a case study is the lack of external validity and its idiosyncratic theories (Eisenhardt, 1989); it is difficult to draw deterministic inferences. We tried to alleviate this concern by sampling across both the public and private sectors. Second, we were unable to gain inter-coder ability on the full set of transcripts as it was very difficult to gain coding assistance from other researchers to code all of the qualitative interview transcripts. Additional researchers would also provide validity to the archetypes as alternative perspectives on each set of interviews and each case would be a tremendous asset to this research. Clearly, the theories we discovered in this study will need to be further developed and tested in future studies. Future studies may consider conducting a scenario-based experiment focusing on the behavioral aspects of

supplier selection and supplier development where soft criteria are concerned. Also, regarding theory development, we may consider developing a configurational theory that links different types of soft criteria portfolios and adoption patterns to patterns or types of novel resources. This could help to develop an interesting theory that further confirms the value of using soft criteria in supplier selection.

CHAPTER 4

SIMULATING PERFORMANCE: HARD-CRITERIA VS. RANDOMLY-SELECTED SUPPLIERS

4.1 Introduction

Supply chain firms have been faced with the challenge of increasing operational performance in their buyer-supplier relationships. Typically, firms may look to cut costs in their supply base and if possible, increase revenue. Methods to increase operational performance in these two ways are typically hard, quantifiable performance metrics such as costs, quality, delivery, and/or measured technical capability. To gain competitive advantage in the market, firms include these hard, quantifiable metrics as criteria in their supplier selection process. In fact, not only have the quantifiable criteria been used for supplier selection, but they have also been used for performance metrics in supplier development activities and initiatives and sourcing in general. Practitioners and scholars alike have agreed on the idea of sourcing based on these hard, quantifiable criteria and performance metrics. However, scholars have gone further in the sourcing research stream to find that other criteria than hard criteria may have more impact on operational performance. More than just hard criteria in the supplier selection process may be needed to achieve operational performance; for instance, the need for supplier development may also play a role (Vonderembse and Tracey, 1999). Kannan and Tan (2001) continued in this research stream and found that not only does soft criteria supplement hard criteria but the soft criteria – like a supplier's commitment to the buyer – have a greater impact on operational performance than the hard criteria. Clearly, it is supported in the literature and in practice that sourcing

based on hard, quantifiable performance metrics impacts operational performance. But in recent years, practitioners have taken more risks and detached from the traditional approach of using only hard criteria for sourcing or using soft criteria as a supplement to hard criteria and have used alternative by using soft criteria sourcing practices only in supplier selection combined with supplier development. This is new phenomena that is not explained in the literature. While Kannan and Tan (2001) found there was importance of soft criteria in sourcing, their research did not provide the conditions under which such criteria would be needed. Further, given such conditions, it may be possible that soft criteria is required to enhance hard-criteria in the selection process. This prompts the research question: *Under what conditions is hard criteria not sufficient for operational performance?*

Our research presents the conditions mentioned above as we examine how well hard-criteria-selected suppliers perform versus randomly selected suppliers. We explore the notion that, if conditions exist wherein a hard-criteria-selected supplier performs no better than randomly selected suppliers, then something beyond hard criteria – such as soft criteria – may be needed for buyers to gain operational performance greater than that of randomly selected suppliers.

With our abductive approach, we propose to use a discrete event-based simulation to answer our proposed research question. By numerically experimenting with this model, we hope this study can elaborate on extant theories pertaining to sourcing while contributing new understanding on the soft-criteria-only alternative sourcing model and provide managerial implications for professionals to better manage operational performance through more efficient resource investments in supplier selection and supplier development process.

4.2 METHODOLOGY

In this section, we discuss our methodology, which is comprised of three steps. First, we set the factors to be examined throughout our research. Second, we conduct a supplier selection experiment given the factors we define. Third, we conduct a simulation of two independent supply chain operations. Our methodology culminates in the simulation as simulation has long been used in operations management, logistics, and supply chain management (see Bowersox and Closs 1989; Chang and Makatsoris 2001; Holweg and Bicheno 2002; Shafer and Smunt 2004; Terzi and Cavalieri 2004; Kleijnen 2005; Evers and Wan 2012, Talluri et al., 2013, Yildiz et al., 2022). Simulation experiments are effective and practical tools for analyzing supply chain phenomena (see Swaminathan et al. 1998 and Smaros et al. 2003). We simulate buyer performance from supplier selection methods under alternative supply chain conditions to test our hypotheses. To compare buyer performance from supplier selection methods under alternative supply chain conditions, we conduct a simulation experiment, grounded in supply chain and simulation modeling theory (Swaminathan et al.. 1998; Law and Kelton, 2000; Melnyk et al., 2009), to generate data on the effects of different buyer performance within different scenarios. To test these conditions, there are five main assumptions in buyer-supplier relationships that we are relaxing:

1) The assumption that the buyer can select a supplier and reduce uncertainty to the extent to gain supplier performance in the post-selection market.
2) The assumption that the buyer understands the entire supplier market size.
3) The assumption that the buyer pays the contractual price over time.
4) The assumption that the buyer receives delivery of products at the contractual delivery time over time.

In the following sections, we discuss the steps of our methodology beginning with factors. Second, we discuss the supplier selection experiment. Third, we explain the simulation. Fourth, we discuss the results before concluding with our discussion.

4.2.1 Factors

The four factors influencing the performance are: 1) supplier market size, 2) candidate supplier mean performance differential, 3) coefficient of variation in supplier mean price, and 4) coefficient of variation in mean delivery times. First, we focus on the factor of supplier market size (i.e., the pool of candidate suppliers, *SupplierPoolSize*) that buyers consider for selecting suppliers. For simplicity purposes, pool size variability is constrained to either high or low. We select a supplier pool size parameter that is either low (n = 2) or high (n= 8). High setting in *SupplierPoolSize* implies greater competition among suppliers, thus greater pressure on suppliers to maintain competitive prices. Low setting in *SupplierPoolSize* implies less competition among suppliers thus lower pressure on suppliers to maintain competitive prices.

Second, we focus on the factor for candidate supplier performance differential, or *differential*, of the suppliers in pre-selection. Specifically, we focus on the variance of the performance of each randomly selected supplier (difference in means: p = .05 and p = .20) to the mean performance of each supplier with the market leader supplier. To establish this differential, we conduct an independent two-sample t-test (Nyaga et al., 2010) given equation (1) below,

$$t = \frac{\text{[illegible]}}{ss_{pp}\text{[illegible]}2/nn} \qquad (1),$$

where

$$s_p = \sqrt{\frac{ss_{xx1}^2 + ss_2^2}{2}} \qquad (2).$$

s_p is the pooled standard deviation for $n = n1 = n2$, and s^2_{x1} and s^2_{x2} are the unbiased estimators of the population variance. The denominator of t is the standard error of the difference between two means. This t-test is conducted for supplier mean price and supplier mean delivery times. Resultant p-values reflect the difference in mean price and mean delivery times with respect to the market leader supplier mean price and mean delivery time. For p-value= .20, differential in the supplier mean price to the market leader supplier mean price reflects a low differential. Thus, a supplier with mean price and mean delivery with low differential maintains a performance differential (pre-supplier selection) not equal to and slightly greater in price and mean delivery time, on average, to the market leader supplier. Alternatively, for p-value = 0.05, differential in supplier mean price to the market leader mean price reflects a high differential. Thus, a supplier with mean price and mean delivery with high differential maintains a performance differential (pre-supplier selection) not equal to and much greater in price and mean delivery time, on average, to the market leader supplier. We assume the market leader supplier maintains the lowest mean price and lowest mean delivery times and, thus, is the supplier selected given the hard-criteria selection method. We select a candidate supplier performance differential of the suppliers that is either low (p= .20) or that the performance differential is high (p = .05). Further, we focus on the performance differential in the price and delivery times. Price is given in price per unit without quantity discount, with the buyer carrying costs for shipping and ordering costs.

Delivery is given in lead time per order, measured in days. For simplicity purposes, performance differential is constrained to either high or low. We select a differential parameter that is either low (p =.20) or high (p= .05).

Third, we focus on the factor of coefficient of variation in the candidate supplier performance differential in pre-selection. Specifically, we focus on the mean, μ, and standard deviation, σ, of the candidate supplier performance in price and delivery time. Kannan and Tan's (2002) research shared that supplier delivery times and price of materials were two of the most important supplier selection criteria as ranked by senior materials and purchasing managers. Kannan and Tan (2002) confirm Ellram's (1990) argument that "hard criteria" such as price and delivery are routinely used for supplier selection and assessment. Thus, we focus on the factors of the mean, μ, and standard deviation, σ, of the candidate supplier performance in price and delivery time to represent critical factors of hard criteria in supplier selection. After determining mean and standard deviation, we select a variance parameter, coefficient of variation, or *CV*, (Qin, 2015). The *CV* is a relative magnitude pertinent to all suppliers that is used to observe the extent of variation statistics in each variable, $\mu_{price,}$, σ_{price}, $\mu_{delivery\ time}$ and $\sigma_{deliver\ time}$. Thus, the CV is calculated as follows:

$$CV = \sigma / \mu \qquad (3)$$

We select a CV parameter that is either low (CV=0.1) or high (CV=0.4) for $pppppppppp_{ssssssssssssss_{ii,jj}}$ and either low (CV = .01) or high (CV = .04) for $ddppddppddpppppdd\ ttppttpp_{ssssssssssssss_{ii,jj}}$. *CV* implies the level of stability in supplier given m and s. Thus, a lower CV implies a greater level of stability in a supplier while a higher CV implies a lower level of stability (or greater level of instability) in a supplier (Qin, 2015).

4.2.2 Supplier Selection Experiment

The supplier selection experiment is conducted in two independent phases in two independent supply chains, with the first phase using a selection model and the second phase using a discrete event simulation. Figure 1 shows the flow chart for this experiment. To execute on the supplier selection model, since we are investigating under which conditions hard-criteria selection method underperforms, a hard-criteria selection method is implemented in one supply chain and, for use as a comparison baseline, a random selection method is implemented for the second supply chain channel. First, we establish a supplier market size (i.e., *SupplierPoolSize*) with variability in the two performance dimensions for candidate suppliers. Second, after establishing the pool of suppliers and listing all of the suppliers and their performance metrics, we establish means for candidate suppliers. Third, we establish standard deviations for candidate suppliers. Fourth, we established the coefficient of variation (Qin, 2015) for each candidate supplier.

The supplier with lowest composite score (weighted for price and delivery times) was the hard-criteria-selected supplier and thus comprises one independent supply chain in the simulation model. All suppliers in the candidate pool were considered for random selection, which is conducted to find the supplier to comprise the second independent supply chain.

< Appendix C insert Figure 1. Flow chart of Experiment>

We draw uniformly random, *R*, a supplier, *x*, from a pool (set) of suppliers, *SS*. This is expressed as follows:

$$SSSS \overset{RR}{\leftarrow} xx \qquad (4)$$

We operationalize this with a random selection model (RANDBETWEEN). Suppliers were listed in columns and occupied i-rows. The "RANDBETWEEN" function was then applied wherein all suppliers listed within the specified range of rows would be in the selection pool. There are two additional functions used to assist in the random selection model: "INDEX" and "ROWS." The "ROWS" function specifies the number of rows used, which is equivalent to the pool size of the suppliers. The "INDEX" function specifies the name of the supplier that is selected with the "RANDBETWEEN" function. Thus, all three functions are included within one cell to randomly select a supplier within the pool list of suppliers. The complete function is displayed below:

=INDEX($*Column*$*Row*$_i$,(RANDBETWEEN(1,ROWS($*Column*$*Row*$_j$)))

This formula provides the coding to select a supplier randomly each time the model is operated.

In phase 2, after each supplier is selected for both supply chain channels, rows of supplier attributes (supplier name and supplier selection performance data) are uploaded into the ProcessAnalyzer – a master control application used in simulation to provide the operator access to the simulation model while also having the ability to apply controls and variation to independent variables before replications of runs are commenced. Table 1 below lists and defines all of the independent and dependent variables used in the simulation model. Further, dependent variables – Sales Orders, Transportation Costs, Inventory Costs, Supply Costs, Manufacturing Costs, and Difference in Net Profit cells – are added for

resultant data to populate. After the supplier scenario results from the supplier selection experiment are uploaded, ProcessAnalyzer is engaged to operationalize all replications of runs within the simulation model and then provide output for all independent and dependent variables. This data output is then available to export for statistical analysis using a general linear model (GLM)–univariate analysis.

< Appendix C insert Table 1. Simulation Variables>

4.2.3 Simulation Model

The influence diagram in Figure 2 depicts the processes that we incorporated into the simulation model. As shown, supply chain costs, such as transportation and inventory, and supply chain performance measures, such as service levels and cycle times, are impacted by supply chain conditions. We simulate the flow of orders throughout two independent supply chains, starting with sales orders in the manufacturing unit and flowing through as production orders through the manufacturing process. These production orders also involve purchase orders flowing through to suppliers where such purchase orders are fulfilled and transported to the manufacturer. Following this basic framework, we built a simulation model to accommodate the multitude of possibilities.

< Appendix C insert Figure 2. Experimental Framework>

4.2.3.1 Simulation structure

To capture the essential features of each supplier selection strategy while incorporating the increasingly common multichannel structure, we created two independent supply chains with

one supplier selected via hard-criteria methods, the other supplier via random method (Figure 3). Because supply chain phenomena are of interest, we assumed the focal firm performs light manufacturing to reduce internal manufacturing complexities. In the base case, we assumed both channels can be supplied independently by a single supplier and serve independent customer markets that do not interact – a plausible condition if customer markets are heterogeneous or channel characteristics are diverse (Anderson et al. 1997).

< Appendix C insert Figure 3. Supply chain structure>

In Figure 3, we show a simple production cycle within each operation transforming raw material into finished goods. We constructed this simulation to model the flows within this supply chain structure. The simulation is empirically grounded and approximates the operating levels found in top performing supply chains as reported in Industry Week's value-chain survey[1]. Manufacturing operations are configured to meet a 95 percent minimum service level, while optimizing[2] and minimizing excess manufacturing capacity and inventory levels. Suppliers are also configured to replicate the same Industry Week benchmarks. Basic model parameters and distribution assumptions are shown in Table 1 and are based on previous studies (Yildiz et al., 2022; Petrovic et al., 1998; Kull and Closs, 2008). Thus, our model is grounded both in theory and in industrial practice. When modeling supply chains, inventory control policies are a primary concern (Swaminathan et al., 1998). For the manufacturer's finished goods, we used a continuous review (s, S) ordering policy because of its popularity and efficiency in a light consumer goods industry (Scarf 1962; Ballou 2004). Our study assumed the following: A production order is issued when the inventory position (IP), which is calculated as on-hand + in-process amount, falls below s, with the order

quantity determined by S-IP. To control the raw material, the manufacturer uses a periodic order-up-to policy in conjunction with a (s, S) policy (Petrovic et al., 1998; Gavirneni et al., 1999). Weekly replenishment orders are issued to the supplier to provide raw material levels up to a specified maximum quantity (M). With the parameters s, S, and M, the manufacturer controls the amount of finished and raw material inventory and the frequency of production orders.

4.2.3.2 Simulation formulation and validation

To simulate the supply chain structure and experiment with the various supply chain conditions, we utilized ARENA V4.01 simulation by Rockwell Software (Kelton et al., 2004). ARENA is a discrete event simulator, combining the SIMAN simulation language with a graphical interface, which aids the visual tracing of orders and material, and allows for operational and conceptual model validity (Sargent 2000). The logical flow of orders, production, and transportation is assured through use of standard simulation flow charts (Banks and Gibson, 2001). Following Law and Kelton's (2000) techniques for simulation model development, and consistent with previous studies (Wan and Evers, 2011), we programmed sub-models and verified them individually before inclusion into the larger model to simplify debugging. In addition, supply chain performance graphs showed expected results during model test-runs under extreme settings (e.g., excessive production or transportation times). Important to the simulation experiment were initial conditions, warm-up length, run length, factorial design, and replications (Law and Kelton, 2000). We set initial inventories at the expected average. Given that preliminary observations found orders to propagate rapidly, and that the system reached steady state quickly, we utilized a 100-day

warm-up length, followed by a 730-day run length. We chose 32 replications with unique random number seeds based on Law and Kelton's (2000) procedure.

We establish face validity of the simulation following Sargent (2013), which defines face validity in a simulation as correctly establishing the logic in the conceptual model. Table 3 presents face validity results, showing outcome differences when a particular disruption or strategy was individually turned on in the model in comparison to the "base case"– the case where no disruptions and no strategies were turned on. The table represents the expected effects and whether the effects were observed in the outputs.

4.3 Test

To test our expectations, we design a model for a full factorial experiment across four factors: *SupplierPoolSize* (2 levels: *SupplierPoolSize* = 8 (high) or *SupplierPoolSize* = 4 (low), *CV* (2 levels: CV = 0.4 (high) or CV = .1 (low)), and *Differential* (p= .2 (low) or p=.05 (high)). We design the model with these factors by setting p-values for the *Differential* factor by applying a root-finding algorithm that adjusts a single variable to find the root of a real-valued function. Given a function f(x), we can change the value of x to make f(x)=a, where *a* is the desired outcome. The algorithm uses an iterative approach, making successive approximations until it finds an *x* that minimizes the difference between f(x) and a. After setting the p-values from equation (1) and the settings from the *CV* (high and low) from equation (3) for the *Differential* factor, the algorithm (called "Goal Seek") then finds the corresponding supplier attributes of μ_{price} and $\mu_{delivery\_time}$. This algorithm is applied across all replications for each of the eight supplier selection scenarios following the random selection methodology.

To assure proper statistical power across factor combinations[1] 32 replications were conducted for each of the eight factorial combinations to generate a total of 280 observations. Table 2 (found in Appendix C) reflects the supplier market pool that we composed for the factorial combinations. To test our expectations, we use a GLM univariate analysis based on the output from 280 simulation runs. Because we expected interactions among experimental factors, we included, in the regression analysis, the factors' main effects and two-way interactions along with the direct effects. We find significant differences at the $p < .05$ level. We review effects for three fixed factors and the interaction between CV and differential. We focus on these effects due to the supply base characteristics given the conditions designed in our model. In this model, we use *NetProfit_D* (difference of net profit between supply chain 1 and supply chain 2) as the dependent variable of buyer net profits after one replication. NetProfit_MD was calculated following equation 4 below.

$$NetProfit\_D = \text{NetProfit}_2 - \text{NetProfit}_1 \quad (4)$$

NetProfit$_i$ π, was calculated following Yildiz et al. (2022) where total costs equaled the sum of inventory costs (*I*), transportation costs (*T*), supply costs (*D*), and manufacturing costs (*r*) following equation 5 below.

$$\pi = \sum R - (p + I + D + T) \quad (5)$$

For purposes of relative magnitude, we include a variable for coefficient of variation, CV (Luo et al., 2021), for both mean price, CV_{price}, and mean delivery time, $CV_{delivery\_time}$.

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[1]To determine the number of replications, an approach based on Law and Kelton (2000, p.512)

$$n^*(\gamma) = \min\left\{ i \geq n : t_{i-1,1-\alpha/2}\sqrt{S^2(n)/i} \,/\, \left|\bar{X}(n)\right| \leq \gamma' \right\}$$

was used. The average variance and mean among the outcome variables for various scenarios were computed for 10 replications. Then, we incremented i from 1 to n*, at which point an error below c = .05 was attained at a = .01 level. Law and Kelton (2000) recommend at most c = .15 and a = .05. It was determined that while at least 25 replications were appropriate, using 32 replications would achieve an error below 2.5% (i.e., c = .025).

We include a variable representing *ContractLength* which includes number of days the buyer-supplier relationship is contractually operates. Further, we use *SuppPoolSize* to represent the size of the pool of suppliers from which buyers can select supply chain partners. We implement an error term, ε, for any omitted variables in the model.

4.4 Expectations

Given high and low settings for factors (*SupplierPoolSize*, $CCCC_{ssssssppss}$, $CCCC_{ddsssssddssssdd\_ttssttss}$, and *Differential)* as well as our dependent variable (Difference in Net Profit), our expectations for the simulation results are as follows. First, implications of *SupplierPoolSize* are that higher pool size will create pressure on suppliers to lower and stabilize prices, thus we expect our results from the simulation will reflect, on average, lower supplier mean prices in higher *SupplierPoolSize* setting and thus a resultant higher net profit from lower supplier mean prices. As hard-criteria-sourced suppliers maintain on average lower-price supply costs than alternative suppliers, we expect hard-criteria-sourced suppliers to have higher net profit then random-selected suppliers in a high setting of *SupplierPoolSize* . Second, implications of $CCCC_{ssssssppss}$ are that higher *CV* implies greater instability in the supplier thus we expect lower net profit in high *CV* settings. As hard-criteria-sourced suppliers maintain on average lower prices than alternative suppliers, we expect hard-criteria-sourced suppliers to have higher net profit than randomly selected suppliers in a higher $CCCC_{sssssppss}$setting. Third, with respect to $CCCC_{ddsssssddssssdd\_ttssttss}$, implications are also that higher *CV* implies greater instability in the supplier, thus we expect lower net profit in high *CV* settings. As hard-criteria-sourced suppliers maintained on average lower delivery times for supplies than alternative suppliers,

we expect hard-criteria-sourced suppliers to have higher net profit then random-selected suppliers in a high $CCCC_{ddsssssddssssdd\_ttssttss}$ setting. Fourth, implications of *Differential* are that higher *Differential* implies greater differences in $\mu_{\text{price,}}$ and $\mu_{\text{delivery time}}$ of suppliers thus we expect lower net profit from supply chains with suppliers of a higher *Differential* and higher net profit from supply chains with suppliers of lower *Differential.* As hard-criteria-sourced suppliers maintain on average lower prices and lower delivery times for supplies than alternative suppliers, we expect hard-criteria-sourced suppliers to have higher net profit than random-selected suppliers in a high *differential* setting.

In terms of two-way effects, we expect the effect between *SupplierPoolSize* and $CCCC_{ssssssppss}$ to be linear. As *SupplierPoolSize* setting is high, the implication is lower mean prices caused by increased supplier competition. As $CCCC_{ssssssppss}$ setting is high, the implication is that supplier instability increases, thus lower net profit. Lower mean prices from the high setting in *SupplierPoolSize* – creating high pressure to lower prices –and lower net profit from high setting in $CCCC_{ssssssppss}$ leads us to expect a higher net profit from the two-way effect of high settings in *SupplierPoolSize* and $CCCC_{ssssssppss}$**.** As hard-criteria-sourced suppliers maintain on average lower prices for supplies than alternative suppliers, we expect hard-criteria-sourced suppliers to have higher net profit than random-selected suppliers in a high setting of *SupplierPoolSize* and a high $CCCC_{ssssssppss}$setting. Second, we expect the effect between *SupplierPoolSize* and $CCCC_{ddsssssddssssdd\_ttssttss}$ to be linear. As *SupplierPoolSize* setting is high, the implication is lower mean prices because of increased supplier competition. As $CCCC_{ddsssssddssssdd\_ttssttss}$ setting is high, the implication is that supplier instability increases lower net

profit. Thus, lower mean prices from the high setting in *SupplierPoolSize* and lower net profit from high setting in $CCCC_{ddsssssddsssdd\_ttssttss}$ lead us to expect a higher net profit from the two-way effect of *SupplierPoolSize* and $CCCC_{ddsssssddssssdd\_ttssttss}$. As hard-criteria-sourced suppliers maintain on average lower prices and lower delivery times for supplies than alternative suppliers, we expect hard-criteria-sourced suppliers to have higher net profit than random-selected suppliers in a high setting of *SupplierPoolSize* and a low $CCCC_{ddsssssddsssdd\_ttssttss}$ setting. Third, we expect the effect between $CCCC_{sssssppss}$ and *Differential* to be linear. As $CCCC_{sssssppss}$ setting is high, the implication is lower net profits due to increased supplier instability. As *Differential* setting is high, the implication is lower net profit. Thus, lower net profit from the high setting in $CCCC_{sssssppss}$ and lower net profit from the high setting in *Differential* leads us to expect a lower net profit from the two-way effect of *Differential* and $CCCC_{sssssppss}$. As hard-criteria-sourced suppliers maintain on average lower prices and lower delivery times for supplies than alternative suppliers, we expect hard-criteria-sourced suppliers to have higher net profit than random-selected suppliers in a high setting of *Differential* and a high $CCCC_{sssssppss}$ setting. Fourth, we expect the effect between $CCCC_{ddsssssddssssdd\_ttssttss}$ and *Differential* to be linear. As $CCCC_{ddsssssddsssdd\_ttssttss}$ setting is high, the implication is lower net profits cause by increased supplier instability. As *Differential* setting is high, the implication is lower net profit. Thus, lower net profit from the high setting in $CCCC_{ddsssssddsssdd\_ttssttss}$ and lower net profit from the high setting in *Differential* leads us to expect a lower net profit from the two-way effect of *Differential* and $CCCC_{ddsssssddssssdd\_ttssttss}$. As hard-criteria-sourced suppliers maintained on average lower prices and lower delivery times for supplies than alternative suppliers, we expect hard-

criteria-sourced suppliers to have lower net profit then random-selected suppliers in a high setting of *Differential* and a high $CCCC_{ddsssssddssssdd\_ttssttss}$ setting. Fifth, we expect the effect between *SupplierPoolSize* and *Differential* to be linear. As *SupplierPoolSize* setting is high, the implication is higher net profits caused by increased competition in supplier mean prices. As *Differential* setting is high, the implication is lower net profit. Thus, higher net profit from the high setting in *SupplierPoolSize* and lower net profit from the high setting in *Differential* leads us to expect a higher net profit from the two-way effect of *Differential* and *SupplierPoolSize* because of the greater influence of supplier competitive pricing in *SupplierPoolSize* . As hard-criteria-sourced suppliers maintain on average lower prices for supplies than alternative suppliers, we expect hard-criteria-sourced suppliers to have higher net profit than random-selected suppliers in a high setting of *Differential* and a high *SupplierPoolSize* setting.

Regarding the factors of CV ($CCCC_{ddsssssddssssdd\_ttssttss}$ and $CCCC_{ssssssppss}$), a higher CV induces a higher variance thus inducing a higher spread in suppler performance. One expectation regarding *CV* ($CCCC_{ddsssssddssssdd\_ttssttss}$ and $CCCC_{ssssssppss}$) may be that higher *CV*, higher variance in performance ($\mu_{price,}$, σ_{price}, $\mu_{delivery\ time}$ and $\sigma_{deliver\ time}$), could lead to higher errors in our estimation methods. One may expect that higher *CV* may relate to non-significant findings while a lower *CV* would have lower error terms, which may relate to significant findings. Further, one could conclude that higher *CV* may lead to non-differentiation in suppliers.

4.5 Results

We have one dependent variable and three control-factors, thus we can test the expectations of our model using an analysis of variance (ANOVA) in the GLM model of

SPSS (Tabachnick and Fidell, 2001). We test for equality of variance using Levene's Test and reject the null hypothesis at the p< .001 level. Further, we test the correlations between dependent variable and factors using the Pearson Correlation. If the Pearson correlation is < .90 then we assume variables are not multi-colinear. Further, we also assume they are related if the Pearson Correlation is > .20. Table 3 shows the Pearson Correlation for the dependent variables. Multicollinearity is reflected between the dependent variables, $CCCC_{ssssssppss}$ and $CCCC_{\mu\mu_{ddddddiiddddddd\_ttiittdd}}$, as the Pearson Correlation > .90.

< Appendix C insert Table 3. Correlation Table. Dependent Variable and Factors>

< Appendix C insert Table 4. GLM Univariate ANOVA: Dependent Variable, NP_Diff>

We perform the GLM model with a univariate analysis. Table 4 shows the tests between subjects and find there is statistical significance at the p< .01 level as shown. *NetProfit_Difference* was analyzed with a 2 ($CCCC_{ssssssppss}$: Low versus High) x 2 (*Differential*: Low versus High) x 2 (*SupplierPoolSize*: Low versus High) between-subjects ANOVA. The main effect of $CCCC_{ssssssppss}$on *NetProfit_Difference* was significant, F(1,252) = 94.104, p < .001. The main effect of *Differential* on *NetProfit_Difference* was also significant, F(1,252) = 16.572, p <.001. There was no statistical significance found in the main effect of *SupplierPoolSize* on *NetProfit_Difference*. The full model multi-factor is shown below in equation (6)

$$YY_{ssiiiiss} = \mu\mu + \alpha\alpha_{ss} + \beta\beta_{ii} + \gamma\gamma_{ii} + pp_{ssiiiiss} \qquad (6)$$

The *F* value (*F**) is used when running the ANOVA test to find out if the means between two populations are significantly different. The *F* value is calculated using equation (7) below.

$$F^* = \frac{MMMMMMRR}{MMMMMM} \qquad (7)$$

where,

$YY_{ssiiiiss}$ is the dependent variable, net profit

$\mu\mu$ is a constant

$\alpha\alpha_{ss}$ is the effect of the i-th level of CV

$\beta\beta_{ii}$ is the effect of the j-th level of Pool Size

$\gamma\gamma_{ii}$ is the effect of the k-th level of Differential

$pp_{ssiiiiss}$ is the effect of the residual variable

Further,

$$MSTR = \frac{nn}{\sum(\bar{YY}_{i} - \bar{YY}_{jj})} \quad \text{when } mm_{ss} \equiv nn \qquad (8)$$

$ss - 1$

And

$$MSE = \frac{1}{nnTT - ss} \sum_{s} (nn - 1)ss^2_{ss} \qquad (9)$$

For the full proof of F*, please see Appendix C.

Lastly, we plot the *NetProfit_Difference* for the control groups and display those profile plots in Figures 1 and 2 below. Figure 1 displays the *NetProfit_Difference* for the $CCCC_{sssssppss}$ (CV=.1

and CV =.4) control groups, using 95 percent confidence intervals for the estimated group

means. The vertical bars represent confidence intervals; confidence intervals that overlap (indicated by intersecting horizontal lines) are not significantly different. The greater the vertical separation between intervals, the greater the significance level of the difference. Figure 1 shows that for smaller coefficient of variation, there is no statistical significance found between control groups for *Differential* (High and Low settings).

<Appendix C Figure 1. Mean Plots: NetProfit_D in $CCCC_{ssssssppss}$ Control Groups>

4.6 Conclusions

The results present conditions under which hard-criteria-selected suppliers may statistically perform no better than random-selected suppliers. It is interesting to discover in Figures 1 and 2 that net profit difference between independent supply chains are statistically significant and no difference exists between the *NetProfit_Difference* for control groups of $CCCC_{ssssssppss}$and *SupplierPoolSize*, given the caveat that the $CCCC_{ssssssppss}$ is low (*CV*=.1). This implies that with a low coefficient of variation in mean price and mean delivery times, there is more stability in supplier price and delivery times. Further, with more stability in the supply base, buyers may be unable to see statistical significance between hard-criteria-selected suppliers and randomly selected suppliers. However, as *CV* increases to 0.4, as shown in Figures 1 and 2, the implication is that the supply base becomes less stable in mean price and mean delivery time. Further, as the supply base destabilizes in mean price and mean delivery time, hard-criteria-selected suppliers provide a statistically significant difference from randomly selected suppliers. Thus, as *CV* increases, hard-criteria selected suppliers can deliver supplies at the

expected price and expected delivery times whereas randomly selected suppliers are not able to do so.

We conclude from the univariate analysis that conditions exist such that randomly selected suppliers may perform no different, possibly even the same as hard-criteria-selected suppliers. Such conditions are those where there is stability in the supply base (CV=.1) that make it difficult for buyers to select suppliers with differing performances. Under such conditions, buyers may need something more than hard-criteria selection methods to find suppliers whose performance is statistically different from randomly selected suppliers. Given this conclusion, this research motivates further examination into other supplier selection methods beyond that of hard-criteria methods.

CHAPTER 5

QUALITATIVE CASE STUDY IN PUBLIC PROCUREMENT INNOVATION: EXAMINING SOCIO-TECHNICAL SYSTEMS IN FEDERAL ACQUISITION TEAMS

1. Introduction

A widely acknowledged finding is that of supply chain management (SCM) as a crucial driver of organizational performance. Li et al. (2006) found that not only can superior supply chain management lead to enhanced competitive advantage and improved organizational performance but competitive advantage can have a direct, positive impact on organizational performance. Strategic impact of supply chain management has been heavily influenced by innovations such as bar codes, radio frequency identification (RFID), cross-docking, and just-in-time delivery (Wuttke et al., 2013). Traditionally, the scope of innovation has been limited to managing physical inventory and information flows (Wuttke et al., 2013) while focusing on downstream innovations toward customers (Flint et al., 2008). Shook (2010) argued that innovation can change culture. Further, Shook claimed to have found how to "act one's way into thinking differently" will ultimately change an organization's culture. An understudied field within supply chain innovation is the impact of upstream innovation adoption on culture.

Scholars investigation of innovation adoption reveals a delineation between product and process innovations (Johannessen et al. 2001). Process innovation has long been investigated and found to increase productivity (Ettlie and Reza, 1992); Cohen and Klepper (1996a, b) developed a model for the relationship between research and development (R&D)

activities and business size and found that process innovation and firms larger in size maintained a positive relationship for effectiveness. A critical element Fritsch and Meschede (2001) found that, when compared with product innovation, process innovation was not suitable as a means of entry to market in saleable form (Cohen and Klepper, 1996a). However, the returns (price-cost margin) on process innovation have a positive relationship with efforts of large firms compared to those of small firms. Knutsson and Thomass (2013) argued that strategic process innovation in procurement can have an impact on an overall market in general.

Furthermore, process innovation reveals a unique upstream dissemination challenge toward buyers as opposed to the landmark supply chain innovation literature typically focusing on downstream innovations toward end-customers (Flint et al., 2008). The main difference lies between the organizational process innovation challenges which the buyer faces when implementing process innovation and the product innovation challenges which the buyer faces when marketing the product innovation to suppliers or even customers. Citing organizational innovation adoption, Appelbaum (1997) stated, "changes that support organizational development goals must consider how relationships among various (organizational) systems will be affected as they all are interdependent." Further, upstream challenges exist in organizations through upstream relationships. In particular, Pereira et al. (2014) argued that upstream relationships are vital as they are responsible for sourcing decisions which act as a bridge between internal and external enterprises. Pereira et al. further argued that procurement was a critical business activity in which the aforementioned critical enterprise bridging events impact companies' performance. For this reason, traditional procurement strategies may

require change (Pereira et al., 2014) in order for supply chain performance to improve. While Pereira et al. (2014) reviewed the role of procurement in supply chain resilience, their study did not focus on procurement innovation nor on the impact of procurement innovation on the organizational culture. Thus, an upstream focus seems appropriate to understand the organizational culture, or social and technical system, relationships from a procurement process innovation perspective.

Procurement process innovation (PPI) is a field which came into focus under heavy scrutiny from government officials in the mid 2000's. From 2004 to 2009, procurement spending by the U.S. federal government included 14.6 million purchases and accounted for $2.6 trillion in government expenditures (Liebman and Mahoney, 2018). By September 17, 2008, a subcommittee was convened for a final time to conclude testimony on waste, mismanagement and abuse of failed contracts. By that date, nineteen hearings had been held discussing the waste of taxpayer money due to a "broken acquisition process" as stated in the Committee on Homeland Security. While federal purchasing projects have been plentiful and budgets ample, neither comes without challenges. Amongst those purchasing challenges are bureaucratic control and process inefficiency. High bureaucratic control within government organizations (Aiken & Hage, 1971; Pierce & Delbecq, 1977) inhibits innovativeness amongst individuals and causes self-reinforcing mechanisms to trigger. U.S. federal government procurement projects had become highly inefficient and "a waste of taxpayer money" (Carney, 2008) because they had been mired in bureaucratic control and a broken acquisition process. Individuals on federal government procurement projects had long been suffering from self-reinforcing mechanisms, creating a path dependence in the procurement process and the U.S.

Congress was calling for accountability and improvement. In the months and years which followed the Committee on Homeland Security, procurement process innovation adoption took on various goals and initiatives. One such initiative was the Procurement Innovation Lab (known as the "PIL"). Created within the Department of Homeland Security in March 2015, the PIL started as an initiative "aimed at experimenting with innovative techniques for increasing efficiencies in the procurement process and institutionalizing best practices." The PIL's structure is organized under the leadership of DHS Chief Procurement Officer (CPO). PIL members, or the PIL team, serve as consultants, coaches, and innovation champions to acquisition teams of all participating DHS organizations, known as components. DHS components include: United States Coast Guard (USCG), Transportation Security Agency (TSA), Customs and Border Patrol (CBP), Immigration and Customs Enforcement (ICE), Federal Emergency Management Agency (FEMA), United States Secret Service (USSS), and Federal Law Enforcement Training Centers (FLETC). PIL team members collaborate with each DHS component to foster an outcome-based, mission driven, innovative culture. When DHS components initiate acquisition (procurement) projects, PIL team members provide training and consultation on up to a total of eighteen tested techniques which are found in the Federal Acquisitions Regulation (FAR) Handbook. Although in existence for five years, the PIL has been viewed as new and as such has faced challenges of new process innovation. Within process innovation research, there seems to be little doubt that manufacturing process innovation can have substantial impact on manufacturing productivity (Ettlie and Reza, 1992). However, in the understudied field of procurement process innovation, we use a theory-building approach by collecting and analyzing qualitative data from eleven cases involving

DHS component procurement projects where the components collaborated with the PIL. We identified five archetypes of PIL-assisted procurement projects and built working propositions. This paper seeks to examine the state of and research outcomes from qualitative case studies in the procurement process innovation field. There have been similar papers within the SCM field. For instance, Wuttke et al. (2013) reviewed managing the innovation adoption of supply chain finance from six European case studies. We are not aware of any papers on procurement process innovation in the SCM discipline and we intend to fill this gap in research. For academia and practice, the adoption of procurement process innovation is new. Therefore, we use an explorative multiple case study approach to build knowledge on how organizations manage the adoption of procurement process innovation. This approach allows us to address research questions which are necessary to understand the complexities of the innovation adoption process. We address the following research questions:

- How do organizations act their way into thinking differently?
- Does culture impact procurement innovation adoption?
- Does procurement innovation adoption cause a change in thinking or behaving in the procurement process?
- Does procurement innovation adoption cause a change in thinking or behaving to make the procurement process more or less difficult?

By addressing these research questions, we make several contributions to SCM research and practice. First, we provide evidence that behavior precedes insight and understanding which expands on Shook's (2010) claim of "acting one's way into thinking differently." Shook's research in the NUMMI venture (GM implementing the Toyota Production System through collaboration with Toyota) found phenomena of GM employees

sharing how their culture changed after the venture was completed. However, Shook did not share *how* this cultural change took place; he shared the results of changed behavior but not what acting or behaviors took place in order to change the thinking that in turn changed the GM culture. Shook's claim contradicted previous theoretical implications which argued that understanding preceded behavior (Schein, 1983; Mariotti et al., 2021; Vitolla et al., 2021). As Shook's research into the NUMMI venture provided results of culture change, his writings have served as a call to provide evidence of how the culture change takes place, i.e., how to act one's way into thinking differently- but have gone mostly unanswered. Our primary contribution is to first answer Shook's writings with evidence of how culture change took place; second, to show how the upstream supply chain field has shifted in behavior- through small actions and interactions- in order to change thinking; and third, to show that behaviors have post-action which effects thinking and behaving in the immediate and sustained future. We argue that these contributions explain behaviors as more than just minor implications in the organization but that minor actions and interactions have major impact on the entire the socio-technical system.

Second, we provide in-depth insights into the adoption of procurement process innovation which also provides further insights into upstream innovation diffusion processes. Practitioners can gain knowledge on the implementation of procurement process innovation from an internal and an upstream perspective reducing uncertainty on how to implement PPI.

Additionally, we provide an empirical contribution to the emerging field of research on the interface of public procurement and organizational process innovation, answering

Peireira's (2014) call for more research on upstream innovation, particularly research on procurement.

The remainder of this paper is structured in six sections. First, we present literature review on organizational and process innovation adoption, concluding with our research framework. Second, we provide definitions of key terms. Third, we describe our case study methodology. Fourth, we provide within case descriptions. Fifth, we present our cross-case comparisons. Sixth, we present the archetypes and delineate key propositions. Finally, we will conclude with a discussion including managerial implications and theoretical contributions.

2. Literature Review

This research is informed by two literature streams: (1) literature on innovation adoption and (2) literature on socio-technical system theory unlocking path dependence through understanding organizational systems.

2.1 Innovation Adoption

To further explain how procurement projects had devolved into such a daunting challenge, we define the dangerous path down which self-reinforcing mechanisms have led. Self-reinforcing mechanisms create a path dependence for individuals and individuals collectively of organizations. As individuals and organizations become path-dependent, extant literature from innovation adoption (IA) theory states that an inefficient long-term predominance is established (David, 1985, 1986). Sydow et al. (2009) further articulate organizational path dependence into three developmental phases; (1) singular historical events, which transform themselves into (2) self-reinforcing dynamics, and ultimately end up in (3) organizational lock-in. Beer & Nohria (2000) support the notion of a "lock in" situation which

makes it difficult to change organizational action patterns. A high degree of external control characteristics of public organizations has a negative influence on managers' desire to delegate authority and causes high levels of bureaucratic control.

Organizational lock-in occurs when self-reinforcing dynamics lead to an irreversible state of total inflexibility beyond the control of the individual (David, 1985). Factors contributing to several self-reinforcing mechanisms include coordination effects (North, 1990), complementary effects (Panzar & Willig, 1981), learning effects (March, 2006), and adaptive expectation effects (Leibenstein 1950; Szulanksi, 1996). Once self-reinforcing mechanisms trigger through multiple iterations of a given action or process, an organizational path is followed which becomes so entrapping, individuals and organizations become long-run dependent. Organizational path dependence- as outlined by Sydow et al. (2009)- leads to predictable actions at both the organizational and individual level since both are now controlled by systemic forces (David, 1985). At the lock-in point, flexibility is lost, originally existing optimal choices are no longer available, and organizations are no longer capable of adopting better alternatives. Lock-in due to organizational path dependency can have effect on systems including rendering them inefficient. Thus, path dependency, in order for organizations to regain optimal choices and efficiencies, must be dissolved.

Extant literature holds the fundamental assumption that path dissolution occurs by an accidental process (Burgelman, 1994 and 2002), such as an exogenous shock or catastrophe. Furthermore, organizations may choose to deliberately break paths in varying levels of intensity and complexity (Sydow et al., 2009), but all path-breaking options must include a minimum condition of "effective choice situation restoration." Breaking, or unlocking,

organizational paths requires a "second-order observation" (von Foerster, 1991) or an integration of an external lens. Knowledgeable agents seeing through this external lens reflect on practices and potentially open path-breaking avenues through which organizations can travel for innovation adoption. From a purchasing agent's perspective, external lens application by knowledgeable IA agents can have a polarizing effect (Marrone et al., 2007) on the purchasing agent's boundary spanning capabilities of interpersonal and inter-organizational trust (Zhang et al., 2010). While purchasing agents play a vital role in "gaining supplier trust by reducing risks suppliers perceive when working with a powerful buyer" (Perrone et al., 2003; Ireland and Webb, 2007), purchasing agents must also "effectively manage their organization's interactions with other entities and facilitate collaborations across organizational boundaries" (Stock, 2006; MacDuffie and Helper, 2006).

While there is limited research on path dissolution, it is unclear what effects knowledgeable agents applying innovation adoption, as noted by von Foerster (1991), during the procurement process could have on purchasing agents' boundary spanning capabilities. It is, however, clear that boundary spanning purchasing agents need to build and maintain capabilities that promote learning and innovation (Hackman, 1987; Sundstrom, DeMuese, & Futrell, 1990). Furthermore, these boundary spanning capabilities (strategic communication, professional knowledge, and ability to reach compromise) could be attributed to organizational training and policies (Doney and Cannon, 1997). Additionally, organizational training and policies are a result of the organizational socialization process, or social systems, of individuals in an organization (Sydow et al., 2009). Social systems within organizations can facilitate or inhibit learning and innovation (Frambach and Schillewaert, 2002). Frambach and

Schillewaert (2002) clarify that organizational facilitators influence individuals' awareness of the functioning and application of innovations in terms of usefulness and fit with the job. Frambach and Schillewaert further clarify that some individuals "more readily accept certain innovations while others do not." Sydow et al. argued that understanding organizational social systems allow for potential path dissolution. Understanding social systems may enhance path dissolution for organizational innovation adoption, however, it is not certain if understanding social systems alone will provide a clear path for innovation adoption. This paper builds on Sydow et al.'s research by arguing the understanding of social and technical systems will not only enhance path dissolution for organizational innovation adoption but will further impact organizational performance. Also, social and technical systems inform current theoretical approaches of understanding and insight preceding behavior. Thus, in the following sections we provide a review of social and technical system theory pertaining to organizational level initiatives.

2.2 Socio-Technical Systems

Extant literature argues that certain social attributes, like having the right culture, must be present before implementing technical systems (McIvor and McHugh, 2000). Pasmore (1988) posits in socio-technical systems (STS) theory that a firm is a system comprised of two subsystems: (1) the social system that "is comprised of people who work in the organization and all that is human about their presence," such as "attitudes, beliefs, relations, cultures, norms, politics, behaviors, and emotions" (Kull et al. 2013) and (2) the technical system that "consists of the tools, techniques, artifacts, methods, configurations, procedures, and knowledge used by the organizational employees to acquire inputs,

transform inputs into outputs, and provide output or services to clients or customers" (Pasmore 1988). In straightforward fashion, a firm is made up of people who adopt and use tools, techniques, processes, procedures, and knowledge to produce products or services required by customers. Harmony amongst the social and the technical systems is a strong barometer for organizational success, not just the technological features or capabilities (Emery 1959).

Having been traditionally focused intra-organizationally, STS research is developing more of a focus on diffusion of innovation and socio-technical principles (e.g., joint design and optimization of social and technical systems) (Matthews, 1997). Clegg (2000) writes that "There would seem … to be no reason why sociotechnical thinking should not be extended to supply chains, partnerships and other networked ways of working that cross-company boundaries." Citing practical application, Appelbaum (1997) observed early the urgency in STS focus on organizational innovation stating, "Changes that support organizational development goals must consider how relationships among various systems will be affected as they all are interdependent." Using observations from literature, Choi and Liker (2002) underscored the important role which social aspects play on technical supply chain change and additionally called for more STS supply chain studies, yet this call has generally gone unanswered.

The literature on socio-technical systems and innovation adoption may be complementary of each other and even overlap in review of the dynamics of social systems and behaviors. The topic of organizational innovation adoption is one of growing research interest. Management scholars of organizational behavior have focused on product

innovation and organizational path dependence, despite recognition of path dissolution through the understanding of self-reinforcing dynamics (Saffold, 1988). Likewise, while strategic management scholars have inter-and intra-organizational interests, socio-behavioral topics are nascent and more individually-focused despite the somewhat recent call for a "behavioral strategy" viewpoint (Powell et al., 2011; Sibony et al., 2017). The supply chain innovation literature, while acknowledging the importance of intra-organizational behavior, primarily treats socio-psychological factors as exogenous to supply chain changes. For instance, Liao and Marsillac (2015) describe how external knowledge acquisition (EKA) is an iterative and interactive process conducted with supply chain partners. Similarly, Stolze et al. (2015) show how socio-relational factors interact exogenously to influence supply chain integrations. Underdeveloped in each of these literature bodies is an underlying framework that shows social and technical factors as inter-dependently influencing innovation adoption.

Upon further review of STS theory, there is an STS-based framework proposed by Kull et al. (2013). In their research, STS theory was used to explain an inter-organizational behavior discovered by Fawcett et al. (2012) and identified as "behavioral constraints." Kull et al. argued that these employee behaviors inhibiting an organizational initiative emerged, partly, from the way an inter-organizational initiative, such as a supplier integration, was technically designed. Specifically, employees react to inter-organizational initiatives that threaten social positions, diverge from social values, dysfunction social associations, and disrupt social experiences. Table 1 provides a summary of the socio-technical system features as researched by Fox (1995), Emery (1959), Seiler (1967), and Pasmore (1988).

<insert Table 1.>

Kull et al., in particular, point out that traditional and non-traditional boundary-spanners assume new forms of interaction due to the integration (inter-organizational) process. Per Kull et al.'s research, socio-technical interactions among supplying firm sales, marketing, and R&D personnel change as the R&D personnel begin spanning boundaries. This dynamic perspective is shown in our research framework found in Figure 5.1, where an inter-organizational IA initiative changes the buyer-supplier technical system, which in turn imparts procurement team-related social system changes, instigating reactions that influence, unintentionally, the same buyer-supplier technical system and, ultimately, buyer-related outcomes.

<insert Figure 5.1 Research Framework>

Kull et al.'s framework is useful in understanding sociotechnical challenges to supplier integration, however, for comprehension on purchasing agent innovation adoption, more specifics are needed for what behaviors are indicative of buying firm sociotechnical dynamics, specifically amongst IA agents and procurement team personnel. That is, what type of behavioral induction might an organization expect given any one of these sociotechnical tensions? As social system threats can be challenging to detect beforehand, observing behavioral inductions are more practicable.

Whereas STS theory may provide foundational steps towards synthesizing sociotechnical reactions to system integration, it currently does not elaborate into innovation adoption. There are insufficient elements available within STS theory itself to make behavioral estimates given IA interactions. Further, STS theory currently provides evidence of understanding and insight preceding behaviors and actions. Our research turns toward a

holistic theory of STS to further the teachings in a supply chain environment. Following the call of theory elaboration by Ketokivi & Choi (2014) is an appropriate continuation in evolving this important topic.

This study includes qualitative interviews from 32 individuals spanning procurement projects completed during the period beginning October 1, 2017 and ending September 30, 2018 from the Department of Homeland Security. These interviewees granted permission for the interviews to be recorded. Transcripts from each interview were coded to find themes, make inferences, and ultimately create case studies which are all discussed in later sections of this paper. The interviews come from acquisition projects assisted by an innovation adoption coaching agency, the Procurement Innovation Lab (PIL), within the large U.S. government department. Knowledgeable IA agents from the Procurement Innovation Lab, henceforth referred to as the "PIL," conducted trainings and assisted with procurement requisition projects. The opportunity to measure their impact on procurement team member behaviors provided the very essence of this research. We discuss the socio-technical systems perspective as it pertains to path dissolution through understanding the social and technical mechanisms within procurement projects. STS systems provide further explanation to innovation adoption by purchasing agents as facilitated by knowledgeable IA agents.

Eliciting from socio-technical system (STS) theory (Pasmore et al. 1982), we examine the effects of IA on buyer performance as assisted by knowledgeable IA agents within the procurement team. This research contributes to extant literature in three essential ways. First, this research builds on Sydow et al.'s (2009) study regarding organizational path dependence with respect to path dissolution. We focus on the understudied field of public procurement

while highlighting the path dissolution approach facilitated by IA agents. With knowledge sharing efforts by knowledgeable IA agents to increase boundary spanning capabilities of purchasing agents, it is crucial to understand behavioral constraints (or inductions) within the purchasing organization which may impede or enhance the innovation adoption using path dissolution in the procurement process. Sydow et al.'s research (2009) concluded that path breaking requires a thorough understanding of the social mechanisms driving the path process. This research builds on the conclusion and adds that the technical mechanisms as well as the social mechanisms should be understood such that optimal paths may be unlocked. Second, we advance a more thorough analysis of IA which facilitates the investigation of the fundamental assumption that organizational path dissolution leads to innovation adoption at the individual level and could assist with innovation adoption at the organization level. Furthermore, IA may motivate behaviors in purchasing agents which positively impact their path dissolution desires to facilitate the procurement process. Third, we build on Pereira et al.'s (2014) research on procurement's crucial role in upstream sourcing relationships while also opening further the understudied field of procurement innovation in upstream supply chain management. Fourth, we expand on Shook's (2010) research of culture change by showing individuals acting their way into thinking thus contradicting extent mental models arguing understanding before behavior.

2.3 Definition of Key Terms

Our extensive research with key informants and stakeholders in the Federal government have provided us key insights into the public procurement process as well as the innovative techniques used therein. Our research focuses on the procurement process and

innovative techniques used within that process. At the level of Federal Government in the United States, procurement is known as *acquisition*. Acquisition is the acquiring by contract with appropriated funds of supplies or services (including construction) by and for the use of the Federal Government through purchase or lease, whether the supplies or services are already in existence or must be created, developed, demonstrated, and evaluated (Federal Acquisition Regulation, "FAR," Handbook). Acquisition begins when agency needs are established and includes the description of requirements to satisfy agency needs, solicitation and selection of sources, award of contracts, contract financing, contract performance, contract administration, and those technical and management functions directly related to the process of fulfilling agency needs by contract. Thus, the *acquisition process* is the "the process by which the efforts of all personnel responsible for an acquisition are coordinated and integrated through a comprehensive plan for fulfilling the agency need in a timely manner and at a reasonable cost. It includes developing the overall strategy for managing the acquisition." (FAR, 2023). This study focuses on innovation applied during each of the activities and tasks of the satisfy agency needs, solicitation and selection of sources, and award of contracts.

Acquisition innovation is defined as the activities and tasks which are "focused on embracing innovation and promoting meaningful communications." Such activities include strategies, practices, and technologies that strengthen the acquisition environment (https://www.dhs.gov/pil, 2023). Many innovative techniques are discussed throughout this paper. These techniques are coached by members of the PIL. The core bundle of techniques which PIL team members coach on are: oral presentations, video proposals, advisory down-

select, multi-phased evaluations, confidence ratings, straight-to-consensus, streamlined documentation, technical demonstrations, and group oral debriefings. Each of the above techniques is defined in the paragraph that follows.

The PIL coaches acquisition teams and assists them to implement innovative techniques throughout the acquisition process. The acquisition process is shown in the flow chart below in Figure 5.2.

<Appendix D insert Figure 5.2 Federal Government Acquisition Process Flow Chart>

The PIL coaches assist by implementing the innovative acquisition techniques from the "needs" phase through the "supplier award recommendations" phase. Our research focuses primarily on the phases of proposals and evaluation. Innovative techniques are both presented by the Federal government to the industry community which may request an alternate mode of proposal such as video proposal, oral presentation, and technical demonstrations. *Video proposals* are defined as an alternate mode of proposal from the vendors in a particular industry of the commodity sourced by the Government. Video proposals are comprised of vendors using smartphones or laptops to record 10-minute videos detailing technical factor(s) and upload them to an application such as YouTube for evaluation. The Federal Government stipulates what the video proposal requirements are to be reviewed so there is no confusion on behalf of the offering vendor. *Oral presentations* are presentations performed in person similar to an interview but may be performed by video conference, or by phone. *Technical demonstrations* are available to allow an offeror to prove its product by having evaluators see and test the product in person similar to an oral presentation but with actual products present.

Other innovative techniques regarding evaluation are those techniques which the Federal government uses to evaluate proposals and communicate to the industry community regarding submitted proposals such as multi-phased evaluations, advisory down-select, confidence ratings, straight-to-consensus, streamlined documentation, and group oral debriefings. Evaluations can be done in multiple phases where each phase of the evaluation reduces offering vendors during the process. The *mulit-phased evaluations* reduce the number of vendor proposals to evaluate and reduce the risk of process in the protest. When the multi-phased evaluations are used in conjunction with the *advisory down-select technique*, the risk of protest can be reduced even more. Acquisition team members perform *advsiory down-slect* when they communicate with a vendor that the vendor's submission for a particular phase in the evaluation process was not competitive with the other vendors' submissions thus they should consider- even though the vendor has the choice- to not continue in any phases that follow. As part of the proposal evaluations, acquisition teams are required to have consensus on their evaluations. Rather than conduct their evaluations separately, acquisition teams may meet together to evaluate all proposals and then come to consensus right after their evaluation. Thus, the straight-to-consensus technique is simply the act of composing the consensus of evaluations of all team members right after the proposal. During the straight-to-consensus exercise (or anytime during the evaluation), acquisition teams can provide *confidence ratings* instead of adjectival ratings. *Confidence ratings* are simple as the acquisition team provides a rating for the proposal of either "high confidence," "some confidence," or "no confidence" that the vendor can perform the work for the government. As teams are completing evaluations and coming to consensus on their proposal ratings, acquisition teams may use

streamlined documentation to write up their evaluations in bullet format rather than a long, voluminous set of documents. Lastly, when the acquisition team needs to communicate results of the evaluation to the pool of offering vendors, the acquisition team need not communicate to one vendor at a time; the team can simply conduct a *group oral debriefing* where they conduct a phone call, virtual meeting, in-person meeting or other format to notify the vendors of evaluation results. This reduces the notification of such results to one short amount of time rather than many separate communications which may take much longer.

3. Methods

Within this study, we seek to understand the adoption of the innovative procurement process, which bears yet unexplored mechanisms such as the role of upstream supply chain members and functional collaboration between PIL team members and government component procurement teams. In accordance with the purpose and research questions we posed, we opted for a qualitative multiple case study approach as research on how government components adopt procurement innovation is still in an exploratory stage and the adoption is complex in nature as multiple systems are involved (Eisenhardt 1989b; Ellram 1996; Meredith 1998; Wacker 1998; Gibbert et al. 2008; Yin 2009; Barratt et al. 2011).

Our case study adopted the grounded theory building approach (e.g. Glaser and Strauss, 1967; Strauss and Corbin, 1990). Specifically, the principles of theory building based on case studies (Eisenhardt, 1989; McCutcheon and Meridith, 1993; Miles and Huberman, 1994; Yin,1994). Researchers in supply chain and operations management have begun using such methods to understand complex organizational phenomena (e.g. Boyer et al., 2000;

Bozarth and McDermott, 1998). Further, the propositions we derive will be grounded in empirical evidence and show relationships among the emergent constructs.

Following the advice of Gibbert et al. (2008) and Yin (2009) we accounted for construct validity, internal validity, external validity, and reliability throughout our research process. For instance, initially we interviewed key informants from legal counsel, contract management, program management, and procurement innovation because the adoption of procurement process innovation often involves cross-functional teams consisting of these functions. Building upon their responses, we requested further interviews until we felt that we collected sufficient data in each organization as additional interviews would not reveal further relevant data. This approach increased construct validity and internal validity, as it enabled us to triangulate different opinions and thus to reduce biases. In total, 32 interviews were conducted.

The case study data were collected throughout the summer of 2019. Interview subjects came from DHS components, supplier (industry) firms, and PIL team members. Getting the data from multiple sources gave us the opportunity to triangulate the information we were collecting (Eisenhardt, 1989; Miles and Huberman, 1994). Usually several interviews were conducted through site visits; five interviews were conducted via telephone calls. The time it took for one interview generally ranged from 45 minutes to 90 minutes. Unclear answers were clarified through email or in follow-up questions in subsequent rounds.

3.1 Sampling and Data Collection

We adopted a theoretical sampling method (Eisenhardt, 1989; McCutcheon and Meridith, 1993; Miles and Huberman, 1994). First, we set out to select government component procurement teams with leading procurement practices so that the propositions will have practical value for other government organizations as well as private companies. We identified these leading procurement teams through inquiry from government officials from the Department of Homeland Security, including the Chief Procurement Officer (CPO) as well as leading procurement professionals and researchers from a supply chain management program at a Research I institution in the U.S. Twenty-seven procurement teams were initially selected and contacted. Fifteen procurement teams were eventually used for this study. The final selection was made based on the willingness to share procurement practices, as discussed in the next paragraph. Studies done by Eisenhardt (1989) and Wu and Choi (2005) recommend about seven or eight cases as being ideal for theory-building purposes, if less, the study might suffer from lack of generalizability, but if too many, the researchers would not be able to process the qualitative data.

While seven or more cases may be preferred for theory-building purposes, case-based studies generally lack external validity (Eisenhardt, 1989; McCutcheon and Meridith, 1993). To address this, we wanted to include a wide spectrum of procurement teams in our study. In order to accomplish this, we used a well-known purchasing product matrix (Kraljic, 1983; Olsen and Ellram, 1997). We selected products to fill all four quadrants of the matrix. Furthermore, to address the issue of external validity, we wanted to match up the US Federal Government

<insert Figure 5.3 Purchasing Matrix>

categories to the purchasing product matrix. Figure 5.3 includes the overlay of the Government wide categories (GSA, 2018) on to the purchasing product matrix. Also, in order to increase variance in the data, we selected cases that clearly fell into one of the four quadrants in the purchasing matrix. Fig. 1 also illustrates the purchasing matrix and shows the names of the eight procurement projects, which represent eight cases.

Together with the persistent and generous support of the Procurement Innovation Lab (PIL), we interviewed 32 individuals. First, exploratory interviews were conducted with persons associated with the PIL to learn the focal organization's IA techniques and experiences on PIL-assisted projects. Second, individuals from each project were emailed to solicit assistance in the qualitative research. Third, individuals accepting the solicitation to assist were scheduled to meet separately with the interviewer. As Yin (2003) explains, the interviewer articulated to each interview subject the objective and expected benefits of our study, guaranteeing confidentiality, and offering a final report upon request. Next, 32 persons from fifteen unique projects agreed to participate in interviews spanning 45-90 minutes using the interview protocol in Table 2. of Appendix 1. Twenty-seven interviews were conducted in person while five interviews were conducted over the phone due to logistical constraints between the interview subject and the interviewer. Where requested by the subjects, the interview protocol was emailed to provide background on the research context and questions (Yin, 2003)

Interview subjects for each project included members from the procurement requirement project. Each project conducted for procurements has a team of purchasing agents assigned to it. The team of purchasing agents maintains a mission of organizing the

procurement process according to the Federal Acquisition Requirement (FAR) standards as set forth by the United States government. The procurement project team consisted of the following roles: contracting specialists (CS), contracting officers (CO), program manager (PM or COR), general counsel/procurement attorney (GC or PA), and technical team members who functioned as commodity or service subject matter experts.

3.2 Coding

Researchers who performed the coding both have conducted qualitative research and interviews in previous studies. One researcher is an academic faculty with a PhD in supply chain management; the other research is in the process of finishing their PhD in supply chain management. We based our data analysis approach on Strauss and Corbin (1990), as we used codes grounded in data. In this step, we obtained and integrated data from all sources discussed above (Moran-Ellis et al. 2006). However, as concepts from related research emerge, these concepts were adapted to relate our findings with previous research (Eisenhardt 1989b; Mello and Flint 2009; Yin 2009). We then pursued selective (Strauss and Corbin 1990) and theoretical coding (Glaser, 1978, 1992) by systematically relating the core category to other categories as well as reviewing each interview. Our coding process was conducted by both researchers conducting a coding session together using the same transcript and the set of selective codes from socio-technical system theory. Next, each researcher coded an additional transcript separately with the set of codes. After each researcher coded the same transcript separately, both researchers met again to discuss codings and discuss any differences in codings. After discussing coded transcripts, we used a natural language processing (NLP) and machine learning application to assist in coding

manuscripts. The application was created using ChatGPT and was trained by applying the set of socio-technical system theory codes before submitting manuscripts to be reviewed. Natural language processing (NLP) and machine learning (ML) have seen increasing application in qualitative analysis and have also been useful in automating the coding process (Marathe and Toyama, 2018). The first author coded each of the 32 interview transcripts whereas the other researcher coded a subsample and the machine learning application was used on a larger subsample of transcripts as well. A subsample of manuscripts was used to train the application to gain an inter-coder agreement rate of 91% before coding the remainder of transcripts.

We based our data analysis approach on Strauss and Corbin (1990), as we used codes grounded in data. In this step, we integrated data obtained from all data sources discussed above (Moran-Ellis et al. 2006). However, as concepts from related research emerged, we adapted these (e.g., socio-technical system) to relate our findings with previous research (Eisenhardt 1989b; Mello and Flint 2009; Yin 2009). Then, we pursued selective (Strauss and Corbin 1990) and theoretical coding (Glaser, 1978, 1992) by systematically relating the core category to other categories as well as reviewing each interview through the lens of socio-technical theory. The codes we applied are displayed in Table 1 previously mentioned. Researchers worked diligently through many coding sessions while also discussing codes and resolving any disagreements of codes to arrive at inter-coder reliability.

3.3 Data Analysis

Having established the specificities of innovation adoption and socio-technical system theory in the literature review, we will now outline the STS particularities of our cases along

Kull et al.'s (2013) framework. After data were collected, we coded the transcripts and compared coding. Data collection stopped when additional data would not provide new information to our understanding of the research questions, this marked the theoretical saturation point (Eisenhardt, 1989; Glaser and Strauss, 1967). For data analysis, we followed the procedure by Miles and Huberman (1994), we first conducted within-case analysis, where the case studies were built based on data and key constructs were derived. We identified the procurement teams and IA agents with relationship dynamics between the two groups in procurement projects. Next, we conducted a cross-case analysis. We show the results of within-case in the Appendix B. The cross-case analyses are discussed in the next section.

4. Cross-case comparisons

Given the within-case analysis above for the eight projects, we implemented a cross-case analysis to find similar patterns observed across the case studies available (Yin, 2009; Wu and Choi, 2005)). Our analysis reveals that changes in the technical systems of the focal acquisition project teams induced changes in the social systems which have been historically maintained. The characteristics of each acquisition project case are captured in Table 3 which is displayed in Appendix A.

The table lists and compares across all eight cases the acquisition project enthusiasm toward PIL techniques, any acquisition project resistance toward PIL techniques, changes in thinking or behaving as a result of PIL technique usage, changes in thinking or behaving which made the acquisition process more (or less) difficult, and implications for acquisition team performance. Below is the discussion of each of these areas of comparison.

4.1 Procurement projects expression of enthusiasm

Team members of an acquisition project may express enthusiasm to PIL techniques used during the procurement process. These expressions of enthusiasm manifest themselves in feelings of approval such as when acquisition team members say they "liked" a technique or that they "saw value in the technique."

Upon reviewing the eight cases, there are many commonalities of enthusiasm toward particular PIL techniques used. First, oral presentations technique was a PIL technique for which seven projects expressed enthusiasm. The most common change caused by use of the oral presentation technique was to technical flows (T4) which induced changes in the social experiences of the acquisition team members.

Second, on-the-spot consensus was a PIL technique for which five projects expressed enthusiasm. The most common changes caused by use of the on-the-spot consensus technique were to technical centralities (T1) and technical flows (T4) which induced changes in the social roles (S1) and social experiences (S4).

Finally, advisory down-select technique was a PIL technique for which four projects expressed enthusiasm. The most common change caused by use of the advisory down-select technique were to technical centralities (T1), technical requisites (T2), and technical flows (T4) which induced changes in social roles (S1), social values (S2), and social experiences (S4).

Other techniques for which acquisition teams expressed enthusiasm were confidence ratings and streamlined documentation. Confidence ratings caused changes in technical centralities (T1) and technical proximities (T3) which induced changes in social roles (S1)

and social associations (S3). Streamlined documentation caused changes in technical flows (T4) which induced changes in social experiences (S4).

The acquisition teams shared enthusiasm for these techniques due to the timesaving and workload reducing attribute which each technique provided in the procurement process. Overall, acquisition teams expressed that changing the flows of the procurement process created an opportunity for developing new skills, knowledge and expertise in their job functions.

4.2 Procurement projects expression of resistance

Team members of an acquisition project may express incongruence to PIL techniques used during the procurement process. These expressions of incongruence manifest themselves in feelings of disapproval such as when acquisition team members say they "didn't like" a technique or that they saw a team member who "did not want to use" the technique.

There are a few commonalities in the techniques which team members expressed resistance or initial resistance. Initial resistance refers to an acquisition team stating they couldn't understand a technique or were unfamiliar with a technique due to not using it before, however, after understanding, using, and seeing results, team members expressed enthusiasm for those techniques used. The two techniques for which initial resistance was expressed were oral presentations and confidence ratings. There were also two projects which did not express any resistance toward any PIL techniques. There were two projects which expressed resistance (including initial resistance) toward oral presentations. The most common changes caused where to technical flows (T4) and centralities (T1) which induced

changes to social experiences (S4) and positions (S1). There were a total of two projects which expressed resistance (including initial resistance) toward confidence ratings. The most common changes caused were to technical proximities (T3) and flows (T4) which induced changes in social associations (S3) and experiences (S4).

Second, there were two projects each which expressed resistance toward video proposals and on-the-spot consensus. The changes caused by video proposals were technical centralities (T1), proximities (T3), and flows (T4) which induced changes in social roles (S1), associations (S3), and experiences (S4). The changes caused by on-the-spot consensus were technical centralities (T1) and requisites (T2) which induced changes in social positions (S1), values (S2), and experiences (S4).

Third, there was one project each which expressed resistance toward advisory down-select and streamlined documentation. The changes caused by advisory down-select technique were technical centralities (T1) and flows (T4) which induced changes in social positions (S1) and experiences (S4). The changes caused by streamlined documentation were technical requisites (T2) which induced changes in social values (S2).

Finally, there were two projects which recognized disagreement between Legal Counsel and the Contracting Officer regarding the use of PIL techniques. In both of these cases, the acquisition team favored the use of PIL techniques and the Legal Counsel did not. In both cases, Legal Counsel did not acquiesce to the use of all PIL techniques. Both projects saw an increase in workload and time spent on the procurement process. In both cases, resistance from legal counsel was recognized which proposed an increase to technical requisites (T2)- the demands of other team members placed on and the degree to which

others need legal counsel- which increased existing social values (S2)- perpetuated the traditional norms and interdependencies of procurement team practices. Resistance from legal counsel also noted that other changes were to technical centralities (T1) and flows (T4) which induced changes in social positions (S1) and social experiences (S4).

4.3 Changes of thinking or behavior in procurement process

Acquisition teams expressed changes in thinking and behaving due to using the PIL techniques. First, we discuss the changes in thinking which teams experienced. Teams stated that they had changed thinking in a more positive manner with respect to operating on an acquisition team. For instance, teams expressed a desire to continue use PIL techniques, as opposed to using traditional techniques, beyond the current acquisition project. Also, regarding oral presentations, acquisition teams changed their thinking regarding the need to have the Contracting Officer present during the presentations. Further, acquisition teams also stated the need to be more confident when using oral presentations technique.

Additionally, acquisition teams changed their thinking regarding the entire teams agreement to use the PIL techniques in general. The thought of agreement may not have originally crossed their minds, however, after using PIL techniques teams changed their minds to state that agreement for use of PIL techniques is desired before initiating an acquisition project.

Further, acquisition teams stated their thinking on total timeline for completion of an acquisition project had changed. Originally, they felt projects would take anywhere from six months to a year, however, after having used PIL techniques they changed their thinking to

reflect a shorter timeline may be required. Also regarding timelines, acquisition teams stated that their thinking regarding the vision of the acquisition project changed. Originally, teams viewed evaluations as how well a vendor responds to a solicitation, however, after applying confidence ratings technique, teams now changed to a forward thinking vision of how well a vendor can perform on the contract if awarded.

Acquisition teams changed their thinking of how they viewed the Legal Counsel representatives on some projects. Originally, team members viewed Legal Counsel with fear and apprehension, however, after having used PIL techniques, Legal Counsel was viewed with much more trust and in a more helpful view.

Finally, acquisition teams expressed a change in thinking regarding a flexibility of use of knowledge when applying confidence ratings. Originally, teams felt too rigid and tense as if they were confined to using adjectival ratings, however, upon using confidence ratings teams felt a greater flexibility to use other knowledge and factors of procurement with the evaluation.

Acquisition teams also shared changes in their behavior during the acquisition process. By far, the greatest change in behavior occurred with evaluation techniques. First, two projects expressed they changed behavior for evaluations by conducting on-the-spot consensus evaluations right after the oral presentations. Second, two projects expressed changes in behavior with the technical team as they asked more questions of the Contracting Officer during the on-the-spot consensus technique, whether it be for clarifications of the evaluation or for assistance on conducting the on-the-spot consensus. Third, teams changed their behavior regarding the composition of evaluation reports such that using on-the-spot

consensus provided the opportunity for the team to write a one-time composition final evaluation report along with writing a more concise report with streamlined documentation (bullet points).

Further, two projects changed their behavior regarding the involvement of Legal Counsel during the entire acquisition process. The teams involved Legal Counsel form initial steps of procurement and throughout until the award whereas following traditional techniques, Legal Counsel may only be involved on an as-needed basis or very seldom. One team expressed they changed behavior with reviewing proposals when using video proposals. Following traditional techniques, teams would only view one stream of information for written proposals. Using the video proposal technique, teams now viewed multiple streams of information and had to adjust their focus and skill set. Lastly, one team shared their changed behavior in a negative manner. Due to Legal Counsel preferring more written explanation for performance work statements, the team had to rewrite the entire performance work statement to meet this preference.

4.4 Changes in thinking or behavior which made procurement process more/less difficult

Acquisition teams shared changes in thinking and behaving which made the procurement process more and less difficult. First, teams shared that applying the on-the-spot consensus and oral presentations induced changes in team members to reduce a dominant voice on the team. The dominant voice was reduced in the two cases of Actors and Vetters. In the case of Actors, the time spent was reduced as well as the workload. In the case of Vetters, technical team members confidence increased in the on-the-spot

consensus as the technical team increased their questions to the Contracting Officer. The result was a balanced set of opinions regarding the evaluation.

Second, teams shared that applying the advisory down-select technique changed their behavior to make more preparations- including more intensity in preparation- at the initial stages of the acquisition process as well as increased communication between the Legal Counsel and the Contracting Officers of each project. In both cases (Managers and Agile), there was initial discomfort and intensity of workload, however, the result was less fear of mistakes, greater confidence in the acquisition process and reduced workload in time spent and paperwork produced.

Third, teams shared that applying multiple PIL techniques such as oral presentations, on-the-spot consensus, advisory down-select, and confidence ratings changed their behavior to not write voluminous reports, spend less time on the overall procurement process, and reduced the feeling of being overwhelmed to accomplish the overall acquisition. In each of the cases- Logistics and Designers- The result was an increase in confidence and self-worth of the acquisition team's skills and knowledge as well as an increase in expertise of the acquisition process.

Fourth, teams shared that changes in behavior regarding agreement of the acquisition team to use PIL techniques changed the vision of the team members on the project. In the case of Agile, agreement of PIL technique usage induced a change of vision to be more forward-thinking of the acquisition team. In the case of Installers, agreement to use confidence ratings induced a change in vision allowing the team to be more flexible with procurement knowledge and evaluation factors. In the case of Actors, team members stated

that Legal Counsel agreement to use PIL techniques (along with the entire acquisition team) would have presented the possibility of induced changes in vision for the Legal Counsel to see a streamlined procurement project timeline.

Lastly, one team shared a change in behavior of not relying on the incumbent vendor relationship to represent the vendor's subject matter expertise throughout the proposal process. In this case, Instructors was able to see greater expertise from vendors as all vendors were essentially forced to present their subject matter expertise and respond to scenarios during the oral presentations. The result was the team was more confident in the evaluations they performed along with a very short time of seventy days to complete the acquisition.

4.5 Implications for performance gains and losses of acquisitions teams

Acquisition teams set out to implement PIL techniques to apply innovative alternatives throughout the procurement process. Many teams were able to agree upon and implement a set of PIL techniques which provided opportunity for teams to enjoy the benefits of using the PIL techniques, such as time-saving and workload reducing attributes. Logistics, Designers, Agile, Installers, Instructors, and Actors all experienced time-saving and workload reducing attributes from using various PIL techniques such as on-the-spot consensus, oral presentations, streamlined documentation, and advisory down-select. Other acquisition teams, however, did not experience such benefits. Vetters, for instance, could not gain complete agreement on using some or all PIL techniques. These projects were not able to fully recognize a time-saving element to the overall acquisition project.

Acquisition teams also set out to learn PIL techniques as they were new compared to the traditional acquisition techniques which teams had used in the past. In all cases, teams were able to gain knowledge, acquire skills, and increase their acquisition process expertise. In most cases, the knowledge, skills, and expertise were developed by members of the acquisition team, apart from Legal Counsel. Also in most cases, acquisition team members shared a greater confidence throughout conducting the acquisition process which they felt helped them to avoid mistakes.

Additionally, related to acquisition team members gaining confidence were the implications of upfront preparation and management team support. In the cases of Managers and Agile, intense up-front preparation by acquisition team members created short term pains and discomfort but provided the teams with confidence as they conducted the projects and yielded outcomes of reduced time in the acquisition process. In the cases of Logistics, Managers, and Agile, teams felt more confident and unafraid of committing mistakes during the process as they felt a support from their management teams.

In some cases, acquisition teams where surprised at certain aspects of how the acquisition played out. For instance, Vetters felt they had increased communication unexpectedly between the technical team and the Contracting Officer. This unexpected frequent communication resulted in more clear instruction and understanding by the technical team which produced a more balanced evaluation without any dominant voice to bias it. In another case, Instructors had realized, practically unexpectedly, that turning away from an existing vendor relationship unveiled a higher quality of proposals and subject matter expertise along with sooner reduction in number of vendors. The Instructors team

was pleasantly surprised to be able to complete the acquisition project (to award) within 70 days.

Of course, not all implications centered around performance gains. There were some loss implications realized as well. The loss mentioned with most frequency was that of Legal Counsel misalignment with PIL techniques whether it be for a short period or for the duration of the acquisition project. In the case of Actors, Legal Counsel disagreed with using oral presentations and on-the-spot consensus initially. The Contracting Officer was persuasive in lobbying for the use of the PIL techniques and eventually Legal Counsel agreed. The period of disagreement, however, resulted in lost time for progress on the project. In the case of Vetters, Legal Counsel and the Contracting Officer never agreed on the PIL techniques used and thus techniques were implemented late in the project. As a result, the most impactful gains (increased knowledge, workload reduction, time-saving, work group unity, etc.) from PIL technique usage were never fully achieved.

5. Results

5.1 Procurement Team Process Innovation Archetypes

Five different archetypes have been identified and are listed in Table 4. The applicable cases listed in the second column categorize the acquisition project into the appropriate archetype based on

<insert Table 4.>

our analysis. Following the case study method of Wu and Choi (2005), definitions are then offered along with descriptions from cases are listed for further explanatory purposes.

Our empirical archetypes are intended as a classification scheme that simplifies the complex dynamics embedded in the phenomena of procurement process innovation in our case analyses. First, the *regulators* archetype refers to acquisition projects where a dominant voice was attempting to or succeeded in steering the project away from focus or from PIL technique usage. The *preparers* archetype refers to projects where team members spent considerable time learning the PIL techniques and preparing upfront in the acquisition process. The r*educers* archetype refers to projects who maintained a confidence in PIL technique usage and significantly reduced paperwork, workload, and overall time spent on the acquisition process. The *visionary* archetype refers to acquisition projects where agreement in usage of PIL techniques changed the vision of team members to be more forward thinking or more flexible in the use of expertise. The *forsakers* archetype refers to the acquisition project which applied a path dissolution method by forsaking the incumbent vendor relationship and applying PIL techniques to require high subject matter expertise from all vendor proposals.

5.2 Working Propositions

For every acquisition project, there are technical systems and social systems. No acquisition project exists in isolation where a technical aspect does not impact a social aspect. As teams altered their acquisition process to utilize PIL techniques, technical systems were altered which in turn altered social systems and thus created archetypes. Further, we argue these propositions explain how individuals act their way into thinking differently while fundamentally changing culture in organizations. Instructors faced considerable time and labor constraints to dedicate to the acquisition process and thus forsook traditional

techniques to create the Forsakers archetype. Also, Managers and Agile spent considerable time researching, learning PIL techniques, and organizing to execute on the acquisition project plan which created the Preparers archetype.

Therefore, when we develop propositions, we move beyond the archetypes of Acquisition Team characteristics to the intricate dynamics that unfold between the management team, the Acquisition Team, and the PIL techniques as well as amongst Acquisition Team members. Many of our propositions cut across several archetypes. We offer propositions pertaining to the dynamics among Acquisition team members with each other and the acquisition process. Further, our propositions provide evidence of acquisition team members aciting their way into thinking differently and thus changing organizational culture in federal acquisition teams.

5.2.1 Sequencing induces changes in sentiments

First, the way acquisition operations are grouped into production phases influences the coordination, the shared information and knowledge of the acquisition project, and the labor skill demands. Applying PIL techniques such as video proposals, oral presentations, on-the-spot consensus, and confidence ratings alters the sequence of acquisition operations. These changes in acquisition sequencing prove to save time and workload while also changing the way acquisition team members feel about themselves and their work on the acquisition project.

For instance, Logistics applied each of these techniques, altering their acquisition sequencing, and found sentiments of trust and enjoyment in completing the acquisition

process in a shorter than expected time. Also, Instructors applied the on-the-spot consensus technique, changing the evaluation sequence, and found trust in each other as well as in the new acquisition technique as they shared more information as a work group. Third, Installers changed the sequencing of their acquisition process by applying the on-the-spot consensus right after oral presentations and found a high self-worth in their abilities to conduct the acquisition process. In each instance the change in sequencing, caused a change in the way the acquisition team members felt about themselves and the acquisition project and process.

Proposition 1a. *Changes to sequencing in the acquisition process caused changes in the way the acquisition team felt about their jobs as the acquisition process time was shortened and/or workload was reduced which caused a change in feeling of greater confidence and a feeling of being less overwhelmed.*

5.2.2 Sequencing induces changes in endowments

Sequencing changes can also change how acquisition team members learn new skills, acquire knowledge, increase their procurement expertise. For instance, Agile change the acquisition sequencing by having oral presentations with vendors and gained new knowledge on how to view vendors during the proposal and evaluation process. Agile was able to see how prepared vendors were as well as how vendors could think quickly and respond to scenarios for which the vendor had no idea to prepare. Also, Installers changed the acquisition sequencing by applying the on-the-spot consensus right after oral presentations. By having on-the-spot consensus, Installers was able to complete their evaluation in a one-time composition format. Installers did not have to compile several reports into one final

evaluation and thus acquired new knowledge and expertise on how to complete vendor evaluations during the acquisition process.

Proposition 1b. *Changes to sequencing in the acquisition process caused changes in the way the acquisition team learned while doing their jobs as the acquisition process time was shortened and/or workload was reduced which caused a change of learning new skills and gaining new knowledge of the acquisition process.*

5.2.3 Input variance induces changes in sentiments

Second, the variation from upstream vendor inputs stresses acquisition skill requirement as well as strains acquisition teams, team members, and component management. Applying PIL techniques such as video proposals and oral presentations alters the input variance of acquisition operations. Acquisition teams required vendors to submit a single format of proposals with a video proposal and also reduced media for follow up presentations to toral presentations after each video proposal was reviewed and passed the advisory down-select process. Vendors followed a singular format instead of multiple formats of their own selection. These changes in vendor input variance proved to reduce feelings of acquisition team members of being overwhelmed and boredom while also reducing time spent on the acquisition process. Further, feelings of fear were also reduced amongst team members. For instance, Logistics implemented video proposals, oral presentations, and on-the-spot consensus techniques and was able to reduce vendor input variance which reduced feelings of being overwhelmed and bored during the acquisition project. Further, Logistics was able to considerably reduce workload and time of the acquisition process.

Proposition 2a. *Changes to input variance in the acquisition process caused changes in the way the acquisition team felt about their jobs as the acquisition process time was shortened and/or workload was reduced which caused a change in feeling of greater confidence, a feeling of being less overwhelmed and bored, and a feeling of less fear toward Legal Counsel.*

5.2.4 Input variance induces changes in endowments

Input variance changes can also change how acquisition team members learn new skills, acquire knowledge, increase their procurement expertise and professional standards. For instance, Agile applied confidence ratings during their acquisition project and reduced the rating inputs such that they altered their view of evaluating vendors. No longer did Agile evaluate vendors on how they responded to the solicitation but how confident Agile felt toward each vendor, if awarded, being able to perform on the contract. This forward thinking in evaluation created a non-organizational standard while increasing Agile's acquisition skill set and expertise. Installers applied the rarely used technique of highest technically rated fair and reasonable price and reduced the vendors inputted into the acquisition process such that they reduced the time spent overall on the evaluation. Installers focused solely on the vendors that met the evaluation criteria and in doing so increased the quality of the technical evaluation. Instructors used the oral presentations technique during their acquisition project and eliminated paper proposals while reducing required reading. Instructors acquired procurement expertise not known before as well as raised their standards for time spent on the acquisition process.

Proposition 2b. *Changes to input variance in the acquisition process caused changes in the way the acquisition team learned while doing their jobs as the acquisition process time was shortened and/or workload*

was reduced which caused a change of learning new skills and gaining new knowledge of the acquisition process.

5.2.5 Spaciotemporal distribution induces changes in social roles

Third, the layout among and time between acquisition team members and process steps influences the coordination and communication requirements between such as well as interpersonal contact and information exchange. Applying PIL techniques such as oral presentations and advisory down-select alters the time between and space amongst acquisition team members and offering vendors. These changes in acquisition spatiotemporal distribution prove to decrease time spent in the acquisition process while also changing the worker and leadership roles of acquisition team members. Additionally, these changes in spatiotemporal distribution also impact the cooperative behavior amongst acquisition team members.

For instance, Logistics implemented a variety of PIL techniques but the Contracting Officer took the lead to make sure to schedule all acquisition team members for an amicable time and location. Organizing everyone's time and schedule for the short but intense time period of the acquisition project, the Contracting Officer's work role evolved more to a leadership role and the team functioned with unity, or as Logistics states "on the same page." Agile applied the advisory down-select and oral presentation techniques and experienced time reduction to the overall acquisition process. The reduction in time spent on the acquisition project impacted the worker and leadership roles for all Agile team members such that they felt they were able to complete the acquisition project in a more concise

manner and "return to their desks" and complete their regular job functions. Actors also implemented oral presentations in their acquisition project and experienced a change in leadership roles within the team. The Legal Counsel was hesitant to use the technique, however, the Contracting Officer- sensing the desire to innovate and reduce paperwork- persisted to use oral presentations. The result was a lighter paperwork load and a more prominent leadership role for the Contracting Officer within the acquisition project.

Proposition 3a. *Changes to spatiotemporal distribution in the acquisition process caused changes in worker and leadership roles of acquisition teams as well as how cooperatively acquisition teams behaved such that the acquisition workload was decreased or increased.*

5.2.6 Spatiotemporal distribution induces changes in affiliations

Spatiotemporal distribution changes to acquisition teams and processes can also change the influence of the team group membership and how teams are collectively motivated to complete the acquisition project. For instance, Designers implemented oral presentations, bullet points, and confidence ratings and reduced the time and space between vendor presentations, the amount of writing for evaluation reports, and the confusion from rating a vendor after presentations. These changes in Designers time and layout between acquisition team members and vendors impacted how Designers affiliated themselves together during the acquisition project as they felt a force of unity to use the PIL techniques. Instructors also implemented oral presentations and confidence ratings right after. By reducing the time and space between vendor presentations and evaluations, Instructors experienced a change of affiliation in their acquisition work group. Instructors had an

increased sense of togetherness, as they state, which assisted them to produce a higher quality technical evaluation document.

Proposition 3b. *Changes to spatiotemporal distribution in the acquisition process caused changes in the way the acquisition teams view their group affiliation throughout the acquisition process such that the acquisition workload was decreased and the quality of work was elevated.*

5.2.7 Support dependence induces changes in collective predispositions

Fourth, the support dependence, or the degree to which acquisition processes need other functions , such as Legal Counsel or Component management teams, to maintain proper or workable conditions influences what is important to acquisition teams. In general, applying PIL techniques during the acquisition process alters the support dependence of acquisition team members. These changes in acquisition support dependence impact the social values of collective predispositions such shared mental models, values, and norms within traditional acquisition practices and techniques. As acquisition team members develop support dependence on alternative acquisition techniques, team members norms and mental models are challenged and impacted to form alternative norms, mental models, and values. Some team members accept these changes internally while others struggle to accept such new models, values, and norms.

For instance, Actors implemented PIL techniques throughout their acquisition project. During this acquisition project, the Legal Counsel representative was observed to show resistance to using the PIL techniques and was cited as not wanting to deviate from the traditional techniques used in prior acquisition projects. Legal Counsel was cited as expressing the need to perform the acquisition using techniques which they preferred as they

felt more confident to reduce the risk of protest while using innovative techniques caused fear of protest.

Proposition 4a. *Changes to support dependence in the acquisition process caused changes in the shared mental models and norms of the acquisition team such that stronger voice team members and traditional leaders struggled to accept the new established models and norms of the innovative acquisition process.*

5.2.8 Support dependence induces changes in social needs

Support dependence changes to acquisition teams and processes can also change the acquisition team member work goals and interdependencies. For instance, Actors changed the support dependence of the acquisition process by agreeing to use PIL techniques and relying on the PIL team for support when applying such techniques. This agreement and PIL support dependence caused acquisition team members to change worker goals such that team members felt they provided more of a contribution to the acquisition compared to their past participation. Managers also changed support dependence for their acquisition project when applying the advisory down-select technique. First, Managers involved the Legal Counsel earlier in the acquisition process such that the Contracting Officer and Legal Counsel maintained a collaborative relationship throughout the process. This collaborative relationships developed a more balanced leadership approach for Managers. Second, Managers relied on less written word for evaluations thus reducing risk of protest from vendors.

Proposition 4b. *Changes to support dependence in the acquisition process caused changes in the worker goals and interdependencies such that acquisition team members and leadership were more involved throughout the acquisition process creating a more equitable acquisition project for each team members.*

5.2.9 Conditions induces changes in collective predispositions

Fifth, changes to the acquisition process task demands in the project setting or in the project ideas cause changes in the shared mental models, norms and values which the acquisition team members maintain throughout performing their job functions. These changes in acquisition conditions impact the social values of collective predispositions such as shared mental models, values, and norms within traditional acquisition practices and techniques. As the acquisition process task demands or ideas are changed to suit alternative acquisition techniques, team members norms and mental models are challenged and impacted to form alternative norms, mental models, and values. Some team members accept the new models, values, and norms such that risk of protest is reduced or the evaluation quality is improved. In short, acquisition team members acted their way into thinking differently (new mental models).

For instance, Vetters implemented the on-the-spot consensus technique and changed the acquisition task demands of the technical team such that the technical team increased the number and type of questions presented to the Contracting specialist, whose role was also cited as changed to one of more of a mediator on the project. Vetters cited the increased questions as a benefit to the acquisition process producing a higher quality evaluation report. These changes in conditions created a new norm and mental model for fairness for evaluating vendors. Agile implemented the advisory down-select technique and altered the acquisition task demand and ideas for evaluations such that vendors moving on to the final evaluation stage were reduced by 70%, also reducing risk of protest from the

eliminated vendors as well. These changes in Agile conditions created a changed mental model of fairness for the acquisition process while also providing a new motivation for reduced risk of protest.

Proposition 5a. *Changes to conditions in the acquisition process caused changes in the collective predispositions such that acquisition teams created new organizational acquisition performance in the form of higher quality evaluations, higher reductions in vendor evaluations, and reduced risk of protest.*

5.2.10 Operational impact induces changes in status landscape

Finally, changes to the criticality, focus and skill demands of acquisition activities cause changes in the significance of certain acquisition team member work roles. These changes in acquisition activity impact the social positions of status landscape, or the varying degrees of importance and leadership among people. Traditionally, Legal Counsel (or Procurement Attorneys) has held a dominant voice and role of leadership within the acquisition process; maintaining a rugged status landscape amongst acquisition team members. As the criticality, focus, and skill demands of acquisition activities changed while applying alternative acquisition techniques, team members outside of the Procurement Attorney increased their voice and leadership thus evening the once rugged status landscape and creating a more collaborative interaction amongst the Procurement Attorney and the other acquisition team members.

For instance, Actors struggled initially with implementing the oral presentations technique during the acquisition process, however, the Contracting Officer persisted and increased her leadership role by doing such. Thus the Procurement Attorney's dominant voice within the once rugged status landscape was reduce to a more consistent voice with

other team members and the Contracting Officer's voice was enhanced to maintain a more balanced status landscape. Further, the Contracting Officer acted their way into thinking differently about the leadership roles of the acquisition team in general as well as their specific leadership role within the acquisition team. Logistics and Managers had not experienced issues implementing PIL techniques in general but experienced early involvement with the Procurement Attorneys and thus enjoyed a more collaborative interaction amongst both the Contracting Officer and Procurement Attorney throughout the acquisition process. Designers had implemented the advisory down-select technique and by doing so cited that they had created an acquisition which was "not protestable." Further, Designers stated the importance among people (status landscape) which contributed to working toward the quality of the acquisition.

Proposition 6a. *Changes to operational impact in the acquisition process caused changes in the significance of work roles amongst acquisition team members such that a more collaborative interaction emerged between Procurement Attorneys and Contracting Officers. This balanced of leadership roles is referred to as a more balanced status landscape.*

5.2.11 Operational impact induces changes in social network

Operational impact changes to acquisition teams and processes can also change the way acquisition team member interpersonally relate while distributing social knowledge and opportunities for helpfulness. For instance, Instructors used the confidence ratings technique. As a result, Instructors team members were able to see the concise, accurate rating from their efforts which created a "sense of togetherness" of Instructors social network. Agile implemented the advisory down-select technique and by doing so reduced

substantially reduced team members workload. Agile team members, experiencing a reduced workload, cited an increase in their cooperative behavior throughout the acquisition project. Logistics implemented oral presentations and was able to experience a unity of having all team members present. Logistics cited the unity provided for a more informed evaluation not having to rely solely on written documents as well as an increased cooperative working environment.

Proposition 6b. *Changes to operational impact in the acquisition process caused changes in the social networks of acquisition teams as the acquisition process workload was decreased and better informed from a sense of unity, togetherness, and cooperative behavior.*

6. Discussion

With eight cases, we have identified five archetypes of procurement process innovation. These archetypes capture the complex details of the relational dynamics between acquisition team members. This study also offers twelve propositions which examine the changes in technical systems and how those changes induce further changes in social systems thus impacting organizational culture. The study has both theoretical and managerial implications which are discussed below.

6.1 Theoretical contributions

This study contributes to theory development in supply chain process innovation in three ways. The first contribution pertains to acquisition project team archetypes. Specification of archetypes is an important theory development endeavor (Wu and Choi, 2005). The archetypes abstract a complex social phenomenon based on empirical evidence and our understanding of existing knowledge regarding the phenomenon under investigation

(Meyer et al., 1993). Specifically, the five archetypes that emerged from the eight cases condense the particulars of upstream supply chain inter-organizational dynamics to types that are easy to relate and grasp. Extant theory by Schein (1983) explained that individuals in the upstream supply chain would need to gain understanding of inter-organizational dynamics before realizing changes in behaviors. These archetypes extend on Shook's (2010) research- contradicting extant theory established by Schein's (1983)- while showing that individuals' behavior (or changes to such) precedes the insight and thus individuals can behave their way into new thinking and culture change. Further, these archetypes reinforce Pereira et al.'s (2014) research on the impact of critical upstream business activities on overall organizational performance.

Second, the five archetypes and the associated propositions attest to the notion of path dissolution through the understanding of social systems (Sydow et al., 2009) as well as technical systems. Sydow et al. (2009) argue that understanding social systems precedes path dissolution. Our research provides evidence that path dissolution and thus the aggregate of small changes in behavior dissolving a path precede the understanding an insight. The archetypes show that acquisition team members changed behavior- dissolving previous acquisition process paths- and in doing so, the sum of many slight or large changes led to greater understanding and insight of a complex acquisition process. The archetypes further show intricate nuance within acquisition teams and how acquisition team members implement behavioral changes in the acquisition process, whether those changes be slight or transformative. Acquisition team members are different and behave differently, however, when implementing innovative techniques, the archetypes provide a summary of the

nuanced federal acquisition process and how acquisition team members can effectively change behaviors while changing federal acquisition culture.

Finally, this study contributes to the body of inter-organizational research in three ways, First, by expanding the examination of socio-technical system theory (Pasmore,1988; Appelbaum, 1997; Kull et al., 2013) to include other inter-organizational initiatives such as procurement process innovation initiatives. Second, by expanding on Fawcett et al.'s (2011) behavioral constraints to include behavioral constraints which enabled a high-level of collaboration thru increased inter-functional and inter-organizational harmony, aligned goals that increased trust, and enabled cultural changes in the socio-technical system. Third, by extending Shook's (2010) research of acting one's way into thinking, our research provides evidence of acquisition teams changing behaviors through implementing innovative procurement techniques which caused changes in thinking. While Shook's research only shared the results of culture change in socio-technical systems, our research shares how the changes in behavior took place which led to the changes in thinking and ultimately changed the organization's procurement culture.

6.2 Managerial implications

There is a DHS component management team, an acquisition team, and acquisition techniques and support which require alignment. Alignment refers to the intraorganizational levels of fit between operations and competitive priorities (Gonzalez-Benito, 2007; Baier et al., 2008). In their research, Baier et al. (2008) found this alignment to be key to achieving superior organizational performance in what they call an "alignment-performance" link.

When innovative techniques (i.e., implementing PIL techniques or dissolving the traditional path of techniques) are to be applied on an acquisition project, alignment becomes paramount across multiple facets. Better said, when striving to implement procurement process innovation, alignment and supportive culture across all organizational levels must be present. First, the DHS Component management team and acquisition team must be in alignment regarding use of PIL techniques. This alignment refers to the management team providing support to the acquisition team for use of the PIL techniques along with encouragement to use such. The management team should provide encouragement and reassurance to the acquisition team to use an abundance of innovative techniques and to feel comfortable that using such technique does not put their job in jeopardy. According to our cases, several acquisition teams (Logistics, Agile, and Designers) received such encouragement and support from their management teams to not only use PIL techniques but to use them from the initiation of the project through to awards. However, there were cases (Vetters and Actors) who did not receive this same level of support regarding PIL technique usage starting at project initiation. These projects suffered through longer procurement process timelines and perceived wasted time, in some cases protests. DHS Component Management team and acquisition team alignment manifested by PIL technique application early and often through the acquisition process increases confidence in acquisition team members abilities and prevents wasted time from disagreements.

There must be alignment between all members of the acquisition team, including the Legal Counsel and the Contracting Officer. This alignment refers to all team members learning and understanding all of the benefits and risks of using PIL techniques, but more

importantly understand the legality and fairness of such. While the PIL Boot Camps and materials explain all the techniques, still there are Legal Counsel representatives who do not fully understand the salient case law as well as the benefits from each PIL technique. For instance, Actors was a case where the Legal Counsel, prior to the Actors acquisition project, was previously worried of risk of protest due to not experiencing the properly executed PIL techniques which mitigated such risks. Additionally, Vetters was a case where the PIL techniques were the Legal Counsel never agreed throughout the acquisition project and thus the PIL technique applied was done so toward the end of the project. In other cases, Legal Counsel and Contracting Officers were in alignment on use of PIL techniques and were able to implement such techniques with confidence and with a feeling of much less overwhelming. Legal Counsel and Contract Officer alignment manifested by understanding of legality and fairness of PIL technique application increases the expertise and acquisition skill set of the acquisition team while producing a concise acquisition outcome.

There must be alignment between the acquisition team and the PIL team. This alignment takes on two primary forms. First, alignment between the Contracting Officer and the PIL team as well as techniques must be present. Contracting Officers who are aligned with the PIL team and techniques will operate with frequent collaboration amongst the acquisition team as well as with PIL coaches. The constant support from the PIL team or coach provides the Contracting Officer with the knowledge and confidence to lead the acquisition team even if a competing, dominant voice (or voices) should oppose the Contracting Officer's leadership. In the case of Actors, the Legal Counsel attempted to dominate the narrative of which techniques to use. However, the Contracting Officer, with

support from the PIL coach and confidence in the PIL techniques, persuaded Legal Counsel and prevailed in establishing PIL techniques throughout the procurement project. In other cases (Logistics, Agile, , Designers, Managers, and Instructors), the Contracting Officer was in constant contact with the PIL coach, fully educated on PIL techniques and legalities of such, and operated in alignment without issue with the remaining Acquisition Team members. Contract Officer and PIL alignment manifested by frequent contact and collaboration amongst the Acquisition Team and the PIL coach will increases the confidence, expertise and acquisition skill set of the Contracting Officer such that dominant characters will be brought in alignment and non-dominant characters will be strengthened in alignment.

The second form of alignment between the Acquisition Team and the PIL is in complete adherence to PIL techniques. When Acquisition Teams agree to use PIL techniques, they agree to forsake the use of traditional techniques. By dissolving this tendency to use a traditional technique, the Acquisition Team dissolves an acquisition path dependence. For instance, Instructors was facing a very tight time compression issue and realized it could not use any of the traditional techniques as those techniques would not fit within the time constraints allotted. Forsaking the traditional techniques, Instructors also dissolved a path of relying on the incumbent vendor relationship as a viable factor for evaluation and established new subject matter expertise as well as standards for the proposed contract. Instructors' decision to dissolve traditional acquisition technique paths results in completing the acquisition in much less time and with a higher standard final product. Acquisition Team and PIL alignment manifested by path dissolution of traditional

acquisition techniques will increases expertise and acquisition skill set of the Acquisition Team and also increase the subject matter expertise of the offering vendors.

6.3 Limitations and future research

The study has three primary limitations. First, the primary disadvantage of a case study is the lack of external validity and its idiosyncratic theories (Eisenhardt, 1989); it is difficult to draw deterministic inferences. We tried to alleviate this concern by using the widely adopted purchasing matrix to select polar cases in the sampling process. In future research, we will look to innovation literature and theory to inform further construct and theory development. Clearly, the theories we discovered in this study will need to be further developed and tested in future studies. Such tests would include to what extent to changes in technical systems induce changes in behaviors and results- i.e., if one changes one technique how much incremental change in the work product takes place, and, even more interesting, how much incremental culture may change as well.

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APPENDIX A

INTRODUCTION APPENDIX

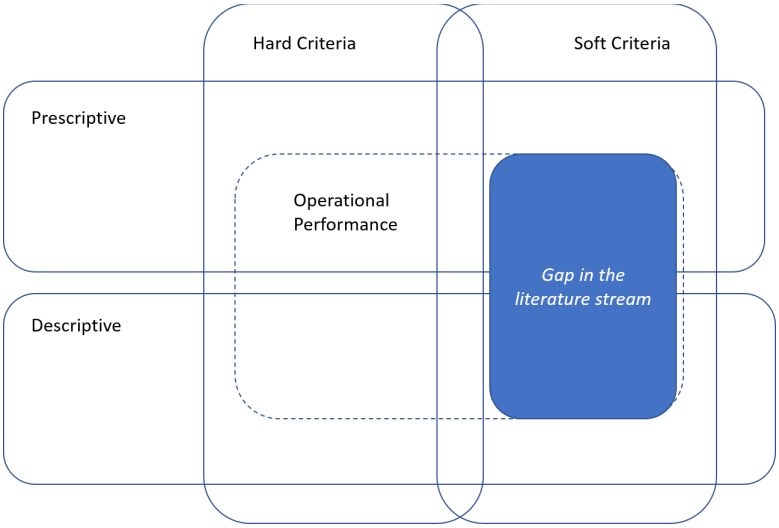
Figure 2.1 Supplier Selection Literature Stream by Category

	Descriptive				Prescriptive			
	Hard criteria		Soft criteria		Hard criteria		Soft criteria	
	Prim.	Suppl.	Prim.	Suppl.	Prim.	Suppl.	Prim.	Suppl.
Dickson (1966)		✓						
Dulmin & Mininno 2003					✓			
Chen et al. 2006					✓			
Saen 2006						✓		✓
Sarkis & Talluri, 2002	✓			✓				
Badorf et al. 2019	✓			✓				
Polyviou et al. 2022								
Sen et al. 2008	✓			✓				
Ho et al. 2010					✓			
Seydel 2006					✓			
Sharma & Yu (2013)					✓			
Rezaei et al. 2016					✓			
Scott et al. 2018	✓				✓			

Rashidi et al. 2020	✓			✓				
de Boer et al. 2001	✓			✓				
Chen et al. 2021					✓			
Yu and Hou 2015					✓			✓
Govindan et al. 2015					✓			✓
Awasthi et al. 2018					✓			✓
Konys 2019					✓			
Thomas et al. 2021	✓			✓				
Kannan and Tan 2001	✓			✓				
Kannan and Tan 2006	✓			✓				
Nair et al. 2015	✓			✓				
Clauss and Tangpong 2019	✓			✓				
Wong 2021	✓							

Dulmin & Mininno 2003							✓	
Liker and Choi 2004							✓	
Riedl et al. 2013							✓	
Polyviou et al. 2018							✓	
Carter et al. 2010			✓					
Calvi et al. 2010							✓	
Kull et al. 2014	✓			✓				
Kurpjuweit et al. 2021	✓			✓				
Lou et al. 2022							✓	
Koufteros et al. 2012							✓	
Yan et al. 2020	✓			✓				

Figure 2.2 Supplier Selection Literature Stream



APPENDIX B

ESSAY 1 APPENDIX

Figure 3.2 Supplier evaluation: Continuum of Criteria (Ellram, 1990; Kannan and Tan, 2002)

Figure 3.3.1 Interview Protocol
Sourcing for Soft criteria (Ellram, 1990; Kannan and Tan, 2002)

I.	Please describe your sourcing process where quantitative criteria are not used.	I.	Establish the primary use of soft criteria and **what** those soft (qualitative) criteria are as they pertain to the specific buyer organization.
II.	Please describe your sourcing process where primarily soft (qualitative) criteria are used.		

Soft criteria supplier selection (Whetten, 1989; Ellram, 1990; Kannan and Tan, 2002)

I.	Please describe **how** soft criteria are used for supplier selection. A. Do you use a scorecard with the soft criteria? B. How are the soft criteria measured? C. Do you assess the soft criteria with the supplier managers/contacts? Or others? (*who*) D. What do you learn from the use of soft criteria? How do you learn it? Why is that important? E. Do you focus on how the potential suppliers learn? How do you focus on their learning? F. Do you assess the soft criteria at the supplier's office or plant? (*where*) G. Who are the individuals involved in this process?	I.	Explain how the soft criteria factors are related or connected. Together with the "what" questions, the "how" and "what" constitute the domain of soft criteria sourcing. as part of this set of questions, the "who" is also included which assists to place limitations on future propositions generated from our theoretical model.

H. Do these individuals work at the plant/shop location? HQ? or something else? I. Please share all of the physical locations involved with supplier selection. 1. Why these physical locations? Or why not any physical locations? J. Please describe any other physical or operational element/aspect where soft criteria may be used after supplier selection? For instance, in supplier development? Relationship management? II. What is the purpose of selecting suppliers without hard criteria and why would any soft criteria be used? A. Is there any spend category where soft criteria is used more prominently for supplier selection? 1. If so, what spend categories? Why those? B. Is there any time when soft criteria is used prominently- for instance, any seasonality or recessionary periods? Inflationary periods? 1. if so , when? Why then? C. Is there any unintended consequences from using soft criteria? 1. If so, what are they? Are they any good consequences? Any bad? How so? III. Please describe any other sourcing processes (supplier development, contract management, relationship management or termination) where you u assess soft criteria and deem it important?	Expansion of inquiry beyond the sub-system of supplier selection to uncover other sub-systems involved (i.e. supplier development, relationship management, or contract maintenance or contract termination. II. Explain the "why" rationale. With the "why" rationale, we can obtain the assumptions- the theoretical glue-welding the model (established in I. above) together. Further, as part of this set of "why" rationale, we can explore "where" and "when" which, combined with the "who" questions in I. above provide the conditions to place limitations on the propositions generated from our theoretical model. These temporal and contextual factors set the boundaries of generalizability, and as such constitute the range of the theory (Whetten, 1989). III. Expand the why to find out what resources are being discovered and why. (Braganza et al., 2017; Kamble et al., 2020; and Rungtusanatham et al., 2003) Theory elaboration

Figure 3.3.2 Research Framework

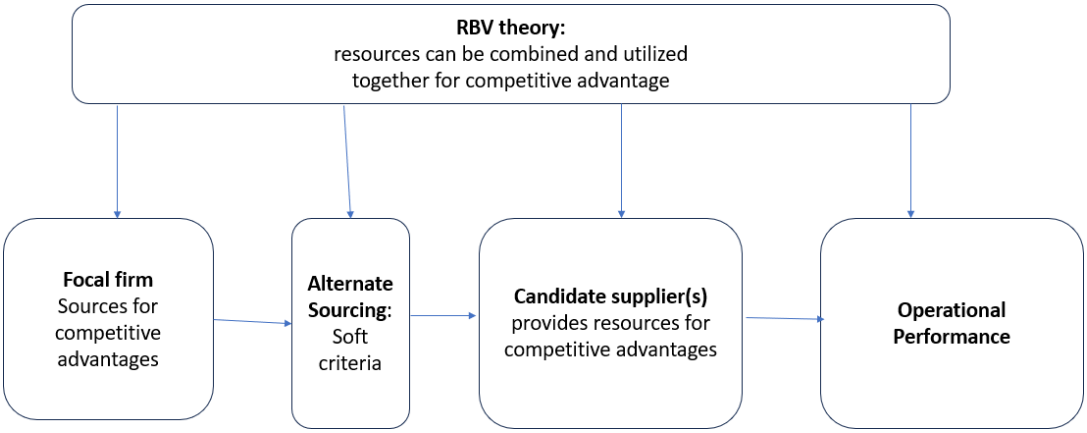


Figure 3.3.3 Kraljic Purchasing Matrix (1983)

Profit impact	Materials Management Machined components Logistics services	Supply Management Vehicle Tooling systems Testing Equipment
	Purchasing Management Peripheral electronic components Package delivery services	Sourcing Management Substrates Specialized molding parts
	Supply Risk	

Table 3.3.2 Resource-based View Codes- "VRINN." Expanded from Braganza et al., 2017; Kamble et al., 2020; and Rungtusanatham et al., 2003

	Characteristics of Resources	Type and descriptions of resources and impact on sustainable competitive advantage. (Qualitative code)					
Categories		Tangible (physical capital; organizational capital such as organizational structures; and human capital)			Tangible-intangible-combination	Intangible (knowledge, managerial skills, organizational goodwill, and brand)	
Types		Financial	Physical	Technological	Human (managerial and technical skills)	Organizational	Intangible (reputation, brand recognition, data-driven culture, and organizational learning)
	Valuable	(VF) Resource benefits offered between buyer-supplier relationships are expected to be mutually beneficial	(VP) Resources centered on the make and deliver aspects of supply –namely transportation, warehouse, and physical aspect of managing inventories and products flowing through the supply chain.	(VT) Technical resources used to increase production, reduce losses, understand information, gather data, manage supply/demand, and increase supply chain efficiencies	(VH) The human resources pertaining to all supply chain aspects including thoughts, opinions, candor, culture, and social influences.	(VO) Internal organization resources of information sharing for designing, planning, scheduling, evaluation	(VI) Resources that support improved planning visibility include external drivers and influencers that determine consumer needs and demands.

	Rare	(RF) Financial resources cannot be exploited.	(RP) Transportation and warehouse resources cannot be exploited	(RT) Resources to increase production, gather data, and increase supply chain efficiencies cannot be exploited	(RH) Human capital, managerial and technical skills cannot be exploited.	(RO) Information sharing for designing, planning, and scheduling cannot be exploited.	(RI) Reputation, brand recognition, and organizational learning cannot be exploited.
	Imperfectly mobile	(IMF) Mutually beneficial financial resources yield little to no value outside of the focal firm.	(IMP) Transportation, warehousing, and other physical resources yield little to no value outside of the focal firm.	(IMT) Resources to increase production, gather data, and increase supply chain efficiencies yield little to no value outside of the focal firm.	(IMH) Human capital, managerial and technical skills yield little to no value outside of the focal firm.	(IMO) Information sharing for designing, planning and scheduling yield little to no value outside of the focal firm.	(IMI) Reputation, brand recognition, and organizational learning yield little to no value outside of the focal firm.
	Not imitable	(NIF) Mutually beneficial financial resources cannot be copied or equaled.	(NIP) Transportation and warehouse resources cannot be copied or equaled	(NIT) Resources to increase production, gather data, and increase supply chain efficiencies cannot be copied or equaled.	(NIH) Human capital, managerial and technical skills cannot be copied or equaled.	(NIO) Information sharing for designing, planning, and scheduling cannot be copied or equaled.	(NII) Reputation, brand recognition, and organizational learning cannot be copied or equaled.
	Not substitutable	(NSF) Mutually beneficial financial resources cannot be replaced by any resource.	(NSP) Transportation, warehousing, and other physical resources cannot be replaced by any resource.	(NST) Information sharing for designing, planning, and scheduling cannot be replaced by any resource.	(NSH) Human capital, managerial and technical skills cannot be replaced by any resource.	(NSO) Information sharing for designing, planning, and scheduling cannot be replaced by any resource.	(NSI) Reputation, brand recognition, and organizational learning cannot be replaced by any resource.

	Characteristics of Resources	Type and descriptions of resources and impact on sustainable competitive advantage. (Qualitative code)					
Categories		Tangible (physical capital; organizational capital such as organizational structures; and human capital)			Tangible-intangible-Combination	Intangible (knowledge, managerial skills, organizational goodwill, and brand)	
Types		Financial	Physical	Technological	Human (Managerial and technical skills)	Organizational	Intangible (reputation, brand recognition, data-driven culture, and organizational learning)
	Valuable	(VF) Resource benefits offered between buyer-supplier relationships are expected to be mutually beneficial	(VP) Resources centered on the make and deliver aspects of supply- namely transportation, warehouse, and any physical aspect of managing inventories and products flowing through the supply chain.	(VT) Technical resources used to increase production, reduce losses, understand information, gather data, manage supply/demand, and increase supply chain efficiencies	(VH) The human resources pertaining to all supply chain aspects including thoughts, opinions, candor, culture, and social influences.	(VO) Internal organization resources of information sharing for designing, planning, scheduling, evaluation	(VI) Resources that support improved planning visibility include external drivers and influencers that determine consumer needs and demands.
	Rare	(RF) Financial resources cannot be exploited.	(RP) Transportation and warehouse resources cannot be exploited	(RT) Resources to increase production, gather data, and increase supply chain efficiencies cannot be exploited	(RH) Human capital, managerial and technical skills cannot be exploited.	(RO) Information sharing for designing, planning and scheduling cannot be exploited.	(RI) Reputation, brand recognition, and organizational learning cannot be exploited.

	Imperfectly mobile	(IMF) Mutually beneficial financial resources yield little to no value outside of the focal firm.	(IMP) Transportation, warehousing, and other physical resources yield little to no value outside of the focal firm.	(IMT) Resources to increase production, gather data, and increase supply chain efficiencies yield little to no value outside of the focal firm.	(IMH) Human capital, managerial and technical skills yield little to no value outside of the focal firm.	(IMO) Information sharing for designing, planning and scheduling yield little to no value outside of the focal firm.	(IMI) Reputation, brand recognition, and organizational learning yield little to no value outside of the focal firm.
	Not imitable	(NIF) Mutually beneficial financial resources cannot be copied or equaled.	(NIP) Transportation and warehouse resources cannot be copied or equaled	(NIT) Resources to increase production, gather data, and increase supply chain efficiencies cannot be copied or equaled.	(NIH) Human capital, managerial and technical skills cannot be copied or equaled.	(NIO) Information sharing for designing, planning and scheduling cannot be copied or equaled.	(NII) Reputation, brand recognition, and organizational learning cannot be copied or equaled.
	Not substitutable	(NSF) Mutually beneficial financial resources cannot be replaced by any resource.	(NSP) Transportation, warehousing, and other physical resources cannot be replaced by any resource.	(NST) Information sharing for designing, planning and scheduling cannot be replaced by any resource.	(NSH) Human capital, managerial and technical skills cannot be replaced by any resource.	(NSO) Information sharing for designing, planning and scheduling cannot be replaced by any resource.	(NSI) Reputation, brand recognition, and organizational learning cannot be replaced by any resource.

Table 3.5.1 Cross-case Analyses

	Who was interviewed, what role in sourcing, what is being sourced?	Soft criteria used?	Why soft criteria?	Who was evaluated and where?	Gained operational performance? Yes/No How?	Soft criteria in supplier development?
Private Sector						
Case 1	Buyer side: senior purchasing official. Supplier side: supply manager heavy machinery manufacturing	Attitude (VH) Willingness to work through difficult issues (VO) Absorptive capacity (VI)	Revealed the necessary traits in the supplier desired by the buyer for fulfillment on current projects as well as future projects in the long-term partnership (VF)	Supplier management team, supplier manufacturing teams, supplier site	Yes; costs decreased substantially over time as supplier became more proficient at manufacturing the machinery. (VF)	Yes; soft criteria remained a focus throughout the life of the buyer-supplier relationship; supplier development began immediately after supplier selection and onboarding and carried throughout the buyer-supplier relationship. Included these criteria on supplier scorecard. (VF)
Case 2	Regional director of supply mgt., supply mgr. (2) director of supplier diversity	DEI: Owner of the supplier business is one of the following: female and/or minority	To increase buyer's supplier base diversity while also providing opportunities to various minority-	Business owners and staff evaluated through documents and interviews with the buyer.	Unclear; the buyer did not share any anecdotal nor historical data or evidence of	No; suppliers are initially placed in a conditional status (probationary) once selected and then, based on operational performance, they

	supply chain analyst commodity support services	(African-American and/or Latino). (NSF and NIH)	owned business. (VF)		operational performance.	can progress to a preferred status.
Case 3	Senior supply manager consumer durable goods	SME: business size (small-to-medium enterprises) DEI: Owner of the supplier business is one of the following: female and/or minority (African-American and/or Latino). (NSF and NIH)	To increase buyer's access to supplier decision makers to execute on decisions in a short-time frame. (VF)	Business owners, staff Supplier business site	Yes; buyer increased suppliers' orders over time due to effective operational performance by the supplier with small initial orders. (VF)	Yes; buyers leveraged the access to the decision makers to assist with initiatives critical to the buyer-supplier relationship.
Case 4	Chief operating officer automotive components and services	Equity and fairness displayed by supplier management to rest of the business (VI, RI, and NSI)	To uncover how the candidate supplier is treating employees and staff in their current operations.	Supplier management and ownership at the Supplier's facility.	Unclear; buyer shared many anecdotal instances of successful partners and how they displayed equity and fairness before and after	Yes; buyers always reviewed the equity and fairness traits of the supplier at each quarterly/semi-/annual review to ensure maintenance of supplier's equitable, fair approach with any profits from the buyer-supplier

					supplier selection. (VF)	relationship. Included these criteria on supplier scorecard.
Case 5	Project manager electronic components	Communication style (VH) Ethics (VI)	To gain insight into the supplier's intentions of buyer-supplier relationship (short-term vs. long-term) (VF)	Sales, marketing, legal, and executive management departments	Buyer shared experiences of successful buyer-supplier relationships which lasted many years however exact details were lacking. (VF)	Yes- buyers continued to assess communication style and ethics at each quarterly and annual review period. Included these criteria on supplier scorecard.
	Who was interviewed, what role in sourcing, what is being sourced?	What soft criteria used?	Why soft criteria?	Who was evaluated and where?	Gained operational performance? Yes/No How?	Soft criteria in supplier development?
Public Sector						
Case A	State CPO State legal counsel (decentralized procurement office)	Strategy to accomplish work (VH and VO)	To receive details on how and who would be completing the work as the selected supplier. (VH and VO)	Supplier personnel as explained in the request for proposal document.	Case A did not track any performance metrics.	Case A shared that their procurement office does not provide supplier development as part of the awarded contract.

	Who was interviewed, what role in sourcing, what is being sourced?	What soft criteria used?	Why soft criteria?	Who was evaluated and where?	Gained operational performance? Yes/No How?	Soft criteria in supplier development?
Case A (cont.)	(Procurement attorney-centralized procurement office) services procurement contracts					
Case B	Procurement official (centralized procurement office) Creative services procurement contracts	In-person interviews Inter-personal dynamics (VH)	To learn who would actually complete the work on the contract if the supplier was awarded To learn the candidate supplier's team chemistry (VF)	Candidate supplier presenters (mix of executives, mid-level managers, and sales managers)	Buyers would maintain contract with the awarded supplier for five years; actual performance metrics not available. (VF)	Buyer not involved in supplier development nor was any provided.
Case C	State procurement manager Contract analyst (centralized	Demonstration ("demo") (VH)	To learn how credible candidate suppliers are in providing the solicited services. (VI)	Candidate supplier presenting the demonstration.	Buyer did not have any operational performance metrics available to share.	No supplier development provided.

	procurement office) Services contracts (non-IT and legal services)					
Case D	State chief procurement officer	Customer service skills displayed in real-time (VH, VO, and VI)	To learn how candidate suppliers could interact and provide contract services to proposed contract clientele (RI)	Candidate supplier management and staff personnel at the candidate supplier's facility.	Buyer did not have any operational performance metrics to share other than the contracts were maintained for a 5-year period.	Buyer does not provide supplier development, however there were programs which the buyer refers to suppliers for any supplier development and resources so the supplier can learn and grow during the contract term.

Table 3.6 Summary of Soft Criteria Sourcing Archetypes

Archetypes	Applicable Cases	Soft Criteria Sourcing focus definition	Descriptions from cases
Long-term partners	Case 1	Sourcing systems focused their supplier selection process on candidate suppliers with whom they could work in a long-term buyer-supplier relationship.	One sourcing team evaluated suppliers for how the supplier learned and interacted with them as they worked through difficult issues. Another sourcing team asked direct questions regarding ethics from a supplier and their goals for a potential partnership. Both sourcing teams strived to find suppliers who would provide intangible resources to facilitate the long-term partnership.
	Case 5		
Stewards	Case 4	Sourcing team focused on what type of steward the candidate suppliers were with the extant financial and physical resources the candidate supplier possessed.	The sourcing team evaluated suppliers at the suppliers' facilities and reviewed financial and physical resources but also human resources like culture as well as intangible resources such as organizational learning. Sourcing team focused on tangible and intangible resources to select suppliers using soft criteria.
Unique Opportunity	Case 2	Buyer-supplier partnership based on unique supplier ownership structure. One sourcing team focused on diversity, equity, and inclusion or provides supplier selection criteria based solely on woman and minority-owned businesses. Another sourcing team focused on direct relationships with decision makers such as chief officers and executives.	Sourcing teams partnered with suppliers based on the ownership structure and maintained the buyer-supplier partnership by combining resources such as valuable and non-imitable human resources.
	Case 3		

Presenters	Case A	Sourcing teams focused their supplier selection process on the candidate suppliers' presentations to evaluate candidate suppliers according to soft criteria.	Sourcing teams focused on soft criteria such as team dynamics and inter-personal attitudes and chemistry, which revealed valuable human and organizational resources and mutually beneficial ones. Sourcing teams selected supplier for tangible and intangible resources.
	Case B		
	Case C		
Customer Service Providers	Case D	The sourcing team focused on suppliers who had met hard criteria (owned a hotel) as a qualifier but then focused on soft criteria (personal respect, courtesy, and managerial skills) as the supplier winner criteria.	The sourcing team focused on soft criteria in candidate suppliers to find valuable human, organizational, and intangible resources such as managerial skills, politeness in inter-personal communication, and organizational learning. Sourcing team selected suppliers for tangible and intangible resources.

APPENDIX C

ESSAY 2 APPENDIX

Table 4.1 Simulation Variables

Variable	Description (where applicable, mean and distribution)	Justification
Dependent		
Difference in Net profit	Net Profit$_j$-NetProfit$_i$	Yildiz et al. (2022); difference in net profit from supplier *j* (randomly selected supplier) minus net profit from supplier *I* (hard-criteria-selected supplier)
Independent		
Unit supply cost	$200	Yildiz et al. (2022)
Unit sales price	$500	
Transit time (supplier delivery of goods to manufacturer)	Domestic: 5 days Offshore: 40 days; Lognormal	Talluri et al. (2013); transit times for China to US (ODM Group, 2021); import quantities to U.S. ports (World Port Source, 2015); unloading and customs clearance (CFC, 2021)
Supplier market size (pool of suppliers)	S_{ij}	where *i* (low) and *j* (high) represent supplier pool size
Candidate supplier performance differential	Coefficient of Variation, CV=σ / μ	Qin (2015)
Annual inventory holding rate	30%	Azzi et al. (2014)
Revenue, *R*	Units sold*Unit sales price	
Manufacturing costs, *r*	Units produced * unit production costs	Manufacturing costs are 57% of price (remainder after all other costs and net margin); 20% of manufacturing costs is assumed to be fixed (Ederhof et al., 2017)
Inventory costs, *I*	1.5% of revenue	Yildiz et al. (2022)
Supply costs, *D*	Units sold * Unit supply costs	Yildiz et al. (2022)
Transportation costs, T	9.3% of revenue for domestic supplier	Yildiz et al. (2022)
Supplier processing time	1 day; Normal (SD = 0.3)	Talluri et al. (2013)
Manufacturer purchase order time	0.3 days; Triangular (0.1, 1.0)	Talluri et al. (2013)

Manufacturer sales order processing time	0.5 days; Triangular (0.2, 2.0)	Talluri et al. (2013)
Demand	100; Uniform (80, 120)	Yildiz et al. (2022)
Retail Service Level	Set to minimum 90%	Talluri et al., 2013; Kull et al., 2013; Kull and Closs, 2008
Finished goods beginning inventory	6.5 DOH	Based on 90% service level
Raw material beginning inventory	50 DOH	Based on 90% service level

Table 4.2 Simulation Factorial Combinations

Supplier			
	CV = .1	Mean Price	Mean Delivery Times
Supplier 1 (Market Leader)		Small	Small
Supplier 2		Large (p=.2 or p=.05)	Small (p=.8)
Supplier 3		Low (p=.8)	Large (p=.2 or p=.05)
Supplier 4		High (p=.2 or p=.05)	High (p=.2 or p=.05)
Supplier 5		Low (p=.8)	Low (p=.8)
Supplier 6		High (p=.2 or p=.05)	Low (p=.8)
Supplier 7		Low (p=.8)	High (p=.2 or p=.05)
Supplier 8		High (p=.2 or p=.05)	High (p=.2 or p=.05)
	CV = .4		
Supplier 1		Low	Low
Supplier 2		High (p=.2 or p=.05)	Low (p=.8)
Supplier 3		Low (p=.8)	High (p=.2 or p=.05)

Supplier 4		High (p=.2 or p=.05)	High (p=.2 or p=.05)
Supplier 5		Low (p=.8)	Low (p=.8)
Supplier 6		High (p=.2 or p=.05)	Low (p=.8)
Supplier 7		Low (p=.8)	High (p=.2 or p=.05)
Supplier 8		High (p=.2 or p=.05)	High (p=.2 or p=.05)

Table 4.3 Simulation Face Validity

Factor Change	Expectation	Validated
CV_{price} increase	Increase in σ_{price}	✓
CV_{price} decrease	Decrease in σ_{price}	✓
$CV_{delivery\_time}$ increase	Increase in $\sigma_{delivery\_time}$	✓
$CV_{delivery\_time}$ decrease	Decrease in $\sigma_{delivery\_time}$	✓
Differential increase	Lower difference of μ_{price} and $\mu_{delivery\_time}$ between $supplier_{market\_leader}$ and $supplier_i$	✓
Differential decrease	Greater difference of μ_{price} and $\mu_{delivery\_time}$ between $supplier_{market\_leader}$ and $supplier_i$	✓
SupplierPoolSize increase	Decrease in μ_{price} and $\mu_{delivery\_time}$	✓
SupplierPoolSize decrease	Increase in μ_{price} and $\mu_{delivery\_time}$	✓

Table 4.4 ANOVA Table. Dependent Variable and Factors

Tests of Between-Subjects Effects

Dependent Variable: NP_Diff

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.006E+14[a]	3	3.352E+13	37.064	<.001
Intercept	2.202E+14	1	2.202E+14	243.510	<.001
CV_mean_price	8.510E+13	1	8.510E+13	94.104	<.001
SupplierPoolSize	4.670E+11	1	4.670E+11	.516	.473
Differential	1.499E+13	1	1.499E+13	16.572	<.001
Error	2.279E+14	252	9.043E+11		
Total	5.486E+14	256			
Corrected Total	3.284E+14	255			

a. R Squared = .306 (Adjusted R Squared = .298)

Table 4.5 Correlation Table. Independent Variable and Factors

Correlations

	CV_mean_price	CV_mean_delivery_time	Supplier Pool Size	Differential	NP_Diff
CV_mean_price	1.0000	1.000**			
CV_mean_delivery_time	1.000**	1.0000			
Supplier Pool Size	0.0000	0.0000	1.0000		
Differential	0.0000	0.0000	0.0000	1.0000	
NP_Diff	-.509**	-.509**	-0.0377	-.214**	1.0000

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 4.1 Flow chart of Experiment

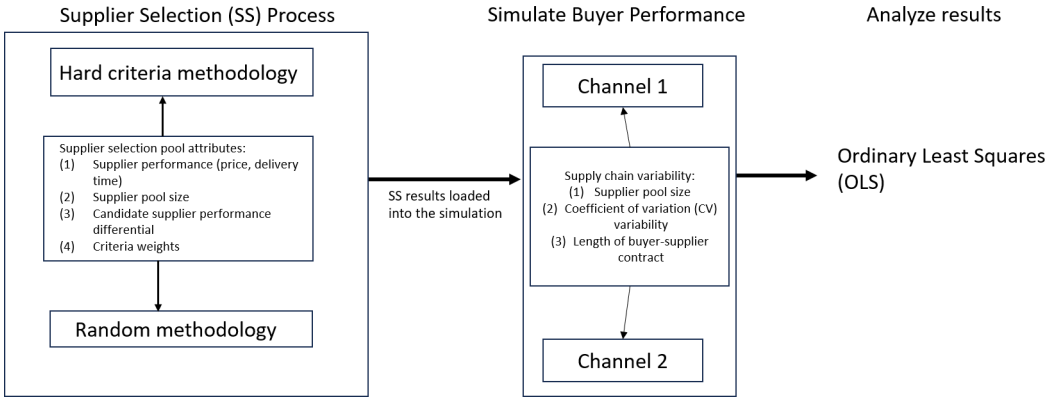


Figure 4.2 Experimental Framework

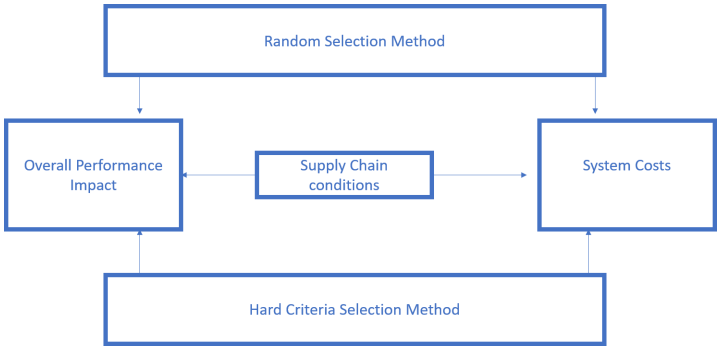


Figure 4.3 Supply chain structure

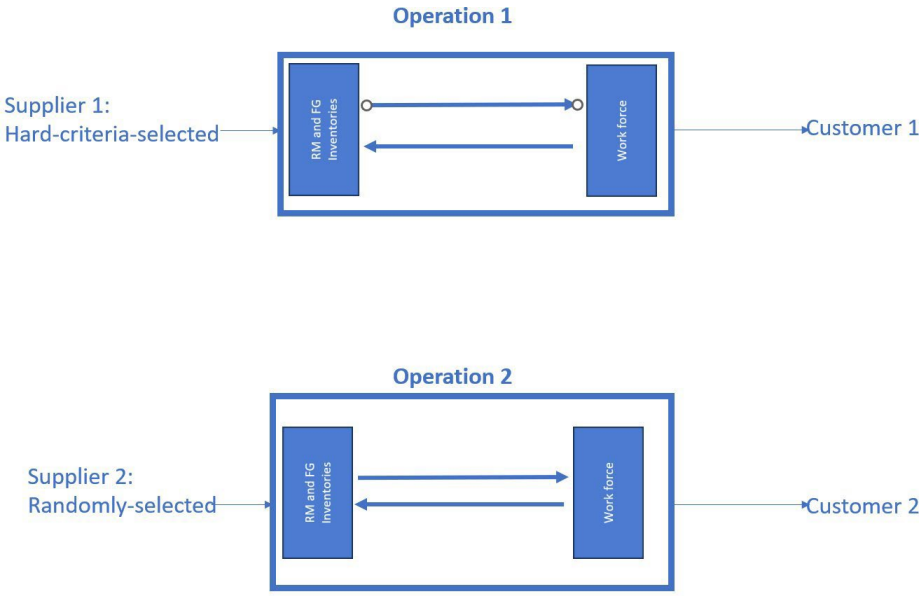
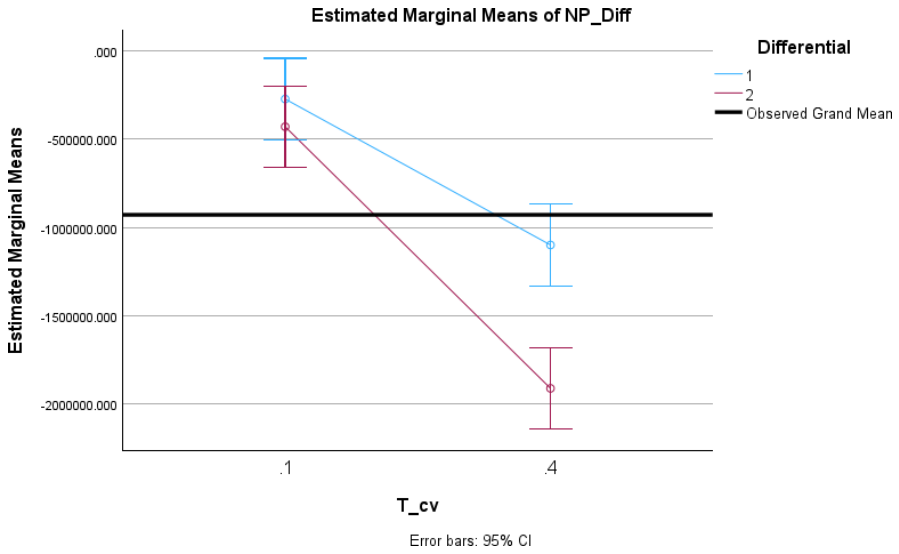


Figure 4.4 Mean Plots: NetProfit_D in CV control groups



Proof of F*.

We first note that *MSE* can be expressed as follows:

$$MSE = \frac{MMMMMM}{nn_{TT}-ss} \qquad (10)$$

Where

$$SSE = \sum_{ss}\sum_{ii}(YY_{ssii} - \bar{Y}_{ll\cdot})^2. \qquad (11).$$

We substitute (11) into (10) and then (10) can be expressed as follows:

$$= \frac{1}{nn_{TT}-ss}\sum_{ss}\sum_{ii}(YY_{ssii} - \bar{Y}_{u})^2$$

$$= \frac{1}{nn_{TT}-ss}\sum_{ss}(nn_{ss} - 1)\frac{\sum_{jj}(YY_{iijj}-\bar{Y}_{ii\cdot})^2}{(nn_{ii}-1)} \qquad (12).$$

We denote ordinary sample variance of the observations for the *i*th factor level by ss_{ss}^2 thus,

$$ss_{ss}^2 = \frac{\sum_{jj}(YY_{iijj}-\bar{Y}_{ii\cdot})^2}{(nn_{ii}-1)} \qquad (13).$$

Equation (13) can thus be expressed as (9). The sample variance, (13), is an unbiased estimator of the population variance –for all factor levels is $\sigma\sigma^2$ in our case – we thus derive:

$$E\{MSE\} = \frac{1}{nn_{TT}-ss}\sum_{ss}(nn_{ss} - 1)\,E\{ss_{ss}^2\}$$

$$= \frac{1}{nn_{TT}-ss}\sum_{ss}(nn_{ss} - 1)\,\sigma\sigma^2$$

$$=\sigma\sigma^2$$

Second, we denote that MSTR can be expressed as

$$MSTR = \frac{MMMMMRR}{ss-1} \quad (14),$$

where we consider the base model

$$YY_{IIii} = \mu\mu_{ss} + \varepsilon\varepsilon_{ssii} \quad (15).$$

Averaging the YY_{IIii} for the ith factor level, we express (15) as

$$\bar{Y}_{ii.} = \mu\mu_{ss} + \bar{\varepsilon}_{ii} \quad (16).$$

Where $\bar{\varepsilon}_{ii.}$ is the average of the $\varepsilon\varepsilon_{ssii}$ for the ith factor level:

$$\bar{\varepsilon}_{ii.} = \frac{\sum_{jj} \varepsilon\varepsilon_{iijj}}{nn} \quad (17).$$

Averaging the YY_{IIii} over all factor levels, we can express:

$$\bar{Y}_{..} = \mu\mu_{.} + \bar{\varepsilon}_{..} \quad (18).$$

Where $\mu\mu_{.}$ becomes for $nn_{ss} \equiv nn$:

$$\mu\mu_{.} = \frac{\sum nn_{ii}\mu\mu_{ii}}{nn_{TT}}$$

$$= \frac{nn\sum \mu\mu_{ii}}{nnss} = \frac{\sum \mu\mu_{ii}}{ss} \quad \text{when } nn_{ss} \equiv nn \quad (19).$$

And $\bar{\varepsilon}_{..}$ Is the average of all $\varepsilon\varepsilon_{ssii}$:

$$\bar{\varepsilon}_{..} = \frac{\sum\sum \varepsilon\varepsilon_{iijj}}{nnss} \quad (20).$$

With equal sample sizes, we have

$$\bar{Y}_{..} = \frac{\sum \bar{Y}_{ii.}}{ss} \quad \bar{\varepsilon}_{..} = \frac{\sum \bar{\varepsilon}_{ii.}}{ss} \quad (21).$$

Using (16) and (18), we obtain:

$$\bar{Y}_{ii.} - \bar{Y}_{..} = (\mu\mu_{ss} + \bar{\varepsilon}_{ii}) - (\mu\mu_{.} + \bar{\varepsilon}_{..}) = (\mu\mu_{ss} - \mu\mu_{.}) + (\bar{\varepsilon}_{ii} - \bar{\varepsilon}_{..}) \quad (22).$$

We then square $\bar{y}_{i..} - \bar{y}_{...}$ and sum over the factor levels, we obtain:

$$\sum_{i}(\bar{y}_{i..} - \bar{y}_{...})^2 = \sum(\mu_i - \mu_.)^2 + \sum(\varepsilon_{i.} - \varepsilon_{..})^2 + 2\sum(\mu_i - \mu_.)(\varepsilon_{i.} - \varepsilon_{..}) \quad (23).$$

We wish to find $E\{\sum_{i.}(\bar{y}_{i..} - \bar{y}_{...})^2\}$, thus we need to find expected values for each term on the right side of (23):

a. Since $\sum(\mu_i - \mu_.)^2$ is a constant, its expectation is,

$$E\{\sum(\mu_i - \mu_.)^2\} = \sum(\mu_i - \mu_.)^2 \quad (24).$$

b. Before finding the expectation of the second term on the right, first consider the expression,

$$\frac{\sum(\varepsilon_{ij} - \varepsilon_{i.})^2}{n-1}$$

This is an ordinary sample variance, since $\varepsilon_{i.}$ is the sample mean of the r terms ε_{ij} per (21). We also know that sample variance is an unbiased estimator of the variance of the variable, in this case ε_{ij}. But $\varepsilon_{i.}$ is just the mean of n independent error terms ε_{ij} by (17). Thus:

$$\sigma^2\{\varepsilon_{i.}\} = \frac{\sigma^2\{\varepsilon_{ij}\}}{n} = \frac{\sigma^2}{n}$$

Therefore:

$$E\left\{\frac{\sum(\varepsilon_{i.} - \varepsilon_{..})^2}{r-1}\right\} = \frac{\sigma^2}{n} \quad (25),$$

so that:

$$E\{\sum_{i}(\varepsilon_{i.} - \varepsilon_{..})^2\} = \frac{(r-1)\sigma^2}{n}$$

c. Since both $\varepsilon_{i.}$ and $\varepsilon_{..}$ are means of ε_{ij} terms, all of which have expectations of 0, it follows that:

$$E\{\varepsilon_{i.}\} = 0 \quad E\{\varepsilon_{..}\} = 0$$

Hence:

$$E\{2\sum_{pp}(\mu_{pp}-\mu_{\cdot\cdot})(\varepsilon_{pp}-\varepsilon_{\cdot\cdot})\} = 2\sum_{pp}(\mu_{pp}-\mu_{\cdot\cdot})\,E\{(\varepsilon_{pp}-\varepsilon_{\cdot\cdot})\} = 0$$

We have thus shown by (24), (25), and (26) that:

$$E\{\sum_{ii}(\bar{Y}_{i\cdot}-\bar{Y}_{\cdot\cdot})^2\} = \sum_{ss}(\mu_{i\cdot}-\mu_{\cdot\cdot})^2 + \frac{(ss-1)\,\sigma\sigma^2}{nn}$$

Then it follows with (8):

$$E\{MSTR\} = E\{nn\frac{\sum(\bar{Y}_{i\cdot}-\bar{Y}_{\cdot\cdot})^2}{ss-1}\} = \frac{}{ss-1}\sum_{ss}(\mu_{i\cdot}-\mu_{\cdot\cdot})^2 + \frac{(ss-1)\,\sigma\sigma^2}{nn}$$

$$\sigma\sigma^2 + \frac{nn\sum(\mu_{ii}-\mu_{\cdot\cdot})^2}{ss-1} \quad \text{when } nn_{ss} \equiv nn$$

APPENDIX D

ESSAY 3 APPENDIX

Table 5.1 Socio-Technical System Features. Expanded from Fox(1995), Emery (1959), and Kull et al. (2013)

Technical System Features	
Feature	Description of Feature and Impact on Social System
T1: Technical Centralities	*Automation:* the use of devices (e.g., mechanical, electronic) for automatic decisions and effort; this determines the relative contribution of people
	Operational impact: the criticality, focus, and skill demands of activities vary; this influences the significance of certain work roles.
T2: Technical Requisites	*Condition:* the situational task demands in the work settings (e.g., physical and psychological) or in the artifacts (e.g., products and ideas); these can be over/under stimulating and distracting; workers infer what is valuable by these conditions.
	Support dependence: the degree to which processes need other functions (e.g., maintenance, engineering) to maintain proper conditions; this influences the value of role relations.
T3: Technical Proximities	*Spatiotemporal distributions:* the layout among and time between workers, machines, and process steps; these influence coordination and communication requirements, interpersonal contact, and information exchange.
	Environmental contact: the importance of inbound and outbound linkages with the external environment; this creates demands for boundary-spanning management and coordination.
T4: Technical Flows	*Input variance:* the variation from upstream inputs; this continually stresses labor/skill requirements, straining individuals, workgroups, and management.
	Sequencing: the way unit operations (value adding activities) are grouped into production phases; this influences demands for labor skills, shared information and knowledge, and coordination.

Table 5.1 Continued. Socio-Technical System Features. Expanded from Fox(1995), Emery (1959), and Kull et al.(2013)

Social System Features	
Feature	Description of Feature and Impact on Technical System
S1: Social Positions	*Status landscape:* the varying degrees of importance and leadership among people; these will challenge formally given authority regarding influence and sources of knowledge.
	Social networks: the network of interpersonal relations distributes social knowledge and opportunities for helpfulness; this creates forms of reciprocity that challenge official knowledge and duties.
S2: Social Values	*Collective predispositions:* the shared mental models, motivations, values, norms, self-identity, fairness, and psychological contracts; these each compete with what is important to organizational performance.
	Social needs: the presence of personal worker goals and interdependencies; these threaten formally specified organizational goals depending upon their over- or under-specification.
S3: Social Associations	*Social roles:* the nature of responsibilities (i.e., work roles) within the social organization; this impacts cooperative behavior, responsibility for variation in processes and outputs, territories and resource allocation.
	Affiliations: the influence of informal group membership, accompanied by rewards and punishments; this creates forms of motivation and challenges formal workgroup control.
S4: Social Experiences	*Sentiments:* the collective emotional role-experience of workers (i.e., inherent attractiveness, dependence perceptions, justice, subordination, self-worth, trust, and social isolation); this influences decision-making and contradicts assumed rationality.
	Endowments: the basic talents, acquired skills, knowledge, expertise, and professional standards; these create technical dependencies, allow technical deficiencies, and introduce non-organizational standards in decisions.

Table 5.2 Interview Protocol Questions related to cultural interactions.

Question	Purpose
1. Briefly describe the recent PIL project you were in and what PIL techniques were used.	1. Orient interviewee to context and learn what they prioritize within that context
2. If project members (or others) seemed enthusiastic about a particular PIL technique or techniques, describe these and why.	2. Identify cultural congruence with PIL techniques
3. If project members (or others) seemed resistant about a particular PIL technique or techniques, describe these and why.	3. Identify cultural incongruence with PIL techniques

Questions related to cultural influences.

Question	Purpose
4. Did a PIL technique require a new way of thinking/acting? If so, describe the new vs. old way.	1. Identify possible dimensions of culture (and directions) that a PIL technique can change
5. How did the PIL technique cause this, do you think?	2. Identify the mechanism of change
6. Describe anything that made the new way of thinking/acting difficult.	3. Identify ways to facilitate/inhibit culture change

Table 5.3 Cross-case descriptions

DHS Component	Enthusiasm	Resistance	Changing in thinking/acting/behaving	Changes that made acquisition less (more) difficult	Implications for acquisition team performance
Logistics	Oral presentations and advisory down-select techniques changed technical flows (T4) that changed the social experiences (S4).	Video proposal technique changed technical flows (input variation, T4) that changed the social experience (sentiments, S4)	Acquisition team agreeing to implement PIL techniques inducing changes in technical proximities (T3) and centralities (T1) that induced changes in social associations (S3) and positions (S1).	Implementation of PIL techniques reduced time spent on acquisition project along with paperwork.	Acquisition team is together from start to finish. Legal counsel is present throughout. Team is cohesive and unified in approach. Contract officer is leading confidently on implementing PIL techniques.
Designers	Oral presentations and streamlined documentation techniques changed technical proximities (T3) and flows (T4) that changed the social associations (S3) and experiences (S4). Advisory down-select technique changed technical centralities (T1) and flows (T4) that changed social values (S1) and experiences (S4)	Advisor down-select technique changed technical centralities (T1) and flows (T4) that changed social positions (S1) and experiences (S4).	Changed thinking to implementing PIL techniques beyond Designers' project. Changed behavior to writing concise and shorter reports. Changes in thinking and behaving induced changes in technical flows (T4) that induced changes to social associations (S3) and experiences (S4)	Changes in thinking induced confidence in PIL technique usage, concise and shorter (not voluminous) reports, and a feeling of being less overwhelmed throughout the acquisition process.	Implementation of PIL techniques provides opportunity to increase skill set, knowledge, and expertise of acquisition process while producing more concise reports and more quality responses from industry (vendors).
Vetters	On-the-spot consensus technique caused changes in technical centralities (T1) that induced changes in social experiences (S4)	On-the-spot consensus technique caused changes in technical centralities (T1) that induced changes in social experiences (S4). Disagreement on usage of PIL techniques by the legal counsel and the	Changes in behaving by the technical team by asking the contracting officer more questions throughout the on-the-spot consensus technique induced changes in technical requisites (T2) inducing changes in social values (S2).	More frequent questions from technical team increased communication between technical team and contracting officer reducing the risk of a dominant, or bully, voice in the room thus a more balanced set of opinions in the evaluation.	Confidence in PIL technique usage is higher with earlier involvement and support from the PIL team. contracting officer and legal counsel agreeing on use of PIL techniques provides confident approach to the rest of the acquisition team. Earlier implementation in the

		other team members. Legal counsel proposed alternative that would have induced changes in technical centralities (T1), requisites (T2), and flows (T4) that may have induced social positions (S1), values (S2) and experiences (S4).			acquisition process of PIL techniques is more effective.
Managers	Advisory down-select caused changes in technical centralities (T1), requisites (T2) and flows (T4) that induced changes in social positions (S1), values (S2) and experiences (S4)	Video proposals caused changes in technical centralities (T1) and proximities (T3) that induced changes in social positions (S1) and associations (S3).	Changed behavior with on-the-spot consensus evaluations right after oral presentations. Changed behavior with video proposals – more streams of information flowed in as opposed to one (written). Both changes in behavior caused changes in technical flows (T4) inducing changes in social experiences (S4) Changed thinking regarding how many projects could be managed at one time – using PIL techniques created asynchronous approach to projects – caused changes in technical centralities (T1) that induced changes in social positions (S1).	Evaluations were more real-time and more verbal. Preparation changes where legal counsel and contracting officer communicate more and review all project materials (documents, slides, etc.) as well as collaborate with acquisition team more.	Acquisition team feels more confident when support from management team is expressed and applied. Less fear of mistakes and faster results leads to continued confidence of acquisition team as well confidence from management in acquisition team.

Agile	Oral presentations and advisory down-select techniques caused changes in technical flows (T4), requisites (T2), and centralities (T1) that induced changes in social experiences (S4), values (S2), and positions (S1)	N/A	Changed behavior by having the legal counsel present for all oral presentations- caused changes in technical proximities (T3) inducing changes in social associations (S3) Changed thinking (by using confidence ratings) of perspective on procurement project to be forward thinking into the future – how well can the contractor perform on the contract as opposed to how well the contractor responds to the solicitation – caused changes in technical flows (T4) inducing changes in social experiences (S4)	Use of oral presentations caused more intense, upfront preparations (logistics, materials, IT, scheduling, etc.) in the short term that created a better outcome of shorter timeframe, faster reduction of offering vendors, less documentation, and less workload overall.	Discomfort or pain from Intense training and preparation upfront in a short amount of time equates to immediate and long-term rewards in acquisition project outcomes for both federal government (less time spent, less workload, better spent budget) and industry participants (better spent time and budget).
Installers	On-the-spot consensus technique caused changes in technical centralities (T1), proximities (T3) and flows (T4) that induced changes in social experiences (S4). Highest technically rated fair and reasonable price and confidence rating techniques caused changes in technical flows (T4) that induced changes in social experiences (S4).	Confidence ratings technique caused changes in technical flows (T4) that induced changes in social experiences (S4).	Changed thinking to be flexible by bringing in other knowledge and factors of the procurement by using confidence ratings caused change in technical flows (T4) inducing changes in social experiences (S4).	Changing thinking to be more flexible and less time spent on procurement process also reduced paperwork.	Acquisition teams need to see that PIL techniques reduce time and provide more flexibility of skill set and knowledge usage on the procurement that will allow teams to return to daily tasks in quicker fashion without shortchanging the acquisition process.

Instructors	Oral presentations and on-the-spot consensus techniques caused changes in technical flows (T4) that induced changes in social experiences (S4). Confidence ratings technique caused changes in technical proximities (T3) and centralities (T1) that induced changes in social associations (S3) and positions (S1).	N/A	Changed thinking with oral presentations to more confidence in using the technique and completed in short time (70 days). Changed behavior of using traditional techniques by never using them again – only using PIL techniques on projects thereafter. Both changes implemented induced changes in technical flows (T4) inducing changes in social experiences (S4)	Changed behavior of relying on incumbent vendor relationships to relying on how well vendors were represented with subject matter expertise in proposal process.	Relying on incumbent relationships and traditional techniques may lead to "lock-in." Use of PIL techniques opens all options and forces teams away from path dependence.
Actors	Oral presentation techniques caused changes in technical flows (T4) and centralities (T1) inducing changes in social experiences (S4) and positions (S1).	Oral presentation caused changes in technical centralities (T1) inducing changes in social positions (S1).	Changed behavior of conducting clarifications of evaluations during on-the-spot consensus – caused changes in technical requisites (T2) and proximities (T3) that induced changes in social values (S2) and associations (S3).	Changed behavior of applying oral presentations and on-the-spot consensus changed status landscape thus legal counsel was not dominant voice or leader in acquisition techniques. PIL techniques reduced time of entire procurement process.	Legal counsel may be resistant to PIL techniques due to not experiencing success with such. Contracting officer with effective and confident leadership may persuade legal counsel toward PIL technique usage and create balance of opinions on acquisition project.

Table 5.4 Summary of Procurement Process Innovation Archetypes

Archetypes	Applicable Cases	Procurement Process Innovation performance definition	Descriptions from cases
Regulators	Vetters Actors	A team member presented a dominant voice attempting to or succeeded in steering the project away from focus or from PIL technique usage.	One acquisition team had a technical team member who presented a dominant voice and opinion that had to be restrained. Another acquisition team had legal counsel members who presented dominant voices that had to be brought into alignment. Both teams strived for alignment amongst all team members in dissolving their traditional procurement process paths.
Preparers	Managers Agile	Team members spent considerable time learning the PIL techniques and preparing up front in the acquisition process.	Both acquisition teams spent many hours preparing for the project. One team reviewed techniques and materials to be prepared to execute at a high level. The other team spent many hours ensuring logistics, planning, and organization was for a smooth operation throughout the project. Both teams strived for alignment amongst all team members in dissolving their traditional procurement process paths.
Reducers	Logistics Designers	Team members maintained a confidence in PIL technique usage and significantly reduced paperwork, workload, and overall time spent on the acquisition process.	Both acquisition teams were aligned with PIL techniques, management team, and among each other and thus sought to reduce time spent and workload. Both teams strived for alignment among all team members in dissolving their

			traditional procurement process paths.
Visionaries	Installers	Team members agreed to use PIL techniques that changed the vision of team members to be more forward thinking or more flexible in the use of procurement expertise.	The acquisition team realized a change of vision for different aspects of the acquisition process whether it be to maintain a vision of forward thinking of the offering vendors or flexibility in the evaluations. The acquisition team strived for alignment amongst all team members in dissolving their traditional procurement process paths.
Forsakers	Instructors	Team members applied a path dissolution method by forsaking the incumbent vendor relationship and applying PIL techniques to require high subject matter expertise from all vendor proposals.	The acquisition team realized that they must dissolve their path of traditional acquisition techniques and try something completely new to meet time constraints of their expiring contract. The acquisition team strived for alignment amongst all team members in dissolving their traditional procurement process paths.

Figure 5.1 Research Framework: An STS View of Innovation adoption (Kull et al., 2013)

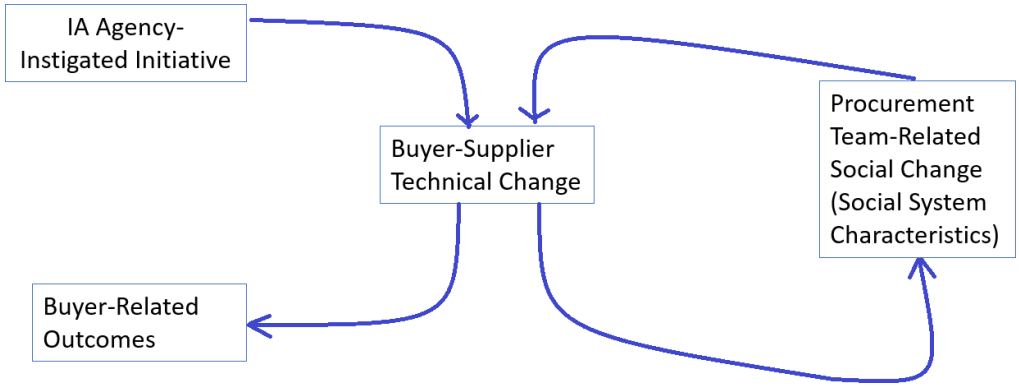
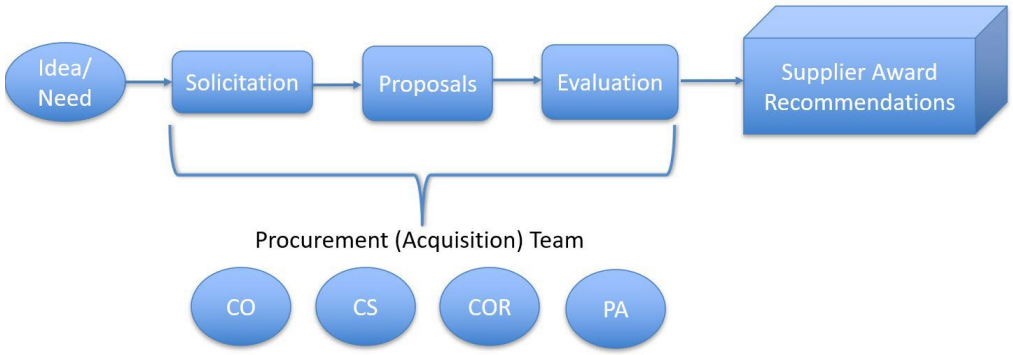


Figure 5.2 Acquisition Process (FAR, 2023)



CO: Contracting Officer
CS: Contracting Specialist
COR: Contract Office representative or Program Manager
PA: Procurement Attorney or General Counsel

Figure 5.3 Purchasing Matrix (Kraljic, 1983)

<table>
<tr><td rowspan="3">Profit impact</td><td>Materials management
Machined components
Logistics services
Transportation and logistics facitilites and construction</td><td>Supply management
Vehicle tooling systems
Testing equipment
Industrial products and services
IT
Security and protection</td></tr>
<tr><td>Purchasing management
Peripheral electronic components
Package delivery services
Office management
Professional services</td><td>Sourcing management
Substrates
Specialized molding parts
Human capital
Medical</td></tr>
<tr><td colspan="2">Supply risk</td></tr>
</table>

4. Within Case Descriptions

The within-case descriptions offer details on the eight cases used in this study and are the result of within-case analysis (Wu and Choi, 2005). As we triangulated data, we obtained key data that guided each case description. We have compiled and written each case in a way that maintains internal consistency and minimal subjective interpretations.

Each case begins with background information on the procurement project, explains what PIL techniques were used, which PIL techniques elicited enthusiasm or resistance, and how the procurement teams changed (or not) thinking and/or behaving with respect to how they conducted procurement projects. Procurement teams are referred to with generic names to maintain confidentiality. We required sample projects to be completed within the given fiscal year, October 1, 2017, through September 30, 2018, to draw generalized explanations and conclusions for focused PIL-assisted projects.

4.1 Materials Management – Logistics

For the Logistics procurement team, members who agreed to hold interviews were the contracting officer (CO), the contracting specialist (CS), the contracting officer representative (COR) or program manager, and the general counsel (GC) representative. All

team members were available in the Washington, D.C. area and did not have to be in a remote location for current assignments. The Logistics team was tasked with the procurement of logistics support during disasters in the Caribbean region. Logistics procurement team members had used traditional techniques in completed projects but were willing to try alternative (PIL) techniques for this procurement.

PIL techniques that Logistics used for this procurement project were the oral presentations, video proposals, advisory down-select, on-the-spot consensus, confidence ratings, streamlined documentation, and multi-phased evaluations. Logistics expressed enthusiasm for the video proposal, oral presentations, and on-the-spot consensus techniques. Regarding oral presentations, Logistics team members shared their enthusiasm:

> "So, I'm a huge lover of pre-award, let me just put that out there, ok – and I love moving from the traditional approach…" *Team Member 1*

> "For requirement work, the people who are running logistics and everything else, it's really important to be able to look at a person and say, "Do they know what they're talking about?" And are they going to be responsive and knowledgeable. You're not gonna have to wait and check back with somebody." *Team Member 2*

> "Yeah, that was huge … It went pretty smooth I would say – we didn't have to dig through a whole bunch of papers. Because papers and stuff, you get kind of bored with it real quick." *Team Member 3*

The quotes above by team members reflect the technical flows (T4) aspects of sequencing and input variance. Logistics changed sequencing in the way procurement operations were grouped in phases through viewing oral presentations together as a team. They also changed input variance by reducing vendor inputs of communication through oral presentations. The technical system changes from sequencing and input variance impacted the social experiences (S4) aspects of sentiments and endowments, also reflect above. Logistics team members shared sentiments such as trust and pleasure in the time saved and the reduction in paperwork created by the oral presentations. They expressed the gain of acquired skills, knowledge, and expertise with oral presentations.

Logistics shared their enthusiasm for the advisory down-select technique.

> "It actually might have made it a little easier because we had a phased approach where we have phase 1 and everyone is allowed to apply for it – they send in a video. And then we say, 'We don't think you have a great chance of award,' so some vendors just decide to not continue on and so we only had a couple of vendors . . . and for phase 2 we received a protest after we did the evaluations for phase 2 so only two vendors were only in the competition and we didn't have 3 or 4 that we had to then bring back into it so it was a little quicker in terms of effort to go back and talk to them. That part was helpful because we were able to whittle it down."

The above quote reflects a change in the technical flows (T4) aspect of input variance as Logistics reduced the number of vendors submitting proposals and continuing in the acquisition process. Further, this change in technical flows impacted the social experience (S4) aspect of endowments as Logistics gained new knowledge and professional standards of conducting the procurement in a more concise manner.

Logistics expressed that they initially felt some resistance toward video proposals, however, after having experience the technique they expressed their enthusiasm for it.

> ". . . just the wonder (of) how it's going to work. The main question we get, 'Can they really convey the information we're requiring in 15 minutes?' and what we're finding is 15 minutes is more than enough time. Then we mentioned 'Hey they're gonna chop it to 12!' So, it's more than enough time." *Team Member 1*

> "The video is always the hardest to get people to buy into. Because it's just so different and you're gonna have them watch YouTube for 15 minutes and then evaluate the contractor. At least I wasn't there when I talked about this one but for other ones it's usually the weirdest sell we have to give to the technical team. But everyone has liked it because you just take notes on the video, but that's good – you don't have to read too much." *Team Member 2*

> "The whole feedback from the program managers was they liked – my boss and his colleagues all liked it . . . (it's) just kinda new, we hadn't used that approach before. It was just kinda new to them. They loved it!" *Team Member 3*

The above quotes reflect changes with technical flows (T4) as Logistics reduced the format of proposals of all vendors such that each vendor only submitted one video proposal. These changes in technical input variance impacted social experience (S4) aspects of sentiments and endowments. Logistics further stated these impacts:

> "Everything kind of just pointed to doing less paperwork and talking together to basically decide what are the main bullet points because usually with other procurements, everyone individually has to go to their own place, and they have to write what they think is important and they meet together to decide which of those are wrong. And it's just a very drawn-out process. In this case, we skip all that and get right to the heart of it so it's just great from a paperwork perspective. From his perspective, we didn't have to meet very much because we took care of the details right then and there on the day of. So, it was very good scheduling purposes even though on our side we had to so some background."

The changes in the technical flow aspects impacted the social experiences by reducing paperwork and meeting times, thus creating a more concise acquisition process for logistics.

Lastly, Logistics team members remarked of changes in behavior that made the procurement process less difficult. Logistics stated the importance of all team members being "on the same page" by agreeing that all PIL techniques presented would be used before and during the acquisition process.

> "… we're just the visiting 24-hour operation so we have a lot of (newly trained contracting officers and contracting specialists) that at any given time could be working 5 of these requirements and some rely more on the program office which to me- to make my life easier-means 'Let's just get everyone on the same page and transparency so we all know where we are going.' Especially with logistics guys we need to reel everybody in, so we were all on the same page." *Team Member 1*
>
> "…we also had our attorney in the room for every step of the process so (they) were able to be aware of everything we were talking about, we didn't have to go back and check with (them), so it was just another way that was a lot quicker." *Team Member 2*
>
> "Absolutely." *Team Member 3*

The above quotes reflect changes to technical proximity (T3) aspect of spatiotemporal distributions and technical centralities (T1) aspect of operational impact. Logistics compacted the space and time of how they met during the acquisition process, furthermore, they changed the criticality and skill demands of team members using the PIL techniques. These technical changes impacted the social positions (S1) and associations (S3) aspects as leadership roles were enhanced as was cooperative behavior amongst Logistics team members.

4.2 Purchasing Management –Designers

The Designers procurement team agreed to have the following team members interviewed: the contracting officer (CO), the contracting officer representative or program manager (COR), and the general counsel (GC) representative. The Designers procurement team was based in the Washington, D.C.-area and did not work or travel to remote areas of the U.S. or other regions. Designers were tasked with procuring training services for law-enforcement and non-law enforcement personnel. While versed in traditional techniques, Designers chose to use PIL techniques as an alternative to assist with the time constraints they faced due to a potential lapse in contract.

Designers used the oral presentations, video proposals, advisory down-select, on-the-spot consensus, confidence ratings, streamlined documentation, and multi-phased evaluations. Designers expressed brief resistance and then enthusiasm for the advisory down-select technique.

> "… so the one unfortunate reality was we have this I think pretty fabulous procurement approach and procurement strategy, but in the end, one capable… I would have liked to have seen a little more competition a little bit more in that dynamic."

Designers realized, however, that this technique had its benefits.

> "We knew it would shake out to the most serious contenders that ended up after coming out around one. We had only a couple. . . (but) we were kind of

> bulletproof. So, we were excited, because we couldn't be . . . really it wasn't protest-able…"

The above quotes reflect changes in technical centralities (T1) and flows (T4) aspects of operational impact and sequencing. Designers changed the focus of activities of vendors along with grouping the tasks the acquisition team completed during the acquisition process. These technical changes impacted the social values (S1) and experiences (S4) aspects of the Designers team. Designers broke from the traditional acquisition process norm and gained new acquisition process skills and knowledge as well as the importance among acquisition team members. The technical changes induced social changes that resulted in additional time saved for the designers acquisition project.

Also, Designers were enthusiastic using oral presentations because it eliminated writing several page reports, instead writing concise, bullet-pointed evaluation reports.

> "… we really loved exploring for the first time how we would handle or oral presentations, they just hadn't been done here. So, a lot of folks saw this thought this was incredibly innovative. It's fantastic. To be honest, you set aside the time. And it reminds me of the employment process for lack of a better description. Okay, you can even hire someone to write your resume, and you can check, you know, dot all the I's, cross all the T's, and just have this fabulous resume, right? Yeah, like your proposal, your written proposal. But how do you present, right? And so, you say, okay, no cell phones, no, reach back come in with your best and brightest. And we were prepared. Like if we wanted to throw them a curveball or other questions." *Team Member 1*

> "… we have a time constraint and just pure dread of me going oh, my God, like this. And then her telling me, 'Oh, you don't have to write this thing at the end this gigantic report at the end that says why you picked it.' I was not looking forward to that because this is not my job, I was like this, and I don't have anybody else who can do it. I can do it. I don't have any subject matter experts who could do it. So, when she was like, Oh, you can just do bullet points. I'm like, we can do bullet points, confidence ratings. I'm there!" *Team Member 2*

Designers' enthusiasm for oral presentations and bullet-pointed reports above reflects changes in the technical proximities (T3) and flows (T4) aspects. They shortened the layout among and time between team members and oral presentations from vendors and decreased

the variation from upstream inputs by requiring all vendors to participate in oral presentations. These technical changes impacted social association (S3) and experience (S4) aspects by altering the dependence perceptions felt as well as the nature of acquisition responsibilities perceived by Designers. Further, Designers experienced relaxed affiliation influence as they viewed oral presentations and bullet-point techniques as motivation for workgroup identity.

Designers articulated that they had changed thinking and behaving to be more open to innovative procurement techniques. First, they changed their thinking with respect to using PIL techniques on a more frequent basis, beyond the Designer acquisition project.

> "So, you are intuitively or kind of naturally thinking that way. Some of the PIL techniques, I think, are friendly to the evaluation team. Because it gives you that freedom in (FAR section) 8.13.16. to, to evaluate the way that you want to, and I feel like it's more flexible. And a lot of times I feel like that's what the government needs sometimes. is a little bit of flexibility."

Additionally, Designers changed their behavior in writing reports to be a more concise and even shorter in reporting format as the behavioral norm for writing reports, following traditional techniques, had been to write voluminous compositions. The above quotes reflect changes in technical flows (T4) with the way Designers changed inputs from vendors as well changed the value adding activities within the acquisition process through the various PIL techniques. These technical aspect changes impacted social association (S3) and experience (S4) aspects in the way Designers felt enthused about shortening reports and gaining the knowledge of an alternative acquisition process to the traditional way they had previously operated.

Second, Designers mentioned a different behavior of feeling less overwhelmed while they used confidence ratings.

> "I kind of probably makes it feel a little more confident. I think in the in the process, because I think it also helps with a good requirement, you know, that industry is going to respond, perhaps a little more serious with the decision on their end. So, I like, I guess in that way, I felt a little more confident about the process. And less overwhelmed."

The Designers' expression above reflects changes in technical flows (T4) that impacted their social experiences (S4). Designers changed the order of value-added activities using confidence ratings, which in turn changed their knowledge, skills, and professional standards of how they could be mentally stressed. These sequencing changes induced changes in Designers endowments.

4.3 Supply Management 2 – Vetters

The Vetters procurement team agreed to conduct interviews with the contracting officer, the contracting specialist, and legal counsel. Vetters agreed to have interviews over the phone because of location constraints during data collection period. The Vetters' procurement team was assigned to procure services for visa screening and vetting analysis of visa applicants to the United States. Vetters had more experience in traditional procurement techniques and were asked to involve the PIL coaches to assist them in the evaluation process. Vetters shared their preference for traditional techniques throughout the data collection process. Their procurement project faced time constraints and were concerned for a lapse in service. Vetters used a single PIL technique throughout their whole procurement process, which was that of on-the-spot consensus in evaluations.

Vetters mentioned that the technical evaluation team agreed to use the on-the-spot consensus technique and had voiced enthusiasm as well. However, the contracting specialist mentioned they became more of a mediator to the technical team by explaining how to use the technique rather than the team creating the collaborated evaluation.

> "Yeah. I mean, we were excited that it was going to skip a step. But the only thing I saw that it, I mean, it maybe it saved a little bit of time. But I do feel like I ended up from an OAQ standpoint, being a bit more of a mediator with the team, because rather than having them evaluated independently, and have their own individual worksheet, and coming together and say, 'Oh, I think this' I think that they were just kind of in a room beating the idea around any time they had a question, they would come to me, because they didn't have their thought processes as to why they felt that way documented and actually, well thought out and articulated."

While this was mentioned initially as a deterrent to the progress of the project, the contracting specialist mentioned that the frequent questions and answers created a "better product" for an evaluation.

> "…it actually ended up helping them in the long run, because they were coming to us more frequently with questions, which helped them put out a better product on their first draft, right."

Vetters' expressions above reflect changes in the technical centralities (T1). Vetters changed the focus and criticality of activities using the on-the-spot consensus instead of using the traditional individual worksheets. The changes Vetters implemented impacted the social experience (S4) aspect of endowments through the "better product" produced in the first draft evaluation.

Vetters also expressed resistance to this singular PIL technique. Team members expressed disagreement on the approach (traditional vs. PIL techniques).

> "So, if you haven't read between the lines yet, (team members 1 and 2) and (team member 3) do not concur on the evaluation strategy."

One team member mentioned the procurement was delayed nearly eight months potentially due to two protests of the award.

> "So, I think that this this procurement could have been awarded using a different evaluation technique, one that is more streamlined than the one that the PIL proposed and was ultimately chosen. And this was the risk inherent in the approach that was utilized resulted in you know, two protests and one supplemental protest. All of which could have been avoided had we not gone down this route, but there was still much not attributing all bad motives, but there was a lot of desire to be innovative. … but the one element, right, the process whereby we skipped individual evaluators and go straight to consensus, I think that's worthwhile."

These expressions above also reflect changes to technical systems that impacted the social systems.

One Vetters team member states above that a change in the focus and acquisition skill demands (T1) would have impacted the social knowledge and opportunities for helpfulness (S1) from their point of view. Further, this same team member above expresses

proposed changes to technical aspects of sequencing (T4) and condition (T2) by changing the acquisition evaluation technique while also changing the situational task demands of the type of technique. These technical changes are offered to propose changes in social aspects of sentiments (S4) and collective predispositions (S2). This Vetters team member cites potential social changes in the attractiveness of the traditional technique to reduce the time and risk of protest while also relying on the shared mental model and norms of the traditional technique.

Vetters articulated that they had changed thinking and behaving based on the frequent questions from the technical team. Frequent questions from the technical team caused them (Vetters) to reflect on increasing communication with the technical team such that specific instructions and articulation of techniques can be clarified with increased verbal contact. Vetters learned of a way to reduce the risk of the strongest voice in the room that might dominate the evaluation as a singular voice.

> "I think because they came to us more often with question, or me serving as mediator, I think that helps. Like we've stated before it created a better product in their first draft . . . but also, I'm now gonna make sure that there's not a bully in the room . . . if I only see (the head of the tech team's) whole individual report and the consensus and none of the other individual thoughts- the other people's individual thoughts- were taken into account. And, you know, they might have believed the other team members. That was a consensus. But they were coming to me with the question, they disagreed with each other, and then they would come and work (consensus)."

Vetters' expression above reflects changes in technical requisites (T2, condition and support dependence) in the way they acted as mediator through the on-the-spot consensus process causing an increase in the acquisition task demand and the degree to which the tech team depended on the Vetters team member above. These changes impacted the social mental models (S2) and norms that Vetters had maintained while establishing new personal worker goals of allowing all tech team members voices to be heard (i.e., regulating the bully voice).

Vetters mentioned that their managers called the project one that met all PIL requirements. Further, Vetters voiced that their management team was pushing strongly for PIL technique usage and to innovate in procurement processes.

> "So I think I think everybody wanted to, you know, support the, you know, I think everybody from management from the DC on down was like, hey, use the PIL, the innovative, you know, want to build a say we've done project with it when I say and I think that was more overriding then that may have played a bigger reason or the basis for the decision to go the way we did then. What would ordinarily be warranted."

While receiving the PIL support was mentioned as a positive aspect to this procurement project, Vetters team members expressed their opinion that PIL involvement should occur much earlier in the project and should include a higher level of comfort and familiarity with the PIL techniques to be used throughout the process.

> "I think that coming to involve the PIL at the stage of the procurement we did was not necessarily, the most effective I think had they been involved in it during an acquisition planning stage, it would have been more effective, because you could have maybe had more time to consider other techniques."

Vetters' expressions above reflect proposed changes to technical sequencing (T4) and operational impact (T1) aspects as Vetters proposes change to the timing of PIL technique usage along with their criticality and focus demands for the PIL techniques used. These changes propose to impact the social aspects of endowment (S4) and social network (S1) as Vetters seem to perceive changes in their acquisition process knowledge, expertise, and professional standards along with changes to their network of interpersonal relations amongst themselves and their management team.

4.4 Supply Management 4 – Managers

Managers was a procurement project focused on complex IT modernization efforts to consolidate legacy systems for grant management. While time compression was not a pressing factor, Managers were enthusiastic to see how the use of PIL techniques would

affect their procurement project. Managers voiced their need for agreement of use of PIL techniques among all team members as well as the need of trust among team members in general. Team members from Managers who agreed to qualitative interviews were the contracting officer, the program manager or COR, and the legal counsel representative. The PIL techniques that Managers used were the video proposals, advisory down-select, on-the-spot consensus, streamlined documentation, interactive dialogue, and multi-phased evaluations.

Applying the multi-phased evaluations with the advisory down-select, Managers evaluated a working prototype of a web-based application. Managers expressed enthusiasm for these techniques.

> "We liked the approval process, using the prototype because it removed fluff, got to the core of the buy."

Managers' expression above reflects reductions in the variations of the format and information contained in the proposals that vendors submitted. These changes to technical flows (T4) impacted Managers' social experiences (S4). Managers collective emotions were impacted as they "liked" the new process while they also gained new knowledge and acquisition expertise from using the new technique.

A separate team member showed enthusiasm for the advisory down-select process as it reduced the amount of written word. With less written words, according to this team member, the less of an opportunity to protest.

> "I was enthusiastic with down-select because it reduces the protest risk – I always ask, 'How are we going to defend this?' Protests will happen with high value projects. I'm worried how well we'll defend protests. Many COs don't involve attorney. But the more complicated the project, the more opportunities to poke holes. Down-select takes protestors out without opportunity to protest."

The Managers' quote above cites changes to technical centralities (T1) and requisites (T2). Managers changed focus of meeting with the Procurement Attorney such that meetings between Managers and the PA were more collaborative. Further, Managers increased their

support dependence on the procurement attorney for the collaborative effort. These technical changes impacted Managers' social positions (S1) and values (S2). Managers' project leadership was balanced with more collaboration between the team and the Procurement Attorney. Furthermore, managers changed their interdependencies between legal counsel and contracting officers by changing the way they conducted the procurement process using the advisory down-select.

Managers resisted the use of video proposals, as they shared it was time consuming. First, some team members felt video proposals affected their ability to give fair attention to presenting suppliers.

> "The videos we had to re-review so to be diligent and fair and equal. That was time consuming, but we had to demonstrate consistency across offerors."

The above expression reflects changes in the technical centralities (T1) and proximities (T3). Managers changed their operational impact with increased focus demands of video proposal activities while also increasing the amount of time spent on the video proposals. These changes impacted their social positions (S1) and social associations (S3). Managers were impacted by having the importance of team members to provide consistency while also having the nature of their work roles become more crucial to the procurement project outcomes.

Second, another team member, expressing resistance, considered the video proposals as time consuming due to the inability to do "word searches" within a document.

> "Videos can be more time consuming. I like using word search technique when reviewing written proposals – we can't do that with a video. 'Where in the video was it?' The evaluation report is the 'first line of defense' against protest."

The above expression reflects a change in technical proximities (T3) as Managers experienced an increase in the time spent on video proposals. This technical change impacted the social associations (S3) aspect of social roles as it changed the work role for some Managers' team members.

Managers articulated that they had changed thinking and behaving in various ways. First, one team member shared that the team had changed their behavior in a manner that was in a more real-time, more verbal fashion.

> "Orals are not innovative, but on-the-spot consensus is – key to this is the interactive dialogue. COs are not used to this. Many people would record and review after the consensus meeting. But consensus goes over what we liked and didn't like, we hash it out. However, the attorney had to steer the group back to the evaluation criteria."

Manager's quote above reflects technical flow (T4) changes in the way they evaluated the proposals from vendors. These technical changes impacted their skills such that they acquired new acquisition process expertise (S4).

Second, another team member shared that the team had changed their behavior of receiving information during the procurement project. Having received information via one stream, they now received multiple streams of information.

> "With the old ways, we are used to one information stream (written), but with videos, there were at least 3 at once . . . IT was process overload. Videos throw a lot at you at once."

The above quote reflects changes in Managers' technical flows (T4) as they changed the variation in how vendors presented information as well as changed the way they grouped their procurement process techniques in phases. These changes impacted Managers' social experiences (S4) by altering their feelings toward the techniques and the basic talents and skills used to perform the procurement process with those techniques.

Third, team members shared that the team had changed their thinking regarding how many projects they could manage at one time. They changed their thinking from an asynchronous way to that of a synchronous one.

> ". . . it actually took a lot of my time (more than the old ways). New ways make it hard to multi-task. I have many projects at once. New ways made managing multiple projects difficult."

Managers mentioned an interesting change in preparation behavior of the CO pertaining to the use of interactive dialogue.

> "… attorney acts different – need to review slides and know eval criteria, have discussions with CO. Need to address team and coach the team a lot, reminding them to steer clear of leading questions, keep to the subject, don't ask about other offerors, etc."

The previous two above quotes reflect changes in technical centralities (T1) with how Managers changed their focus and skill demands for using interactive dialogue. These operational changes impacted Managers' social positions (S1) by increasing the leadership role and the workload of the contracting officer.

Further, Managers shared that use of the PIL techniques and new ways in general by the procurement team allows for more confidence and less fear when supported by leadership from their component.

> "(DHS Component) took to methods better because it has a history of shoot first and ask questions later. We have leadership support to do this, but some are afraid to make a mistake. My job is not at risk, but with government it is not going to be bottom up – we need it to be top-down. There's an inertia to government work. (Component) is embracing more new ways, particularly with IT. Until leadership supports, which happens when success is demonstrated and there's familiarity and comfort. Leadership does like delivering outcomes more quickly. Leadership must support the CO (because) there is still a fear factor."

Managers' expression above reflects a proposal of operational impact changes (T1) on their status landscape (S1) previously mentioned. Additionally, this quote reflects proposed technical flow (T4) changes with how other procurement projects can alter the way the procurement value added activities are grouped into phases (oral presentations, advisory down selects, and on-the-spot consensus, etc.). The technical flow changes proposed had impacted Managers' confidence and sense of self-worth (S4) and they propose that these same sentiments can be shared by other procurement projects as well.

4.5 Supply Management 5 – Agile

The Agile procurement project was identified as an Agile pilot project by the Department of Homeland Security Under Secretary of Management as well as the Office of

the Chief Information Officer. The Agile procurement team was tasked with obtaining agile development services to modernize a national program's IT system that included large legacy solutions with a significant number of interfaces and large data stores. The Agile procurement team had responded to natural disasters across the nation and at the time of the execution of the procurement project they needed to respond in quick fashion to provide services amid a regional natural disaster. Members of Agile who agreed to interviews were the contracting specialist and the procurement attorney. The contracting officer for Agile was amicable to a previous interview on another project but declined to interview on this project stating that (their) feelings and opinions had not changed regarding PIL techniques and the use thereof. The PIL techniques which Agile used were oral presentations, video proposals, advisory down-select, on-the-spot consensus, confidence ratings, streamlined documentation, and multi-phased evaluations.

Agile did not resist PIL techniques that they used. Both Agile team members expressed enthusiasm for the PIL techniques. One Agile team member expressed enthusiasm for using oral presentations.

> "I know for the (oral presentations) scenario(s) where basically we would, we would have the vendor come in, and we would give them five scenarios. And they would have to provide an answer to, and they would have one hour, we would leave the room take their cell phones. And in an hour later, they would have to present their answer to the scenarios for one hour. That was really, I think, informative and really did change what our expectations were for which vendor was going to be top tier or lower . . . but they came in and you can talk to them in person. And you know, you see them answer questions for an hour that they had no way to prepare for. And it was really revealing, I think, and definitely sorted stuff out there was a clear vendor that was superior to the others in terms of respond to the scenarios."

Agile's expression above reflects changes to the technical flows (T4) with how they changed their procurement proposal process (sequencing) with vendors. By having face-to-face meetings and asking questions directly to the vendors, Agile's technical changes provided new social experiences (S4) in the form of endowments such as newly acquired skills, knowledge, and expertise for the acquisition process.

Agile also expressed enthusiasm for the advisory down-select process. Another Agile team member shared their enthusiasm attributed to the reduction in risk of protest.

> "Yeah, just from a legal perspective, I think that piece of it that I really think attorney(s) probably appreciate the most is the down select process. For a couple of reasons. For procurement attorney perspective, we're thinking about how we reduce protest risk. You know and by having a down select process, basically, we had about two thirds — what was... we have 10 offers for three. Yeah, so we were able to, you know, reduce by 70%, the field that was really eligible for award. And since the offers were taking themselves out of the process, they weren't eligible for protest. So, after the reducing protest risk, that's really good."

The above quote by the Agile team member reflects changes to technical requisites (T2) aspects. Agile expressed changes to the focus and criticality demands of the actual procurement process, which was originally focused solely on reduction in risk of protest. By changing this focus (condition), Agile changed the social values (S2), which in turn changed the shared mental models and norms away from traditional techniques toward PIL techniques.

The same Agile team member above also shared enthusiasm for the down-select process attributed to the workload reducing results it provided.

> "The other part is, it significantly reduces our workload, and coming to a final word decision. If we had all 10 offers of participating in the things, we did at phase two, that's, you know, exponentially more work for the team to do. And for attorneys to review. You know, any one of those offers may have had no realistic chance of winning the award, and we would still have to dot our I's and cross our T's and make sure that we documented it thoroughly so that they couldn't attack it in a protest, which … if they were to find some flaw, we may have to start the process over again. So, in terms of saving time and effort and reducing our protest risk, from an attorney perspective, the down-select process is really a good thing."

Agile's expression above addresses changes to technical centralities (T1). Agile changed the focus and criticality of procurement process demands by applying the down-select process that impacted the social positions (S1). Agile's network among the team

members increased their interpersonal relations through sharing knowledge and opportunities for helpfulness while completing the down-select process.

Agile articulated that they had changed behaving and thinking from using the PIL techniques. First, an Agile team member cited how they behaved differently using oral presentations:

> "…as the attorney that, you know, frequently, I'm not in the room for oral presentations. And so, in this case, I really needed to be there. And I needed to be with the group because the oral presentations were given and we went into break for 15 minutes ... Typically, that's not what would happen … I was able to, if they kind of got off point, like they were talking about some unstated criteria, for example, I could kind of redirect them."

The quote above from Agile expresses the changes in technical proximities (T3). Agile changed the meetings so that the legal counsel was present through oral presentations. This change in spatiotemporal distribution impacted Agile's social associations (S3). The nature of the legal counsel's work role was changed such that the procurement team focused more clearly on the process at hand throughout the oral presentations.

Second, the other Agile team member shared that members of the Agile team changed their thinking through use of the confidence ratings.

> "…one other thing that we added to it was the confidence ratings, … And so, all of our conversations were centered around that, which was different than the traditional adjectival rating of poor, fair, good, or excellent. … it made it a lot easier for the technical team to differentiate between them and think about them in a very simple way. Because excellent and good is very difficult to parse sometimes. It also changed a little bit how you think about how you're evaluating the contractor. Through my experience, traditionally, what you're asking is how well does the contractor respond to the solicitation. In this case, we're asking how confident are we that the contractor can perform the work after seeing their proposal… But it changes the direction more towards the future, rather than responding to the solicitation…"

Agile's expression above reflects changes to the technical flows (T4) that impacted Agile's social experience (S4). Agile changed the way they applied ratings while using confidence ratings instead of adjectival ratings, which reduced the variation of inputs into the evaluation

process. This technical change to input variance impacted Agile's skills, knowledge, and expertise for acquisition. Thus, Agile was introduced to a non-organizational standard in decisions focused on the future.

Agile team members shared how their change in behavior from using the PIL techniques made the procurement process difficult or easy. First, one Agile team member mentioned the behavior change from oral presentations made the procurement project more difficult up front, but the difficulties produced a better outcome:

> "I do think (what) was more difficult was surrounding the oral presentations. Because it really required the team to prepare beforehand to… everything needed to be ready to just logistical things for (contracting specialist) and (contracting officer) to make sure that everything-conference rooms were reserved, materials are ready that, you know, any AV equipment- is ready to go. … everything was done in a professional manner, that we have needed an additional room to go to our consensus and to discuss following questions. And we had to do our on-the-spot consensus, which, you know, people had to make sure that their schedules were blocked, and… the entire team schedules were blocked. And they also had to really think intensely to… kind of get their consensus during…maybe a limited period of time. So, while that made that piece harder. It was over a short period of time. And in the long run, I think there's no better outcome. That is maybe more difficult than a typical.... [Unintelligible] more difficult, but typical procurement."

Agile's expression above reflects changes to the technical centralities (T1) that impacted the social positions (S1). Agile changed the focus and criticality demands of activities for pre-proposal work such that the team was more engaged in preparation. This change in operational impact caused a change in Agile's social positions aspects. Agile's opportunities for helpfulness were augmented and the social network between Agile and the technical team was more cooperative compared to during the use of traditional techniques.

Agile team members also shared how their change in behavior from using the advisory down-select technique made the procurement process easier. One team member shared how the documentation load was reduced and thus made easier:

> "… it's hard to overstate the difference between doing and reviewing award documentation for three offers vs. ten. It's a significant difference in time

> and I provide it by attorney. Because we have to, you know, we have to comb through all the documentation, see if we are treating offers fairly and not having disparate treatment of the much simpler process, if you have three offers that you're comparing rather than 10 … that's not just a straight line, difference in workload – it is really exponential. And I don't know how to describe that. And I think, just one other thing about that too is because it takes so long, particularly, when you're talking about your presentations, your memory state, it takes a lot longer to write the report when you got 10. And then it takes a lot longer for me to review. So, you know, we may not have an accurate product at the end of it."

The other Agile team member agreed with the change in behavior from using the advisory down-select making the procurement process easier.

> "So, people that you know that are very valuable in their organization coming up to (DHS component) and blocking out their entire day to do an oral presentation, and you have 10 of those companies doing it. Not only is it time intensive for us, but it's also (time intensive) for them, it's costly for them. They have a lot more … it's basically they already have bought in so much that they may see the protest as just a very cheap, you know, kind of way to save, maybe they can save some of that money that they've already spent… But just when you have fewer there, you're able to spend your energy lot more efficiently. You just end up putting out a better product no matter what. And I think that was the case here. You know, the more you write, there's the more opportunities you have to mess up. But it's also you may just lose your … lose your focus occasionally too, and, or introducing more offers who feel like they were just kind of given for a ride, or we weren't really fair to them. We were very open with the contractors where we told them you do not have a high chance of award if you continue, and, and they made the decision that they didn't want to."

The previous two quotes by Agile reflect changes to technical proximities (T3) that impacted the social associations (S3). Agile's change in the procurement process by using the advisory down-select technique decreased the time and space among the vendor documentation reviews that they completed. This change in spatiotemporal distributions impacted the Agile social roles as it freed up time for the team members, namely the legal counsel, to provide a work role with more cooperative behavior. This change also created an affiliation motivation amongst the team to spend their energy more efficiently as a team.

4.6 Supply Management 7 – Installers

Installers were tasked with the procurement requirement to purchase and install security-related equipment that support electronic baggage screening initiatives. Members of the Installers procurement team who agreed to interviews were the contracting specialist and the COR. The PIL techniques that Installers used were on-the-spot consensus, confidence ratings, and highest technically rated fair and reasonable price.

Installers showed enthusiasm for the techniques used during the acquisition process. First, Installers was enthusiastic regarding the on-the-spot consensus technique due to the paperwork reducing nature. On-the-spot consensus allowed Installers to keep concise documentation as opposed to the traditional approach that carried separate evaluations from each team member.

> "Definitely on the spot consensus, and that was a huge help . . . it's one consolidated evaluation, there are no ancillary documents that are involved at that point. So, they come together, it's quicker. You write your final analysis, essentially, right there in the room. Now, obviously, then it has to go through legal review and stuff. So, some, there might be some clarifications but it's one evaluation, one set of readings for all of the technical factors."

Further, Installers stated reasons for enthusiasm as expediting the evaluation and using less time.

> "It's helpful for some reasons, first of all, it expedites evaluation. . . There was definitely enthusiasm shown for it. Because it's, again, a lot of it has to do with the time factor. Evaluations take up a lot of time. . . And also, I think it was a little bit smoother it was a little bit easier when you're reading stuff and talking about it kind of right there in the moment. As opposed to kind of individually kind of coming up with your own opinion, and then coming into a room and having to defend your opinions. I think they liked the ease. And it was easier, because since we were all there and all taking notes."

Installers' expressions above reflect changes in technical centralities (T1), proximities (T3) and flows (T4) that impacted the social experiences (S4). Applying the on-the-spot consensus, Installers increased their focus and emphasis on sharing opinions and evaluation

while congregated together. This change in operational impact changed the team's interpersonal relations such that opportunities for helpfulness increased or became "smoother." Second, Installers met together and spoke frequently after every oral presentation, thus increasing the time and collaboration amongst the team. This change in spatiotemporal distributions created formal and informal group membership that provided the reward of a quicker composed final analysis. Finally, Installers reduced the variation of evaluation inputs into a final evaluation. This change with input variance impacted Installers' endowments as Installers acquired new skills and expertise of how to effect acquisition evaluations.

Second, Installers showed enthusiasm for the technique called highest technically rated fair and reasonable price. Installers were enthusiastic about this technique as it reduced time spent on the procurement project.

> "… when you do highest technically rated fair and reasonable price, you don't look at the lower rated price proposal. You just look at the price proposal from the highest technically rated. And you use other pricing factors and other price analysis tools, historical contracts, comparable services contracts … it's the timing, people's time is valuable. And anytime you can get them back to their standard job duties, is better. Without taking away from the acquisition, you know, you don't want to shortchange the acquisition process, just to get them back to their desks. But if there's a way that you can get a good, valuable technical evaluation and save time, it's better for everybody."

Installers' expression above reflects technical changes through decreasing the input variance (T4), which induced social changes with their endowment (S4). Installers reduced the variation in evaluation proposal inputs that they would evaluate. By doing so, they reduced time spent on the evaluation, which created new skills and a new professional standard for the evaluation.

Third, Installers showed enthusiasm for confidence ratings after having initially shown resistance. One team member shared how they changed their opinion for confidence ratings as they used the technique in the procurement project.

> "I was hesitant. I'd never heard of it before. And I didn't see how it worked, and how it was different or better than the traditional adjectival ratings . . . it allows you to bring in kind of other factors that impact evaluation and impact our thought as to whether or not this vendor can actually do the job. As opposed to just 'well, they write a pretty proposal and they say they can do this and you know, all the other good buzzwords are there.' But you say that, and I have not seen the ability to use kind of external information outside of the proposals in traditional evaluation it's just. . . it was nice to see that the technical evaluation team could use more of their expertise."

Installers' quote represents how they became enthusiastic for the use of confidence ratings after changing technical flows (T4) from the acquisition process. Installers increased the variation of evaluation factor inputs such that their social experiences (S4) were impacted. This change with Installers' evaluation input variance increased their endowments of acquired skills, knowledge, and expertise in the acquisition process. Other than the initial resistance shown toward confidence ratings, Installers were not resistant to any other technique nor to the PIL in general.

Installers articulated that they had changed thinking in the way they thought of the flexibility in completing a procurement. Specifically, using the confidence rating technique provided them the opportunity to see how flexible their thinking could be as they used more of their knowledge from previous or other projects to assist them in the Installers project.

> "… with the confidence ratings, your... you have that flexibility is saying, 'You say you can do this. But given your comments here, and our knowledge and of other similar projects that you've worked on with us, we don't agree with that.' So, it allows you to bring in knowledge of the vendor and knowledge of the program."

Installers' expression above reflects changes in technical flows (T4) that impacted Installers' social experiences (S4). They altered the way they performed acquisition tasks by using confidence ratings while increasing the variation of inputs used for the evaluation. These technical flow changes induced changes with Installers' sentiments and endowments. Installers gained a sense of self-worth while acquiring new skills and introduced a non-organizational standard in acquisition evaluation decision making.

Installers summarized how using the PIL techniques caused new ways of thinking that made the procurement project less difficult.

> "It's a big aspect. So, for the on-the-spot consensus, it made things better because of the timing. As far as the evaluation team, kind of also reduced paperwork too, they didn't that have to write up two evaluations, it was one single evaluation."

The above quote from Installers reflects changes in technical centralities (T1) that impacted social positions (S1). Installers changed their criticality and focus demands for all the PIL techniques, moving away from traditional techniques. This change in operational impact induced changes in the distribution of Installers' acquisition process knowledge as well as Installers' helpfulness among themselves as they reduced overall workload (paperwork) for the team. Further, Installers quote also reflects changes in technical proximities that impacted social associations. Installers reduced the time and space layout among team members, meeting together immediately after each oral presentation, which induced changes with Installers group affiliation. Installers team and acquisition process improved ("made things better") because of their technical changes and social group affiliation.

4.7 Sourcing Management – Instructors

The Instructors' procurement team was a project that required operations and related support services.The Instructors' team experienced a unique situation where the program manager was transitioning out of the role right before the initiation of the project. Thus, both the existing and the new program managers (CORs) agreed to interview. Additionally, the contracting officer agreed to a qualitative interview. Instructors faced numerous potential issues. First, Instructors were running out of time to complete the procurement. The incumbent supplier's six-month contract extension was soon to run out. Second, Instructors' procurement team members, like most procurement teams, had day jobs and little spare time to offer for evaluating proposals, much less to operate as a full-time acquisition team. Facing these constraints, the contracting officer met with the other team members to discuss this procurement. The PIL techniques were offered – with no

guarantees – as an alternative that might save time on the project. Instructors optimistically agreed to use the PIL techniques. The PIL techniques that Instructors used were the oral presentations, video proposals, advisory down-select, on-the-spot consensus, confidence ratings, streamlined documentation, and multi-phased evaluations. Instructors did not express any resistance towards any of the PIL techniques.

Instructors expressed the most enthusiasm for the oral presentations, on-the-spot consensus, confidence ratings, and streamlined documentation. There were several reasons cited for the enthusiasm. First, Instructors felt that the oral presentations given by the suppliers provided an opportunity for Instructors to receive direct and concise information that contributed to a time-saving element on the project in general.

> "… (Instructors) really liked the idea of not receiving any proposal, any part of the technical proposal on paper, they really liked that idea a lot. Like that's what got them on board, because they just don't have the time or patience to read a lot of documentation. Because the nature of the government evaluations, teamwork, it's one where they're just not behind their desk a lot."

The Instructors' expression above reflects changes in technical flows (T4) that impacted Instructors social experiences (S4). They changed the format of proposals they received. By altering the variety of the proposal inputs, Instructors changed their acquisition process endowments. As a result of applying the oral presentation technique, Instructors gained new skills, knowledge, and expertise for the acquisition process.

Second, Instructors stated that using the on-the-spot consensus technique presented the opportunity for the team to all express their opinions of the vendors presentations such that each team member shared their point of view without any impediment.

> "…after phase one, they would look at one video, and then they would do their consensus on the spot, and they'd write it. And then phase two, they see the world presentation consensus on the spot and write it. And they also were able to ask those questions. And I think, I think because they all I think that facilitation and that all of them making the decision at one time and document the decision at one time. They all just felt like they had a little bit

> more input than they normally would back when they would maybe read a proposal, right there little individual reports, send it in."

Instructors' expression above reflects changes in technical flows (T4), which induced changes in social experiences (S4). They separated from the traditional consensus technique and applied the on-the-spot consensus that grouped the meetings together in a more concise, collaborative manner right after each oral presentation. As a result, changes were induced in Instructors' self-worth and trust in the procurement process and each other as they shared more input.

Third, Instructors were enthusiastic regarding the confidence ratings as team members conveyed how they felt for each supplier right after the oral presentations were given.

> "… by having a really good technical evaluation document written because you've used confidence ratings, I think that sort of brings them together more as a team, because they both have something at stake here. But they also both win if things go really well. And that winning together it kind of in a weird way that kind of creates togetherness."

The above quote from Instructors reflects changes in technical proximities (T3) and centralities (T1) that impacted social associations (S3) and positions (S1). Instructors reduced clutter and confusion in the rating process by applying the confidence rating technique. This change in spatiotemporal distribution induced change in the group affiliation for Instructors. Instructors had an increased sense of "togetherness" as an acquisition work group. Further, Instructors changed focus and criticality of demand confidence in vendors to apply the rating, separating from the traditional adjectival rating. This change in operational impact induced change with Instructors' social network as social knowledge and opportunities for Instructors to assist each other in the acquisition process became an instrument of cohesion.

Instructors changed their way of thinking and behaving in various ways. First, Instructors felt more confident regarding their procurement process after having completed this project within 70 days. They felt confident that they could assess a supplier's ability to

perform (or not) on the contract based on how they felt when suppliers gave oral presentations. One team expressed the confidence felt when viewing the oral presentations:

> "… for me the oral presentation, to actually have them in front of us and ask questions and talk to them. And I think it's very easy for professionals who have experience in this field over an hour time, you can kind of realize if they know what they're doing, or they, they just learned it from (quick research)."

Instructors' expression above reflects changes in technical flows (T4) that impacted social experiences (S4). Instructors changed the sequencing of the procurement process proposals by having vendors provide oral presentations instead of the traditional written proposal. This change impacted Instructors' endowments by helping them develop new skills and acquire new knowledge and expertise for evaluating vendors. Instructors gained more confidence in the vendors ability by seeing the vendors' presentations in person.

Second, Instructors changed their behavior by choosing to use PIL techniques in future procurements as they expressed their desire to change away from the traditional techniques. One team member expressed:

> "I will tell you, I can never go back to doing contracts the old way. I can never not use confidence ratings, I would only use confidence ratings for the rest of my career . . . I can never go back."

Third, Instructors expressed a change in their behavior as one from relying on the established business relationship with the incumbent supplier to relying on how well all suppliers – incumbents included – could present their companies in a manner that conveyed their subject matter expertise along with confidence in their ability to perform on the proposed contract.

> "I could tell that at least two of them in the past. Were the ones who went out and hired professional assistance to do solicitations for them … as if they were saying 'why am I gonna waste my time with this, I just want to reap the benefits the profits, I want to', you know, 'get the business, I want to turn wrenches, I want to do the project. But I don't want to deal with the administrative side of the house, because they had somebody else dealing with it.' And their nervousness came from now having to be put in that position because of the guidelines we put into it, which I'm going to categorize as a tool that, yeah, this is you, you need to sell us, you know,

> we're buying your product, but you need to sell us what it is that you've done in the past."

The previous two quotes reflect changes in technical flows (T4) impacting social experiences (S4). In both expressions, Instructors convey the changes desired and realized from varying the proposal inputs from vendors as well as the grouping of the acquisition activities in compact phases. These changes impacted Instructors' endowments and sentiments by helping Instructors develop a sense of self-worth and trust in the PIL techniques and the ability to complete the procurement process in shorter amount of time. These technical changes also impacted Instructors skill set and knowledge by helping them develop an alternative method to completing the procurement process. Instructors changed technical aspects in their acquisition process that impacted social aspects and ultimately caused Instructors to change their behavior.

4.8 Sourcing Management 2 – Actors

Actors procurement team was tasked with acquiring services for sthe purpose of assisting training exercises. The main services for this procurement contract were those of actors playing a role while following an inflexible script and acting on an impromptu basis. The Actors procurement team was facing a potential break in service with the subsequent contract. Additionally, many Actors team members worked in the field and were very limited on time to dedicate to this procurement project. Members of the Actors procurement team who agreed to interviews were the contracting officer and the program manager. The PIL techniques that Actors used were oral presentations and on-the-spot consensus.

Actors expressed enthusiasm and observations of enthusiasm by other team members who were not interviewed. First, Actors showed enthusiasm towards the oral presentations for the time-saving attribute it added to the procurement process.

> "Absolutely. Okay, that, that (team) loved it (oral presentations), okay, because they were like, we didn't know, it could be this easy. They were all prepared for, 'we're gonna be sequestered in this room.' And can you know, and it's the fear of, you know, you can get bored quickly and easily to, you

> know, just read, you have to sometimes you glaze over and have to go back over the paragraph. So, I get it. … so long story short, they, they were very enthused, because the two of the people serve(d) previously on the team for the for the contract that was awarded three years prior. And they talked about how tedious that was, and then it took them such a long time to get to consensus…"

Actors' expression above reflects changes in technical flows (T4) and centralities (T1) that impact social experiences (S4) and positions (S1). Actors varied the proposal inputs from vendors by requiring oral presentations. This input variance change impacted Actors' collective emotional role-experience such that Actors was more less fear and more trust in the acquisition process. Additionally, Actors altered the focus and criticality demands toward the oral presentations that impacted the degree of importance among Actors team members of the acquisition project. From this technical change, Actors found increased leadership from the contracting officer leading the oral presentations technique.

Second, one Actors team member recognized resistance in another team member (not interviewed) regarding the use of oral presentations due to fear of protest.

> "…we went back and forth for a long time with legal, which was tedious because maybe, I think because we didn't get total buy in from everyone involved. Because initially, our legal guy is a little adverse to going the way that I was going. But I kind of put my foot down and said, No, we're going to do this. We're not going to do the 'Paper Chase.' We're going to do this oral presentations. It worked out now it probably would have worked out better if he were in the room with us. Okay, when we did the oral presentations, but because he wasn't we then had to go back and forth with the email . . . He just said every time they always go to protests, he always sees it just doesn't end up well. But he never did a straight to consensus. He never he did oral presentations, but never straight to consensus type. And so it was just his experience. And I don't know how much experience he had. It could have been one previous or presentation. But he just personally didn't like it. And so we battled all along the way… But I think to him, rightfully so, because it's his position to protect us from a legal standpoint in terms of how we perceive things, and how we how we lay out our request for proposal to ensure that there's no - nothing in which our process of what we did leads us down the road to protest. Now, we did go to protests and we got five, but we won, we won them all."

The Actors' team member recognition of resistance above reflects changes of technical centralities (T1) that impacted social positions (S1). Actors struggled with legal counsel to implement a change in focus and skill demands toward the oral presentation but after having implemented the change, legal counsel's social position was impacted. Actors' status landscape, once rugged due to legal counsel having a dominant leadership position within the procurement process, was now more even and balanced with the contracting officer leading alternative techniques in the procurement project.

Actors articulated that they had changed their behavior while conducting their procurements with respect to the use of oral presentations. As Actors team members sat through oral presentations, they could discuss among themselves any clarifications either before or after the presentations. Alternatively, one Actors team member shared that these clarifications would have occurred over the course of many emails and across many days, possibly weeks.

> "I think previously, with some of the contracts that I've had, that we did the paper chase, I could find that a lot of times, there were lots of questions that were being asked of me, because they weren't sure of what to exactly look for. Or if they could evaluate a piece of it or define what a deficiency was versus what just a simple omission may have been just reading through it, because sometimes they missed it in the reading, and then I'll and then I have to go back through… We sat there-I was in the room- we were able to talk it through, you know, because we gave ourselves two hours in between the time of each contractor coming in. So, we talked it (clarifications) through … that immediate response and that immediate time to get the questions now then ask directly was very helpful to them, instead of waiting a two-week process or a week out for people to respond to the clarifications. All of that just was very, it felt seamless at the time."

Actors' expression above reflects changes in technical requisites (T2) and proximities (T3) that impacted social values (S2) and associations (S3). Actors changed situational task demands of the vendors' proposals by requiring in-person oral presentations. By changing the condition, Actors changed the shared mental models, norms, and fairness perceived by the procurement team. Further, Actors changed the layout among and time between the procurement team and the vendors. By reducing the time between vendor proposals and

increasing the contact and collaboration with them, Actors changed the work roles of team members during the procurement process. Actors found a new leadership role from the contracting officer from this technical change.

One Actors team member stated how the drive of the contracting officer led to the use of PIL techniques to bring about more effective results.

> "… (contracting officer) was frustrated at one point because even internally with (our) division, and the people that were supposed to back (contracting officer), others started siding with legal like, yeah, we probably should go this way. And (contracting officer) was like, "No, we shouldn't, no, we if we keep doing the same old thing. We're going to get the same results. That was what drove (contracting officer) and (contracting officer) was like, 'you listen, even if we fail, it's we know now it doesn't work. But you give me an opportunity to at least try it. If I fail, oh, well, I'll take the loss. But if I when you have something new you can drive off of.' And since (our division) has done that, there have been at least three more that used oral presentations and straight-to-consensus, because they found it works."

Finally, Actors shared an interesting opinion on trying innovative techniques for a procurement project and then being subject to protests.

> "If we do something that works, it's okay. It's okay to get a protest. That's how I feel about it anyway, I don't ever feel offended because I think whenever you get a protest, whenever somebody complains, it just gives you better insight on what you can do the next time. Failure is not a bad thing, being open to a new process. And in getting the hits along the way, you know how not to get the hits the next night. That's just part of the process when you're trying to improve something, or you make something efficient or make something innovative."

The previous two quotes reflect changes in the technical flows (T4) that impacted social experiences (S4). Actors reflected on changes to the variation of proposal inputs along with changes to the groupings of operational phases. Actors' reduction in proposal inputs (i.e., requiring oral presentations) and grouping the PIL techniques together during the process (oral presentations with on-the-spot consensus) changed the way Actors felt about themselves, the acquisition process, and other team members. Additionally, these changes introduced new skills and expertise that Actors found to be helpful to completing their

procurement project. Thus, the technical changes induced changes to Actors' sentiments and endowments.

APPENDIX E

ASU IRB APPENDIX

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This activity is not human subjects so 45 CFR part 46 does not apply. To see the regulation [45 CFR 46.102(e)] click here.

Other Federal, State, and local laws and /or regulations may apply to the activity.