



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

MBA PROFESSIONAL REPORT

**Analysis of the Relationships among Trust Antecedents, Organizational
Structures, and Performance Outcomes**

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December 2009**

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REPORT DOCUMENTATION PAGE			<i>Form Approved OMB No. 0704-0188</i>	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE December 2009	3. REPORT TYPE AND DATES COVERED MBA Professional Report	
4. TITLE AND SUBTITLE Analysis of the Relationships among Trust Antecedents, Organizational Structures, and Performance Outcomes			5. FUNDING NUMBERS	
6. AUTHOR(S) Seykora, Joseph T.				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Distribution Statement A: Approved for public release; distribution is unlimited			12b. DISTRIBUTION CODE	
13. ABSTRACT (maximum 200 words) The project explores and seeks to identify relationships among four trust antecedents, two organizational structures, and two performance outcomes. The results will help to further explain associations between trust level (high or low) and organizational structure. Past research found that the edge organization operating in a high trust environment produces the most accurate results in the least amount of time. Additionally, the research found that accuracy performance in the rigid hierarchy was more resilient than the flexible edge structure to changes in trust level. What has yet to be determined is the extent to which factors leading to perceived trust, also known as "trust antecedents," are responsible for performance in a given structure. To empirically study these relationships, the present research analyzes data collected during an ELICIT simulation experiment involving 135 subject responses. The objective of this project is to identify relationships among the trust antecedents (competence, openness, concern, and reliability), organizational structure (edge and hierarchy), and performance (speed and accuracy). Benefits of this research include recommendations for program/project managers of Integrated Product Teams in Defense Acquisition Programs who desire to optimize team performance by addressing trust antecedents and/or organizational structure. In doing so, managers can make more informed decisions regarding team member organization and trust in order to more accurately and rapidly achieve organizational objectives.				
14. SUBJECT TERMS TRUST, TRUST ANTECEDENT(S), STRUCTURE, HIERARCHY, EDGE, PERFORMANCE OUTCOMES, SPEED, ACCURACY, ORGANIZATIONAL THEORY, CONTINGENCY THEORY, INTEGRATED PRODUCT TEAM(S), DEFENSE ACQUISITION PROGRAM			15. NUMBER OF PAGES 101	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UU	

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**ANALYSIS OF THE RELATIONSHIPS AMONG TRUST
ANTECEDENTS, ORGANIZATIONAL STRUCTURES, AND
PERFORMANCE OUTCOMES**

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Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

**NAVAL POSTGRADUATE SCHOOL
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ABSTRACT

The project explores and seeks to identify relationships among four trust antecedents, two organizational structures, and two performance outcomes. The results will help to further explain associations between trust level (high or low) and organizational structure. Past research found that the edge organization operating in a high trust environment produces the most accurate results in the least amount of time. Additionally, the research found that accuracy performance in the rigid hierarchy was more resilient than the flexible edge structure to changes in trust level.

What has yet to be determined is the extent to which factors leading to perceived trust, also known as “trust antecedents,” are responsible for performance in a given structure. To empirically study these relationships, the present research analyzes data collected during an ELICIT simulation experiment involving 135 subject responses. The objective of this project is to identify relationships among the trust antecedents (competence, openness, concern, and reliability), organizational structure (edge and hierarchy), and performance (speed and accuracy).

Benefits of this research include recommendations for program/project managers of Integrated Product Teams in Defense Acquisition Programs who desire to optimize team performance by addressing trust antecedents and/or organizational structure. In doing so, managers can make more informed decisions regarding team member organization and trust in order to more accurately and rapidly achieve organizational objectives.

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TABLE OF CONTENTS

I.	INTRODUCTION.....	1
A.	THE DYNAMICS OF TRUST	1
B.	ORGANIZATIONAL STRUCTURE	4
C.	IMPACT OF TRUST AND STRUCTURE ON ORGANIZATIONAL PERFORMANCE	7
D.	RESEARCH PROJECT FORMAT.....	10
II.	LITERATURE REVIEW	13
A.	TWO ORGANIZATIONAL STRUCTURES	13
B.	TRUST AS A CONTINGENCY FACTOR.....	23
C.	TRUST DEFINED	28
D.	TRUST ANTECEDENTS	34
III.	METHODOLOGY	39
A.	OVERVIEW.....	39
B.	ELICIT INTELLIGENCE GAME AND MANIPULATIONS	41
C.	QUESTIONNAIRE AND MEASUREMENTS.....	43
IV.	ANALYSIS AND RESULTS	47
A.	DESCRIPTIVE STATISTICS.....	47
B.	DESCRIPTIVE STATISTICS AND CORRELATIONS	48
C.	MULTIVARIATE ANALYSIS	50
D.	SUPPORT FOR HYPOTHESES	51
E.	KEY FINDINGS	53
V.	CONCLUSION	57
A.	DISCUSSION.....	57
B.	IMPLICATIONS	58
C.	RECOMMENDATIONS FOR FUTURE RESEARCH.....	61
	APPENDIX A.....	65
	APPENDIX B.....	67
	APPENDIX C.....	71
	APPENDIX D.....	73
	LIST OF REFERENCES.....	75
	INITIAL DISTRIBUTION LIST	83

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LIST OF FIGURES

Figure 1.	Comparison of Attributes of Hierarchies and Edge Organizations (From Alberts & Hayes, 2005, p. 218)	17
Figure 2.	Topologies (from left to right) of the Hierarchy, Network, and Edge (From Alberts & Hayes, 2005, pp. 91-92)	19

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LIST OF TABLES

Table 1.	Descriptive Statistics by Group	48
Table 2.	Descriptive Statistics and Correlations (n = 135)	49
Table 3.	Results of Regression Analysis for (a) Speed and (b) Accuracy: Trust and/or Structure Type ^a	50
Table 4.	Results of Hypothesis Testing ^a for (a) Speed or (b) Accuracy: Trust Antecedents ^b	52

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LIST OF ACRONYMS AND ABBREVIATIONS

DAU	Defense Acquisition University
DoD	Department of Defense
GAO	Government Accountability Office (formerly, General Accounting Office)
HE	High trust Edge (configuration)
HH	High trust Hierarchy (configuration)
IPPD	Integrated Product and Process Development
IPT	Integrated Product Team
LE	Low trust Edge (configuration)
LH	Low trust Hierarchy (configuration)
OIPT	Overarching Integrated Product Team
PBO	Post-bureaucratic Organization
RTR	Risk Taking in Relationship
SDT	Self-Directed Team
USD	Under Secretary of Defense
(AT&L)	for Acquisition, Technology, and Logistics
(AR)	for Acquisition Reform
WIPT	Working-level Integrated Product Team

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ACKNOWLEDGMENTS

Sincere gratitude goes to Professor Mark Nissen, who kept this project “statistically significant,” and to Professor Ned Powley, who first piqued my interest in the multifarious and far-reaching nature of trust. Thank you, gentlemen, for entrusting me with this portion of your broader research.

* * *

Heartfelt thankfulness goes, as always, to my wife, Tara, who continuously offered encouragement through her excitement for me and this project, and who supported me by lovingly caring for our sons as she did during several deployments. To Luke, Ty, and Jadon: “Dada’s big paper” is finished!

* * *

Trust in the Lord...(Proverbs 3:5)

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I. INTRODUCTION

This research examines trust within the context of two fundamental forms of organizational design: hierarchy and edge structures. Specifically, the extent of factors responsible for trust (high trust) or distrust (low trust) within these two structures is studied. Using a questionnaire survey after an ELICIT computer simulation experiment, the four factors, or “antecedents,” of trust—competence, openness, concern, and reliability—and their individual or collective effect on trust level and ultimately organizational performance outcomes in either organization structure is analyzed. This research seeks to identify which antecedent(s) may be primary or secondary reasons for trust and performance levels and, once identified, to recommend to Defense acquisition program managers and team leaders how to better create and sustain trust by focusing on particular trust factors within that manager’s given structural context. Furthermore, this research will help establish a foundation for trust as a contingency factor. Ultimately, the goal of this study is to provide organizational researchers and practitioners a means to address trust issues and improve performance outcomes within a given organizational structure.

A. THE DYNAMICS OF TRUST

Trust has varied meanings found in diverse arenas. As a reverential concept found in the Christian Bible, trust describes faith in God. Trust has also been adopted by the U.S. Marine Corps as one of fourteen desirable traits that leaders should develop. In market economies, trust refers to “a combination of corporations with the purpose of reducing competition and controlling prices” (Webster’s Collegiate Dictionary, 9th ed., 1983). Though it is commonly spoken of in conversation between individuals and amongst group members, the concept of trust continues to demand a great deal of multidisciplinary research (Schoorman, Mayer, & Davis, 2007; Kramer, 1999; Bigley & Pearce, 1998; Lewicki, McAllister, & Bies, 1998; Creed & Miles, 1996; Kramer & Tyler,

1996; Bromiley & Cummings, 1995; Mayer, Davis, & Schoorman, 1995). As Kramer and Cook (2004) state, “Trust often constitutes an important resource within social systems” (p. 1).

Within the social system of the American federal government, trust has been identified by the Department of Defense (DoD) as a critical ingredient of successfully acquiring products and services from industry for the Armed Services. In 1995, as part of the DoD’s Integrated Product and Process Development (IPPD) managerial concept, the Secretary of Defense directed the use of Integrated Product Teams (IPTs) as a means of promoting “flexible, tailored approaches to oversight and review [of acquisition programs] based on mutual trust” (OIPT-WIPT Information Guide, 1996, p. 26; Valdez & Kleiner, 1996). The Undersecretary of Defense for Acquisition, Technology, and Logistics (USD [AT&L]) underscored the importance of trust in Defense acquisition: “The two most important characteristics of IPTs are empowerment and cooperation—trust n’ teamwork by another name. The teams must have full and open discussions with no secrets. Team members must be empowered to speak for their superiors in the decision-making process” (OIPT-WIPT Information Guide, 1996, p. 50). The USD(AT&L) goes on to cite the Apollo 11 mission as an example of successful use of “trust n’ teamwork,” believing that “trust and teamwork is a topic of central importance to our ongoing acquisition reform efforts” (OIPT-WIPT Information Guide, 1996, p. 54).

Yet as successful as the Apollo 11 mission was, and as critically important as the DoD has deemed trust to be, Kramer and Cook (2004) reflect that trust is “a desired but elusive and fragile resource” (p. 1). For example, the events of the 9/11 attack and corporate scandals in recent years (Enron, WorldCom, Arthur Anderson, et al.), have challenged the trustworthiness of social organizations in general. A peculiar disenchantment with “command and control” managerial philosophies found in traditional organizations has brought trust to the center of scholarly research on organizations. In addition to identifying the essence of trust, researchers also postulate, for example, different ways trust operates across emerging innovative forms in response to such disenchantment. (Covey, 2006; Kramer & Cook, 2004)

To recognize and thus utilize trust as a resource, a basic but solid understanding of the general essence and scope of trust must first be developed. Zand (1972) describes clearly the core nature of trust, in that it takes form in the interaction between two (or more) people. Trust is based in relationships (Schoorman et al., 2007). To fully understand the concept of trust (or trusting behavior), one must understand the dimensions (factors) that together help formulate trust and affect trustworthiness, and which are applicable to individuals, as well as groups or organizations (Schoorman et al., 2007; Mayer et al., 1995). Additionally, one must appreciate why people trust and the dynamics of trust in organizations (Kramer & Tyler, 1996).

The two dynamics of trust, identified by Kramer and Tyler (1996), involve macro level and micro level analyses. Macro level analysis refers to the study of the relationship between trust and management philosophy, whereas micro level analysis examines the relationship between trust and the psychology of the individual. Since the dimensions of trust may be applied to interpersonal, intergroup, and interorganizational levels of analyses, trust should be examined at both the macro and micro levels within a social organization (Schoorman et al., 2007).

Such analyses can lead to much more than well-meaning rhetoric and catch-phrases using the word “trust” often found in fruitless efforts to establish and sustain trusting relationships between managers and workers or among group members. A thorough appreciation of the nature of trust by managers and leaders can, for example, result in those individuals being managed and led to generate and/or reciprocate trust. As Kramer (1999) states, “By institutionalizing trust through practices at the macro-organizational (collective) level, trust becomes internalized at the micro-organizational (individual) level” (p. 581).

Institutionalizing trust in an organization is given as much attention as other “popular” attitudinal variables such as job satisfaction, organizational commitment, job involvement, and procedural justice when managers and leaders consider trust an item for effective organizational functioning (Dirks & Skarlicki, 2004). This is a worthy consideration, since trust can actually become a competitive advantage for a firm if it is established and sustained within the organization and garnered from external entities

(Schoorman et al., 2007; Overholt, 1997). The challenge lies in creating and sustaining trust or minimizing distrust (Kramer, 1999; Lewicki, McAllister, & Bies, 1998). The level of trust or distrust is connected to managerial (leadership) influence. As Creed and Miles (1996) explain, “Managers are the primary designers of the total organizational form employed—the combination of strategy, structure, and internal mechanisms that provide the overall operating logic and resource allocation and governance mechanisms of the organization” (p. 19). Thus, managers are to some extent responsible for trust levels within their organization based on their determination of the optimal organizational form employed. Conversely, an organization’s level of trust can also affect its processes and structure (Grey & Garsten, 2001; Creed & Miles, 1996; Bromiley & Cummings, 1995; Ruekert, 1985; see also Donaldson, 2001; Bigley & Pearce, 1998).

B. ORGANIZATIONAL STRUCTURE

Organizational structure is comprised of the division of labor, formal (or informal) method of coordination, communication, and workflow, and degree of centralized decision-making that direct the conduct of activities in an organization. The division of labor is usually thought of horizontally and/or vertically in order to achieve some desired efficiency. Coordination refers to mechanisms of informal communication, formal hierarchy, and standardization of processes, outputs, and skills. An element of organizational structures is the span of control, where a “wide” span means a manager has supervision over a large number of employees; “flatter” structures with fewer management levels normally consist of managers assigned wide spans of control. Other structural elements include the degree of centralization for decision making, formalization for communication and coordination, and departmentalization (how employees and work activities are grouped together). The departmentalization of a structure can be organized around specific knowledge (functional structure) or around geographic areas, outputs, or clients (divisional, or M-form, structure) (Ruekert, 1985; Mintzberg, 1980; Burns & Stalker, 1961).

At the turn of the 20th century, Max Weber, the German sociologist, developed what is known as the bureaucracy model by systematically identifying a set of features

common to large organizations in public and private sectors. When his work was eventually published in English in 1940, his model provided a conceptual framework with which to generalize among nearly all formal organizations. During the 1950s and 60s, the “modern” bureaucratic organization consisted of clearly delineated specialized individual positions and jobs; a formal hierarchy of these positions with clear lines of authority (such as a chain of command or command and control system); set boundaries for each department or subunit, as well as boundaries between the organization and its environment; standardized training requirements, career paths, and reward systems; and formal rules and standard operating procedures governing activities. Interestingly, it is this last characteristic of the bureaucratic structure that ultimately assigned “bureaucracy” the negative connotation it has for many individuals in American society (Grey & Garsten, 2001; Ruekert, 1985; Burns & Stalker, 1961).

During this same period, Burns and Stalker (1961) established the basic concepts of mechanistic and organic organizational structures through observation of several organizations in Scotland (and elsewhere) interacting with their environments while seeking high levels of profit and efficiency. Keeping in mind the structural components explained at the beginning of this chapter, a mechanistic structure is characterized by a narrow span of control and a high degree of formalization, specialization and centralization. It operates best in stable environments because the organization relies on efficiency and routine behaviors to carry out its functions. The organic structure has a wide span of control—and thus inherently fewer levels of management, little formalization, lower specialization, and uses decentralized decision making in order to reach its objectives. This structure is optimal in dynamic environments because the organization is more internally flexible and can be responsive to rapid changes (Moon, Humphrey, & Ilgen, 2004; Donaldson, 2001; Mintzberg, 1980; Burns and Stalker, 1961).

Environmental factors such as globalization, competition, technology, customer expectations, and workforce dynamics increasingly compel firms and other groups worldwide to structure their organizations in ways that emphasize flexibility, participation, and agility (Liu, Magjuka, & Lee, 2008; Alberts & Hayes, 2005; Grey & Garsten, 2001; Porter & Lilly, 1996; Adams & Webb, n.d.). They continue to explain

that structures in stable environments tend to be hierarchical and rules-oriented. Although he identified five types of structures—simple structure (or, as Donaldson [2001] calls it, the “unbureaucratic” structure), machine bureaucracy, professional bureaucracy, divisionalized form, and adhocracy—Mintzberg (1980) acknowledges that organizations tend to adapt to some suitable configuration in order to become and remain effective, even if they have to adopt a hybrid structure in reacting to contradicting pressures. Such increasing pressures, especially external competitive elements (such as globalization and technological advances), have forced organizations to adopt a more organic structure since the 1980’s and into the 21st century. This “post-bureaucratic organization” (PBO) trend in the Information Age is comprised of organizations moving away from hierarchical design and rule-following toward flatter structures whose members garner trust and authority by their expertise (Alberts & Hayes, 2005; Grey & Garsten, 2001; Chandler, 2000).

Whereas the hierarchy (formal, mechanistic) structure has been the typical bureaucratic structure (Grey & Garsten, 2001), emerging PBOs primarily use the network or “edge” structure. “The Edge proposes to capitalize upon fully connected, geographically distributed, organizational participants by moving knowledge and power to the edges of organizations” (Leweling & Nissen, 2007, p. 1). Edge organizations are agile, flexible, and robust entities. Organic, flat, networked structures such as edge-type organizations demand that managers not rely upon formal authority to accomplish goals. Instead, individuals working in edge organizations must negotiate with key players, work across boundaries of assigned roles, and build trust. (Leweling & Nissen, 2007; Alberts & Hayes, 2005; Grey & Garsten, 2001)

In contrast, hierarchies are preferred for optimal coordination but lack agility due to the high formalization of rules and procedures characteristic of such a structure (Grey & Garsten, 2001; Leavitt & Bahrami, 1988; Burns & Stalker, 1961). Yet, according to Kramer (1996), the hierarchy remains one of the most prevalent structures found in contemporary organizations. Hierarchies consist of relationships that are unequal in power or status, presenting an interesting arena in which to examine trust among organizational members (Kramer & Cook, 2004). The present research examines the

factors of trust in the context of two basic organizational structures: the hierarchy and the edge. Whether or not an optimal combination between high trust or low trust levels and these two structures is ascertained by the organization's overall performance.

C. IMPACT OF TRUST AND STRUCTURE ON ORGANIZATIONAL PERFORMANCE

Establishing a comprehensive link between trust and organizational structure is of little use if it cannot positively affect the effectiveness or performance of the organization or provide a competitive advantage. Researchers have found that performance indicators such as sales, profits, and employee turnover are related to trust levels of an organization (Dirks & Skarlicki, 2004). Liu et al. (2008) assert that "successful organizations that are able to utilize advanced information technology to establish a dynamic form to adapt to the ever-changing landscape and customer requirements always gain a competitive advantage in global competition" (p.1). In terms of structure, organic forms are more suitable for higher performance in a rapidly changing environment, whereas hierarchical (or bureaucratic) structures perform well in stable environments (Alberts & Hayes, 2005; Donaldson, 2001; Grey & Garsten, 2001; Mintzberg, 1980).

Higher performance may be determined by trust among managers of an organization, since trust at this level in the firm is what will ultimately govern the overarching strategic actions of the organization (Schoorman et al., 2007; Creed & Miles, 1996). Trust among co-workers can positively affect organizational performance because trusting and being trusted leads to better performance (Zolin & Hinds, 2004; Hughes, Rosenbach, & Clover, 1983). Zand (1972) demonstrates trust to be an integral element of a group's problem-solving capacity, asserting that persons who trust each other "will provide relevant, comprehensive, accurate, and timely information, and thereby contribute realistic data for problem-solving efforts" (p. 231).

The outcome of trust level resulting from member interaction and organizational processes in an organization can be the resulting performance level of that organization (Dirks & Skarlicki, 2004; Dirks & Ferrin, 2001). Schoorman et al. (2007) note that the poor organizational performance of several corporations and some government agencies

during the late 1990s and early 2000s, as indicated by publicized scandals, has increased research regarding trust and organizational performance. For example, distrust has been found to reduce cooperative efforts in more organically structured organizations (Bromiley & Cummings, 1995). Research conducted by Moonier, Baker, and Greene (2008) reveals that high performance, defined as optimal speed and accuracy of decision making and problem solving among group members during a simulated event, requires high levels of trust for edge organizations. Hierarchies, alternatively, can function adequately in environments with low trust (distrust). The simulation, results, and analysis are further discussed later in this writing. In any case, there are strong indications that trust level, organizational structure, and performance/effectiveness are interactive (Levit, 2009; Covey, 2006).

Teams, also known as “work groups,” have become a primary vehicle for coordinating people in flat, flexible organic structures and conducting work in large organizations in order to achieve high performance objectives. The “world-class” post-bureaucratic organization will be marked by its ability to manage its human resources using local and global teams (Liu et al., 2008; Edison, 2007; Knight, 2007; Grey & Garsten, 2001; Murphy & Heberling, 1996). Other research suggests that there is a tendency for team-based organizations to be more effective than traditional, bureaucratic organizations (Guzzo & Dickson, 1996). Therefore, it is worth considering the effect of trust level and organizational structure on team performance. For example, self-directed teams (SDTs) perform best with informal communication, specialized knowledge, and little formal hierarchy. In contrast, tall hierarchies tend to inherently empower managers rather than employees (Moon et al., 2004).

Porter and Lilly (1996) provide empirical evidence that a relationship exists among trust, commitment, task processes, conflict and performance. These categories are also affected by the nature of the larger organization in which the team or work group operates (also see Guzzo & Dickson, 1996). The DoD contends that high performing IPTs require “an organizational culture that exhibits openness and trust among its employees” (USD(AT&L), 1999, p. 16). Nevertheless, individual members can effect outcomes of their respective teams, as well. Top performing teams have an effective

pattern of roles and relationships among team members focused on attaining common goals (Liu et al., 2008; Porter & Lilly, 1996). Included in the DoD's best practices for high performing teams is the assertion that members "trust and accept each person's expertise and advice" (USD(AT&L), 1999, p. 19).

From the individual team member perspective, team performance is linked to trust in that group's leader more than trust among group members (Dirks & Skarlicki, 2004). This does not imply that the leader determines the outcome of team performance, per se. As Zell (2008) found, executives reaching out for support can be vulnerable, but doing so is necessary for success of the team or organization overall.

Guzzo and Dickson (1996) view team performance more abstractly, stating that group effectiveness "is indicated by (a) group-produced outputs...(b) the consequences a group has for its members, or (c) the enhancement of a team's capability to perform effectively in the future" (p. 309). Katzenbach and Smith (1993) identify the following characteristics of high performing teams that implicitly address the indicators given by Guzzo and Dickson (1996). High performing teams:

- shape their purpose in response to higher management demands and opportunities;
- translate their common purpose into specific, measurable performance goals;
- are of a manageable size;
- develop the right mix of expertise;
- develop common commitment to working relationships by establishing a social contract that obligates members to how they will work together;
- consist of members who hold themselves collectively accountable.

To this end, the DoD desires to achieve successful results in its acquisition of Defense products and services by striving for high performing IPTs and learning how to sustain them (Valdez & Kleiner, 1996; DoD, 2007).

IPTs were instituted to "streamline an inefficient, antiquated process" (USD(AT&L), 1999, p. 2) needed to manage the acquisition of large-scale, complex

military systems (Briggs & Kleiner, 2002). Where the “functional” team was non-adaptive and less integrated across departments, and the “project” team was costly and prone to lose institutional expertise, the IPT enabled the DoD to conduct multiple acquisition projects (programs) simultaneously and adapt accordingly to program scope and size (USD(AT&L), 1999). Because teams can become the building blocks of an entire organization and enable it to quickly adapt to fluid constraints, use of IPTs in the DoD has largely resulted in the reduction of time and cost of its acquisition programs (Murphy and Heberling, 1996). Attesting to the success of high performing IPTs in the DoD, a General Accounting Office report (GAO, 1996) determined that the Federal Aviation Administration should rigorously adopt the same IPT/IPPD concepts into its organization. In 2001 the GAO reiterated its support of high performing teams in a report that considered DoD’s use of IPTs a “best practice” (Edison, 2007).

D. RESEARCH PROJECT FORMAT

So far, a dependent relationship between team/organizational performance (speed and accuracy) and trust level (high or low) and organizational structure (hierarchy or edge) has been introduced and briefly outlined. The multifarious nature of trust has also been presented, as well as a contrast between the traditional hierarchy and the organic, newly emerging edge structure. The relevance of this research to the Department of Defense acquisition integrated product teams, in light of an extremely dynamic environment, has also been explained.

The next section is a literature review that will further describe the two organizational structures, suggest how trust may be considered an organizational contingency factor, and rest on a succinct definition of trust. The trust factors of competence, openness, concern, and reliability will be described and, based upon previous ELICIT simulation research (Moonier et al., 2008; Mishra, 1996) developed into hypotheses regarding which factor may be responsible for high or low trust in either structure.

An explanation of the methodology of this research will follow, outlining statistical and multivariate analyses used to support (or not support) the hypotheses. Key

findings will lead into the final discussion section of this writing, in which implications, recommendations and conclusions, including areas for further research, are presented for other researchers and managers.

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II. LITERATURE REVIEW

A. TWO ORGANIZATIONAL STRUCTURES

In studying trust factors leading to performance outcomes of an organization, it is important to validate the selection of the hierarchy and the edge as the two structures to be used in such analysis. To effectively compare the processes and characteristics of hierarchy and edge structures, which are ultimately comprised of human beings, it is appropriate to observe the societal and historical context in which these two structures exist. Present-day organizations in American society are structured generally in one of four forms that have their roots in the functional structure characterized by a bureaucratic hierarchy (Donaldson, 2001; Miles & Snow, 1992; Mintzberg, 1980; Burns & Stalker, 1961). Wal-Mart, grouping its employees and work activities around specific knowledge, is a current example of this type of structure that is identified as a product of the Industrial Age beginning (first with the commercial period) in the 18th Century (Alberts & Hayes, 2005; Chandler, 2000; Miles & Snow, 1992; Clawson, 1996). GM is an example of the divisionalized structure, recognized after WWI and predominantly utilized into the 1950s, which has an overall functional hierarchy but organizes its tasks and workers using entire departments dedicated to geographic-, output-, or client-based business processes (Miles & Snow, 1992; Burns & Stalker, 1961).

The 1960s and 70s witnessed the emergence of the matrix structure, a combination of functional and divisionalized structure aspects with the additional “requirement for balance among the components to produce mutually beneficial allocations of resources” (Miles & Snow, 1992, p. 61; see also Donaldson, 2001). TRW, which has been active primarily in the space industry, is a matrix organization (Miles & Snow, 1992; TRW website). Finally, network structures—used by organizations such as Nike—began to form during the 1980’s as a reaction to fundamental change factors in social and market environments (Grey & Garsten, 2001; Miles & Snow, 1992).

Miles and Snow (1992), Grey and Garsten (2001), Castells (2002), Alberts and Hayes (2005), Adams and Webb, among others, cite a variety of environmental factors to

(or in) which organizations have had to adapt in order to survive and succeed (recall Grey and Garsten's PBO trend). These 21st Century challenges demand organizations to be flexible, agile, and even permeable (Leweling & Nissen, 2007; Alberts & Hayes, 2005; Castells, 2002; Grey & Garsten, 2001; Castells, 1999; Mintzberg, 1980; Ruekert, 1985). Among these factors, technological advancements, international competition, and globalization appear to be the primary contributors to shaping organizational structure. And of these, it can be argued that the "transformation in the informational environment" (John, 2000, p. 55) during the past two and a half centuries has had the most fundamental and far-reaching effect on contemporary societal organizing (Castells, 2002; Cox, Mowatt, & Prevez, 2002; Chandler, 2000; John, 2000; Yates, 2000; Castells, 1999).

Although the Information Technology Revolution emerged as early as the 1970s (Castells, 2002) or even the 1950's (Yates, 2000), "technology" as we know it today, in and of itself, is not necessarily the genesis of the Information Age (Castells, 2002; Castells, 1999; Clawson, 1996). The inherently human demand for information (encouraged by, for example, American democratic ideology and the printing press capability) and the early modes of processing data (such as the postal system, railroad, and telegraph) in organized American society has steadily grown since the 18th century (John, 2000; Yates, 2000). Social and corporate culture realizations (such as feminism, ecologism, and managerial philosophies at large firms like GE and Motorola, whose leaders came to regard their distance from first-hand information as a hindrance to sound decision making) also contributed to a recent surge for the need to access and process information (Castells, 2002; Clawson, 1996). These elements have helped provide inertia to industrial and technological developments, which, in turn, continue to feed the demand for and use of information. Consequently, at present, society at large finds itself in an information technology-dependent state: leaving the Industrial Age and entering—if not already in—the Information Age (Alberts and Hayes, 2005; Castells, 2002; Chandler, 2000; Yates, 2000; Clawson, 1996). As Castells (1999) states, "The availability and use of information and communication technologies are a pre-requisite for economic and social development in our world. They are the functional equivalent of electricity in the

industrial era” (p. 3). Given the corporate reactions to information technology, one scholar even suggests calling the new era the “Process Age” (Clawson, 1996).

In spite of this fundamental shift in their operating environment, organizations have not automatically abandoned the hierarchy to adopt the network. In fact, the hierarchy appears to remain relatively common and resilient at the dawn of this era (Grey & Garsten, 2001; Kramer & Tyler, 1996). One reason for this may be the hierarchical strengths of predictability, control, and fairness. Based on these strengths, modifications and hybrids can be created using the fundamental hierarchy structure. Adler and Borys (1996) found that morale among workers is higher when organizational structure enabled them to accomplish the task. Although these studies did not prove that hierarchies were “better” than other structures, they disproved the assumption that workers always seem to desire more choices and latitude when working in an organization. In other words, trying the latest structural form just because it is “new” or provides all employees with “empowerment” is not necessarily the optimal structure for a given organization.

Another reason hierarchies continue to thrive in some variation can be found in the analysis of communication patterns of organizations. Leavitt and Bahrami (1988) studied four topology types of communication patterns. The researchers found that the topologies revealed an organization’s true structure and characteristics. Comparing the traditional hierarchy to the circle topology, Leavitt and Bahrami (1988) found that problem-solving occurred fastest in hierarchies, and that this topology functioned better than the circle for simple, stable situations. This finding is consistent with two prevailing concepts: (1) that direct control of information comes by centralized decision making and indirect control through formalized rules/processes and specialized job descriptions; and (2) that such controls (i.e., a bureaucracy) can expedite decisions and actions of the organization in a relatively stable environment by coordinating and integrating activities of specialists and specialized departments (Alberts & Hayes, 2005; Grey & Garsten, 2001; Bromiley & Cummings, 1992; Burns & Stalker, 1961).

A final reason why the hierarchy continues to survive into the Information Age is that individuals can readily adapt within the parameters of the organizational structure. Adaptation has been occurring in response to environmental factors mentioned earlier as

organizational members seek ways to interact with such changes in order to help their organization gain a competitive advantage and achieve its objectives (Liu et al., 2008; Alberts & Hayes, 2005; Porter & Lilly, 1996). But this adaptation, argue Alberts and Hayes (2005), is ultimately limited by available technology, existing cultures, and hierarchical structures. An example of this phenomenon is the tactical and operational adaptation military service members, as well as smaller, subordinate military commands, have been making in response to the increasing challenges of operating in nonlinear battle space against an asymmetrical enemy (such as guerillas or terrorists). This adaptation has been occurring through the present day within the structural confines of the massive size and numerous layers of management in DoD and its component services, which structurally are better suited for the linear battlefield against symmetrical adversaries. The institutional practice of implementing such military hierarchical structure in the U.S. can be traced back to the Civil War; such lineage makes it difficult for the military organization as a whole to adapt its fundamental structure. (Alberts & Hayes, 2005)

The hierarchy, then, does have limitations. As military, government, and other corporate or private organizations have grown into unprecedented sizes with more and more layers of management, the communication flow of information up and down the “chain of command” – a characteristic tool of the Industrial Age – takes longer to travel and increases the probability for distortion and error (Alberts & Hayes, 2005). Miles and Snow (1992) explain that misapplication or over-extension of the hierarchy structure by managers and decision makers can result in organizational failures, whether internal or external. In contrast to the hierarchy topology, Leavitt and Bahrami (1988) found the circle topology as best suited for complex, dynamic situations where learning is involved. Members of the circle topology also, as a group, learned the fastest. Even hybrid structures based on the hierarchy eventually find limitations: Carley, Lee, and Krackhardt (2002) compared a hierarchical centralized network with a distributed decentralized network and found that it was more difficult to destabilize the distributed decentralized network.

Recall, however, that the purpose in reviewing this literature is not to justify selecting the network or edge structure over the hierarchy form as a rule (although several cited authors may in fact argue for full embrace of one structure over the other). Rather, the aim is to validate the use of the hierarchical and edge structures in the present research of trust antecedents by comparing the processes and characteristics of hierarchy and edge structures in a societal and historical context. Figure 1 provides a concrete summary of comparisons between attributes of the hierarchy and characteristics of the edge structure.

	Hierarchies	Edge Organizations
Command	By directive	Establishing conditions
Leadership	By position	By competence
Control	By direction	An emergent property
Decisionmaking	Line function	Everyone's job
Information	Hoarded	Shared
Predominant Information Flows	Vertical, coupled with chain of command	Horizontal, independent of chain of command
Information Management	Push	Post - Pull
Sources of Information	Stovepipe monopolies	Eclectic, adaptable marketplaces
Organizational Processes	Prescribed Sequential	Dynamic Concurrent
Individuals at the Edge	Constrained	Empowered

Figure 1. Comparison of Attributes of Hierarchies and Edge Organizations (From Alberts & Hayes, 2005, p. 218)

The attributes of command, leadership, movement of information, and personnel empowerment in a prescribed organizational structure are given implicit emphasis as the present writing explores the nature of trust. Within this framework of organizational design, the function of trust can be identified and described since it can be applied to each organizational structure with observable effects on performance (refer back to Section I-C).

As we enter the Information Age, there is little indication that trust *per se* is an organizational element of lessening importance; in fact, the opposite is more likely occurring (Edelman, 2009; Covey, 2006). What is of interest is the role trust plays in each of these structures, particularly as we witness almost simultaneously the arrival at the limitations of one while confronted with the seemingly inevitable necessity to adopt and use the other. (see, for example, Alberts & Hayes, 2005; Castells, 2002; Donaldson, 2001; Chandler, 2000; Kramer & Tyler, 1996) As Alberts and Hayes (2005) conclude: “The Information Age...has witnessed the breakdown of Industrial Age approaches and solutions to organization and management” (p. 7).

Adapting structure to facilitate information processing with the hope of achieving organizational objectives is not a new strategy. Burns and Stalker (1961) noted that trouble arose for an organization operating in a dynamic, fluid environment because traditional structures had managers acting within prescribed boundaries. To cope with this environment, organizations learned to empower lower level managers with the autonomy to make certain decisions based on ever-increasing amounts of information. The structural result was the emergence of the multidivisional (M-) form, a bureaucratic variant that moves decision making closer to the origin of information, i.e., among division managers and middle managers rather than senior executives (Bromiley & Cummings, 1995). The matrix organization, too, was another structural variation in response to an increasingly information-dominated environment, integrating departmental functions with expert capabilities and empowering individuals at the point of integration with decision-making authority. Although matrices can exist in a more fluid

organizational culture of “openness and problem-solving,” the form may not be inherently organic since it “seem[s] to be just a more complex type of hierarchy” (Donaldson, 2001 p. 88).

Moving decision making to the point where information is exchanged and processed is the primary operating logic and distinguishing feature of the edge structure (Leweling & Nissen, 2007; Alberts & Hayes, 2005). In an era characterized by a constantly changing and widening environment (Leweling & Nissen, 2007; Edison, 2007; Grey & Garsten, 2001; Ruekert, 1985; Pitts, 1980), the PBO organization requires a structure that places it close to the customer, is adaptable and flexible to a volatile environment (Grey & Garsten, 2001), and is more agile than its competitors (Leweling & Nissen, 2007) in order to achieve its objectives. The network structure can somewhat satisfy these basic requirements resulting from such conditions. However, maximizing the potential to achieve objectives under these conditions means making the organization even “more powerful,” enabling it “to accomplish more, in less time, under more adverse conditions, and at lower cost than Industrial Age organizations and architectures” (Alberts & Hayes, 2005, pp. 213-214). Figure 2 illustrates these concepts between the network and more robust edge topology, each in contrast to the traditional hierarchy.

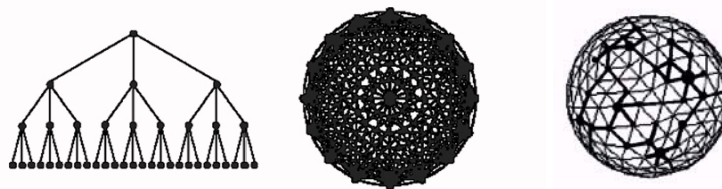


Figure 2. Topologies (from left to right) of the Hierarchy, Network, and Edge (From Alberts & Hayes, 2005, pp. 91-92)

The edge capitalizes on two key factors to increase the power of the network: agility and empowerment. Agility is a premium characteristic that allows an organization to quickly and accurately respond to an environment with “increased uncertainty, volatility, and complexity [as] part of the transition from the Industrial Age to the Information Age” (Alberts & Hayes, 2005, p. 6). The edge structure places decision making at the point where it needs to be most agile, the point at which it interacts with its

environment. This structure inherently provides decision rights, information accessibility, and empowerment to virtually all organizational members (Leweling & Nissen, 2007; Alberts & Hayes, 2005).

By empowering those who operate on an organization's edge—the place at which an organization interacts with its external environment—the edge structure optimizes information processing through its “greatly enhanced peer-to-peer interactions” (Alberts & Hayes, 2005, p.5) as notionally implied in Figure 2. Empowerment is key to simultaneously handling large numbers of tasks in a dynamic environment. “Empowered individuals and organizations that constitute an edge organization,” state Alberts and Hayes (2005), “have a greater “bandwidth” for action than their unempowered counterparts in traditional hierarchies” (p. 185).

But if so much empowerment is offered to every member of the edge structure, how can the organization remain cohesive and oriented on the same objectives? According to Alberts and Hayes (2005), the edge is capable of self-organizing and self-synchronizing to the environment when key conditions among members are obtained:

- shared situation awareness
- congruent command intent
- professional competence
- trust

The particular details of each of these conditions are explained by the emergence of a leader for a particular task at a particular time and place. Determination of the leader—who can be, as a result of technological capabilities, any one of the organization's members—is based on characteristics of the individuals in the network, the situation at a given point in time, and who has what information. This emergence is known as a meritocracy and is based on information centrality—what individual has the most access to the most information.

Grey and Garsten (2001) have made a similar determination regarding organizations in what they call the post-bureaucratic period. They remark that organizations are now subject to fluid boundaries with constant transfers of staff. Consequently, PBOs:

- utilize consensus-building dialogue to orient on objectives
- determine action by member expertise
- base trust on member interdependence

Throughout this section, one begins to see a relationship among organizational structure, information accessibility, and trust. The hierarchy topology, based on Industrial Age conceptions of span of control, dictates vertical interaction among members. Its departmentalization can spawn “stovepipes,” making the organization evolve into a “collection of tribes” with their own language and culture (Alberts & Hayes, 2005, p. 216). The likely result is limited knowledge sharing among members and trust limited to among members identified with each department (Dirks & Skarlicki, 2004). However, the hierarchy provides control of information at each level of management, enabling managers to mandate appropriate action throughout the organization (Alberts & Hayes, 2005; Burns & Stalker, 1961). Trust-based controls in the bureaucratic hierarchy include formalization and cultural norms; therefore, trust in this structure requires relatively less effort to maintain (Grey & Garsten, 2001). Using established routines, coordinated communications, rules, and consequences for rule violations, an “invisible” form of trust exists in the hierarchy (Grey & Garsten, 2001, p. 235).

Interestingly, this observation is similar to that of Kramer and Tyler’s (1996) findings regarding trust in hierarchical relationships. In such relationships, trust tends to be viewed from the top as a strategic issue. Managers, for example, are concerned with the organization’s success and realize this depends on organizational members’ (subordinates’) performance. Consequently, trust is introduced into the relationship as a question: will the workers do their tasks “competently and faithfully” (Kramer & Tyler, 1996, p. 226). On the other hand in the same hierarchical relationship, the subordinate’s

lack of information about his or her manager or supervisor prevents making an informed assessment about that superior's trustworthiness. The worker also depends upon the manager for resources and support, both organizational and personal. Thus, trust is more salient to those in a lower position because of their dependency and vulnerability in a hierarchical relationship (Kramer 1999).

The edge structure encourages interaction among any and all organization members, including individuals outside the organization, when appropriate. Alberts and Hayes (2005) argue that such interaction allows an organization to combine information in new ways, which leads to increased agility. The scholars assert: "Edge organizations are particularly well suited to deal with uncertainty and unfamiliarity because they make more of their relevant knowledge, experience, and expertise available" (Alberts & Hayes, 2005, p. 217). Yet the mechanism enabling the edge to "make more" of its information assets is trust. As Grey and Garsten (2001) observe, trust in the PBO exists in part through individual "self-making," where individual choices and actions determine predictability of trust/trustworthiness. In other words, if the individual can be relied upon to do a good job in a predictable way, then trust among members is achieved. A noticeable characteristic of the PBO trend; however, is a constant transfer of staffs in and out of organizations. The continuous change of relationships in edge (network) organizations requires more time and effort from the organization as a whole to maintain trust, which for the PBO-type organization is based on member interdependence, consensus-building dialogue, and action determined by expertise (Grey & Garsten, 2001).

Regardless of organizational structure, managers can establish a predisposition for trust or distrust in the organization through their managerial philosophies, which, too, have evolved throughout the Industrial Age and into the Information Age (Castells, 2002; Creed & Miles, 1996). The functional and divisionalized forms of hierarchy structure, for example, reflect the human relations philosophy of management by exception, where a manager must trust his or her employees to behave as desired if treated properly and that the employees "have adequate technical and business capabilities and share the same values and goals" (Creed & Miles, 1996, p. 25). The human resource philosophy, in which managers, supervisors, and other decision-makers must establish and maintain

trust through joint planning or negotiation, arose with the formulation of the matrix structure. Trust within and among network (edge) organizations is based upon recognition of co-dependence and a foregoing of personal interests. This basis helps to ensure that – at individual, team, and corporate network levels—appropriate actions that will be mutually beneficial will be taken in response to change. The distinguishing element of the human investment philosophy is that the trust investment occurs at all levels (Creed & Miles, 1996).

The conclusion drawn by Creed and Miles (1996) is that the connection between organizational structure and trust is “clear and compelling” (p. 24). Bromiley and Cummings (1995) also arrived at a similar conclusion, arguing that trust level can affect some organizational structures and processes. To what degree, then, does trust determine organizational structure, or vice versa? Potential answers are explored in the next chapter.

B. TRUST AS A CONTINGENCY FACTOR

Succinctly stated, contingency theory means that no single approach to organizational design is optimal in all contexts or across all structures (Liu et al., 2008; Leweling & Nissen, 2007; Donaldson, 2001; Ruekert, 1985; Pitts, 1980). The theory is based on the contingency approach in science: the effect of one variable on another depends upon some third variable (called a moderator or conditioning variable). Thus, the contingency theory of organizations involves a specific contingency factor (the moderator) that determines which aspect of an organization produces high or low effectiveness for that organization (or some part of it, such as a department or individual member). Organizational effectiveness is “the ability of the organization to attain the goals set by itself...or to function well as a system...[and is similar to] performance” (Donaldson, 2001, p.6). This is important to organizational theory, which is concerned with explaining the success or failure of organizations (Donaldson, 2001).

Shepard and Hougland (1978) describe contingency theory as an attempt “to deal with the differing conditions faced by organizations” (p. 413). They suggest interactions exist among the individual, the organization, and the environment – each responding to

changes in the other. Organizational structure is contingent upon the contextual conditions under which firms operate (Pitts, 1980) or “under certain environmental conditions rather than under others” (Ruekert, 1985, p. 14). Mintzberg (1980) believes that such environmental conditions collectively make up only one of four contingency factors he identified: age and size; technical system; environment; and power.

In some cases, it appears that the structure may be the contingency factor affecting, at least, the perception of trust. For example, Kramer and Tyler (1996) provide empirical evidence that “cognitive and structural features of hierarchical relations influence individuals’ judgments about trust” (p. 218). This finding is consistent with the research of Mayer et al. (1995), who suggest that selecting an organizational structure determines which controls are to be utilized, which together creates the context in which trust operates. “A strong organizational control system could inhibit the development of trust” (Mayer et al., 1995, p. 727) since an individual may be responding to the control system rather than to the trustworthiness of the other person. Additionally, trust may be construed through performance of a particular task and the individual’s ability to act—both aspects dependent on the local work environment (Zolin & Hinds, 2004; Gambetta, 1988).

To help determine which element—in this case, trust or structure—should be considered the contingency factor, Donaldson (2001) has identified three core tenets to follow resulting from the integration of organization theory with contingency theory. First, an association must exist between a contingency and an organizational structure. Second, the contingency determines the structure because the organization that changes its contingency will consequently change its structure. Third, a particular fit exists between some level of an organizational structure variable and some level of a contingency factor. The fit, continues Donaldson (2001), is described in terms of performance or effectiveness: The higher performing, more effective organization has a “fit” between its structure and a unique contingency factor. If performance is low and less effective, there is a “misfit” between an organization’s structure and the contingency factor. To increase performance and mitigate poor performance “any organization tends to adopt the structure that fits its level of the contingency. This means that a change in

contingency leads to a change in structure, so that contingency determines structure” (Donaldson, 2001, p. 8). According to these tenets, then, the findings of Kramer and Tyler (1996), Mayer et al. (1995), Gambetta (1988), and Zolin and Hinds (2004) are not useful in determining to what degree trust is a contingency factor for organizational structure leading to high or low performance.

This is not to imply that one contingency factor determines a possible structure; there may be several factors and multiple other causes that together determine which structure is modeled. According to Donaldson (2001), virtually any identifiable contingency can be placed into one of two categories: size and task uncertainty. The number of personnel in an organization, as well as the degree (high or low) of uncertainty in completing an organizational task will determine the type of structure used by the organization. The possible structural types are viewed from the organic theory and bureaucracy theory perspectives. Depending on one’s view of the underlying structural dimension, the structural elements of centralization, specialization, and formalization, will determine which structure is modeled: organic or bureaucratic.

In the overall context of contingency theory, Donaldson (2001) explains that organic theory fits a structure’s degree of “organicness” (mechanistic or organic) to a level of task uncertainty. If task uncertainty is low, the structure is likely to be mechanistic; if task uncertainty is relatively high, the structure is more likely to be organic. Similarly, bureaucracy theory fits a structure’s degree of bureaucracy (bureaucratic or “unbureaucratic”) to size, meaning the number of people in an organization. If the organization is small with few employees, then the structure will likely be unbureaucratic (simple); if it is large with many employees, then the structure becomes more bureaucratic. (Donaldson, 2001; Burns & Stalker, 1961)

Let us explore further this basic relationship between contingencies and structure, keeping in mind the recent study (Moonier et al., 2008) linking trust level with organizational structure, and this present research analyzing the four factors of trust. Low task uncertainty brings about a mechanistic structure in which knowledge and information sharing is also low (specialization-formalization) and held by senior managers (centralization) (Donaldson, 2001; Burns & Stalker, 1961). In an environment

of low task uncertainty—i.e., stable and more predictable, such as during the Industrial Age—this structural design enables the organization to maximize performance and achieve its objectives. Task uncertainty is ultimately determined externally by the technological environment and market changes, compelling an organization to innovate so as to remain effective and competitive through high performance (Donaldson, 2001; Burns & Stalker, 1961). In contrast, the degree of “organicness” is driven internally by “the human needs and aspirations of organizational members” (Donaldson, 2001, p. 25), advocating more participatory structures. Thus, when task uncertainty is high, a greater frequency and amount of knowledge and information sharing, as well as maximized participation among members toward organizational objectives, is required for success. An organic structure best facilitates this requirement. Donaldson (2001) states that “much expertise and information is distributed among employees, so that they have to be empowered to use their initiative and make decisions in a participatory manner, in order for the organization to innovate and be effective” (p. 23).

The size of an organization can also determine the type of structure used. A small organization with few employees leads to the use of an unbureaucratic (simple) structure in which decisions and process are directly controlled by top management. As the number of employees grows and layers of management are added for a larger organization, the structure becomes increasingly more bureaucratic. Here senior managers exercise indirect control through the delegation of recurring decision making. The large organizational size results in a tall, complex hierarchy, furthering the need for decentralization and fostering divisions of labor that necessitate formalization and high specialization. As Donaldson (2001) explains, “Increasing size of an organization requires that its structure change from simple toward bureaucratic, to maintain fit and effectiveness” (p. 24).

It is worth noting that the organic and the bureaucratic structure types both exhibit characteristics of decentralization. The primary distinction is that a bureaucracy implements delegation to assign certain decision-making authority to particular managerial positions/levels. In contrast, technical experts in an organic structure are given autonomy and encouraged—even expected—to participate in the decision-making

process. The organic structure emphasizes “lateral forms of coordination, such as cross-functional project teams and ad hoc communication...these nonhierarchical coordination mechanisms provide additional forums in which participation occurs” (Donaldson, 2001, p. 25).

The above discussion on contingency theory has used the terms of mechanistic/organic and bureaucratic/unbureaucratic (simple) as structural attributes. To analyze the dimensions of trust in organizations, this paper considers the “architectural” aspect of organizational structure. Consider this illustration for clarification: If one thinks of an organization as the human body, then the skeleton is its fundamental structure, while the muscle and tendons represent its method of processing information and exercising trust, respectively, to achieve objectives. In this sense, it is the skeleton in which we are interested at the moment. Thus, in terms of contingency theory, the hierarchy is the structural manifestation of bureaucratic attributes and the edge is the structural manifestation of organic characteristics. Furthermore, for purposes of the present research, the hierarchy and the edge will be considered the two fundamental organizational structures when analyzing dimensions of trust affecting performance in terms of speed and accuracy.

Determining “whether a factor is a contingency of organization depends on whether aligning the structure and the contingency produces higher performance” (Donaldson, 2001, p. 89). Dirks and Ferrin (2001) pursued a model that helps establish trust as a conditional factor under which desirable organizational outcomes, such as high performance and cooperation among members, are likely to occur. In contrast, after strictly comparing multidivisional (M-form) and functional (U-form) structures, Bromiley and Cummings (1995) argue that trust may not be a significant determinant in choosing one form over the other. Like Dirks and Ferrin (2001), however, other researchers have also determined trust to be a likely contingency factor or moderator having some definitive effect on business controls and processes (Creed & Miles, 1996; Grey & Garsten, 2001) when considering, for example, such routines as a “mechanistic form of trust” found in bureaucratic organizations (Grey & Garsten, 2001, p. 234). Finally, the findings of Moonier et al. (2008) indicate that the level of trust among a

group of individuals can positively or negatively impact speed and accuracy as performance outcomes in either hierarchical or edge structured groups. The present research seeks to identify and determine what trust factor(s) is/are responsible for high or low trust in either a hierarchy or edge organization. In doing so, a thorough understanding of trust itself is necessary.

C. TRUST DEFINED

Trust has been researched for more than half a century, especially during the last two decades, indicating an increasing importance placed on the need to understand and utilize trust at the individual, group, and organizational levels in order to achieve desirable outcomes (Schoorman et al., 2007; Kramer, 1999; Bigley & Pearce, 1998; Lewicki et al., 1998; Creed & Miles, 1996; Kramer & Tyler, 1996; Mayer et al., 1995; Bromiley & Cummings, 1992; Deutsch, 1958; Chuang, Choul, & Yeh). Individuals and organizations find themselves in an increasingly complex and fluid environment, where risk and uncertainty are commonplace (Leweling & Nissen, 2007; Alberts & Hayes, 2005; Grey & Garsten, 2001; Kramer & Tyler, 1996;). Under such conditions, trust has become of critical importance, as Adams and Webb state, “Issues of trust come into play in situations that contain risk, vulnerability, uncertainty and interdependence” (p. 3). An increasingly diverse workforce (workforce composition) and the proliferation of self-directed teams around which to organize work have also increased the importance of trust in the corporate world (Adams and Webb, n.d.).

Trust is highly beneficial to organizations and has been shown to have a positive effect on individual performance (Dirks & Skarlicki, 2004; Dirks & Ferrin, 2001; Creed & Miles, 1996; Barber, 1983) and attitudinal behavior outcomes (Liu et al., 2004). Additionally, trust among workers can lead to higher performance by the organization overall (Zolin & Hinds, 2004; Hughes, Rosenbach, & Clover, 1983; see also Kramer, 1999). Indeed, trust at the individual and organizational level is increasingly being considered essential for achieving objectives, being viewed by career promoters as a “competency” (Levit, 2009; Covey, 2006). Ironically, despite such reinforcement to foster trust, levels of trust across broad, global social organizations have fluctuated from

year to year during the past decade. Trust levels dropped by 20 percentage points during 2008, indicating that we may be propelling further into “a trust crisis” (Covey, 2006, p. 7; Levit, 2009; Edelman, 2009).

In light of such a dynamic present-day environment, the need for trust has shifted to a more central role in the way individuals and organizations relate. A main driver of this shift may be the effect of organizational structure evolution on formalization elements. Whereas bureaucratic hierarchies utilize formal controls to accomplish tasks and allocate resources, emphasizing trust may reduce the need for such controls (Grey & Garsten, 2001; Adams & Webb, n.d.). Trust itself comes from the need to trust, which stems from an individual’s need to believe others will be positively motivated towards him/her. Adams and Webb explain: “Trust simplifies and reduces the complex set of expectations that we use to predict how people will behave. In deciding to trust, we decide to believe that others will be predictable and will act in our best interests on a consistent basis” (p. 2-3). The predictability of another person’s behavior is increased as an individual observes the other’s actions over time.

The person-based trust described above is one of several conceptual frameworks (Kramer, 1999) for understanding overall relationship-based trust within organizations. It is based on a history of behavior observation and, naturally, takes time to develop (Adams & Webb, n.d.). Thus, it is also known as history-based trust (Deutsch, 1958). Another framework is category-based trust, which can emerge as the product of the perceived membership of the other person in a group or category of people that a person has come to trust. Category-based, or role-based, trust is grounded on the training and experience known to be associated with certain categorical roles (Brewer, 1981; Adams & Webb, n.d.). Therefore, trust can emerge even without person-based trust or in lieu of the opportunity to learn about the other’s behavior. Adams and Webb explain: “The emergence of category-based trust can enable people to trust each other implicitly and immediately” (p. 8). Similarly, rule-based trust is predicated on the established norms and routines—or even on a system of expertise, such as the accounting or engineering arenas—of an organization rather than on the historical behavior of an individual or the role they fulfill (Fine & Holyfield, 1996).

Other researchers describe trust in terms of one of three somewhat progressive foundations: calculus, knowledge, and identification based. Briefly stated, calculus-based trust is the logical calculation by an individual that other team members will act appropriately. It is established upon minimal interaction. Knowledge-based trust considers the predictability of another's behavior, the consistency or inconsistency of which that generates trust or distrust, respectively. Knowledge-based trust relates to the confidence one has in the other's ability or competence and is a higher and more stable level of trust as it develops over time. Finally, identification-based trust is borne out of a mutual understanding and emotional bond among members. This, argue scholars, is the strongest and most robust form of trust as it is established over time and because an individual's self-image is based partly on membership (Bigley & Pearce, 1998).

Dirks and Skarlicki (2004) offer a final conceptual framework of trust particularly useful in observing hierarchical relationships and organizations. Relationship-based trust is established on how a follower construes his or her relationship to a leader. If the relationship is positive, the follower is more likely to trust the leader. On the other hand, a follower using (albeit unconsciously) character-based trust focuses on the leaders characteristics. Upon this trust basis, a follower's trust in his or her leader is influenced by the perception of that leader's fairness, trustworthiness, and competence. The follower is likely to be willing to engage in behaviors that put them at risk when they attribute competence and benevolence to their leaders.

These conceptual frameworks demonstrate an academic understanding by a majority of researchers that trust is largely a cognitive, psychological state (Creed & Miles, 1996; Kramer & Tyler, 1996; Lewicki et al., 1998; Mayer et al., 1995; Deutsch, 1958; Chuang et al., n.d.). There is also some significant research supporting trust as an affective attribute (Bigley & Pearce, 1998; McAllister, 1995; Adams & Webb, n.d.). But according to Kramer (1999), most scholars agree that "trust is fundamentally a psychological state" made up of "several interrelated cognitive processes and orientations" (p. 571). Zand (1972) is more emphatic, stating that trust "is not a global feeling of warmth and affection, but the conscious regulation of one's dependence on another that will vary with the task, the situation, and the other person" (p. 230).

Additionally, trust is neither the confidence in nor cooperation with another (Adams & Webb). Simply put, trust is a calculated decision, arrived at through a cognitive process, to cooperate with specific others (Bigley & Pearce, 1998; Gambetta, 1980). A concise definition of trust can thus be explained, and its antecedents determined.

First, for a definition of trust itself, it is helpful to understand that “cognition-based approaches focus on actors’ cognitions and expectations about themselves and others” (Grey & Garsten, 2001, p. 232). Rotter (1980) suggests that trust is based on the expectancy that an individual or group can rely upon the statement (oral or otherwise) of another person or group. Dirks and Skarlicki (2004) add that an individual’s expectations are “based on perception of the integrity or capability of another party” (p. 28). As with their research on trust in hierarchical relationships mentioned earlier, Dirks and Skarlicki (2004) describe trust in terms of what they believe to be its components: integrity, fairness and benevolence, competence and capability, and trustworthiness. They base their working definition of trust on the model established by Mayer et al. (1995), which, in turn, parallels Gambetta’s (1988) definition and adds the component of vulnerability (Zand, 1972). For general understanding, this research will therefore use the Mayer et al. (1995) definition of trust: “Trust is the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party” (p. 712).

Through their model of trust, Mayer et al. (1995), and likewise Schoorman et al. (2007), explain that trust is based on several cognitive inputs by the “trustor” (individual “doing” the trusting), including perceived trustworthiness described by three factors—ability, benevolence, and integrity—and the trustor’s propensity to trust the “trustee” (individual being trusted). Propensity to trust is the innate tendency of an individual or group to trust another individual or group; it is the trustworthiness ascribed by the trustor to the trustee (Dirks & Skarlicki, 2004; Mayer et al., 1995; Rotter, 1967). Because trust is an individual’s expectation of another’s trustworthiness, Grey and Garsten (2001) argue that trustworthiness is the relative predictability that the other will exercise their autonomy with a reasonable degree of responsibility. Mayer et al. (1995) and Deutsch

(1958) believe that to explain trust one must go beyond the trustee's predictability. However, the propensity of the trustor is not enough to explain the observed variance of trust from one trustee to the next, nor does propensity account for situational conditions affecting trust outcomes (see also Schoorman et al., 2007). Propensity to trust, then, is affected by the three antecedent factors of ability, benevolence, and integrity, which describe the trustor's perception of the trustee's trustworthiness.

Schoorman et al. (2007) point out that "Trust [is] an aspect of relationships" (p. 344) rather than a character trait per se. It is "a willingness to be vulnerable to another party" (Mayer, 1995, p. 712). The scholars make a distinction between trust and trusting behavior: trust includes the willingness of an individual to assume perceived risk (vulnerability); trust behavior is the assuming of risk – the latter is captured by Mayer et al. (1995) as the Risk Taking in Relationship (RTR) component of the trust model. Risk exists because another's actions are unpredictable; there is uncertainty because of incomplete knowledge; vulnerability is present because of the possibility of loss. Trust mitigates risk, uncertainty, and vulnerability (Adams & Webb). But trust is more sensitive to perceived risk (Zolin & Hinds, 2004), and the higher the uncertainty, the more significant the role trust plays in an individual's behavior (Dirks & Ferrin, 2001). Consistent with the Mayer et al. (1995) trust model, Dirks and Skarlicki (2004) explain that risk and vulnerability are affected by a follower's (trustor's) perceptions of his or her leader's (trustee's) character in a hierarchical relationship. When a follower believes their leader has some degree of integrity, fairness and benevolence, competence and capability, and trustworthiness, they are likely to be more comfortable engaging in behaviors that put them at risk.

The perceived factors the trustor ascribes to the trustee act as antecedents to trust, ultimately affecting the level of trust the trustor will have—and act upon (trust behavior)—toward the trustee. Researchers identify several antecedent trust factors: Adams and Webb describe competence as the trustee's level of expert knowledge and technical facility; Barber (1983) states that benevolence is the positive motivation to act in one's best interest and that integrity is the belief that the other is in fact benevolent; the trust antecedent conditions identified by Bromiley and Cummings (1998) mirror that of

benevolence and integrity; Chuang et al. list four referents to trust: reliability, integrity, honesty, and fairness. As part of their analysis of trust factors, Mayer et al. (1995) examined the research of no less than 23 other scholars who identified antecedent trust factors and concluded the definitions and implicit meanings in the mass terminology could be captured by using the terms ability, benevolence, and integrity.

Based on his own literature review and interview of 33 managers from more than 12 firms, Mishra (1996) identified four antecedent dimensions related to the Mayer et al. (1995) factors in his definition of trust: “Trust is one party’s willingness to be vulnerable to another party based on the belief that the latter party is 1) competent, 2) open, 3) concerned, and 4) reliable” (p. 5). These factors are modeled in the ELICIT computer simulation questionnaire, which asks participants sixteen questions reflecting the four trust factors. Each antecedent factor and a corresponding hypothesis are described in the next section. First, the “antithesis” of trust should be briefly explained.

Understanding the “opposite” of trust is necessary since the “lack of trust would in general reduce cooperative efforts of all kinds” (Bromiley & Cummings, 1995, p. 232). A lack of trust has been found to be problematic for organizations, particularly federal government agencies (Jansen, Hocevar, Rendon, & Thomas, 2009; GAO, 2005). Zand (1972) explains that when individuals in a group or organization “encounter low-trust behavior, initially they will hesitate to reveal information, reject influence, and evade control” (p. 230). Such situations increase the likelihood for misunderstandings among members and between workers and managers and can lead to lower performance, as lack of trust—like trust—is embedded in managers’ philosophies (Creed & Miles, 1996; Zand, 1972).

Two general perspectives exist in trying to determine the relationship between trust and the opposite of trust. One perspective argues that since relationships are multiplex, trust and distrust can exist simultaneously in the same relationship (Lewicki, McAllister, & Bies, 1998), although the authors acknowledge this to be a significant departure from traditional views on trust. A stronger argument remains for the perspective of trust and distrust—or “not trust”—on a continuum, upon which a relationship can exist at only one point at a given time and in a particular context

(Schoorman et al., 2007; Bromiley & Cummings, 1998; Mishra, 1996; Mayer et al., 1995). Thus, this research will describe levels of trust on a continuum by placing, like Adams and Webb, “high trust” on one end and “low trust” on the other. Similarly, this research will use “high” and “low” to analyze and describe the relative levels of each trust factor described next (Mishra, 1996; Mayer et al., 1995).

D. TRUST ANTECEDENTS

The literature review has thus far validated comparing the two fundamental organizational structures: the hierarchy and the edge. The review has also established the potential for trust as a contingency factor of the performance (effectiveness) of each structure in terms of speed and accuracy. Finally, the definition of trust for purposes of this research follows that of Mayer et al. (1995) and which is recapitulated by Schoorman et al. (2007): Trust is “a willingness to be vulnerable to another party” (p. 347). Using a similar definition, Mishra (1996) provides the four antecedent factors (dimensions) of trust: competence, openness, concern, and reliability. We now arrive at the overarching question guiding this research: Which factor(s) explain(s) high or low trust levels in either a hierarchy or edge structure, leading to high or low levels of performance as indicated by speed and accuracy?

In their research on trust, Moonier et al. (2008) analyzed performance levels associated with trust level and organizational structure. Performance was measured by speed and accuracy in decision-making during a one-hour simulated problem-solving scenario. Data was gathered using a questionnaire reflecting trust factors given to each participant after the simulation. Speed, accuracy, and the responses to the questionnaire were converted to numerical data for analysis. Moonier et al. (2008) identified several key findings. When trust level is high, speed is high in the edge structure and low in the hierarchy. Similarly, accuracy is high in the edge structure with high trust but low in the hierarchy. Under conditions of low trust, however, speed in decision making is high in a hierarchy structure and low in an edge structure. Similarly, accuracy in both structures is relatively low when trust is low.

Analyzing trust levels associated with desired performance might indicate which structure to utilize for a particular organization. However, examining the antecedent factors involved in producing a trust level leading to desirable performance outcomes in a particular structural context is perhaps more salient for managers and other designers responsible for regularly maintaining their organization (Creed & Miles, 1996; Chuang et al.). The factors potentially responsible for “high” trust or “low” trust identified by the ELICIT computer simulation questionnaire – and supported by the literature reviewed in the previous section – are competence, openness, concern, and reliability. A detailed explanation of each factor and the formulation of three hypotheses incorporating trust antecedents, organizational structure, and performance follows next.

Competence is defined by Webster’s dictionary (1983) as “requisite or adequate ability.” Although Mayer et al. (1995) prefer to use the term “ability,” their own review of terminology used by other scholars suggests a significant use of the terms competence, perceived expertise, and expertness. Kramer (1999) highlights the significance of individual expertise to help formulate trust within a group, as well as that of trust in the system of expertise in a given organization. Competence is described by Mishra (1996) as a factor in trust between a manager or leader and a subordinate. Fast (2009) observes that competence, or lack thereof, drastically affects execution of defense acquisition programs. He suggests that “outsiders” may not have requisite experience unique to the defense industry, and “because of the importance of teamwork and trust,” leaders should be careful when giving such individuals consideration for hire (Fast, 2009, p. 12). Zell (2008) asserts that “competence is useful for types of support requiring high information complexity” in order to achieve corporate objectives (p. 17).

Certainly, the Information Age can be characterized as an environment of high complexity (Leweling & Nissen, 2007; Chandler, 2000). The more responsive and effective structure in such an environment is the edge, which relies on an organic network of experts who are competent in their particular field (Alberts & Hayes, 2005; Grey & Garsten, 2001; Donaldson, 2001). According to the research of Moonier et al. (2008), the edge outperforms the hierarchy when organization members have high trust toward each

other. What, then, is responsible for high trust in an edge organization? It is worth considering a second trust antecedent before forming a hypothetical answer.

Openness refers to the degree that an individual is honest with another individual. For example, a manager may be “open” with a peer or an employee in expressing a critique of their performance. Openness is only meaningful, however, if the employee trusts his or her manager. The converse in such a relationship works similarly; the manager is more likely to be open with an employee whom he or she trusts. In contrast, extreme honesty can actually damage the trust between individuals in an organization. (Mishra, 1996).

Dirks and Ferrin (2001) provide empirical evidence that suggests a relationship among trust, openness, communication, and information sharing. The acquisition field in the Department of Defense recognizes this relationship, stating “Direct communication...is expected as a means of exchanging information and building trust” (p.7 DAG). Such communication of information is essential for any organization, but is generally limited to the confines of interaction vertically up or down one level in a hierarchy; it is also most often processed and redistributed by those few members near or at the top of the hierarchy (Alberts & Hayes, 2005; Burns & Stalker, 1961). In an edge structure, however, openness among members is vital to achieving objectives successfully (Alberts & Hayes, 2005; Grey & Garsten, 2001; Donaldson, 2001). Thus, the above arguments on competence and openness lead to the first hypothesis:

Hypothesis 1. Under conditions of high trust, members of an edge structure exhibit high levels of competence and openness, and perform with high speed and accuracy.

The next hypothesis involves a third trust antecedent. Concern is influenced by the extent that the trustor’s behavior toward the trustee is relevant to the trustee’s needs and desires (Mayer et al., 1995). Benevolence has a similar meaning as concern, but suggests an attachment between two individuals and a complete forgoing of self-interest. Concern, on the other hand, means “such self-interest is balanced by interest in the welfare of others” (Mishra, 1996, p. 7). Concern suggests that “interdependence is a

critical antecedent to trust, because there would be no need to trust without one's own outcomes being in some way dependent on another person" (Adams and Webb, p. 3).

Interdependence is characteristic of relationships between various PBOs, such as organic networks of teams, companies, and industries (Grey & Garsten, 2001; Chandler, 2000). Miles and Snow (1992) explain that the growth of an organization is achieved in part through interdependent alliances with suppliers and distributors clarified by contracts and exchange agreements. The authors describe concern as being necessary to establish and foster trust among team members and among network organizations. A member of one organization is concerned for a member of another organization when he or she realizes that the relationship is mutually beneficial in a continuously changing and increasingly competitive environment (Miles & Snow, 1992).

An individual's or an organization's outlook for another may reach a limit at self-preservation, however. Concern is not demonstrated by an individual at the expense of his or her self-interest, such as achieving personal goals or the objectives of his or her organization (Miles & Snow, 1992). Similarly, the concern (or benevolence) displayed by a company for another likely originates from its own financial interests (Schoorman et al., 2007). Because the trustor reaches a limit at the preservation of his or her own self-interests when trusting another individual (or organization), the trustor's concern for that other, as an antecedent factor, does not significantly contribute to high trust. The hypothesis follows:

Hypothesis 2. Under conditions of high trust, members of an edge structure exhibit moderate or low levels of concern, and perform with high speed and accuracy.

The final hypothesis is based on a fourth trust antecedent and seeks to explain the relationship between high performance and low trust level in a hierarchy structure. Reliability refers to the "consistency between words and action" (Mishra, 1996, p. 9). The reliability antecedent factor stems from the expectancy aspect of trust that the trustor has of the trustee to behave in a way important to the trustor and that the trustor can rely

upon statements by the trustee (Mishra, 1996; Mayer et al., 1995; Rotter, 1980). Mayer et al. (1995) describe reliability—which they label integrity—as the consistency of acts based upon an acceptable set of principles.

It can be argued that, given the dynamic and fluid nature of the environment in which an organization may operate, members of an edge organization—an organic structure—might regard trust in each other in terms of reliability as a “skill” or personal, professional “quality” in and of itself (Grey & Garsten, 2001). However, the concept of such a skill or quality, and its antecedent role to trusting behavior, is captured in the competence factor described above. In the same research, Grey and Garsten (2001) also state “Action in PBOs is determined by reference to those with appropriate expertise...” (p. 236). Additionally, throughout a bureaucratic hierarchy, each member is expected to behave consistently according to a set of prescribed controls, routines, and norms (Mintzberg, 1980; Burns & Stalker, 1961). By comparison then, reliability rather than competence, openness, or concern likely plays a determinant role of performance level in the hierarchy, a mechanistic structure or bureaucracy. In other words, as long as hierarchy members continue to perceive one another as reliable, then it is possible that the organization can perform as well, and even better than, the edge organization under conditions of low trust brought about by a lack of competence, openness, and concern. Thus, the final hypothesis for this research is:

Hypothesis 3. Under conditions of low trust, members of a hierarchy structure exhibit high levels of reliability and perform with high speed and low accuracy.

The following section describes the methodology followed to test each of these three hypotheses.

III. METHODOLOGY

A. OVERVIEW

The present methodology is based on the sample and data collection procedures of Moonier et al. (2008), who sought to identify a relationship between trust level as a contingency factor of performance given a context of either an edge or hierarchy organizational structure. The researchers collected data, in part, using a survey questionnaire given to individuals who participated in an ELICIT multiplayer simulated intelligence game. While the computer-based simulation measured speed and accuracy by which to assess performance during and after the game, trust level and organizational structure were established (somewhat incognito) by one of four prescribed game scenarios provided to each group: high or low trust in an edge or hierarchy organization. The questionnaire was given to participants twice, as a pre- and post- survey, and was designed to measure each individual's perception of trust in this context before and after the simulation. (Moonier et al., 2008)

The participants in the experiment consisted of 68 different active duty military personnel currently attending a core organizational behavior course (as part of various Master's degree curricula) at the Graduate School of Business and Public Policy, U.S. Naval Postgraduate School (NPS) in Monterey, California. A small percentage of each individual's course grade was based on his or her participation and performance in the experiment, thus serving as an incentive for the individual to do well. These men and women included active and reserve officers in all four branches of the U.S. Armed Services, a small number of DoD employees, and foreign military officers (as students of NPS). The military participants held ranks ranging from O1 (lieutenant/ensign) to O5 (lieutenant colonel/commander), possessed 1 to 18 years of military experience, and hold undergraduate degrees. As subjects of the experiment, these individuals represented a diverse sample of the broader Defense population (Moonier et al., 2008).

Each subject was randomly assigned to one of four groups so that each group consisted of approximately 17 members. The groups contained an equally distributed

representation of age, experience, military service branch, officer subspecialty, gender, and country of service in order to more accurately simulate conditions present in joint or coalition military organizations. Each group participated in two different ELICIT game scenarios over a two-day period resulting in a total of eight experiments during which a combined total of 272 questionnaires (pre- and post- surveys) were issued. 135 responses were received out of the 136 post-surveys issued, resulting in a 99.3 percent response rate. (Moonier et al., 2008)

Extending the empirical research of Moonier et al. (2008), the data collected utilizing the post-survey is used to test the present hypotheses. The post-survey results are believed to be most relevant, since interactive relationships are an integral part of trust, and vice versa (Schoorman, 2007; Dirks & Skarlicki, 2004; Kramer, 1999; Hughes et al., 1983; Zand, 1972). Such interactions during the game occur after the pre-survey is completed. Therefore, in this instance, it is the post-survey that best captures each subject's perception of trust during the simulation.

While the questionnaire as a whole served the initial purpose of measuring perceived trust level (high or low), each statement scored by a respondent corresponds to one of the four antecedent factors of trust identified by Mishra (1996) and congruent with the Mayer et al. (1995) trust model. Appendix A shows the "trust survey" statements with the Likert scale and associated trust antecedents. (Naturally, subjects were not aware of the specific antecedent reflected in a given statement.) Inherently collected by Moonier et al. (2008), then, was data with the potential to demonstrate to what degree openness, competence, reliability, and concern contribute to high or low trust levels in a hierarchy or edge structure. Furthermore, with this data, one can establish a relationship between a trust antecedent and a performance outcome. Below is a more detailed explanation of the ELICIT intelligence game, including the two manipulations used to 1) create an organizational structure context for group members, and 2) induce a high or low trust level in each participant. The survey statements and measurements reflecting the antecedents of trust and performance outcomes are also described.

B. ELICIT INTELLIGENCE GAME AND MANIPULATIONS

The ELICIT intelligence game is an experiment in which participants are required to interact and collaborate via computer terminal client interfaces in order to collectively disrupt (solve) a simulated terrorist plot. Throughout this chapter, see Appendix B for excerpts from the ELICIT simulation game handout, which is given to each subject and includes the simulated organizational settings and trust environment among group members. At the beginning of the experiment, participants for the Moonier et al. (2008) study were first given a written scenario briefly describing the fictitious terrorist situation, nature of their organization's structure, and type of trust environment in which they were required to interact with other members. Instructions about playing the game were also included in the writing. After this introduction and a 10-minute break, participants completed a pre-survey before beginning the computer-based portion of the experiment. Once the group "solved" the terrorist plot, the computer-based portion ended, and participants were asked to complete a post-survey consisting of the same questions as the pre-survey. The total time for each of the eight experiments was approximately one hour (Moonier et al., 2008; Leweling & Nissen, 2007).

The object of the ELICIT game is to solve the terrorist plot, and thereby prevent the terrorist action from occurring, by answering the following questions:

- Who planned/led the effort to attack and who will execute the attack?
- In what country (where) will the attack take place?
- What is the specific target or event to be attacked?
- When (month, day and time) will the attack occur?

During the initial 10 minutes of the game, each participant is given a pseudonym and eventually receives four "factoids" that provide clues to answering the questions above. A total of 68 factoids are distributed throughout the group, but not all factoids are needed to solve the plot, and some of the factoids are irrelevant to the solution. The simulation is designed such that no single individual can solve the game independently. Speaking, signaling, emailing, or otherwise communicating is not allowed during the

experiment, as this would negate the purpose of using pseudonyms (to reduce personal biases of actual persons in the group) and ultimately alter the measurements of trust and trust factors extracted from the questionnaire. Members must collaborate and interact through their computer terminal using one of five simulation software functions: “list, post, pull, share,” and “identify.” The game ends when one or more participants receive/obtain enough information (factoids) to answer all four questions accurately, or when a pre-designated amount of time has elapsed. Because multiple scenarios with distinct factoids and terrorist plot solutions are available, the game can be played multiple times, even by the same participants (Moonier et al., 2008; Leweling & Nissen, 2007).

As indicated earlier, the written scenario is a manipulation device given to individuals of a group that establishes the structural and trust-level context in which those particular participants will play the game. For example, the structure manipulation for a hierarchy assigns each of the group members to one of three tiers consisting of 12 “Operators” divided into four teams, each of which is responsible for answering only one pre-assigned question of the four listed above. Four “Middle Managers” lead the teams and answer to one “Senior Supervisor.” In this structure, Operators may share information only with other team members or their Middle Manager, and not directly with the Senior Supervisor or across teams. Additionally, none of the group members may post information globally (sharing information with all participants) (Moonier et al., 2008; Leweling & Nissen, 2007).

In contrast, the structure manipulation for an edge design does not assign any functional or leadership role to specific participants. Instead, the concept of the edge structure is explained briefly and, during the 10-minute break, group members are allowed to discuss approaches to how they might best self-organize in order to solve the game. As with a “real” edge-structured organization, participants must determine who should focus on which aspect of the simulated terrorist plot, as well as who will post, pull, and share what information with whom. At the game’s end, each participant must enter an answer for each question to the best of their current “simulated” knowledge (Moonier et al., 2008; Leweling & Nissen, 2007).

The written game scenario given to participants also serves to manipulate the trust level within a particular group and is independent of the structure manipulation previously described. For example, stating to a participant that his or her “actions will be consistent, congruent, and credible with established protocols and guidelines” helps to induce reliability during the game. Similarly, describing to the participant that his or her local community exhibits positive interactions, unhindered information sharing, and “doing good to others” helps establish a sense of openness and concern. Finally, an atmosphere of competence is created when participants are told in the scenario that their experience, skill, and intellect indicate they “are well qualified to solve the terrorist threat problem” (Moonier et al., 2008; Leweling & Nissen, 2007).

On the other hand, using the trust manipulation, these trust antecedents are minimized in other scenarios seeking to create conditions of low trust for the game. Statements such as “Members of your community normally work well together, but frequently withhold information from each other,” along with references to negative interactions affecting relationships seek to negate openness and concern. Questioning the intellect and skill of the participant’s simulated character helps induce a sense of low competence, and reliability is diminished by scenario expressions such as “Your actions may not be consistent, congruent, and credible with established protocols and guidelines,” and “Simply put, be wary of moles and free-riders.”

Performance outcomes of speed and accuracy were used to measure the effects of the trust and structure manipulations. To measure the specific effects of the trust antecedents, we turn to the questionnaire itself. These measurements are explained in the next section (Moonier et al., 2008; Leweling & Nissen, 2007).

C. QUESTIONNAIRE AND MEASUREMENTS

The survey questionnaire developed by Mishra and Mishra (1994) was the instrument utilized to measure each subject’s perception of the levels of overall trust and trust antecedents. Mishra and Mishra (1994) used the survey as part of an overall

assessment of mutual trust. In doing so, the researchers were able to capture indications of the four trust antecedents among managers, employees, and customers experiencing the effects of corporate downsizing.

Several other studies have incorporated adaptations of the same instrument. Spreitzer and Mishra (1999) used the questionnaire to collect perceived trust and trust factor (competence, openness, concern, reliability) data from personnel working in the American and Canadian automotive industries. Spreitzer and Mishra (2002) used the instrument to analyze survivor reactions and retention after corporate downsizing has occurred, followed by Brockner, Spreitzer, Mishra, Hochwarter, Pepper, and Weinberg (2004), who used the same tool to further study the negative effects of downsizing. Leweling and Nissen (2007) used the questionnaire in conjunction with an ELICIT simulation experiment comparing performance levels between edge and hierarchy structures as part of broader “command and control” research.

The post-survey questionnaire used in the ELICIT experiment conducted by Moonier et al. (2008) asked subjects to evaluate the simulated organization of their test group and the trust level they perceived during the game by indicating how much they agreed or disagreed with 16 different statements. (Again, see Appendix A.) For purposes of this experiment, the term “Site Management” was used in the survey to refer to the organizational design utilized by the group during the experiment. The term is valid since management is a major, even primary, contributor to the organizational form and strategy employed to coordinate people and achieve objectives (Schoorman et al., 2007; Creed & Miles, 1996; Burns & Stalker, 1961).

Unbeknownst to the subjects, the statements were divided into groups of four to reflect the four trust antecedents. For example, the first statement, “I believe that Site Management is straightforward with employees,” reflects the trust antecedent openness. Statement #6 reflects the factor competence: “I believe that Site Management can contribute to our organization’s success.” Other statements in the questionnaire are more direct and obvious in connection with the associated trust antecedent, such as #11, “...is reliable,” and #14, “...is concerned for employees’ welfare” (Moonier et al., 2008).

Subjects responded to each statement using a 7-point Likert scale with endpoints of “(1) very strongly disagree” and “(7) very strongly agree.” The scale mid-point was “(4) hard to decide.” Similar to the methods used by Brockner et al. (2004, pp. 82-83), the present research averages each set of four related numerical responses into a single index corresponding to each trust antecedent. Additionally, the average of these indices provides a “trust omnibus” index. Hence, each of the 135 subject responses consists of a total of 5 indices: “openness, competence, reliability, concern,” and “trust omnibus.”

Two additional measurements per subject are “speed” and “accuracy,” which indicate the performance outcome of each subject group that participated in the ELICIT simulation experiment. “Speed” refers to the time required by the subject to identify the simulation plot details correctly. During the experiment conducted by Moonier et al. (2008), the simulation software logged the time lapse in seconds of each subject, which was then normalized (based on a maximum time of 2,872 seconds) to a scale from 0 to 1 where 1 indicates a faster time.

“Accuracy” is whether or not a subject answers each of the four plot questions of “who, where, what, when” correctly. A score is given for each component question correctly answered and is then normalized to a scale from 0 to 1. A normalized score of 1 indicates the subject solved each component of the simulated terrorist plot correctly; blank or “non” answers received a zero. Appendix C describes the calculations used to normalize the speed and accuracy scores (Moonier et al., 2008; Leweling & Nissen, 2007).

To summarize, the present research uses data collected by Moonier et al. (2008) through the performance simulation experiment and trust survey questionnaire. Specifically, the measurements of high/low trust and high/low trust antecedent levels for a hierarchy or edge structure are averaged into distinct indices. The speed and accuracy measures were normalized into a 0-1 scale, where 1 is desirable for each measure. The data reflect the variables of speed and accuracy as the measures of effectiveness (performance), and trust antecedent levels (trust level) and structure type as the inputs affecting that performance. An analysis of the relationships among these eight variables is presented in the following section.

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IV. ANALYSIS AND RESULTS

The data analysis focuses on the observable effects each trust antecedent has on performance within a given organizational structure. First, a descriptive overview provides a comparison of the trust antecedents across the four experiment groups (also referred to here as “cells”) of high-trust hierarchy (HH), high-trust edge (HE), low-trust hierarchy (LH), and low-trust edge (LE). Next, descriptive statistics and correlations are identified across the entire sample of 135 respondents, followed by regression analysis of the same sample in order to establish basic relationships among trust antecedents, organization structure type, and performance outcomes. Hypothesis testing and a summary of key findings conclude the analysis.

A. DESCRIPTIVE STATISTICS

As indicated in the previous section, a subject’s response to each of the 16 trust post-survey statements was averaged with the other 3 statements reflecting the same trust antecedent. Thus, each of the 135 surveys consisted of 4 numerical indices reflecting that subject’s “level” of openness, competence, reliability, and concern based on the 7-point Likert scale. The mean of these 4 indices created that subject’s “trust omnibus,” a single numerical value representing his or her overall level of trust during the experiment. Table 1 shows the index means, as well as the standard deviations, for each antecedent and the trust omnibus across the four experiment groups consisting of a high or low trust level in either an edge or hierarchy structure.

The openness index for each group falls below that of the other trust antecedents; its standard deviation, however, is the smallest in each group, indicating that the index may be more robust in its effect on performance than the other antecedents. As an example, the concern index for the LE group falls below 5.0; however, its relatively high standard deviation implies it would be well above this level approximately 68 percent of the time. Interestingly, the trust omnibus for the HH group is the second highest and has two antecedents whose levels surpass those of the HE group. However, openness in the HH group is the lowest value in the entire table.

Table 1. Descriptive Statistics by Group

Group	Mean & Standard Deviation	Openness	Competence	Reliability	Concern	Trust Omnibus
HH (n=34)	Mean	4.2647	5.3971	5.3824	5.4338	5.1195
	s. d.	0.8140	1.1516	1.1336	1.1169	0.9796
HE (n=35)	Mean	4.9286	5.4500	5.3214	5.2357	5.2339
	s. d.	0.7240	1.3996	1.3606	1.3352	1.1516
LH (n=33)	Mean	4.5606	5.2424	5.2348	5.0909	5.0322
	s. d.	0.8029	1.2303	1.1574	1.2132	1.0306
LE (n=33)	Mean	4.8561	5.1742	5.1364	4.9621	5.0322
	s. d.	0.7182	1.0707	1.0479	1.1526	0.9301

Notice, too, the trust antecedent indices of Table 1 in relation to the present hypotheses: As one might expect, the highest trust omnibus level is with the HE group. Competence is the primary input, but reliability, not openness, is the secondary contributor to the HE trust omnibus. Similarly, openness appears responsible for the low trust omnibus in the same group as opposed to the hypothesized effect of concern, which is nevertheless below 5.0. Finally, examining the LH indices reveals that reliability, narrowly surpassed by competence, is indeed highly responsible for the trust omnibus in that group.

B. DESCRIPTIVE STATISTICS AND CORRELATIONS

Descriptive statistics of the entire sample of 135 questionnaires are consistent with those found across experimental groups. In particular, the openness index level (mean) and standard deviation are again the lowest of the trust antecedents, as can be seen in Table 2. Openness appears approximately equally correlated to each of the other three antecedents and is weakly correlated with speed and accuracy. However, openness and structure are negatively correlated: As the openness index increases, the value for structure type “decreases” to 0, which represents the edge structure in this analysis.

A similar correlation occurs between structure type and performance indicators. As structure type “increases” toward the value representing the hierarchy (1), both speed

and accuracy scores decrease. Focusing on the two highest (absolute value) correlation coefficients of the performance indicators also reveals a negative correlation between speed and reliability.

Table 2. Descriptive Statistics and Correlations (n = 135)

Variables	Mean	s. d.	1	2	3	4	5	6	7
<i>Trust Antecedents</i>									
1. Openness	4.654	0.802							
2. Competence	5.319	1.213	0.667						
3. Reliability	5.270	1.173	0.666	0.943					
4. Concern	5.183	1.208	0.617	0.901	0.923				
5. Trust Omnibus	5.107	1.020	0.769	0.967	0.972	0.951			
<i>Organization Type</i>									
6. Structure (Hierarchy=1)	0.496	0.502	-0.302	0.002	0.033	0.067	-0.029		
<i>Performance Indicators</i>									
7. Speed Score	0.173	0.149	0.073	-0.122	-0.166	-0.105	-0.101	-0.082	
8. Accuracy Score	0.386	0.286	0.083	0.061	0.029	0.009	0.045	-0.181	0.281

Additionally, competence, concern, and the trust omnibus are each negatively correlated to speed. These relationships in Table 2 are counter-intuitive, seem to go against the literature reviewed in Section II, and reveal a problematic challenge in the present analysis.

The high correlation coefficients between the trust antecedents i.e., competence, reliability, concern, and the overall trust score (each $r > 0.90$) suggest multicollinearity. Several reasons may exist for this occurrence, including the possibility that the construct development for the survey items was not as robust as previously thought, that is, there may not be four empirically derived factors. A second possibility may be the improper administration of the questionnaire. Individuals participating in the experiment may have interpreted the questionnaire statements differently, unintentionally skewing the results. Alternatively, the need to feel trusted, to think of him or herself as exhibiting trusting

behavior, or to be perceived by others as trustworthy may create strong social desirability bias (that is, it is undesirable to be perceived as untrustworthy, particularly in military or intelligence contexts) further skewing responses to the questionnaire. In any case, these results make it difficult to clearly identify relationships among trust antecedents, organization structure types, and performance outcomes.

C. MULTIVARIATE ANALYSIS

In light of the multicollinearity among antecedents, it is nevertheless worthwhile to analyze some general regression models to determine if any relationships among the variables may exist. Table 3 summarizes the findings.

Table 3. Results of Regression Analysis for (a) Speed and (b) Accuracy: Trust and/or Structure Type^a

	Models							
	1a	1b	2a	2b	3a	3b	4a	4b
R ²	0.1038	0.0213	0.1042	0.0442	0.0102	0.0021	0.0174	0.0343
F	3.7622	0.7068	3.0024	1.1929	1.3689	0.2733	1.1667	2.3429
Sig. F	0.0063	0.5887	0.0135	0.3163	0.2441	0.6020	0.3146	0.1000
<u>Variables^b</u>								
<i>Trust Antecedents</i>								
Openness	0.0054	0.4355	0.0088	0.9692				
Competence	0.6644	0.2310	0.6562	0.2637				
Reliability	0.0108	0.5936	0.0106	0.7051				
Concern	0.1879	0.4118	0.2034	0.5395				
Trust Omnibus					0.2441	0.6020	0.2330	0.6408
<i>Organization Type</i>								
Structure (Hierarchy=1)			0.7910	0.0811			0.3278	0.0377

^a n = 135.

^b P-values are used in the table.

Of the eight regression models, four include the dependent variable speed score (a) and four have accuracy score (b) as the dependent variable. The independent variables for models 1 and 2 include the trust antecedents; the trust omnibus index represents “trust” as the independent variable for models 3 and 4. Additionally, models 2 and 4 also include structure type as an independent variable.

Regressing all 135 responses reveals models 1a, 2a, and 4b as significant at the 0.01, 0.05, and 0.10 levels, respectively (see the Significance of F values in Table 3). Model 4b shows structure type ($p\text{-value} = 0.0377$) as significant at the 0.05 level, suggesting the idea that structure, not trust level, may have more of an impact upon accuracy. Model 1a demonstrates that openness and reliability significantly contribute to speed score at the 0.01 and 0.05 levels, respectively. This holds true when structure type is introduced as an independent but insignificant variable, shown by Model 2a. Openness remains highly significant, while structure is not significant when included in the speed model. On the other hand, structure becomes significant at the 0.10 level when included in the accuracy regression, as seen in Model 2b. The model overall, however, is not significant (Sig. F = 0.3163).

In sum, across the entire sample of 135 questionnaire responses, speed score appears to be consistently dependent upon openness and reliability index levels. The observed openness indices reinforce this finding, whereas the multicollinearity among the antecedents weakens it. In contrast, accuracy score appears to be significantly determined by structure type and is reinforced by the correlations explained previously. Hypothesis testing follows next to analyze these results from the perspective of the reviewed literature.

D. SUPPORT FOR HYPOTHESES

The hypotheses formed in the present research make claims regarding a relative level of each trust antecedent. Each hypothesis establishes parameters of either a high or low trusting environment among members of either a hierarchy or edge structure, the combination of which leads to high or low scores for speed or accuracy. The regression models in Table 4 are numbered according to their respective hypothesis. Additionally,

an “alternative” model at the far right reflects an unanticipated finding through analysis of the data. The table does not include structure type or trust omnibus as these variables are defined by the group sample and, hence, are held constant.

Table 4. Results of Hypothesis Testing^a for (a) Speed or (b) Accuracy: Trust Antecedents^b

	Models for Hypothesis Testing							
	1a	1b	2a	2b	3a	3b	Alt.a	Alt.b
Group (n)	HE (35)	HE (35)	HE (35)	HE (35)	LH (33)	LH (33)	HH (34)	HH (34)
R ²	0.0743	0.0050	0.0030	0.0001	0.0487	0.0002	0.3266	0.0299
F	1.2845	0.0803	0.0980	0.0045	1.5881	0.0048	7.5163	0.4778
Sig. F	0.2907	0.9230	0.7563	0.9471	0.2170	0.9453	0.0022	0.6246
<u>Variables^c</u>								
Openness	0.1761	0.7332						
Competence	0.1298	0.6992					0.0007	0.3564
Reliability					0.2170	0.9453	0.0005	0.4439
Concern			0.7563	0.9471				
<u>Support for Hypothesis</u>								
	No	No	No	No	No	No	Yes	No

^a H1: Members of high trust edge groups exhibit high levels of competence & openness and perform with high speed and accuracy.

H2: Members of high trust edge groups exhibit moderate or low levels of concern and perform with high speed and accuracy.

H3: Members of a low trust hierarchy group exhibit high levels of reliability and perform with high speed and low accuracy.

^b Regressed by group, holding trust level (high/low) and structure (hierarchy/edge) constant.

^c P-values are used in the table.

As one can see, none of the proposed hypotheses are supported by the data regression analysis. Variations of these models (not listed), such as including all three independent variables of Models 1 and 2 into a single model, do not change the significance level of either the variables or the model itself. Furthermore, the R-square values of each hypothesis regression model are very small.

Although only two different “cell groups” are included in the hypotheses, which focus on trust antecedents, all four were tested for comparison. Like the HE and LH groups, the LE group was not significant overall and did not reveal any significant variables. Interestingly, however, the alternative model “a” (“Alt. a”) produced a

relatively large R-square value of 0.3266 that is significant at the 0.01 level. The model reveals two highly significant ($p > 0.001$) trust antecedents: competence and reliability.

Speed score in this group was highly determined by competence (somewhat similar to Hypothesis 1) and reliability (somewhat similar to Hypothesis 3). In this sense, portions of Hypotheses 1 and 3 are supported by the data in Table 4. For the HH group (Model “Alt. b”), trust antecedents did not determine accuracy scores; this reinforces the idea that structure type, rather than trust level, affects accuracy. Model “Alt. b” lends some support to Hypothesis 3, as well.

E. KEY FINDINGS

The above analyses lead to several key findings. To begin with, the data generally support the claims made by Moonier et al. (2008), who identified the HE cell group as having the highest speed and accuracy scores that reflected the highest trust level. Additionally, the present analysis adds some empirical credence to the general assertion that the edge structure may be the most effective organization given a high level of trust among its members and between its corporate partners (Powley & Nissen, 2009; Leweling & Nissen, 2007; Alberts & Hayes, 2005). The trust omnibus index for the HE group, as well as the negative correlation between structure type and trust omnibus level, reinforce this assertion. However, the data does not support a significant model utilizing trust omnibus as an independent variable.

A second key finding is the recognition that several of the seemingly important results are confounding because of the small sample size for each group, where $n < 40$ in each case and for which it is commonly desirable to have $n > 30$ for each independent variable included in a given model. Nevertheless, the sample $n = 135$ was sufficient for models including all four antecedents. Somewhat surprisingly, the HH group model with a sample of only 34 produced the most significant results in the present study, leading to a third and fourth key findings.

Obviously, human error exists in the creation and implementation of any controlled experiment. As part of the experiment, explanation and administration of the questionnaire instrument to the subjects may have included human error that

unintentionally appeared in the results when coupled with small sample sizes of each experimental group. Alternatively, human error entered the data and subsequent analysis based on subjects' interpretation of the questionnaire statements. Personal biases of each subject desiring to be perceived by others as trustworthy also possibly skewed the data results. Both reasons might explain why openness has a consistently lower index across groups, yet no group model reflected openness as a significant variable. Error and bias may also account for the relatively strong HH model.

Bias and interpretation are related to the fourth finding of this research. The high-trust hierarchy model above ("Alt. a") illustrates the most significant and consistent model contained in the present research. Considering the general design of the U.S. military organization, and considering that the sampled members of the HH group come predominantly from the same organization, it is not entirely surprising that results in such an experiment may exhibit characteristics more in line with the nature of the organization and its members rather than those expected through a literature review encompassing a myriad of samples. The HH data are encouraging to this study, but further research is warranted to determine whether or not such results indicate a general relationship among trust antecedents, structure type, and performance indicators, or if the results more closely reflect a military culture in which high trust is valued as a means to achieve objectives rapidly (but not necessarily accurately) in a hierarchical structure.

A final key finding is that the argument that trust is comprised of "trust antecedents" cannot be empirically supported. Mishra and Mishra (1994) created the instrument to help determine what characteristics of an individual come together into his or her trustworthiness as perceived by others. Mayer et al. (1995) and Schoorman et al. (2007) hold the same argument and call for empirical studies needed to corroborate their proposed trust model. Though somewhat limited in sample size and/or diversity, and requiring further experimentation and validation, the present data analysis suggests that trust antecedents may have an aggregate effect on speed and accuracy, rather than represent three separate trust factors. Of particular note, in some studies using the

questionnaire, researchers opt not to report the trust factors separately, but instead consider the total items in the scale as an overall indicator of trust (see, for example, Brockner et al., 2004).

Although the present research seeks to identify relative levels of each trust antecedent in a particular structure, it must again be made clear that the ultimate purpose of the research is to identify variables that do or do not lead to higher performance in terms of faster speeds and more accurate solutions during problem solving. The next and final section of this research is a conclusion framed in this perspective.

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V. CONCLUSION

A. DISCUSSION

Trust has gained increased recognition as an element vital to organizational survivability and success. The emergence of the PBO trend at the turn of the 21st Century has lead researchers and practitioners to give much attention to the role of trust associated with an organization. As Kramer (1999) observes, “Trust has rightly moved from bit player to center stage in contemporary organizational theory and research” (p. 594). The present research has helped empirically validate this claim, especially as the DoD explores the future use of edge type groups and organizations, while continuing to refine its current traditional, robust hierarchy. This research empirically supports the argument that the edge organization in a high trust environment outperforms each of the other three trust-structure type configurations. Additionally, the hierarchy in a high trust environment studied here is found to be robust, potentially reflecting a high regard for trusting behavior and rapid problem solving in a military culture.

Speed and accuracy were the outcomes used to evaluate the performance of each cell group in the experiment. Trust and structure type were the organizational inputs during the ELICIT simulation. Trust, specifically, is also linked to other aspects of organizational measures of effectiveness such as meeting performance objectives, minimizing transaction costs, and determining the amount of resources devoted to key tasks to achieve team objectives rather than to supplant coordination and control efforts (Liu et al., 2004; Devine, Clayton, Philips, Dunford, & Melner, 1999; Kirkman & Rosen, 1999; Bromiley & Cummings, 1995; Hughes et al., 1983). Researchers have also called for empirical studies to validate proposed theories and models regarding perceived trust among organizational members and between different organizations (Dirks & Skarlicki, 2004; Mayer et al., 1995).

Unique to focused studies on structure type, empirical evidence is requested to support the argument that trust impacts performance outcomes as it interacts with organizational design (Creed & Miles, 1996). As an example of an answer to this call,

Liu et al. (2008) and Urban (1995) independently found that non-hierarchical team structures tended to outperform hierarchy teams under various conditions, lending support to the present findings that trust level and structure type have an effect on speed and accuracy (and also to the Moonier et al. (2008) finding that the edge outperforms the hierarchy). Additionally, Pina et al. (2008) argue that trust is an attitudinal variable affecting team performance and effectiveness.

Together, these studies focused on trust or structure type, as each relates to measures of effectiveness, and they help identify organizational performance as an outcome variable dependent upon trust level and structure type as organizational input variables. Certainly, outcomes then in turn positively or negatively reinforce trust-structure type inputs, but the practical aspect of this research is to understand how managers can better achieve their organizational objectives when considering trust and organizational design. The present findings reinforce the idea that trust level is a legitimate contingency factor, which impacts specific performance outcomes of a given organizational structure. Chuang et al. provide a succinct explanation as to why this is important for organizational practitioners:

If we can find out the antecedents and consequences of the trust more clearly, managers and team leaders will more understand how to lead a team and build trust. Also we can find out whether trust is important when considering the team's effectiveness and performance. (p. 479)

With this in mind, the present study sifts out implications for managers regarding trust, structure, and performance according to findings from the analysis of current data. The reader is then presented with related areas requiring further research, explanation, and empirical support.

B. IMPLICATIONS

Managers and leaders can create conditions for a trusting environment (Levin et al., 2002). When trust is high, the more organic, flexible edge structure type offers the highest desirable results among the configurations tested in the present study and by

Moonier et al. (2008). In environments characterized by low trust, the rigid hierarchy structure provides more desirable results from the organization and team members than the edge structure. (see also Dirks & Ferrin, 2001)

The implication is that a manager can achieve better performance outcomes under low trust conditions by structuring his or her team into a hierarchy, even if the outcomes are not as high as enabled by a HE configuration. Additionally, the leader can establish a relative measure of trust level in his or her organization in order to determine which structure type is most suitable. Another implication is that leaders and managers can distinguish the effects of trust level and structure type. For example, accuracy appears to be affected more by structure type, while trust level has a more noticeable impact on speed during problem solving. Alternatively, configuring a group into a hierarchy does not necessarily mean trust level will be low, nor does it mean performance outcomes will be poor. Such possibilities may be particularly useful to program managers operating in the dynamic, high-paced environment of DoD acquisition industry. Rather than feeling high trust is always required for success, the manager or team leader has an option through the hierarchy structure.

A low trust level is often due to factors beyond the manager's and group members' control: although they may trust each other personally, circumstances limit their trust professionally and functionally. The hierarchy characterized by bureaucracy serves as a trust substitute (Grey & Garsten, 2001). Bigley and Pearce (1998) explain: "The bureaucratic organizational form is an example of a trust-producing mechanism for situations where the scale and scope of economic activity overwhelm interpersonal trust relations" (p. 411). Schoorman et al. (2007) take a different view, asserting that the bureaucracy traditionally associated with a hierarchy only fosters a perception of trust; the cause for trust is actually found in trust antecedents. For example, the control systems in such an organization may be the perceived reason for "trusting" another. Yet, it is the trustor's benevolence and integrity that is "causing" the trustee to trust the trustor. Indeed, according to the findings of the present research, the HH configuration suggests that the trust antecedents of competence and reliability are responsible for the high trust level.

The implication for leaders and managers is that high levels of competence and reliability can produce a high level of trust in the organization and lead to better performance in a hierarchy structure. It seems reasonable, then, that the manager who fosters knowledge, skill sets, task completion, and a sense of loyalty in his or her employees/subordinates is inherently improving the performance (at least in terms of faster results) of the team. A challenge—also from the present study—that weakens this argument, however, is that only one of eight models tested reflected statistically significant antecedents. If antecedents consistently produced unique trust levels, one would expect at least some of the other configuration models to show significant antecedent variables. Hence, two additional implications follow.

Since neither competence and reliability nor any of the trust antecedents, appeared in the analysis with significance (with the above HH exception), one must consider other influences on the HH group during the experiment and, perhaps more intriguing, the possibility that the effects of trust level are found in the aggregate of any trust antecedents, rather than in one or two distinct antecedents. Regarding the first implication, the HH sample group was approximately the same size as the other three cells. As explained in Section III, subjects were given scenario instructions to induce a particular high or low trust context. Appendix D depicts the demographic makeup of the entire sample, from which each cell was selected. Although the sample is diverse internationally and has at least some gender differentiation, each individual is a part of or directly interactive with the military culture. Additionally, the interpretations and biases of each individual toward statements contained in the trust survey may have been filtered by the need to feel trustworthy. The implication, therefore, is that the premium value placed on trustworthiness, the familiarity with the traditional hierarchy structure, and the desire to be perceived as exhibiting trusting behavior among members of the military culture may have inherently heightened the measurements and results of the HH group experiment. Thus, competence and reliability may not necessarily be the causes of faster speed times in the hierarchy.

A final implication for scholars, as well as managers, is that trust antecedents may not have unique levels that, when combined with a particular structure type, lead to

optimal performance outcomes. In other words, an overall trust level may have a greater effect than the aggregate of the trust antecedents. The present research analyzed each antecedent as a numerical index value and also averaged the indices to analyze a “total” trust level (trust omnibus) for comparison. Along with the Brockner et al. (2004) research, such studies suggest that a measurement of trust level is more meaningful to performance outcomes than an assessment of each trust antecedent. To determine the validity of this claim, further research is necessary.

C. RECOMMENDATIONS FOR FUTURE RESEARCH

To begin with, an additional experiment or series of experiments using the ELICIT simulation would help identify trends among each of the variables in question. The results may be more pronounced if a larger sample size for each cell can be used and if the trust manipulations in the experiment can be uniformly implemented. The survey questionnaire instrument, too, might be adapted in such a way that frames each trust antecedent with more contrast to reduce the possibility of misinterpretation. Kramer and Tyler (1996) are wary of survey studies, since they may “suffer from the ways in which questions and answers are framed,” and that the range of responses “is already sharply constrained by the researcher” (p. 239). Nevertheless, several scholarly studies have utilized the Mishra and Mishra (1994) survey. As Mayer et al. (1995) assert, “Measures of [trust antecedents] must be developed that are consistent with the definitions provided” (p. 729). It may be possible to use a more narrow scale in the questionnaire, or to account for subject bias in some way during the experiment. Several iterations of such experiments may be necessary, as well, to help validate the instrument and the presence of trust antecedent effects.

A second area for further research is to study the trust and trust antecedent effects on performance outcomes in the behavior of individuals belonging to a hierarchy but necessarily operating via an informal network, i.e., edge type. Informal networks form across structural boundaries of more rigid structures to achieve organizational objectives.

These networks are not legitimized through bureaucracy, but it may be the level of trust and exhibited trust antecedents that give, in part at least, the informal network its power to achieve desired results.

Perhaps a more fascinating study related to trust antecedents would be one centered on social networks. Indications from the present research suggest that social groups could ultimately form around a desired outcome and be determined by the perceived trust among members. Such research would encompass not only the corporate or government organizational arena, but also society at large. The role of trust antecedents in determining how social groups form into particular structures and exchange information could be explored. For example, questions to be asked might be: Do social groups tend to gravitate on their own toward a hierarchy or edge-like structure? Does the edge structure facilitate social networking as it becomes a more global phenomenon? To what extent does trust affect achieving desired outcomes in social networks? Similarly, the Information Age warrants studies surrounding the role of trust antecedents and structure types as group members interact through online services such as LinkedIn, MeetUp, and Facebook.

Lastly, this report has introduced the application of the present research on trust, structure type, and performance outcomes to Integrated Product Teams in the DoD acquisition program. Currently, IPT structures typically are some hybrid of cross-functional matrices and/or network designs with a hierarchical structure. Like many other groups, IPTs are embedded in a larger social system (i.e., DoD and the Federal government) that largely defines the context in which these teams operate (Guzzo & Dickson, 1996). However, certain interventions can bring about improved team performance (Grey & Garsten, 2001), and further research considering the IPT as a more organic entity may lead to interventions that address trust antecedents and structure types. What if the IPT could—as a high-trust edge group, for example—self-organize around a pre-determined outcome in a way unique to that desired outcome? With additional research, prerequisite conditions and tools for program managers will be identified that help answer such questions. The world continues to become increasingly complex and the challenges facing DoD reflect this complexity (Jansen et al., 2009). As the GAO

(2005) continues to identify trust as a key element for successful federal institutions, and scholars and practitioners alike recognize a need for greater understanding in such areas, this research is both relevant and timely.

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APPENDIX A.

Trust Survey
(from Moonier et al., 2008; originated by Mishra and Mishra, 1994)

(The following statements-to-trust antecedent association is not revealed to subjects: Openness: 1, 5, 9, 13; Reliability: 3, 7, 11, 15; Competence: 2, 6, 10, 16; Concern: 4, 8, 12, 14)

How much do you agree or disagree with each of the statements about Site Management?

“I believe that Site Management (organization)...”

		Very Strongly Disagree	Strongly Disagree	Tend to Disagree	Hard to Decide	Tend to Agree	Strongly Agree	Very Strongly Agree
1. is straightforward with employees	1	2	3	4	5	6	7	
2. is competent and knowledgeable	1	2	3	4	5	6	7	
3. does not try to get out of its commitments	1	2	3	4	5	6	7	
4. does not take advantage of employees	1	2	3	4	5	6	7	
5. communicates honestly with employees	1	2	3	4	5	6	7	
6. contributes to our organization's success	1	2	3	4	5	6	7	
7. behaves consistently	1	2	3	4	5	6	7	
8. does not exploit employees	1	2	3	4	5	6	7	
9. does not mislead employees in their communications	1	2	3	4	5	6	7	
10. can help our organization survive during the next decade	1	2	3	4	5	6	7	
11. is reliable	1	2	3	4	5	6	7	
12. cares about employees' best interests	1	2	3	4	5	6	7	
13. does not withhold important information from employees	1	2	3	4	5	6	7	
14. is concerned for employees' welfare	1	2	3	4	5	6	7	
15. can be counted on	1	2	3	4	5	6	7	
16. can help solve important problems faced by our organization	1	2	3	4	5	6	7	

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APPENDIX B.

Excerpts from the ELICIT Simulated Intelligence Game Instructions To Subjects
(From Moonier et al., 2008 and Leweling and Nissen, 2007)

Instructions to "A" Community

High Trust-Edge (HE) group designator not revealed to subjects.

You have been randomly assigned to the "A" community group. Your community is a group of intelligence officers whose task is to reveal the identity of a threatening terrorist group, plot, location, and date/time of an impending attack. Working with the members for your community, you will share information and piece the data together to provide a solution.

Members of your community share information freely with a general orientation toward doing good to others. We are impressed with this orientation and are encouraged by the positive interactions among your fellow cohort members. Moreover, your intellect, varying skills, and past experience lead us to believe that you are well qualified to solve the terrorist threat problem. We have every reason to believe that when it comes to solving critical problems in group settings such as this that your actions will be consistent, congruent, and credible with established protocols and guidelines.

Group communications capabilities are available to enable you to share information with any member of your group. As a member of "A" community, your knowledge and unique experiences are valuable assets, and you are expected to give best effort to the success of your team. You are invited to establish communication with any and all members of your group and organize your group in any way that best suits your problem solving.

Instructions to "B" Community

High Trust-Hierarchy (HH) group designator not revealed to subjects.

You have been randomly assigned to the "B" organizational group. Your community is a group of intelligence officers whose task is to reveal the identity of a threatening terrorist group, plot, location, and date/time of an impending attack. Working with the members for your community, you will share information and piece the data together to provide a solution.

Members of your community share information freely with a general orientation toward doing good to others. We are impressed with this orientation and are encouraged by the positive interactions among your fellow cohort members. Moreover, your intellect,

varying skills, and past experience lead us to believe that you are well qualified to solve the terrorist threat problem. We have every reason to believe that when it comes to solving critical problems in group settings such as this that your actions will be consistent, congruent, and credible with established protocols and guidelines.

In the "B" organization, there are four teams of four members each plus an overall cross-team coordinator. The four teams are organized along the lines of a traditional hierarchical command structure, each with a leader.

Team A is focused on Who, team B on What, team C on Where and team D on When. The overall coordinator coordinates information between the team leaders across team boundaries.

Instructions to Second "A" Community

Low Trust-Edge (LE) group designator not revealed to subjects.

You have been randomly assigned to the "A" community group. Your community is a group of intelligence officers whose task is to reveal the identity of a threatening terrorist group, plot, location, and date/time of an impending attack. Working with the members for your community, you will share information and piece the data together to provide a solution.

Members of your community normally work well together, but frequently withhold information from each other. We are unsure about how you interact among your fellow cohort members and question whether negative interactions have affected your relationships. Moreover, we have yet to assess your intellect and skills, and wonder whether past experience qualifies you to solve the terrorist threat problem as a group. Previous sessions reveal that some individuals take pride in undermining team cohesion and effectiveness by generating and releasing false information or by non-participation in the exercise. We are discouraged that when it comes to solving critical problems in group settings such as this that your actions may not be consistent, congruent, and credible with established protocols and guidelines. Simply put, be wary of moles and free-riders.

Instructions to Second "B" Community

Low Trust-Hierarchy (LH) group designator not revealed to subjects.

You have been randomly assigned to the "B" organizational group. Your community is a group of intelligence officers whose task is to reveal the identity of a threatening terrorist group, plot, location, and date/time of an impending attack. Working with the members for your community, you will share information and piece the data together to provide a solution.

Members of your community normally work well together, but frequently withhold information from each other. We are unsure about how you interact among your fellow cohort members and question whether negative interactions have affected your relationships. Moreover, we have yet to assess your intellect and skills, and wonder whether past experience qualifies you to solve the terrorist threat problem as a group.

Previous sessions reveal that some individuals take pride in undermining team cohesion and effectiveness by generating and releasing false information or by non-participation in the exercise. We are discouraged that when it comes to solving critical problems in group settings such as this that your actions may not be consistent, congruent, and credible with established protocols and guidelines. Simply put, be wary of moles and free-riders.

In the "B" organization, there are four teams of four members each plus an overall cross-team coordinator. The four teams are organized along the lines of a traditional hierarchical command structure, each with a leader.

Team A is focused on Who, team B on What, team C on Where and team D on When. The overall coordinator coordinates information between the team leaders across team boundaries.

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APPENDIX C.

Treatment of Data (from Moonier et al., 2008 and Leweling and Nissen, 2007)

The results of the ELICIT study provide us with one data set per group. Each individual subject is assigned two measures of effectiveness.

1. Accuracy rate of ELICIT solution:

a. Each individual will receive a score of 1.0 for each correct aspect of the ELICIT solution derived from the Factoids (Who, What, Where, When Month, When Day, and When Time).

b. The subject-group's accuracy score is the mean of the 17 participants' accuracy scores.

c. Calculations:

$$\begin{aligned} & ((\text{Who} + \text{What} + \text{Where}) + (\text{When Month} + \text{When Day} + \text{When Time})/3) / 4 \\ & ((1.0 + 1.0 + 1.0) + (0.0 + 1.0 + 0.0)/3) / 4 = 0.83 \end{aligned}$$

2. Time in elapsed seconds submission of final ELICIT solution:

a. Each individual will have elapsed time recorded upon their final "Identify" of their ELICIT solution derived from the Factoids. Baseline Time is established by the maximum time elapsed until the last individual submission of their ELICIT solution (2872 seconds).

b. The subject-group's accuracy score is the mean of the 17 participants' accuracy scores.

c. Calculations:

$$\begin{aligned} & (\text{Baseline} - \text{Individual Identify Time}) / \text{Baseline} \\ & (2872 - 2385) / 2872 = 0.1695 \end{aligned}$$

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APPENDIX D.

Demographic Statistics of Subjects Participating in ELICIT Simulation Experiment

Gender	
Male	86%
Female	14%
Nationality	
American	85%
Non-American*	15%
U.S. Armed Service	
Navy	56%
Marine Corps	20%
Other**	24%
Military Rank (Marine Corps, Army, Air Force ranks/Navy, Coast Guard ranks)	
Captain/Lieutenant (O3)	54%
2 nd Lieutenant/Ensign and 1 st Lieutenant/Lieutenant Junior Grade	21%
Major/Lieutenant Commander and Lieutenant Colonel/Commander	20%
DoD Civilian Employee	5%

*Includes officers from the Australian, French, German, Hungarian, Indian, Korean, Polish, Singapore, Turkish, and Greek militaries.

**Includes Air Force, Army, Coast Guard, and DoD civilian employees.

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