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DECIDING BETWEEN PUBLIC AND PRIVATE PROVIDERS OF HIGH  
TECHNOLOGY COMMERCIAL-LIKE ACTIVITIES:  
THE CASE OF WEAPON SYSTEM DEPOT MAINTENANCE

by

James A. Forbes

Bachelor of Arts  
Pennsylvania State University, 1963

Master of Science  
Air Force Institute of Technology, 1975

A Dissertation Submitted to the School of Business and Public Management of the George  
Washington University in Partial Fulfillment of the Requirements for the Degree  
of Doctor of Philosophy

Volume I

Washington, DC  
October 2001

Dissertation directed by:

Professor Richard G. Donnelly  
Department of Management Science

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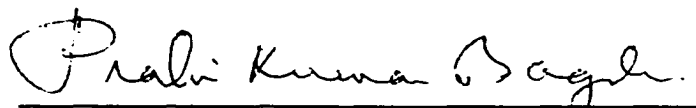
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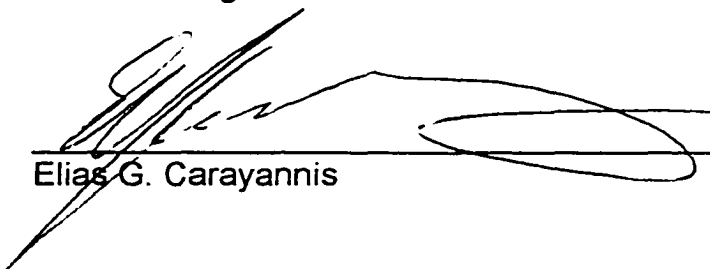
The undersigned Committee has examined Mr. James A. Forbes, a candidate for the Doctor of Philosophy degree, on his dissertation entitled: "Deciding Between Public and Private Providers of High Technology Commercial-Like Activities: The Case of Weapon System Depot Maintenance." The Committee has found the candidate's work to be acceptable and recommends to the Board of Trustees that he be granted the Doctor of Philosophy degree on January 30, 2002.

  
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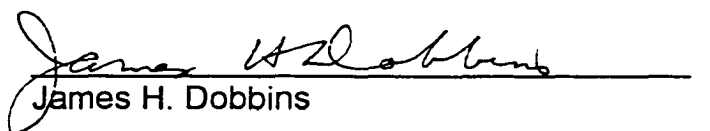
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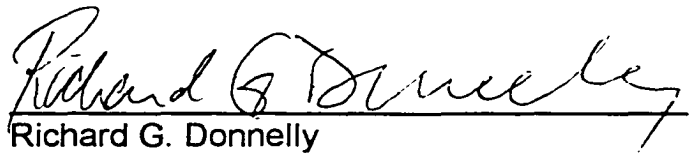
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The support and patience of all are appreciated. Any and all errors, of course, remain my responsibility.

# ABSTRACT

Deciding Between Public and Private Providers of High Technology Commercial-Like Activities: The Case of Weapon System Depot Maintenance

by

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This research addressed four questions: what factors are important to the choice between public and private providers of U.S. Department of Defense depot maintenance, the relative importance of those factors, where there is consensus and where there is not, and to what extent the factors are consistent with available theory. The choice of depot maintenance providers is an instance of a broader issue—the choice between public and private providers of high-technology commercial-like activities generally. Thus results here may have broader implications.

The author drew from the fields of neoclassical economic theory; transaction cost economics; principal-agent theory; public choice theory; public administration; technology and strategic management; relational, social exchange, and resource dependency theories; logistics and supply chain management; and theories having to do with organizational rationality and structure. From these fields, the author identified 14 theoretical constructs and, from them, 60 hypotheses which were tested using both indirect elicitation and survey methods.

Generally speaking, factors from public choice, transaction cost economics, resource/competency, and relational/social exchange fields were the most important. It is with these fields, therefore, that the present research is most consistent. Within these fields, public choice and transaction cost economics factors dominated.

This research identified two issues that went beyond the research questions. First, cognitive and motivational biases play a significant role, one that appears to have not been previously addressed. Second, there appear to be two sets of processes at work. One, principally centered in neoclassical economic considerations such as competition and scale economy, is explicit but of limited importance. The other, grounded in a combination of public choice theory, resource/competency theory, and relational/social exchange theory—but under the influence of cognitive and motivational biases—is tacit and considerably more important. This tacit process is deserving of more attention in both research and policy.

# **CHAPTER 1 INTRODUCTION**

## **Purpose of This Research**

The purpose of this study is to understand the factors that stakeholders within and outside the U.S. Department of Defense (DoD) perceived as important for deciding whether or not to outsource weapon system depot maintenance to the commercial sector.

## **The Problem and Its Significance**

The choice between public and private providers of depot maintenance is an instance of a broader issue—the choice between public and private providers of high-technology commercial-like activities generally. Both the depot maintenance-specific issue and the broader issue have significance as described below.

### **The Choice Between Public and Private Providers of Depot Maintenance and Its Significance**

Depot maintenance, defined broadly, entails repair, rebuilding, and major overhaul of weapon systems (e.g., ships, tanks, and aircraft), parts, assemblies, and subassemblies

(Forbes, Hutcheson, and Timko 1997, pg. 1-1).<sup>1</sup> Depot (i.e., centralized) repair exists as a function at all because for a wide range of components it is less expensive to repair them when they fail than to replace them, and because certain repairs require such specialized skills and equipment that it is held to be more cost-effective to repair at a central location than in the field.

DoD expended about \$15 billion for depot maintenance in U. S. government fiscal year 2000 (Beck 2000, pg. 2-2). Depot maintenance was performed by both the public and private sectors. Public depots (those owned, operated and staffed by the Department of Defense) performed approximately 57 percent of the work in fiscal year 2000, based on dollar value, and commercial sources the balance. The particular division of labor owed as much or more to accidents of history as it did to deliberate planning (Congressional Budget Office 1995, x).

During the 1980s and 1990s, numerous changes occurred in the public and private sectors that affected the division of depot maintenance work. First, there was significant interest in the perceived shift to outsourcing in the commercial sector (Christie et al. 1995). With regard to logistics operations in particular, large-scale reductions in the cost of transportation and information relative to other factors such as inventory and labor helped fuel such a shift—with significant perceived benefits from the outsourcing (Sheffi 1990; Witt 1994). Largely because of the perceived benefits, senior DoD executives have pushed for greater outsourcing of depot maintenance (Celarier 1998; Robbert, Gates, and Elliott 1997, 3).

Second, in the face of a decline in sales of new military aircraft after the end of the Cold War as well as increased complexity of components, original equipment

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<sup>1</sup> This definition is fairly encompassing. At the time this research was performed, 10 U.S.C. §2460 provided a more specific and narrower definition, primarily to provide a basis for determining compliance with a requirement in 10 U.S.C §2466 that not more than 50 percent of depot maintenance funds be used to contract for performance by non-federal employees. As defined in 10 U.S.C. §2460, depot-level maintenance and repair meant material maintenance or repair requiring overhaul, upgrading, or rebuilding of parts, assemblies, or subassemblies, and the testing and reclamation of equipment as necessary, regardless of the source of funds for the maintenance or repair. Depot maintenance or repair included software maintenance but excluded major modifications or upgrades of weapon systems that are designed to improve program performance or the nuclear refueling of an aircraft carrier. The term also excluded the procurement of parts for safety modifications but included the installation of the parts.



manufacturers (OEMs) and their major subcontractors showed a stronger interest in “heavy” or depot-level maintenance work in both the commercial and military sectors than had historically been the case (Reed 1994; Seidenman and Spanovich 2000). Additionally, third-party maintenance providers emerged with technical capabilities generally equivalent to those of the public depots (Forbes, Hutcheson, and Timko 1997, pg. 1-1; Phillips 1994; Reed 1994; Vail 1994; Witt 1994). And fourth, the total amount of DoD depot maintenance work decreased by about 35 percent in the 10-year period from 1987 to 1996 (Defense Depot Maintenance Council 1996, pg. 1-7; Office of the Deputy Under Secretary of Defense (Logistics) 1993 pg. 2-5),<sup>2</sup> with the result that the public and private sectors have been vigorously contending for slices of a diminishing pie.

In the face of these changes, the available procedures for allocating work between the public and private sectors have proved less than satisfactory. Both internal and external critics have continued to call into question their adequacy, especially in terms of comprehensiveness, consistency, fairness, and effectiveness in mitigating performance risk (Congressional Budget Office 1995, ix; Hansen et al. 1995; Warren 1996). To some extent these criticisms are legitimate: to some extent they reflect the competing sectors’ parochial interests in retaining or obtaining workload. Regardless, the department did not have, at the time of this research, a depot maintenance management process for making the decision to outsource or not outsource in which the various constituencies could place confidence.

What have been the procedures for deciding whether to outsource depot maintenance to the commercial sector? DoD has, at various times, tried various methodologies such decision tree analysis (DTA); life-cycle cost (LCC) analysis; and, more recently, the so-called “CORE” methodology (a specific method for deciding what is and what is not core workload) to express analytically and explicitly the norms and values important to these decisions. The DTA method depended on simple yes-no responses to a chain of questions and was an unsophisticated approach to a complex problem. LCC analysis, by focusing exclusively on cost (and at that, only production cost while ignoring transaction costs), ignored potentially crucial differences in relative performance risk. And in any event,

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<sup>2</sup> 1987 was commonly used as a baseline since it represented a peak of sorts toward the end of the Cold War.

analysis of public and private options often did not indicate a clear cost advantage for either sector (Parker 1994, pg. F-3; Warren 1997, 25). Although the CORE methodology, which was in use at the time this research was undertaken, addressed risk and initially appeared to hold promise, in practice it had proved difficult to decide in any consistent way what needed to be in core workload and what did not. For instance, all three military services entrusted some frontline weapons to commercial sources of repair—suggesting that performance by federal government employees in organic maintenance depots is not always essential, but leaving unclear the circumstances where it is not. All of the more mechanical decision methods narrowly focused on depot maintenance per se rather than considering depot maintenance as one component of a supply chain extending from factory to military end user.

Additionally, there was some indication—perhaps not unexpected—that the services<sup>3</sup> were able to adapt the mechanical methods to yield results consistent with the views of their senior leaders (Congressional Budget Office 1995, xi). Such senior judgments might even do a better job than mechanical methods of reaching useful conclusions, but were subject to criticism because they tended not to be open to evaluation (Congressional Budget Office 1995, xii; Gulley and Mei 1985, 1548).

Freeman (1984, 42-43) has argued that organizations are effective to the extent that they satisfy the interest groups on which they depend for resources and support. Further, he has argued that prior to development of strategies and specific programs, managers should undertake stakeholder behavior analysis and explanation (Freeman 1984, 131). In this spirit, rather than attempting to create a new model for making the public-versus-private choice, it was the intent of the author to examine the factors that are perceived as important and who it is that perceives them as important. By doing so, by showing how those perceived factors differ by stakeholder group, and by showing how they do or do not relate to received theory, it was hoped that this study could facilitate the development of policy on the depot maintenance outsourcing decision.

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<sup>3</sup> The terms “services,” “components,” and “agencies” are used in inconsistent and confusing ways by various studies when referring to DoD organizations. Here we will use the term “services” to mean the Army, Navy, and Air Force. The term “components,” when used in this study, includes the services, the Marine Corps, and the defense agencies (e.g., Defense Logistics Agency).

## The Choice Between Public and Private Providers of High Technology Commercial-Like Activities and Its Significance.

Despite the difficulties surrounding them, the habituated norm- and value-based institutional procedures for choosing between public and private providers can be understood to carry important benefits, because choices are narrowed, the overall amount of work required to make choices is reduced (Berger and Luckmann 1966, 53), and ideas that would turn out to be worthless are discarded to begin with (Margolis 1993, 32). The DTA, LCC, and CORE methodologies can be considered attempts to make tacit norms, values, and procedures explicit in formal rules and regulations. That these various efforts fell short of universal acceptability should not be surprising. Explicit theory is always an abstraction and simplification of a deeper and more complete tacit understanding (Argyris and Schon 1978, 3; Bernstein 1983, 31-33; Rioch 1970, 56-66; Vickers 1965, 103-111). Because this is the case, theory can never correspond exactly to the underlying, inter-subjective understanding it is attempting to capture (Senge 1992). Further, the underlying tacit understanding is community-dependent. Thus different constituencies can be operating from different theories and not be aware of that difference. That scenario is especially likely where technology comes into play, since different constituencies can have a stake in the design and operation of technology, and the stochastic nature of technologies that emerged in the latter part of the twentieth century undermined the relevance of established norms, values, and procedures (Weick 1990, 5-21).

Given the existence of different, often disparate, constituencies, resolution of the issues to everybody's satisfaction was likely to be a task not worth undertaking. However, as indicated above, what was proposed for this study was to attempt to understand the various theories in use and how they were the same or differed across communities—as Rorty has described it, determining the extent to which they could be woven together (1991, 38). Such an understanding, coupled with an understanding of the extent to which the theories in use correspond to received theory, could at least inform the debate and hopefully move it along. Since the depot maintenance outsourcing decision is an instance of a broader set of problems—the choice between public and private provision of high technology,

commercial-like activities generally (Schine and Dunham 1994)—it is hoped that this research can shed some light on the broader problem as well.

## Research Questions

The research questions are as follows:

1. What factors are perceived as important to the choice between public and private providers of depot maintenance?
2. What is the relative importance of the factors compared to one another?
3. Where is there consensus between different constituencies, and where are there differences?
4. To what extent are the perceptions consistent or inconsistent with received theory?

## Approach

Keeney, Winterfeldt, and Eppel (1990, 1011-1030) have suggested that there are five methods for eliciting and understanding norms and values in policy decision making. They include:

- Surveys
- Indirect elicitation of public values by inferring values from behavior in the marketplace
- Direct value elicitation, for instance through multi-attribute utility methods
- Focus groups
- Public involvement through a series of hearings and meetings.

The Department of Defense used the public involvement approach in two studies (Office of the Deputy Under Secretary of Defense (Logistics) 1993; Parker 1994). Subsequently, Forbes, Hutcheson, and Timko (1997) used multi-attribute utility and focus groups in combination to empirically study the depot maintenance outsourcing decision. They identified almost 30 relevant factors and used those to formulate a multi-attribute utility model of the outsourcing decision process. Their model, however, like any other, was a simplification. Additionally, its findings could not be generalized, since they tested the

model on only one aircraft type; and their research did not consider important, relevant streams of literature. These streams included public choice theory, strategic management, relational/social exchange theory, and the literature on organizational rationality and structure. Public choice theory informs our understanding of political markets and interest group behavior. The strategic management literature is where one finds discussion of the “core” concept. Relational/social exchange theory recognizes that partnerships are an alternative to the in-sourcing-outsourcing dichotomy. And conjectures such as Cohen, March, and Olsen’s “garbage can” model call into question the idea that the in-sourcing-outsourcing choice might be a rational activity at all.

The intent of this research is to build on the prior DoD studies as well as Forbes, Hutcheson, and Timko’s work, and at least partially “triangulate” the subject area by employing the indirect elicitation and survey methods. In the first approach, indirect elicitation is used to analyze weapon system-related source of repair data created by the armed services. These data associated the choice of public or private depot maintenance provider (by weapon system) with the reasons for the choice, where the “menu” of choices was established in advance. Analysis of these data was proposed because the menu of choices (perhaps better termed “criteria”) was closely aligned with the subject matter of this dissertation, the data had not been previously explored statistically, and the criteria corresponded reasonably well to the relevant concepts and hypotheses identified during the literature review.

The service-generated weapon system data, although comprehensive in the sense of including all DoD weapon systems, did not touch all of the relevant concepts. Thus, it was proposed also to survey stakeholders both in and outside DoD to determine their perceptions related to depot maintenance outsourcing decisions. The stakeholders to be surveyed included the following:

- Managers within the Department of Defense, including users of depot maintenance, depot maintenance personnel, item managers (who buy depot repairs for reparable components), and acquisition managers (who make many of the early public-versus-private choices)
- Managers on the staffs of defense contractors

- Defense attaches from embassies of U.S. allies. (Data from this latter group were not included in the analysis, because responses were too few for statistical significance).

## Frame of Reference

The present research borrows from both the functionalist and interpretive frames of reference in order to benefit from the insights they have to offer. Using multiple perspectives is not an especially novel idea. Graham Allison, for instance, pursued such a course over 25 years ago when he used three different models (rational choice, organization theory, and bureaucratic politics) to examine the Cuban Missile Crisis (Bendor and Hammond 1992, 302).

The functionalist account seeks to discover law-like relationships (Burrell and Morgan 1979, 41), while the interpretivist account provides a perspective within which contradictory and inconsistent results are expected because experience is not considered to be objective in the usual logico-technical sense. Instead, objective knowledge means socially constructed, reciprocal typifications of conduct (Berger and Luckmann 1966, 58), and the point of view is that of the social actors themselves (Burrell and Morgan 1979, 227) rather than external to them. Given two or more communities, each can see (i.e., construct) an objectively different result. The author anticipated that the interpretive model would be useful in understanding the origins of both the inconsistent depot maintenance results and the inconsistent results in the received theory, because the model assumes there may be many communities, each with its own typification. If many communities, the multiple typifications result in different norms and attitudes; and—as Fishbein (1979, 69) has argued—different subjective norms and attitudes will be accompanied by different behaviors.

Although the interpretive model dominates the research, its application is probably best characterized as generally rather than strictly interpretive. Many components of the theoretical base from which this research draws are rooted in the functionalist paradigm. Thus functionalist theories are used here for interpretive purposes. The epistemological conflicts that consequently arise do so at a level beyond easy reach. The author does not claim to have either resolved or identified all of the conflicts.

## Organization of This Dissertation

Chapter 2 is a review of the literature. In that chapter the reader will find a review of three bodies of research:

- Major Department of Defense studies that were either devoted specifically to depot maintenance or that treated depot maintenance as a major subject area. There were 10 major studies during the 1990s. This section of the literature review also summarizes related DoD policy.
- Related studies and publications by RAND, the Logistics Management Institute, the Center for Naval Analyses, Coopers and Lybrand, the Congressional Budget Office, the General Accounting Office, and others that dealt with depot maintenance
- The general literature related to outsourcing and privatization. This literature comprises nine fields: neoclassical economic theory; transaction cost economics; principal-agent theory; public choice theory; public administration; technology and strategic management; relational, social exchange, and resource dependency theories; logistics and supply chain management; and theories having to do with organizational rationality and structure. Out of this literature base, the author identified 14 theoretical constructs.

Chapter 3 then presents the methodology for analyzing the weapon system-related data and the methodology for the survey.

Chapter 4 analyzes the survey data that relate to the first eight theoretical constructs, those related to economics. It also examines and interprets a significant problem found in the survey data: the frequent appearance of bimodal response patterns, clear evidence of multiple constituencies (or, more formally, multiple, socially constructed typifications).

Chapter 5 analyzes the survey data that relate to the last six theoretical constructs, those from fields outside economics.

Chapter 6 analyzes the service-generated data related to weapon systems.

Chapter 7 discusses and integrates the results of data analysis with the results of the literature review, explores the implications of the research, makes recommendations for further research, and reaches some tentative conclusions.

Additionally, a number of appendices provide supporting and amplifying information.





# CHAPTER 2

## REVIEW OF THE LITERATURE

The received literature relevant to depot maintenance outsourcing includes a set of studies—most of which were funded by the Department of Defense—that either focus specifically on depot maintenance or address it as a major issue. As shall become evident from the discussion below, these studies and contemporaneous Department of Defense policy documents identify some of the factors that stakeholders might consider important. They do not, however, provide either a comprehensive or consistent set of factors. Nor do they, in most cases, provide an especially clear understanding of why certain factors might be important.

As indicated in Chapter 1, to get at these considerations it was necessary to look elsewhere—particularly into the fields of (and the much more extensive literature in) neo-classical economic theory; transaction cost economics; principal-agent theory; public choice theory; public administration; technology and strategic management; relational, social exchange, and resource dependency theories; logistics and supply chain management; and theories having to do with organizational rationality and structure. This chapter will first summarize the studies that touch directly on depot maintenance and then examine the broader literature. It should be noted that this chapter will depart somewhat from convention. A literature review is generally limited to that alone and excludes contributions from the research it is supporting. As shall be seen, this research will pose 60 hypotheses to be tested. As an aid in making the origins of the hypotheses readily apparent, without a second presentation of theoretical material, the hypotheses are presented in this chapter,

interposed with discussion of the relevant literature that motivate them (see appendix A, also).

## Depot Maintenance Literature

### Major Department of Defense Studies

From 1993 through the time during which the present research was conducted, there were at least 10 major studies by the Department of Defense (DoD) that were either devoted specifically to depot maintenance or treated depot maintenance as a major subject area. Performing organizations included the Joint Staff (Went 1992), the Deputy Undersecretary of Defense (Logistics) (1993), the Commission on Roles and Missions of the Armed Forces (White 1995), the Defense Science Board (Gansler and England 1996; Odeen 1996; Parker 1994; Tuttle 1996; Tuttle et al. 1998), the National Defense Panel (Odeen et al. 1997), and a DoD Product Support Reengineering Team (1999). Table 2-1 summarizes the 10 major studies that were accomplished during the decade of the 1990s through the year 1998.

#### Policy Documents

In the five-year span covered by Table 2-1, there is a noticeable transition in emphasis from consolidation and downsizing for reducing costs (in the first two studies in the table) to outsourcing (and “competitive sourcing”) for both reducing costs and improving capabilities. Outsourcing was almost an afterthought in the Went study. It first became a central issue beginning with the Commission on Roles and Missions (Robbert, Gates, and Elliott 1995, 3). In another shift, the presumption that an organic,<sup>1</sup> core depot maintenance capability is needed to control risk (*Integrated Management study and first Defense*

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<sup>1</sup>. The term “organic” is used frequently in the DoD literature on depot maintenance and other logistics capabilities. Organic refers to activities that are performed internally by the department in its own behalf. Depots that are owned, managed, and staffed by DoD are organic.

**TABLE 2-1**  
**MAJOR DOD STUDIES OF DEPOT MAINTENANCE**

Study	Primary Focus	Approach	Major Results Relevant to Depot Maintenance
1993— <i>Depot Maintenance Consolidation</i> (sometimes called the Went Study after its chairman), Joint Staff	Reduction in excess capacity	Dedicated study team working in conjunction with representatives of the individual components	<ul style="list-style-type: none"> <li>•Recommended consolidation under a Joint Depot Maintenance Command and closure of a significant number of depots through the Base Realignment and Closure Process.</li> <li>•Recognized contracting out to commercial industry as a long-term possibility but did not discuss in any detail.</li> </ul>
1993— <i>Integrated Management of Department of Defense Depot Maintenance Activities</i> , Deputy Undersecretary for Logistics	<ul style="list-style-type: none"> <li>•Determining whether organic core capability is needed</li> <li>•Benefits of enhanced competitive bidding for depot work</li> <li>•Reduction in excess capacity</li> <li>•Potential benefits of consolidation of depot activities</li> </ul>	Dedicated study team working in conjunction with representatives of the components	<ul style="list-style-type: none"> <li>•Organic core capability was needed to minimize operational risk and control costs.</li> <li>•Competition, whether public-private, public-public, or private-private, was driving efficiencies that might not otherwise be realized.</li> <li>•Depot maintenance personnel, budgets, and number of depots remaining open were decreasing at roughly the same rates as active force military personnel levels and operational activity levels.</li> <li>•Preferred organizational option was empowered Defense Depot Maintenance Council (essentially a weak hierarchical structure).</li> </ul>

**TABLE 2-1**  
**MAJOR DOD STUDIES OF DEPOT MAINTENANCE (CONTINUED)**

<b>Study</b>	<b>Primary Focus</b>	<b>Approach</b>	<b>Major Results Relevant to Depot Maintenance</b>
1994— <i>Report of the Defense Science Board Task Force on Depot Maintenance Management</i> , Under Secretary for Acquisition and Technology	<ul style="list-style-type: none"> <li>•Rationale for retaining service maintenance depots</li> <li>•Balance of workload between public and private sectors</li> <li>•Appropriateness of competition as a management tool to determine workload sources of repair</li> </ul>	Task force comprising senior representatives of both the Department of Defense and industry	<ul style="list-style-type: none"> <li>•Armed services must retain control of core depot capabilities to satisfy 10 U.S.C. requirements.</li> <li>•Replace congressionally mandated 60/40 restriction with core concept.</li> <li>•Major modifications and upgrades should be primarily accomplished in private sector.</li> <li>•Excepting Air Force, public-private competition should be abandoned.</li> </ul>
1995— <i>Report of the Commission on Roles and Missions of the Armed Forces</i> , Commission on Roles and Missions of the Armed Forces	Review appropriateness of then current allocations of roles, missions, and functions among the Armed Forces; evaluate and report on alternative allocations; recommend changes	Commission established for this purpose; supported by study team	<ul style="list-style-type: none"> <li>•DoD should move to a depot maintenance system relying on the private sector.</li> <li>•Establish a time-phased plan to privatize essentially all existing depot maintenance.</li> <li>•Create an office under the Assistance Secretary (Economic Security) to oversee privatization of depots.</li> <li>•Place support of all new systems (including depot maintenance) with private contractors.</li> </ul>

**TABLE 2-1**  
**MAJOR DoD STUDIES OF DEPOT MAINTENANCE (CONTINUED)**

Study	Primary Focus	Approach	Major Results Relevant to Depot Maintenance
1996— <i>Report of the Defense Science Board 1996 Summer Study on Achieving an Innovative Support Structure for 21st Century Military Superiority: Higher Performance at Lower Costs</i> , Under Secretary for Acquisition and Technology	Assessment of the then current DoD support infrastructure and processes to recommend approaches that would enhance performance and reduce cost	Task force comprising senior representatives of both Department of Defense and industry	<ul style="list-style-type: none"> <li>•Place public-sector employees only in inherently governmental functions (war-fighting, direct battlefield support, decision policy making, and oversight).</li> <li>•Accomplish all other functions, including depot maintenance, in the private sector.</li> </ul>
1996— <i>Report of the Defense Science Board Task Force on Logistics Modernization</i> , Under Secretary for Acquisition and Technology	DoD logistics modernization generally	Task force comprising senior representatives of both Department of Defense and industry	<ul style="list-style-type: none"> <li>•Undertake life-cycle logistics support for new systems.</li> <li>•Most effective way to outsource is whole systems rather than functions such as cataloging or depot overhaul.</li> <li>•Rely on private sector using commercial-like practices such as “power-by-the-hour” contracts.</li> </ul>

TABLE 2-1  
MAJOR DOD STUDIES OF DEPOT MAINTENANCE (CONTINUED)

Study	Primary Focus	Approach	Major Results Relevant to Depot Maintenance
<p>1996—<i>Report of the Defense Science Board Task Force on Outsourcing and Privatization</i>, Under Secretary for Acquisition and Technology</p>	<p>Develop recommendations on ways DoD could use outsourcing as a tool to reduce the cost of the support structure and free up substantial funds to support modernization needs</p>	<p>Task force comprising senior representatives of both Department of Defense and industry</p>	<ul style="list-style-type: none"> <li>•Outsourcing is expanding rapidly in the private sector. While cost savings are a factor in growth of outsourcing, access to better technology and better qualified people is the primary reason. Companies have also turned to outsourcing to focus on core competencies.</li> <li>•All DoD support functions could be contracted out to private vendors except those that are inherently governmental, are directly involved in war-fighting, or for which no adequate private-sector capability exists or is likely to exist.</li> </ul>
<p>1997—<i>Transforming Defense: National Security in the 21st Century</i>, National Defense Panel</p>	<p>Long-term issues facing U.S. defense and national security. Included operational concepts, force structures, equipment; procurement reform, changes to support structure (including depot maintenance), and base closures.</p>	<p>Panel comprising senior national figures</p>	<ul style="list-style-type: none"> <li>•DoD is not an efficient or effective manager of industrial facilities and should get out of the business to the extent possible.</li> <li>•Congress should provide legislation that removes statutory barriers to greater private-sector role in mission-essential depot maintenance work.</li> </ul>

TABLE 2-1  
MAJOR DoD STUDIES OF DEPOT MAINTENANCE (CONTINUED)

Study	Primary Focus	Approach	Major Results Relevant to Depot Maintenance
1998— <i>Report of the Defense Science Board Acquisition sub-panel of the Defense Acquisition Reform Task Force on Defense Reform</i> , Under Secretary for Acquisition and Technology	Reshaping the acquisition workforce (defined broadly to include logistics and the depot maintenance function) to perform acquisition “better, faster, and cheaper”	Task force comprising senior representatives of both Department of Defense and industry	<ul style="list-style-type: none"> <li>•Expand the outsourcing of sustainment activities that need not be performed in house.</li> <li>•Provision of product support [including depot maintenance] by government personnel indicates DoD’s failure to fully integrate with and capitalize on strengths of industry.</li> <li>•DoD has stayed involved in functions that industry is well-qualified to handle.</li> <li>•DoD’s depot repair cycle times of 56 to 130 days were far greater than approximately 5 to 21 days in private sector.</li> </ul>
1999— <i>Product Support for the 21st Century</i> , DoD Product Support Reengineering Implementation Team	Build on extant product support improvement efforts, couple them with appropriate commercial practices, reengineer product support from war-fighters through sustaining base	Dedicated study team working with representatives of the individual components and industry subject matter experts.	<ul style="list-style-type: none"> <li>•Competitively source the product support (including depot maintenance) for 30 pilot programs.</li> <li>•Expand “prime vendor” arrangements.</li> <li>•Increase funding and incentives for enhancements of reliability, maintainability, and sustainability through continuous technology refreshment.</li> </ul>

*Science Board study*) shifted to a position that no form of weapon system support—depot maintenance or otherwise—need necessarily be a core capability (as evidenced in the later Defense Science Board studies).

This transition from a lack of concern with outsourcing in early 1993 to an effort to legitimize depot maintenance as a core competency in late 1993 and 1994, and then to

challenging that role for depot maintenance and support in general since 1995 is, of course, a significant transformation. The transformation has not been particularly smooth, nor is it complete or stable. There were, at the time of this writing, constituencies both in and outside the Department of Defense both for and against outsourcing depot maintenance (Congressional Budget Office 1995, pg. 1-5). (Such was also the case for outsourcing of DoD commercial activities in general (Robbert, Gates, and Elliott 1997, 11).) At various times different constituencies' views prevailed, with the result that the department's official policy on the subject has been at times ambiguous and, over time, inconsistent. To illustrate, DOD regulation 5000.2R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPS) and Major Automated Information Systems (MAIS) Acquisition Programs," in 1996 stated:

*It is DoD policy to retain limited organic core depot maintenance capability to meet essential wartime surge demands, promote competition, and sustain institutional expertise. Support concepts for new and modified systems shall maximize the use of contractor provided, long-term, total life-cycle logistics support that combines depot-level maintenance along with wholesale and selected retail materiel management functions. Life-cycle costs and use of existing capabilities, particularly while the system is in production, shall play a key role in the overall selection process. Other than stated above, and with an appropriate waiver, DoD organizations may be used as substitutes for contractor-provided logistics support, such as when contractors are unwilling to perform support, or where there is a clear, well-documented cost advantage. The waiver to use DoD organizations must be approved by the MDA [milestone decision authority] (emphasis added) (Office of the Secretary of Defense 1996a, para. 3.3.7).*

Note that this paragraph is internally inconsistent when it attempts to both defend the concept of a core depot maintenance capability and simultaneously require a waiver to use DoD organizations. A slightly later version of the same regulation, but published in the same year, softened the argument for outsourcing noticeably when it said:

*Support resources such as operator and maintenance manuals, tools, support equipment, training devices, etc. for major weapon system components shall not be procured before the weapon system/component hardware and software design stabilizes. The PM shall consider the use of embedded training and maintenance techniques to enhance user capability and reduce life-cycle costs. Where they are available, cost-effective, and can readily meet the user's requirements, commercial support resources shall be used (emphasis added) (Office of the Secretary of Defense 1996a, para. 4.3.3.4).*



During the same time frame that the second 1996 version of DoDR 5000.2R was published, the department issued its *Plan for Increasing Depot Maintenance Privatization and Outsourcing* (Assistant Deputy Under Secretary of Defense (Logistics)/Maintenance Programs Plans and Resources 1996). This plan, like the 5000.2R statement, had difficulty articulating a consistent policy. One of the tasks in the plan called for enumerating and evaluating the steps that would be needed to establish a preference for outsourcing logistics support (including depot maintenance) for new and future weapon systems. Elsewhere the document generally assumed that the department needed to retain a core capability, with the term “core” defined as follows:

The organic depot maintenance capability (including personnel, equipment, and facilities) maintained by the Department of Defense as the ready and controlled source of technical competence and resources necessary to ensure effective and timely response to a mobilization, national defense contingency situations, and other emergency conditions (Assistant Deputy Under Secretary of Defense (Logistics)/Maintenance Programs Plans and Resources 1996, Glossary).<sup>2</sup>

As another measure of the inconsistency, the concepts of promoting competition and sustaining institutional expertise were absent from this definition, even though they were found in the first 1996 version of DoDR 5000.2R—published during the same year. Policy as of late 1997 was to “pursue public-private competitions for depot maintenance to the full extent allowed by law” (Office of the Assistant Secretary of Defense for Public Affairs 1997).

The individual armed services, not surprisingly, struggled with the same difficulties. For instance, in 1996 the emergent Air Force policy on deciding between private and public depot sources of repair was based on the tenet that each service should retain the organic skills, facilities, and equipment to ensure essential capability to meet war scenarios, and that this capability was what was meant by the term “core” (Hq AFMC/LGPY 1996). However, when the Air Force participated in the 1994 Defense Science Board study on depot maintenance, it took the position that public-public and public-private competitions should be used to reduce cost and determine the size and structure of the organic depot

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<sup>2</sup> Almost identical language is found in the 1 January 1996 version of 10 U.S.C. §2464.

capability (Parker 1994, 3). There is something problematic when “core” is defined as the organic skills, facilities, and equipment to ensure essential capability, but then core capability is determined through cost competition with the private sector.

Before closing this section, it is worth noting that there is symbolic uncertainty not just with the definition of “core” but also with the definition of depot maintenance itself. In Chapter 1, we defined depot maintenance as the centralized repair, rebuilding, and major overhaul of weapon systems (e.g., ships, tanks, and aircraft), parts, assemblies, and subassemblies. Both historically (Townsend 1978, 15) and in current practice, the boundary around depot maintenance has not been especially well fixed. For instance, in the late 1990s the Air Force converted some avionics and engine repair from three-level to two-level maintenance. That is, they eliminated the field (“intermediate”) level of repair and moved that workload in with what had been depot-level repair—leaving just two organizational levels: the depot level and on-aircraft. Is the sum of what had been depot repair and field repair now depot-level repair, consistent with one Defense Science Board Report (Parker 1994, 10)? Or does the meaning of “depot level” inhere in the nature of the work itself? The Navy had also recently blurred the distinction between depot and intermediate levels by assigning work on a regional basis, initially for ship-related work and by shifting aviation work previously performed in depots to the field (Forbes et al. 2001, 12).

In summary, consistent answers to the question of who should do depot-level maintenance are not available, in either the studies the department has performed or in its policy. To some extent this uncertainty is both reflected in and exacerbated by symbolic uncertainty. We shall next examine studies by organizations outside the department.

### Related Literature

In addition to studies performed by the department, a number of related studies and publications appeared during (roughly) the 1990s by RAND, the Logistics Management Institute, the Center for Naval Analyses, Coopers and Lybrand, the Congressional Budget Office, the General Accounting Office, and others. (Studies by the first four organizations were DoD-sponsored.) We review this literature next. The order of presentation begins with

studies that focus on the issue of organic versus contract repair, and then moves onward to other relevant articles and reports.

### *Depot Repair in General*

Embry et al. (1985) examined contractor versus organic depot maintenance of Navy aviation components in the mid 1980s. They noted at that time that the services preferred to use organic maintenance facilities because they were easier to control than contractors; were perceived to be more flexible, responsive, and less expensive; and had the residual capacity to handle surge workloads in wartime. Important characteristics of Navy aviation components included very low expected peacetime and wartime repair volumes (making it difficult to achieve efficiency or responsiveness), absence of repair contractors with a broad scope of repair capability (hence affecting scope economies), and the pairing of a monopolistic buyer with a monopolistic supplier— which could be either the manufacturer or the government’s own depot. Embry et al. recommended a strategy that featured early reliance on the original manufacturer until designs stabilized, followed by a transition to a controlled (i.e., organic) source, followed by a second transition back to contractor support as technology ages and more repair sources become available.

Camm (1993), drawing largely on concepts from transaction cost economics, explored the issue of organic and contract sources of depot-level services in 1993 as a “make” versus “buy” decision. He held that a review of the organic-contract split would likely support continuing a significant amount of organic logistics capability. The essence of his reasoning was that DoD would (or should) follow much the same dictates that private firms do in reaching similar decisions. As he summarized it, private firms retain activities in house:

- When the uncertainty of the environment and complex technology require close control and coordination
- When few outside firms have the required technology or process capability
- When it is difficult to objectively measure important elements of the activity
- To provide a means of training managers who will oversee the work, or
- To create, albeit in house, a competitor.

Camm argued that all five criteria were relevant to DoD: (1) the DoD depot maintenance environment is uncertain; (2) the technology and repair processes are complex; (3) some of the elements of the activity are difficult to objectively measure; (4) there is a need to train depot maintenance managers; (5) and, absent an organic capability, there might not be an alternative source. This being the case, the department should retain depot maintenance activities in house even if the private sector were arguably more efficient. The first, fourth, and last criteria are clearly echoed in the 1996 versions of DoDR 5000.2R.

The Congressional Budget Office (1995) published *Public and Private Roles in Maintaining Military Equipment at the Depot Level* in 1995. This report held that shifting a larger share of maintenance to the private sector could reduce costs while providing high-quality, responsive support. It also held, however, that rather than rely on the core concept of public-private competition, the Department of Defense should administratively allocate workloads to public, private, and mixed modes of production based on particular strengths of each mode. (As we shall discuss later, this is a concept comfortable within competency-based theory.) The Congressional Budget Office report did not define a process for doing so or shed much light on what might be the particular strengths of each mode.

The Center for Naval Analyses (CNA) (Keenan et al. 1994) examined the question of public versus private depot maintenance in the Navy shortly after Camm's work. CNA asserted that three issues were central:

- *Core issue* —Is there an operational reason why the Navy needs to keep depot maintenance in-house?
- *Efficiency issue*—Is commercial repair cheaper?
- *Industrial base issue*—Does placing depot repair in the commercial sector help protect national production capability?

Looking at the core issue from the perspectives of control, process integration, and market limitations—much as did Camm—CNA reached essentially the opposite conclusion, that control was not a critical concern. Using data from both the Navy's commercial activities program (which did not include depot maintenance) and from competition of depot maintenance workloads, they found savings on the order of 20 to 40 percent when work was competed between public and private providers. Finally, they concluded that

moving more repair work to the private sector would delay but not prevent the eventual need to dispose of excess private construction or assembly capacity.

Cox (1994), in support of CNA efforts to develop Navy industrial base policy, looked at seven options for restructuring Naval Aviation Depot (NADEP) maintenance. Four of them had to do with various means of reducing the excess infrastructure that resulted from the end of the Cold War. Three of them, however, dealt with privatization. These three, along with Cox's assessment of them, are summarized in Table 2-2.

Chenoweth and Abell (1994) examined the effectiveness of contractual repair of avionics-related depot-level recoverables<sup>3</sup> managed by the Air Force's Ogden Air Logistics Center. They found that contractual repair was not responsive. Actual flow days were on the order of twice the negotiated flow days. They attributed this non-responsiveness largely to the government-imposed terms and conditions under which contractors worked. Examples of policies that impaired responsiveness included:

- Accumulation of reparable into batches before shipping, rather than shipping them to the contractor as they became available
- The arrival at the contractor's facility of contractual authority to perform repair and the reparable items themselves at different times
- Absence of a mechanism to routinely track how long repairs actually take
- Absence of incentives to turn assets around quickly
- Prohibitions against using repair parts purchased in support of one contract on a different contract (with the result that reparable would sit awaiting parts even though parts were available).

The Director for Defense Management Issues of the General Accounting Office (GAO) reported on a GAO analysis of DoD depot maintenance policy in a statement to the

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<sup>3</sup>. Another source of terminological confusion is the set of terms "recoverables," "reparables" (for obscure historical reasons the term is not spelled "repairables"), "rotables," "components", "secondary items," and "primary items." A weapon system platform (e.g., an aircraft or ship) is a primary item. Secondary items are removable parts of a weapon system such as a tire, black box, rivet, skin panel, gun, etc. The terms "components" and "secondary items" mean essentially the same thing and are used interchangeably. Recoverable components are those that, after removal from a weapon system, can be repaired and returned to service. The terms recoverables, reparable, and rotables mean the same thing and are generally used interchangeably.

**TABLE 2-2**  
**NAVAL AVIATION PRIVATIZATION ALTERNATIVES**

Alternative	Assessment
1. Privatize all NADEP maintenance and engineering support functions with sole-source contracts to the original equipment manufacturer (OEM) for each aircraft	Privatization without cost competition did not make good business sense. Further, with a few exceptions, OEMs were not appropriate as long-term maintenance or repair contractors.
2. Privatize and compete NADEP maintenance and engineering support using non-OEM contractors and contractor facilities	Recommended for commercial derivative aircraft; already effectively used by both the Navy and Air Force on selected commercial-derivative aircraft. Less effective for unique military aircraft where only one set of government-owned jigs exists, or where long-term competition is hampered by difficulty of market entry due to an entrenched incumbent.
3. Privatize and compete NADEP maintenance and engineering support functions with non-OEM contractors, but house the repair in a single government-owned facility	Possible cost of business advantages for all Navy aircraft types, and has the potential to improve costs through competition. Inconsistent with DoD policy at the time of the study.

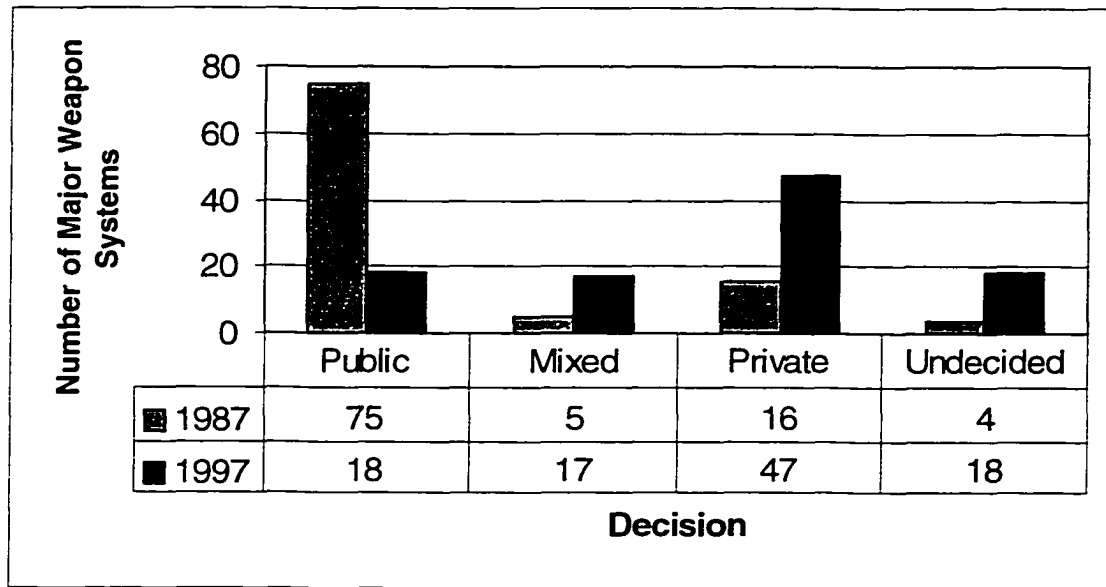
House of Representatives Committee on National Security (Warren 1996). He concluded that DoD policy:

- Provided a framework for managing defense depot maintenance activities;
- Set forth a clear preference for moving workload to the private sector; but
- Was not consistent with congressional guidance to use public-private competitions for non-core workloads.

Section 311(d)5 of the National Defense Authorization Act for fiscal year 1996 stated that DoD policy should provide for competition of non-core work between public and private entities when doing so could reduce costs. Warren held that the DoD policy called for such competition only when there was not an adequate competition among private firms alone.

Warren's statement also raised a caution flag with regard to the potential results of competitions and the ability to mount them. He held that the GAO's review of previous public-private competitions showed that 67 percent were won by DoD depots at an average cost 40 percent less than the closest private-sector competitor. Further, there were no private-sector offers for almost a quarter of the competitions, and only one private-sector

**FIGURE 2-1**  
SOURCE OF REPAIR DECISIONS FOR MAJOR WEAPON SYSTEMS, FISCAL YEARS 1987 AND 1997



competitor in an additional 35 percent. He also noted that of 240 active depot maintenance contracts examined, 182 had been awarded to a sole source.

In a later report (Warren 1998b, 20-21), the GAO reviewed 71 DoD system acquisition programs to determine how they were approaching the decision on source of repair, and the decisions they were reaching. The GAO found so much confusion about guidance and widely disparate approaches to decision-making that it believed the service secretaries should reassess the adequacy of analysis supporting decisions made over the preceding two years (1996 and 1997). Additionally, the GAO found a real, empirical shift from the historical preference for organic sources to a preference for commercial sources. (Figure 2-1)(Warren 1998b, 10).

Leland (1995) began with the assumptions that the portion of depot maintenance that should be conducted in-house was modest and that acquiring maintenance through market transactions would improve flexibility while reducing cost. He looked at the features of depot maintenance that would foster or impede privatization, and described the favorable and unfavorable features shown in Table 2-3. This table merits some caution. At least the first two “features” might be better characterized as assertions. The idea that future demand for depot maintenance is predictable is contradicted by the results of other

researchers (Embry et al. 1985, 8-9; Moore, Embry, and Dey 1985, 2), as is the notion that privatization will not produce firms with substantial market power—discussed later in this chapter under the heading “Imperfect Competition.”

**TABLE 2-3**  
**FEATURES AFFECTING PRIVATIZATION OF DEPOT MAINTENANCE**

<b>Feature</b>	<b>Impact on Privatization</b>	<b>Rationale</b>
Future demand for various types of maintenance services is predictable and can be made widely available.	Fosters	Provides common and accurate information on which to base valuations. Homogeneous valuations of assets for sale expedites exchange and maximize seller's revenue. Helps assure markets will operate smoothly after divestiture.
Will not produce commercial concerns with substantial market power.	Fosters	Workload conducted commercially at time of study (stated as 40 percent) is distributed among many different companies.
Amount of work involved is substantial.	Fosters	If 20 facilities that were candidates were converted directly into equivalent commercial firms each would have nearly \$500 million in revenue.
Workers at public facilities and communities that host them will oppose efforts at privatization.	Hinders	Self-evident
Many persons within and outside the military believe that retaining capital investment in public depots is critical to responsiveness.	Hinders	Can be expected to oppose privatization (implied in report rather than explicit)
Existing private-sector providers may balk at having potential competitors	Hinders	Can be expected to oppose privatization (implied in report)
Market for depot maintenance has shrunk substantially since end of Cold War.	Hinders	Excess capacity in both the private and public depots—requiring reduction in quantity of capital and/or labor. Conflict between pursuit of efficiency and stakeholder interests is likely to be intense.
Equity concerns and perceived harm from privatization will depend on how implemented.	Hinders or at least makes more complicated	If privatization is concentrated on certain facilities, then impact on those facilities will be greater than if distributed.



Leland also anticipated three approaches to privatization:

- Attempt to accommodate stakeholder interests by restricting the ability of managers of commercially performed maintenance to adjust capital or labor. Examples would be creating a government-owned, contractor-operated (GOCO) facility or placing restrictions on disposition of labor.
- Break the link between efficiency and equity considerations by allowing the unrestricted use of depot maintenance capabilities after disposition, and by treating compensation of displaced workers as a separable issue.
- Attempt to reconcile interests. Leland suggested, as an example, an arrangement where displaced labor would receive compensation from the proceeds of a public depot sale.

### *Decisions on Large Maintenance Workloads*

Decisions about organic versus commercial depot-level repair are made at all levels of the maintenance work breakdown structure—from individual components, such as avionics black boxes, to large support packages, including those that span whole weapon systems. Three of these cases can illustrate some of the issues involved, particularly where large workloads are involved.

In 1989, the Oklahoma City Air Logistics Center looked at logistics support in general for the KC-10 weapon system (Slaughter 1989). The cost of organic support was projected to be more than 60 percent greater than the cost for contract support. The difference was attributable to the existing contractor's ability to use the worldwide pool of commercial DC-10 spare parts, whereas the Air Force would have had to incur a large initial investment to acquire spare parts.

In 1992, Warner Robins Air Logistics Center (WR-ALC) conducted a competition for replacement of the C-141 aircraft center wing box. Three private firms and WR-ALC itself competed for the contract. The contract was awarded to the WR-ALC. (WR-ALC created separate buyer and seller teams in an effort to avoid internal conflicts of interest.) Coopers and Lybrand (1994), in a post award review, concluded that:

- Although the WR-ALC offer was represented as firm fixed price, it was more analogous to a cost reimbursement offer, because the government would pay the full cost one way or another—hence, public and private offerors did not see the same risk

- WR-ALC, under considerable pressure to win, proposed labor hours and rates not supported by past experience, a plan that would bring considerable criticism were it proposed by a private firm
- The WR-ALC buyer allowed the WR-ALC seller to charge common tasks to projects other than the wing box replacement, in violation of the Federal Cost Accounting Standards
- While the competition was in progress, WR-ALC underwent extensive training on the wing box tasks at government expense—an opportunity not afforded its private competitors
- During actual performance of the work by WR-ALC, the center ran a loss but, as a result of mischarges, reports did not accurately reflect true program costs.

In 1997, the Aircraft Directorate at Kelly Air Force Base conducted a public-private competition for C-5 aircraft workload. This workload had been performed by the San Antonio Air Logistics Center (SA-ALC), which was closing as a result of the 1995 Base Realignment and Closure (BRAC) decisions. The work was awarded to Warner Robins Air Logistics Center (WR-ALC). The General Accounting Office did a post-award assessment to determine whether the Air Force's procedures provided substantially equal opportunity to both public and private offerors, whether the Air Force complied with the Federal Acquisition Regulation (FAR) and other provisions of law, and whether the award resulted in the lowest total cost to the government (Warren 1998c). The GAO concluded that the answers to all three questions were positive.

At least two issues were related to this competition, however. First, in common with the center wing box competition, the GAO noted that unnamed private-sector sources felt there was an inherent inequity because the government would have to pay for any overruns if a public offeror won—whereas a private offeror would have to absorb the loss. Second, WR-ALC was perceived as unfairly advantaged, because it was able to show a \$153 million cost avoidance by using the C-5 workload to help absorb overhead costs it would have had to pay in any event. This cost advantage was the primary determining factor in the competition. The GAO concluded that an extensive realism analysis of the WR-ALC proposal was a reasonable approach to the first problem, and the second had been provided for in the original solicitation.

Issues such as whether fixed-price offers by government agencies are not really fixed-price and whether those agencies enjoy unfair cost advantages are often colloquially summed up as lack of a level playing field (Parker 1994, 25). Different studies at different times have come to conflicting conclusions over whether this is even a relevant issue and, if it is, whether the playing field can be made level in a meaningful way (Congressional Budget Office 1995; Office of the Deputy Under Secretary of Defense (Logistics) 1993; Parker 1994; Warren 1996). Generally speaking, however, looking over the experience base of public-private competitions, each sector has won about half of the competitions, except in the Air Force, where at one point 65 percent were won by the public sector (Parker 1994, F-31). Having said that, a firm grasp of the cost savings or other benefits from public-private competitions appears to be elusive (Office of the Deputy Under Secretary of Defense (Logistics) 1993, pg. 4-15-5-16; Parker 1994, F-25-F-30).

In summary, the DoD policy on depot maintenance outsourcing has been inconsistent over time, as well as inconsistent between different policy documents at a given point in time. The various studies of depot maintenance have also reached conflicting conclusions—at times when drawing from the same or similar data. We turn next to the general literature related to outsourcing and privatization.

### **General Literature Related to Outsourcing and Privatization**

No single stream of literature in and of itself is a sufficient basis for establishing the factors that stakeholders might consider relevant in deciding the depot maintenance source of repair. Some investigators have suggested that the combination of two to three theoretical vantage points—such as economic and social (Loh 1993), or risk, transaction cost, and resource-based (Lever 1997)—can provide a basis for characterizing outsourcing or privatization decisions. The present investigator, however, is not convinced that the current state of theory building is cooperative in this endeavor.

In fact, an examination of the literature reveals at least nine fields or streams of research that can offer important contributions to a composite theoretical base. The nine fields and their relevance are presented in Table 2-4. It would be impractical to do complete justice to any of these fields within the scope of the present research. Here, in the interest

of parsimony, our interest is in conveying enough about each of these fields to provide a foundation for the research.

As shall be seen, the boundaries between fields are often fuzzy. Much of the literature crosses over two or more fields, or incorporates the results of one field within another in ways that are not consistent from one piece of research to another. (Sometimes it is not even clear which is a parent field and which is a subordinate field.) Thus, classifying a particular piece of research as belonging to one field or the other is admittedly subjective and, at times, almost arbitrary.

The order of presentation will be as shown in Table 2-4. Generally speaking, and subject to the state of the literature as the present researcher found it, the presentation of each field will proceed from the general to the specific by considering the literature that:

- Articulates the field and states (or challenges) major tenets
- Relates the field to public administration, DoD, and/or depot maintenance
- Empirically examines the related theory in the contexts of outsourcing, privatization, the DoD, and depot maintenance.

**TABLE 2-4**  
**RELEVANT FIELDS OF RESEARCH**

Field	Relevance
1. Neoclassical economic theory	Market theory (price-coordinated economic activity, imperfect competition, conditions for market failure); economies of scale and scope
2. Transaction cost economics	Make-or-buy decisions in general
3. Principal-agent theory	Principal-agent relationship exists when principal (purchaser of depot maintenance) contracts with an agent (public or private) to perform depot maintenance tasks
4. Public choice theory	Economics of politics, political markets, behavior of interest groups; insight into behavior of Congress, depot workforces
5. Public administration	Problem being studied is, by definition, a public administration problem; theory of non-market failure; research on privatization.

**TABLE 2-4**  
**RELEVANT FIELDS OF RESEARCH (CONTINUED)**

Field	Relevance
6. Technology and strategic management	Problem involves high-technology weapon systems. The choice of maintenance sources inherently impacts technology insertion methods and rates, as well as the coupling of product and process design. Outsourcing can be considered an "administrative" innovation. Resource-based (also called competency-based) theory, found within strategic management literature, is where the concept of core competencies resides.
7. Relational, social exchange, resource dependency theories	Neoclassical economic accounts are arguably undersocialized, do not consider embeddedness in social structure. Relational, social exchange, and to lesser extent resource dependency theories consider embeddedness.
8. Logistics and supply chain management	Logistics concepts nominally underpin design of logistics systems, including depot maintenance. Supply chain literature addresses issues related to supply chain integration and vertical partnerships.
9. Organizational rationality and structure theories	Decision on internal or external production is an organizational decision. Arrival at that decision is accomplished within broad public administration organization of DoD and Congress.

Chapters 3 through 7 draw on the nine fields to examine the various factors that contribute to the depot maintenance outsourcing decision. To provide a basis for doing so, this chapter sets out general hypotheses to be examined. Chapter 3 will operationalize the hypotheses and describe how they will be tested. Chapters 4 through 7 then present the data and analysis. In this chapter, each hypothesis will initially be stated following discussion of the literature that motivates it, and then all of the hypotheses will be summarized at the end of the chapter. The hypotheses are intentionally drawn narrowly in order to lead as directly as possible to measurement scale items. Since Chapter 3 provides the structure for an empirical analysis, the final section in this chapter will also summarize and comment on the state of relevant empirical research.

### Economic Literature

As indicated in Table 2-4, at least four different vantage points appear in the economic literature. Here we shall summarize important results and implications of

neoclassical economics, transaction cost economics, principal-agent theory, and public choice theory. However, because the concept of organizational rational action—that organizations will act rationally to achieve maximum utility—plays an important part in these theories it is necessary to first describe this concept.

### *Rational Action and the Rational Model*

The concept of instrumental reason holds that rational thought follows the rules of deductive inference in order to determine the best means to a given end (White 1990, 132). An example would be the assumption that organizations will act rationally to achieve maximum asset utilization (Riley 1993, 69-70). Determining the best means for doing so is accomplished through rational action—the application of the rational model (sometimes also referred to using terms such as decision-phase theory (Sink 1995, 29) or the scientific approach (Margolis 1993, 188)).

The most common exposition of the rational model (which we will call the strong form) follows the familiar sequence of problem definition, criteria selection, formation of alternatives, comparison of alternatives against criteria, selection of an optimal solution, implementation, and follow-up (Lindenberg 1989, 175; Oman et al. 1992, 155). An alternative to the strong form, which we will call the weak form, is found in the work of Charles Lindblom and holds that because it is difficult or costly to analyze all alternatives in advance, a rational way to proceed is to select an option that is at least better than other possibilities (Patton and Sawicki 1986, 25).

Although the rational model has been criticized as impractical, undesirable, or both (White 1990, 134), it is central to much economic, political science, and organizational theory, as well as the manifestation of these theories in policy making, budgeting, financial management, program evaluation, logistics management, and similar activities (Bendor and Hammond 1992, 302-304; Dunn et al. 1993, 2; White 1990, 134). Further, there is empirical evidence that commercial and government buyers at least in some circumstances appear to follow the rational model when making outsourcing decisions, albeit with bounded rationality (Carver 1988, 192), much cycling and iteration (Sink 1995, 292-293), and varying degrees of success (Davis 1996, 277-278; Loh 1993, 103, 190). As shall be

seen below, one of the features that distinguishes one economic theory from another is the extent to which they adopt the rational model. Thus, the first hypothesis is:

**H01** Persons with an interest in depot maintenance will perceive themselves as following the dictates of the rational model when making depot sourcing decisions.

### *Neoclassical Economic Theory*

In neoclassical economic theory, it is assumed that the goal of economic action is rational maximization of utility in the presence of environmental constraints or limits on resources (Glazer, Steckel, and Winer 1992, 214; Sink 1995, 43-68). Managers maximize profits (or, in the case of public entities, optimize outputs) subject to demand and cost functions. The market provides the information, in the form of prices, that is needed to manage (Rowley 1995, 96-98). As Niman (1992, 1919) notes, “From an information processing perspective, the advantage of the market is that it economizes in the use of information by employing the mechanism of price.” Thus, at the center of neoclassical economics is price theory—which explains what it is that determines relative prices and how prices coordinate economic activity (Friedman 1986, 27). Since there is evidence that more than price information is needed to make depot maintenance outsourcing decisions (Forbes, Hutcheson, and Timko 1997, 4-7-4-14), later we shall discuss the situation where price information provided through the market is not sufficient. We shall also challenge the assumption that the rational model and prices, even conceptually, could be sufficient to coordinate activity.

For the moment, however, we put those issues aside in order to profit from the insights of the neoclassical theory. Three particular concepts from neoclassical economic theory echo through the depot maintenance literature: imperfectly competitive markets; market failure; and economies of scale. Before discussing those concepts it will be valuable to first summarize the concept of the perfectly competitive market.

## Perfectly Competitive Markets

Because there are many buyers and many sellers in a perfectly competitive market, the effects of the decisions of one buyer or one seller on market price can be ignored (Friedman 1986, 215). Although overall demand curves for an industry are downward sloping (the more sold, the lower the price), the demand curve for an individual firm is essentially flat—from the vantage point of an individual firm, demand appears to be completely elastic. Individual firms are price takers: they take the price established by the market as a given, have no ability to influence that price, and assume they can sell as much as they want at that price. Similarly, the actions of any single buyer have no appreciable effect on the market. A perfectly competitive market is Pareto-efficient; there is no way of increasing the benefit for one person or organization without at the same time decreasing the benefits to others (Friedman 1986, 351).

## Imperfect Competition

Maximum social benefit (where social benefit is the societal equivalent of individual utility) and Pareto efficiency result when firms behave as if they are under perfect competition, even if such is not the case (Friedman 1986, 27, 350-351, 365). However, from the vantage point of individual firms, it is not in their individual self-interest to do so (Lancaster 1973, 177). A firm can improve its profit position by exerting some control over price; thus it is rational for it to do so. As Weiss and Birnbaum (1989, 1018) have noted, firms will develop accustomed trading relationships—complete with norms, rules, and traditions—to negotiate the environment and reduce uncertainty. From the vantage point of the firm, the “best” position is to be a pure monopoly: a firm in a pure monopoly position is synonymous with its industry and it can dictate price (Baumol 1977, 393-419).

Other recognized forms of imperfect competition include monopolistic competition, where a relatively large number of firms produce similar but not identical products; monopsony (one buyer); bilateral monopoly (one buyer and one seller); and the various forms of oligopoly, including mixed structures where there might be a single or small number of large firms and smaller rivals. Any of these imperfectly competitive forms can



lead to distorted prices and other behaviors that, from society's view, are perverse, even though arrived at rationally by economic actors.

As Kettl (1993, 14-17) has noted, meaningful competition is difficult to achieve when the government is the buyer, since the government is usually buying custom goods from a limited number of providers. Certainly this has historically been the case for defense goods. However, it is even more the case at present because there has been a sharp consolidation of prime defense contractors since the end of the Cold War (Cooper 1998). From 1990 until 1998, the number of tactical missile contractors shrank from 13 to 4, the number of fixed-wing aircraft contractors from 8 to 3, and the number of surface ship contractors from 8 to 5. With regard to repair specifically, the General Accounting Office in 1996 found that of 240 active depot maintenance contracts, 76 percent were awarded noncompetitively and, of those that were competed, 86 percent had 4 or fewer offerors (Warren 1996). In a subsequent and much larger study of 15,346 depot maintenance contracts totaling \$2.2 billion, the GAO found that 91 percent, worth \$1.5 billion, had been awarded noncompetitively (Warren 1998a, 3-5).

Since DoD is also the single customer for many defense industry products, the market is monopsonistic from that standpoint (Parker 1994, 22). Given the small number of sellers, the market is also at least oligopolistic, and in specific instances monopolistic. As has been noted in some of the literature on depot maintenance described earlier (Camm 1993, 3; Office of the Deputy Under Secretary of Defense (Logistics) 1993, pg. 3-4), at least one reason for creating an organic depot maintenance capability is to create what amounts to an artificial, government-owned competitor. Hence, factors of abiding interest are likely to be the uniqueness of the DoD depot maintenance work (i.e., is it the only market for this work?), the availability of more than one source, the interest by potential sources, and the impact of anticompetitive circumstances such as proprietary data (Forbes, Hutcheson, and Timko 1997, pp. 2-19-2-20). Hence, related hypotheses are:

<b>H02</b>	Depot maintenance workload will be perceived as unique and outside the commercial mainstream.
<b>H03</b>	Availability of more than one source will be perceived as important to the decision on allocation of organic versus commercial workload.

**H04** Existence of proprietary data will be perceived as important to the decision on allocation of organic versus commercial workload.

Before leaving this discussion, it is worth considering two specific facets of imperfect competition that could be important to decisions on the allocation of public versus private depot maintenance. The first is the presence of a large and imperfect internal market. The second is public-private competition.

*DoD Internal Market.* DoD depots produce goods (e.g., repaired components) for consumption by DoD field forces; thus, DoD has an internal market. This market is quite large. Of the \$15 billion in annual depot maintenance revenues, over half of these revenues, as indicated in Chapter 1, involve DoD's depots as the seller. As do many private firms, DoD uses internal transfer prices to coordinate its internal market (Shycoff 1995, 14-15). The DoD internal market is monopolistic in the sense that depots normally do not compete against one another and DoD has complete control over its internal prices. In that light it is interesting to note that Rogerson (1995, pp. 1-1-1-3) has shown that the internal prices are, in fact, distorted and are not achieving the available efficiencies. This leads to the next hypothesis:

**H05** Managers of and other persons with an interest in depot maintenance will perceive organic depot maintenance capability to be an internal monopoly.

*Public-Private Competition.* DoD has attempted public-private competition as a means of allocating depot maintenance workload with mixed results. Public-private competition began in 1985 when the DoD Appropriation Act of that year authorized the Navy to test the feasibility of competition between public and private shipyards (Office of the Deputy Under Secretary of Defense (Logistics) 1993, pg. 4-12). Public-private competition slowly expanded through 1993, when DoD projected a total of over \$1.7 billion in savings by FY 1997.

A central problem mentioned earlier, however, was the perception of a lack of a level public-private playing field. This problem was handled in part through a cost-comparability handbook (which provided adjustments for the imputed costs of DoD higher

headquarters, for the lack of profit in government, etc.) and through a provision for Defense Contract Audit Agency audits of government proposals prior to award (Office of the Deputy Under Secretary of Defense (Logistics) 1993, pg. 4-14). Cost adjustments could not compensate, however, for the fact that a private company that underbid would have to absorb the loss, while a government depot could recoup its losses through higher subsequent charges. Industry was not alone in disliking the public-private competition. On the government side, the competitions were perceived as difficult and expensive to mount.

The result was both internal and external dissension. By 1994 the Army, Navy, and industry took the position that the competitions were causing more trouble than they were worth, and the Defense Science Board recommended they be discontinued. The Air Force, in contrast, maintained that public-private competitions were a viable means of both reducing cost and deciding the size and structure of organic capability (Parker 1994, 3).

The issue of public-private competitions has stayed unsettled—as indicated by the examples of the C-141 wing box and C-5 workload discussed earlier. Whether the competitions have been difficult to do well, however, has proved to be beside the point. As a result of congressional interest, public-private competition at the time of this research was the sole means by which work performed in the public sector could be moved to the private sector (10 U.S.C. §2469). Thus the next hypotheses is:

<b>H06</b>	Managers of and other persons with an interest in depot maintenance will perceive of public versus private competition for depot maintenance as being conducted on a playing field that is not level.
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### Market Failure

Imperfect competition can result in more than distorted prices, it can lead to outright market failure if the market lacks structure to accomplish essential exchange of goods or information, or fails to settle into an equilibrium (Lancaster 1973, 217). One concern to depot maintenance, and one rationale behind the depot maintenance core concept, is failure of the market to produce the required repairs when the private sector has no interest in the work (Office of the Deputy Under Secretary of Defense (Logistics) 1993, pg. 3-4). This can

occur, for instance, when the equipment to be repaired is unique to military systems and, especially, when it is obsolescent. The problem of finding a repair source for obsolescent parts is one instance of a larger issue, called diminishing manufacturing sources (General Accounting Office 1990, 9), that includes both manufacture and repair. Hence, the possibility of market failure is a real issue for DoD in the sense of lack of commercial firms willing to do the work (Forbes, Hutcheson, and Timko 1997, pp. 2-19–2-20).

A second issue is that the commercial sector generally is perceived to lack the scope of capability (i.e., the breadth of skills and equipment) to respond in the quantity necessary without an initial start-up delay (Office of the Deputy Under Secretary of Defense (Logistics) 1993, pg. 1-3).

The related hypotheses, then, are:

<b>H07</b>	For at least some depot maintenance workloads there will be a perceived lack of commercial firms willing to do the work.
<b>H08</b>	For at least some depot maintenance workloads there will be a perceived lack of commercial firms with the scope of capability to respond in the quantity necessary without an initial start-up delay.

### Economies of Scale and Scope

Economy of scale, also called increasing returns to scale, refers to the situation where large output levels generate lower average costs than do small output levels (Lancaster 1973, 183). Reasons put forward to account for scale economies are division of labor (and resulting opportunity to use lower-paid skills) when there is a large labor pool; quantity discounts available to larger firms; availability of specialized machinery; easier access to credit; the ability to benefit from collateral research, development, and by-products (Antell 1970, 87-89); organized knowledge, skill, experience, and teamwork (Chandler 1992, 486); and economies of massed reserves such as inventories of spare parts (Mulligan 1983, 725). The relation between availability of specialized machinery and scale economy is sometimes cast in terms of indivisibility of technology (Baumol 1977, 274; Lancaster 1973, 183)—by which it is meant that some equipment just does not come in small units.

A related concept is scope economy. If the production of heterogeneous components uses complementary processes and resources (similar skills, equipment, task sequences, etc.), then a manufacturer can switch from repair of one component to another to respond to a change in requirements (Melnik and Denzler 1996, 100). The broader the scope, the more the peaks and valleys from individual components' demand patterns will tend to level each other out when viewed in the aggregate.

Regard for economies of scale and scope is reflected in the depot maintenance literature when it posits the need for organic maintenance depot capability in terms of "ability to increase output and change priorities within a wide compass of potential, but inherently unpredictable needs" and to "bring to bear a wide spectrum of industrial repair facilities at a single site" (Embry et al. 1985, vii; Office of the Deputy Under Secretary of Defense (Logistics) 1993, pg. 3-4). It is not a given, however, that public providers have superior scale or scope economies. Where the equipment to be maintained is also found in the commercial world, or has significant commonality with commercial products, then economies of scale or scope are perceived to accrue to commercial providers. A specific example referred to earlier is the KC-10 tanker, where a commercial contractor was better able to pool spare parts than was the government (Slaughter 1989, 3).

Despite the intuitive attractiveness of scale economy and scope economy and how often one finds them in the literature, there is controversy over how much credence should be given to these concepts, either in general or specifically with regard to depot maintenance. Although returns to scale have arguably been demonstrated by researchers such as Argote, Beckman, and Epple (1990, 149) in shipbuilding, Kumbhakar (1990) in the airline industry, and undoubtedly others, Wolf (1994, 120) notes that the literature is inconclusive regarding whether scale economies actually lead to decreasing costs. Lucas (1978, 509) concluded that, under conditions of competition, social welfare is indifferent to the distribution of firm size. Milgrom, Qian, and Roberts (1991, 84) held that it is not economy of scale that counts but the complementarities among technology choices, marketing strategies, personnel policies, supplier relations, lines of internal communications, and other operational policies.

Additionally, using econometric theory to relate scale to marginal cost can be a difficult undertaking in practice. For instance, Gray (1993) used the concept of scale economy to relate increased costs of naval aviation depot labor to over-capacity. However, when the U.S. Army attempted to use Gray's methodology for its depots, it met with inconclusive results and concluded that such analysis was not a useful tool (in at least the Army case) for addressing depot maintenance capacity questions (Shetterly and Kise 1994). At least part of the difficulty with economy of scale or scope appears to stem from the significant difficulty in operationalizing these constructs (Forbes, Hutcheson, and Timko 1997, pp. 4-8-4-9).

The hypotheses related to scale and scope economy are:

<b>H09</b>	Managers of and other persons with an interest in depot maintenance will perceive ability to achieve economies of scale and or scope as important to the depot maintenance outsourcing decision.
<b>H10</b>	Outsourcing depot maintenance improves depot maintenance economy of scale.

### *Transaction Cost Economics (TCE)*

In contrast to the neoclassical tendency to concentrate on production costs while viewing information as costless and perfectly available, an important body of research indicates that the cost of information transfer can vary significantly (von Hippel 1994, 429). It is neither difficult to find concrete instances where these costs are ignored nor to find evidence that the costs can be large in absolute terms. As an example of the first case, and one that happens to be specific to depot maintenance, Rogerson (1995, pg. 2-2) used price theory exclusively (he ignored transaction costs) to describe the circumstances under which users would procure repair services from the depots and when they would do repairs themselves.

With regard to evidence of the importance of transaction costs, a Coopers and Lybrand and TASC team (1994), in a study for the Department of Defense, developed an empirically based estimate of the cost impact of DoD contract regulation and oversight. This estimate, which included contractor compliance costs and the impact of regulations

and oversight on contractor processes, *but did not account for the DoD's direct oversight costs*, found that 18 percent of the final cost of a DoD contractor's products and services was attributable to these sources. Donahue (1987, 109) cites estimates of 20 percent to 40 percent. (He also indicates that the cost of competitive sourcing is in the range of 5 percent to 10 percent.) Clearly, if the up-front costs to establish contracts and direct oversight costs were also accounted for, then the transaction cost contribution to final product cost would likely be considerably higher. As another example, Kettl (1993, 56), discussing the DoD A-76 program,<sup>4</sup> quotes a Senate statement that over 1,700 persons were assigned to DoD A-76 studies at an annual cost of approximately \$150 million to \$300 million, and that this cost was greater than the savings generated. Finally, Masten (1984, 413) has demonstrated how the make-or-buy program requirements levied on defense contractors by the Federal Acquisition Regulations are grounded in transaction cost economics.

Having established the relevance of TCE, however, understanding the concept well enough to put it to use in the present study requires further effort. Such is the purpose of the discussion that follows.

TCE owes its origins to Coase (1937, 386-405), who observed that the price mechanism of the market is in some instances the mechanism for coordinating production, but in others it is the entrepreneur. Transaction cost economics is an attempt to explain why some transactions are done in markets (i.e., via the price mechanism) and others in hierarchies (Coase's "entrepreneurs").<sup>5</sup> Although there are probably various definitions of hierarchy, here we will define it as a large number of people who stay together for some time, are organized into various ranks of leaders, and are led (Tullock 1992).

Central to TCE are the concepts transaction and transaction costs. A transaction occurs when individuals or groups transfer resources across an interface that separates where one stage of activity ends and another begins (Williamson 1979). In the context of

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<sup>4</sup> The A-76 program is a competition-like process for choosing between public and private providers. The government designs a most efficient organization (MEO), determines the price to do business using this organization, and then compares that price to prices submitted by commercial offerors. The depot maintenance program is exempt from A-76 procedures under Public Law 105-56, October 8, 1997, and 10 USC §2464.

<sup>5</sup> Coase used the term "entrepreneur" where the subsequent literature on TCE more typically uses the term "hierarchy."

depot maintenance, this interface exists between the buyer and the seller of depot maintenance, whether or not depot maintenance is provided under contract or organically. (That is, “seller” is a general concept that includes both public and private providers.) The cost of the transaction is the cost to establish the initial contract, to renegotiate during execution, and to monitor performance (Petersen 1995b, 17, 18, 24, 35). Transaction costs occur under both market and hierarchical forms of governance (Petersen 1995b, 35). TCE holds that if transaction costs were negligible, or if they were the same no matter how economic activity were organized, then it would not matter how economic activity were organized, since the advantages of any particular choice over another would be eliminated by the costless (or constant cost of) contracting. But, consistent with our discussion above, TCE holds that the choice does matter, because the costs are not negligible, and they differ for reasons that are important to understand.

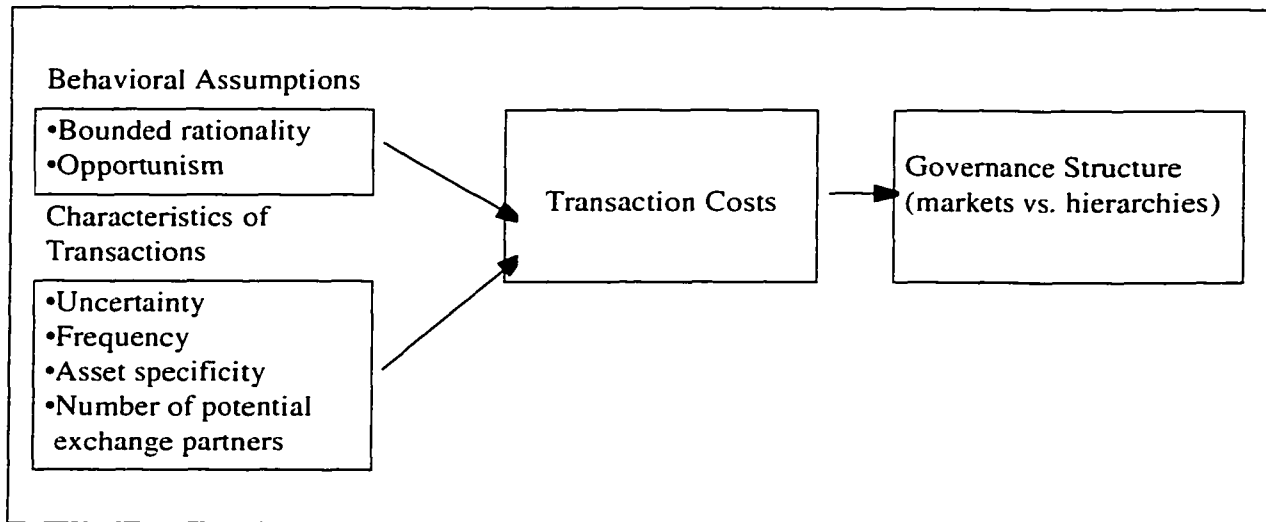
TCE theory attempts to explain transaction costs. In doing so, it starts with two basic assumptions: bounded rationality and opportunism (Petersen 1995b, 19-20, 239). Bounded rationality means the same thing here as it did to Simon, that humans making decisions are limited by innate skills, habits, reflexes, values, and the amount of relevant knowledge (Simon 1976, 39-40). Opportunism means self-seeking accompanied by guile (Williamson 1979, 234, 247). TCE asserts that hierarchy, by reducing the problems associated with bounded rationality and opportunism, economizes in the costs of transmitting and processing information (Niman 1992, 1819)—i.e., it can reduce the transaction costs.

The TCE model is illustrated in Figure 2-2. The interaction among the assumed behavioral characteristics of bounded rationality and opportunism and the characteristics of transactions determines the transaction costs. Those costs, in turn, determine which governance structure (market or hierarchy) is more appropriate in a given circumstance. As an example, when the costs of carrying out a transaction as a regular contractual exchange are high, then transactions will often be carried out through hierarchy (Petersen 1995b, 18).

Oliver Williamson, TCE’s most important proponent, holds that four characteristics of transactions themselves determine transaction costs: frequency, asset specificity, uncertainty, and the number of potential exchange partners (which determines the level of potential competition). Following Williamson, we will start with a framework comprising



**FIGURE 2-2**  
TRANSACTION COST ECONOMICS



frequency and asset specificity and discuss uncertainty within that framework, since these three factors are interrelated. Figure 2-3, reproduced from Williamson's 1979 article on transaction cost economics (1979, 247), is the basis for discussion.

Frequency can range from one time to recurrent, and investments from nonspecific to idiosyncratic—yielding the combinations of frequency and degree of asset specificity shown, although clearly the number of categories and the boundaries between them are somewhat artificial. Naturally, there are intermediate examples as well. A reasonable intermediate example is probably the purchase by field units of repair parts for military-unique components, such as electronic equipment that is installed only on U.S.-built tanks or fighter aircraft. It is in this center column of intermediate cases where most of the controversy lies—where there is a *prima facie* case for neither commercial repair nor vertical integration.

Here we will also focus primarily on the lower row of Figure 2-3 and define the concept of material to include failed material that is made serviceable through a repair process. It is reasonable to include repair in this definition, since depot repair is, by nature, recurrent. In the lower left corner of Figure 2-3 is the case of recurrent purchase of standard material, a nonspecific investment where most everything relevant to the exchange can be understood in advance and there is little uncertainty. An example in depot maintenance would be

**FIGURE 2-3**  
**FREQUENCY VERSUS INVESTMENT CHARACTERISTICS**

		Investment Characteristics		
		Nonspecific	Mixed	Idiosyncratic
Frequency	Occasional	Purchasing Standard Equipment	Purchasing Customized Equipment	Constructing a Plant
	Recurrent	Purchasing Standard Material	Purchasing Customized Material	Site-Specific Transfer of Intermediate Product Across Successive Stages

the purchase of repair for aircraft radios that are in wide use in both military and commercial aircraft.

It is relatively easy as well to find a depot-maintenance example for site-specific transfer of an intermediate product across successive stages (lower right corner of Figure 2-3). One such example would be the repair of aircraft landing gear—which involves disassembly, initial inspection, deplating, replating, grinding, welding, painting, reassembly, final inspection, and other subordinate processes that are done by different shops and skills as stages in a production process. Asset specificity is to be expected in depot maintenance. The reason is that the systems on which maintenance is being performed have a relatively stable design (in fact, lack of product innovation is more of a problem than the opposite). As Clark has observed, under such conditions, general-purpose machines are normally replaced by dedicated, highly specific, equipment as part of process innovation (Clark 1985, 236).

In concert with TCE concepts, the tight linkages among stages, the specificity of the production equipment, the difficulty (actually, impossibility) of stating in advance all of the contingencies that are likely to arise, the need to monitor shirking (Tullock 1992, 3), and the difficulties that would be encountered finding another supplier or buyer all open up the possibility of opportunistic behavior by either party. Under such circumstances it can make sense to establish a relationship where one party has the authority to impose decisions and

the other has the duty to obey—in other words, to vertically integrate under a hierarchy. As indicated earlier, hierarchy, by reducing problems associated with bounded rationality and opportunism, economizes in the transmission and processing of information (Niman 1992, 1819). It is a tradeoff between production costs and governance costs (Globerman and Vining 1996, 577), as well as between the opportunity costs of being bound to an inflexible agreement with an external source and the hazards of negotiating follow-on procurements in the natural condition of bilateral monopoly when production is performed internally (Masten 1984, 405).

Under internal production, the option of sequentially rendering decisions and thence adapting to circumstances removes the need to enumerate all contingencies in advance. Hierarchy and vertical integration, however, are not without their down sides—in particular, the weakening of incentives as organizations get large (Masten 1984, 406; Tullock 1992, 3)—including DoD depots (Office of the Deputy Under Secretary of Defense (Logistics) 1993, pg. 4-3)—and diseconomies related to increasing complexity of the organization as it grows larger (Mueller 1989, 536).

Out of all of this it should be reasonably clear that TCE offers up some factors that could be of interest to those who must choose between organic and depot repair, and it is not surprising to find these factors in policy (Office of the Secretary of Defense 1996b, 8). Since the behaviors embodied in the behavioral assumptions are, at least in the short term, immutable according to TCE, the factors of interest are those intrinsic to the transactions: uncertainty, frequency, and asset specificity. In particular, TCE and the behavior of private firms suggest that the more precisely a repair task can be specified in advance (e.g., the less uncertain is the environment and simpler the technology), the easier it is to confirm appropriate performance after the fact, the easier it is to replace or otherwise penalize disappointing contractors (e.g., through recompetition), and (as will be discussed later under the topic of public choice theory) the more government cares about ends to the exclusion of means, the stronger the basis for outsourcing to commercial enterprise (Camm 1993, 4; Donahue 1987, 79-80, 82).

The hypotheses drawn from TCE are:

<b>H11</b>	Managers of and other persons with an interest in depot maintenance will perceive tight linkage among stages in the depot maintenance repair process as important to deciding between organic and commercial sources of repair.
<b>H12</b>	Managers of and other persons with an interest in depot maintenance will perceive specificity of production equipment as important to deciding between organic and commercial sources of repair.
<b>H13</b>	Managers of and other persons with an interest in depot maintenance will perceive the difficulty of stating all contingencies in advance as important to deciding between organic and commercial sources of repair.
<b>H14</b>	Managers of and other persons with an interest in depot maintenance will perceive the need to monitor shirking as important to deciding between organic and commercial sources of repair.
<b>H15</b>	Managers and others with an interest in depot maintenance will perceive increased risk if crucial contingencies are left to the market.
<b>H16</b>	Managers of and others with an interest in depot maintenance will perceive the combination of low task frequency and high uncertainty as leading to high transaction costs if depot maintenance is outsourced.
<b>H17</b>	The choice between public and commercial providers of depot maintenance will be perceived to depend on the total cost, where total cost is the sum of production cost and transaction costs.

Despite TCE's strong theoretical appeal, when researchers have attempted to employ TCE to explain outsourcing decisions, the results have been less than completely clear-cut. Notwithstanding some equivocal results (Lever 1997, 153; McCray 1996, 281), however, the empirical work on outsourcing appears to be supportive in a range of fields, including information technology (Borchers 1996, 85; Chung 1996, 109-114; Davis 1996, 277-278; Loh 1993, 103-104), banking (Jensen 1993, 54-71), human resources (Spee 1994, 131), logistics (Daugherty 1988, 171; Maltz 1992, 250-251), and U.S. manufacturing generally (D'Aveni and Ravenscraft 1994, 1182-1187). The more limited work on privatization (Coopers and Lybrand and TASC Project Team 1994, 94; Kettl 1993, 57; Poudier 1993, 90-91) is also supportive. There appears to be a single empirical study relating TCE to depot maintenance, and it was also supportive (Forbes, Hutcheson, and Timko 1997, pp. 4-8-4-9).

### *Principal-Agent Theory*

As Davis has observed (1996, 31), agency problems involve hidden action or purposes that neoclassical economic models are not adept at explaining. Thus principal-agent theory is another important source of conjectures regarding criteria for forms of governance (Halachmi and Nichols 1997, 10). Principal-agent theory is closely related to TCE, but its theoretical position in relation to TCE is not clear. Chandler (1992, 484) describes principal-agent theory as one of four economic theories of the firm, the others being neoclassical, TCE, and evolutionary. Peterson (1995a, 189-190) characterizes TCE as one of two strands in the field of organizational economics, with principal-agent theory being the second strand. Tullock (1992, 2-3), in contrast, asserts that five theories have developed out of TCE, one of which is actually called TCE, and that TCE theory has six strains, one of which is principal-agent theory.<sup>6</sup> McCray (1996, 20) sees the relationship between TCE and agency theory the other way around—with agency theory being the broader. Given this confusion, we will somewhat arbitrarily align with Tullock's characterization and use principal-agent theory to amplify on TCE.

Although the heritage of principal-agent theory might be at issue, its basic tenets are a little more settled. A principal-agent relationship exists when a principal arranges with an agent to perform some task or tasks on behalf of the principal (Halachmi and Nichols 1997, 6-7; Petersen 1995a, 187). Agency relationships exist both between and within organizations (Halachmi and Nichols 1997, 8). The following are among the basic concepts of principal-agent theory:

- Principals and agents have conflicts of interest (different utility functions).
- Agents differ from one another in ways relevant to the task to be done. They may be careful or careless, industrious or lazy, trustworthy or untrustworthy, able or not, and so on.

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<sup>6</sup> The other strains are : highly specific capital may lead to exploitation; organizations exist to monitor shirking; X-efficiency—people do not work as hard as they could; sociological interaction of group dynamics with market forces; and the mechanisms for design of organizations in the presence of asymmetric information. Tullock does not list the other five theories that he had in mind.

- The agent has some contribution to and influence over the desired outcome of the relationship. As an example, because there is a cost (if nothing else, in time) to perform the task for the principal and this is time that could be spent on some other task, it is to the agent's benefit to minimize the time spent. Thus, in this example, other things being equal, the agent will try to influence the desired outcome to minimize his or her task performance time.
- Random factors over which neither the principal nor agent has control influence the outcome.
- Outcome—which depends on the agent, the agent's actions to influence outcome, and random factors—is usually observable to both the agent and to the principal. Outcome can, however, have many facets.
- The agent and the principal have asymmetrical information. Although both parties observe outcome, the agent has better information on his or her degree of care, industriousness, trustworthiness, ability, and how he or she is attempting to influence desired outcome. Of the six concepts listed here, this is arguably the most important, since it is held to be always present (transaction costs, therefore, are positive), whereas the others may or may not be present.

Principal-agent theory, like TCE, makes two assumptions about human nature, although they are not the same as those of TCE. The first is that humans are hyper-rational—they can make difficult decisions quickly. Thus, in contrast to transaction cost economics, they are not assumed to be boundedly rational. Second, both principal and agent, but particularly the agent, are assumed to be selfish, to act with guile, and (consistent with TCE) to be opportunistic.

The hypotheses stemming from principal-agent theory are:

<b>H18</b>	Organic and commercial providers of depot maintenance are perceived as differing in the extent to which they have conflicts of interest with the users of depot maintenance.
<b>H19</b>	Organic and commercial providers of depot maintenance are perceived as differing in their degree of carefulness, industriousness, and trustworthiness.
<b>H20</b>	Organic and commercial providers of depot maintenance are perceived as differing in the degree to which they can influence the desired outcome of depot maintenance activity.
<b>H21</b>	Random factors, under the control of neither depot maintenance providers nor managers, are perceived as being able to influence the outcome of depot maintenance.
<b>H22</b>	The outcome of depot maintenance is perceived as observable to both providers of depot maintenance and to government managers of depot maintenance.

<b>H23</b>	The providers of depot maintenance will be perceived as having better information than government managers of depot maintenance about the degree of care exercised during the performance of depot maintenance.
<b>H24</b>	Public and commercial providers are perceived as having different potential to act opportunistically.
<b>H25</b>	Retention by the government of “smart buyer” capability will be perceived as important.

The relevance of principal-agent theory to this study is that it can help inform criteria (e.g., carefulness, industry, trustworthiness, ability) for deciding which depot maintenance agents to choose. For instance, in the related context of franchising (establishing competition within government for common support services) and cross-servicing within government, Halachmi used principal-agent theory as a basis for understanding these kinds of issues (Halachmi and Nichols 1997, 10). And an argument can be made that at least echoes of principal-agent theory are incorporated in existing DoD policy when it asserts that it needs to do enough of the work itself to make sure it understands what it is asking for and, thus, is a “smart buyer” (Office of the Deputy Under Secretary of Defense (Logistics) 1993, pp. 3-4, 3-6, 3-7), assumedly to protect against opportunism.

Recent empirical tests of principal-agent theory in the context of outsourcing or privatization do not appear to be as varied as was the case with TCE—but there is some supporting evidence in information systems (Davis 1996, 278; Loh 1993, 103; McCray 1996, 281), community health centers (Shiang 1995), and depot maintenance specifically (Forbes, Hutcheson, and Timko 1997, pp. 2-23, 4-8–4-9).

### *Public Choice Theory*

A potentially key difference between outsourcing as practiced by commercial firms and privatization as practiced by governments is that privatization occurs in a more highly politicized market. This distinction is important in the depot maintenance outsourcing context since, as the Congressional Budget Office has noted, the thrust of most related congressional action has been to support a dominant role for the public depots (Congressional

Budget Office 1995, 15). Public choice theory is an attempt to understand the behavior of political markets (Rowley 1995, 63), and that is the reason for addressing it here.

Public choice theory assumes, as does principal-agent theory, that individuals are motivated by self-interest and act to maximize their individual utilities (Harmon and Mayer 1986, 259). The theory dates from 1948 research into group decision making, began to center on democracy and representative government in the late 1950s, and then began to focus on interest group considerations in the mid 1960s (Rowley 1995, 63). The tenets of public choice theory are that it is costly to establish interests groups; existing groups have significant advantages in political markets; groups offering concentrated benefits have advantages over those offering dispersed benefits; small groups are more effective than are large groups; and groups that can coerce supply have an advantage over those that cannot. The implications are that interest group behavior distorts the political agenda and outcomes in favor of the concentrated benefits preferred by the effective interest groups. A special interest or interest group generates substantial personal benefit for a small number of individuals, while imposing a small (but potentially cumulatively large) individual cost on a large number of other individuals (Rowley 1995, 63, 65, 71).

There are three schools of research in public choice that differ in terms of assumptions and research focus: Rochester, Chicago, and Virginia (Rowley 1995, 65). The Rochester school has a relatively narrow focus, ignoring institutions (and interactions with institutions) at other than the federal level. The Chicago school, based on price theory, very nearly denies the possibility that there can be such a thing as the public interest. Here our interest shall be in the Virginia school, putatively the most far-reaching of the three, for which intellectual leadership is credited to James M. Buchanan and Gordon Tullock.

The Virginia school rejects the idea that a public official could be dedicated to the public interest and, instead, views the public official (bureaucrat) as a rational but self-interested maximizer of his or her own utility—where utility is a combination of wealth, ideology, patronage, discretionary power, and ease of management, all summed up in the proxy of budget maximization. Bureaucrats operate as free-riding special interests. They understand the likely response of legislators to specific initiatives and also understand the policies that their bureaus are likely to champion. Typically they will support policy initi-



atives that act to conceal special interest considerations from electoral scrutiny and to maximize their own discretionary power. Because they are differentially well informed in comparison to legislators, they dominate in budget negotiations, extract excessive appropriations from the legislature, supply an excessive output, and do so in an inefficient manner (Rowley 1995, 73).

The legislature works to benefit interest groups by generating benefits for small but well-organized groups of individuals while imposing a small (but, again, potentially cumulatively large) individual cost on diffuse and less well organized interests. Politicians undertake this wealth transfer in exchange for campaign contributions, the expectation of post-political career benefits, and promised votes.

The relevance of public choice theory to depot maintenance should be obvious. It suggests that at least some Department of Defense bureaucrats might act to supply more depot maintenance than is needed and to provide it inefficiently. Similarly, it provides an explanation for the congressional interest noted above. Empirical work relating public choice theory to privatization, although apparently limited, is supportive. Scholmach (1996, 183) used public choice concepts to examine the provision of public roads in Texas and concluded that as a result of political interests the costs of roads are not kept as low as possible. Ward (1988, 246) compared contracting out for local government services in Ohio and Mississippi. He found that contracting out was much more pervasive in Ohio and attributed the difference to two factors: a higher level of affluence in Ohio and a political culture more interested in quality than the opportunity to create public-sector employment. In the depot maintenance arena, Kiebler et al (1996, pp. 3-8–3-9) found that most DoD depots induct more assets into depot maintenance than are needed to satisfy requirements, and more than the depots can repair. In one instance managers had serviceable aircraft engines on hand that were more than seven times the requirement, yet continued to induct even more engines into maintenance.

Hypotheses drawn from public choice theory are:

<b>H26</b>	Interest groups internal to government (Department of Defense, ministry of defense, or other government agency as applicable) will be perceived as influencing the choice of public versus commercial provision of depot maintenance.
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**H27** Interest groups external to government (Department of Defense, ministry of defense, or other government agency as applicable) will be perceived as influencing the choice of public versus commercial provision of depot maintenance.

An additional potential hypothesis arises from the public choice literature: that managers of the public depot system will be perceived as providing depot maintenance inefficiently. However, the issue of private versus public efficiency and related hypotheses are dealt with below in the review of privatization literature.

### Public Administration

Since national defense is one of the classic public goods (Hirschman 1970, 101), the administration of the maintenance of armed forces, including the administrative process for choosing between public and private providers, is a matter of public administration. For this reason, it would seem almost mandatory to explore what the field of public administration<sup>7</sup> offers on the subject.

#### *Concepts of Public Administration*

As a self-aware field, public administration traces its roots to Woodrow Wilson's 1887 essay, "The Study of Administration" (Fry 1989, 6). As Harmon and Mayer (1986, 6) phrased it, public administration deals with decisions that are made in the name of the public and use public resources. Thus, within Donahue's (1987, 7) two-dimensional framework for public/private choice in Figure 2-3, public administration deals with any of the three quadrants other than the lower right—the domain of the market. More particularly for the present research, our interest is in the left column of that figure, the choice between

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<sup>7</sup> As was noted in the introduction to this chapter, decisions on what to include within any one of the nine fields listed in Table 2-4 are somewhat arbitrary. This is specifically the case with public administration. Public choice theory, for instance, is probably usually thought of as an element of economics—where it is discussed in this chapter—but is also discussed in the context of organization theory for public administration (Harmon and Mayer 1986, 244-264). The theory of non-market failure, introduced in this section, is in the same category. Thus, although a general sense of what individual fields of research are about is helpful in getting one's arms around theory applicable to the public-private repair source decision, fine distinctions probably are not.

public- and private-sector delivery under conditions of collective payment (which, of course, is the case for military forces).

**FIGURE 2-4**  
DIMENSIONS OF PUBLIC/PRIVATE CHOICE

	Collective Payment	Individual Payment
Public-Sector Delivery		
Private-Sector Delivery		

Wilson's main concern, as articulated in his 1887 essay, was the separation of political and policy concerns from administration. This concern, more than a century later, has obvious relevance for the current research. Given such a separation—that is, political concerns are resolved prior to the public-versus-private choice, rather than intruding into it—public administration faces the same issues as any administration: how best to accomplish given ends. In addressing these issues, in fact, the literature on public administration often echoes the literature on administration and organization theory generally, by tracing the usual route through Max Weber, Fredrick Taylor, Mary Parker Follet, Elton Mayo, Chester Barnard, and Herbert Simon. It is probably fair to say, however, few today would still buy into Wilson's dichotomy. Administrators make policy while doing their jobs and, as discussed earlier under the topic of public choice theory, Congress helps with administrative decisions such as where to accomplish work.

Mainstream public administration theory is enduring a period of challenge. Beginning with Ostrom's *The Intellectual Crisis in American Public Administration* (1974), there has been significant energy devoted to the perceived inadequacy of the functionalist underpinnings (e.g., instrumental rationality and the scientific method) of traditional public administration (Hummel 1997, 33).

More recently, and of special interest here, a fairly extensive (and in part ideological) literature challenges the very legitimacy of the public provision of services and touts private provision as a preferred alternative. This literature is at least in part motivated by the antigovernment stance of political campaigns and administrations dating to the Carter era (Wamsley et al. 1990, 11), and by the (imported) privatization initiatives of Margaret Thatcher (Johnson 1998; Kouzmin and Johnston 1998, 168-169) as well as those of Ronald Reagan (Donahue 1987, 4-5; Noonan 1998).

The hypothesis drawn from public administration theory is:

**H28** Private provision of goods and services will be preferred, in general, to public provision.

### *Privatization Literature*

The more general literature on public administration—which to this author seems to lack a concept of government performance of commercial-like activities—does not provide much in the way of insights for the choice between public and private provision of commercial-like activities such as depot maintenance. See, for instance, Ostrom (1974), Harmon (1986), Fry (1989), Wamsley (1990), or Kass (1990). For such insights it is necessary to look at the narrower corpus of public administration literature that deals specifically with privatization. Here also, however, it will be necessary to sharpen the focus even more. Defined broadly, privatization can include any reduction in the scale or scope of government (Starr 1990, 2-4). Thus the broad definition could include lower taxes, lower spending, deregulation, and financing of private provision of services through devices such as vouchers. In a more specific sense, privatization is a change in mode of operations from public to private delivery of public goods under conditions of collective payment (Donahue 1987, 3). It is this more specific sense that is of interest here.

The literature deals with at least two different forms of privatization. One form, of limited relevance for the present research, is the privatization of state-owned enterprises (SOEs) (Donahue 1987, 6)—a movement from the upper right quadrant of Figure 2-4 to the lower right. (In the United Kingdom, the term for this form of privatization was

denationalization (Kouzmin and Johnston 1998, 1.) Examples from the literature in this vein are Al-Homeadan (1996), Bhandari (1993), Hutchinson (1989), Ioannidis (1994), Lewis (1996), and Sappington and Stiglitz (1987).

A second form, the one we are interested in, is privatization of the means of production while responsibility for delivery still lies in the public sector—a movement from the upper left quadrant of Figure 2-4 to the lower left. It is this literature on which we draw below. We will not deal with public corporations (such as the Postal Service) that operate in the upper right quadrant of Figure 2-4, since it is unlikely that depot maintenance would be accomplished via fee-for-service rather than an appropriation. (However, a Federal Aviation Administration study on privatizing the air traffic control system (Kelly 1994) is an example analysis of the potential for transforming a public administration entity into a public corporation.)

The literature on privatization does not appear to be as well integrated as any of the streams we have described from the economic literature. For that reason, rather than describing a formal body of knowledge, here we will summarize five specific contributions to the literature on privatization. Further, to provide a consistent focus, we will define privatization in the narrow sense of moving vertically in the left column of Figure 2-4. The five contributions are John D. Donahue's *The Privatization Decision*, Donald F. Kettl's *Sharing Power*, Steven Globerman and Aidan Vining's "A Framework for Evaluating the Government Contracting-Out Decision with an Application to Information Technology," Graeme Hodge's empirically oriented *Contracting Out Government Services: A Review of International Evidence*, and Charles Wolf Jr.'s *Markets or Governments*.

Donahue (1987, 3-5), in *The Privatization Decision*, noted a worldwide shift from collective to market approaches. He defined privatization as delegation of public duties to private organizations and asserted that, in the United States, the privatization movement can be traced back to the 1950s, when the former Bureau of the Budget encouraged federal agencies to buy, through regular business channels, products that were available from private enterprise, rather than producing such products themselves.

He noted a tendency to consider the public-versus-private choice as an integrated package of functional, philosophical, and symbolic attributes (Donahue 1987, 10). In order

to untangle those attributes, he examined the particular strengths and limitations of public and private institutions, and especially the relationships among individuals. His working assumption was that different kinds of tasks will require different kinds of relationships (in the sense of expectations, obligations, rights, and duties) between those who carry out tasks and those on whose behalf they are performed. In other words, his central theme was the principal-agent relationship.

His research is probably best described as a meta-analysis of prior empirical studies. In order to discover the conditions under which private provision was more efficient than public, he reviewed studies of public versus private delivery of garbage collection services, Pentagon support services competitions under Office of Management and Budget (OMB) Circular A-76 rules, office cleaning services, firefighting services, airlines in Australia, railroads in Canada, buses in the United States, and water and power utilities (Donahue 1987, 58-78). The results, which partly overlap those reported by Wolf (described later under the section "Theory of Non-Market Failure"), are summarized in Table 2-5.

**TABLE 2-5**  
**RESULTS OF STUDIES OF PUBLIC VERSUS PRIVATE PROVISION OF SERVICES**

Area	Results	Discussion
Garbage collection	<ul style="list-style-type: none"> <li>•Contracting less expensive than public provision, but</li> <li>•Open competition can be more expensive than public provision.</li> </ul>	<ul style="list-style-type: none"> <li>•Less restrictive work rules and lower labor rates favor contractors.</li> <li>•Higher costs under open competitions are probably explained by administrative costs to bill customers (as opposed to funding through taxes), loss of economies of contiguity when several companies are operating on the same street and each ends up skipping houses, and potential for hidden cartels (i.e., not competitive in actuality).</li> </ul>
DoD support services	<ul style="list-style-type: none"> <li>•On average, public-private competitions using OMB circular A-76 procedures saved 22 percent.</li> </ul>	<ul style="list-style-type: none"> <li>•When in-house bidders won, costs also decreased an average of 18 percent.</li> <li>•Follow-up studies by the General Accounting Office found that although costs did rise after award, competitive contracting still offered substantial savings.</li> </ul>
General Services Administration office cleaning	<ul style="list-style-type: none"> <li>•Contracting out cleaning chores cost \$0.73/sq. ft. per year compared to \$1.18 for in-house performance and \$0.63 for private landlords.</li> </ul>	<ul style="list-style-type: none"> <li>•Quality was equivalent in all three cases.</li> <li>•Public workers were paid higher wages, were less well equipped, and followed less efficient procedures.</li> </ul>

**TABLE 2-5**  
**RESULTS OF STUDIES OF PUBLIC VERSUS PRIVATE PROVISION OF SERVICES (CONTINUED)**

Area	Results	Discussion
Firefighting services in Scottsdale, AZ	<ul style="list-style-type: none"> <li>•Private provision of firefighting services cost \$4 per capita compared to estimated \$7 per capita for public provision.</li> </ul>	<ul style="list-style-type: none"> <li>•Private firefighting company was able to spread overhead costs, since it served other rural communities in same proximate area.</li> <li>•Technological and managerial innovation (such as using part-time workers) also accounted for part of difference.</li> </ul>
Airlines in Australia	<ul style="list-style-type: none"> <li>•For period studied (1958 through 1974), private airline got more output from each worker (100 percent more for freight, 22 percent for passengers, 13 percent more for revenue).</li> </ul>	<ul style="list-style-type: none"> <li>•Government and private airlines used same equipment and terminals, operated over same routes, with same schedules.</li> <li>•Differences were attributed to rules and customs associated with exchangeable private property rights.</li> </ul>
Railroads in Canada	<ul style="list-style-type: none"> <li>•During period 1956–1965, productivity of public Canadian National was between 81 percent and 91 percent of privately owned Canadian Pacific's productivity.</li> <li>•During period 1966–1975, Canadian National productivity was the same or higher.</li> </ul>	<ul style="list-style-type: none"> <li>•Good performance of publicly owned Canadian National, especially in second period, attributed to the need to compete for business with Canadian National, as well as with other transportation modes (cars, buses, trucks, airplanes, ships, and pipelines).</li> </ul>
250 urban transit systems in the United States in early 1980s	<ul style="list-style-type: none"> <li>•Privately owned and operated systems were measurably more efficient and possibly safer as well.</li> <li>•Privately managed, publicly owned transit systems were not more efficient than publicly owned, publicly managed.</li> </ul>	<ul style="list-style-type: none"> <li>•When publicly owned transit systems were privately managed, the limited stakes in increasing efficiency (as a result of working for fees rather than net profits) decreased incentives for improvement.</li> </ul>
U.S. water and power utilities	<ul style="list-style-type: none"> <li>•Private water or power utilities did not tend to be more efficient than public counterparts.</li> </ul>	<ul style="list-style-type: none"> <li>•Absence of difference between the two organizational forms was attributed to fact of both operating under conditions of monopoly.</li> </ul>

Based on the data summarized in Table 2-5, Donahue reached two conclusions. First, the private firm is potentially far more efficient than its public counterpart. Second, tapping into that potential depends on a competitive marketplace and on the credible prospect of replacement that competition brings. Absent such a prospect, the potential disappears. As Donahue stated it: "*Public versus private matters, but competitive versus non-*

*competitive usually matters more*” (1987, 78) (emphasis in original). Interestingly, he also holds that if effective competition is impractical, then public provision will frequently be better—despite bureaucracy’s weak incentives for cost control.

This position is not universally accepted; for instance Megginson, Nash, and Randenborgh (1994, 405) reach exactly the opposite conclusion. In the fifth chapter of Donahue’s dissertation (1987, 79-80), he combined the results of the empirical studies with observations from transaction cost economics to construct a series of propositions. Here we are quoting verbatim, but formatting them to highlight the factors involved:

- The more precisely a task can be specified in advance and
- its performance evaluated after the fact,
- the more certainly contractors can be made to compete;
- the more readily disappointing contractors can be replaced (or otherwise penalized);
- and the more narrowly government cares about ends to the exclusion of means,
- the stronger becomes the case for employing profit-seekers rather than civil servants.

Or, as Donahue also phrased it, the basic distinction is not between public and private but between competitive output-based relationships and noncompetitive input-based relationships (1987, 82). The efficiency gains from competition come at the expense of some control over means and a loss of the ability to redirect effort without a change in the contract.



The observations above lead to two hypotheses:

<b>H29</b>	Private providers of depot maintenance will be perceived as more efficient at depot maintenance than their public counterparts.
<b>H30</b>	The availability of a competitive marketplace will be perceived as mattering if government is to benefit from commercial capabilities.

Kettl (1993), as mentioned earlier, examined the A-76 contracting-out program, the FTS-2000 telecommunications system, the Superfund, and the Department of Energy Nuclear Weapons Complex, as well as state and local government contracting. Drawing on problems he found with these examples (using them essentially as case studies) and also on principal-agent theory, he saw a different central problem to contend with than did Donahue. Kettl very nearly assumes away the possibility of meaningful competition (1993, 14-16). He asserts that the government is often buying custom goods for which there are only one or two providers and that government is more often in a partnership with its suppliers than acting at arm's length.

Although it is not clear whether he meant the statement about one or two providers literally, or whether he uses the concept of partnership in the same way discussed below under "Relational or Social Exchange Theories," he argues that the central concern is not competition but that the government retain what he calls "smart buyer" capability (Kettl 1993, 17). By this he means that the government needs to know what it wants to buy, know how to buy it, and be able to monitor whether it got what it asked for. He attributes the problems with procurement from commercial sources to failure to retain this capability. The related hypothesis, already covered under principal-agent theory, is:

<b>H25</b>	Retention by the government of smart buyer capability will be perceived as important.
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Globerman and Vining (1996), writing in the *Public Administration Review*, although focused on information technology, offer a framework for contracting-out decisions that could have broader applicability than that field. As Globerman and Vining see it, the primary issues in deciding whether to contract out have to do with minimizing costs.

Consistent with TCE, they define total costs as comprising both production costs and the costs associated with governance. They observe that “the evidence suggests that contracting out has a potential for lowering the first set of costs, ... but these savings might be more than offset by increases in governance costs” (pg. 577). Although they do not use the terms “transaction cost economics” or “principal-agent theory,” their framework is rooted in these concepts. But they depart from TCE’s prescription that governance costs are a function of asset specificity, uncertainty, contestability, and frequency, by asserting that such costs hinge instead on asset specificity, task complexity, and contestability.

In any event, they divide governance costs into bargaining costs and opportunism costs. They define bargaining as occurring when both parties act with self-interest but in good faith, and opportunism as occurring under conditions of bad faith. They note that both bargaining and opportunism costs are experienced under internal performance or when work is contracted out. Further, they acknowledge that the distinction between those costs may be of more scholarly interest than practical interest. Their definitions for task complexity, contestability, and asset specificity are as follows:

- *Task complexity* is the degree of difficulty in detailing and monitoring the terms and conditions of a contract. It is important because it determines the potential for information asymmetry, for bounded rationality, and the likelihood that there will be externalities.
- *Contestability* describes the degree to which there is or can be competition. A contestable market helps discipline opportunism. In this regard, it is interesting to note that Globerman and Vining make a point of the OMB Circular A-76 provision that precludes contracting-out functions critical to defense. As they note, this provision does not necessarily reduce the risk of opportunism, because government employees can also act opportunistically.
- *Asset specificity* describes the situation where an asset is necessary for the production of a good but has much less value in alternative uses. Asset specificity can also raise the specter of opportunism.

Based on this triad, they offer a framework of possible contracting-out states. Their framework appears in somewhat modified form in Table 2-6.

Globerman and Vining’s work provides further support for three of the hypotheses already stated (relating to ability to specify contingencies in advance, asset specificity, and level of competition), and it reemphasizes a hypothesis already covered under TCE:

**TABLE 2-6  
CONTRACTING OUT STATES**

<b>Task Complexity</b>	<b>Asset Specificity</b>	<b>Contestability</b>	<b>Examples and Dominant Problems</b>	<b>Solutions</b>
Low	Low	High	<ul style="list-style-type: none"> <li>•Example: Simple circuit-board repairs; operation of distribution depots</li> <li>•Relatively problem-free</li> </ul>	<ul style="list-style-type: none"> <li>•Take advantage of competition, out-source</li> </ul>
Low	Low	Low	<ul style="list-style-type: none"> <li>•Example: Maintenance of obsolete but simple equipment</li> <li>•Lack of contestability</li> </ul>	<ul style="list-style-type: none"> <li>•Develop alternative source(s)—including organic if need be; duplication not that costly</li> </ul>
Low	High	High	<ul style="list-style-type: none"> <li>•Example: C3 and space system software maintenance</li> <li>•Contractors may be reluctant to invest in equipment and training for fear of DoD opportunism</li> </ul>	<ul style="list-style-type: none"> <li>•Government should own specific assets and</li> <li>•In-source, or</li> <li>•Contract for labor</li> </ul>
Low	High	Low	<ul style="list-style-type: none"> <li>•Example: Manufacturing or repair of obsolete electronics requiring specialized manufacturing or test equipment (e.g., diminishing manufacturing sources problem)</li> <li>•Mutual hostage situation if contractor owns equipment</li> </ul>	<ul style="list-style-type: none"> <li>•Contract out</li> <li>•If contestability problems override, reduce to minimum efficient scale</li> <li>•If asset specificity problems override, hold some of the assets</li> <li>•Set up organic capability as source of last resort</li> </ul>
High	Low	High	<ul style="list-style-type: none"> <li>•Example: Major modification</li> <li>•Genuine uncertainty about costs and/or performance. Can involve potential for major breach of performance</li> </ul>	<ul style="list-style-type: none"> <li>•Reduce task complexity (e.g., through prototyping), or provide for mid-term corrections while under contract</li> <li>•Otherwise in-source</li> </ul>

**TABLE 2-6**  
**CONTRACTING OUT STATES (CONTINUED)**

<b>Task Complexity</b>	<b>Asset Specificity</b>	<b>Contestability</b>	<b>Examples and Dominant Problems</b>	<b>Solutions</b>
High	Low	Low	<ul style="list-style-type: none"> <li>•Example: Item management, maintenance of stochastically-failing equipment with high demand variability</li> <li>•Difficult to distinguish between disagreement over satisfaction of terms and conditions and opportunistic behavior</li> <li>•Exacerbated by high switching costs</li> </ul>	<ul style="list-style-type: none"> <li>•Dual-source prototypes</li> <li>•Share data</li> <li>•Provide for mid-term corrections while under contract</li> </ul>
High	High	High	<ul style="list-style-type: none"> <li>•Example: Initial design and development of new weapon system, major information system, or major new support capability</li> <li>•Can be exceptionally difficult to stipulate required performance in advance</li> </ul>	<ul style="list-style-type: none"> <li>•Phased competitive procurement</li> <li>•Incremental or evolutionary development models instead of waterfall model</li> </ul>

**TABLE 2-6**  
**CONTRACTING OUT STATES (CONTINUED)**

<b>Task Complexity</b>	<b>Asset Specificity</b>	<b>Contestability</b>	<b>Examples and Dominant Problems</b>	<b>Solutions</b>
High	High	Low	<ul style="list-style-type: none"> <li>•Example: Only one source of repair for complex system with high demand variability (e.g., military derivatives of commercial aircraft)</li> <li>•Hard to specify required performance in advance</li> <li>•Very high switching costs because of both asset specificity and low contestability</li> <li>•Open to opportunistic behavior</li> </ul>	<ul style="list-style-type: none"> <li>•Develop long-term relationship, or</li> <li>•In-source</li> </ul>

The table presented here is modified in three ways compared to Gloverman and Vining's version. First, the table in their article was evidently typeset incorrectly, and column headings corresponded to the wrong columns. Second, their table, for reasons that are not clear in their article, included only seven of the eight possible states; this table portrays all eight. Finally, the relatively general phraseology in the model has been made more specific to depot maintenance, while hopefully maintaining the intent of their examples.

**H17** The choice between public and commercial providers of depot maintenance will be perceived to depend on the total cost, where total cost is the sum of production cost and transaction costs.

There has been a continuing stream of empirical privatization research. Hodge (1996) identified and reviewed over 129 English-language studies of contracting out (public-private, public-public, private-sector to private sector, and other mechanisms) that included empirical results. The studies, which were mostly from the economics, finance, and business disciplines, and mostly U.S. in origin, spanned the period 1974–1995. Although Hodge is not completely clear with regard to his frame of reference, it appears that he is comparing contracting out (with or without competition) to internal provision of services under hierarchical governance. As illustrated in Table 2-7, any form of contracting appears to generate claimed cost savings.

TABLE 2-7  
EMPIRICAL FINDINGS IN CONTRACTING LITERATURE

Sectors contracting	Number of cost savings estimates	Average claimed amount of savings (%)	Standard deviation (%)
From public sector to private sector	135	14	38
From public sector to public sector	24	22	14
From private sector to private sector	9	18	14
Other mechanisms	14	13	10

The values reported in Table 2-7 were those claimed in the sources Hodge consulted. He also isolated 28 studies (with a combined sample size of 20,131 comparisons) that provided enough statistical data for him to calculate an effect size—the estimate of the size of a change compared to the background variation. For this subset of studies, he calculated an average cost reduction of between 9 percent and 14 percent from contracting services (including contracting in) when compared to previous governance mechanisms.

There was no difference in savings when contracting in was compared to contracting out. Hodge also noted that some services lent themselves to statistically significant savings, while others did not (Table 2-8). That maintenance is among the fields showing statistically significant evidence of savings is intriguing in the context of the present study. There was no evidence that quality of services either improved or got worse. Unfortunately, Hodge does not provide similar analysis that compares either claimed or measured savings in the situations where contracting was competitive against those where it was not, nor is it possible to discern from his data what fraction of his results might fall into either category.

Hodge does note that more recent studies tended to find smaller effects than did earlier studies, and that more sophisticated studies (with more controls for more variables) tended to find smaller effects than did simpler studies. Overall, then, Hodge's work provides further support for hypotheses already stated, rather than suggesting new ones.

### *Theory of Non-Market Failure*

Neoclassical economic theory, covered earlier in this chapter, provides a foundation for understanding how markets should work (at least in the restricted sense of allocation

**TABLE 2-8**  
**CONTRACTING META-ANALYTIC RESULTS**

Statistical Result	Types of Service
Statistically significant saving	<ul style="list-style-type: none"> <li>•Maintenance</li> <li>•Cleaning</li> <li>•Refuse collection</li> </ul>
No statistically significant saving	<ul style="list-style-type: none"> <li>•Corporate services</li> <li>•Police/security</li> <li>•Health</li> <li>•Parks and recreation</li> <li>•Engineering</li> <li>•Training</li> <li>•Transportation</li> </ul>

efficiency) and the conditions under which they fail to work well. However, it would be a mistake to think of government as the automatic, preferred alternative to an imperfect market. As already indicated, DoD's internal market exhibits the defects of a vertically integrated monopoly (Thompson 1995, 17). Thus the choice could well be between an external monopoly and an internal monopoly, neither of which might be particularly attractive.

More generally the choice, rather than being between imperfect markets and government, is between *imperfect* markets and *imperfect* government (Wolf 1994). Recognizing this, Wolf has attempted to provide a balanced view by establishing a theory of non-market (government) failure, as a counterpart to what he sees as the well developed theory of market failure. In essence his theory acknowledges that it is widely accepted that the market system is more efficient at both a given time and over time than non-market systems (Wolf 1994, 122-127, 182), and attributes this efficiency to three "ingredients":

- *Dynamic efficiency*—the ability to develop new technology that lowers cost functions, improves product quality, and creates new and marketable products;
- *Technological efficiency*—the ability to find and employ the best technology currently available, thus producing at lower cost and higher quality; and
- *X-efficiency*—the ability, given a specific technology, to reduce cost, raise productivity, and improve quality through changes in organization, management practices, and worker motivation.

Wolf asserts that it is likely that market enterprises generally do better than public enterprises because they provide better rewards (hence stronger incentives) on all three of

these factors. In an appendix to his book he includes a summary of 53 market versus non-market studies in 23 different industry groups. Of these 53 studies, 46 compare private versus public provision. Since these studies appear to make comparisons at a point in time rather than longitudinally, they are probably best thought of as comparing X-efficiency. In 35 cases private provision was more efficient—generally with public provision costing 20 percent to 50 percent more; in 3 cases public provision was more efficient. In the other cases, public and private performance were either equivalent (6 cases) or ambiguous (2 cases). On balance, his evidence would point toward private performance being more X-efficient than public performance. Boardman and Vining (1989, 11-26), after examining performance indicators for the 500 largest manufacturing and mining corporations in the world outside the United States, reached comparable conclusions.

Out of the theory of non-market failure, we then draw three hypotheses:

<b>H31</b>	Compared to government, commercial firms will be perceived as having better dynamic efficiency—the ability to develop new technology that lowers cost functions, improves product quality, and creates new and marketable products.
<b>H32</b>	Compared to government, commercial firms will be perceived as having better technological efficiency—the ability to find and employ the best technology currently available, thus producing at lower cost and higher quality.
<b>H33</b>	Compared to government, commercial firms will be perceived as having better X-efficiency—the ability, given a specific technology, to reduce cost, raise productivity, and improve quality through changes in organization, management practices, and worker motivation.

### Technology and Strategic Management

As indicated earlier in Table 2-4, there are a number of reasons for seeking insights from the literature on technology and strategic management:

- The maintenance under consideration is performed on high-technology weapon systems.
- The choice of maintenance sources can impact technology insertion methods and rates, as well as the coupling of product and process design.
- This is the literature stream within which one finds the concept of “core competencies.”



- Outsourcing can be considered an “administrative” innovation.

The field of technology management at one time was accused of lacking shared perspectives (Utterback 1986). At present, however, this arguably would be an overly pessimistic view, if only because most of the current literature is generally based on (“shares”) either economic or strategic planning perspectives (Ulhoi 1996). The discussion that follows will draw on the literature in the fields of technology and strategic management to first establish the general implications of maintaining high-technology weapon systems, and then examine the extent to which the choice of depot maintenance provider can either contribute to or “cure” ongoing problems with technological obsolescence. In these two cases we are treating technology in a fairly conventional sense as embodied in artifacts. Then we will define technology more broadly, as a complete “system” embedded in a social context, in order to benefit from resource/competency-based theory and the concept of organizational isomorphism.

### *Maintenance of High-Technology Weapon Systems*

Throughout the Cold War, technological superiority of weapon systems was a central tenet of national security policy (Branscomb 1997, Chapter 5; Phillips 1991, 2; Thompson and Jones 1994, 104). One result was that product quality in the form of technologically sophisticated weapons became a competitive strength for the U.S. arms industry (Thompson and Jones 1994, 104). A second was that technologies as embodied in weapon systems tended to be unique implementations. Although there is some expectation that the future will be dominated by dual-use technologies—supplied by contractors whose primary orientation in design is commercial use (Pages 1998)—at present, as the General Accounting Office has summarized it, “a primary characteristic of DoD depot maintenance is that most of it is performed on noncommercial, DoD unique, weapon systems parts and components for which there is often no competition or a limited competitive market” (Warren 1998a. 4). Uniqueness of the technology, it should be evident, is not far removed from the asset specificity described previously under transaction cost economics.

### *Technology Insertion Methods and Rates*

Despite the fact that DoD weapon systems at the time of design are technologically advanced, an irony is that they also suffer from technological obsolescence (Forbes 1993, 6). Although 15- or 20-year lifetimes are often used for analysis purposes during design, the actual lifetimes can be considerably longer. A-7 and F-4 aircraft saw more than 25 years of service, and many aircraft types fought in both the Vietnam and Persian Gulf conflicts. The SSN688 submarine, AIM-9 missile, B-52 bomber, F-14 fighter, and F-15 fighter will all see more than 40 years of service (Willis 1997).

Technology lifetimes, in contrast, are much shorter—especially in the case of electronics, where one generation follows another every four to five years (Forbes, Hutcheson, and Timko 1997)—with the natural result that weapon system components become obsolete while still in use. DoD refers to this phenomenon under the rubric of the diminishing manufacturing sources problem—where manufacturers no longer support older technologies, generally because they have lost interest in them.

Given this tendency toward obsolescent technologies, insertion of updated technology has significant cost reduction and other benefits (Forbes, Hutcheson, and Staples 1996), with a 10-year return on investment of 4.5:1 not unreasonable. However, as anticipated by Wolf in his discussion of dynamic efficiency, differences in engineering capabilities and incentive structures between one repair sector and another can greatly influence the ability to capitalize on new technology opportunities (Forbes, Hutcheson, and Timko 1997, pg. 2-14). In particular, placing work with the original equipment manufacturer, who understands the underlying design, can have important benefits for technology insertion—given that there are incentives in place to motivate the OEM to insert technology. We have already captured this issue in hypotheses H29 and H30, which assert that commercial firms will be perceived as having better dynamic and technological efficiency.

### *Resource- or Competency-Based Theory*

The foregoing discussion considered “technology” as it is embodied in weapon systems. Here we expand its meaning beyond artifacts in order to gain from the insights of

what is variously called resource- or competency-based theory. The reason is that, as discussed in Chapter 1, the issue of “core” capabilities figures heavily in the debate over private versus public provision of depot maintenance, and this stream of literature is where one finds a discussion of the concept of core competencies.

Teece, Pisano, and Shuen (1997, 513), in discussing the resource-based approach or theory, provide an interesting contrast to the prescriptions from neoclassical economics. They see firms as profitable not because they deter entry and raise prices above long-run costs, but because they have lower costs, higher quality, or better product performance. Further, they attribute this competitive advantage to a firm’s idiosyncratic and difficult-to-imitate resources. Ohloi (1996, 204) articulates much the same concept when he states that the “core of a company is what it knows and what it can do rather than the products it makes or the markets it serves.”

Milgrom, Qian, and Roberts (1991, 85) and Quinn (1994, 3) would agree with this characterization but, to illustrate the amount of confusion about the concept of “core,” Venkatesan does describe core competencies in terms of the products a firm makes (1992, 101). According to Ohloi, however, core capabilities can be difficult to perceive from within the organization, because they are institutionalized and become part of an organization’s taken-for-granted reality. Ohloi is taking a position with some foundation. Other authors have described essentially the same phenomenon, although in terms such as tacit and community-dependent perceptual space organization and paradigm formation (Gersick 1991), or reciprocal typification of habituated actions (Berger and Luckmann 1966, 54).

The implication, of course, is that an organization may have great difficulty articulating its real strengths, even to itself, because familiarity leads to invisibility. In fact, the description of core competency tends to become tautological, and core comes to simply mean key or critical or fundamental (Quinn and Hilmer 1994, 2). According to Leonard-Barton, however, there are four components to these taken-for-granted core capabilities: employee knowledge and skills; technical systems; managerial systems; and values and norms (1992, 113). Leonard-Barton’s position is closely echoed by Hall (1992, 135-136) in the context of intangible firm resources.

The literature on depot maintenance, when it discusses core capabilities, is inconsistent and confused. In at least part it echoes the concept of core competencies as expressed in competency-based theory. For instance, the Congressional Budget Office uses essentially similar language when it argues that DoD should not rely on its existing core methodology—which is more than anything else is based on the TCE concept of contingent performance (Forbes, Hutcheson, and Timko 1997, pg. 2-4)—and instead allocate workload between the private and public sectors based on the relative strengths of each sector (Congressional Budget Office 1995, xiii). However, others who have examined depot maintenance dismiss the whole idea of core capabilities and argue that the issue is simply how to get on with outsourcing (Keenan et al. 1994).

Given the confusion about core competencies generally or as applied to DoD depot maintenance specifically, it is reasonable to wonder whether there is empirical support for the concept of core competencies that would earn it greater credence. The answer is that there is, in a number of fields—including information technology (Loh 1993, 79, 103), hospitals (Cooley 1997, 69-71, 79, 103), human resource management (Lever 1997, 158), and commercial logistics (Sink 1995). On the other hand, there are also examples of empirical research where competency-based theory was not supported (Borchers 1996, 86; Maltz 1992, 252) or where it was included in a research model but not separately identifiable in results (Cheon 1992, 156-166).

Hypotheses regarding resource- or competency-based theory are:

<b>H34</b>	An organization's core competencies are perceived as being defined by the products it makes, services it provides, and markets it serves.
<b>H35</b>	An organization's core competencies are perceived as defined by what it knows and what it can do.
<b>H36</b>	Members of an organization perceive themselves as able to articulate their organization's core competencies.
<b>H37</b>	Government depot maintenance capability is perceived to be a core government logistics competency.
<b>H38</b>	Employee knowledge and skills are perceived as an important component of a depot maintenance organization's core competencies.
<b>H39</b>	Technical systems are perceived as an important component of a depot maintenance organization's core competencies.

<b>H40</b>	Managerial systems are perceived as an important component of a depot maintenance organization's core competencies.
<b>H41</b>	Values and norms are perceived as important components of a depot maintenance organization's core competencies.
<b>H42</b>	There will be differing interpretations of the concept of core.

### *Administrative Innovations and Isomorphism*

Within the field of technology management, the pattern of growth of an innovation and the factors underlying diffusion of innovations have been important subjects of study (Chatterjee and Eliashberg 1990, 1057). Although, as Goodman Griffith, and Fenner (Goodman, Griffith, and Fenner 1990,45-50) have noted, innovation is inherently uncertain and disorderly, the study of innovation and technology management does contribute to understanding the patterns and forces involved. Kline and Rosenberg (1986) argue that innovation should be viewed as series of changes in a complete system, including not only hardware but also market environment, production facilities, and knowledge, as well as the social context. Devendra makes much the same point (1985, 443) as do Goodman, et al. (1990, 48) when they describe a technological system as the equipment, materials, physical environment, and program (i.e., rules, procedures, and design heuristics used in a transformation process). Thus, following Goodman et al.'s characterization and consistent with Forester (1989, 11), it would seem reasonable to recognize outsourcing practices as part of the rules, procedures, and design heuristics; allow for administrative innovations as Leonard-Barton and Deschamps (1988) have suggested; and consider the contemporary practice of outsourcing as an administrative innovation (Loh 1993, 159-160).

Here our interest is mostly in the cultural aspects of the diffusion of administrative innovations. First, diffusion of any technology is tightly linked to the development of cultural values (specifically a normative and value consensus) (Goodman, Griffith, and Fenner 1990, 64). And second, DoD's own pronouncements indicate that it is mirroring a particular "culture" when it seeks to emulate the "management techniques and business practices that have restored American corporations to leadership in the marketplace" (Cohen 1997, i).

Culture, however, is an exceptionally broad concept; one aspect of culture, isomorphism, is of particular interest here for reasons that will become apparent below.

Dimaggio and Powell (1983, 150-152) describe three isomorphic processes: coercive, normative, and mimetic:

- *Coercive* isomorphism implies that there are formal or informal pressures to structure organizational relationships in a particular manner. Arguably, for example, unions attempt to coerce companies to structure labor relationships according to certain patterns.
- *Normative* isomorphism stems primarily from professionalization, a collective effort to define conditions and methods of work.
- *Mimetic* isomorphism results when organizational technologies are poorly understood, goals are ambiguous, and the environment creates symbolic uncertainty. Under these conditions organizations may model on other organizations as a way to claim legitimacy.

All three forms may be present in the context of public versus private provision of depot maintenance. First, we discussed the presence of symbolic uncertainty relating to the definitions of “depot maintenance” and “core” previously in our review of policy documents. Second, as just discussed, the public work force would appear to be acting through the legislature to retain the historical arrangements. Third, the present restriction in 10 U.S.C. §2464 that not more than 50 percent of the funds for depot maintenance be outsourced is arguably an attempt to retain the status quo. Fourth, internal to the department, the professional logistics managers have what appears to be a strong professional preference for in-sourcing. Finally, it should be evident from the review of DoD-sponsored studies in the beginning of this chapter than the debate over public or private provision of depot maintenance is dominated by ambiguous goals, poor understanding of the advantages or disadvantages of outsourcing, and a fair amount of symbolic uncertainty. For instance, there is no general agreement in the literature on the meaning of the term “core.” Perhaps even more problematic, the term “depot maintenance” is subject to definitional uncertainty. These are all *prima facie* indications that isomorphism is a path worth exploring.

The hypotheses from this stream of literature, particularized to the present context, are:

<b>H42</b>	There will be differing interpretations of the concept of core. (This hypothesis, already introduced as part of resource- or competency-based theory, will be examined in conjunction with hypotheses H25 through H31.)
<b>H43</b>	Professional managers in government will prefer in-sourcing.
<b>H44</b>	Managers of and others with an interest in the decision on public versus private allocation of the depot maintenance workload will be uncertain of the definition of depot maintenance.
<b>H45</b>	Persons with an interest in the decision on public versus private allocation of the depot maintenance workload will perceive themselves as having unclear expectations of the benefits of outsourcing.
<b>H46</b>	Persons with an interest in the decision on public versus private allocation of the depot maintenance workload will perceive themselves as having a unclear understanding of the purpose of outsourcing.
<b>H47</b>	Government managers will perceive themselves as under pressure from top-level management to outsource depot maintenance.

There has been some exploration of isomorphism as related to outsourcing, although the research is limited and results are not clear-cut. In the context of information technology, as noted earlier, Loh (1993, 159-160) treated outsourcing as an administrative technology. He found both internal and external influences on the diffusion of outsourcing—with more explanatory power coming from modeling of internal influences. More particularly for our purposes here, his results were consistent with the concepts of isomorphism.

Pouder (1993, 20), writing in the context of institutional theory, expected that corporation structures, rather than being efficiency-based, would reflect isomorphism—in particular the adoption of structures that prevail in other, successful, organizations. In an examination of local government services (Pouder 1993, 87), he found that efficiency concerns were stronger predictors of privatization than were interorganizational norms (i.e., mimetic isomorphism), that unions have a significant negative effect on privatization, and that professional managers were more likely (notionally as a result of normative isomorphism) to privatize than were nonprofessionals.

Finally, and in at least an indirect way, Harris (1996, 137-138) supported the relevance of the concept of isomorphism to privatization when he found that the degree of

flexibility incorporated into information technology contracts would reflect the flexibility of the organization writing the contract. Interestingly, however, Harris was then not able to find any relationship between such flexibility and outcome.

### Relational or Social Exchange Theories

All organizations find themselves dependent to some extent on the external environment, and organizations adopt strategies to secure access to critical resources (Cheon 1992, 22-23). Such is unarguably the case for depot maintenance: when the cost of replacement parts is included, the total dollar expenditure in the private sector exceeds 50 percent of the annual budget of approximately \$15 billion (Office of the Deputy Under Secretary of Defense (Logistics) 1993, pg. 1-2).

Relational/social exchange theory argues that the typical neoclassical economic formulation of market exchange provides an undersocialized, atomized-actor explanation and neglects the structures of social relations (Granovetter 1985, 481; Powell 1990, 297, 299). It contends that an improved account needs to recognize that economic action is embedded in social structure. To a significant extent, of course, that is what the isomorphism concept does. Here we would like to go beyond the discussion of isomorphism and consider relational (sometimes also called "social") exchange theory and the related concept of trust. Trust is defined for this purpose as either confidence or predictability in one's expectations, or confidence in an other's goodwill (Ring and Van De Ven 1992, 488). Trust is a measure of the degree to which one party judges that another will intend to and be able to fulfill its commitments, and that the exchange between the two parties is equitable.

Since there are ethical elements behind any contract (Ring and Van De Ven 1992, 488), trust-based exchange is not that novel a concept. But it is of particular contemporary interest, since rapid changes in technology (especially communication technology), a competitive environment, firm strategies, and other pressures are held to be motivating firms to seek continuing relationships with other firms in the form of alliances and other similar cooperative efforts (Carayannis and Alexander 1998; Ring and Van De Ven 1992, 483-484; Witt 1994, 47-48).



Griesinger (1990, 485) provides an explanation for this pattern by making a distinction between uncertainty and equivocality. Where uncertainty leads to the search for objective information (e.g., information with which to monitor for shirking), equivocality—the existence of multiple and conflicting interpretations of the organizational situation—leads to social exchange of opinions and beliefs in order to define the problem and resolve conflicts, what Weick has called efferent, or outwardly oriented, sensemaking (1979, 159). The essence of this process is the enactment of a shared interpretation that will provide a basis for trust as defined above—a concept, incidentally, comfortable in action theory, which holds that rather than thinking preceding doing, thought and action are mutually constitutive and coextensive (Harmon 1989, 146).

Trust-based relationships thus differ from both the market and hierarchical forms of governance, and firms pursuing such arrangements do so because their business objectives require cooperation as result of reciprocal dependencies. Transaction cost economics, reviewed earlier in this chapter, assumes that economic actors are opportunistic, as does principal-agent theory. Yet both ignore the possibility of trust-based behavior as an alternative to either the market or hierarchy. Also, TCE has an inherent focus on the single transaction as a unit of analysis rather than a longer-term series of transactions among trading partners. In fact, the basic TCE assumptions of self-interest, bounded rationality, and negative opportunism become an insufficient basis for understanding organizational economics, because they fail to capture the importance of interpersonal and other non-market resources (Griesinger 1990, 478).

The relational exchange alternative to either the market or hierarchical form of governance is the trust-based relational contract. In the familiar market-based discrete exchange, the relationship between buyer and seller is short-term; buyers and sellers are largely autonomous. By contrast, in the relational exchange a specific transaction is set in the context of both the history of a relationship and expectations about its future (Chisholm 1989, 114-120; Chung 1996, 21-22), and trust is a critical factor (Helper 1991, 16; Ring and Van De Ven 1992, 488). Further, there is evidence that governance costs under conditions of trust are lower than under conditions of distrust (Griesinger 1990, 488; Helper and Sako 1995) and that relational exchange is a superior method for reducing equivocality

(Chisholm 1989, 112-114). Powell (1990, 300) has put these various contrasts of markets, hierarchies, and relational exchanges (he refers to relational exchanges as networks) together in the form of a stylized comparison of forms of economic organization, presented here as Table 2-9.

**TABLE 2-9**  
**MARKET, HIERARCHY, AND RELATIONAL EXCHANGE**

Key Features	Forms of Organization		
	Market	Hierarchy	Relational
Normative basis	Contract, property rights	Employment relationship	Complementary strengths
Means of communication	Prices	Routines	Relations
Methods of conflict resolution	Haggling, resort to courts for enforcement	Administrative fiat, supervision	Norm of reciprocity, concern for reputation
Degree of flexibility	High	Low	Medium
Amount of commitment among the parties	Low	Medium to high	Medium to high
Tone or climate	Precision and/or suspicion	Formal, bureaucratic	Open-ended, mutual benefits
Actor preferences or choices	Independent	Dependent	Interdependent
Mixing of forms	<ul style="list-style-type: none"> <li>•Repeat transactions</li> <li>•Contracts as hierarchical instruments</li> </ul>	<ul style="list-style-type: none"> <li>•Informal organization</li> <li>•Market-like features: profit centers, transfer pricing</li> </ul>	<ul style="list-style-type: none"> <li>•Status hierarchies</li> <li>•Multiple partners</li> <li>•Formal rules</li> </ul>

Relational exchange theory, however, is one of those areas that, like technology management at one point in time, appears to lack boundaries or ownership of a set of shared perspectives (or at least terminology). Powell, cited above, refers to the same phenomenon as the network form of organization. Cheon, working within the perspective of what he called network/interaction theory, uses much the same construct to describe the activities by a firm to build, maintain, and develop customer relations. In doing so, he emphasizes the idea of shared experience and how shared experiences increase the likelihood that service quality will be consistent with expectations (Cheon 1992, 32). Other terms that mean more or less the same thing are hybrid mode, quasi-integration, quasi-firm, dynamic networks,

and strategic networks (Takeishi and Cusumano 1995, 1), as well as commitment strategy (Waller and Landeros 1994, 13). This researcher fails to see a meaningful distinction among network form of exchange, network/interaction, creation of shared experience in Cheon's view, the enactment of shared expectations as described under relational exchange, or the various other labels. Perhaps, however, rather than a weakness of nomenclature, this is an asset, since they all tend to contribute to the legitimacy of the concept of trust-based relations.

There have been a number of attempts to examine trust-based relationships empirically. Jap (1995, ii), working in the context of outsourcing, concluded that trust is important but not entirely necessary; common goals can act as substitutes for trust. If the degree of trust is low—as an example, during the early phases of a relationship—exchange of idiosyncratic assets can act as a credible commitment. Further, the existence of complementary competencies are important to the decision to work together.

Chung (1996, 110) examined relational exchange theory in the context of information technology outsourcing. He found that, except for role integrity, all dimensions of relational exchange theory were positively and strongly correlated with at least one of three success measures.

Davis (1996, 275-278) also used relational exchange theory to examine information technology outsourcing. He determined, consistent with the precepts above, that trust-based relationships were used when equivocality (he referred to it as uncertainty) was high. He also noted that trust-based relationships were more difficult for managers to implement, since higher-level managers tended to ask for economic, price-based justification of trust-based relationships—which, of course, the proponents were unable to provide.

Cheon (1992, 156-166), mentioned earlier, included network/interaction theory in an integrated model of information technology outsourcing, but the contribution of network/interaction theory to his model was not separately identifiable.

Moore (1996, 121-122) used trust and commitment in a look at logistics outsourcing. He was able to show that both trust and commitment were related to effectiveness, but he was not able to show that they were related to each other.

Sink also looked at trust and commitment in the context of logistics outsourcing. He found that whereas the selection of a logistics supplier had in the past decade focused on cost and quality, there had been a shift to long-term alliances (1995, 102, 108). In his empirical work, he found that once cost and service were ascertained, trust and the degree of cultural compatibility were the most salient factors (Sink 1995, 300).

The hypotheses from relational exchange theory are:

<b>H48</b>	Long-term alliances between users of depot maintenance and commercial firms will be perceived as important to effective depot maintenance support.
<b>H49</b>	Long-term alliances between organic depots and their customers will be perceived as important to effective depot maintenance support.
<b>H50</b>	Building and sustaining trust will be perceived as important to effective long-term depot maintenance alliances.
<b>H51</b>	Building and sustaining trust will be perceived as difficult.

### Logistics and Supply Chain Management

Depot maintenance is a logistics function within DoD. At the Office of the Secretary of Defense (OSD) level, depot maintenance has historically been managed by an assistant deputy under secretary of defense for logistics or equivalent on the OSD staff. Each of the services also manages depot maintenance within its logistics staff. For this reason, and because in recent years depot maintenance, privatization, and logistics or supply chain management are often integrated in policy pronouncements,<sup>8</sup> it is essential to understand what the logistics literature has to offer.

This discussion immediately follows the discussion of relational exchange, since the behavior of individual firms can have significant overall logistics cost impacts (Bowersox, Closs, and Helferich 1986, 9), and a significant trend in recent years is the collaboration of participants in a supply chain to reduce logistics costs (Copacino 1997, 24; Rao and Yound 1994, 11-12; Sink 1995, 73). These collaborations are alternatively referred to in terms of supply chain management, supply chain integration, logistics partnerships, or

<sup>8</sup>. As an example, 10 U.S.C. §2464 (May 1998), Core Logistics Capabilities, does so.

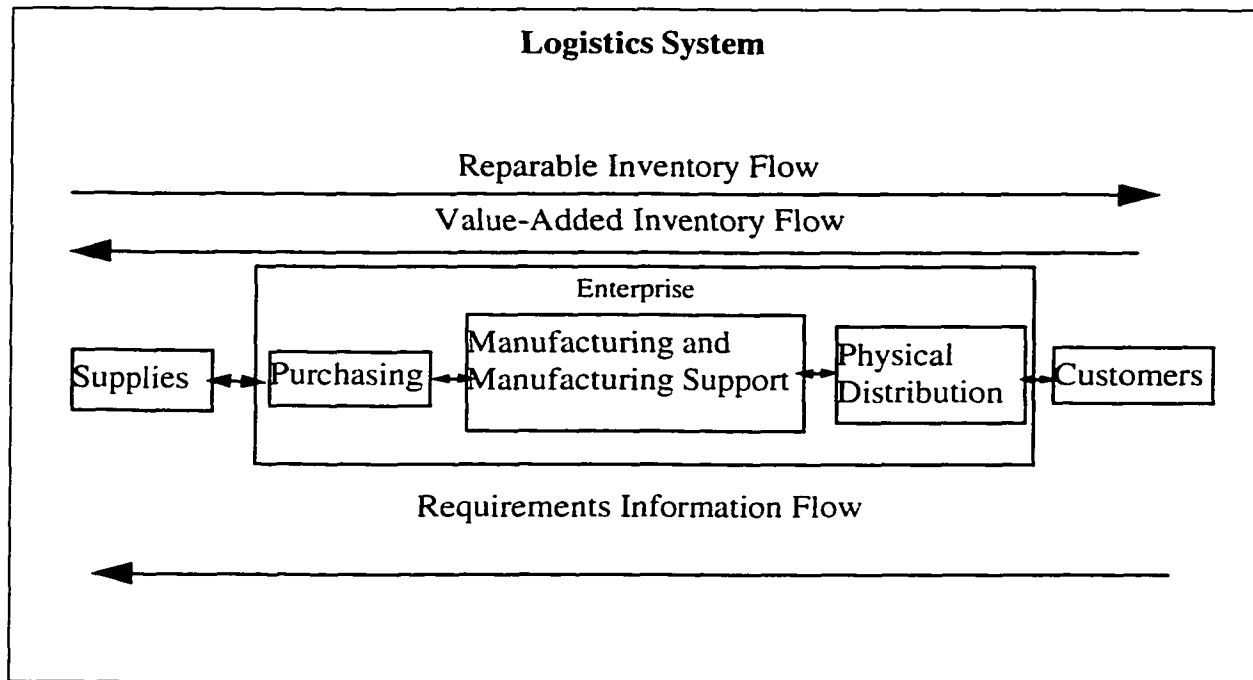
intercorporate logistics management. (The two most frequently encountered terms appear to be logistics and supply chain management.) There do not appear to be any operationally useful distinctions among logistics (defined broadly), supply chain management, and supply chain integration, and the terms are generally used interchangeably, so they will be used interchangeably here.

Broadly speaking, logistics provides time and place utility for inventory (Bowersox, Closs, and Helferich 1986, 4). It originally meant the methods for providing everything material that was needed during a march of troops. A more modern but not markedly broader definition is the creation and sustained support of combat forces and weapons (Rider 1970, 26). Although as recently as 1970 Rider was able to conceptualize logistics as principally a military subject, the field is now recognized as encompassing commercial activities. Copacino (1997, 7) defines modern logistics as “the art of managing the flow of materials and products from source to user.” To Copacino, the flow of materials extends from the acquisition of raw materials to delivery of finished products to the ultimate user. It includes purchasing; manufacturing; distribution; warehouse operations; inventory management; transportation; and the linkage to customer service, sales, promotion, and marketing. Some authors use the term logistics in a more restricted sense that would include manufacturing support but exclude manufacturing itself (Bowersox, Closs, and Helferich 1986).

Here we will, somewhat tautologically, adopt Copacino’s definition, since depot maintenance, which includes both repair (i.e., remanufacturing) and some light manufacturing, is a logistician’s responsibility in the Department of Defense. The logistics system, including manufacturing, is illustrated in Figure 2-5, adapted from Bowersox, Closs, and Helferich (1986, 16), but extended in concept to include a reverse flow (Copacino 1997, 184-185) for remanufacturing. Although relatively new and growing in the commercial sector, this reverse flow is a historical fixture within DoD; there would be no depot maintenance without it.

A tenet of modern logistics is that logistics system performance is improved by integrating activity across functions, processes, and organizations in the supply chain, rather than letting organizations proceed independently (Copacino 1997, 2). Factors facilitating

**FIGURE 2-5**  
LOGISTICS SYSTEMS



integration (and concomitant outsourcing) include reduced cost of transportation resulting from deregulation under the Motor Carrier Regulatory Reform and Modernization Act, and the impact of the revolution in microprocessor and communications technology (Bowersox, Closs, and Helferich 1986, 12-13; Forbes, Hutcheson, and Timko 1997, pg. 1-1; Sheffi 1990, 28; Vail 1994, 56; Witt 1994, 47). The impact of information technology on communication ability, and thereby on the ability to create and sustain trust, is especially important. As we have already remarked, the present depot maintenance situation is characterized by ambiguity and uncertainty. Griesinger (1990, 484), cited earlier, notes that as complexity (surely a companion to ambiguity) exceeds supervisors' capacities, organizations can either reduce the need for information processing (e.g., by lowering performance expectations or creating autonomous units) or increase the capacity for information processing. Thus, following the arguments presented earlier under the heading "Relational or Social Exchange Theories," it should be no surprise if better and cheaper information technology, by increasing capacity for information processing, led organizations to embrace increased use of logistics partnerships as a response to ambiguity. However, Copacino (1997, 64) has argued that there are also factors that will work against supply chain integration. These include asymmetrical accrual of benefits to the buyer rather than

proportionately to suppliers and buyer, significant up-front investment, and the presence in some companies of a culture and attitude not supportive of partnering.

Although promotional literature on partnership-based supply chain management and outsourcing is not difficult to find, the empirical literature appears to be less prolific. Lieb (1992) surveyed chief logistics executives of the 500 largest manufacturing companies in the United States (with a 26 percent response rate) to develop aggregate data about the use of third-party logistics in American industry. He found that 37 percent of the respondents indicated their companies used third-party logistics services. Among non-users, 11 percent were considering such services. More than 60 percent of the users of such services had done so for more than five years. The most frequently outsourced functions were warehouse management, shipment consolidation, information systems, fleet management and operations, and order fulfillment. During initial implementation, common concerns were potential loss of direct control and uncertainty about level of service. The most common implementation problem, which clearly relates to these concerns, was getting buy-in from operating personnel and managers, a problem that had its foundation in lack of trust in the third party and concerns over job security. Of the companies using third-party services, 59 percent indicated that they gave less than 10 percent of the related budget to such services, with the balance remaining in-house. Contract duration was generally for one to three years (86 percent), and only 6 percent were for more than five years. The majority of companies (57 percent) indicated they were at least satisfied with third-party logistics services.

Rao and Young (1994) used a case study methodology to study 44 firms engaged in export-import. For shippers, Rao and Young sought information on industry characteristics, the characteristics of the firms themselves, and their international trading partners. For logistics service providers, they focused on capabilities, services offered, tie-ins (partnerships and alliances) with other logistics firms, and major customers. They found five key and interacting factors in the decision to utilize third parties or retain in-house capabilities to perform international logistics functions: centrality of the logistics function to core competency; risk liability and control; operating cost/service tradeoffs; information and communication systems; and market relationships.

Sink (1995, 298), examining logistics outsourcing, found that buyers emphasize reliability and integration of logistics services when choosing suppliers. Daugherty (1988, 158), also examining logistics outsourcing, found that strategic orientation (channel, market, or process) was not a significant factor in anticipated usage of outside logistical services. Although there have been a number of studies of the DoD supply chain and outsourcing, none seem to focus on trust-based supply chain relationships.

Specifically in the context of depot maintenance, there have been a small but informative group of studies. Forbes, Hutcheson, and Timko (1997, pp. 2-15-2-19, 4-9, D-5) focused on the decision to provide depot maintenance internally or via commercial sources. They observed that the decision to perform work in-house or externally depended on the nature of the potential relationship (flexibility, scope, policy on related functions, policy on lot sizes, policy on repair parts), as well as on the incentive structure—but they did not study the possibility of partnering. Chenoweth and Abell (1994, xi-xiii) examined contractual depot maintenance for a subset of DoD avionics components. As discussed earlier in this chapter, they found very long flow times and attributed them to a lack of DoD concern regarding supplier responsiveness, as well as to a requirement that the suppliers obtain repair parts from the government. Klapper and Kiebler examined contractual component repair across all of DoD reparable items (1997). Although they found repair cycle times for contractor-performed repairs to be much longer than for organic repairs (140 days versus 45 days), the underlying reasons were much the same as those described by Chenoweth and Abell. To put this claim in perspective, a number of other reports have found that DoD's supply chain is non-responsive in general (Kiebler et al. 1996; Kiebler, Klapper, and Frank 1990; Klapper, Jordan, and McGrath 1996; Perry, Silins, and Kiebler 1987).

Finally, a fairly recent report by the General Accounting Office (Warren 1998a) argued that it would be difficult for depot maintenance to rely on commercial market forces to assure low-cost repair, since most depot maintenance is performed on noncommercial, DoD-unique items. About 91 percent of the contracts that the GAO examined were awarded noncompetitively, mostly to the original equipment manufacturers that owned the data rights, although other factors such as the difficulty in defining requirements also impacted ability to use competitive forces.



It is interesting, and certainly relevant to the present research, that none of the studies of depot maintenance cited above appeared to conceive of options other than internal provision of depot maintenance or a market-based solution; the option of partnerships and trust-based relationships is noticeable by its absence.

Hypotheses from the perspective of logistics and supply chain management are:

<b>H52</b>	Supply chain integration will be perceived as important to providing effective depot maintenance.
<b>H53</b>	Managers and others interested in depot maintenance will perceive themselves as uncertain of the meaning of supply chain integration.
<b>H54</b>	Supply chain integration will be perceived as difficult to achieve.
<b>H55</b>	Supply chain integration will be perceived as more difficult to achieve with commercial (i.e., external) sources than with organic (i.e., internal) sources.

### Organizational Rationality and the "Garbage Can" Model

Much if not all of the literature reviewed above is either explicitly or implicitly founded on a rational system model of organizations. The rational system model conceives of organizations as instruments or tools designed to achieve specific goals, or at least clusters of goals (Bryman 1984, 391-394). Its assumptions are consistent with the expectancy theory of value, where motivation is explained in terms of the value that an individual attaches to each potential outcome (Lovata 1987, 193). But expectancy theory is only one of several theories of value, others being operant theory and the "garbage can." Operant theory holds that individuals will continue behavior that is positively reinforced and eliminate behavior that is punished. The garbage can model challenges the very notion that problem solving is organized or rational.

The garbage can, however, is not the only perspective to challenge the rational model. In addition to the simple observation that the sum of the results of individual rationality is not necessarily cumulative rationality (Glazer, Steckel, and Winer 1992; Sterman 1989), there are at least three other such perspectives: institutional, political, and Marxist. Under the institutional perspective, organizations take on particular forms not so much for

purposes of efficiency as to gain legitimacy; structures have ceremonial or symbolic functions. The political approach is concerned with the study of internal politics, and the Marxist with the part that organizational structure plays in societal structures of domination.

The institutional perspective has much in common with mimetic isomorphism already mentioned. The concept of power will be dealt with later in this chapter. The possible role of structures of domination does not suggest itself as especially relevant to the depot maintenance question.

The garbage can model, however, does provide potentially useful insights. According to that model, the concept of “organized anarchy” stands in for organization:

[A]n organized anarchy is a collection of choices looking for problems, issues and feelings looking for decision situations in which they might be aired, solutions looking for issues to which they might be the answer, and decision-makers looking for work (Cohen, March, and Olsen 1972, 1).

Although apparently not noticed by Cohen, March, and Olsen, or others who have written about the garbage can model, this description is not that dissimilar to nonlinear models of the innovation process—which posit innovation as involving the matching, coupling, or synthesis of needs with technical possibilities under conditions of pervasive uncertainty (Mowery and Rosenberg 1979, 114, 138, 145). In other words, what is being described is a form of marketing. The present author thinks this is an avenue worthy of further exploration outside of the present study.

Cohen, March, and Olsen (1972, 1) state that there are three properties of organized anarchies: problematic preferences (ill-defined goals, lack of or inconsistent consensus on goals), unclear technology (ends-means) relationships, and fluid participation—where actors come and go according to their level of interest and available time. Two of these characteristics, ill-defined goals and unclear administrative technology, were also important to the discussion under the topic of isomorphism and resulted in the generation of hypotheses H42, H45, and H46. The concept of fluid participation, however, is first introduced here with the garbage can theory.

It is fairly straightforward to paint the depot maintenance problem with the colors of the garbage can theory. First, as discussed earlier in this chapter, consensus over even

the definition of depot maintenance has been difficult to achieve, let alone consensus on a desirable split between public and private performance, or the reasons for any particular split. Second, the benefits and penalties of shifting performance from the public to private sector are anything but clear. And, finally, over the last five years alone, there has been a continuing changeover in the responsible senior staff within DoD. Two additional hypotheses result:

<b>H56</b>	Participants in the depot maintenance public versus private allocation decision will be perceived as continually changing.
<b>H57</b>	Chance occurrences rather than a rational process will be perceived as important to outcomes of depot maintenance public versus private allocation decision situations.

Having argued that the garbage can model might have something to offer and put forward hypotheses, it is appropriate to wonder what the more empirically oriented literature has to say about the garbage can model. The balance of this section addresses that question.

Eisenhardt and Zbaracki (1992, 17, 19-20, 24-25, 28-30, 32), writing under the academic umbrella of strategic decision making literature, reviewed what they saw as the three dominant paradigms in that literature, all of which have already been mentioned: rationality and bounded rationality, politics and power, and garbage can. They concluded that “decision makers are boundedly rational, power wins battles of choice, and chance matters.” With regard to the garbage can model specifically, they state that although the model has generated provocative ideas, the field research has been principally descriptive.

Lorendahl (1991, 263), also noting that empirical applications of the garbage can model were limited, extended the model to include participant shift (e.g., as a result of general elections), ambiguity avoidance, selective garbage separation (taking easy problems first), and garbage collection when faced with tight deadlines. He used a case study approach and concluded from the results that—especially relevant here—the garbage can model is more applicable to public organizations than to private. He also concluded that the garbage can model, rather than being limited to intraorganizational behavior, also provided

a useful interpretative framework for studying interorganizational behavior—again relevant here.

Takahashi (1997, 91, 93), in general agreement with Lorendahl as well as Eisenhardt and Zbaracki, commented that the garbage can model had not generated much interest in the literature compared with alternative rational-model-based views such as contingency theory or population ecology. He used both a simulation and a survey approach to extend the garbage can model. The simulation served to generate a research hypothesis—that rather than decide, sometimes organizations will act to avoid a decision (what he called decision by flight, and what appears to be at least approximately the same concept Lorendahl had in mind when he described ambiguity avoidance). His research indicated that the frequency of such avoidance was related to decision load.

Collins and Munter (1990, 269-281) interpreted the results of researchers such as Cohen, March, and Olsen as indicating that the garbage can model describes aggregate flows of people, problems, and solutions through an information network. They used both a case study and a path model to study communications in the context of business firms' information technology management. Their study, however, was limited to identifying hypotheses for further research. Those that they concluded were of merit for research were the following: problem senders and solvers are paramount in organizational problem identification; both general- and problem-type communications are correlated with and might result in solution identification; both types of communications might result in problem identification; and under conditions of high role stress, the importance of general communications to solutions is reduced. They recognized that although they were able to confirm a relationship among problem, solution, and general communications, they were unable to discover any relationship between discussion of a specific problem and its specific solution—or general communications related to a specific problem and its solution.

Sink (1995, 300) was the only researcher found during a review of the literature to apply the garbage can model to the outsourcing problem. His research supported the model: industrial buyers in his survey frame often did not have a clear conceptualization of solution alternatives. Data were also routinely lacking to guide preliminary cost and service analysis.

## Political Economy and Bureaucratic Politics

The final conceptual framework to be covered deals with the issue of internal politics and power. Political science literature, beginning in the 1950s, provides the basis of the political perspective on strategic decision making (Eisenhardt and Zbaracki 1992, 22-27). The basic tenets of this view are that decision making within government is situated in conflict, the decision makers will have different goals, they will come together through coalitions, and the preferences of the most powerful will prevail. What the political model has in common with a model centered in bounded rationality, and where it differs from power as viewed in public choice theory, is the assumption that although individuals might have competing interests, the organization will have a single, superordinate goal.

Eisenhardt and Zbaracki provide a fairly substantial review of the literature on the political economy view. They conclude, based on their review, that there is an empirical basis for most scholars accepting the central ideas of the political model: that organizations comprise people with conflicting preferences, that powerful people will get what they want, and that people will engage in political acts like cooptation, coalition formation, and selective use of information to enhance power.

Some research efforts have attempted to use the power framework to examine outsourcing and privatization decisions. Borchers (1996, 87), examining information technology outsourcing, could not confirm the role of power but attributed that result to use of a survey instrument—which he felt was an inappropriate methodology for the construct. Chung (1996, 110-111) also looked at power in the context of information technology. However, Chung did so using a “political economy paradigm” that also incorporated aspects of relational exchange theory and TCE—with the result that the role of power is not separable. McCray (1996, 281-282), in a third examination of information technology outsourcing, used a simulation model to show that power, defined as management pressure to retain internal control, would result in less outsourcing if there were more pressure. Daugherty, in a study of logistics outsourcing, supported the political economy model by finding that the strongest explanatory factor for anticipated usage of outside logistics services was the management level of senior logistics executives (Daugherty 1988). Finally,

Sink (1995, 294), who also examined logistics outsourcing, concluded that politics, power, and personality play important roles.

Hypotheses from this stream of research are:

<b>H58</b>	Managers of and others with an interest in the depot maintenance public versus private workload allocation decision will perceive that decision makers have conflicting preferences with regard to the depot maintenance organic versus commercial source of repair allocation decision.
<b>H59</b>	Managers of and others with an interest in the depot maintenance public versus private workload allocation decision will perceive powerful people, defined as higher managerial levels, as getting what they want with regard to the depot maintenance organic versus commercial source of repair decision.
<b>H60</b>	Managers of and others with an interest in the depot maintenance public versus private workload allocation decision will perceive coalition formation.

### Hypotheses Summarized

Throughout this chapter, we have stated a number of hypotheses in the context of the particular research streams that motivated them. Appendix A summarizes the hypotheses that were presented and indicates the constructs to which they relate. An abbreviated view is in Table 2-10.

TABLE 2-10  
RELATIONSHIP OF CONSTRUCTS TO HYPOTHESIS

Theoretical Construct	Confirming Hypotheses	Refuting Hypotheses
1. Rational model	H01	H56, H57
2. Imperfect competition	H02, H03, H04, H05, H06, H30	
3. Market failure	H07, H08	
4. Economy of scale and scope	H09, H10	
5. Transaction cost economics	H11, H12, H13, H14, H15, H16, H17	H48, H49, H50
6. Principal-agent theory	H18, H19, H20, H21, H22, H23, H24, H25	H48, H49, H50
7. Public choice theory	H26, H27	
8. Privatization and theory of non-market failure	H17, H25, H28, H29, H30, H31, H32, H33, H37	
9. Resource- or competency-based theory	H35, H36, H37, H38, H39, H40, H41, H42	H34

**TABLE 2-10**  
**RELATIONSHIP OF CONSTRUCTS TO HYPOTHESIS (CONTINUED)**

<b>Theoretical Construct</b>	<b>Confirming Hypotheses</b>	<b>Refuting Hypotheses</b>
10. Administrative innovations and isomorphism	H43, H44, H45, H46, H47	
11. Relational or social exchange theory	H48, H49, H50, H51, H52	H11, H12, H13, H14, H24
12. Logistics and supply chain management	H51, H52, H53, H54, H55	
13. Garbage can model	H21, H42, H45, H46, H53, H56, H57	H01
14. Political economy and bureaucratic politics	H47, H58, H59, H60	

### **Empirical Studies Summarized**

In the preceding discussion of the literature on outsourcing and privatization, this chapter described a number of major fields of study and examined the related empirical research in the context of each field. As a steppingstone to constructing a research methodology in Chapter 3, Table 2-11 is a top-level overview, by topic, of the number of empirical sources discussed in this chapter. It is clear that the empirical evidence discovered by the present researcher is at best a patchwork. Although there are a number of results for TCE, principal-agent theory, resource- or competency-based theory, and relational or social exchange theory, empirical results in other areas are sparse. Further, only in the case of TCE and principal-agent theory do we find empirical results in all three columns of Table 2-11.

Appendix B provides a more comprehensive overview by displaying a capsule summary of each empirical study against the same topic headings. As can be gleaned by viewing that appendix, the results of the available research, although in most cases supportive of the theories the researchers set out to study, are anything but definitive. Additionally, no one, it appears, has attempted an integrated view of more than a few theories at a time. Examination of Appendix C—which provides yet a more complete summary in the form of individual reviews of the empirical studies—shows a wide variety of units of analysis that are difficult to integrate.

**TABLE 2-11**  
**NUMBER OF EMPIRICAL STUDIES CITED BY TOPIC**

Topic/Subtopic	Context of Study		
	Outsourcing	Privatization	DoD, depot maintenance
Neoclassical economics			
Rational model	2	1	—
Price-coordinated economic activity	3	—	—
Imperfect competition	—	—	—
Market failure	—	—	1
Scale and scope	—	—	3
Transaction cost economics (TCE)	10	1	3
Principal-agent theory	4	1	1
Public Choice Theory		2	
Public administration/privatization		2	
Innovation, technology, strategic management			
Resource- or competency-based theory	8	—	—
Technology diffusion	1	2	—
Relational or social exchange	7	—	—
Logistics/supply chain management	4	—	2
Organizational rationality/garbage can	1	—	—
Political economy, bureaucratic politics	2	—	—

Looking back over the various streams of literature that claim to have something to offer to the outsourcing and privatization debate, the overall impression this researcher formed is that both the theoretical and empirical study of outsourcing and privatization are in a state of conceptual disharmony. It is hoped that the present effort will contribute to integrating the diverse and often conflicting views.



# CHAPTER 3

## METHODOLOGY

### Introduction

Keeney, Winterfeldt, and Eppel (1990, 1011-1030), as noted in Chapter 1, have suggested that there are five methods for eliciting and understanding norms and values in policy decision making. They include:

- Surveys
- Indirect elicitation of public values by inferring values from behavior in the marketplace
- Direct value elicitation, for instance through multi-attribute utility (MAUT) methods
- Focus groups
- Public involvement through a series of hearings and meetings.

The present research:

- Uses the choice between public and private performance of depot maintenance as a specific focal point around which to elicit values;
- Elicits those values using two different methodologies—indirect elicitation and a survey;
- Compares the results to the results of depot maintenance studies that used methodologies other than those employed in the present research;
- Compares the results to those reported by others outside the depot maintenance area; and
- Compares results with the received theory.

The reason for using both indirect and survey methodologies in this research, and then comparing to other depot maintenance studies that used different methodologies, is basic triangulation—to come at the problem from more than one vantage point. The reason for comparing results to those of other researchers outside depot maintenance as well as to received theory is nomological validity. If results are consistent with those of other researchers and the received theory, then the theory and the constructs in this research are mutually supported, nomological validity is supported, and (consistent with the argument mounted in the conclusion of Appendix D) establishment of objectivity is aided.

Similarly, if results of this research are inconsistent with other results or with received theory, it could be for a number of reasons (e.g., a construct did not measure the intended latent variables, or the underlying theory was a flawed characterization of the habituated actions). These possibilities are examined when interpreting the results of the analysis.

### Comparison With Prior Depot Maintenance Research

Table 3-1 compares prior depot maintenance-related efforts to the present research. The present research is summarized in the right two columns of this figure. Each of the prior efforts was reviewed in Chapter 2. Both the Depot Maintenance *Integrated Management* report (Office of the Deputy Under Secretary of Defense (Logistics) 1993) and the Defense Science Board Depot Maintenance Study (Parker 1994) used a series of public meetings to elicit values. In the case of the *Integrated Management* report the meetings were conducted among stakeholders within the Department of Defense. The Defense Science Board study, in its public meetings, included senior representatives from industry (typically chief executive officers) and senior officials from the Department of Defense (i.e., flag officers and members of the senior executive service).

As indicated in Chapter 2, both of these studies developed important insights. Both, however, were also limited in the scope of issues examined. The *Integrated Management* report reflected values that mostly aligned along an economic dimension. Even though it offered an extended discussion of the concept of core capabilities, that discussion also had a strong economic flavor. The Defense Science Board study, despite its broader range of

**TABLE 3-1  
PRIOR DEPOT MAINTENANCE RESEARCH COMPARED TO PROPOSED RESEARCH**

Sources of Concepts	Prior Efforts			This Research	
	Integrated Management Report	Defense Science Board Depot Study	Source of Repair Methodology	Analysis of Weapon System Data	Survey of Stakeholders
Neoclassical economics					
Price-coordinated economy	√	√	√		√
Imperfect Competition	√	√	√	√	√
Market Failure	√		√	√	√
Scale and scope	√	√	√		√
Transaction cost economics	√		√	√	√
Principal agent theory					√
Public Administration					
Political economy					√
Privatization, non-market failure					√
Technology, strategic management					
Competency-based theory (core)	√			√	√
Technology diffusion			√		√
Relational/social exchange (partnering)					√
Logistics/supply chain management			√		√
Garbage can model					√
Bureaucratic politics					√
Methodology	Public meetings	public meetings	Focus groups/ MAUT	Indirect	Survey
Unit of analysis	Not applicable	Not applicable	Subsystem	Weapon system/ major equipment category	Constituency

players, ended up with a slightly narrower scope. The Logistics Management Institute proposal for a new approach to choosing between public and private providers (Forbes, Hutcheson, and Timko 1997) elicited values from focus groups as an input to a multi-attribute utility (MAUT) model.

### Comparison to Research Outside Depot Maintenance

This chapter, beginning on page 108, describes a survey of depot maintenance stakeholders using an instrument created for the purpose. The author considered the potential for replicating the depot maintenance survey in a subject area other than depot maintenance but rejected this alternative. The reason is that from a practical standpoint it required a substantial effort to understand the depot maintenance context, actors, and issues well enough to proceed with confidence that meaningful data representing the point of view of the actors involved could be obtained in that area. To replicate this survey with confidence in another area would have required an unknown number of preliminary explorations in various promising areas to establish potential feasibility, substantial additional research to assess the risk of being able to generate usable results in one or more feasible areas, and then a concerted effort not unlike that described here to actually replicate the research. The author concluded that, although this could be done, there was considerable execution risk.

A lower risk approach—and the path that was taken—was to compare to results of others who had already examined the outsourcing decision in the commercial arena and the privatization decision in the public arena. This path, however, is not without its limitations. In addition to almost inevitably dissimilar units of analysis, there are at least five other issues.

1. No prior research reviewed by the author has considered all of the 14 theoretical bases included here; the most in any single study was 6. Hence, all comparisons are at best partial. Further, in order to cover the scope of theoretical constructs considered in the present research, it was necessary to review and integrate results from both commercial and public contexts, rather than just public. Of the 27 studies summarized in Appendices B and C (all of which are in areas other than depot maintenance), only 10 relate to the outsourcing decision in a public context. (A matrix contrasting the 27 studies is presented at Appendix E.)

2. Whereas the focus in this research is depot maintenance on high-technology weapon systems, prior research addresses a mix of high-technology (primarily information technology) and low-technology work such as refuse collection and other municipal services.
3. Some of the 27 prior studies attempted to elicit values and norms, and some did not. By eliciting values and norms is meant the inclusion of questions similar to those in Borchers (1996, 92-93) that ask such information as:

How relevant (or irrelevant) are the following attributes in choosing an outsourcing vendor for your firm?

or

To what extent would you feel that the following are potential problems in a contractual relationship with a vendor?

4. Most previous research uncovered by the present author was more nearly centered in the functionalist paradigm than the interpretivist. The consequence is that the author uses results created in a functionalist frame of reference for interpretive purposes—posing analytical risks even when adequate care is used in comparing results.
5. In undertaking to simultaneously encompass 14 fields of research, within the confines of a single study, the author implicitly traded off depth for breadth. In the survey, for instance, this tradeoff shows up in the limited number of items (often just one item) per construct because the alternative would have been a survey instrument that was simply too long to generate a reasonable response rate. The decision on questionnaire length, however, was subjective. As Bogen has pointed out, a quarter century of research has left us with confused and contradictory evidence on the relationship between questionnaire length and response rate (1996).

### Overview of the Research Process

In the first approach, indirect elicitation, the author's initial intention was to use structural equation modeling to analyze weapon system-related data that the DoD services had already collected, and then create a causal model that linked choices with the underlying factors associated with those choices. The DoD services had developed data showing the choice of public or private depot maintenance provider by weapon system along with reasons for the choice, where the "menu" of choices was established in advance. The creation of a causal model was proposed because the menu of choices corresponded well with many of the concepts and hypotheses summarized in the previous chapter—hence making

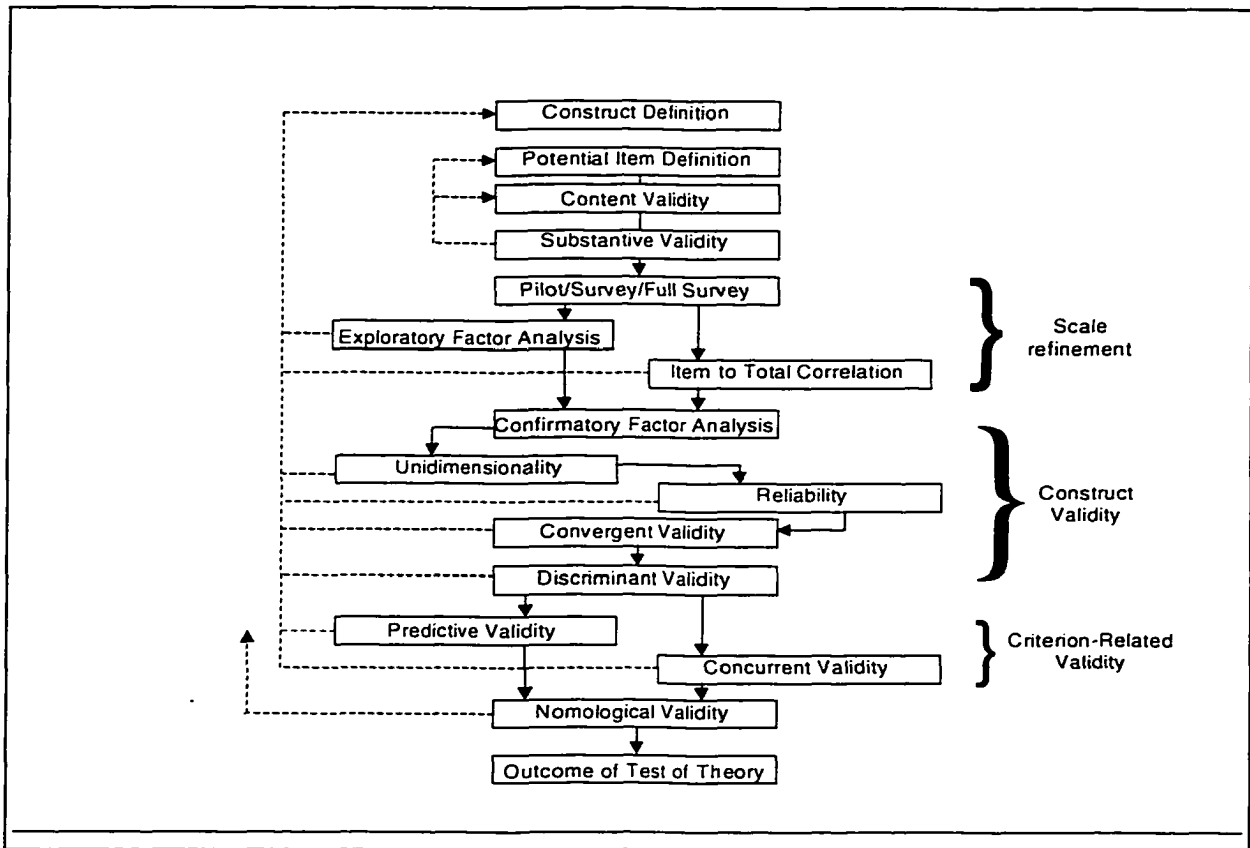
it potentially possible to infer underlying norms, attitudes, and values. Further, the resulting data were comprehensive: the services generated 139 individual datapoints (a data point being a weapon system source of repair choice along with the associated factors) covering all of their major weapon systems.

Although, as is discussed in Chapter 6, there are content and substantive validity problems with the menu of choices, the comprehensiveness of the dataset made it of such potential value that it would have been a mistake to not explore what insights it might yield. Unfortunately the sample size was well short of the thresholds for a path model that are recommended in the literature. Although there is some argument about the minimum number of cases needed, it appears to be somewhere between 150 and 200 (Anderson and Gerbing 1988, 415-416; Bearden, Sharma, and Teel 1982, 429). Ultimately, because of this limitation as well as less than ideal comparative fit indices, the author used structural equation modeling only for confirmatory factor analysis. Factor analysis provided some insight, but it was also limited by the sample size. Thus the author supplemented factor analysis with a logistics regression and a step-wise multiple regression. Chapter 6 describes all three approaches and the results.

Although the armed services' data were comprehensive in the sense of covering all DoD weapon systems, they did not touch all of the concepts or hypotheses from Chapter 2. Nor, so far as the present researcher was able to determine, were the specific reporting requirements subjected to scrutiny regarding internal and external validity or other considerations normally part of scholarly research. Thus the researcher also conducted a survey of stakeholders both internal to DoD and external to the department. The survey encompassed all of the constructs introduced in Chapter 2 and was the major part of the empirical research effort.

In order to help assure that the results of the present research had the characteristics of generalizability, internal validity, and simplicity, the research followed the outlines of Dunn, Seaker, and Waller's social science research process model (Figure 3-1). The general flow of steps in this process is from top to bottom. A discussion of the model can be found in Appendix D.

**FIGURE 3-1**  
**RESEARCH PROCESS MODEL**



The basis for the first step, definition of constructs, was completed in chapter 2, which reviewed nine streams of research and generated 14 constructs and 60 hypotheses. All remaining steps are described in this chapter. In the remainder of this chapter we will first discuss analysis of the weapon system-related data, and then creation and execution of a survey.

### **Indirect Elicitation: Examination of Weapon System-Related Data**

The services captured notional source of repair choices in conjunction with the criteria described below. After each criterion the author has included in braces a short-hand description of the criterion and the acronym used during statistical analysis. A causal model is at Figure 3-2. Government-owned and government-operated facilities would apply if

- A. The work involves unique or valuable workforce skills that should be maintained in the public sector in the national interest { need for unique skills, **SKL\_UNIK** }
- B. Private-sector sources that can perform the workloads include industry sources that are vulnerable to work stoppages { work stoppage vulnerability, **WORKSTOP** }
- C. Private-sector sources that can perform the workloads have insufficient workforce levels or skills to perform the quantity of depot-level maintenance and repair workloads needed or avoid disruption or delay { sufficiency of private sector skills to meet needs, **SKL\_QTY** }
- D. The need for performance of workloads is too infrequent, cyclical, or variable to sustain a reliable base of private sector sources having the workforce levels or skills to perform the workloads { workload variability, **WORK\_VAR** }
- E. The market conditions or workloads are insufficient to ensure that the price of private sector-performance of the workloads can be controlled through competition or other means { market conditions, **MARKET** }
- F. Private-sector sources are not adequately responsive to the requirements for rapid, cost-effective, and flexible response to surge requirements, changes in the mix or priority of previously scheduled workloads, or other contingency situations without the requirement for additional contractual negotiations { private-sector responsiveness, **PR\_RSPON** }
- G. Private-sector sources cannot maintain continuity of workforce expertise, as a result of high rates of employee turnover { high employee turnover, **EMP\_TRN** }.

The systems or equipment should be maintained in government-owned facilities, whether government- or contractor-operated (GOGO or GOCO), if:

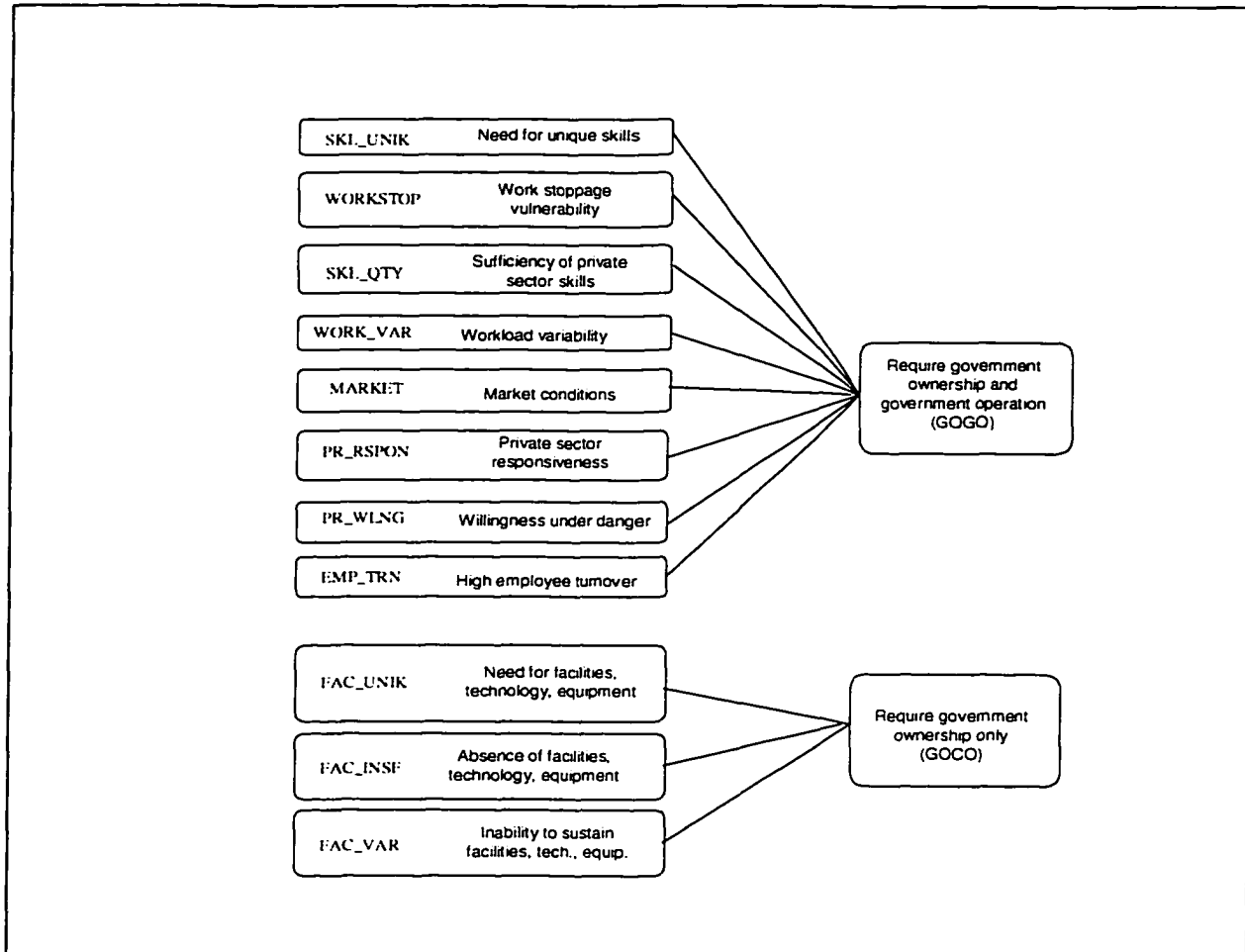
- A. The work involves facilities, technologies, or equipment that is unique and sufficiently valuable that the facilities, technologies, or equipment must be maintained in the public sector { need for facilities, technology, or equipment, **FAC\_UNIK** };
- B. The private-sector sources that can perform the workloads have insufficient facilities, technology, or equipment to perform the needed workload of depot-level maintenance and repair without significant disruption or delay { absence of private-sector facilities, technology, or equipment, **FAC\_INSF** };



- C. The need for performance of workloads is too infrequent, cyclical, or variable to sustain a reliable base of private-sector sources having the facilities, technology, or equipment to perform the workloads {inability to sustain private-sector facilities, technology, or equipment, **FAC\_VAR**}.

All other workload can be performed in contractor-owned, contractor-operated (COCO) facilities.

**FIGURE 3-2**  
IMPLIED CAUSAL MODEL



### Measurement Scale Development and Validation

For purposes of this research, the author considered the criteria just described as scales. Although the “scales” described above pre-existed the present research and are not susceptible to modification, in order to interpret the data provided by the armed services it

is useful to understand the extent to which the scales complied with good scale construction practice.

### *Criteria as Scale Items*

The criteria described above implied the causal model at Figure 3-2, although it was not clear if it was intended that the criteria were to act independently or together.

It is reasonably straightforward to relate almost all the criteria just described to the concepts and hypotheses presented in chapter 2. Table 3-2 does so.

**TABLE 3-2**  
**RELATIONSHIP OF CRITERIA TO CONCEPTS AND HYPOTHESES FROM CHAPTER 2**

<b>Description and Variable Name</b>	<b>Paraphrased Narrative</b>	<b>Related Concept and Source</b>	<b>Related Hypotheses</b>
Need for unique skills <b>SKL_UNIK</b>	Work involves unique or valuable workforce skills that should be maintained in the public sector.	Organizations succeed because of difficult to imitate resources. Competencies are defined by what an organization knows and what it can do, not what it makes or markets served. ( <i>Competency-Based Theory</i> )	<b>H38</b> Employee knowledge and skills are perceived as an important component of organic depot core competencies.
Work stoppage vulnerability <b>WORKSTOP</b>	Private-sector sources having capability to perform the workloads are vulnerable to work stoppages.	Organizations keep activities in-house if otherwise would result in crucial contingencies being left to market. ( <i>TCE</i> )	<b>H15</b> Managers of and others with an interest in depot maintenance will perceive increased risk if crucial contingencies are left to the market.

TABLE 3-2  
RELATIONSHIP OF CRITERIA TO CONCEPTS AND HYPOTHESES FROM CHAPTER 2 (CONTINUED)

Description and Variable Name	Paraphrased Narrative	Related Concept and Source	Related Hypotheses
Sufficiency of private sector skills <b>SKL_QTY</b>	Private-sector sources having capability to perform the workloads have insufficient workforce levels or skills to perform the depot-level maintenance and repair workload in the quantity necessary or as rapidly as necessary without significant disruption or delay.	Market failure—market lacks structure to accomplish essential exchange of goods. ( <i>Neo-classical Economics</i> )	<b>H38</b> Employee knowledge and skills are perceived as an important component of a depot maintenance organization's core competencies. <b>H08</b> For at least some depot maintenance workloads there will be a perceived lack of commercial firms with scope of capability to respond in the quantity necessary without an initial start-up delay.
Workload variability <b>WORK_VAR</b>	The need for performance of workload is too infrequent, cyclical, or variable to sustain a reliable base of private-sector sources.	Low frequency and high uncertainty lead to high transaction costs. ( <i>TCE</i> )	<b>H16</b> Managers of and others with an interest in depot maintenance will perceive the combination of low task frequency and high uncertainty as leading to high transaction costs if depot maintenance is outsourced.
Market conditions <b>MARKET</b>	Market conditions or workloads are insufficient to ensure that the price of private-sector performance can be controlled through competition or other means.	Imperfect competition (monopoly, oligopoly) can lead to distorted prices. ( <i>Neo-classical Economics</i> )	<b>H03</b> Availability of more than one source will be perceived as important to the organic versus commercial workload allocation decision. <b>H26</b> The availability of a competitive marketplace will be perceived as mattering if government is to benefit from commercial capabilities.

**TABLE 3-2**  
**RELATIONSHIP OF CRITERIA TO CONCEPTS AND HYPOTHESES FROM CHAPTER 2 (CONTINUED)**

Description and Variable Name	Paraphrased Narrative	Related Concept and Source	Related Hypotheses
Private-sector responsiveness <b>PR_RSPON</b>	Private-sector sources are not adequately responsive to the requirements for rapid, cost-effective, and flexible response to surge requirements or other contingencies.	Impossible to enumerate all contingencies in advance; opens up possibility for opportunism. If in-source then can render decisions sequentially, adapt to circumstances as needed. (TCE)	<b>H13</b> Managers of and other persons with an interest in depot maintenance will perceive the difficulty of stating all contingencies in advance as important to deciding between organic and commercial sources of repair.
High employee turnover <b>EMP_TRN</b>	Private-sector sources cannot maintain continuity of workforce expertise as a result of high rates of employee turnover.	Not within concepts summarized in Chapter 2	None
Need for facilities, technology, or equipment <b>FAC_UNIK</b>	Work involves facilities, technologies, or equipment that are unique and sufficiently valuable that they must be maintained in the public sector in the national interest.	When design is stable, firms replace general-purpose equipment with special-purpose to reduce cost. But then the tight linkages among stages and specificity of equipment can lead to opportunism. Response is in-sourcing. (TCE)	<b>H11</b> Managers of and other persons with an interest in depot maintenance will perceive tight linkage among stages in the depot maintenance repair process as important to deciding between organic and commercial sources of repair. <b>H12</b> Managers of and other persons with an interest in depot maintenance will perceive specificity of production equipment as important to deciding between organic and commercial sources of repair.

**TABLE 3-2**  
**RELATIONSHIP OF CRITERIA TO CONCEPTS AND HYPOTHESES FROM CHAPTER 2 (CONTINUED)**

Description and Variable Name	Paraphrased Narrative	Related Concept and Source	Related Hypotheses
Absence of facilities, technology, or equipment <b>FAC_INSF</b>	Private-sector sources having the capability to perform the workloads have insufficient facilities, technology, or equipment to perform the depot-level maintenance and repair workload in the quantity necessary or as rapidly as necessary without significant disruption or delay.	Market failure—market lack structure to accomplish essential exchange of goods. ( <i>Neo-classical Economics</i> )	<b>H08</b> For at least some depot maintenance workloads there will be a perceived lack of commercial firms with the scope of capability to respond in the quantity necessary without an initial start-up delay.
Inability to sustain facilities, technology, or equipment <b>FAC_VAR</b>	The need for performance is too infrequent, cyclical, or variable to sustain a reliable base of private sector sources having the facilities, technology, or equipment to perform the workloads.	Low frequency and high uncertainty lead to high transaction costs. ( <i>TCE</i> )	<b>H16</b> Manager of and others with an interest in depot maintenance will perceive the combination of low task frequency and high uncertainty as leading to high transaction costs if depot maintenance is outsourced.

Hypotheses H4, existence of proprietary data, and H6, level competitive playing field, are also related to market conditions. However, it would be overreaching to conclude that DoD services' personnel had these conditions in mind if they indicate that market conditions influence their choice of depot maintenance provider. In any particular situation they may or may not. For that reason they are not shown as related hypotheses. As discussed in Chapter 2 during the review of the depot maintenance literature, the requirement for more than one source is on more solid ground.

### *Content Validity*

As described in Appendix D, a scale possesses content validity when the scope of a construct is reflected in the items intended to measure it. One can view the scale items as reflecting one or more of the constructs from Chapter 2, since the scale items did, as indicated in Table 3-2, relate back to the concepts of imperfect competition, market failure, transaction cost economics, privatization, and competency-based theory. Although there is a fairly clear relationship between those Chapter 2 constructs and the scale items, it is also

the case that the scale items do not fully reflect the scope of any of the constructs. As a crude indicator, Table 3-3 compares the total number of hypotheses related to a construct to the number that are documented in Table 3-2. Since the scales do not appear to possess content validity, the results could not be used alone, and were used in conjunction with the survey to add additional insights into the constructs to which the scale items relate.

**TABLE 3-3**  
**SCOPE OF CONSTRUCT COVERAGE**

<b>Chapter 2 Construct</b>	<b>Number of hypotheses related to this construct</b>	<b>Number of related hypotheses in Table 3-2</b>
Imperfect competition	3	1
Market failure	2	1
Transaction cost economics	6	5
Privatization	2	1
Competency-based theory	7	1

### *Substantive Validity*

A scale possesses substantive validity when the items used in the scale are conceptually or theoretically linked to the construct being measured. Examination of Table 3-2, which shows close conceptual alignment to the constructs from Chapter 2—in some cases in near identical language—suggests that the weapon system-related scale items do possess substantive validity

### *Scale Refinement*

Scale refinement is the process of eliminating items from a scale that do not statistically agree with other items on the scale. Scale refinement can be accomplished using either exploratory factor analysis or Cronbach's coefficient alpha. Exploratory factor analysis was used to refine the scale, because the results could be used to inform the generation of a structural equation model (in this case a confirmatory factor model) as a way to "test" the causal model previously illustrated in Figure 3-2, or at least aspects of it.

## *Construct Validity*

### Unidimensionality

To establish unidimensionality, the author used confirmatory factor analysis to eliminate items that loaded weakly on scales. It was recognized that there could be a tradeoff between unidimensionality and content validity—that by eliminating some items the scale unidimensionality could be improved, but at the same time could result in poorer coverage of the scope of the construct being measured. This problem did occur. Deciding where to place the balance was informed by the literature review in Chapter 2.

### Reliability

Reliability was tested by measuring internal consistency using Cronbach's coefficient alpha.

### Convergent and Discriminant Validity

Convergent validity measures the extent to which dissimilar methods of measuring a construct achieve similar results. Convergent validity was tested using confirmatory factor analysis. If the appropriate factors loaded on the appropriate constructs then convergent validity was held to exist. Discriminant validity is a measure of the degree to which scales intended to measure distinct constructs achieve distinct results. To test for discriminant validity the author checked for correlation between the constructs; correlation indicated a limitation on discriminant validity.

### *Criterion-Related Validity*

Criterion-related validity indicates if a scale correlates with the criterion it is intended to predict. Concurrent validity applies when the criterion exists in the present and predictive when the criterion exists in the future. Since the armed services reported on the de facto arrangements for depot maintenance, rather than arrangements that might be put

in place as a result of analysis, concurrent rather than predictive validity applied and will be discussed when the data are presented.

### Objectivity, Nomological Validity, and Test of Theory

Objectivity and nomological validity will be discussed when comparing the results of the analysis to the received theory. For the weapon system-related data, the theoretical base was limited to those theories from Chapter 2 that were identified in Table 3-2.

### Data

The armed services generated the data during calendar year 1998.

#### *Unit of Analysis*

The unit of analysis is the weapon system and other military equipment. In practical terms what this translated into was major weapon systems such as particular aircraft, wheeled and tracked vehicles, and ships, as well as major subsystems such as engines and avionics.

#### *Data Collection*

The internal DoD process for collecting the data involved a data call from the Office of the Secretary of Defense to the Services; data were collected during calendar year 1988. The Logistics Management Institute (LMI) assisted in the data collection and analysis. In some cases, LMI worked with the armed service focal points to highlight apparent errors or inconsistencies in data and suggest possible corrections. Although LMI did not arbitrarily change any of the data, the result is still a more consistent set of data than would otherwise have obtained. These data were not, however, subjected to a final vetting process as DoD, for internal reasons, stopped the process before that point.



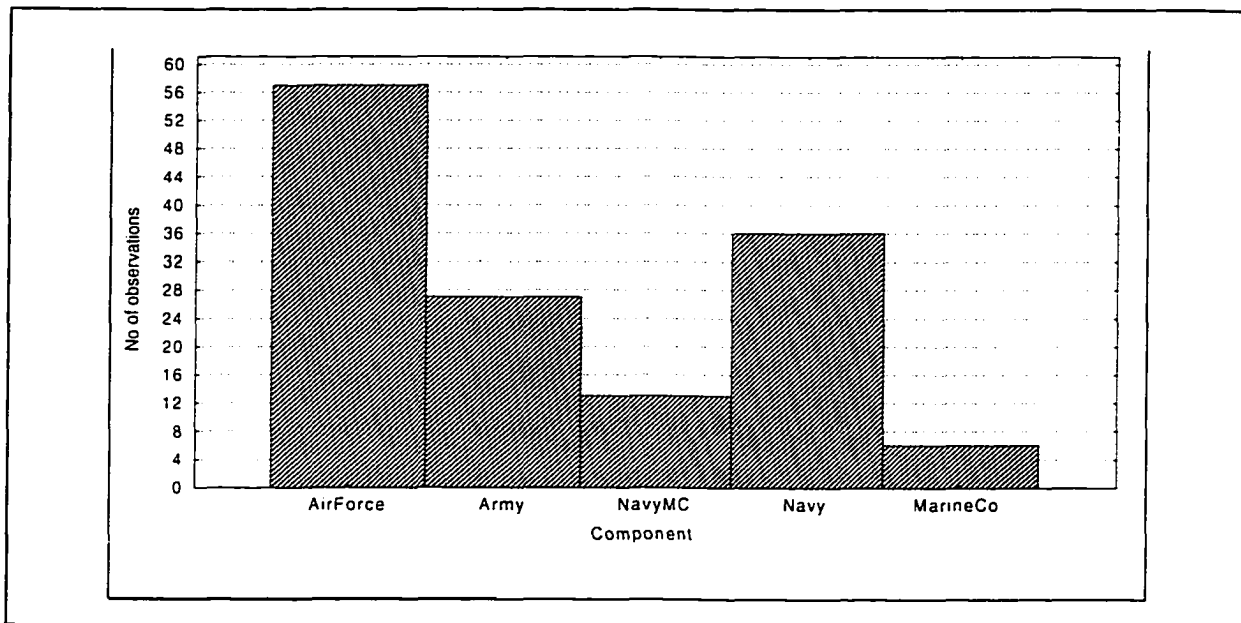
### *Response Rate and Non-Response Bias*

The armed services intended that the data they provided be complete—that is, inclusive of all weapon systems and other military equipment. LMI's review did not indicate any reason to doubt essential completeness. Thus the response rate, as best can be determined, was 100% and non-response bias was not an issue.

### *Responding Sample Characteristics*

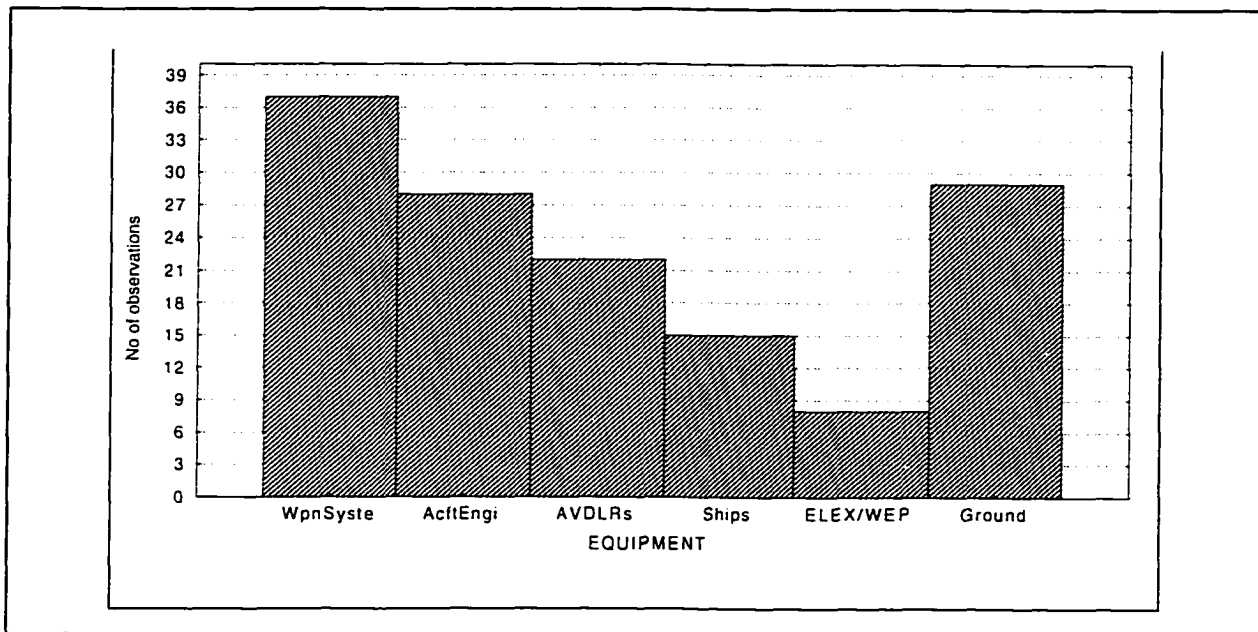
There were 139 responses. The number of responses by component is displayed in Figure 3-3. On this figure, NAVMC means Navy and Marine Corps while MarineCo means the Marine Corps by itself.

**FIGURE 3-3**  
NUMBER OF OBSERVATIONS BY COMPONENT



The number of responses by type of equipment is displayed in Figure 3-4. On this figure, the titles for the bars should be self-explanatory except for AVDLRs, which means aviation depot-level reparables; AcftEngi, which means aircraft engines; and ELEX/WEP, which stands for ship electronics and weapons.

**FIGURE 3-4**  
**RESPONSES BY TYPE OF EQUIPMENT**



## Survey

### Purpose of the Survey

Since there is no known set of existing data that covered all of the constructs from Chapter 2, the author created a survey instrument and conducted a survey of stakeholders both inside and outside the Department of Defense.

### Measurement Scale Development and Validation

#### *Scale Development*

The research process model (Figure 3-1) began with construct definition. At the highest level in the present research were the 14 broad theoretical constructs such as rational action, transaction cost economics, and principal-agent theory. These had associated hypotheses that, as illustrated on Table 3-4, act to either confirm or disconfirm that the constituencies surveyed held values and norms consistent with the broad theoretical constructs. The hypotheses themselves, of course, are also constructs, but of a narrower scope.

**TABLE 3-4**  
**RELATIONSHIPS BETWEEN CONSTRUCTS AND HYPOTHESES**

<b>Theoretical Construct</b>	<b>Related Confirming Hypotheses</b>	<b>Related Disconfirming Hypotheses</b>
1. Rational model	H01	H56, H57
2. Imperfect competition	H02, H03, H04, H05, H06, H30	
3. Market failure	H07, H08	
4. Economy of scale and scope	H09, H10	
5. Transaction cost economics	H11, H12, H13, H14, H15, H16, H17	H48, H49, H50
6. Principal-agent theory	H18, H19, H20, H21, H22, H23, H24, H25	H48, H49, H50
7. Public choice theory	H26, H27	
8. Privatization and theory of non-market failure	H17, H25, H28, H29, H30, H31, H32, H33, H37	
9. Resource/competency-based theory	H35, H36, H37, H38, H39, H40, H41, H42	H34
10. Administrative innovations and isomorphism	H43, H44, H45, H46, H47	
11. Relational/social exchange theory	H48, H49, H50, H51, H52	H11, H12, H13, H14, H24
12. Logistics and supply chain management	H51, H52, H53, H54, H55	
13. Garbage can model	H21, H42, H45, H46, H53, H56, H57	H01
14. Political economy and bureaucratic politics	H47, H58, H59, H60	

It is the hypotheses that established the basis for scale development. A complete listing of the hypotheses, indicating which constructs are supported by each hypothesis and those that are contradicted, is available in Appendix A. Table 3-4 provides the same information in summary form. If it were found by analysis of the survey data, for instance, that there was support for hypotheses H1 but not for H56 and H57, then that would have been considered as evidence that those who responded to the survey saw the process of deciding between organic and commercial providers of depot maintenance as following the rational model.

#### *Potential Item Definition*

The definition of survey items was accomplished by reference to both the literature where the concepts were found and to previous empirical studies that had already opera-

tionalized one or more of these concepts (Borchers 1996; Cheon 1992; Chung 1996; Harris 1996; Lever 1997; Moore 1996; Pouder 1993; Sink 1995; Spee 1994). As indicated in Chapter 2, hypotheses were intentionally drawn narrowly to lead as directly as possible to item definition. To illustrate, the first hypothesis from Chapter 2 was:

**H1** Managers of and others with an interest in the depot maintenance public versus private workload allocation decision will perceive themselves as following the dictates of the rational model.

One of the items related to hypothesis H1 was:

Number	Item
476	Using a rational process means defining the problem, choosing criteria, comparing alternatives against the criteria, and selecting an optimal solution.

In some cases a single item was sufficient to cover the scope of a hypothesis, and in other cases multiple items were required. Item comprehensiveness, comprehendability, and freedom from equivocality are discussed below under the topics of validity, scale refinement, and pretests.

Items were stored and manipulated in a Microsoft Access database. The item numbers were sequentially assigned in the range of 400 to 800 (the numbers had no inherent meaning other than unique identification). Items were of eight basic forms. The first form is illustrated by item 476, above, and was presented on the survey instrument with a seven-point Likert scale ranging from agree to disagree. A second form is illustrated by item 583, below. For items like this the scale did not express degree of agreement but sought to obtain an estimate of some other quantity—generally a probability..

Number	Item
583	How difficult is it (or would it be) to determine availability of a contractor (very low ... very high)?

Appendix F presents examples of the eight different item forms and, for each item, Appendix G indicates its assigned form.

Table 3-4 above indicated which hypotheses acted to confirm or disconfirm which theoretical constructs. For convenience, the “primary” theoretical construct is that theoretical construct in Chapter 2 where a hypotheses was first introduced. Table 3-5 below shows, by primary construct, the number of hypotheses and number of potential items that were defined—a total of 153 potential items after item definition.

**TABLE 3-5**  
**PRIMARY CONSTRUCTS, HYPOTHESES, AND ITEMS**

<b>Primary Construct Number</b>	<b>Primary Construct Name</b>	<b>Number of Hypotheses</b>	<b>Number of Items</b>
1	Rational model	1	3
2	Imperfect competition	5	9
3	Market failure	2	4
4	Economy of scale and scope	2	5
5	Transaction cost economics	7	26
6	Principal-agent theory	8	31
7	Public choice theory	2	4
8	Theory of non-market failure	6	18
9	Resource/competency-based theory	9	16
10	Administrative innovations and isomorphism	5	11
11	Relational/social exchange theory	4	16
12	Logistics and supply chain management	4	5
13	Garbage can model	2	2
14	Political economy and bureaucratic politics	3	3

### *Content Validity*

A scale possesses content validity when the scope of a construct is reflected in the items intended to measure it. The literature review reported in Chapter 2 is the basis for asserting content validity—by which is meant that the hypotheses do relate to the theoretical constructs in Table 3-4 as depicted in that table. It is usual to include multiple items on the scale to provide for thorough coverage. In general, multiple hypotheses were needed to cover the scope of each theoretical construct. As indicated earlier, hypotheses were

intentionally drawn narrowly to lead as directly as possible to items. Where a single item could not cover the scope of a hypothesis, multiple items were used—as illustrated in Table 3-5. The term “scale,” itself, can have more than one meaning. In the discussion that follows, when the term is used it will mean either the items associated with a hypothesis or the seven-point Likert scale for an individual item, depending on the context.

### *Substantive Validity*

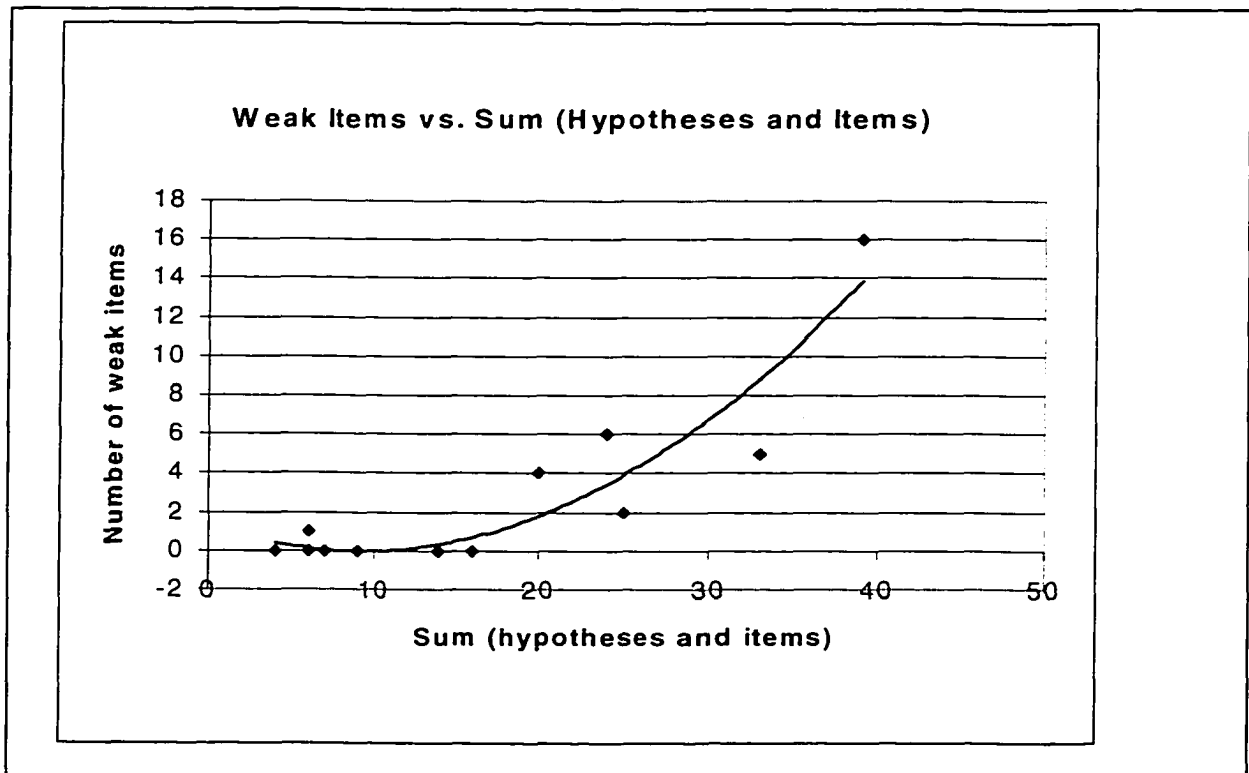
A scale possesses substantive validity when the items used in the scale are conceptually or theoretically linked to the construct being measured. The method used in the present research to make sure that items were linked to the hypotheses they purported to measure was the item-sort using indices for the proportion of substantive agreement (PSA) and substantive validity coefficient (CSV). The item sort is a bottom-up assignment of items to hypotheses (intentionally in the absence of information that would indicate which items were supposed to connect to which hypotheses). What one is hoping to find is that the results of bottom-up assignment of items to hypotheses agrees with the top-down design.

Five research fellows on the staff of the Logistics Management Institute and the author performed the item sort (hereafter these individuals will simply be referred to as item validators). The item validators were knowledgeable about logistics and depot maintenance and, hence, were representative of the sample frame. Although the literature suggests using two paper-based lists, one of constructs and one of items, in this case the author arranged for a custom software tool in addition to the lists. The tool, created in Microsoft Visual Basic, provided an interface similar to Microsoft Windows Explorer (with which all the item validators were already familiar). The reasons for going to this effort were: 1) concern on the part of the researcher that, lacking a way to manage complexity, the large number of hypotheses and items would result in such a difficult item sorting task that the results of the item sort could be unstable; and 2) a desire to have the item sort results in electronic form ready for subsequent analysis to avoid the potential for data entry error.

In the design of the tool one additional step was taken to reduce complexity. Rather than ask the item validators to attempt to match 152 items to 60 hypotheses, they were

asked to match items to hypotheses within constructs only. This proved a prudent step. As illustrated in Figure 3-5, where a second-order polynomial is fitted to a plot of misassignments versus the sum of items and hypotheses, the misassignment rate increased faster than linearly as the number of hypotheses and items increased. Review of the results showed that the item validators (including the author) sometimes became confused when working with a large number of hypotheses and items, and missed obvious assignments. Attempting to match all items to all hypotheses at once would have been unworkable. As a final note, one of the item validators did use paper. He made simple misassignment errors—such as assigning an item from one construct to a hypothesis in another, or assigning the same item to more than one construct—that the software tool prevented for the other five individuals.

**FIGURE 3-5**  
WEAK ITEMS VS. SUM (HYPOTHESES AND ITEMS)



The final results of the item sort are displayed in Appendix G. This appendix also shows the disposition of each of the preliminary items. Where weak items (those with a PSA less than 0.67 or a CSV of less than 0.50) were retained, the rationale for retention is given in the comments.

After the item sort and further elimination of redundant items by the author, a total of 119 items remained. The 119 items are in Appendix H. The steps described above, beginning with item creation and finishing with the item sort, were accomplished prior to creation of a survey instrument and pretest of the instrument. All further steps depended on pretest results.

### *Pretests*

The Logistics Management Institute had on its staff a small cadre of professional analysts with experience in depot maintenance. This cadre had experience across the full spectrum of depot maintenance workloads, in industry, and across all of the services. With the cooperation of LMI management, the pretest was accomplished with the aid of this staff. Additionally, the staff of the Department of Defense Assistant Deputy Under Secretary for Maintenance Planning, Policy, and Resources (ADUSD(L)/MPPR) participated.

### *Scale Refinement*

Scale refinement is the process of eliminating items from a scale that do not statistically agree with other items on the scale. Both exploratory factor analysis and Cronbach's coefficient alpha (for item-to-total correlation) were used when there were three or more items on a scale. The Kaiser criterion was applied to the exploratory factor results, and only factors with eigenvalues greater than 1 were retained. Since these were new scales, a Cronbach alpha value of 0.6 was treated as acceptable. After the pretest, low Kaiser criterion scores, low Cronbach alpha values, and feedback from the individuals who participated in the pretest were also used to further reduce the number of items on the survey instrument from the 119 that remained after the item sort to 99 for the final instrument.

After the item sort, 15 hypotheses had three or more items—and thus were amenable to factor analysis and calculation of item-to-total correlation. For these 15 hypotheses, the author used Statistica to compute coefficient alpha and perform a factor analysis on the related items. The 15 hypotheses, related items, Cronbach's coefficient alpha, and the number of factors extracted are listed in Table 3-6.



TABLE 3-6  
SCALE REFINEMENT ANALYSIS

	Items						Alpha	Number of Factors	Comment
	1	2	3	4	5	6			
H01	476	536	581	631			0.244	2	631 added after item sort and pilot survey. Low alpha because of two factors rather than one.
H10	530	576	601				0.895	1	
H12	486	544	604				0.651	1	
H15	489	547	587				0.783	1	
H16	490	548	607	638			-0.535	1	
H22	495	553	591				0.896	1	
H23	496	634	635					1	
H30	559	594	612	624			0.363	2	Low alpha because of two factors rather than one
H31	504	562	595				0.701	1	
H32	505	563	596				-0.924	1	
H38	510	566	598				0.653	1	
H44	535	580	603				0.551	1	
H48	519	574	599				0.553	1	
H49	520	575	600					1	
H51	531	577	616	625	637	630	0.880	1	637 not on trial survey due to error

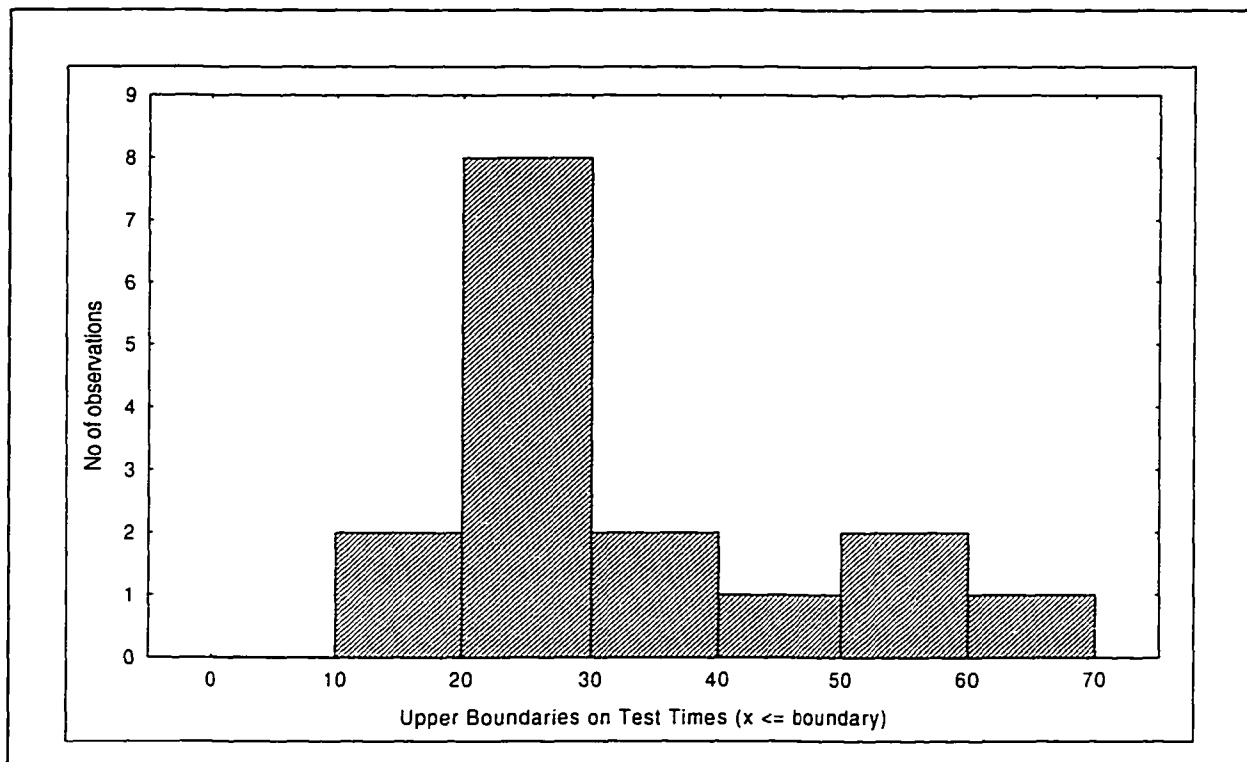
In general, coefficient alpha was well behaved and exceeded the threshold of 0.60 proposed in Chapter 3. The exceptions were:

- Hypotheses H01 and H30, where the associated items loaded on two factors rather than one. Here the author recognized that the items would need to be treated on two scales and retained all the items.
- Hypotheses H16 and H32, where alpha was negative. In these two cases factors loaded with opposing signs—some positive and others negative. Since in these two cases the explained variation was reasonable at 52% and 74% respectively, the author relied on the factor analysis rather than coefficient alpha and retained all the items.
- Hypothesis H44, where alpha was 0.55, but again factors loaded with opposing signs. Here also the author relied on the factor analysis and retained all items.

The result, then, of determining coefficient alpha and performing factor analysis on the items belonging to the 15 hypotheses was to retain the items so analyzed.

Of greater impact on the final survey instrument was written feedback from the individuals who took the pretest. This feedback identified items that were difficult to understand; were perceived as “double-barreled,” in the sense of comprising two questions rather than one; were likely to lead to different answers, depending on the circumstances a respondent had in mind; or were troublesome for other reasons. About one-half of the items received comments. In addition to needing to clean up the troublesome items, it was also evident (and not unexpected) that the questionnaire was simply too long. As is evident from Figure 3-6, most of the pretests took more than 20 minutes, with some taking as much as an hour. Although these pretest times included time spent making written comments, it seemed reasonable to conclude that the test needed to be shortened.

FIGURE 3-6  
DISTRIBUTION OF PRETEST TIMES



Given the evidence of the written comments and the distribution of test times, the author revised the items where comments indicated ambiguity; separated the instrument into two sections, one for items that were unlikely to be affected by specific circumstances or assumed characteristics of workload, and one for items that were; and reduced the total number of items to a final count of 99. Reducing the number of items was accomplished primarily by eliminating alternate form redundancy, where the same piece of information was obtained by more than one question. However, in reducing the number of items it was necessary to forego four hypothesis (Table 3-7). In each case other hypotheses supported the related construct. Some confidence in final results is given up by eliminating alternate form redundancy and the four hypotheses. But the choice seemed reasonable, since the alternative would have been a questionnaire that was too long.

**TABLE 3-7**  
**HYPOTHESES ELIMINATED DURING ITEM REDUCTION**

<b>Number</b>	<b>Narrative</b>	<b>Supporting Construct</b>
H10	Outsourcing depot maintenance improves depot maintenance economy of scale.	Economy of scale and scope
H34	An organization's core competencies are perceived as being defined by the products it makes, services it provides, and markets it serves.	Resource/competency-based theory
H35	An organization's core competencies are perceived as defined by what it knows and what it can do.	Resource/competency-based theory
H55	Supply chain integration will be perceived as more difficult to achieve with commercial (i.e., external) sources than with organic (i.e., internal) sources.	Logistics and supply chain management

### *Construct Validity*

#### Unidimensionality

A scale cannot possess construct validity unless it is unidimensional: unidimensionality is a necessary but not sufficient condition for construct validity. Exploratory factor analysis was used to assess unidimensionality and eliminate items that loaded weakly on scales. Since there is a tradeoff between unidimensionality and content validity, deciding where to place the balance was informed by the literature review in Chapter 2. In some

cases, as was discussed earlier and will also be discussed in Chapters 4 and 5, the data revealed that the multiple items associated with a hypothesis related to two scales rather than one. Where this occurred the “natural” scales were honored after confirming that both were needed to cover the scope of the hypothesis.

### Reliability

Reliability was tested by measuring internal consistency using Cronbach’s coefficient alpha.

### Convergent and Discriminant Validity

Convergent validity was tested using confirmatory factor analysis when there were three or more items on a scale. If the appropriate items loaded on the hypotheses, then convergent validity was held to exist. To test for discriminant validity, the author employed confirmatory factor analysis to check for correlation between the constructs; correlation indicated a limitation on discriminant validity.

### *Criterion-Related Validity*

Criterion-related validity indicates whether a scale correlates with the criterion it is intended to predict. Criterion-related validity was not applicable to the survey data, since there was no intent to specify a causal model.

### Objectivity, Nomological Validity, and Test of Theory

A construct is nomologically valid when it relates to other research in such a way that it is consistent with the received theory. Where the survey results were consistent with the received theory, the theory and the construct being examined were mutually supported and objectivity was also supported. Consistency in the present case means, first, that items loaded on the anticipated hypotheses. Second, where the received theory suggested there would be differences in responses between constituency groups then consistency with received theory meant that those differences were observed.

As an example, the isomorphism concept suggested that there would be differing interpretations of the concept of core and that professional managers in the DoD would have a stronger preference for in-sourcing than would managers not in the department. If results were not consistent with the received theory, then it could indicate that the item(s) were not measuring the intended latent variable but could also have indicated that the underlying theory was a flawed characterization of the habituated actions. These possibilities are examined when integrating the results of the analysis in Chapter 7.

As indicated in Chapter 2, the received theory is in many ways contradictory and equivocal. For this reason, nomological validity and objectivity in any complete sense was anticipated at the outset to be unlikely. As is discussed in Chapter 7, results confirmed this expectation.

## Data Collection

### *Sample Frame and Unit of Analysis*

The proposed research topic was discussed with the ADUSD(L)/MPPR. As a result of that discussion, and consistent with theoretical predictions that responses would differ by constituency, this research examined how perceptions differed depending on the constituency group to which individuals belonged. Subsequent to discussions with the ADUSD(L)/MPPR, knowledgeable research fellows on the staff of the Logistics Management Institute, and representatives from three industry associations, the constituency groups were defined to include:

- Managers within the Department of Defense, including users of depot maintenance, depot maintenance personnel, and item managers (who buy depot repairs to reparable components);
- Managers in that part of U.S. commercial industry affiliated with the Department of Defense; and
- Defense attachés from embassies of U.S. allies.

The reason for administering the survey to managers within the Department of Defense should be self-evident. There are at least two reasons for administering the survey

to managers in industry. First, as discussed by Forbes et al. (1997, pg. 4-6), the industry perspective on the question of commercial versus organic performance can be quite different than the government perspective. Second, as discussed in the early text of Chapter 2, the top leadership in the Department of Defense had steadily increased its interest in and commitment to outsourcing depot maintenance to the defense industry. Especially for this latter reason it was worth eliciting the industry view on the factors that are perceived as important to the commercial versus organic decision.

The reason for including allied nations was that DoD's issues and motivations for considering privatization (improvement in cost effectiveness) are arguably shared by U.S. allies. In at least two cases, Britain (Tighe and Tripathi 1993) and Australia (Walls 1997), there had already been significant privatization of their equivalents of depot maintenance. Thus, a reasonable way to enrich the insights of the survey was to include the perspective of U.S. allies. The attachés are included in the sample frame because they were knowledgeable of the issues and, pragmatically, were anticipated to be more accessible than managers within their ministries of defense. Before leaving this section, it should be noted that, although the author was successful in arranging for attaché participation, the number of survey instruments returned was not large enough to make statistical analysis meaningful. For this reason, the survey results reported in Chapters 4, 5, and 7 do not include attachés.

### *Required Sample Size*

Required sample size for a fixed sampling plan as was implemented here depends on the type of statistical test (one-tailed or two), acceptable type I error rate (rejecting  $H_0$  when it should not have been rejected), acceptable type II error rate (rejecting  $H_1$  when it should not have been rejected), hypothesized mean for  $H_0$ , hypothesized mean for  $H_1$ , and assumed the assumed sigma (StatSoft 1994, 3571-3573). In the case of a hypothesis such as

$H_0$ : Managers and others perceive themselves as following the dictates of the rational model.

where a related item has an associated Likert scale from 1 (strongly agree) to 7 (strongly disagree), we would reject  $H_0$  if we can show that the sample mean is statistically less than the midpoint (4)—i.e., a one-tailed test. Statistica software was used to perform a power

analysis. Table 3-8 provides required sample sizes to achieve statistical significance for  $\alpha = 0.05$ ,  $\beta = 0.1$ , and  $\mu (H_0) = 4$  for the  $\mu (H_1)$  and  $\sigma$  values shown.

TABLE 3-8  
PRELIMINARY POWER ANALYSIS

Mu (H1)	Sigma			
	0.5	1	1.5	2
4.1	215	857	1927	3426
4.3	24	96	215	381
4.7	9	35	78	138
4.9	3	11	24	43
5.0	3	9	20	35

This table shows, for instance, that if the sample mean is 4.1 (i.e., quite close to the mean for  $H_0$ ), then it would require a sample size of 215 if the standard deviation is 0.5, and a sample size of 1,927 if the standard deviation is 1.5. Although, given a large enough sample size, one can achieve statistical significance with a sample mean of 4.1, the author anticipated that a sample mean this close to the mean for  $H_0$  might be of limited practical significance. On an admittedly somewhat arbitrary basis, a sample mean on the order of at least 5—one full point to the right of 4 (or 3 if the sense is in the opposite direction) was used in the power analysis. In addition to being of more practical significance, the required sample size is also smaller: even with a  $\sigma$  of 2, a sample size of 35 would be enough to provide statistical significance. Since there was no information available prior to application of the pretest on which to base a belief about  $\sigma$ , fine-tuning the estimates of the required sample size awaited completion of the pretest. The mean and standard deviation of all responses from the pretest were 4.6 and 1.1 respectively—indicating that sample sizes of approximately 35 per cell were probably reasonable.

### *Proposed Sample*

In the text above, it was proposed to include users, depot maintenance personnel, item managers, industry personnel, and defense attachés in the sample frame. The author coordinated with the following to make arrangements for execution of the survey:

- ADUSD(L)/MPPR
- Staff of the Acting Assistant Deputy Assistant Undersecretary of Defense for Materiel Distribution and Management (ADUSD(L)/MDM)
- Assistant Vice President for Operations, National Defense Industrial Association (NDIA)
- Director, Technical Programs, Government Electronics and Information Technology Association (GEIA)
- Staff Director, Market Forecasting, GEIA
- Director, Product Support & Quality Assurance, Aerospace Industries Association of America, Inc. (AIA)
- The Counselor for Defense Cooperation, Embassy of Sweden (indirectly through a member of the LMI staff supporting the DUSD(L)/MPPR).

To gain industry association cooperation, the researcher committed to providing each association an executive summary of the results as well as at least one personal briefing.

As a result of the coordination with DoD and industry representatives and additional consultation with a member of the LMI staff who has extensive experience with government surveys, the anticipated number of addressees to whom the survey was offered and expected response rates were established as shown in Table 3-9.

The 50% to 80% response rate is typical of surveys administered within the Department of Defense if the surveys are well designed and include multiple follow-ups (Schwarz 1996). Because of the targeted audience in the case of embassy attachés, which made follow-up relatively straightforward, a 50% to 80% range was anticipated there as well. The industry contacts indicated a 10% to 20% range when surveying their member companies. In the case of high visibility and controversial topics (they included depot maintenance as one), the higher percentage would be more likely. However, the author was inclined to be conservative and planned for responses in the ranges shown. Comparing Table 3-8 and Table 3-9 indicates that a combination of low response rate, large standard deviation, and a sample mean close to 4 would compromise statistical significance for embassy attachés. In this instance, follow-up was particularly important. Despite follow-up, however, there were not enough attaché responses to make statistical analysis meaningful and they were not included in analysis.



**TABLE 3-9  
ANTICIPATED SAMPLE STATISTIC**

	Number of addresses		Survey will go to	Anticipated response rate (%)		Resulting sample size	
	Low	High		Low	High	Low	High
<b>Department of Defense</b>							
Users	300	500	Individuals	50	80	150	400
DoD depots	400	450	Individuals	50	80	200	360
Item managers	100	200	Individuals	50	80	50	160
Acquisition managers	100	150	Individuals	50	80	50	120
<b>Industry</b>							
AIA	400	500	Individuals	10	20		
<b>EIA</b>							
Engineering and operations	40	40	Companies	10	20		
Market Development	70	70	Companies	10	20		
<b>NDIA</b>							
Logisticians	300	400	Individuals	10	20		
Quality assurance	150	150	Individuals	10	20		
Automated test equipment	150	200	Individuals	10	20		
Total industry	1110	1360		10	20	111	272
Embassy attaches	50	50	Individuals	50	70	25	35
<b>Total</b>	<b>2060</b>	<b>2660</b>				<b>586</b>	<b>1347</b>

### *Execution of the Survey*

Surveys can be performed in person, by telephone, by mail (paper or electronic), and, more recently, using World-Wide Web technology. Although in-person and telephone surveys typically achieve higher response rates than do mail surveys, the latter have the desirable attributes of universal access, relatively low cost, and suitability when the survey, as in this case, is moderately long (Schwarz 1996, 9). A mail survey was the primary means for reaching DoD addressees. For industry addresses, industry associations chose to notify their members of the survey by electronic mail and place a copy of the survey instrument on World Wide Web sites for downloading. As a convenience to potential industry respondents, the author provided the instrument in two formats: a Microsoft Word file and a Microsoft Excel workbook.

The Department of Defense has a formal process under DoD Instruction 1100.13, “Surveys of DoD Personnel,” for obtaining permission to conduct a survey when a survey involves more than one service. The technical experts in the department who review such requests are in the Defense Manpower Data Center (DMDC). DMDC is assigned this role because of its extensive experience administering opinion surveys for the department. The author prepared an approval package for submittal by the survey sponsor, the Assistant Deputy Under Secretary for Maintenance Policy, Plans, and Resources. The approval package included a sampling plan, a near-final draft of the survey instrument, and data needed to ensure that requirements of the Privacy Act were satisfied. The DMDC reviewer provided approximately 30 comments over and above those obtained from the individuals who participated in the trial survey. The issues the reviewer identified varied from grammatical to substantive. Examples were:

- Missing or incorrect punctuation
- Missing words
- Section headings inconsistently shaded—some shaded and some not
- Unclear terminology. For instance the author had used the terms “public performance” and “private performance” but the meanings of these terms for readers not intimately familiar with depot maintenance could have been unclear in the context in which they were used.

- Overly complex item statements
- Inclusion by the author of explanatory material that was not needed to answer the questions and, hence, could be a distraction
- Arbitrarily different scale anchors for items that, for consistency, should have had the same anchors
- Inconsistency between word choice in items stems and the scale anchors (e.g., “private firms” in the stem and “private providers” in the anchors)
- Asking in an item stem about extent, but then providing a scale that related to significance

The author agreed with all but four of the DMDC reviewer’s comments and revised the survey instrument to correct the identified problems. It is the author’s belief that the attention to detail in the DMDC review resulted in a cleaner, simpler, and easier to understand instrument than would have otherwise been the case. A copy of the final survey instrument is provided at Appendix I.

The mechanics of actually executing the DoD part of the survey, designed to provide for anonymity of responses while providing a means for tracking who had responded and who had not, were as follows:

- Names were not entered on survey instruments. Instead each survey instrument was numbered with a four-digit number. The numbers were used to determine if addressees had responded and to check for duplicate submissions. Respondents were informed of this policy in the cover letter.
- Return envelopes for DoD addressees were addressed to a “George Washington University Survey” post office box.
- Industry responses were primarily transmitted by e-mail to the researcher at a George Washington University electronic mail address, with a few being returned via surface mail to the “George Washinton University Survey” post office box.

In discussions with the DUSD(L)/MPPR it became clear that those receiving a survey instrument were more likely to perceive the survey as legitimate if they received it through Department of Defense channels than if it came directly from the researcher. A somewhat similar situation pertained to industry: as one industry association representative put it, the industry associations normally act as a buffer between industry firms and the DoD. Absent this buffer, industry respondents would be likely to couch their responses in ways to avoid the possibility of offending potential customers. Because perceived

legitimacy was likely to be important to response rate, the survey instrument was transmitted under the DUSD(L)/MPPR signature to DoD addressees, and in the case of industry by the industry associations to member companies.

Response rate is always a concern when conducting surveys. This is especially true with mail surveys, since they typically have a lower response rate than do in-person or telephone surveys. In order to help ensure a reasonable response rate, several steps were taken. First, the cover letter to DoD addressees showed that the issues in the survey were perceived to be of both national and international significance and that the survey had the sponsorship of the DUSD(L)/MPPR. The cover letter to DoD addressees also showed that industry and allied nations were being invited to participate. Copies of the transmittal correspondence are at Appendix J.

Further, as suggested by Schwartz (1996, 19), the author followed a protocol that featured these steps:

1. Print survey booklets, cover letters, post cards, envelopes, and mailing labels and mail the initial survey during weeks 1-3 of the survey;
2. Send a first thank-you/reminder post card at week 5 to non-respondents;
3. Mail a second survey booklet with a second cover letter and self-addressed postage-paid envelope to nonrespondents at week 7; and
4. Send a second thank-you/reminder post card to recipients of the second survey mailing who have not responded at week 8.

#### DoD and Industry Association Addressees

The survey instruments were mailed to 2,222 DoD addressees on 3 August 2000 by a professional mailing service. On 15 August, one industry association loaded instruments on one of its Web sites and then sent e-mail messages to approximately 300 of its members. On approximately 24 August the second industry association did the same for approximately 265 of its members. A follow-up postcard to the same 2,222 DoD addressees was mailed on 18 Aug 2000. Both industry associations also sent follow-up messages via e-mail.

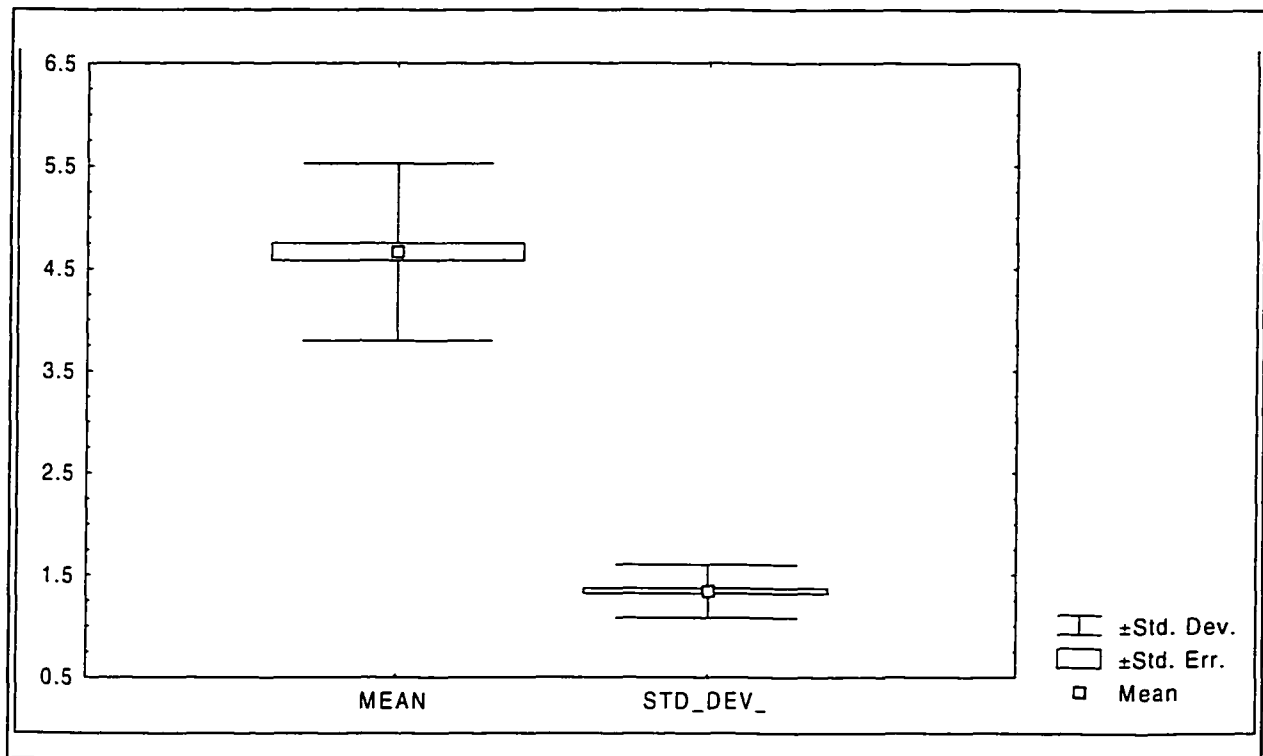
By the end of the third week, 411 responses had been received from DoD (just under 20%) and 21 from industry. In general, the DoD responses appeared to be couched as

personal expression: written responses were phrased in the first person singular—"in my opinion," "in my experience," or similar phraseology. Industry comments in some cases were presented as a company (or major division) position but, generally speaking, were also personal.

Although the protocol the author was following would have created a second mailing of survey instruments to all those who had not yet responded, it was not clear—at the end of the third week—that this was an appropriate use of resources, since even a cursory review of the returned instruments showed an uneven rate of response across demographic categories. For this reason, the author performed the following sequence of steps to target a second mailing of booklets and determine where additional data would not be needed:

- Based on 411 responses that had been entered in a response database at the time, determined the mean and standard deviation for each of the items on the survey instrument
- Computed the average mean (i.e., mean of the means) across all 99 survey items and computed the average standard deviation across all 99 survey items. Both distributions were relatively sharply defined, as can be seen in the box and whisker chart at Figure 3-7. The mean of the means was 4.663 and the mean of the standard deviations was 1.345.
- Used the information from the two preceding steps to perform a power analysis to determine the sample size needed in each "cell" for an alpha error of 0.05 and beta error of 0.10. The required sample size was 36
- Ran a series of queries against the original mailing list and the response database to determine how many responses had been received by cell. The results, along with the number of addressees in the sample frame, appear in Table 3-10
- For those cells with less than 36 responses ran another set of database queries to "pull" all addresses in the database
  - from whom a response had not yet been received if they
  - belonged to one of the cells that had less than 36 responses and
  - a mailed envelope had not been returned as undeliverable by the Postal Service while
  - eliminating duplicates (some addresses belonged to more than one cell).

FIGURE 3-7  
MEAN AND STANDARD DEVIATION OF FIRST 311 RESPONSES BY ITEM



The result of this series of operations was a follow-up mailing list of 485 addresses. A second batch of survey booklets was mailed to these 485 addresses on 19 September 2000 and a follow-up post card a week later. The decision to send the second mailing to a subset of the original sample frame, of course, increased the risk of non-response bias. (As will be discussed below, non-response bias cannot be dismissed, but statistical analysis of responses over time for those who did respond did not disclose a difference between early and late respondents.) Industry associations sent follow-up e-mail messages in coordination with the second mailing.

Eleven addresses were added to the sample frame after the mailing. Three of these were individuals who contacted either the sponsor or the author, expressed concern that they had not been offered the opportunity to respond, and requested a booklet. It can reasonably be expected that such self-selection could introduce bias into the results but—since eventual buy-in to the results is important and the number of instances was small—the author accommodated the requests. The second reason for additions was somewhat different. In three instances organizations took the initiative to make copies of the booklet

**TABLE 3-10  
RESPONSES TO FIRST MAILING**

<b>Cell</b>	<b>Sample Frame</b>	<b>Received</b>	<b>Percent</b>	<b>&lt;Desired n</b>
<b>Component</b>				
Army	722	101	14.0%	
Navy	690	85	12.3%	
Air Force	505	165	32.7%	
USMC	162	16	9.9%	◆
OSD/JCS	88	23	26.1%	◆
DLA/Other	55	19	34.5%	◆
<b>Function</b>				
Acquisition	290	93	32.1%	
Logistics General	322	60	18.6%	
Maintenance	773	148	19.1%	
Matériel Management	45	8	17.8%	◆
Operations & Logistics	664	64	9.6%	
Other Nonsupport	33	12	36.4%	◆
Support Other	89	24	27.0%	◆
<b>Organizational Level</b>				
Component Hq	106	30	28.3%	◆
Field	2028	356	17.6%	
OSD/JCS	88	23	26.1%	◆
<b>Maintenance Level</b>				
Depot Maintenance	61	16	26.2%	◆
Field Maintenance	1597	225	14.1%	
HHQ Management	39	8	20.5%	◆
N/A	525	160	30.5%	

and “farm them out.” In each instance, because of a limited number of addresses, the author had selected all of the available addresses within the respective category and these extra responses were accepted under the theory that if the author had had the addresses for the respondents they would have been mailed booklets to begin with. A total of eight additional responses were involved.

It was intended to close the survey for both DoD and industry responses on 26 October 2000. The actual closure, since outside conflicts prevented proceeding with analysis as scheduled, was subsequently extended another week.

## Survey of attachés

On 20 October 2000 the author made a presentation to 19 “MOU” (memorandum of understanding) attachés at the Embassy of the Netherlands in Washington, D.C., explained the nature of the research and sponsor, and invited the attachés present to participate. A follow-up electronic mail message was transmitted 3 November 2000. The survey of attachés was closed on 20 November 2000. The number of responses received was not sufficient to provide reasonable assurance of statistical significance. For this reason the data from the attachés are not included in the analysis.

### *Description of the final respondents*

In this section we will first discuss non-response bias and then describe the demographic attributes of those who responded.

A total of 647 responses were received from DoD addresses (85 from the second mailing) and a total of 47 from industry. For DoD the overall response rate was 31.6 % of valid addresses (those not returned as undeliverable by the Postal Service). For industry the response rate was approximately 8.3% based on the two industry associations having sent electronic mail messages to approximately 565 addressees. In the case of DoD—and even more so in the case of industry—these response rates raise a question of non-response bias.

### Nonresponse bias

As Fowler (1993, 38) has pointed out, failure to obtain responses from a high percentage of a sample can be a major source of survey error. Fowler also points out that there are three categories of non-respondents: those whom the survey instrument does not reach, those who decline to respond, and those who are unable to perform the task. In the case of the present research there were instances of all three for DoD addresses, as shown in Table 3-11.

The number of DoD respondents involved in category 2, unable to complete task, was small; and in the case of category 1, where the survey did not reach the addressee, it



**TABLE 3-11**  
**RESPONSE AND NON-RESPONSE RATES**

Category	Description	Number of Addresses	Percent (of sample frame)	Comments
1	Survey instrument did not reach	180	8.1	Returned by Postal Service. Typical reasons were addressee had moved and forwarding address expired, addressee's unit had been disestablished, and in relatively few instances the address was insufficient.
2	Unable to complete task	3	0.1	Addressees returned booklet with a note that they did not have appropriate background to respond to the questions.
3	Declined to respond	1,403	62.8	Instruments presumed to reach intended addressees (i.e., not returned by the Postal Service) for which responses were not received.
	DoD responses	647	29.0 (31.6, excluding categories 1 and 2)	
	Total	2,233 (2,222 + 11)	—	

could be argued that had it been known the addresses were invalid they would not have been included in the sample to begin with. Similarly, the industry association representative with whom the author worked did not report problems with industry e-mail addresses, and no industry respondents reported that they were unable to complete the task.

Categories 1 and 2 were not as much a concern as was category 3, declined to respond. Self non-selection can introduce bias, and the roughly 32% return rate achieved here for DoD is relatively low (Fowler 1993,40). The industry return rate is also low, as was anticipated. It is also somewhat more difficult to interpret, since the industry responses included both individual and consolidated responses (a single response that represented a consensus position of several or more individuals.)(Balish 2000).

Fowler (1993, 47-49) suggests three ways to correct for non-response: using proxy respondents, surveying non-respondents, and making statistical adjustments to correct for

non-response. None of these three approaches would work well here for the reasons shown in Table 3-12.

**TABLE 3-12**  
**APPROACHES TO RESOLUTION OF NON-RESPONSE BIAS**

Approach	Discussion
Use proxy respondents (interview somebody else within the same strata)	This approach is generally not acceptable for subjective states such as feelings, knowledge, or opinions.
Make statistical adjustments (based on demographic or other characteristics of sample)	In this case, within a strata of the sample, there is no finer stratification on which to base a statistical adjustment.
Survey non-respondents (conduct telephone or in-person interviews of a sample of non-respondents)	For most non-respondents telephone numbers were not available. Expense of in-person interviews was prohibitive, and in-person interviews would have been difficult to arrange in any event, given lack of telephone numbers.

Since none of the three approaches for correcting for non-response was feasible, the researcher used a method that had been used adopted by others (Cheon 1992, 89; Moore 1996,74-75; Smith and Deschter 1993, 350-351) and split the received responses into early and later categories in order to determine if there was a time-dependent bias. Since the only data are from those who did respond, nothing is known directly about those who did not respond. However:

- If a time-dependent bias were evident in the responses received, then that would be cause to anticipate bias between those that did respond and those that did not.
- Absence of a time-dependent bias, although it would not prove non-response bias was absent, would at least give some credence to the notion that non-response bias was not present.

#### Test for Non-Response Bias

The specific procedure the researcher followed was to split the responses into three groups: the earliest one-fourth received, the middle two-fourths, and the latest one-fourth. The author did not separate DoD from industry responses but treated them in aggregate. With these three groups formed (as summarized in Table 3-13), the author then performed the Kruskal-Wallis ANOVA by ranks test and median test to determine if the three groups were different.

**TABLE 3-13**  
**RESPONSE GROUPS FOR KRUSKAL-WALLIS TEST**

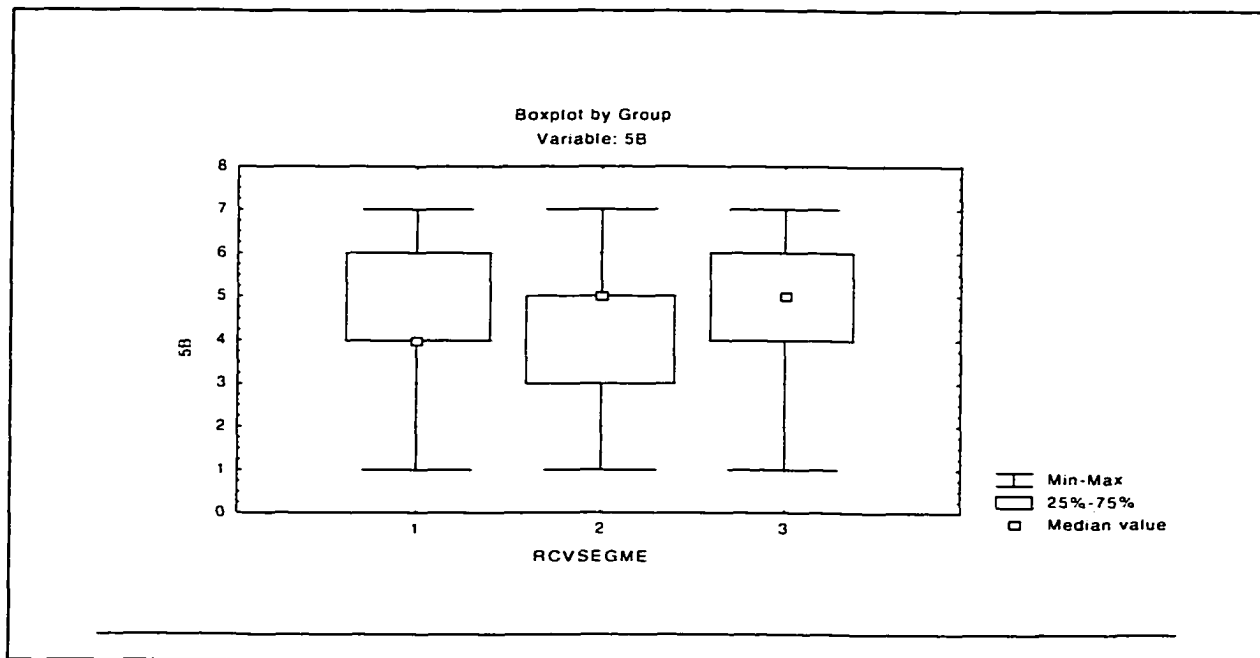
<b>Group</b>	<b>Composition</b>	<b>Inclusive dates</b>	<b>Number of responses in group</b>
1	Early returns: first quarter of responses received	3 August through 18 August	174
2	Middle returns: second and third quarters of responses	19 August through 14 September	346
3	Late returns: last quarter of responses received	15 September through 18 October	174
Total	All responses	3 August through 18 October	694

The author chose the Kruskal-Wallis ANOVA by ranks and median tests rather than a test based on means, because examination of the histograms of responses showed apparent skewedness, leptokurtosis (peakedness), platykurtosis (flatness), and bi-modality for some of the questions. Further, as will be discussed later, statistical tests for normality were less than reassuring even in the absence of skewedness, kurtosis, or bi-modality.

The Kruskal-Wallis ANOVA by ranks test assumes that the variable being tested is inherently continuous and that it was measured on at least an ordinal (rank order) scale (StatSoft 1999). Both of these assumptions are satisfied in the current case. It tests whether different samples in a comparison were drawn from the same distribution or from distributions with the same median. Thus, it is similar in interpretation to the parametric one-way ANOVA, except that it is based on ranks rather than means. The median test is a "crude" version of the Kruskal-Wallis ANOVA (StatSoft 1999). It creates a contingency table with the count of the number of cases in each sample that fall above or below the common median, and determines chi-square values for the contingency table. Under the null hypothesis (all samples come from populations with identical medians), approximately 50% of all cases in each sample should fall above (or below) the common median.

Of the 42 questions on which Kruskal-Wallis ANOVA by ranks and median tests were performed, 8 showed a statistically significant difference ( $\alpha \leq 0.05$ ) among the early, middle, and late returns on the Kruskal-Wallis test, median test, or both. Of the 8 questions for which both tests were significant, only one showed what appeared to be a trend when medians were examined using a box-and-whisker plot (Figure 3-8). In this case the author

**FIGURE 3-8**  
**ITEM 5B KRUSKAL-WALLIS RESULTS**



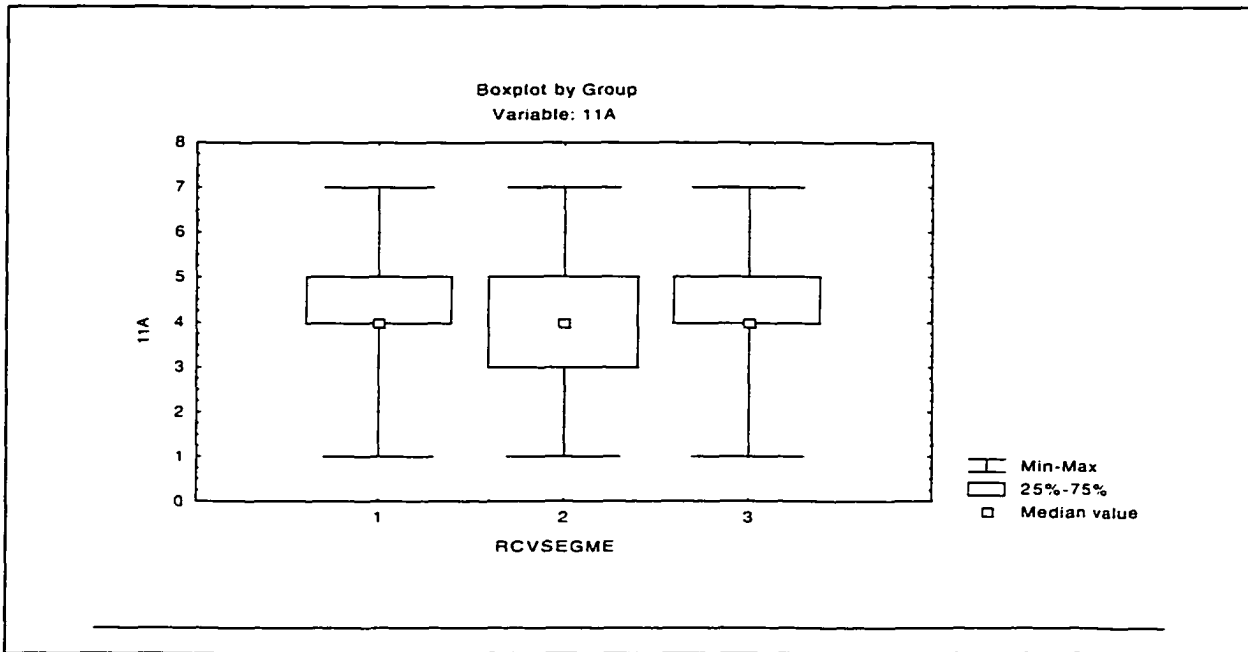
then regressed the responses against the actual receipt dates. Although the regression coefficients were significant, the  $R^2$  value was negligible (approximately 0.0). In all of the other 7 cases, the medians across all three groupings were equal. In 3 of the cases the box plots looked the same; in 3 of the cases there were differences when upper or lower quartiles were compared. Figure 3-9 is typical.

Based on the results of the Kruskal-Wallis ANOVA by ranks test and the median test, the author concludes there is no evidence of time-related bias in the responses received. Honesty compels the author to point out that absence of time-related bias in the received responses does not necessarily translate into absence of response-mode bias. This is an instance of absence of proof not being the same as proof of absence. The author simple has no way of knowing for sure if there is or is not a problem with response-mode bias. The fact that non-response bias cannot be demonstrated (alternatively, the response mode bias may exist but be undetected) will be included when articulating study limitations.

Demographics of DoD respondents.

The demographics of DoD respondents are shown in Table 3-14.

**FIGURE 3-9**  
TYPICAL COMPARISON OF MEDIANS



**TABLE 3-14**  
FINAL RESPONSE RATES

Cell	Sample Frame	Received	Percent of sample frame
<b>Component</b>			
Army	722	156	21.6
Navy	690	151	21.9
Air Force	505	222	44.0
USMC	162	42	25.9
OSD/JCS	88	36	40.9
DLA/Other	55	32	58.2
Total	2,222	639	—
<b>Function</b>			
Acquisition	290	141	48.6
Logistics General	322	90	28.0
Maintenance	773	213	27.6
Materiel Management	45	26	57.8
Operations & Logistics	664	113	17.0
Other Nonsupport	33	18	57.8
Support, Other	89	35	39.3
Indeterminate	6	3	50.0
Total	2,222	639	—

**TABLE 3-14**  
**FINAL RESPONSE RATES (CONTINUED)**

Cell	Sample Frame	Received	Percent of sample frame
<b>Organizational Level</b>			
Component HQ	106	57	53.8
Field	2,028	546	26.9
OSD/JCS	88	36	40.9
Total	2,222	639	—
<b>Maintenance Level</b>			
Depot Maintenance	61	32	52.4
Field Maintenance	1,597	337	21.1
HHQ Management	39	16	41.0
N/A	525	254	48.4
Total	2,222	639	—

### Demographics of Industry Respondents

Table 3-15 provides demographics for industry respondents. In the case of industry, since this information was not available in advance to the researcher, respondents were asked to provide the information.

As is evident from Table 3-15, industry respondents have experience across the spectrum of commercial, DoD, and other government customers. Similarly they have experience in all life-cycle phases. The preponderance of technology experience (reflective of the industry associations that participated) is in the areas of aviation and electronics. Although there is some experience in ships, vehicles, propulsion, and armament, the proportions in these areas are smaller. Since the researcher obtained the data in Table 3-15 for purposes of background information rather than statistical analysis, the limited numbers of responses in these four areas are not of analytic importance.

### **Bias from a Broader Perspective: Non-Reciprocal Typifications**

In the text above, the author discussed non-response bias. Bias, of course, can arise from many sources and generally means that that responses are skewed in some way (Meyer and Booker 1991, 36). In a functionalist framework bias implies lack of objectivity

**TABLE 3-15**  
**DEMOGRAPHICS OF INDUSTRY RESPONSES**

Major Dimension	Subdimension	Number
<b>Customers</b>		
	Commercial	24
	DoD	45
	Other government	23
	Other	7
<b>Life cycle phases</b>		
	Pre-concept	14
	Concept development	23
	Demonstration-validation	27
	Engineering and manufacturing development	34
	Production	35
	Support	44
	Disposal	18
<b>Technology areas</b>		
	Ships	5
	Aviation	35
	Vehicles	11
	Electronics	28
	Propulsion	9
	Armament	9
	Information technology	18
	Other	5

and consequent failure of results to reflect external reality. As stated in Chapter 1, this research is more nearly situated in a pragmatist's interpretive frame of reference. In the interpretivist framework objectivity means socially constructed reciprocal typification rather than coherence with an external reality or truth: in the interpretive frame there is no external reference point against which to compare results (Rorty 1991, 22-23; Stout 1988, 26-35). In fact, bias in the sense of non-reciprocal typifications is what this research is about, rather than an undesirable artifact to be prevented. Further, prior research on the depot maintenance source of repair decision process (Forbes, Hutcheson, and Timko 1997, pg. 4-6) confirmed the likelihood of such non-reciprocal typifications.

Having taken this position, it is worth noting that—non-response bias aside—there could be two sources of non-reciprocal typifications: on the part of the author and on the part of the individuals who provided weapon system-related data or who participated in the survey. Intrusion of the author’s personal typifications is unwarranted (Stout 1988, 28) and would be a delimitation on the research.

The second source of non-reciprocal typifications is the individuals who provided weapon system-related data or who provided data in response to the survey. (For convenience’ sake we will drop the term “non-reciprocal typification” and use the simpler “bias” in the discussion that follows.) Bias from this source can be considered as arising from motivational and cognitive considerations (Meyer and Booker 1991, 37-40). Motivational bias has as its source human needs (e.g., for approval) and would be expected, for instance, in conjunction with the isomorphic processes discussed in Chapter 2. Cognitive bias is a function of individual information processing constraints. Based on discussion in Meyer and Booker, Hogarth (1975), and Hogarth and Makridakis (1981) as well as the results of Forbes et al., likely sources of bias are shown in Table 3-16. This table distinguishes between bias that is sought for and bias that is not sought for. There is one cognitive bias (number 8) that would be a result of survey instrument design and is unwanted.

Table 3-16 also discusses the proposed program to handle bias. Where in Table 3-16 the effects of a particular bias are indicated as sought for, this does not necessarily mean that the effects of that *particular* bias will necessarily be individually discernable in the data. As an example, it is likely that effects of biases 1, 2, and 3 will be reflected in the data in such a way that they will not be individually distinguishable.



**TABLE 3-16**  
**SOURCES OF BIAS AND DISCUSSION**

Name of Bias	Explanation or Example	Discussion (Sought vs. unsought, how detected and addressed)
<b>Motivational Biases</b>		
1.	Outright selfishness and guile	Intentional deception  (Sought) <ul style="list-style-type: none"> <li>•Consistent with public choice theory, principal agent theory, and political power theory, this bias is expected to be present with results that will differ by constituency.</li> <li>•Will probably not be able to detect in weapon system data unless varies by branch of armed service.</li> <li>•Will attempt to detect in survey by including respondents from multiple constituencies (e.g., industry, government depots, buyers of depot maintenance, users of depot maintenance).</li> </ul>
2.	Wishful thinking	Responding based on hoped-for results  (Sought) <ul style="list-style-type: none"> <li>•Anticipated in both weapon system data and survey data as a result of coercive, mimetic, and normative isomorphism processes as well as political economy theory.</li> <li>•Will attempt to detect in weapon system data if varies by branch of armed service.</li> <li>•Will attempt to detect in survey data if varies by constituency.</li> </ul>
3.	Impression management	What would my organization think of my answer?  (Sought) <ul style="list-style-type: none"> <li>•Anticipated in both weapon system data and survey data as a result of coercive, mimetic, and normative isomorphism processes.</li> <li>•Will attempt to detect in weapon system data if varies by branch of armed service.</li> <li>•Will attempt to detect in survey data if varies by constituency.</li> </ul>
4.	Misinterpretation	Tacitly assuming a meaning based on experience with similar sounding terms  (Not Sought) <ul style="list-style-type: none"> <li>•Regarding weapon system data, misinterpretation did occur, was detected by LMI analysts who reviewed the data for DoD, and addressed through coordination with service representatives.</li> <li>•Regarding survey data, screened for misinterpretation bias through item sort. Screened again during survey pretest.</li> </ul>

**TABLE 3-16**  
**SOURCES OF BIAS AND DISCUSSION (CONTINUED)**

	<b>Name of Bias</b>	<b>Explanation or Example</b>	<b>Discussion (Sought vs. unsought, how detected and addressed)</b>
5.	Misrepresentation	Making an invalid assumption about a probability distribution—such as ignoring low-likelihood events	(Sought) <ul style="list-style-type: none"> <li>•Will not be able to detect in weapon system data because choices are binary, did not ask for estimates of probability.</li> <li>•Anticipated in survey data, will detect by comparing results of different constituencies to each other.</li> </ul>
<b>Cognitive Biases</b>			
6	Failure to take into account base rates	Ignoring lessons of experience and history	(Sought) <ul style="list-style-type: none"> <li>•Anticipated in weapon system data (e.g., vulnerability of industry sources to work stoppage) but may not be able to detect unless varies by branch of armed service.</li> <li>•Anticipated in survey data, will detect by comparing results of different constituencies to each other.</li> </ul>
7	Anchoring without adequate adjustment	Attaching too much importance to a particular, generally recent, event with a person is familiar	(Sought) Anticipated in both weapon system data (e.g., vulnerability of industry sources to work stoppage) and survey data. <ul style="list-style-type: none"> <li>•Will attempt to detect in weapon system data if varies by branch of armed services.</li> <li>•Will detect in survey data by comparing results of different constituencies to each other.</li> </ul>
8	Inconsistency	Forgetting an assumption made earlier while completing the instrument and contradicting it	(Not Sought) <ul style="list-style-type: none"> <li>•In weapon system data was detected previously by LMI analysts who reviewed the data for DoD. Analysts coordinated their findings with service representatives who then modified the data to remove inconsistencies from this source.</li> <li>•In survey data, will guard against and test for by including multiple items per construct while separating the individual items on the survey instrument.</li> </ul>
9	Availability	Recalling familiar, concrete, or recent events and overestimating the frequency of similar events	(Sought) Anticipated in weapon system data (e.g., vulnerability of industry sources to work stoppage) and survey data. <ul style="list-style-type: none"> <li>•May not be able to detect in weapon system data unless varies by branch of armed service.</li> <li>•Will detect by comparing results of different constituencies to each other.</li> </ul>

**TABLE 3-16**  
**SOURCES OF BIAS AND DISCUSSION (CONTINUED)**

	<b>Name of Bias</b>	<b>Explanation or Example</b>	<b>Discussion (Sought vs. unsought, how detected and addressed)</b>
10	Underestimation of uncertainty	Underestimation of outcomes of exponentially increasing events or of joint probabilities	(Sought) <ul style="list-style-type: none"> <li>•Will probably not be able to detect in weapon system data.</li> <li>•In survey data, where frequency or probability information is elicited, the degree of consensus within constituencies versus between constituencies will be taken as a partial indicator of underestimation of uncertainty.</li> </ul>
11	Failure to seek evidence to the contrary	People are more likely to seek evidence that confirms their views than that challenges their views.	(Sought) Anticipated in both weapon system data (e.g., vulnerability of industry sources to work stoppage) and survey data. <ul style="list-style-type: none"> <li>•May not be able to detect unless varies by branch of armed service.</li> <li>•Will detect in survey data by comparing results of different constituencies to each other.</li> </ul>

### **Potential Risks and Actions Taken to Mitigate Risks**

Although the author attempted to follow a rigorous research process model, a number of risks remain inherent in the research. The risks in Table 3-17, some of which have already been discussed, are among the most prominent. For each risk, the action taken to mitigate it is indicated.

**TABLE 3-17**  
**RISKS AND PROPOSED MITIGATION STEPS**

	<b>Source of Risk</b>	<b>Mitigation Steps</b>
1.	Inadequate sample size for statistical significance	<ul style="list-style-type: none"> <li>•Power analysis</li> <li>•Compensated for unanticipated non-responses through follow-up</li> </ul>
2.	Non-response bias	<ul style="list-style-type: none"> <li>•Followed an established and tested protocol to maximize the number of responses</li> <li>•Split received responses into earlier and later categories and tested for time-dependent bias. None was found.</li> </ul>

**TABLE 3-17**  
**RISKS AND PROPOSED MITIGATION STEPS (CONTINUED)**

	Source of Risk	Mitigation Steps
3.	Survey instrument difficult to understand, or individual items difficult to interpret and complete	•Implemented pretest using subjects representative of target audience
4.	Failure of an industry group to actually participate in survey or achieve anticipated response rate	•Inclusion of three industry groups provided built-in redundancy. (One of the three industry groups did not participate.)
5.	Loss of support by one or more critical sub-offices within the Office of the Secretary of Defense	•Continued coordination throughout remaining life of research project. (Support continued throughout the project.)
6.	Inability to achieve convergence (i.e., generate singular matrices) when performing path analysis on weapon system data	•Conducted preliminary confirmatory factor analysis prior to comprehensive analysis. Did not prove to be a problem in either preliminary or comprehensive analysis. Confirmatory factor analysis solutions converged.

### Limitations and Delimitations

This research like any other is subject to certain limitations and delimitations. Although possibly not a comprehensive accounting, some of the more important limitations and delimitations are set forth below.

#### Limitations

First, the number of survey responses was about 30% of the sample frame for DoD respondents and less than 10% for industry respondents. The potential for non-response bias is, therefore, an issue. Although a check for time-dependent biases in the received responses was negative, absence of time-related bias in the received responses does not necessarily translate into absence of response-mode bias. The author does not know if there is or is not a problem with response-mode bias.

As described earlier in this chapter, there was a deliberate effort to relate the results from analysis to other prior research and to the received theory. Nonetheless, the sample frame for both data sets is taken from the area of DoD depot maintenance. Therefore results pertain primarily to the choice between public and private providers (rather than to make or buy decisions generally) and, more particularly, to the choice between public and private

providers of depot maintenance. Although it is hoped that the results of this research are useful in the context of the choice between public and private providers of high technology commercial-like activities generally, it would be incautious, on the basis of this research alone, to generalize the results to all high-technology commercial-like activities, and even more incautious to generalize to all commercial-like activities.

As discussed in this chapter and Chapter 2, a potential limitation of earlier research efforts was, in each case, the inclusion of a limited number of theoretical constructs and the exclusion (or possibly unawareness) of others. The present research seeks to overcome that limitation by spanning 14 theoretical constructs that the 9 fields studied indicate are relevant to the topic being studied. But, as also noted in Chapter 2, the boundaries between fields are often fuzzy. Much of the literature crosses over two or more fields or incorporates the results of one field within another in ways that are not consistent from one piece of research to another. It is probable that other researchers would not necessarily agree with the framework of 9 fields and 14 constructs, or that taken as a whole the framework is inclusive of the theoretical base.

### Delimitations

The primary delimitations derive from the researcher's own frame of reference. First, the researcher is intimately familiar with depot maintenance and current Department of Defense policy as a result of having been an active duty Air Force maintenance officer and having, since retirement, accomplished a number of related studies under contract to the DoD. Although the researcher would like to think that he is not an unwitting captive of DoD patterns of thinking, it is unlikely that this is the case. He is a member of the same professional community and by the very nature of professional communities shares the same tacit values. The dissertation committee, formed as it is from outside the DoD, provides some protection against intrusion of tacit biases, but this protection is limited because the biases may go unrecognized.

A second delimitation stems from the researcher's professional work in technology management. Consistent with Rogers (1995, 11,30-31), the researcher is more comfortable with the notion that an innovation is idea, practice, or artifact that is perceived as new rather

than the notion that an innovation is an instrumental means to some goal. Innovations can, and generally do, have desirable outcomes but inevitably have unexpected consequences which may or may not be desirable. Desirability itself depends on one's point of view. Outsourcing and, more particularly, privatization, are seen by the researcher primarily as interesting administrative innovations. An inherent skepticism about ultimate outcomes and their desirability may have affected the researcher's approach to and execution of this research without his awareness.

# **CHAPTER 4**

## **ANALYSIS OF SURVEY RESULTS: CONSTRUCTS 1 THROUGH 7 AND BIMODAL RESPONSES**

### **Introduction**

At the highest level in the present research are the 14 broad theoretical constructs such as rational action, transaction cost economics, and principal-agent theory. These constructs have associated hypotheses that will act to either confirm or disconfirm that the constituencies surveyed hold values and norms consistent with the constructs. The hypotheses themselves, of course, are also constructs, but of a narrower scope.

Table 4-1 summarizes the relationship between theoretical constructs and hypotheses. If it is found by analysis of the survey data, for instance, that there is support for hypotheses H1 but not for H56 and H57, then there is evidence that those who responded to the survey see the process of deciding between organic and commercial providers of depot maintenance as following the rational model.

Chapter 3 described the purpose of the survey, potential item definition, how content validity was established, how substantive validity was established, the process of scale refinement, and the details of survey execution. This chapter will:

**TABLE 4-1**  
**RELATIONSHIP BETWEEN CONSTRUCTS AND HYPOTHESES**

<b>Theoretical Construct</b>	<b>Related Confirming Hypotheses</b>	<b>Related Disconfirming Hypotheses</b>
1. Rational model	H01	H56, H57
2. Imperfect competition	H02, H03, H04, H05, H06, H30	
3. Market failure	H07, H08	
4. Economy of scale and scope	H09, H10	
5. Transaction cost economics	H11, H12, H13, H14, H15, H16, H17	H48, H49, H50
6. Principal-agent theory	H18, H19, H20, H21, H22, H23, H24, H25	H48, H49, H50
7. Public choice theory	H26, H27	
8. Privatization and theory of non-market failure	H17, H25, H28, H29, H30, H31, H32, H33, H37	
9. Resource/competency-based theory	H35, H36, H37, H38, H39, H40, H41, H42	H34
10. Administrative innovations and isomorphism	H43, H44, H45, H46, H47	
11. Relational/social exchange theory	H48, H49, H50, H51, H52	H11, H12, H13, H14, H24
12. Logistics and supply chain management	H51, H52, H53, H54, H55	
13. Garbage can model	H21, H42, H53, H56, H57	H01
14. Political economy and bureaucratic politics	H47, H58, H59, H60	

- Summarize key facts and limitations related to the survey
- Discuss the salient statistical assumptions and how well they are satisfied
- Present the analysis of survey items related to constructs 1 through 7, beginning with construct 1, the rational model. Constructs 2 through 7 are grouped together because they fall within the scope of economics; construct 1 is included with them since much of economics assumes rational choice.



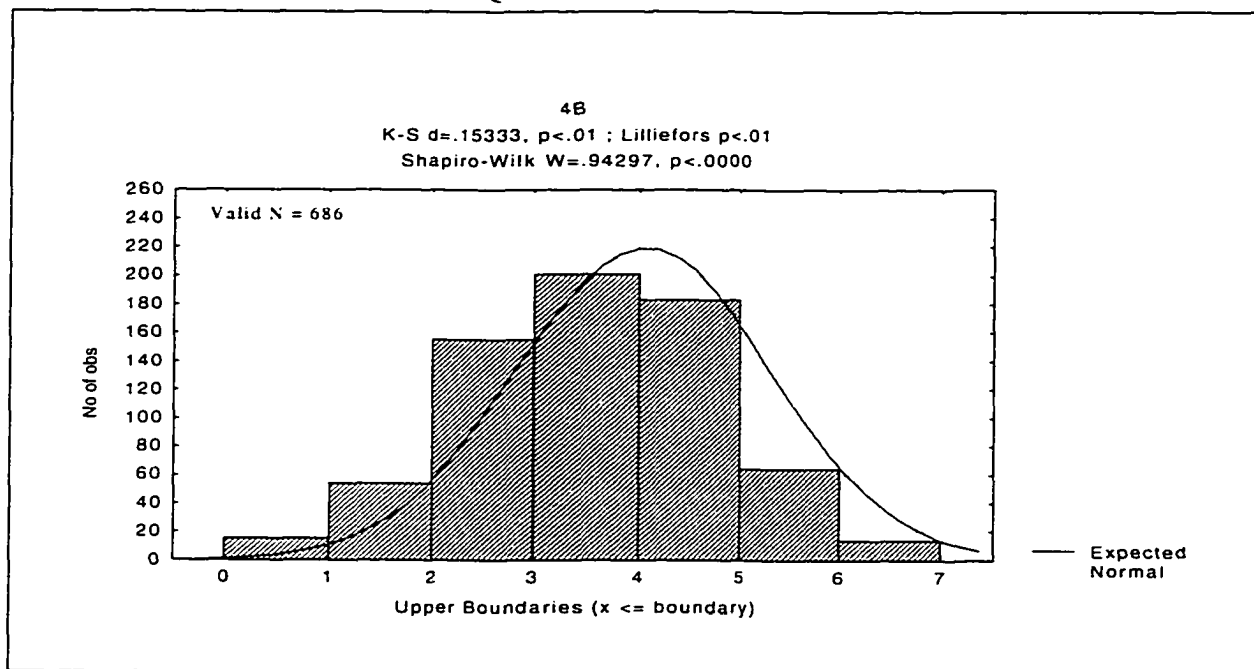
## Statistical Assumptions

The analysis in this chapter relies to an important extent on the t-test to examine differences between means. The t-test is commonly used to evaluate the differences in means between two groups. Arguably, the t-test can be used even if the sample sizes ( $N$ ) are very small (e.g., as small as 10) (StatSoft 1994), as long as the variables are normally distributed within each group and the variation of scores in the two groups is not different. Walpole and Myers (1993, 216) argue that, as a result of the central limit theorem, the normal approximation to the mean will generally be good if  $N$  is equal to or greater than 30, regardless of the shape of the distribution. Further, the approximation is good even when  $N$  is less than 30, if the population is not “too different” from a normal distribution.

Since the number of received responses is less than 30 only in the case of “material management” and “other non-support,” the available data would appear to satisfy the Walpole and Myers criteria except for those two. However, rather than cavalierly accepting the normality assumption, the researcher examined the data for normality. The normality assumption can be evaluated by looking at the distribution of the data using histograms (examining the data for central tendency), by performing a normality test, or preferably both. The researcher did both, for all of the questions. Examination of the histograms is integrated throughout this chapter and Chapter 6. Some items with histograms appear to be clearly bimodal. The problem with bimodality will be first brought up on page 155 and then treated more fully in a special section devoted to it on page 225.

The results of normality tests—even when the histograms showed a well-behaved central tendency—would have led to rejecting the assumption of normality. This unexpected result appears to be an artifact of the small number (integers 1-7) of ordinal response possibilities. When a statistical procedure like the Lilliefors compares the empirical number of observations to the expected number, there are large differences, resulting in significant Kolmogorov-Smirnov (K-S), Lilliefors, and Shapiro-Wilk statistics, as shown in Figure 4-1. If these statistics are significant, then one rejects the null hypothesis that the observed data follow a normal curve.

**FIGURE 4-1**  
QUESTION 4B HISTOGRAM



Given the visually apparent central tendency in Figure 4-1, rejecting the normality assumption seemed unreasonable. The author is not alone in noting this problem; as did Borchers (1996, 167), the author synthesized a smoothed continuous distribution of responses in an attempt to confirm that the problem stemmed from the limited number of ordinal responses. The procedure was to:

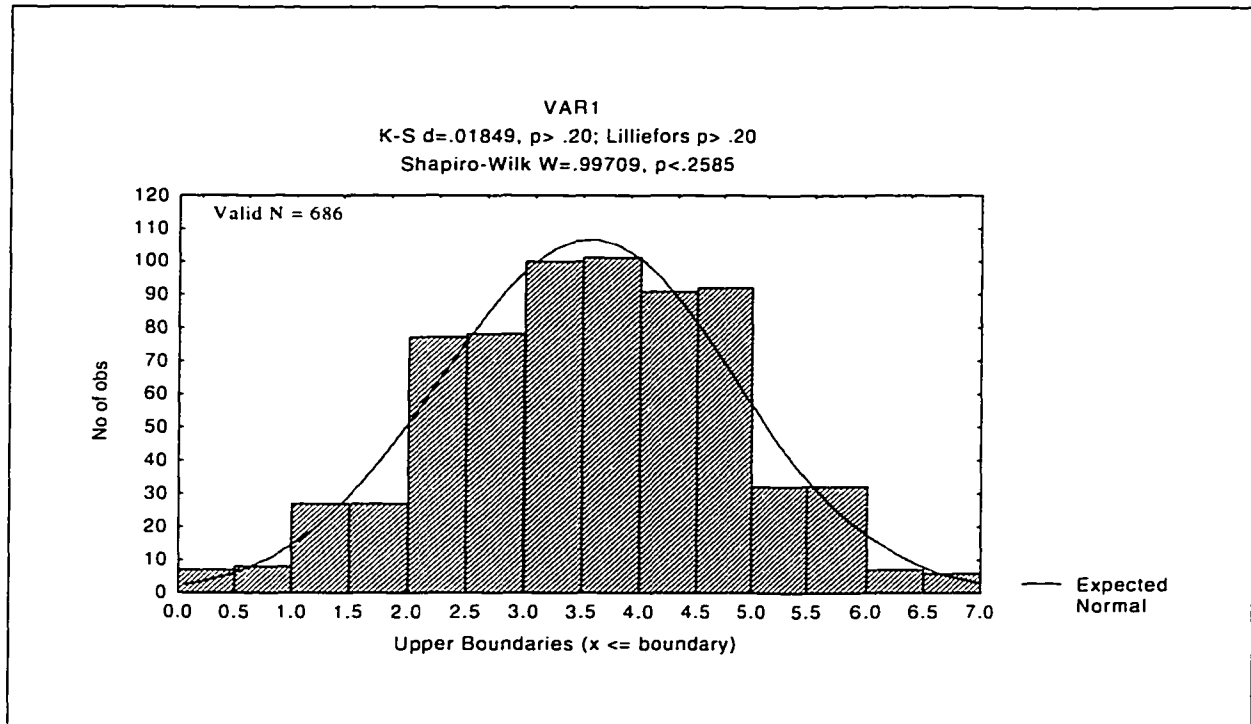
- Count the number of observations for the value 1
- Divide the interval between 0 and 1 into that many equidistant sub-intervals
- Replace those integer observations with real observations, where the real observations were spaced one sub-interval apart
- Repeat the procedure for the values 2, 3, etc.

For instance, if there were five 1s, they would be replaced by 0.2, 0.4, 0.6, 0.8, and 1.0.

When the K-S, Lilliefors, and Shapiro-Wilk statistics were computed on the smoothed distribution, all were non-significant (Figure 4-2). In fact, the result was still a crude approximation of a normal distribution. Note that there are an equal number of observations in the intervals 1.0 to 1.5 and 1.5 to 2.0, instead of more in the interval 1.5 to 2.0 as

would be expected. Since the appropriate statistical tests were non-significant even with this crude smoothing, the assumption of normality was accepted for the survey data.<sup>1</sup>

FIGURE 4-2  
ARTIFICIALLY SMOOTHED DISTRIBUTION



The p-level reported with a t-test represents the probability of error involved in rejecting the hypothesis that there is no difference between the two categories of observations (corresponding to the groups) in the population when, in fact, there is a difference. There is some argument over whether one can use a “one-tailed” test if the difference is in a predicted direction. However here the researcher has opted to use one-tailed tests where appropriate.

In addition to the t-test, analysis of variance (ANOVA) and factor analysis are also used extensively in the following discussion. ANOVA also depends on the normality

<sup>1</sup> The author consulted approximately a half-dozen texts on survey methods looking for treatment of this issue. Interestingly, and somewhat surprisingly, he found none. Since most texts on survey research include some discussion on t-tests, analysis of variance, and other procedures that depend on the normality assumption—and since most survey instruments elicit interval-level data—the absence of discussion of this issue is puzzling.

assumption, and factor analysis on an assumption of multivariate normality. Therefore the discussion above relates to them as well.

## Construct 1—Rational Model

For this and subsequent constructs, we will:

- Examine the survey items related to each hypothesis to determine if it is supported
- Comment on whether the theoretical construct is supported by conclusions drawn with regard to the hypotheses.

Discussion of scale validity will be included where scales comprise three or more items. Discussion of construct validity (i.e., convergent validity and discriminate validity) will also be woven throughout this chapter where factor analysis is used.

The rational model construct had three associated hypotheses, as shown in Table 4-2.

TABLE 4-2  
RATIONAL MODEL HYPOTHESES

<b>H01</b>	Persons with an interest in the depot maintenance will perceive themselves as following the dictates of the rational model when making depot sourcing decisions.
<b>H56</b>	Participants in the depot maintenance public versus private allocation decision will be perceived as continually changing.
<b>H57</b>	Chance occurrences rather than a rational process will be perceived as important to outcomes of depot maintenance public versus private allocation decision situations.

Support for the first of these, H01, would tend to confirm the rational model. The second and third would act to disconfirm it.

### Confirming Hypothesis

There was one confirming hypothesis, H01. The associated items and their related questions are shown in Table 4-3.

The author performed factor analysis on the items associated with H01. Loadings are as shown in Table 4-4.

**TABLE 4-3**  
**HYPOTHESIS H01 ITEMS AND QUESTIONS**

Item	Question	Narrative
476	18F	For a decision process to be rational, it needs to have a well defined problem, a means for telling good alternatives from bad, a comparison of alternatives, and selection of the best alternative.
536	18G	Managers and others with an interest in depot maintenance should use rational processes to allocate workload between the public and private sectors.
581	18H	A rational process is used to allocate workload between the public and private sectors.
631	19A	Because it is hard to analyze all alternatives in advance, a reasonable way to solve a problem is to find an alternative that is at least better than other possibilities.

**TABLE 4-4**  
**FACTOR LOADINGS (VARIMAX RAW)**

Factor Loadings (Varimax raw)			
Extraction: Principal component			
Item	Question	Factor 1	Factor 2
476	18F	<u>0.8340</u>	-0.0758
536	18G	<u>0.8736</u>	0.0194
581	18H	-0.2608	<u>0.8000</u>
631	19A	0.4055	0.6863
Expl. Var		1.6913	1.1171
Prp. Total		0.4228	0.2793

Underlined loadings exceed 0.70

As is evident from Table 4-4, questions 18F and 18G load on a single factor. This factor is essentially normative in nature—how the respondents thought the decision process should work. Question 18H loads significantly on factor 2, and question 19A is nearly significant with the same sign. The author retained both 18H and 19A because of the conceptual link between the two and in the interest of more complete coverage of the scope of the construct represented by the second factor. This second factor is an empirical view—how the respondents view the decision process as actually working.

Since neither factor had three or more items, scale reliability was not calculated. Convergent and discriminate validity were examined by splitting the original data file in

half (selecting every other record) and then performing confirmatory factor analysis on the half of the records that were selected. The author permitted the two factors to inter-correlate. The results generated by the Statistica SEPATH module (values statistically significant at  $P \leq 0.5$  are underlined; in this instance all of the values were) are in Table 4-5. (Subsequently in this chapter and in Chapter 5 the author followed the process described here to examine convergent and discriminate validity. However, to avoid interrupting the flow of discussion, the author will summarize the results of confirmatory factor analysis rather than including the Statistica SEPATH output tables.)

TABLE 4-5  
CONFIRMATORY FACTOR ANALYSIS

	Parameter Estimate	Standard Error	t Statistic	Prob. Level
(Factor1)-1->[18F]	<u>0.480</u>	<u>0.043</u>	<u>11.173</u>	<u>0.000</u>
(Factor1)-2->[18G]	<u>0.918</u>	<u>0.035</u>	<u>25.923</u>	<u>0.000</u>
(Factor2)-3->[18H]	<u>0.196</u>	<u>0.076</u>	<u>2.575</u>	<u>0.010</u>
(Factor2)-4->[19A]	<u>1.126</u>	<u>0.043</u>	<u>25.923</u>	<u>0.000</u>
(DELTA1)—>[18F]				
(DELTA2)—>[18G]				
(DELTA3)—>[18H]				
(DELTA4)—>[19A]				
(DELTA1)-5-(DELTA1)	<u>0.505</u>	<u>0.039</u>	<u>12.961</u>	<u>0.000</u>
(DELTA2)-6-(DELTA2)	<u>0.000</u>	<u>0.000</u>		
(DELTA3)-7-(DELTA3)	<u>1.932</u>	<u>0.149</u>	<u>12.961</u>	<u>0.000</u>
(DELTA4)-8-(DELTA4)	<u>0.000</u>	<u>0.000</u>		
(Factor2)-9-(Factor1)	<u>0.308</u>	<u>0.049</u>	<u>6.227</u>	<u>0.000</u>

Underlined values significant at 0.05.

The four items loaded on the anticipated factors as desired, supporting convergent validity. However, the correlation path between the two factors is also significant. Therefore discriminate validity is challenged.

There is no single, generally accepted goodness-of-fit measure for methods such as this that are based on structural equation modeling (Hartwick and Barki 1994, 448). Accordingly, as have other researchers generally, the author used multiple measures. The measures that were both available in Statistica and for which threshold values were found

in the literature are shown in Table 4-6, along with the values generated by the above model. The threshold values for the first two measures are from Hartwick and Barki (1994, 448-449). The third is from Ghani and Deshpande (1994, 385).

**TABLE 4-6  
MODEL FIT INDICES**

Index	Range	Threshold for Good Fit	Value Achieved
Bentler-Bonett non-normed fit index (a transformation of chi-square that takes degrees of freedom into account)	0-1	> 0.9	.754
Bentler comparative fit index	0-1	> 0.9	.908
Joreskog adjusted goodness of fit index	0-1	> 0.9	.413

The Bentler comparative fit index indicates a good fit, although the other two measures do not. If item 19A is deleted, all three fit indices are greater than 0.9. The author chose, however, to retain item 19A for the reasons stated above.

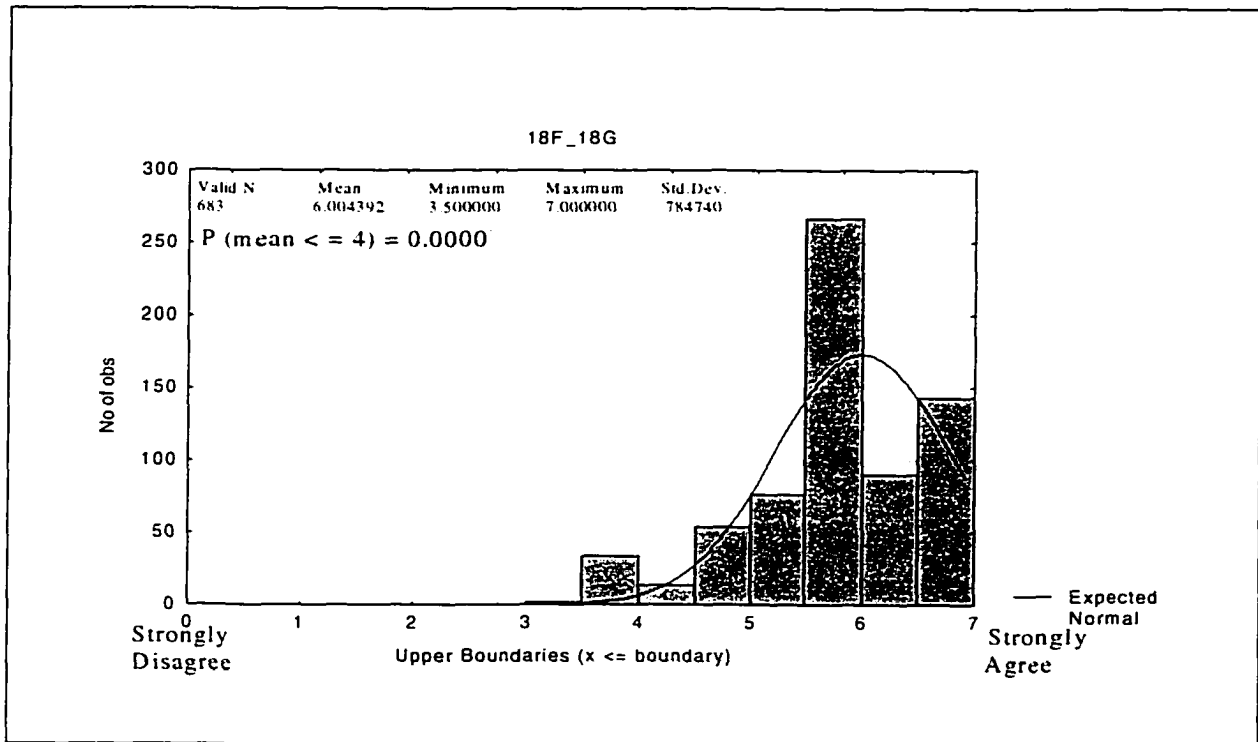
Having completed confirmatory factor analysis with the results above, the author created a single dataset for factor 1 by summing individual response scores for items 476 and 536 and then dividing by 2 so that the results would be between 1 and 7. He did the same for the items contributing to factor 2 (items 581 and 631). The resulting histograms are in Figure 4-3 and Figure 4-4.

Figure 4-3 is interpreted to mean that:

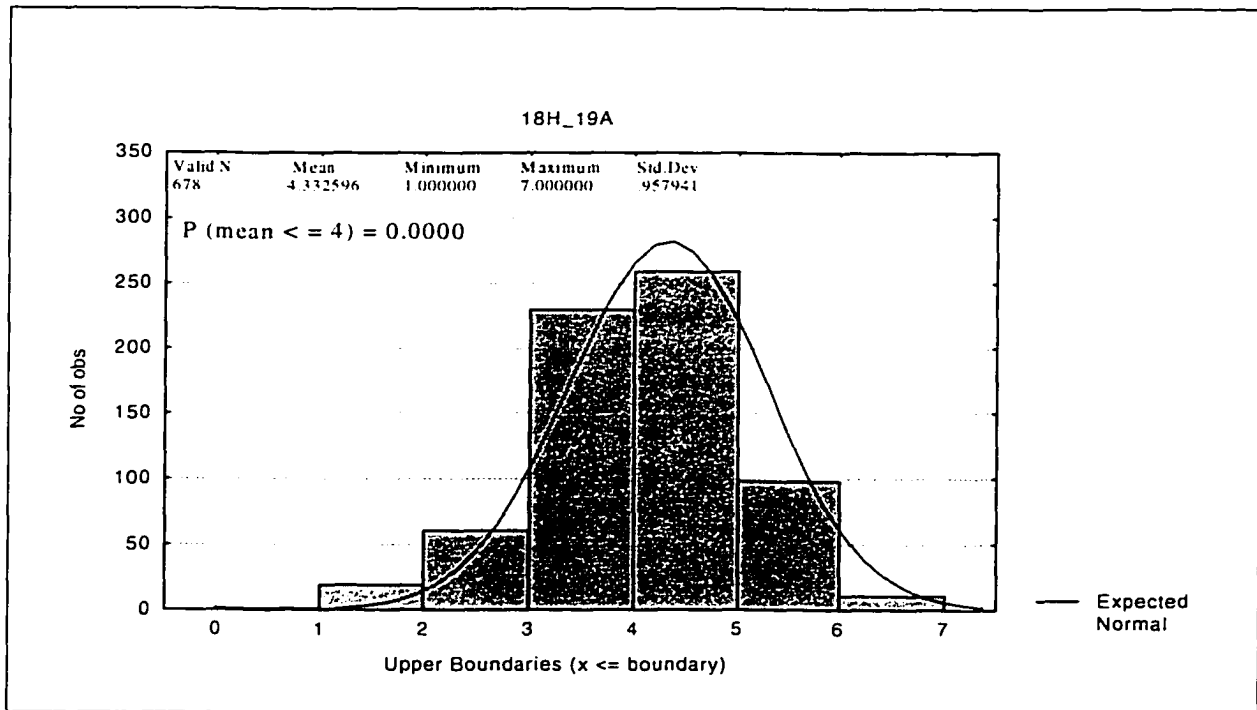
- The statement “Managers and others with an interest in depot maintenance should use rational processes to allocate workload between the public and private sectors” was accepted, where
- The definition of a rational process was as proposed: for a decision process to be rational, it needs to have a well-defined problem, a means for telling good alternatives from bad, a comparison of alternatives, and selection of the best alternative.

Figure 4-4 is interpreted to mean that over half the respondents (the mean response is greater than 4) perceived that a rational process is used to allocate workload between the public and private sectors. However, such a rational process could consist of finding an alternative that is at least better than other possibilities—as opposed to an exhaustive search

**FIGURE 4-3**  
HISTOGRAM OF SUM OF ITEMS 476 AND 536



**FIGURE 4-4**  
HISTOGRAM OF SUM OF ITEMS 581 AND 631





among possible alternatives. Additionally, this is an instance when statistical confidence that the mean is greater than 4 has its limitations as a guide: nearly half of the respondents do not view the process as rational, even with the broadened definition of rational.

### Disconfirming Hypotheses

There were two disconfirming hypotheses, H56 and H57. Each had one related item as shown in Table 4-7.

TABLE 4-7  
HYPOTHESES H56 AND H57

Hypothesis	Item	Question	Narrative
H56	525	18A	The participants in the public versus private depot maintenance controversy always seem to be changing.
H57	526	18B	It does not matter how much effort is put into deciding between public and private providers of depot maintenance, something unexpected always seems to determine the final outcome.

The text of the survey question and histogram of survey responses for item 525 are in Figure 4-5. This and all subsequent histograms are arranged as follows:

- The item is identified in the figure title.
- Below it is the text of the question, in some cases slightly paraphrased so that it will stand on its own without the entire accompanying response scale.
- Below the text is the histogram itself; the corresponding survey question number is centered above the histogram.
- Overlaid on the histogram are the basic statistics: valid N, mean, minimum and maximum, and standard deviation. For each item, assuming central tendency is evident, N, the mean, and standard deviation are used in a t-test to determine the probability that the mean is less than 4, greater than 4, or not equal to 4, depending on the nature of the item. The probability resulting from the t-test is also overlaid on the histogram. In the case of multi- (generally bi-) modality, the t-statistic is not computed since the assumption of normality is clearly violated and a note why it is not computed is overlaid on the histogram.
- Finally, the left and right anchors are overlaid, at the bottom, on the horizontal scale.
- As is fairly evident from the histogram, item 477 evidences at least bimodality.

**FIGURE 4-5**  
ITEM 525 HISTOGRAM

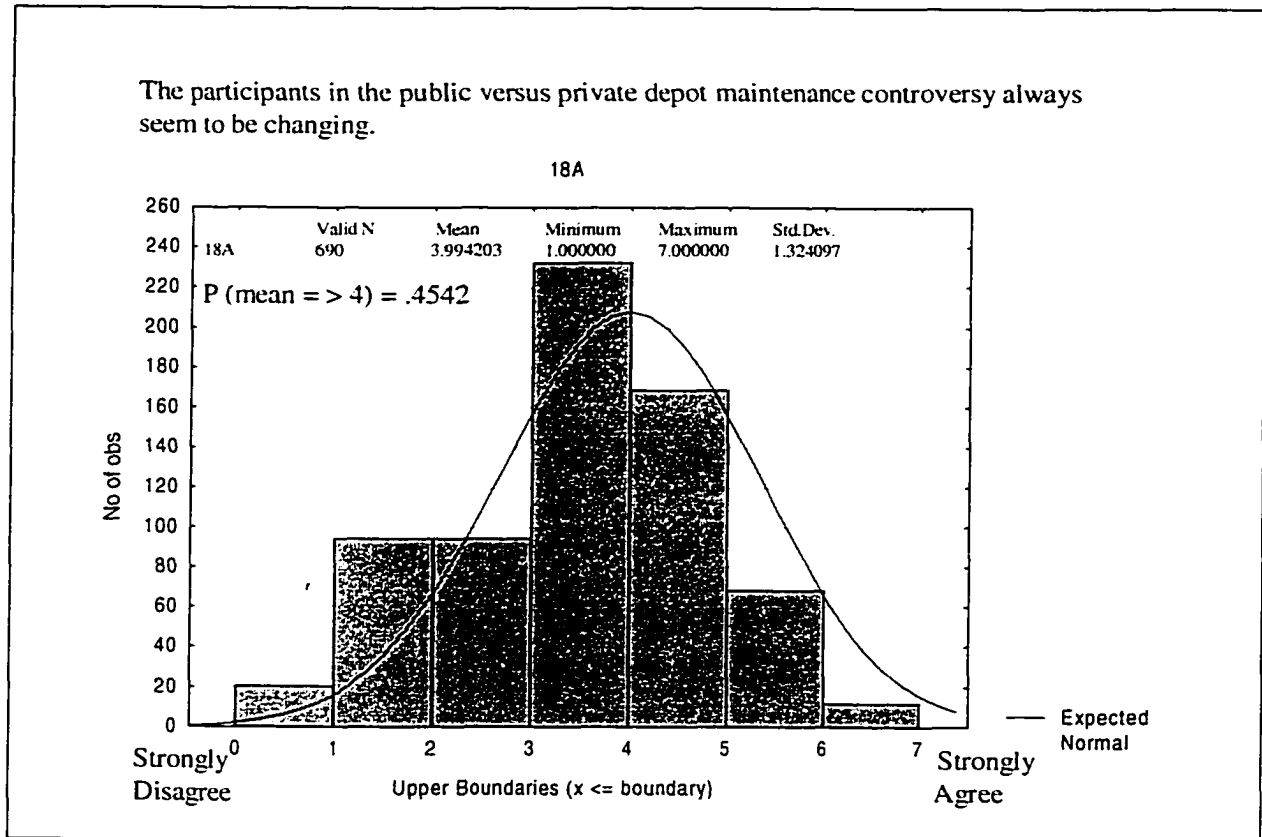


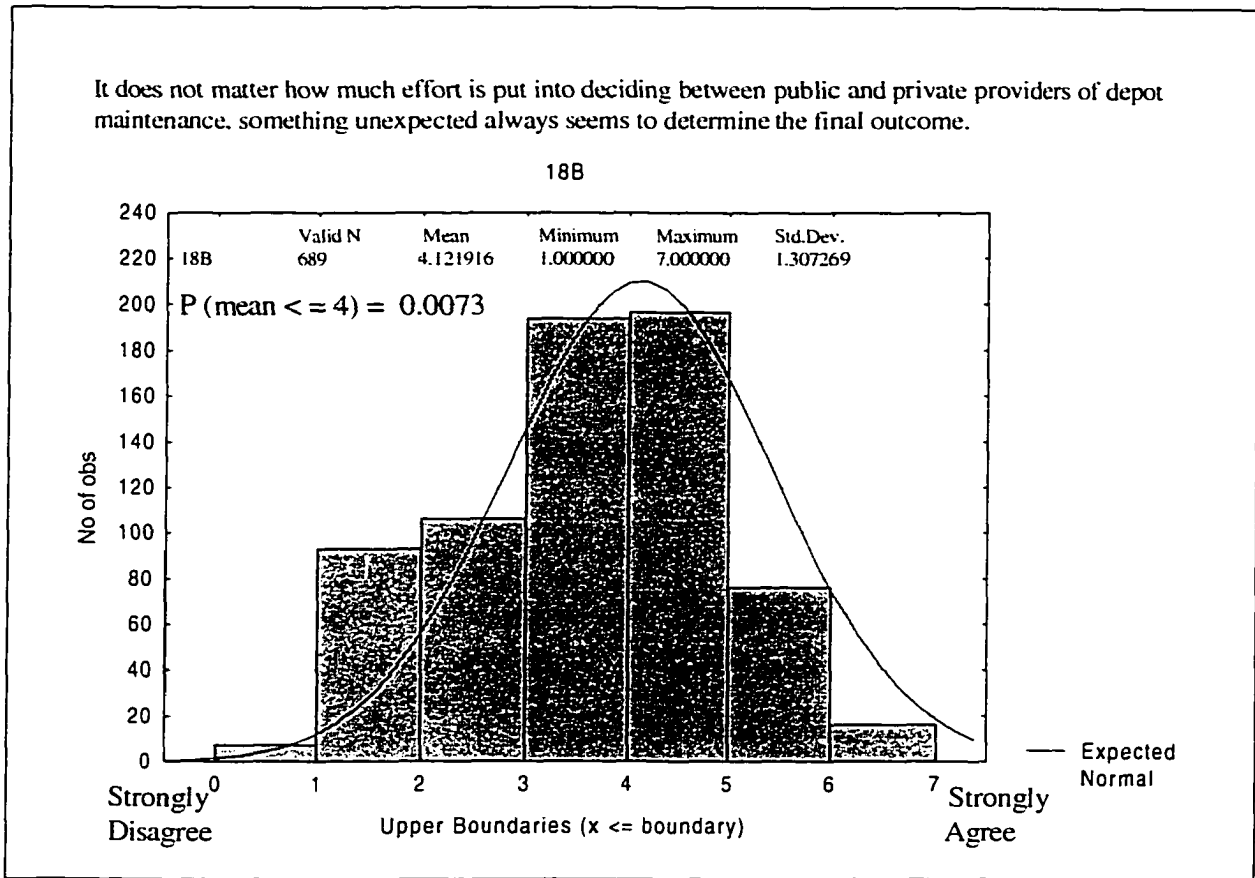
Figure 4-5 does not confirm that respondents viewed participants in the depot maintenance sourcing decisions as always changing (which, if it were the case, would putatively confound use of a rational process for making sourcing decisions).

However, the results in Figure 4-6 support the statement “It does not matter how much effort is put into deciding between public and private providers of depot maintenance, something unexpected always seems to determine the final outcome.”

#### Summary of Results for Construct 1, Rational Model

The above analysis suggests that participants in the survey supported use of rational processes for making sourcing decisions. Perceived actual use of such processes is equivocal. The results for the second factor under H01 would support a view that turnover among decision makers is not perceived as interfering with implementation of a rational process and that a rational process is used. The results for hypotheses H56 and H57 suggest that,

**FIGURE 4-6**  
ITEM 526 HISTOGRAM



although turnover among decision makers is not perceived as an issue, arbitrary decision making is an issue. Table 4-8 summarizes the results by hypothesis.

TABLE 4-8  
CONSTRUCT 1 RESULTS

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H01	Persons with an interest in the depot maintenance will perceive themselves as following the dictates of the rational model when making depot sourcing decisions.	Supported. Although ideal rational process was desired, in-use rational process could consist of finding alternative at least better than other possibilities.	Items 476, 536. Rational process highly desired where rational process defined as well defined problem, means for telling good alternatives from bad, comparison of alternatives, and selection of the best alternative  Items 581, 631. Rational process perceived as used but defined as finding alternative at least better than other possibilities.
H56	Participants in the depot maintenance public versus private allocation decision will be perceived as continually changing.	Not supported	Item 525. Survey respondents did not view participants as always changing
H57	Chance occurrences rather than a rational process will be perceived as important to outcomes of depot maintenance public versus private allocation decision situations.	Supported. "Chance occurrences" operationalized as "something unexpected."	Item 526. Respondents agreed with statement: It does not matter how much effort is put into deciding between public and private providers of depot maintenance, something unexpected always seems to determine the final outcome.

## Construct 2—Imperfect Competition

### Related Hypotheses

The imperfect competition construct had six related hypotheses as shown in Table 4-9. All are confirming. We examine each in turn.

**TABLE 4-9**  
**IMPERFECT COMPETITION HYPOTHESES**

H02	Depot maintenance workload will be perceived as unique and outside the commercial mainstream.
H03	Availability of more than one source will be perceived as important to the organic versus commercial workload allocation decision.
H04	Existence of proprietary data will be perceived as important to the organic versus commercial workload allocation decision.
H05	Managers of and other persons with an interest in depot maintenance will perceive organic depot maintenance capability to be an internal monopoly.
H06	Managers of and other persons with an interest in depot maintenance will perceive of public versus private competition for depot maintenance as being conducted on a playing field that is not level.
H30	The availability of a competitive marketplace will be perceived as mattering if government is to benefit from commercial capabilities.

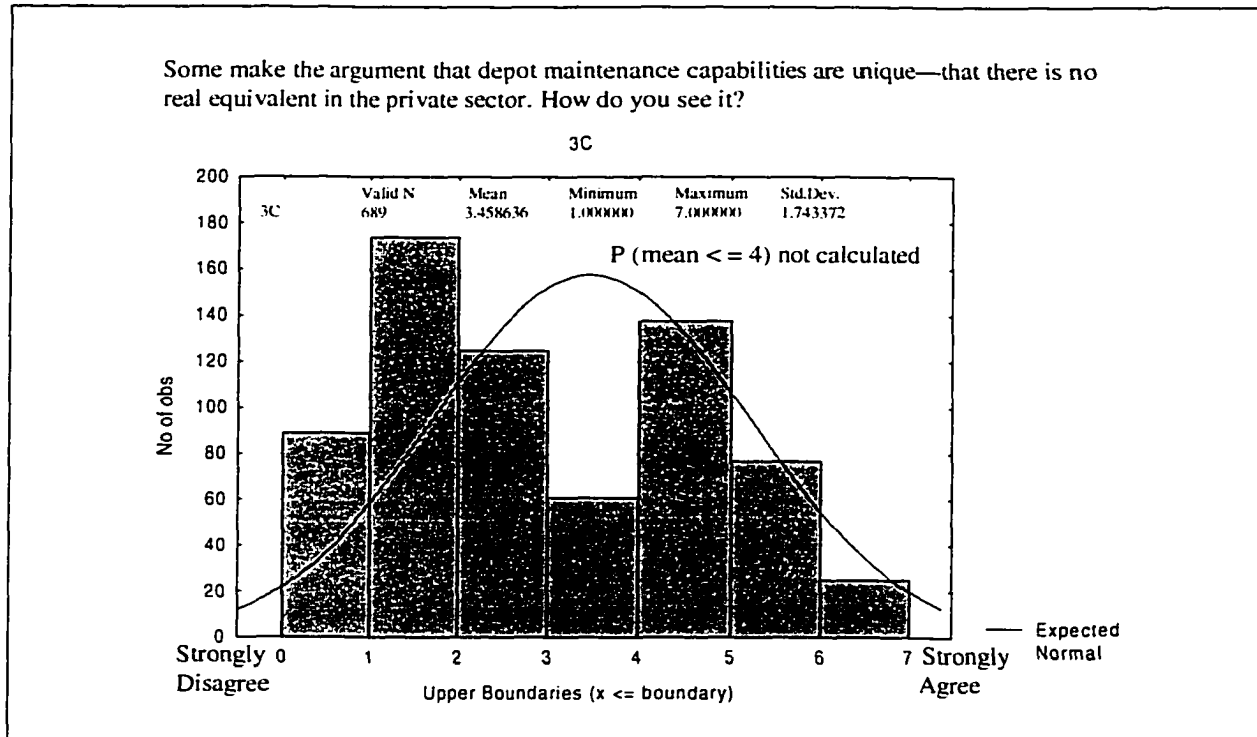
#### *H02 Depot Maintenance Relation to Commercial Mainstream.*

This hypothesis has one associated item, number 477 (question 3C).

The text of the survey question and histogram of responses for item 477 are shown in Figure 4-7. In the case of item 477, the statement in the question would be rejected if we could show that the mean of responses is less than 4. Unfortunately, because the responses to item 477 do not show central tendency, it would be improper to use a t-test on the aggregate responses.

To gain insight into the source of multimodality, the author initially used analysis of variance along the six dimensions that are available: component, function, system, organizational level, maintenance level, and sector. The results are in Table 4-10. This and all subsequent ANOVA results reflect the six dimensions along which the sampling frame

**FIGURE 4-7**  
**ITEM 477 HISTOGRAM**



was stratified. The operational definitions of the variables (e.g., Component, Logistics, Acquisition) used to stratify the sampling frame are in Appendix M.

There are statistically significant differences among the means for three dimensions: function, maintenance level, and sector. Unfortunately, as shown in Figure 4-8, the bimodality is also evident within the dimensions. This is especially so in the case of field-level maintenance. Bimodality also shows up:

- At the field level, when comparing organizational levels
- For all three of the armed Services (Army, Navy, and Air Force)
- For the maintenance, acquisition, logistics, and operations functions—when comparing functions.

Since the normality assumption implicit in ANOVA is violated, the ANOVA results are suspect, and analysis of the responses to item 477 (using only these data) is ambiguous. There is no convincing basis for either accepting or rejecting the statement.

**TABLE 4-10**  
**ITEM 477 ANOVA RESULTS**

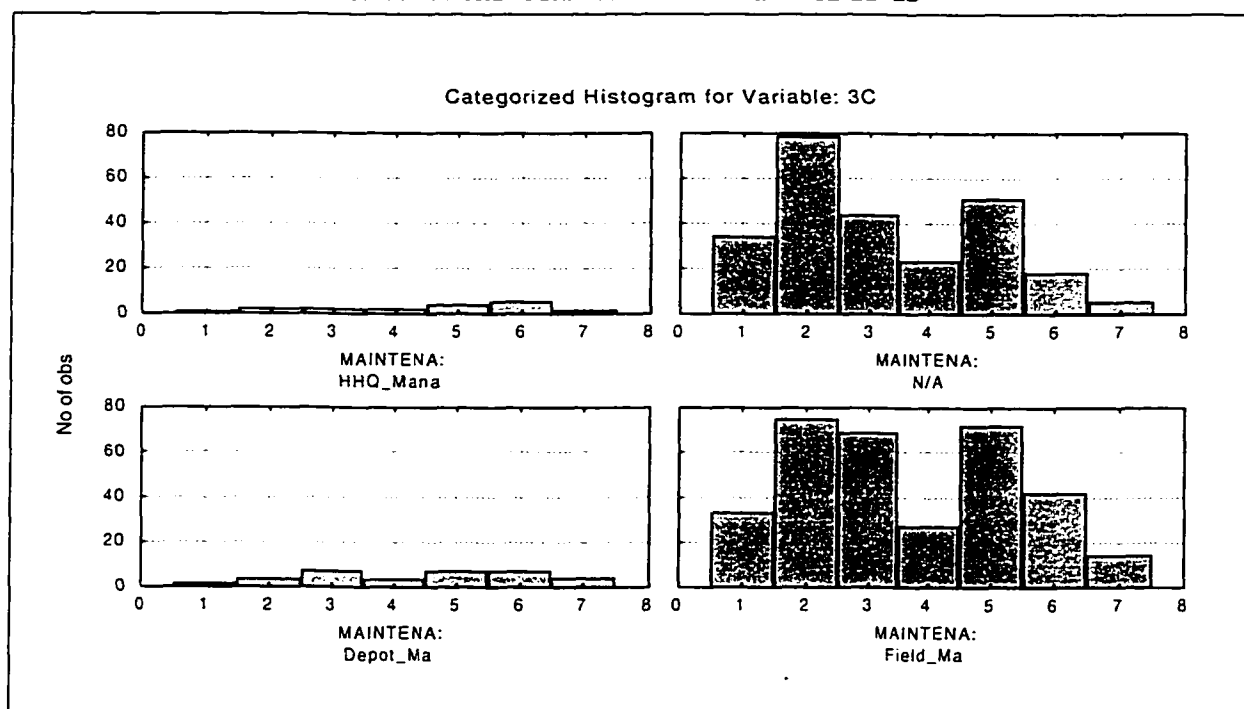
Item 477 Survey question 3C					
Component		Function		System	
F(6,627)=1.67; p<.1254		F(7,626)=3.32; p<.0018		F(6,627)=.75; p<.6093	
	Means		Means		Means
Army	3.871	Support_ other	4.029	Ordnance	3.913
Other	3.591	Maintenance	3.741	Multiple	3.664
Navy	3.480	Logistics Mgt. General	3.708	Ground	3.567
Air Force	3.452	Materiel Mgt.	3.692	Other	3.563
USMC	3.405	Operations	3.564	Ship	3.541
DLA	3.100	Other_ non-support	3.444	Aviation	3.416
OSD/JCS	3.083	Acquisition	2.979	N/A	3.400
		Indeterminate	2.667		
Level		Maintenance Level		Sector	
F(2,631)=1.44; p<.2378		F(3,630)=9.90; p<.0000		F(1,687)=33.83; p<.0000	
	Means		Means		Means
Component	3.667	HHQ_ Management	4.688	DoD	3.561
Field	3.553	Depot_ Maintenance	4.531	Industry	2.064
OSD/JCS	3.083	Field_ Maintenance	3.639		
		N/A	3.205		

Underline indicates significance at 0.05 level.

As will be noted throughout this chapter, bimodal response patterns appeared for a number of items, generally with internal minima at 4. As is the case here, these patterns persist across most or all of the dimensions considered (excepting sector).

Because the bimodal pattern both confounded analysis, as it did here, and might be an indication of important information not being captured in the six dimensions considered, the author looked further into this phenomenon. Fortunately, additional insight was available from the comments provided by survey recipients. (See the discussion under the heading "Analysis of Apparent Bimodal Responses" on page 225.) Generally speaking, the comments appear to reflect the existence of two different populations:

**FIGURE 4-8**  
**ITEM 477 HISTOGRAMS BY MAINTENANCE LEVEL**



- Those who hold negative opinions of public providers, positive opinions of commercial providers, or a combination of the two
- Those who hold the opposite opinions.

Further, the opinions appear to be related to:

- Experience with commercial providers (possibly a single particularly sharp experience)
- Experience with public providers (again, possibly a single particularly sharp experience)
- Overall preference for one sector or the other.

The bimodal pattern for responses to item 477 appears to reflect these two different populations. The specifics of data encoding are described beginning on page 225. But, as illustrated in Table 4-11, when the data are simplified so that it is possible to create a simple two-by-two contingency table, the relationship between coded experience with the commercial sector and responses to item 477 is statistically significant at the  $\alpha=0.05$  level. All three factors (commercial experience, public experience, and sector preference) were significantly related to item 477 scores at the 0.10 level or better.



**TABLE 4-11**  
**ITEM 477 CONTINGENCY TABLE**

	Observed Frequencies Experience Scores					Expected Frequencies Experience Scores			
	Range	<3	>3	Total		Range	<3	>3	Total
<b>Item scores</b>	<4	24	4	28	<b>Item scores</b>	<4	19.7	8.3	28.0
	>4	9	10	19		>4	13.3	5.7	19.0
	Total	33	14	47		Total	33.0	14.0	47.0

Chi square value: 6.23  
Chi square critical (0.95): 3.84

Thus, support for item 477 and hypothesis H02 is ambivalent. Whether depot maintenance capabilities are perceived as outside the commercial mainstream appears to depend on the population to which a respondent belongs.

### *H03 Availability of More Than One Source*

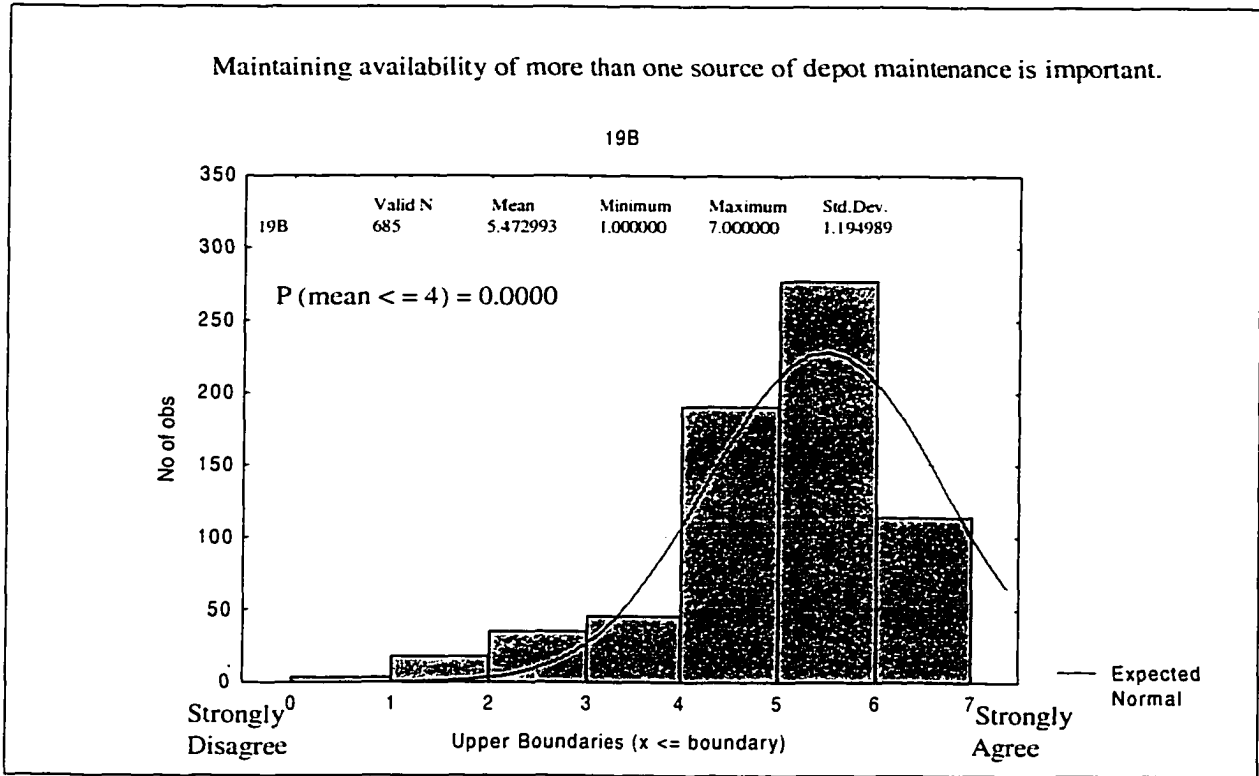
This hypothesis has two associated items, 478 (question 19B) and 636 (question 5A). The histogram of responses for item 478 is shown in Figure 4-9.

The probability that the mean of the responses is less than 4 is 0.0. Therefore the premise of item 478 is accepted, and corresponding hypothesis H03 is supported.

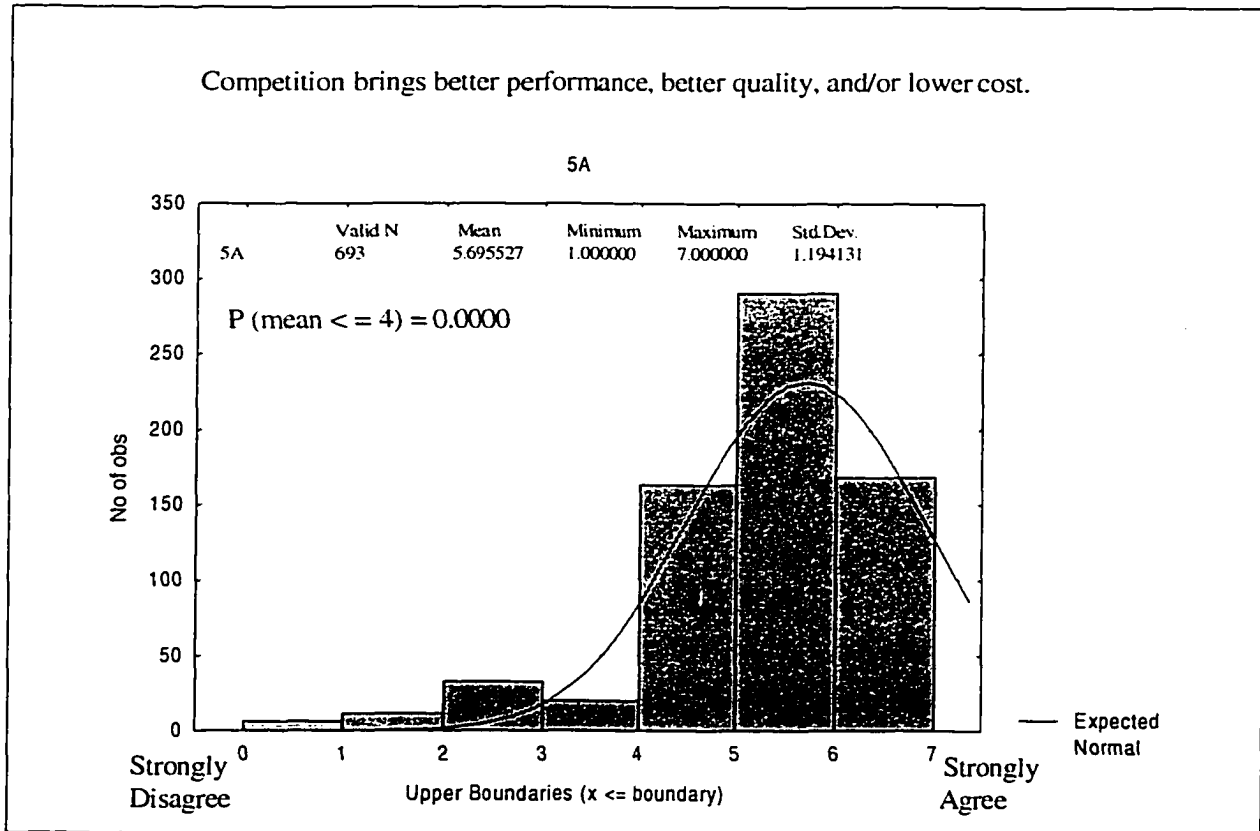
The histogram for item 636 is shown in Figure 4-10.

The probability that the mean of responses to item 636 is less than 4 is 0.0, and the premise of the item is supported. Since the premises of both item 478 and 636 were accepted, H03 is also accepted.

**FIGURE 4-9**  
ITEM 478 HISTOGRAM



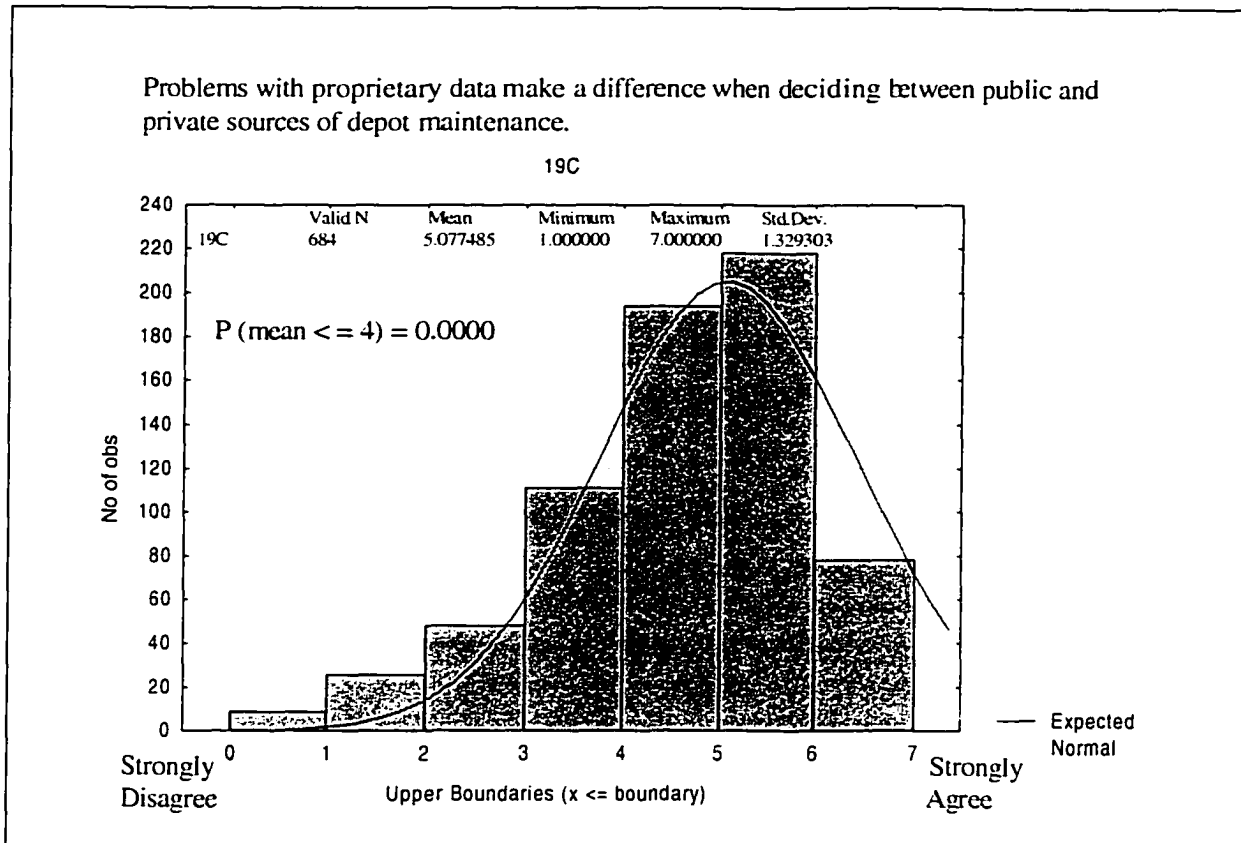
**FIGURE 4-10**  
ITEM 636 HISTOGRAM



### H04 Existence of Proprietary Data

Hypothesis H04 has one corresponding item, 479 (question 19C). The histogram of responses for item 479 is at Figure 4-11.

**FIGURE 4-11**  
ITEM 479 HISTOGRAM

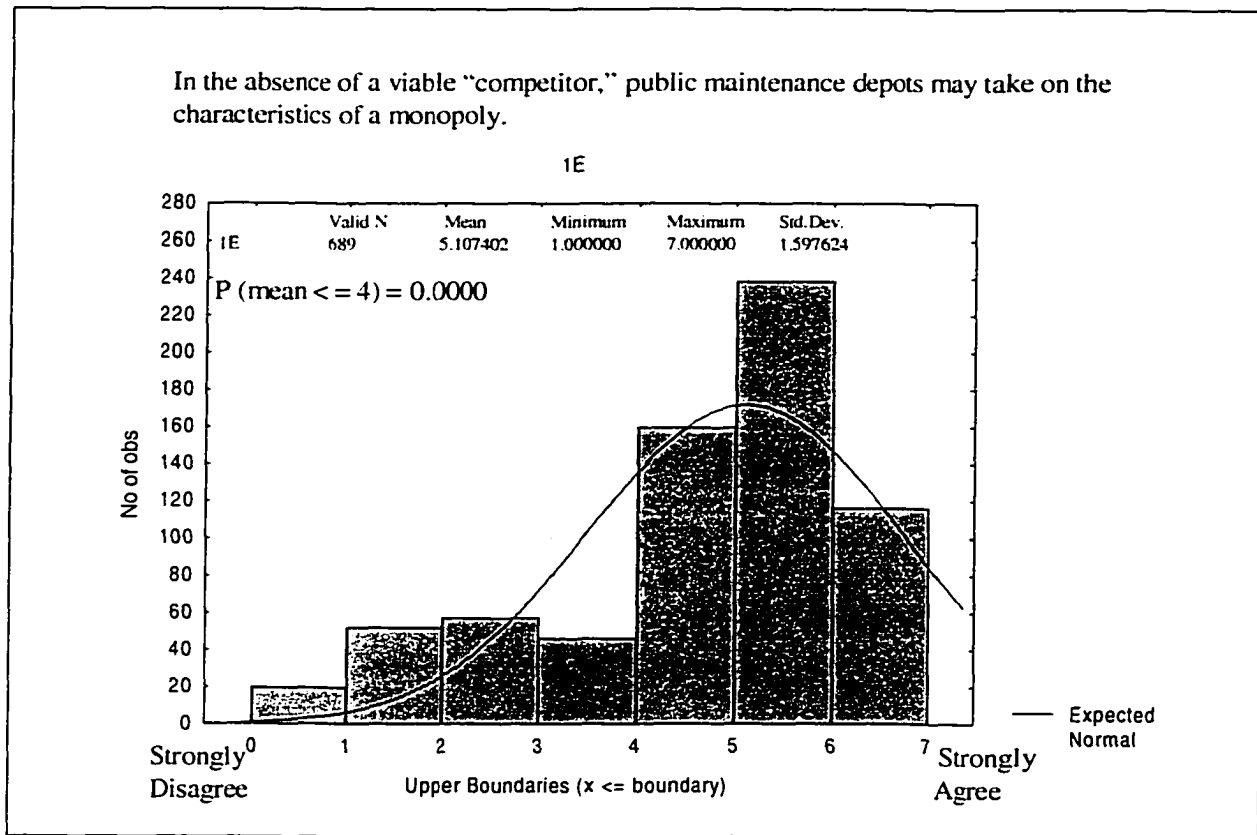


The probability that the mean of responses to item 479 is less than 4 is 0.0. Therefore the premise of the question is accepted, and corresponding hypothesis H04 is also accepted.

### H05 Organic Depot Maintenance Capability as Internal Monopoly.

Hypothesis H05 has one corresponding item, 480 (question 1E). The histogram for item 480 is at Figure 4-12.

FIGURE 4-12  
ITEM 480 HISTOGRAM



The probability that the mean of responses is less than 4 is 0.0. The premise of the item is accepted, and corresponding hypothesis H05 is supported.

*H06 Public Versus Private Competition on Playing Field That Is Not Level*

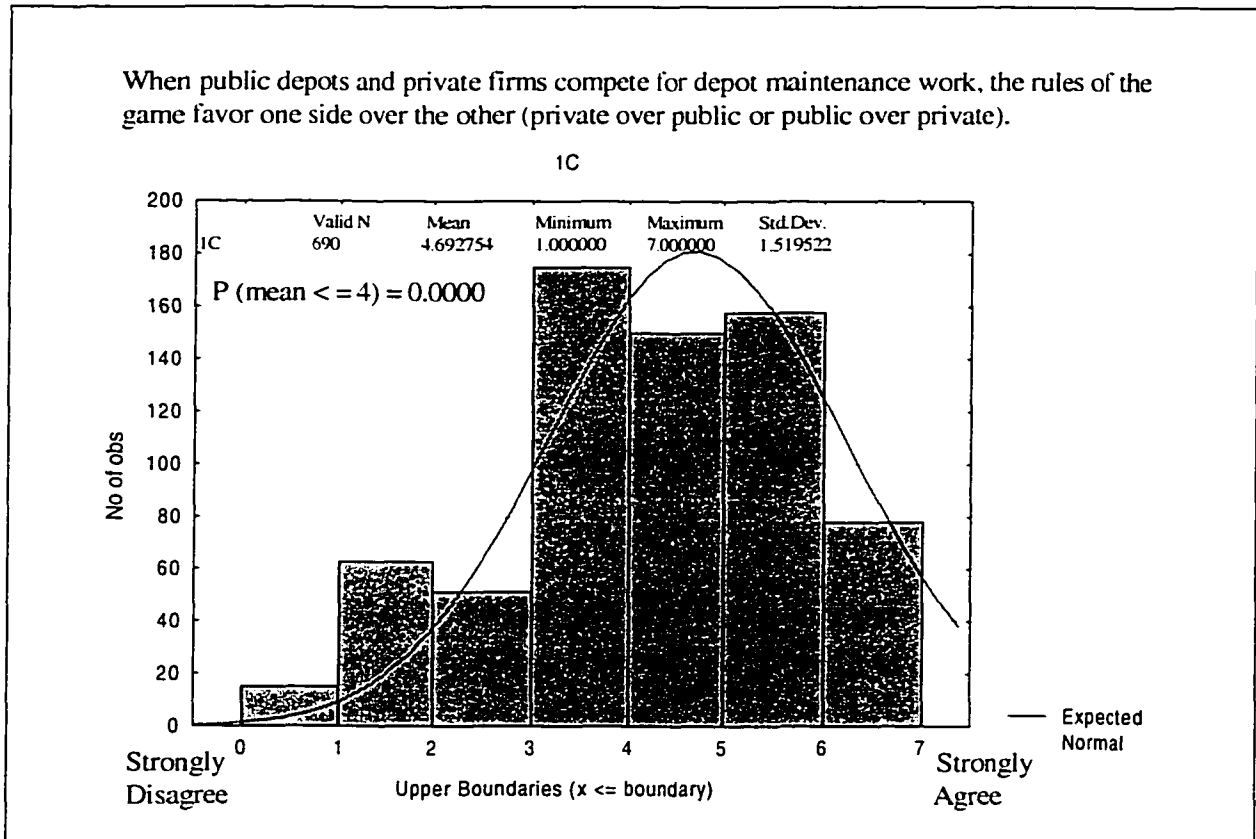
Hypothesis H06 has one corresponding item, 541 (question 1C). The histogram for item 541 is at Figure 4-13.

The probability that the mean is less than 4 is 0.0. The premise of item 541 is supported, and corresponding hypothesis H06 is supported.

*H30 Importance of Availability of a Competitive Marketplace*

Hypothesis H30 has four corresponding items: 559 (question 3D), 624 (question 1B), 612 (question 20D), and 594 (question 20C). When the author performed item

FIGURE 4-13  
ITEM 541 HISTOGRAM



purification, item 559 loaded on one factor, and items 612 and 594 loaded on a second. Item 624 did not load at a significant level (loading was less than 0.70). The author repeated the factor analysis using the final data set with similar results.

The results of a Varimax rotation are shown in Table 4-12, where loadings greater than 0.7 are indicated by an underline. The two factors shown account for nearly 70 percent of variability in the responses on these four items. Items 594 and 612 load on a single factor. Item 559 loads greater than 0.7 on a second factor. Although the loading for item 624 is not greater than 0.7 on either factor, the author retained its association to factor 2 for further analysis because of the conceptual link between items 624 and 559. Items 559 and 624 deal with the importance of avoiding a sole-source situation. Items 594 and 612 deal respectively with the relative ease with which the existence of a competitive marketplace can be determined or a competitive marketplace created.

**TABLE 4-12**  
**HYPOTHESIS H30 FACTORS**

Factor Loadings (Varimax raw)			
Extraction: Principal components			
Item	Question	Factor 1	Factor 2
624	1B	-0.505	0.569
559	3D	0.169	<u>0.869</u>
594	20C	<u>0.821</u>	0.067
612	20D	<u>0.848</u>	0.078
Expl. Var		1.676	1.089
Prp. Totl		0.419	0.272

Underlined loadings exceed 0.70.

When the author performed confirmatory factor analysis, items 594 and 612 loaded on a single factor as anticipated. Item 559 loaded on a second factor, and item 624 did not. Thus convergent validity is challenged by the decision to include 624 in the interest of covering the scope of the factor. Discriminate validity is also challenged, since there appears to be correlation between the two factors.

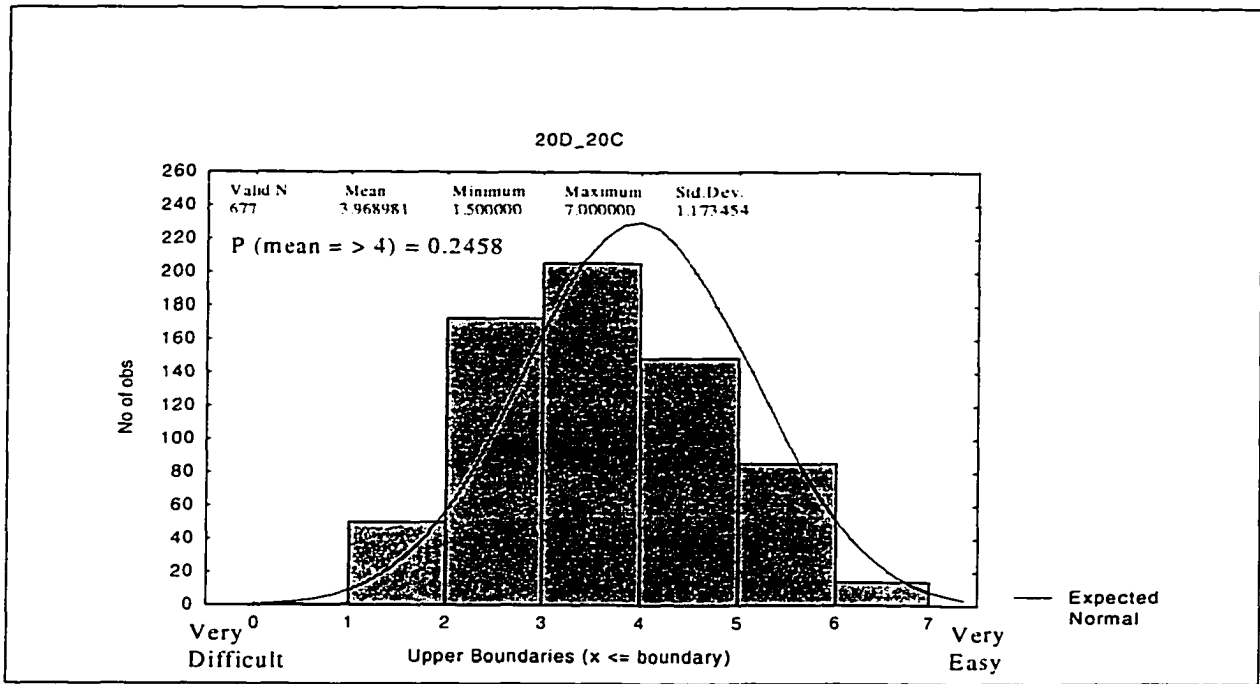
In the case of both factors the author linearly combined the individual responses for corresponding items by summing them and then dividing by 2 so that the results would be in the 1 to 7 range. The resulting histograms are plotted in Figure 4-14 and Figure 4-16.

Referring to Figure 4-14, we cannot reject the possibility that the true mean is greater than 4. Therefore the importance of determining a competitive marketplace exists (or creating one) cannot be established from these results.

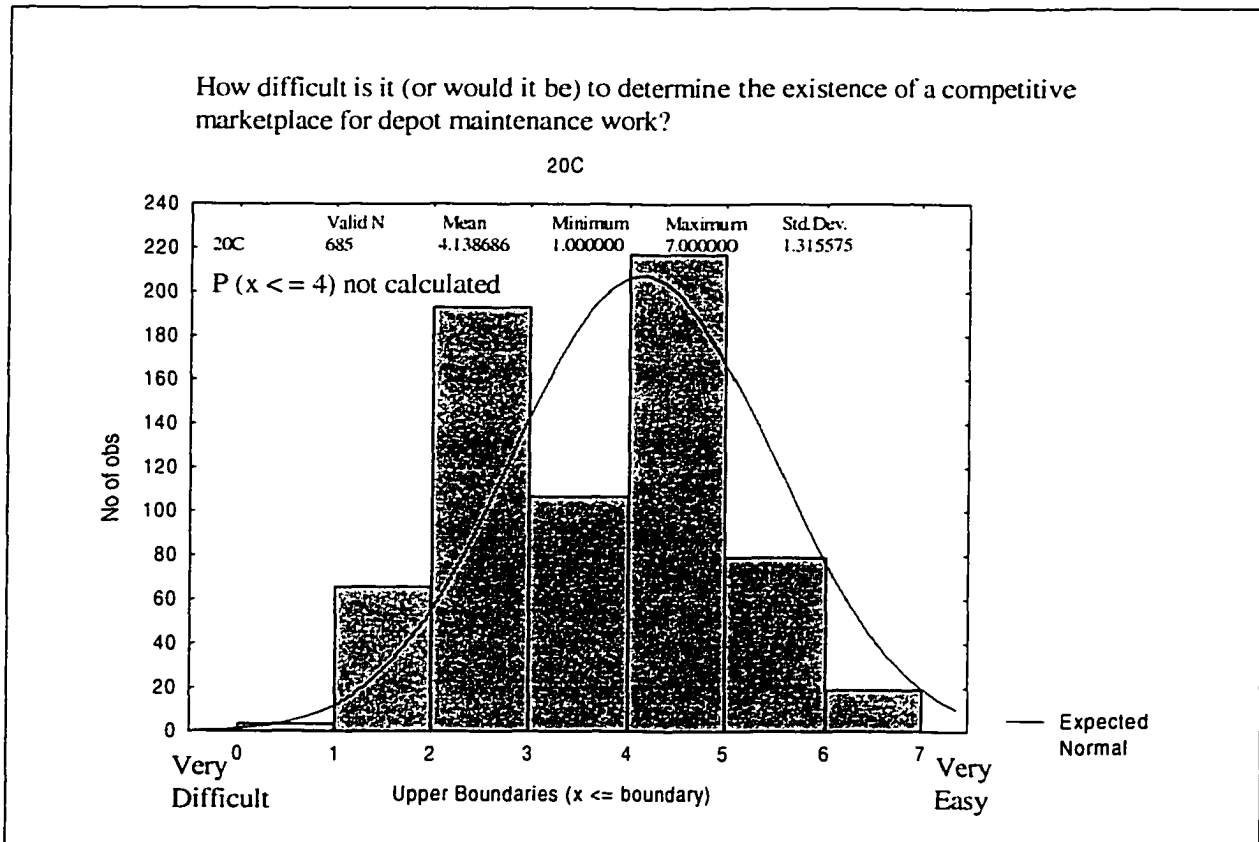
There is more to this analysis: combining items 612 and 594 masks an underlying bimodal response to both of the m—as illustrated in Figure 4-15.

The author created two-by-two contingency tables by dividing the responses from item 612 into those less than 4 and more than 4 and comparing the results to expressed sector preference, experience with public providers, and experience with commercial providers as reflected in the numerically encoded written comments. Table 4-13 illustrates the results for sector preference. The results for experience with public providers was also statistically significant but the results for experience with private providers was not. When contingency tables for item 594 were similarly created, there was a statistically significant

**FIGURE 4-14**  
**HISTOGRAM OF SUM OF ITEMS 612 AND 594**



**FIGURE 4-15**  
**ITEM 594 HISTOGRAM**



relationship between sector preference and the score for item 594. Basically, a preference for the public sector corresponds with a perceived difficulty determining the existence of a competitive marketplace (or creating one), and preference for the private sector corresponds with perceived ease of determining the existence of a competitive marketplace (or creating one). Perhaps these are not surprising results.

**TABLE 4-13**  
**ITEM 612 VS. SECTOR PREFERENCE CONTINGENCY**

Item scores	Observed Frequencies				Item scores	Expected Frequencies			
	Range	Sector Preference				Range	Sector Preference		
		<3	>3	Total			<3	>3	Total
<4	29	15	44	<4	23.5	20.5	44.0		
>4	10	19	29	>4	15.5	13.5	29.0		
Total	39	34	73	Total	39.0	34.0	73.0		

Chi square value: 5.732  
Chi square critical (0.05): 3.84

Summing up these results, it appears that:

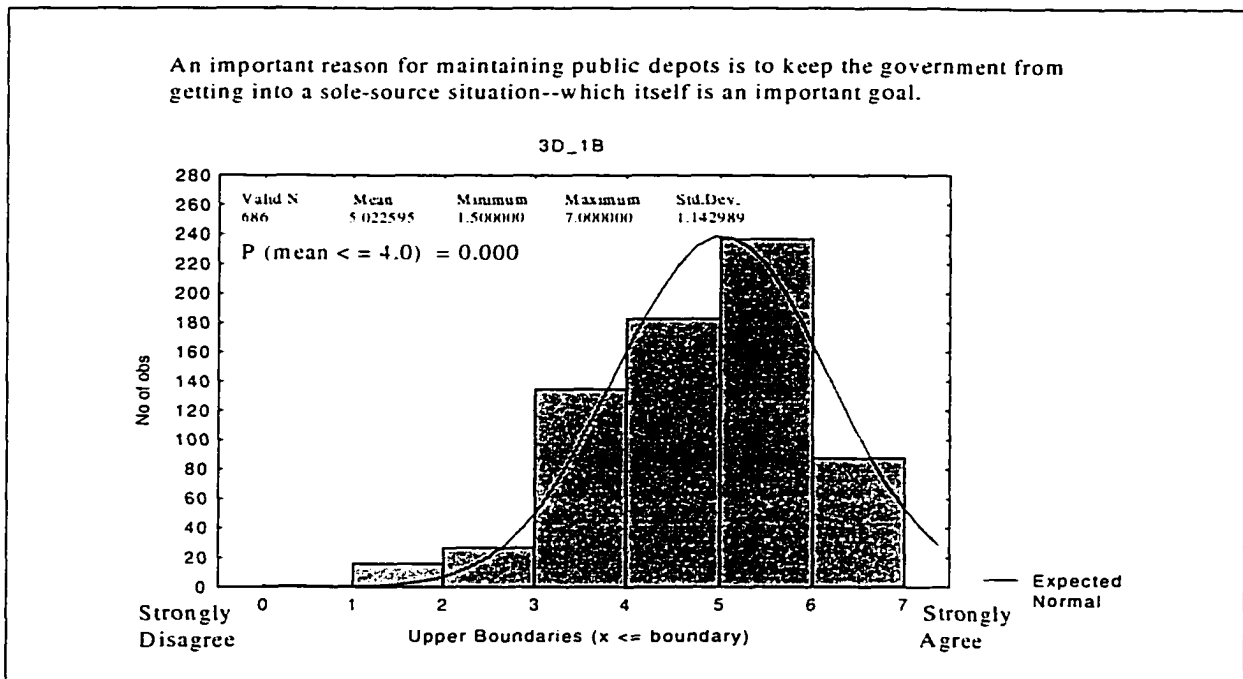
- Perceived difficulty determining the existence of a competitive marketplace for depot maintenance work (item 594) is related to overall sector preference.
- Perceived difficulty creating a competitive marketplace for depot maintenance work is related to both overall sector preference and experience with public providers.

The histogram for items 559 and 624 when linearly combined is at Figure 4-16.

The interpretation of Figure 4-16 is that one of the rationales for government depots is to prevent sole-source situations and that avoiding a sole-source situation is important. The hypothesis—the availability of a competitive marketplace will be perceived as mattering if government is to benefit from commercial capabilities—is partially supported.



**FIGURE 4-16**  
**HISTOGRAM OF SUM OF ITEMS 559 AND 624**



Summary of Results for Construct 2, Imperfect Competition

Table 4-14 integrates the above analysis of hypotheses related to Construct 2.

**TABLE 4-14**  
**CONSTRUCT 2 RESULTS**

Narrative Description		Result	Discussion of Corresponding Items
H02	Depot maintenance workload will be perceived as unique and outside the commercial mainstream.	Indeterminate	Item 477. Responses appeared to depend on respondent's perceived experience with commercial providers, experience with public providers, and overall sector preference.
H03	Availability of more than one source will be perceived as important to the organic versus commercial workload allocation decision.	Supported	The premise of item 478 was accepted. The premise of item 636 was accepted.

**TABLE 4-14**  
**CONSTRUCT 2 RESULTS (CONTINUED)**

Narrative Description		Result	Discussion of Corresponding Items
H04	Existence of proprietary data will be perceived as important to the organic versus commercial workload allocation decision.	Supported	Premise of item 479 was accepted.
H05	Managers of and other persons with an interest in depot maintenance will perceive organic depot maintenance capability to be an internal monopoly.	Supported	The premise of item 480 was accepted.
H06	Managers of and other persons with an interest in depot maintenance will perceive of public versus private competition for depot maintenance as being conducted on a playing field that is not level.	Supported	The premise of item 541 was accepted.
H30	The availability of a competitive marketplace will be perceived as mattering if government is to benefit from commercial capabilities.	Partially Supported	Items 624, 559, 594, 612 loaded on 2 factors.  The role of public depots in preventing a sole source situation was affirmed.  However, perceived difficulty determining the existence of a competitive marketplace or creating a competitive marketplace appears to be related to overall sector preference and experience with public providers.

Overall, four of the six hypotheses related to construct 2, imperfect market, were supported, 1 was partially supported, and 1 was indeterminate.

### Construct 3—Market Failure

#### Related Hypotheses

The concept of market failure had two related hypotheses, H07 and H08, each of which has one related item and one related question ( Table 4-15).

TABLE 4-15  
MARKET FAILURE HYPOTHESES

Hypothesis	Item	Question	Narrative
H07	482	1A	For some workloads there is a lack of private firms willing to do the work.
H08	483	3B	How often would you expect to be able to find private firms who can deliver the quantity of depot maintenance work that is needed without an initial start-up delay?

Histograms for items 482 and 483 are in Figure 4-17 and Figure 4-18, respectively. The researcher interprets Figure 4-17 as indicating a belief that, for some workloads, there is a lack of private firms willing do the work.

FIGURE 4-17  
ITEM 482 HISTOGRAM

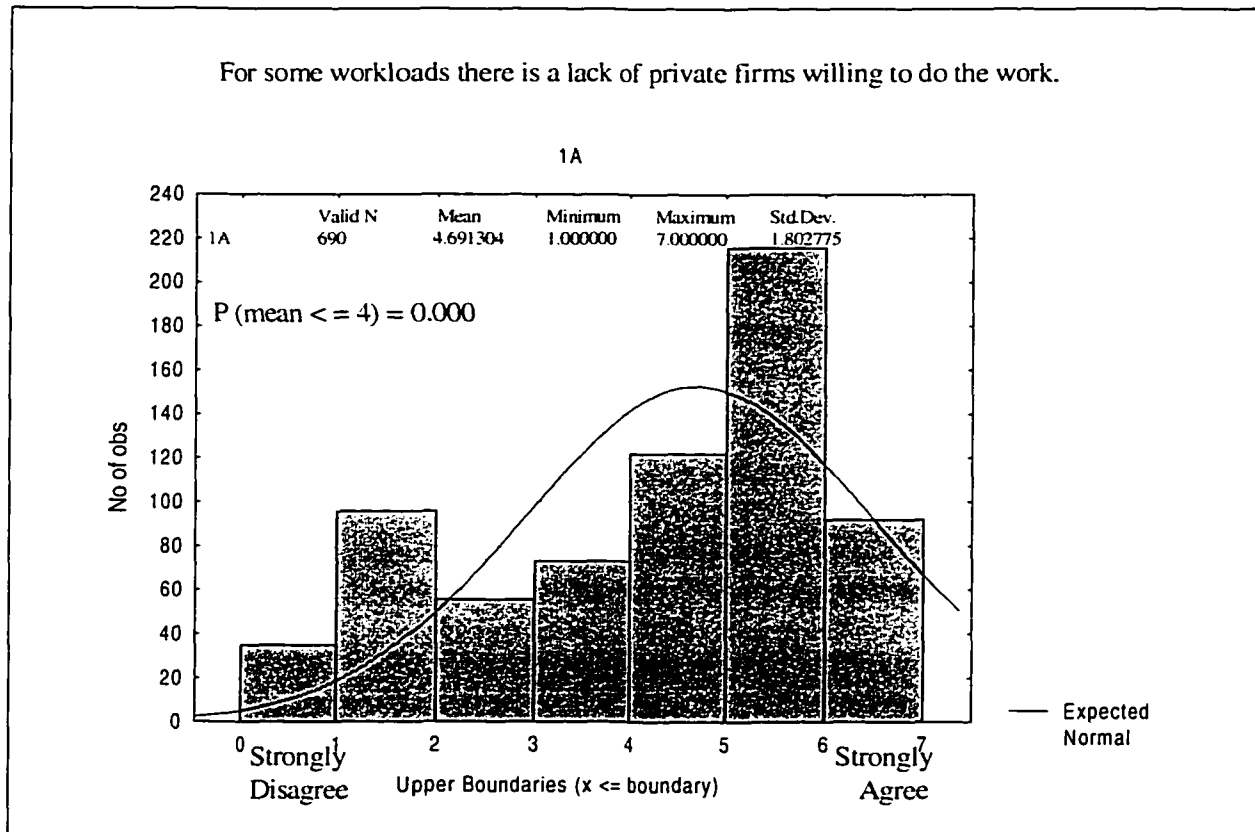
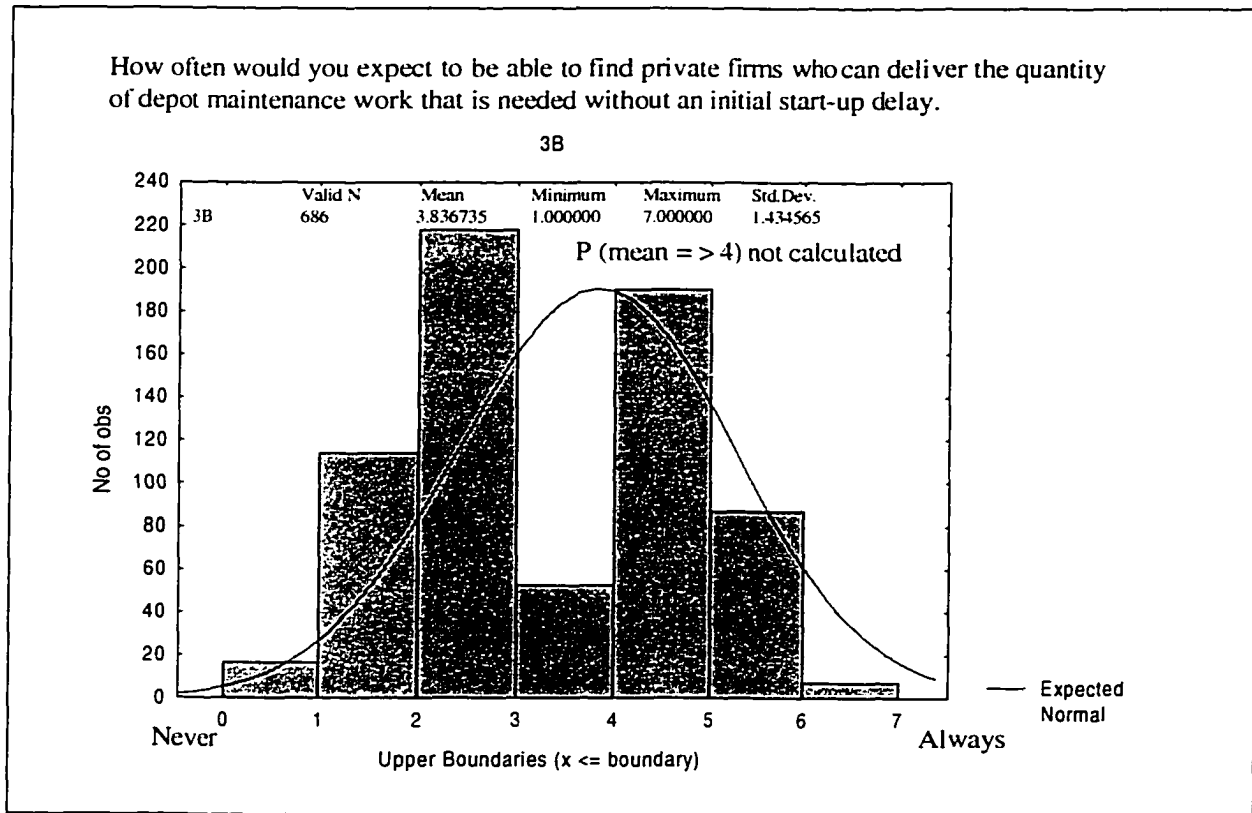


Figure 4-18 is more difficult to interpret because of the evident bimodal nature of the responses. To gain additional insight into the source of this phenomenon, the researcher

plotted the histograms for all six dimensions on which data were collected (function, organizational level, system, maintenance level, sector, and component).

**FIGURE 4-18**  
ITEM 483 HISTOGRAM

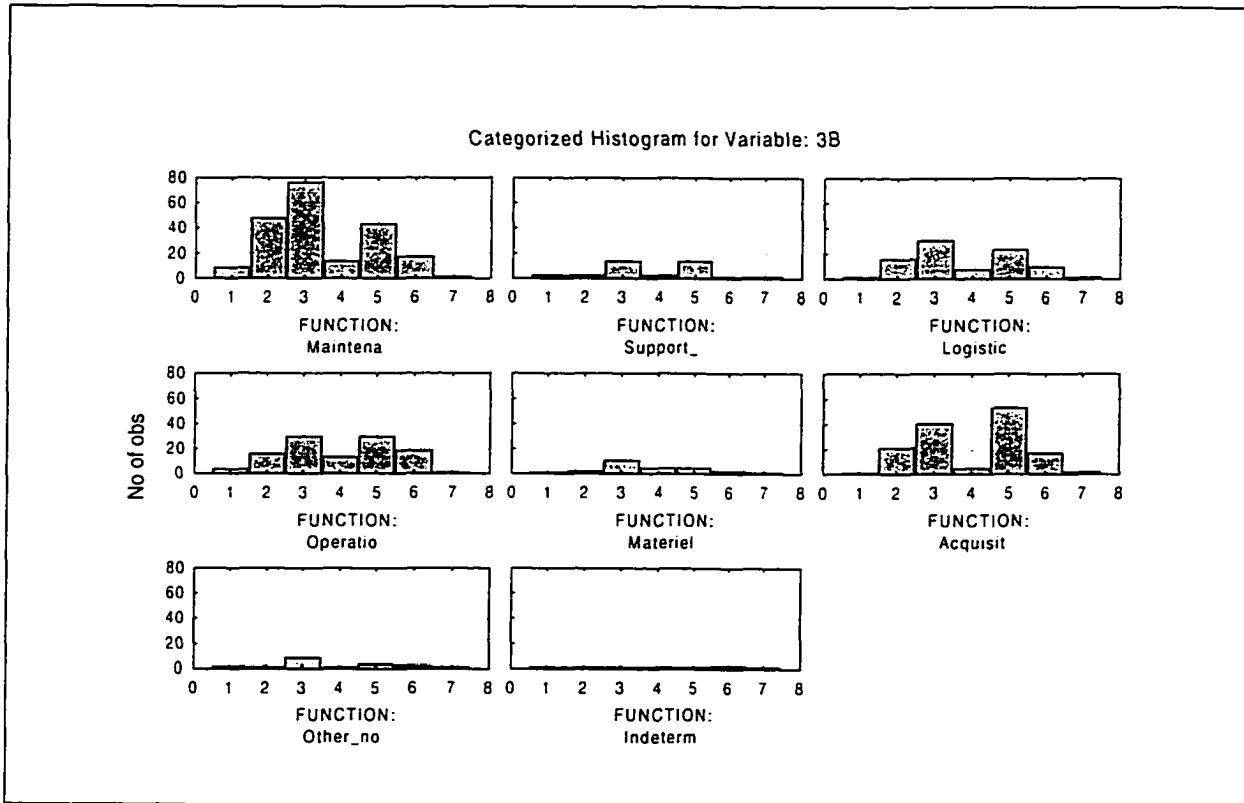


With the exception of the sector dimension—where bimodality did not show up for industry—the bimodal pattern appeared nearly ubiquitous. Figure 4-19 is illustrative.

The author performed contingency table analysis, using encoded narrative comments in a process similar to that described above for Table 4-13. Results indicated that the perceived ability to find private firms who can deliver the quantity of depot maintenance work that is needed without a start-up delay is related to overall sector preference and specific experience with commercial providers. There is also another discernable difference that appears from application of ANOVA to the six dimensions shown in Table 4-16

Although the statistical significance of results in Table 4-16 are probably misleading because normality assumptions are violated (e.g., lack of central tendency), the differences in means among various groups on all of the dimensions are interesting. The Offices of the Secretary of Defense and Joint Chiefs of Staff (OSD/JCS) and the Defense Logistics

**FIGURE 4-19**  
ITEM 483 HISTOGRAMS BY FUNCTION



**TABLE 4-16**  
ITEM 483 ANOVA RESULTS

Item 482, Survey question 3B					
Component		Function		System	
$F(6,625)=4.04; p<0.0006$		$F(7,624)=3.78; p<0.0005$		$F(6,625)=2.75; p<0.0119$	
	Means		Means		Means
OSD/JCS	4.657	Indeterminate	5.333	N/A	4.143
DLA	4.200	Acquisition	4.093	Ship	4.138
Navy	3.933	Operations	3.964	Other	3.969
USMC	3.929	Other_non-support	3.944	Ordnance	3.870
Army	3.727	Materiel Mgt.	3.846	Multiple	3.838
Other	3.682	Logistics Mgt.	3.778	Ground	3.800
Air Force	3.534	Support_general	3.771	Aviation	3.545
		Maintenance	3.428		

**TABLE 4-16**  
**ITEM 483 ANOVA RESULTS (CONTINUED)**

<b>Item 482, Survey question 3B</b>					
<b>Level</b>		<b>Maintenance Level</b>		<b>Sector</b>	
<u>F(2,629)=7.32; p&lt;0.0007</u>		<u>F(3,628)=6.18; p&lt;0.0004</u>		<u>F(1,684)=27.68; p&lt;0.0000</u>	
	Means		Means		Means
<b>OSD/JCS</b>	4.657	<b>N/A</b>	3.980	<b>Industry</b>	4.891
Field	3.733	Field_Maintenance	3.716	DoD	3.761
Component	3.684	HHQ_Management	3.688		
		Depot_Maintenance	2.906		

Underline indicates significance at 0.05 level.

Agency (DLA) share a belief—apparently in common with industry—that firms are available to do depot maintenance without a startup delay. The acquisition community is on the fence. All others appear to anticipate that firms would encounter a startup delay. Given these results, the hypothesis—that there will be a lack of firms for at least some workloads—is supported.

#### Summary of Results for Construct 3, Market Failure

With regard to depot maintenance, there is qualified support that the survey respondents perceived market failure. There is a perception that for some workloads there is a lack of private firms willing to do the work. With regard to the second hypothesis—how often respondents would expect to be able to find private firms that can deliver the quantity of depot maintenance work needed without an initial start-up delay—results were ambiguous. There appear to be differences in perception based on organizational affiliation, prior experience with private sources of depot maintenance, and overall preference for one sector or the other. Results are summarized in Table 4-17.

**TABLE 4-17**  
**CONSTRUCT 3 RESULTS**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H07	For at least some depot maintenance workloads there will be a perceived lack of commercial firms willing to do the work.	Supported	Item 482. Premise of item—that there is a lack of firms willing to do the work—was supported.
H08	For at least some depot maintenance workloads there will be a perceived lack of commercial firms with the scope of capability to respond in the quantity necessary without an initial start-up delay.	Supported with qualifications	Item 483. Perceived ability to provide quantity needed without startup delay depended on who was doing perceiving (their overall sector preference, specific experience with commercial providers, organization, and sector to which they belonged).

### **Construct 4—Economy of Scope and Scale**

#### Related Hypotheses

Chapter 2 identified two hypotheses associated with this construct (Table 4-18).

**TABLE 4-18**  
**CONSTRUCT 4 HYPOTHESES**

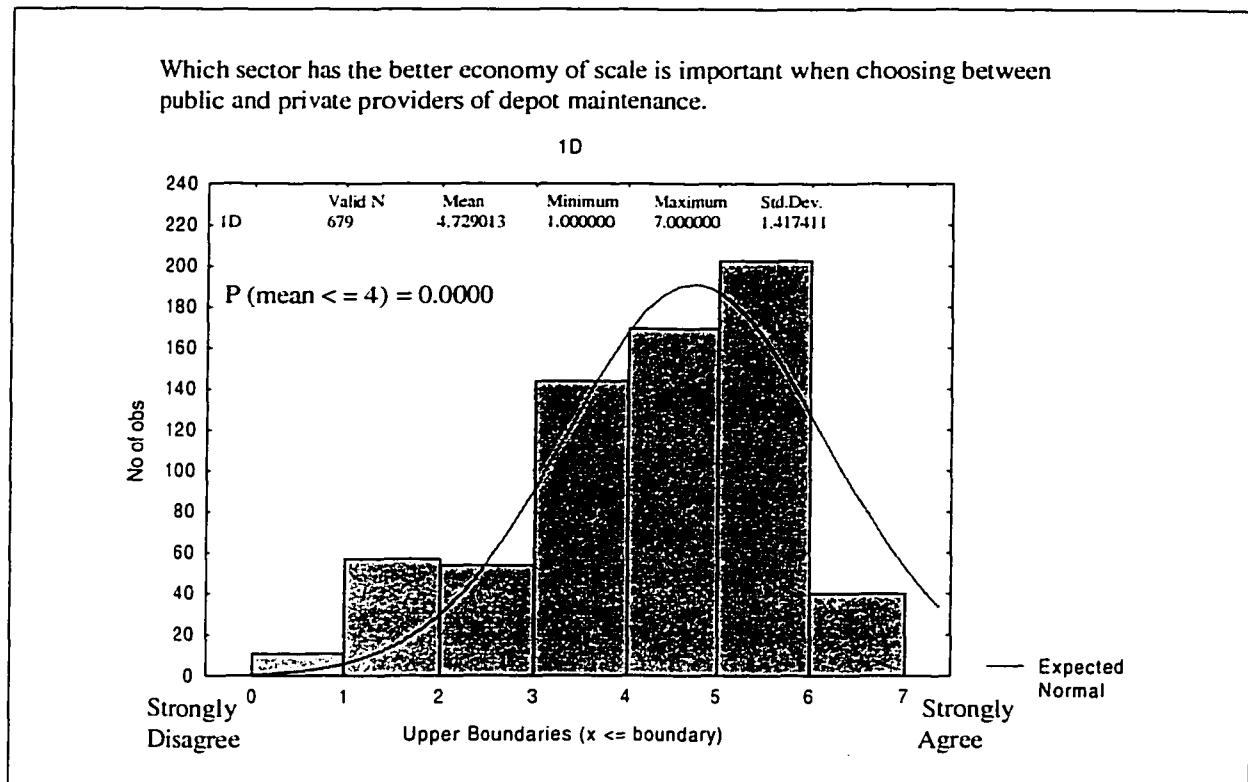
H09	Managers of and other persons with an interest in depot maintenance will perceive ability to achieve economies of scale and or scope as important to the depot maintenance outsourcing decision.
H10	Outsourcing depot maintenance improves depot maintenance economy of scale. (Hypothesis dropped as a result of pilot survey.)

As a result of the pilot-test, all three items associated with hypothesis 10 were dropped, necessitating dropping the hypothesis as well. Accordingly, hypothesis H09 is the only hypothesis associated with the economy of scope and scale construct.

*H09 Importance of economy of scope and scale.*

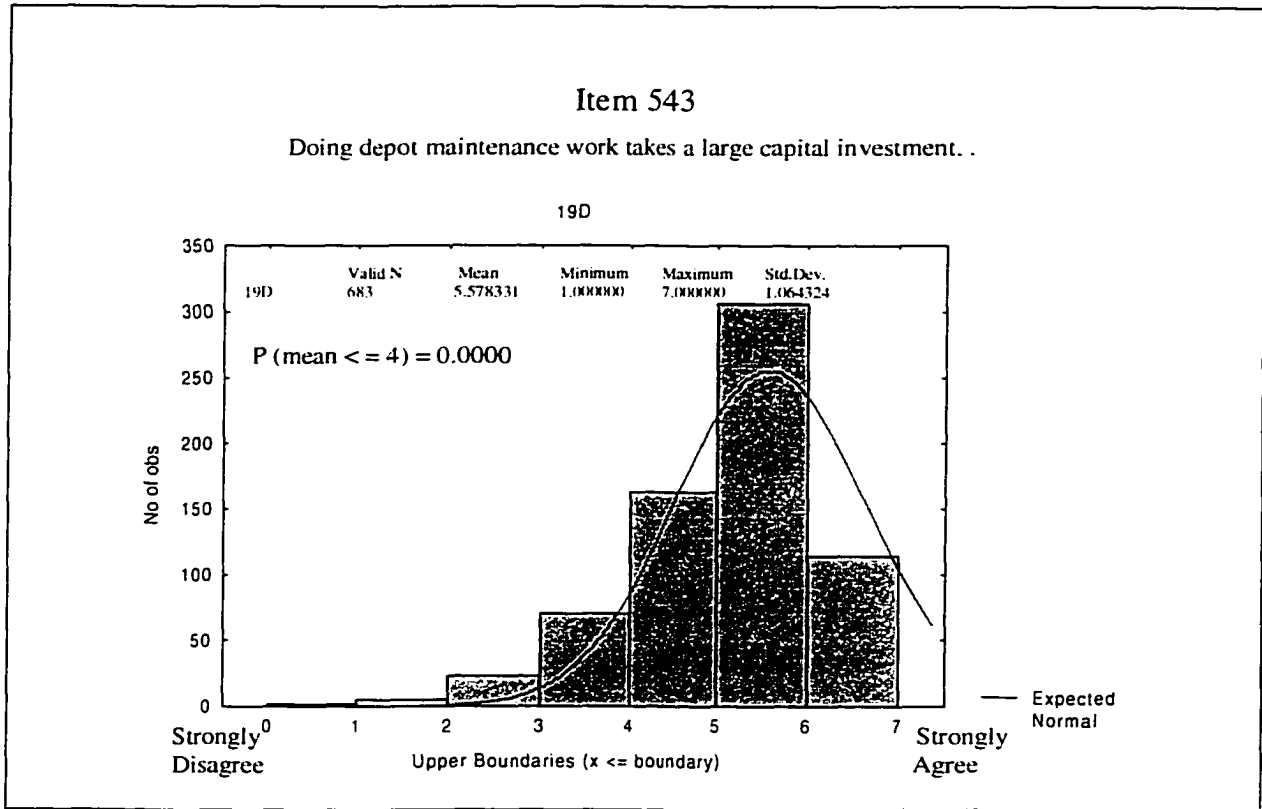
Hypothesis H09 has two associated items, 484 (question 1D) and 543 (item 19D). Although the two items are correlated, the coefficient of correlation is small ( $r = 0.117$ ,  $p = 0.0$ ). Hence, they will be examined independently. Histograms of the results for these two items are at Figure 4-20 and Figure 4-21.

**FIGURE 4-20**  
ITEM 484 HISTOGRAM





**FIGURE 4-21**  
**ITEM 543 HISTOGRAM**



**Summary of Results for Construct 4, Economy of Scope and Scale**

As is evident from the histograms, respondents held perceptions consistent with the statements associated with both items. Since hypothesis H09 is supported, construct 4 is also supported as relevant to the choice between sectors. Results are summarized in Table 4-19.

**TABLE 4-19**  
**CONSTRUCT 4 RESULTS**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H09	Managers of and other persons with an interest in depot maintenance will perceive ability to achieve economies of scale and or scope as important to the depot maintenance outsourcing decision.	Supported	Item 484. Premise—which sector has better economy of scale is important to public-private choice—was supported.  Item 643. Premise—depot maintenance takes large capital investment—was supported.
H10	Outsourcing depot maintenance improves depot maintenance economy of scale.	Hypothesis dropped after pilot-test.	—

### **Construct 5—Transaction Cost Economics**

The transaction cost economics (TCE) construct carries both confirming and disconfirming hypotheses. As described in Chapter 2, if support for the confirming hypotheses is found, then that would indicate that respondents held beliefs consistent with TCE. Support for the disconfirming hypotheses would indicate the opposite.

#### **Confirming Hypotheses**

There are seven confirming hypotheses (Table 4-20). In the text below, we will examine each hypothesis in turn.

**TABLE 4-20**  
**TCE CONFIRMING HYPOTHESES**

H11	Managers of and other persons with an interest in depot maintenance will perceive tight linkage among stages in the depot maintenance repair process as important to deciding between organic and commercial sources of repair.
H12	Managers of and other persons with an interest in depot maintenance will perceive specificity of production equipment as important to deciding between organic and commercial sources of repair.
H13	Managers of and other persons with an interest in depot maintenance will perceive the difficulty of stating all contingencies in advance as important to deciding between organic and commercial sources of repair.

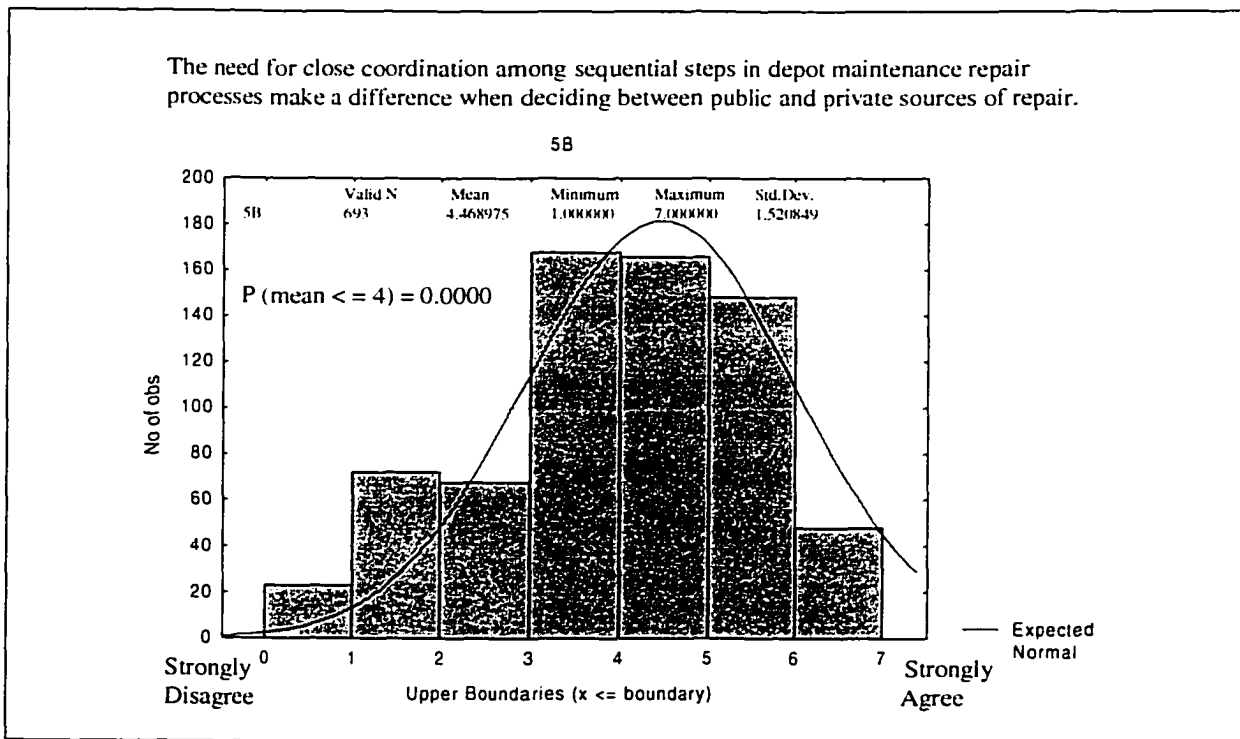
**TABLE 4-20**  
TCE CONFIRMING HYPOTHESES (CONTINUED)

H14	Managers of and other persons with an interest in depot maintenance will perceive the need to monitor shirking as important to deciding between organic and commercial sources of repair.
H15	Managers and others with an interest in depot maintenance will perceive increased risk if crucial contingencies are left to the market.
H16	Managers of and others with an interest in depot maintenance will perceive the combination of low task frequency and high uncertainty as leading to high transaction costs if depot maintenance is outsourced.
H17	The choice between public and commercial providers of depot maintenance will be perceived to depend on the total cost where total cost is the sum of production cost and transaction costs.

*H11 Linkage among stages in the depot maintenance repair process*

Hypothesis H11 has one item, 485 (question 5B), associated with it. The histogram for item 485 is at Figure 4-22. Results indicate that respondents hold beliefs consistent with the statement for item 485, and hypothesis H11 is supported.

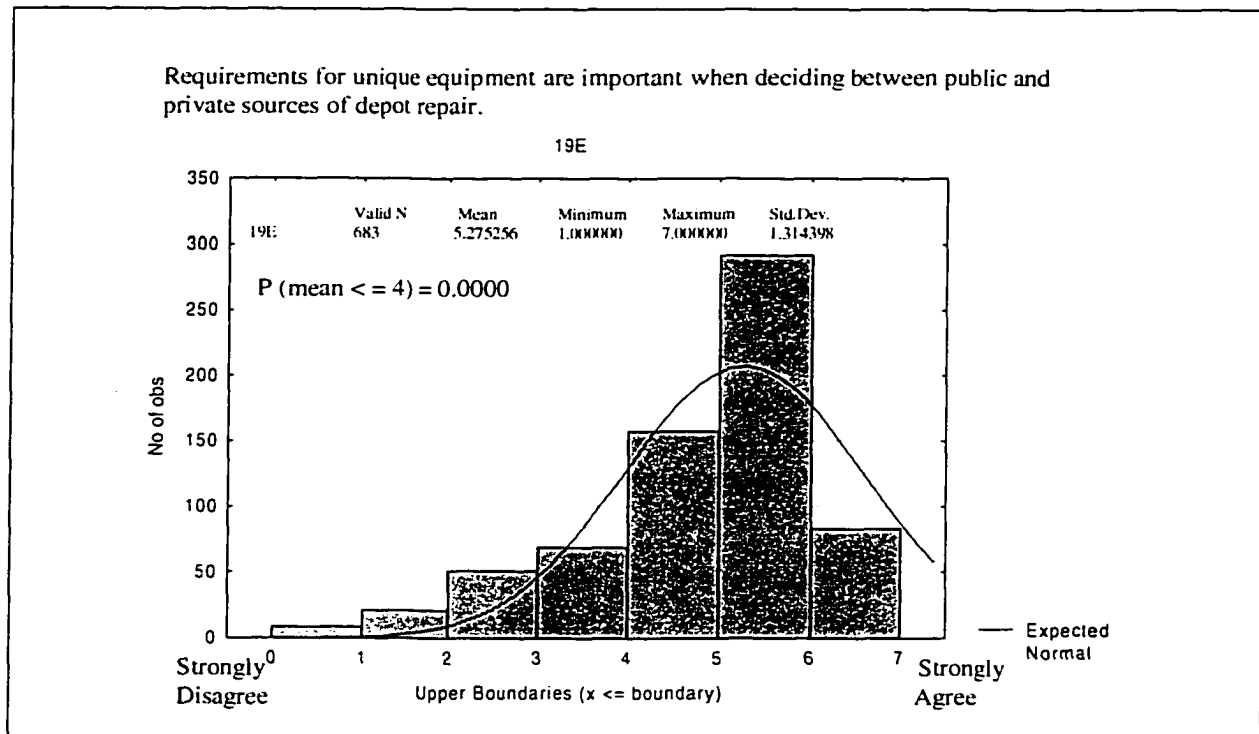
**FIGURE 4-22**  
ITEM 485 HISTOGRAM



### *H12 Specificity of production equipment*

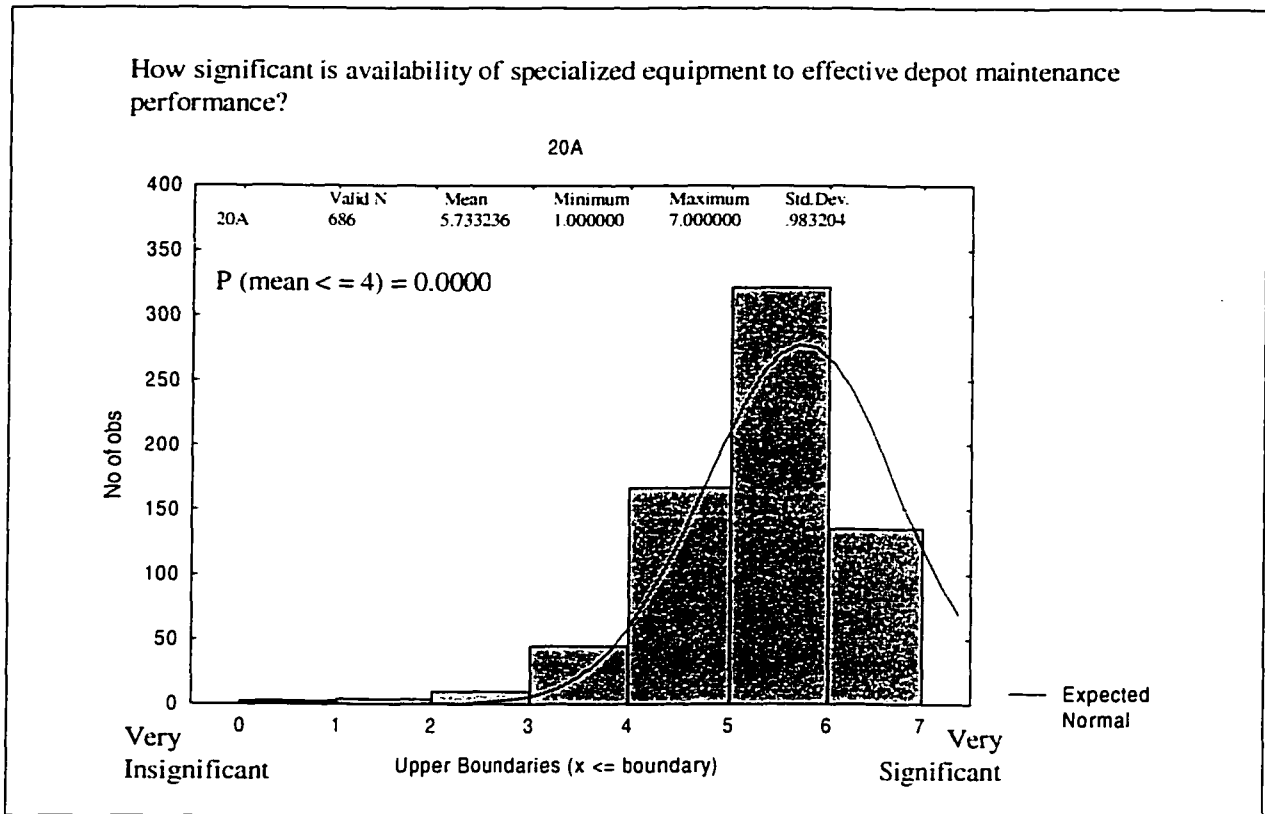
Hypothesis H12 is associated with two items: 544 (question 19E) and 604 (question 20A). The author regressed the responses to question 19E against question 20A and found a correlation coefficient of 0.34 ( $p = 0.0$ ). Although correlation is present it is modest, and the author treated the two items independently rather than summing them and treating them as one item. Histograms for items 544 and 604 are in Figure 4-23 and Figure 4-24.

**FIGURE 4-23**  
ITEM 544 HISTOGRAM



The results for item 544 indicate that the survey respondents believe that requirements for unique equipment are important when deciding between public and private sources of depot repair. The results for item 604 indicate that availability of specialized equipment is important to effective depot maintenance performance. Both support the premise of the hypothesis: managers of and other persons with an interest in depot maintenance will perceive specificity of production equipment as important to deciding between organic and commercial sources of repair.

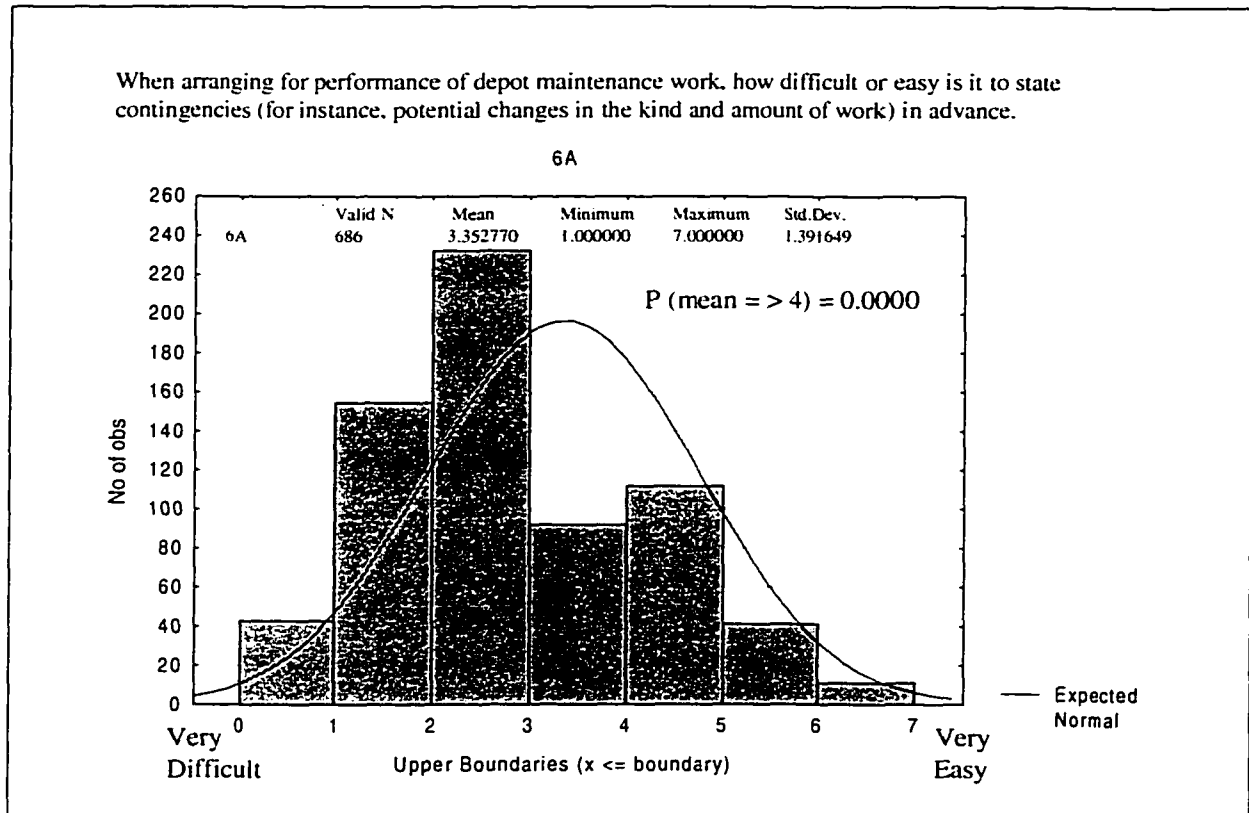
**FIGURE 4-24**  
ITEM 604 HISTOGRAM



*H13 Difficulty stating all contingencies in advance*

Hypothesis H13 has one associated item, 487 (question 6A). The histogram is at Figure 4-25. The results indicate that survey participants do view it as difficult to state contingencies in advance when arranging for performance of depot maintenance work. Thus hypothesis H13 is supported.

**FIGURE 4-25**  
ITEM 487 HISTOGRAM

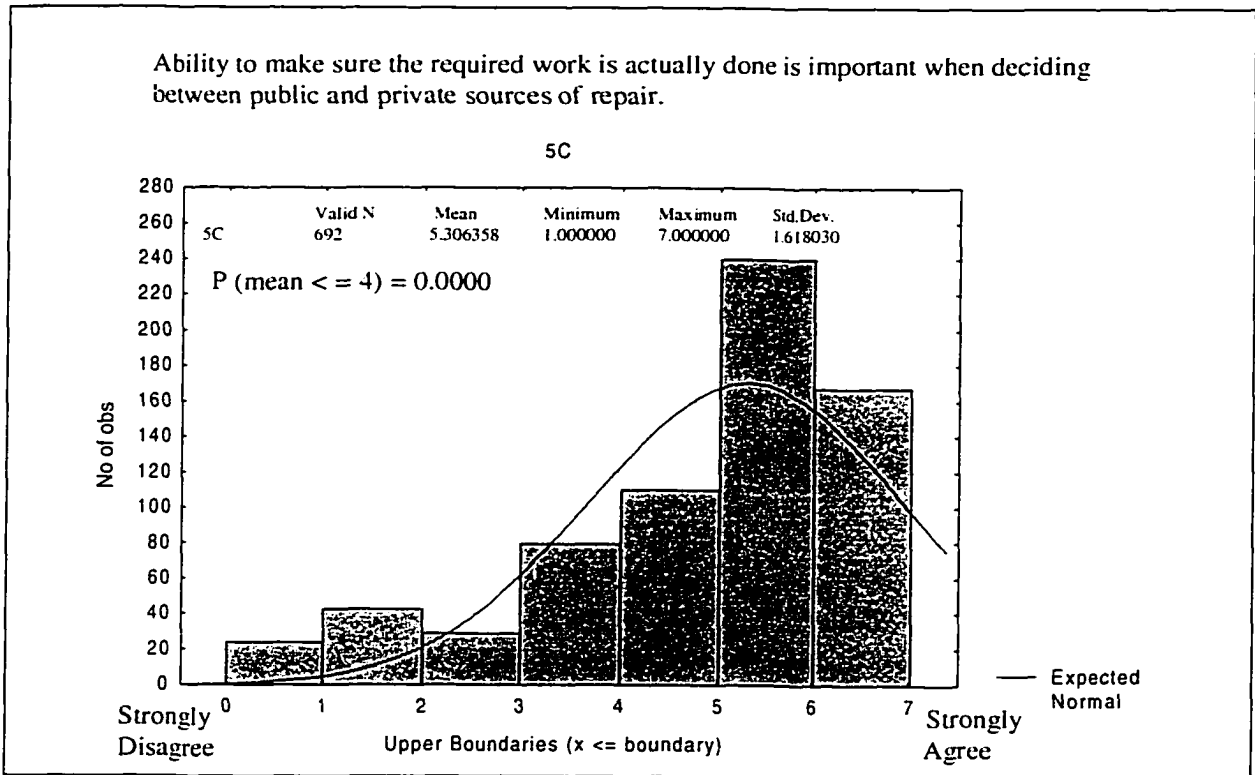


#### *H14 Need to monitor shirking*

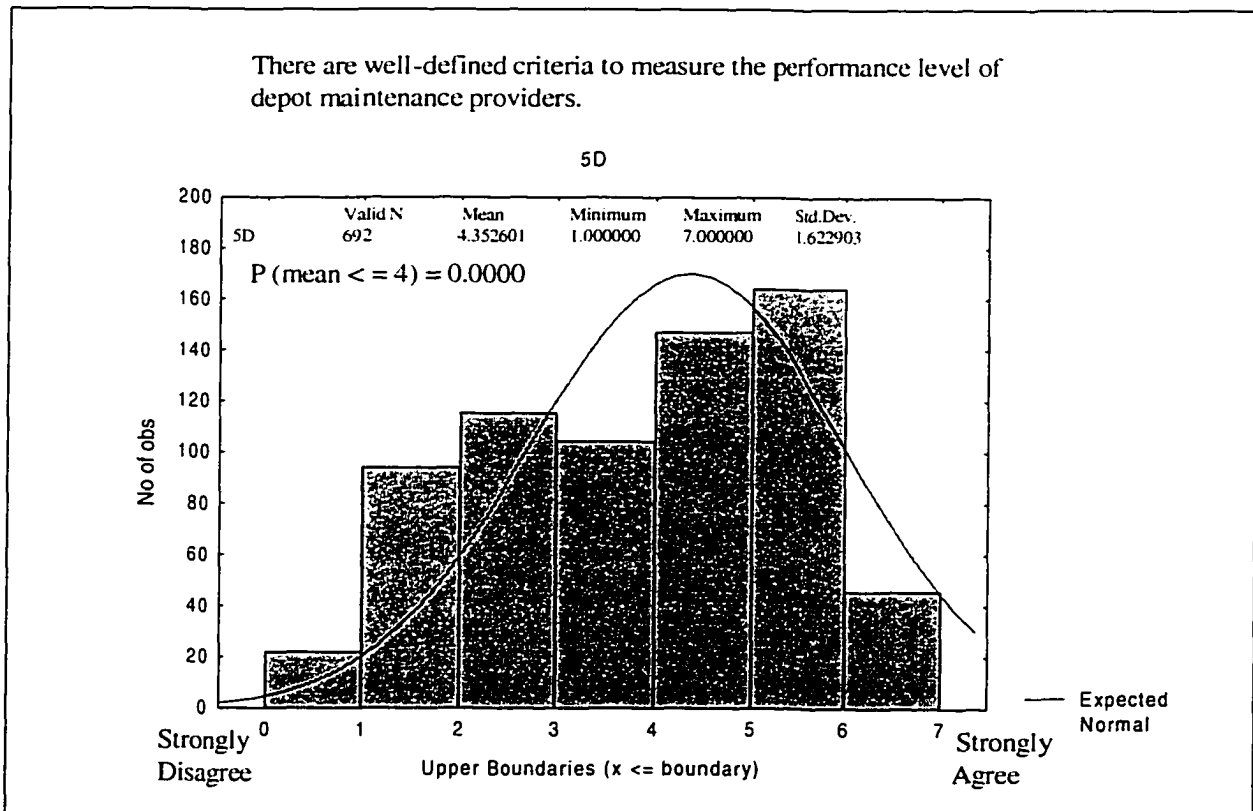
This hypothesis has two associated items, 488 (question 5C) and 586 (question 5D). Because the items are not correlated ( $r = 0.00$ ,  $p = 0.49$ ), they will be examined independently. Histograms are at Figure 4-26 and Figure 4-27, respectively.

The results in Figure 4-26 indicate that respondents believe it is important to be able to make sure the required work is actually done when deciding between public and private sources of repair. The results in Figure 4-27 indicate that they also believe criteria are available for doing so. These results thus support the hypothesis "Managers of and other persons with an interest in depot maintenance will perceive the need to monitor shirking as important to deciding between organic and commercial sources of repair."

**FIGURE 4-26**  
ITEM 488 HISTOGRAM



**FIGURE 4-27**  
ITEM 586 HISTOGRAM



*H15 Risk if crucial contingencies are left to the market*

Hypothesis H15 comprises three items: 489 (question 19F), 547 (question 5E), and 587 (question 5F). Factor analysis indicated a single factor. Two of the items (489 and 547) have loadings greater than 0.7, and one (587) does not (Table 4-21). This is not surprising, since items 489 and 547 amount to the same question in different forms; both relate to the potential for increased risk if depot maintenance is outsourced.

**TABLE 4-21**  
**H15 FACTOR LOADINGS**

<b>Factor Loadings (Unrotated)</b>		
Extraction: Principal component		
<b>Item</b>	<b>Question</b>	<b>Factor 1</b>
547	5E	<u>0.877</u>
587	5F	0.462
489	19F	<u>0.869</u>
Expl. Var		1.739
Prp. Totl		0.580

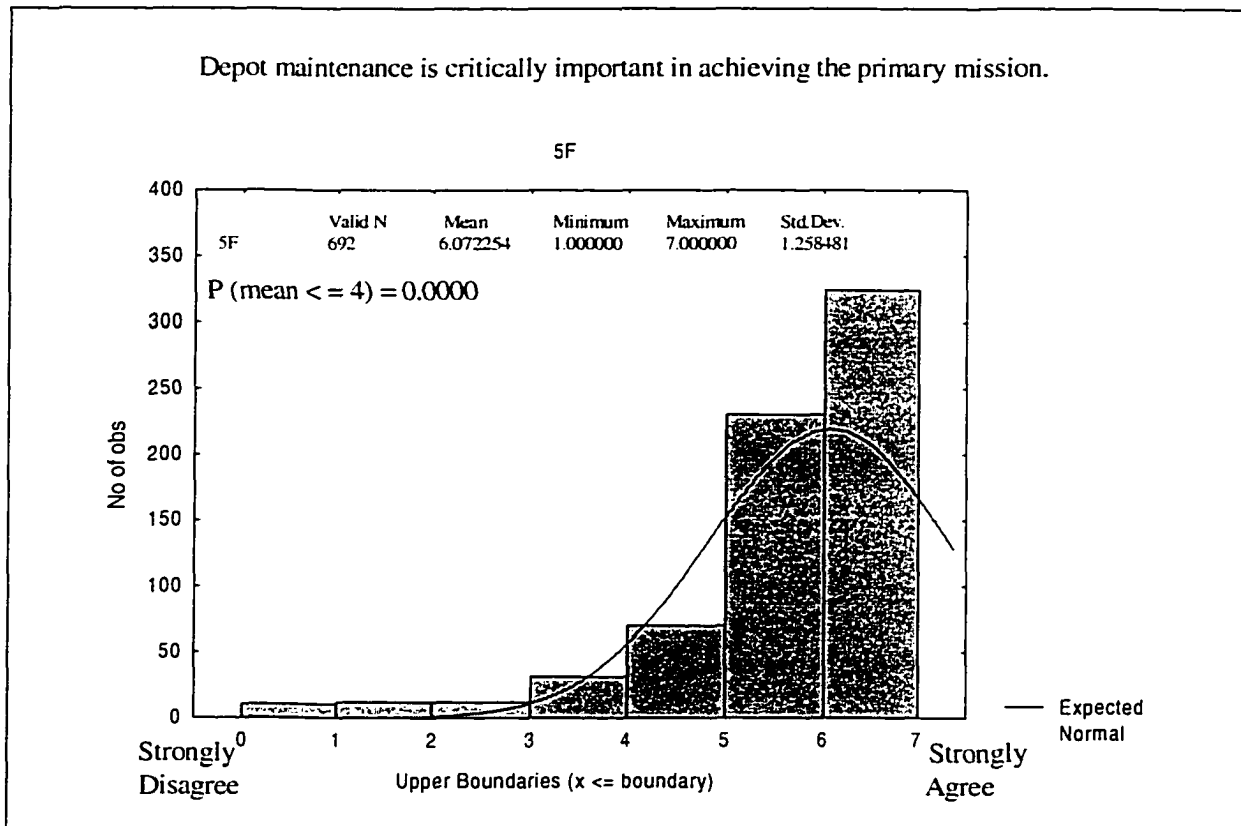
Underlined loadings exceed 0.70.

When confirmatory factor analysis was performed on items 489 and 547 both items loaded significantly on one factor. Since there is only one factor, discriminate validity is not an issue. For purposes of performing a t test, the author added the responses for items 489 and 547 together and then divided by 2 so that the results remained in the range of 1 to 7.

Because of the weak loading for item 587 it was treated separately. Here for purposes of more logical presentation we will consider it first. The results in Figure 4-28 would seem to leave little doubt that the survey respondents consider depot maintenance important to DoD's mission.



FIGURE 4-28  
ITEM 587 HISTOGRAM

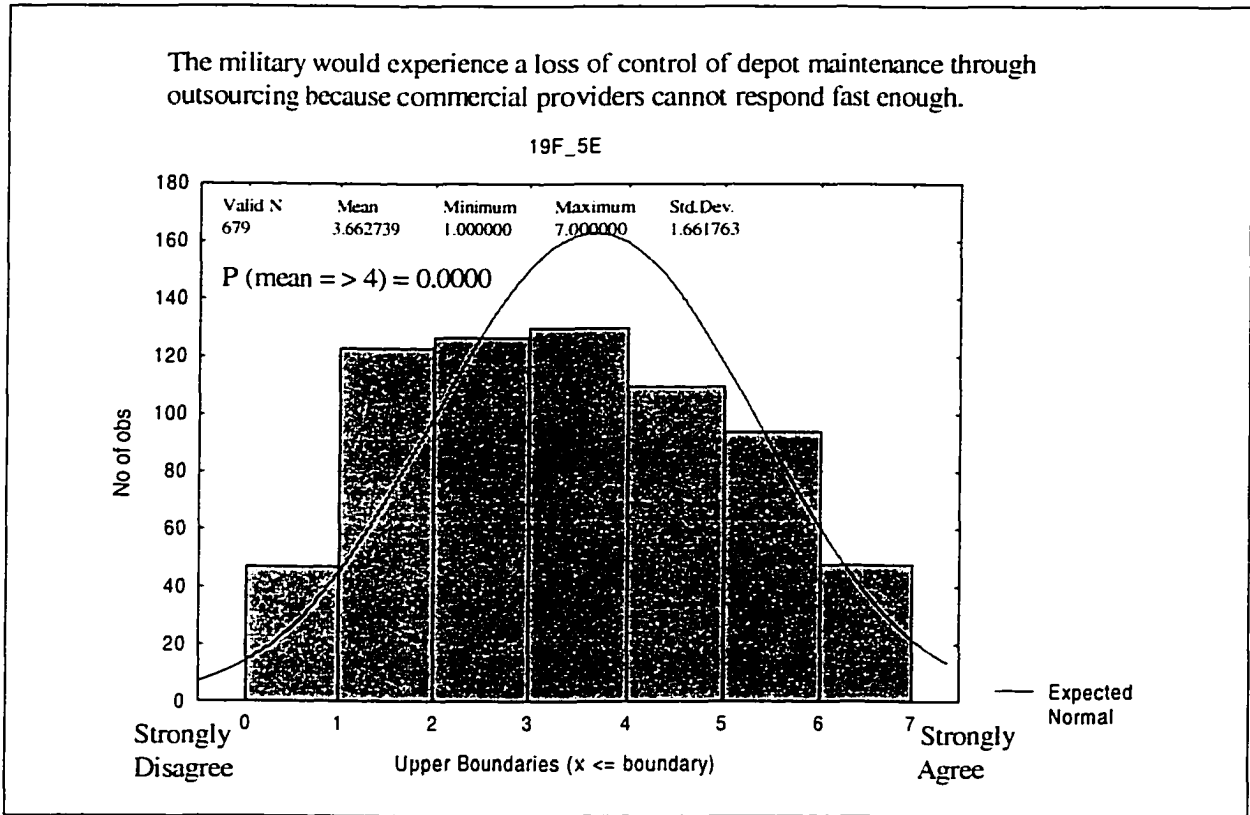


Interestingly, the results in Figure 4-29 do not indicate consensus that outsourcing of depot maintenance would increase risk (in this figure, a mean score greater than 4 would indicate agreement with such a proposition).

As the ANOVA results indicate in Table 4-22 (where all dimensions show significant differences), there are different opinions on the subject. To understand which elements within each dimension are involved, the author performed post hoc analysis using the facilities within Statistica that are provided for this purpose.

A number of post hoc tests are available. For both the present analysis and subsequent post hoc analysis the author used the Tukey Honest Significant Difference (HSD) test, because it is generally regarded as conservative (StatSoft 1999). Further, since the number of cases for elements within dimensions are not equal, the author used the Tukey HSD for uneven N—the Spjotvoll/Toline test.

**FIGURE 4-29**  
HISTOGRAM OF SUM OF ITEMS 489 AND 547



**TABLE 4-22**  
ANOVA FOR ITEMS 489 AND 547

Items 489 and 547, Survey questions 19F and 5E					
Component		Function		System	
$F(6,620)=4.16; p<0.0004$		$F(7,619)=8.47; p<0.0000$		$F(6,620)=2.42; p<0.0253$	
	Means		Means		Means
Army	4.043	Maintenance	4.237	Ordnance	4.289
Air Force	3.970	Logistics	4.142	Aviation	3.893
Other	3.619	Materiel Mgt.	4.135	Ground	3.828
USMC	3.571	Operations	3.634	Multiple	3.724
Navy	3.568	Support_other	3.456	Other	3.672
OSD/JCS	2.900	Other_non-support	3.167	Ship	3.517
DLA	2.850	Acquisition	3.066	N/A	3.103
		Indeterminate	3.000		

TABLE 4-22  
ANOVA FOR ITEMS 489 AND 547 (CONTINUED)

Items 489 and 547, Survey questions 19F and 5E					
Level		Maintenance Level		Sector	
<u>F(2,624)=5.71; p&lt;0.0035</u>		<u>F(3,623)=18.88; p&lt;0.0000</u>		<u>F(1,677)=63.82; p&lt;0.0000</u>	
	Means		Means		Means
Field	3.841	Depot Maintenance	5.281	DoD	3.793
Component	3.709	HHQ Management	4.344	Industry	1.833
OSD/JCS	2.900	Field Maintenance	3.940		
		N/A	3.329		

Underlined values are significant at 0.05 or better.

In regard to the ANOVA results reported in Table 4-22, the five tables beginning with Table 4-23 display post hoc analysis results for all dimensions except sector (where post hoc analysis is not needed, since there are only two elements within the sector). Here the Tukey HSD results are reported in full. In the interest of some economy of presentation, post hoc analysis later in this chapter and in Chapter 5 provide only summary results.

TABLE 4-23  
POST HOC ANALYSIS: COMPONENT

Unequal N HSD; variable 19F_5E							
Probabilities for Post Hoc Test							
	{1}	{2}	{3}	{4}	{5}	{6}	{7}
Means	3.970	4.043	3.571	3.568	2.900	3.619	2.850
Air Force {1}		0.9997	0.9128	0.3077	0.0728	0.9917	0.6990
Army {2}	0.9997		0.8241	0.1352	<u>0.0425</u>	0.9779	0.6321
USMC {3}	0.9128	0.8241		1.0000	0.5720	1.0000	0.9511
Navy {4}	0.3077	0.1352	1.0000		0.5790	1.0000	0.9523
OSD/JCS {5}	0.0728	<u>0.0425</u>	0.5720	0.5790		0.7663	1.0000
Other {6}	0.9917	0.9779	1.0000	1.0000	0.7663		0.9340
DLA {7}	0.6990	0.6321	0.9511	0.9523	1.0000	0.9340	

Underlined values are significant at 0.05 or better.

**TABLE 4-24**  
**POST HOC ANALYSIS: FUNCTION**

<b>Unequal N HSD; variable 19F_5E</b>								
Probabilities for Post Hoc Tests								
	{1}	{2}	{3}	{4}	{5}	{6}	{7}	{8}
Means	4.237	3.456	4.142	3.634	4.135	3.066	3.167	3.000
Maintenance {1}		0.4314	0.9999	0.0711	1.0000	<u>0.0000</u>	0.4354	0.9778
Support-other {2}	0.4314		0.6043	0.9998	0.7644	0.9689	0.9993	1.0000
Logistics {3}	0.9999	0.6043		0.3689	1.0000	<u>0.0001</u>	0.5610	0.9860
Operations {4}	0.0711	0.9998	0.3689		0.9422	0.1108	0.9859	0.9997
Materiel Mgt. {5}	1.0000	0.7644	1.0000	0.9422		0.2024	0.5709	0.9866
Acquisition {6}	<u>0.0000</u>	0.9689	<u>0.0001</u>	0.1108	0.2024		1.0000	1.0000
Other non-support {7}	0.4354	0.9993	0.5610	0.9859	0.5709	1.0000		1.0000
Indeterminate {8}	0.9778	1.0000	0.9860	0.9997	0.9866	1.0000	1.0000	

Underlined values are significant at 0.05 or better.

**TABLE 4-25**  
**POST HOC ANALYSIS: ORGANIZATIONAL LEVEL**

<b>Unequal N HSD; variable 19F_5E</b>			
Probabilities for Post Hoc Tests			
	{1}	{2}	{3}
Means	3.709	3.841	2.900
Component {1}		0.9028	0.0876
Field {2}	0.9028		<u>0.0376</u>
OSD/JCS {3}	0.0876	<u>0.0376</u>	

Underlined values are significant at 0.05 or better

**TABLE 4-26**  
**POST HOC ANALYSIS: MAINTENANCE LEVEL**

<b>Unequal N HSD; variable 19F_5E</b>				
Probabilities for Post Hoc Tests				
	{1}	{2}	{3}	{4}
Means	4.344	3.329	5.281	3.940
HHQ Management {1}		0.2491	0.3182	0.8821
N/A {2}	0.2491		<u>0.0000</u>	<u>0.0001</u>
Depot Maintenance {3}	0.3182	<u>0.0000</u>		0.0030
Field Maintenance {4}	0.8821	<u>0.0001</u>	0.0030	

Underlined values are significant at 0.05 or better.

**TABLE 4-27**  
**POST HOC ANALYSIS: SYSTEM TYPE**

<b>Unequal N HSD; variable 19F_5E</b>							
Probabilities for Post Hoc Tests							
	{1}	{2}	{3}	{4}	{5}	{6}	{7}
Means	3.893	3.672	3.724	3.828	4.289	3.517	3.103
Aviation {1}		0.9980	0.9778	1.0000	0.9056	0.7231	0.3950
Other {2}	0.9980		1.0000	0.9998	0.7217	0.9997	0.7922
Multiple {3}	0.9778	1.0000		1.0000	0.6361	0.9803	0.6853
Ground {4}	1.0000	0.9998	1.0000		0.9299	0.9904	0.6027
Ordnance {5}	0.9056	0.7217	0.6361	0.9299		0.2534	<u>0.0374</u>
Ship {6}	0.7231	0.9997	0.9803	0.9904	0.2534		0.9382
N/A {7}	0.3950	0.7922	0.6853	0.6027	<u>0.0374</u>	0.9382	

Underlined values are significant at 0.05 or better

The author interprets the above Tukey HSD results to indicate that:

- (Table 4-23) With the exception of a difference between OSD/JCS and the Army, differences among means are not significant. OSD/JCS would be less inclined than the Army to view outsourcing of depot maintenance as increasing risk. Although the Army had a mean greater than 4, indicating a perception that there would be increased risk, this is likely of little import since the mean is barely greater than 4.
- (Table 4-24) Those in acquisition, who do not see increased risk, differ from those in maintenance and logistics management generally, who do.
- (Table 4-25) When considering organizational level, the OSD/JCS perception differs from that of the field—consistent with the results in Table 4-23. However, all means are less than 4, so this is of limited importance.
- (Table 4-26) Those in depot maintenance perceive increased risk from outsourcing. Those involved in field-level maintenance do not perceive increased risk.) When considering system type, the only significant difference is between those uninvolved in system support and those involved in ordnance management.
- (Table 4-27) When considering system type, the only significant difference is between those involved in system support and those involved in ordnance management.

The results of the above post hoc analysis support the hypothesis: managers and others with an interest in depot maintenance will perceive increased risk if crucial contin-

gencies are left to the market. Actually, one can clarify the statement as follows: managers and others *with the most direct interest* perceive increased risk, while others do not.

*H16 Effect of task frequency and uncertainty on transaction costs if outsourced*

Hypothesis H16 has three associated items (Table 4-28).

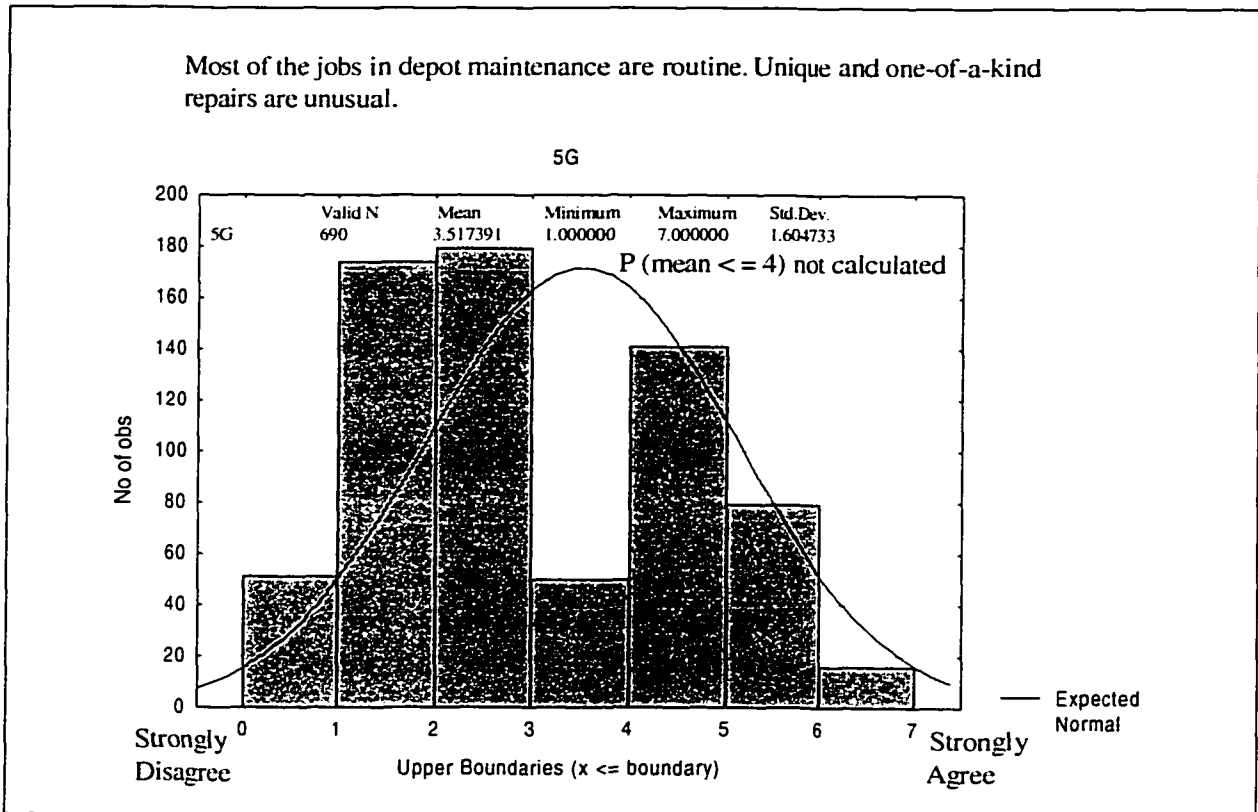
**TABLE 4-28**  
**HYPOTHESIS H16 ITEMS AND QUESTIONS**

<b>Item</b>	<b>Question</b>	<b>Question Narrative</b>
607	4A	How would you rate the costs for monitoring depot maintenance private performance (i.e., performance by a commercial firm) when compared to the costs of production?
638	4B	How would you rate the costs for monitoring depot maintenance public performance (i.e., performance by DoD) when compared to the costs of production?
490	5G	Most of the jobs in depot maintenance are routine. Unique and one-of-a-kind repairs are unusual.

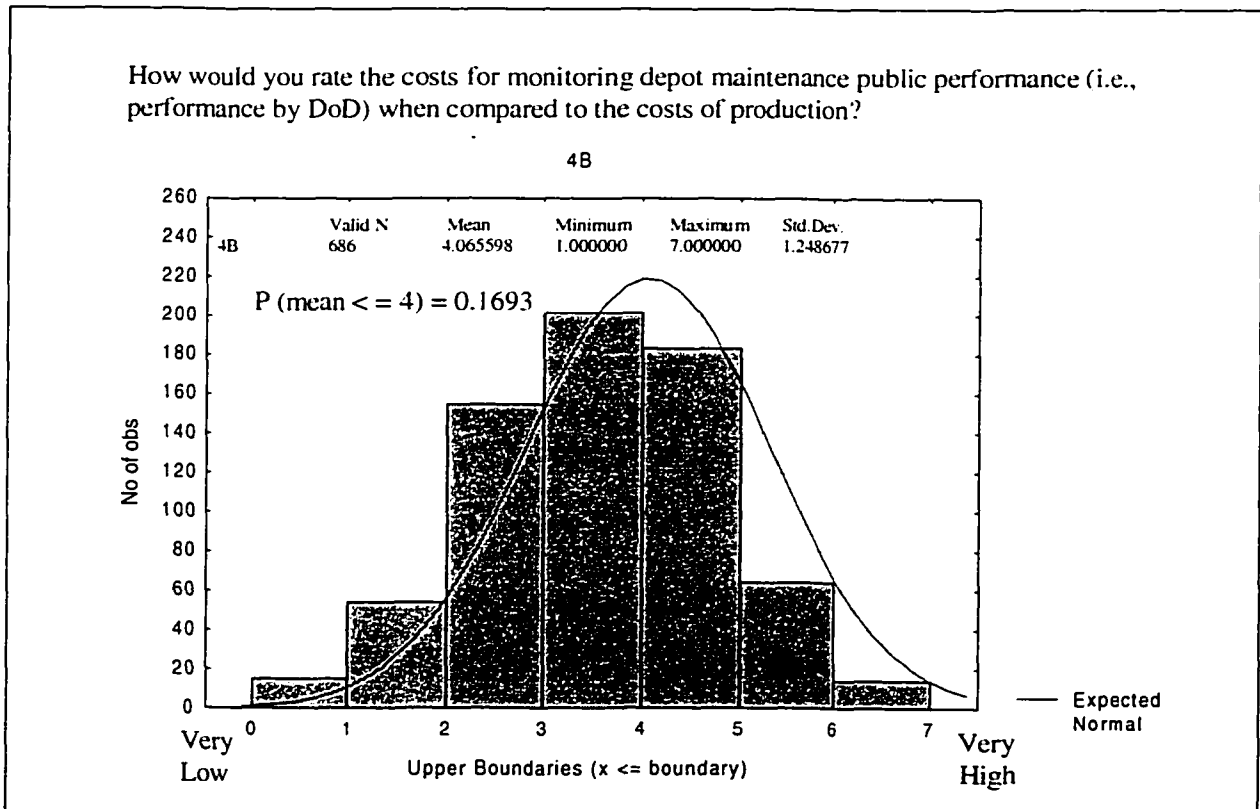
As a first task in analyzing the responses to these three items, the author examined the responses to item 490 (Figure 4-30). The histogram of responses is bimodal, indicating lack of consensus with regard to the uniqueness of depot maintenance jobs.

As a second step, the author examined the responses to items 638 and 607. The results are at Figure 4-31 and Figure 4-32. . In neither case is the probability that the mean is other than 4 significant. Further, when the author compared the two means, the result was anything but significant ( $p = 0.9948$ ). More meaningful insights were available from a factor analysis involving all three items (607, 638, and 490), discussed next.

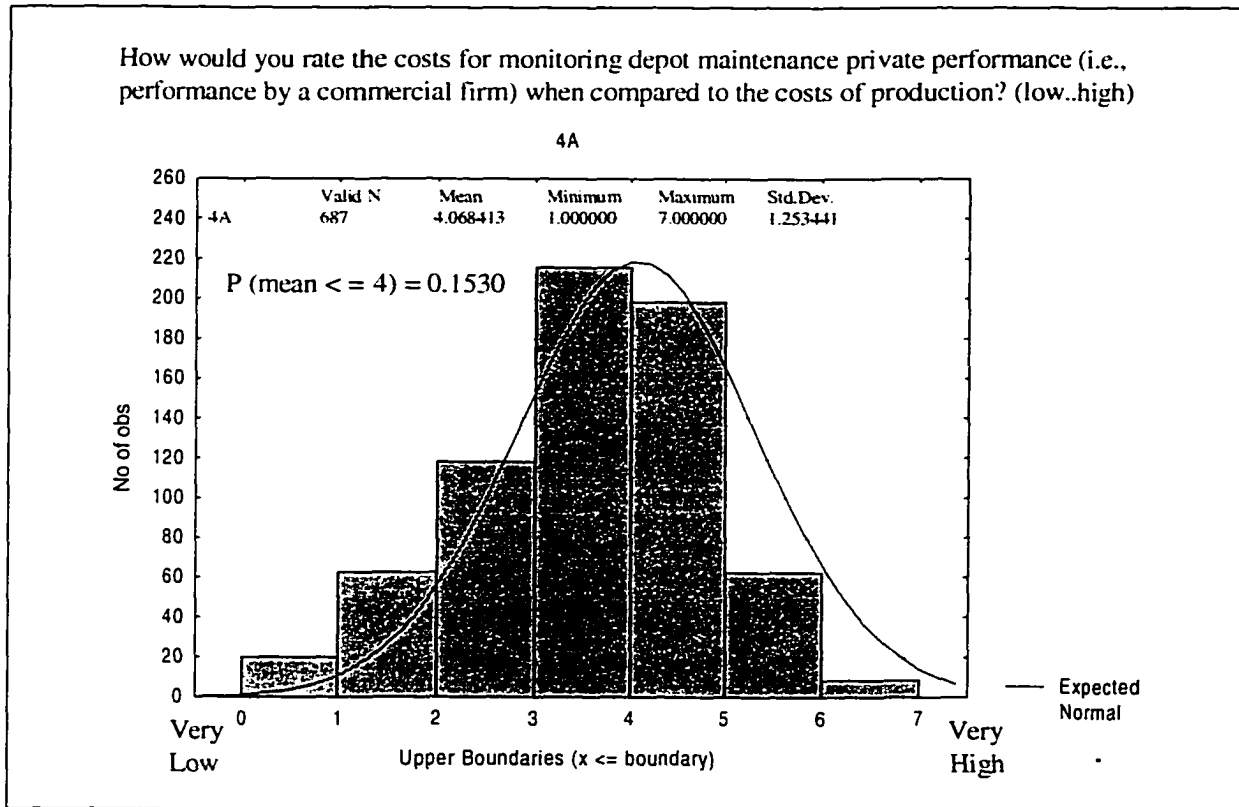
**FIGURE 4-30**  
ITEM 490 HISTOGRAM



**FIGURE 4-31**  
ITEM 638 HISTOGRAM



**FIGURE 4-32**  
ITEM 607 HISTOGRAM



Factor analysis revealed two factors, as shown in Table 4-29. Items 607 and 638 have loadings greater than 0.7. Item 490 nearly reached 0.7 on Factor 1, but with a negative sign. Item 490 loads on factor 2—though well below the 0.7 threshold—with a positive sign. Neither convergent nor discriminate validity holds in this case.

**TABLE 4-29**  
**HYPOTHESES H16 FACTOR LOADINGS**

<b>Factor Loadings (Varimax raw)</b>			
Extraction: Principal components			
<b>Item</b>	<b>Question</b>	<b>Factor 1</b>	<b>Factor 2</b>
607	4A	<u>0.820</u>	0.255
638	4B	0.090	<u>0.883</u>
490	5G	-0.664	0.484
Expl. Var.		1.121	1.079
Prp. Totl		0.374	0.360

Underlined loadings exceed 0.70.



Since items 607 and 638 load with positive signs on different factors and item 490 very nearly reached the 0.7 threshold on factor 1 with item 607, but with a negative sign, there is evidence of two sub-populations with opposing perceptions. ANOVA and contingency analysis results (not included here in the interest of conserving space) indicated that perceptions depend on two considerations:

- The first is whether a respondent was associated with ground equipment. (The system dimension was the only dimension on which there was a statistically significant difference of means.) Those who were so associated were more likely to perceive depot maintenance jobs as routine.
- The second was prior experience with commercial firms. Negative experience correlated with disagreement that jobs are routine. (See Table 4-48)

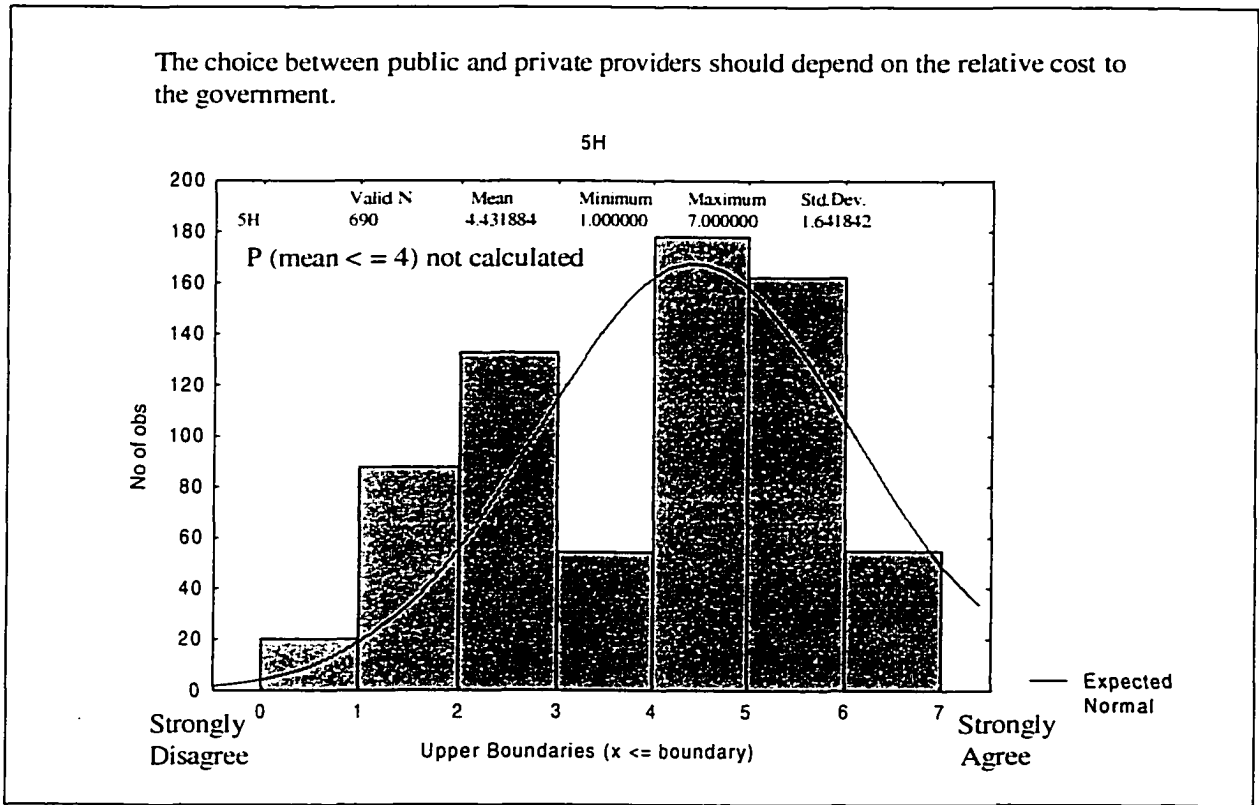
Based on this evidence alone, support for the hypothesis is equivocal. There is evidence of two different sub-populations, most likely related to the complexity of technology with which respondents were familiar. Those who perceive low task frequency and high uncertainty (i.e., depot maintenance tasks are unique) also perceive high transaction costs if depot maintenance is outsourced.

*H17 Choice between public and commercial providers depends on sum of production and transaction costs*

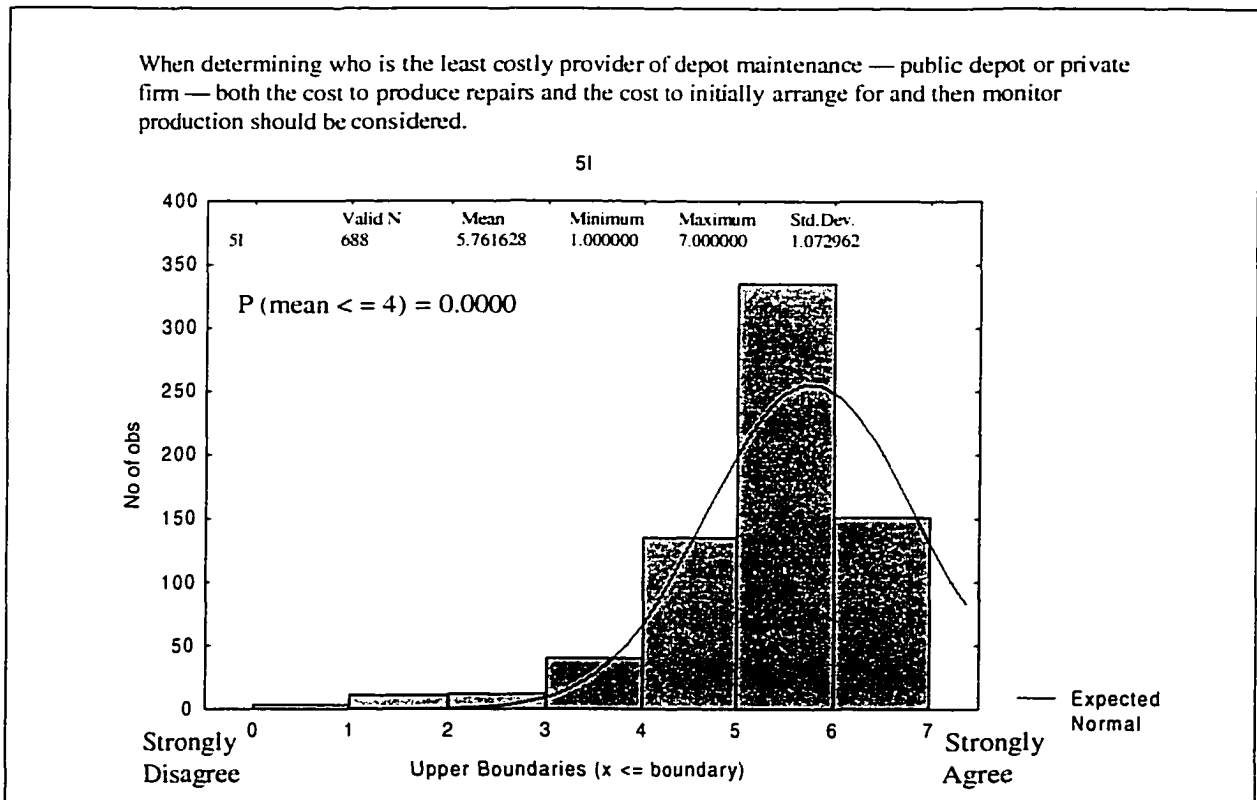
Hypothesis H17 has two items, 503 (question 5H) and 561 (question 5I). Although the two items are correlated, the correlation between them is relatively low ( $r = 0.24$ ,  $p = 0.0$ ). Therefore the author examined them independently. The histogram for item 503 is at Figure 4-33, and for item 561 at Figure 4-34. Interestingly, these two items evoked differing responses. The response to item 561 indicates a consensus that both production and transaction costs should be included when determining cost. Where there is a lack of consensus is whether the choice between public and private providers should depend on cost—that is, cost alone. The author explored this phenomenon through both ANOVA along the six usual dimensions and through contingency analysis using the numerically encoded written comments.

ANOVA and post hoc analysis of the ANOVA results did not reveal any significant differences among means on any of the six dimensions.

**FIGURE 4-33**  
ITEM 503 HISTOGRAM



**FIGURE 4-34**  
ITEM 561 HISTOGRAM



The author then formed two-by-two contingency tables of scores for item 503 and numerically encoded comment scores (using the method described later in this chapter, beginning on page 226). Results were statistically significant when comparing scores for overall sector preference to scores on item 503 (Table 4-30).

**TABLE 4-30**  
**ITEM 503 CONTINGENCY TABLE FOR SECTOR PREFERENCE**

Observed Frequencies					Expected Frequencies				
Item scores	Range	Sector Scores			Item scores	Range	Sector Score		
		<3	>3	Total			<3	>3	Total
	<4	25	7	32		<4	16.6	15.4	32.0
>4	16	31	47	>4	24.4	22.6	47.0		
Total	41	38	79	Total	41.0	38.0	79.0		

Essentially, those whose overall preference is the public sector do not believe the decision should depend on cost: they evidently are willing to pay more to keep the sector they want.

Thus, the hypothesis—that the choice between public and commercial providers of depot maintenance will be perceived to depend on the total cost, where total cost is the sum of production cost and transaction costs—is supported. What is not necessarily supported is a contention that the choice between providers should depend on cost alone.

### Disconfirming Hypotheses

Three hypotheses, if supported, would suggest that survey respondents do not hold views consistent with transaction cost economics. These hypotheses, all of which originated in relational exchange theory, are displayed in Table 4-31.

**TABLE 4-31**  
**TCE DISCONFIRMING HYPOTHESES**

H48	Long-term alliances between users of depot maintenance and commercial firms will be perceived as important to effective depot maintenance support.
H49	Long-term alliances between organic depots and their customers will be perceived as important to effective depot maintenance support.
H50	Building and sustaining trust will be perceived as important to effective long-term depot maintenance alliances.

*H48 Importance of long-term alliances between users of depot maintenance and commercial firms*

Hypothesis H48 is associated with two items, 519 (question 14C) and 599 (question 14D). The correlation between the two is limited ( $r = 0.26$ ,  $p = 0.0$ ) and, for this reason the author considered the two items independently. Histograms are at Figure 4-35 and Figure 4-36.

**FIGURE 4-35**  
**ITEM 519 HISTOGRAM**

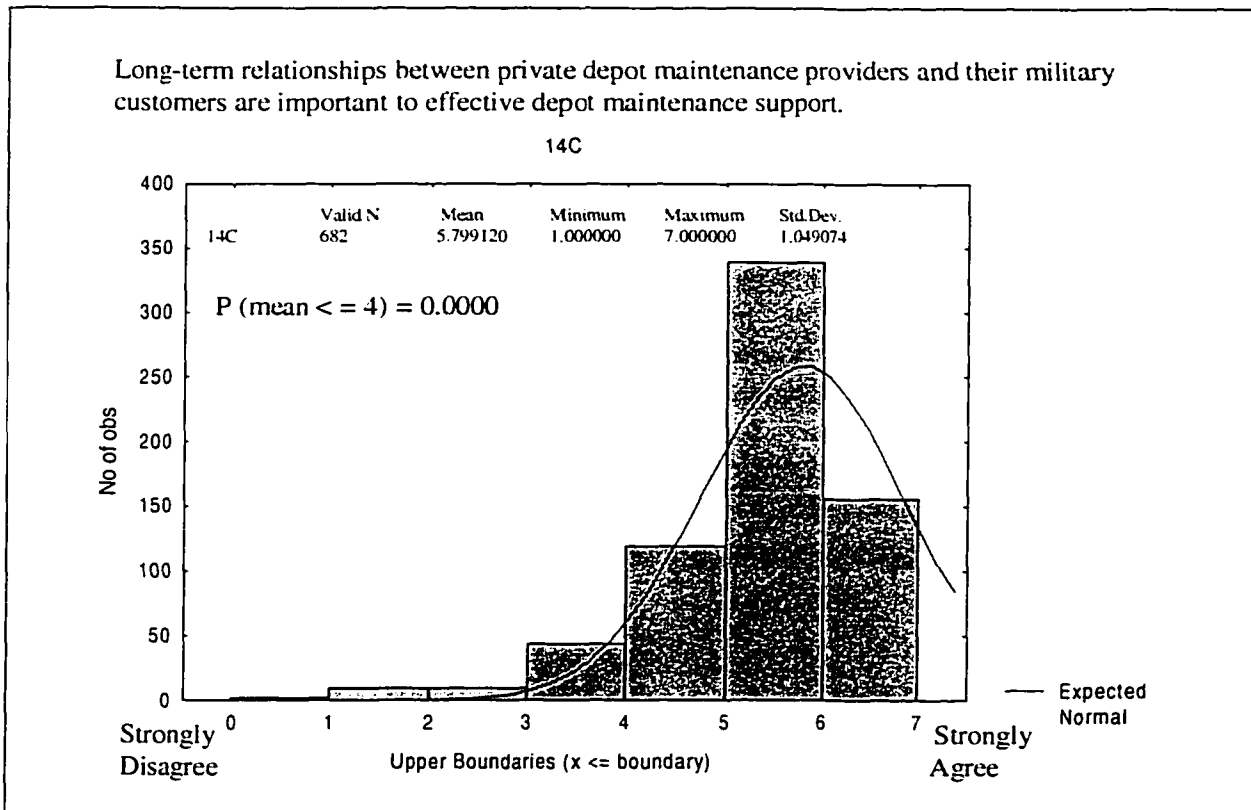
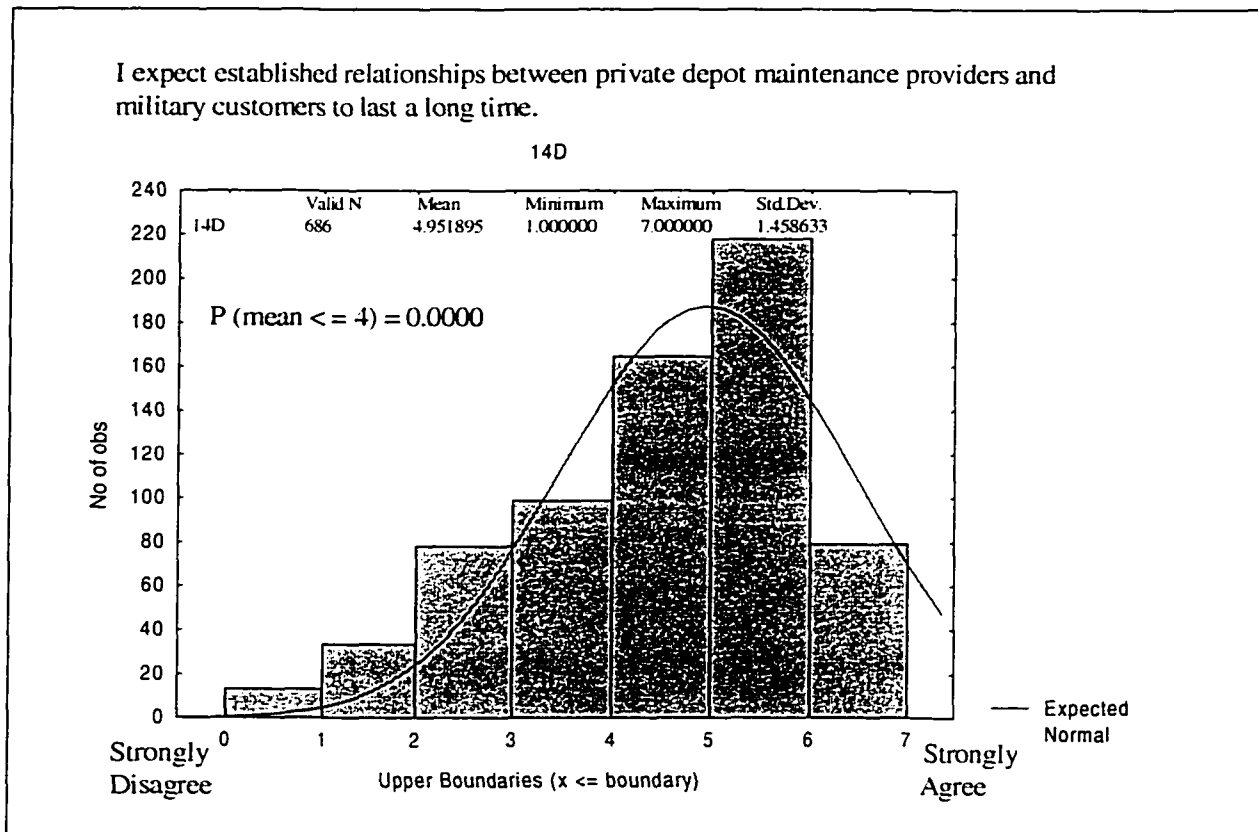


FIGURE 4-36  
ITEM 599 HISTOGRAM

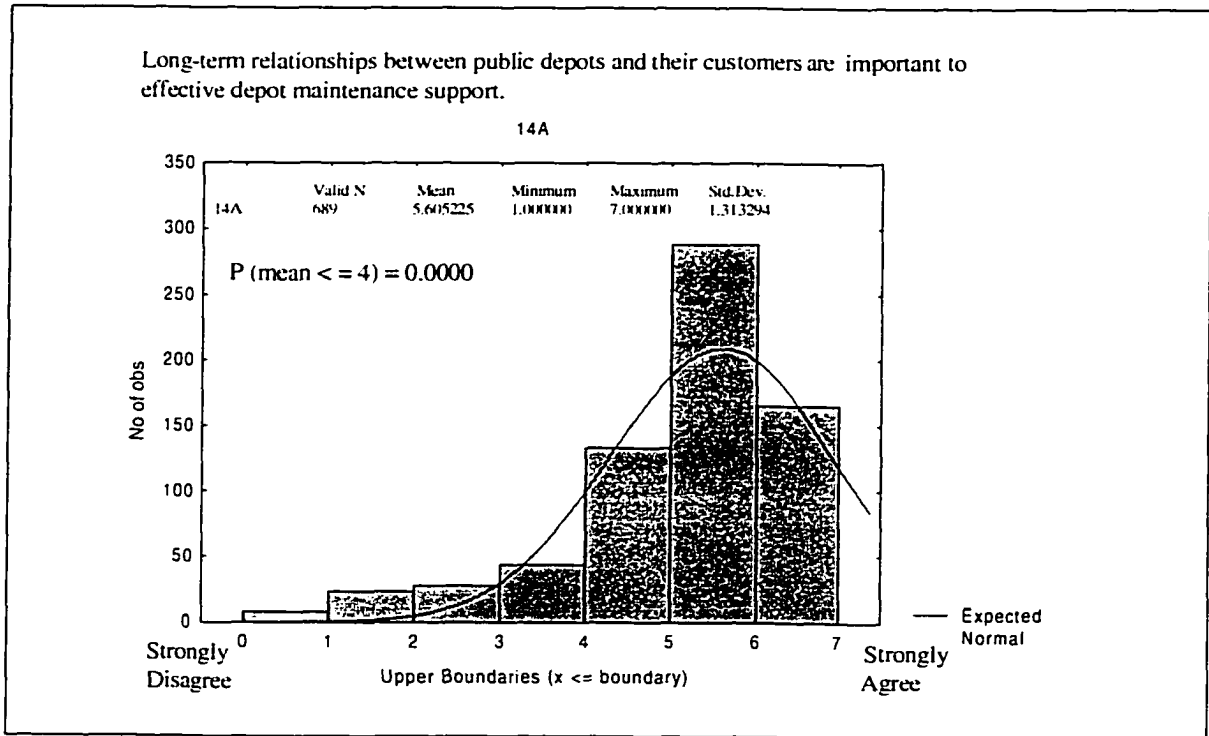


Since responses to both of the items associated with hypothesis H48 show agreement with the item statements, the hypothesis is supported.

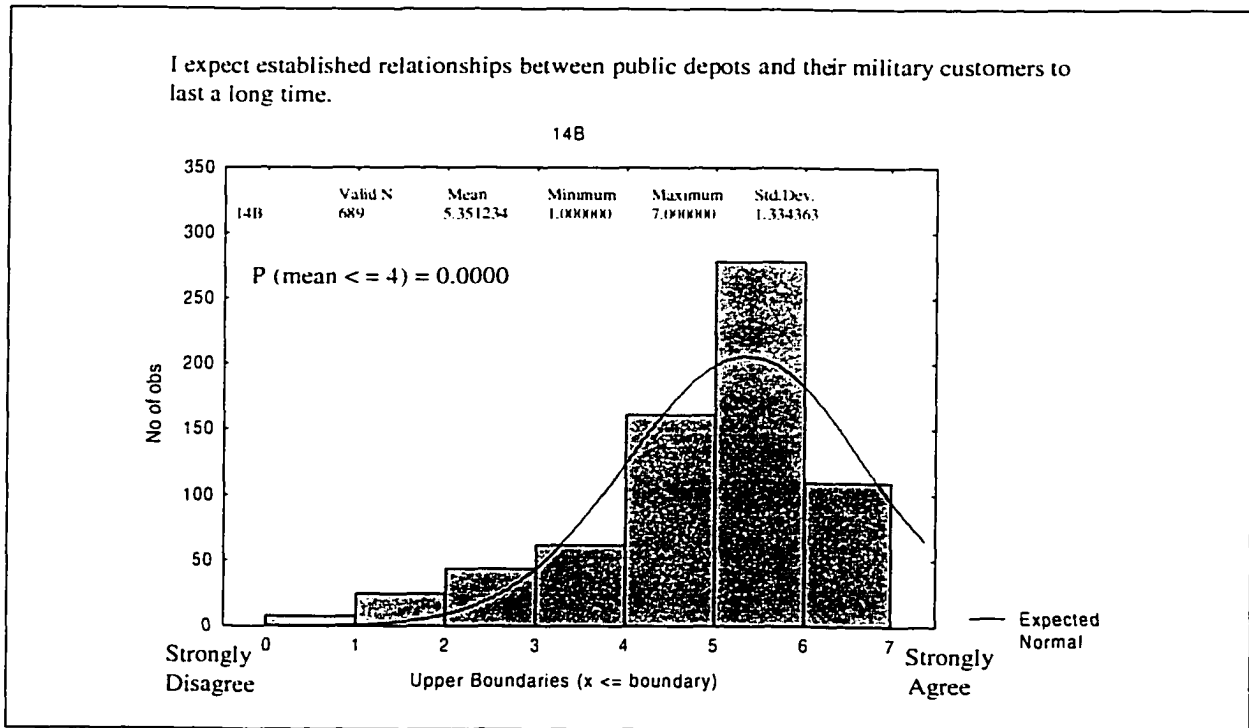
*H49 Long-term alliances between organic depots and their customers will be perceived as important to effective depot maintenance support*

Hypothesis H49 is also associated with two items, 520 (question 14A) and 600 (question 14B). The responses to the two items are more strongly correlated ( $r = 0.61$ ,  $p = 0.0$ ) than was the case with H48. However, because the questions are parallel to those in H48, the author considered the items separately. Histograms are at Figure 4-37 and Figure 4-38. The results are quite similar to those described for H48, above, and hypothesis H49 is supported.

**FIGURE 4-37**  
ITEM 520 HISTOGRAM



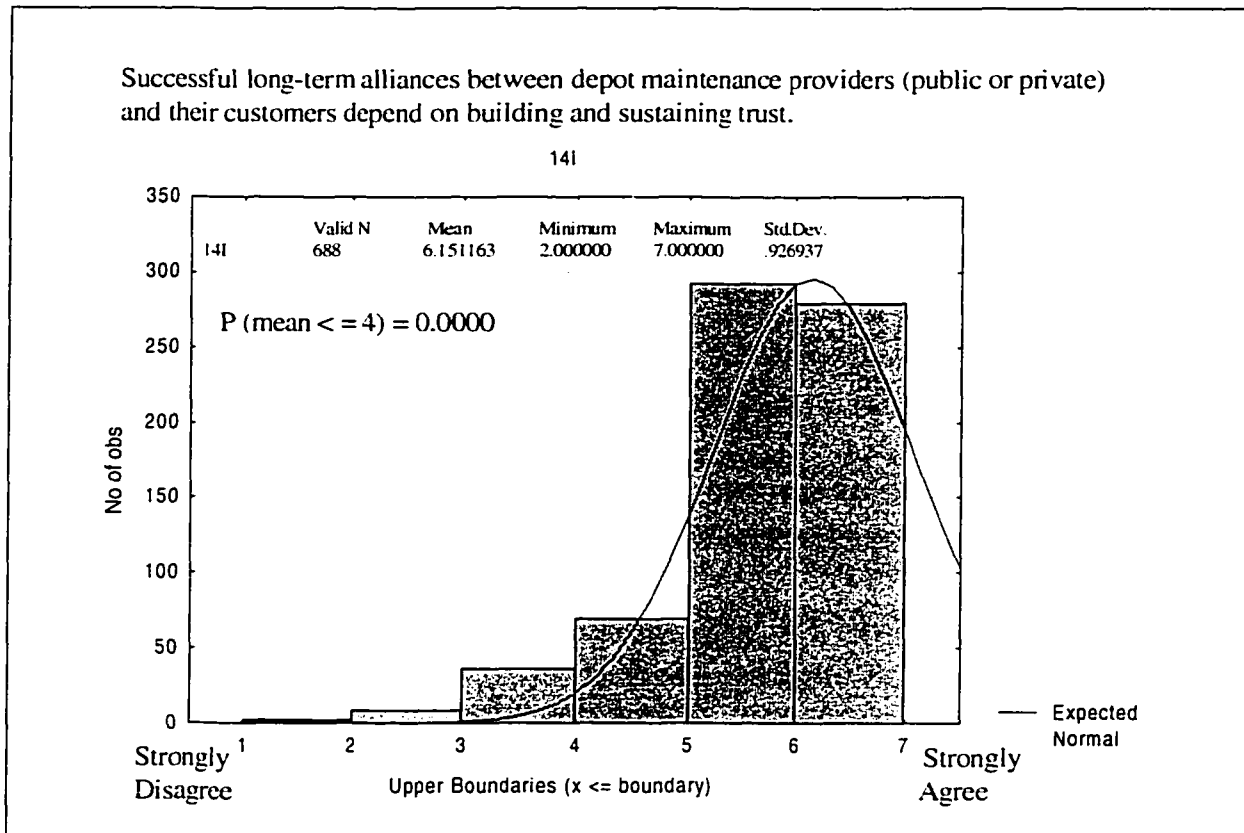
**FIGURE 4-38**  
ITEM 600 HISTOGRAM



### *H50 Importance of building and sustaining trust*

This is the last of the disconfirming hypotheses under transaction cost economics. It has one associated item, 521 (question 14I). The histogram for this item is at Figure 4-39. There appears to be consensus agreement with the statement in question 14I. Therefore hypothesis H50 is supported.

**FIGURE 4-39**  
ITEM 521 HISTOGRAM



### *Factor analysis of disconfirming hypotheses*

Because of the close relationship among the constructs of H48, H49, H50 and their associated items, the author also performed a factor analysis both with and without item 521. The results with and without item 521 are shown in Table 4-32. Both scales are reliable, since Cronbach alpha was greater than 0.6. Further convergent reliability was supported in both cases with all three (or four) items loading significantly.

**TABLE 4-32**  
**H48, H49, AND H50 FACTOR ANALYSIS**

Extraction: Principal Components			
Item	Question	H48, H49, and H50 Items (Cronbach alpha = 0.79)	H48 and H49 Items (Cronbach alpha = 0.81)
520	14A	<u>0.837</u>	<u>-0.845</u>
600	14B	<u>0.802</u>	<u>-0.836</u>
519	14C	<u>0.841</u>	<u>-0.846</u>
599	14D	0.429	-0.459
521	14I	0.608	n/a
Expl. Var		2.603	2.339
Prp Totl		0.521	0.585

Underlined loadings are >0.70.

The table reveals that questions 14A, 14B, and 14C all load at absolute values of about 0.85 and question 14D does not. This suggests that survey respondents believe long-term relationships are important for both organic and commercial providers. But whereas respondents would expect long-term relationships with public suppliers, they would not necessarily expect long-term relationships with commercial suppliers. It is probably reasonable to view such a difference as consistent with the expectations of transaction cost economics. The government's emphasis on competition for services it obtains from the commercial market—and the difficulty that naturally imposes on long-term government-commercial relationships—may also be an explanation.

The results in column "H48, H49, and H50 Items" indicate, in addition to the sign reversals, that the proportion of variation explained is somewhat worse when item 521 is included and that the loading for 521 does not reach the 0.7 threshold. Therefore, this analysis does not offer support for a relationship between trust and long-term relationships.

#### Summary of Results for Construct 5, Transaction Cost Economics

Both the confirming and disconfirming hypotheses are supported. Evidently the respondents held views that were simultaneously consistent with the precepts of transaction cost economics and relational exchange theory. This is an unexpected result, since the literature reviewed would suggest that the two views are in opposition. Results are summarized in Table 4-33.



TABLE 4-33  
CONSTRUCT 5 RESULTS

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H11	Managers of and other persons with an interest in depot maintenance will perceive tight linkage among stages in the depot maintenance repair process as important to deciding between organic and commercial sources of repair.	Supported	Item 485. Premise—that close coordination among sequential steps in depot maintenance repair process is important to public-private choice—was accepted.
H12	Managers of and other persons with an interest in depot maintenance will perceive specificity of production equipment as important to deciding between organic and commercial sources of repair.	Supported	Item 544. Premise—that requirements for unique equipment are important to public-private decision—was accepted. Item 604. Premise—that availability of specialized equipment is important to effective depot maintenance—was accepted.
H13	Managers of and other persons with an interest in depot maintenance will perceive the difficulty of stating all contingencies in advance as important to deciding between organic and commercial sources of repair.	Supported	Item 487. Respondents perceived stating all contingencies in advance when arranging for depot maintenance work as difficult.
H14	Managers of and other persons with an interest in depot maintenance will perceive the need to monitor shirking as important to deciding between organic and commercial sources of repair.	Supported	Item 488. Precept—that ability to make sure work is actually done is important to public-private source of repair choice—was accepted. Item 586. Precept—that there are well-defined criteria for measuring performance of depot maintenance providers—was accepted.

**TABLE 4-33**  
**CONSTRUCT 5 RESULTS (CONTINUED)**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H15	Managers and others with an interest in depot maintenance will perceive increased risk if crucial contingencies are left to the market.	Supported. More particularly, managers and others with the most direct interest in depot maintenance perceive risk while others do not.	<p>Items 489 and 587 addressed issue of risk in alternate forms. Those involved in depot maintenance or higher headquarters management of depot maintenance perceive loss of control if depot maintenance is outsourced. Those in OSD/JCS, acquisition, and field-level maintenance do not.</p> <p>Item 587. Precept—that depot maintenance is critically important to achieving primary mission—was strongly supported, very few responses were in disagreement or neutral.</p>
H16	Managers of and others with an interest in depot maintenance will perceive the combination of low task frequency and high uncertainty as leading to high transaction costs if depot maintenance is outsourced.	Indeterminate. Evidence of two different sub-populations—most likely related to complexity of technology with which respondents were familiar.	<p>Item 490. Premise was that most jobs in depot maintenance are routine. Response was bimodal. Item 607 compared monitoring cost to production cost in case of private provider. Item 490 compared monitoring cost to production cost in case of public provider</p> <p>Items 607 and 490 load with positive signs on one factor. Item 490 loaded on a second factor with item 607, but with negative sign. Evidence of two sub-populations with opposing perceptions. ANOVA and contingency analysis indicate perceptions depend on whether or not one is associated with ground equipment (perceive jobs as routine) and prior experience with commercial firms (negative experience correlated with disagreement that jobs are routine.)</p>

**TABLE 4-33**  
**CONSTRUCT 5 RESULTS (CONTINUED)**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H17	The choice between public and commercial providers of depot maintenance will be perceived to depend on the total cost where total cost is the sum of production cost and transaction costs.	Supported. However there is lack of consensus that choice should depend on cost alone.	Item 503. Lack of consensus. Contingency analysis indicated that those whose overall preference was public sector do not believe decision should depend on cost alone.  Item 561. Agreement that cost should comprise both production cost and transaction costs.
H48	Long-term alliances between users of depot maintenance and commercial firms will be perceived as important to effective depot maintenance support.	Supported	Item 518. Premise—that long term relationships between private providers and military customers are important—was supported.  Item 519. Premise—that established relationships between private providers and military customers will last a long time—was supported.
H49	Long-term alliances between organic depots and their customers will be perceived as important to effective depot maintenance support.	Supported	Item 520. Premise—that long term relationships between public providers and military customers are important—was supported.  Item 600. Premise—that established relationships between public providers and military customers will last a long time—was supported.
H50	Building and sustaining trust will be perceived as important to effective long-term depot maintenance alliances.	Supported.	Item 521. Premise—that successful long-term relationships between depot maintenance providers (public or private) and customers depend on building trust—supported. Factor analysis (of items 520, 521, 519, and 600) indicated respondents perceived long-term relationships with public providers as more likely.

## Construct 6—Principal-Agent Theory

As with transaction cost economics, principal-agent theory was tested by both confirming and disconfirming hypotheses.

### Confirming Hypotheses

The eight confirming hypotheses are summarized in Table 4-34.

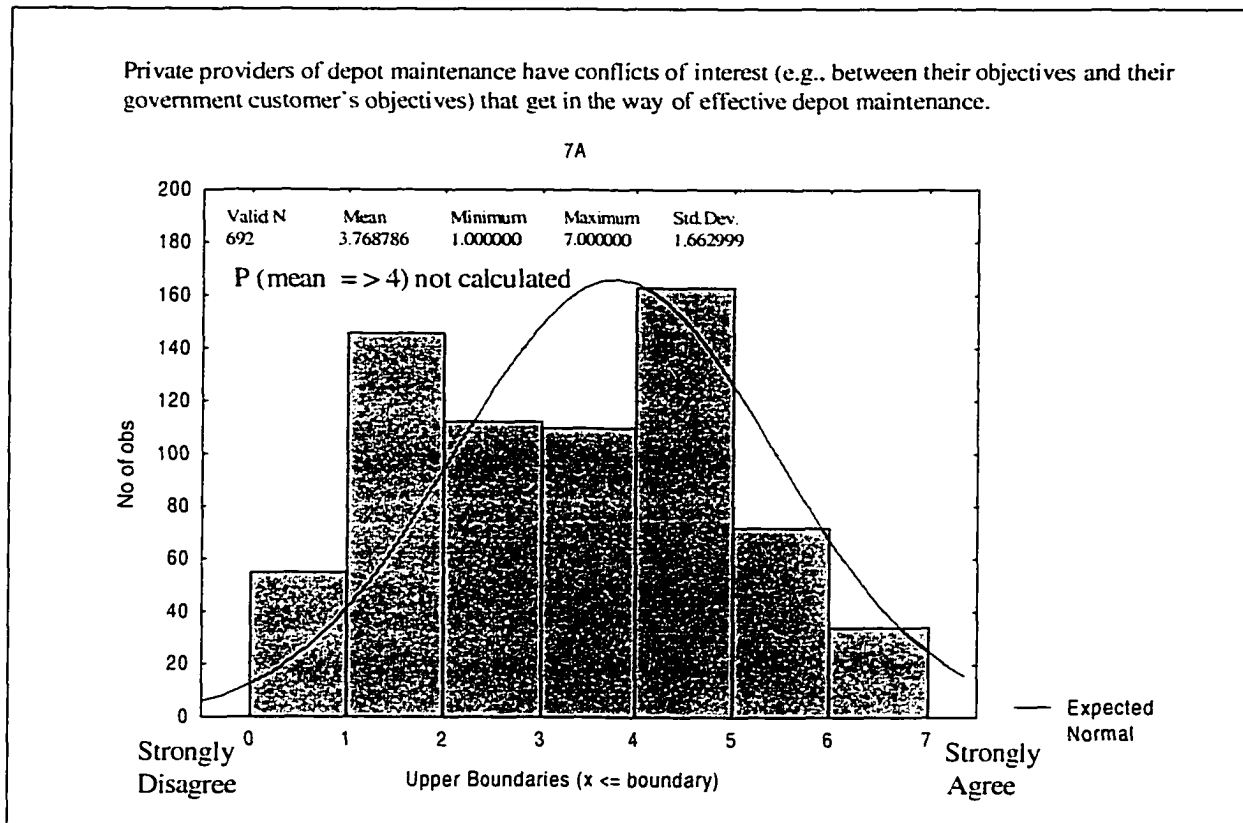
TABLE 4-34  
CONFIRMING HYPOTHESES

H18	Organic and commercial providers of depot maintenance are perceived as differing in the extent to which they have conflicts of interest with the users of depot maintenance.
H19	Organic and commercial providers of depot maintenance are perceived as differing in their degree of carefulness, industriousness, and trustworthiness.
H20	Organic and commercial providers of depot maintenance are perceived as differing in the degree to which they can influence the desired outcome of depot maintenance activity.
H21	Random factors, under neither the control of depot maintenance providers nor managers, are perceived as being able to influence the outcome of depot maintenance.
H22	The outcome of depot maintenance is perceived as observable to both providers of depot maintenance and to government managers of depot maintenance.
H23	The providers of depot maintenance will be perceived as having better information than government managers of depot maintenance about the degree of care exercised during the performance of depot maintenance.
H24	Public and commercial providers are perceived as having different potential to act opportunistically.
H25	Retention by the government of smart buyer capability will be perceived as important.

### *H18 Differences in extent of conflicts of interest with the users of depot maintenance*

Hypothesis H18 has two associated items, 491 (question 7A) and 549 (question 7B). These two items are not correlated ( $r = 0.0$ ,  $p = 0.15$ ) and will be considered independently. The histogram for item 491 is at Figure 4-40. Because the histogram appears to be bimodal, the author did not compute the probability that the mean is greater than 4. Instead, he performed ANOVA against the six available dimensions and contingency analysis against the numerically encoded comments for insight into the shape of the distribution.

FIGURE 4-40  
ITEM 491 HISTOGRAM



ANOVA revealed differences among means on the dimensions function, organizational level, maintenance level, and sector. On the dimensions function, organizational level, and sector, however, the means were all less than 4. The differences of interest occurred on the maintenance level dimension (Table 4-35). Here there is a distinction between the perceptions of those in the field and in depot maintenance. The field (and, for that matter, those not involved in maintenance) do not see private providers as having conflicts of interest that get in the way of effective depot maintenance. Those who are directly involved in the performance of depot maintenance do see this conflict as problematic.

As indicated later in this chapter in Table 4-48, perceived experience with public providers, perceived experience with commercial providers, and overall sector preference all appear to be related to how respondents scored this item.

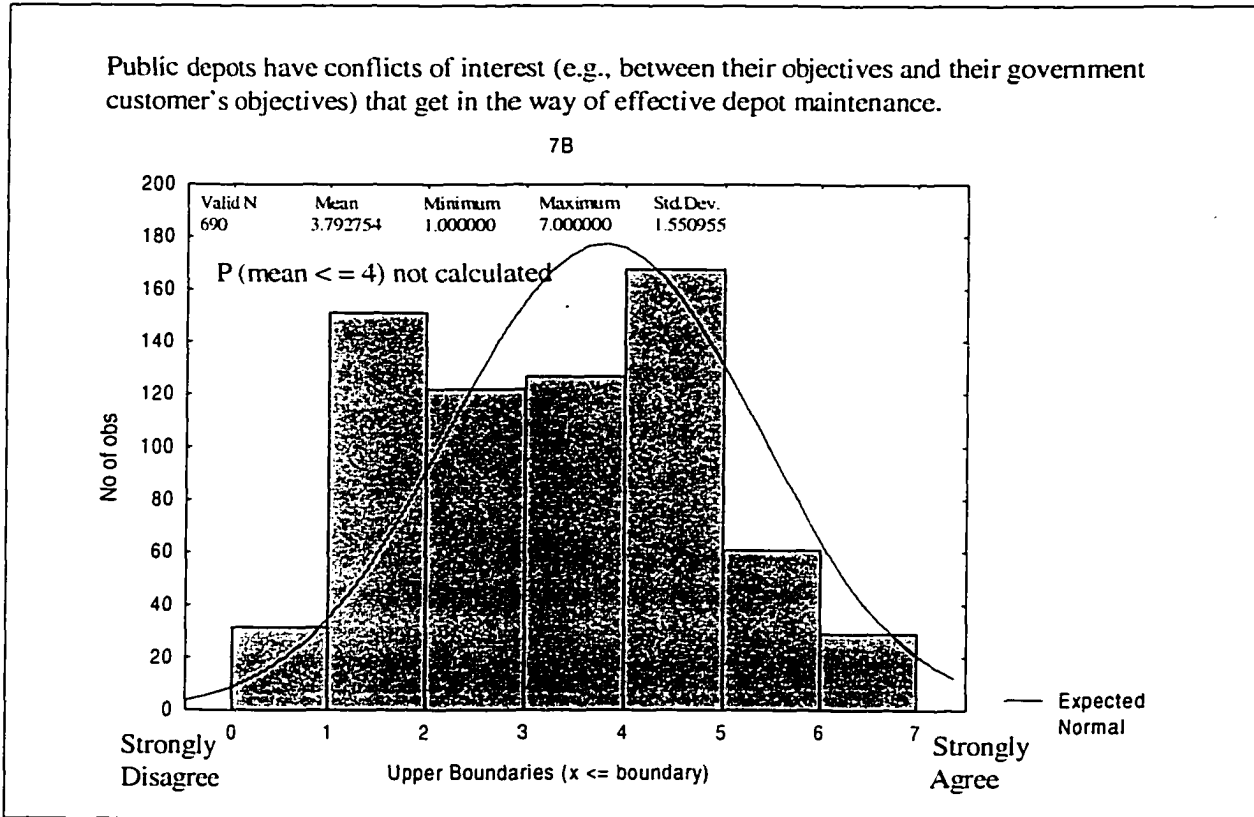
The histogram for item 549 is at Figure 4-41.

**TABLE 4-35**  
**491 ANOVA POST HOC ANALYSIS**

<b>Unequal N HSD; variable 7A</b>				
Probabilities for Post Hoc Test				
<b>MAIN EFFECT: MAINTENANCE LEVEL</b>				
	{1}	{2}	{3}	{4}
	4.5000	3.5669	4.9063	3.9373
HHQ Management {1}		0.3504	0.8898	0.7521
N/A {2}	0.3504		<u>0.0045</u>	<u>0.0448</u>
Depot Maintenance {3}	0.8898	<u>0.0045</u>		0.0727
Field Maintenance {4}	0.7521	<u>0.0448</u>	0.0727	

Significance at 0.05 underlined

**FIGURE 4-41**  
**ITEM 549 HISTOGRAM**



The histogram shape for item 549 is similar to that of item 491. ANOVA indicated significant differences among means on two dimensions, component and organizational level. Post hoc analysis (Table 4-36) revealed a difference on just the organizational level dimension, between OSD/JCS respondents and the field. OSD/JCS respondents perceive

public depots as having conflicts of interest that get in the way of effective depot maintenance.

TABLE 4-36  
ITEM 549 ANOVA POST HOC ANALYSIS

Unequal N HSD; variable 7B			
Probabilities for Post Hoc Tests			
MAIN EFFECT: ORGANIZATIONAL LEVEL			
	{1}	{2}	{3}
Means	3.3509	3.7767	4.4444
Component {1}		0.3035	<u>0.0074</u>
Field {2}	0.3035		0.1578
OSD/JCS {3}	<u>0.0074</u>	0.1578	

Significance at 0.05 underlined.

The differences in views on this item appear to also be related to overall sector preference (Table 4-37), although there was not a statistically significant relationship to either experience with public providers or commercial providers.

TABLE 4-37  
ITEM 549 CONTINGENCY ANALYSIS VS. SECTOR PREFERENCE

Observed Frequencies					Expected Frequencies				
		Sector Scores					Sector Scores		
Item scores	Range	<3	>3	Total	Item scores	Range	<3	>3	Total
	<4	13	2	15		<4	7.8	7.2	15.0
	>4	25	33	58		>4	30.2	27.8	58.0
	Total	38	35	73		Total	38.0	35.0	73.0

Chi square value: 7.401

Chi square critical: 3.84

Since item 491 examines conflicts of interest on the part of commercial providers and item 549 does the same for public providers, it would be useful to know if the responses to those items differ, particularly with regard to central tendency. Although the distribu-

tions for the items are too non-normal to check for differences of their means, we can implement non-parametric equivalents in the form of difference of medians and Kruskal-Wallis ANOVA by ranks tests. Both results were statistically significant, the Kruskal-Wallis test at the 0.0005 level and the difference of medians test at approximately 0.0000. However, the cause of this result appears to be that the distributions differ in shape rather than central tendency; the median of each distribution is 4.

The above results do not support the hypothesis that organic and commercial providers of depot maintenance would be perceived as differing in the extent to which they have conflicts of interest with the users of depot maintenance. What does appear to be the case is that perceived conflicts of interest depend on who is doing the perceiving.

#### *H19 Differing degree of carefulness, industriousness, and trustworthiness*

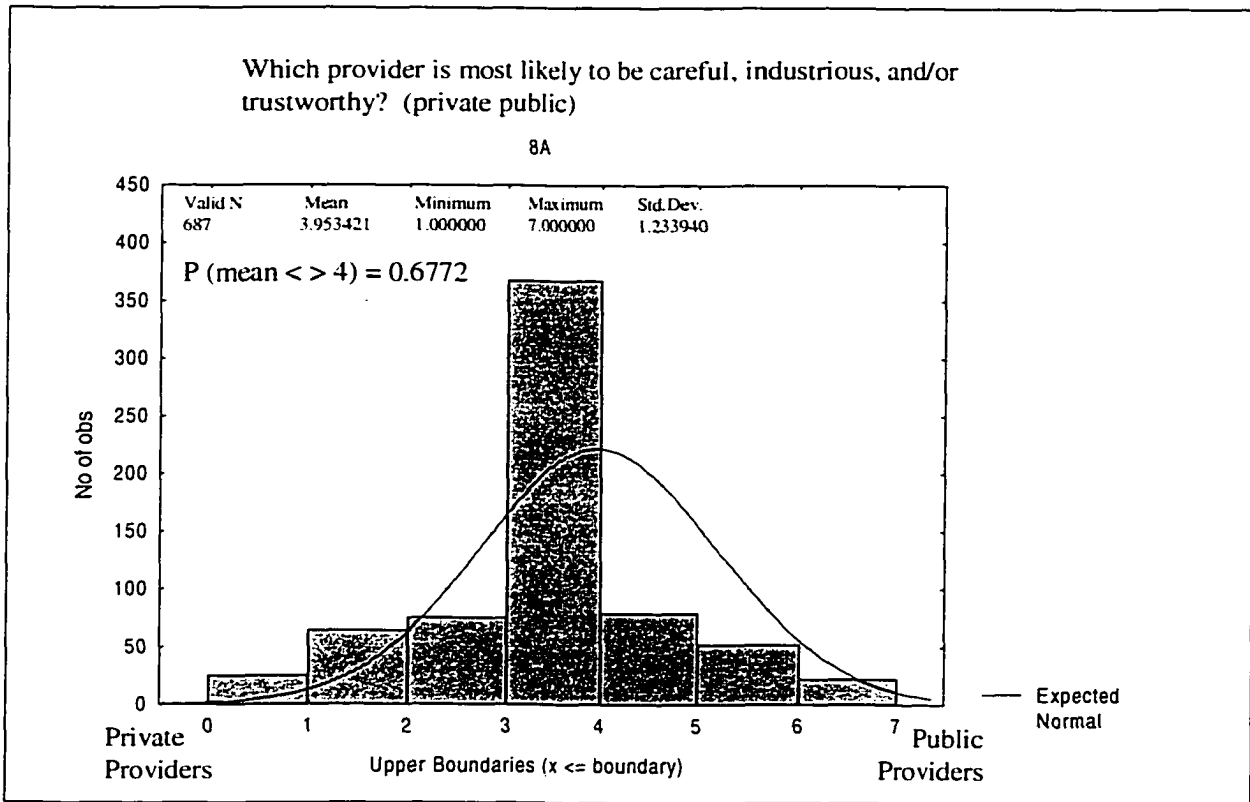
Hypothesis H19 has one corresponding item, 492 (question 8A). The histogram for this item is at Figure 4-42. Clearly, the respondents do not perceive a difference in carefulness, industriousness, and/or trustworthiness between public and private providers. Therefore hypothesis H19 is not supported.

#### *H20 Differing ability to influence the desired outcomes*

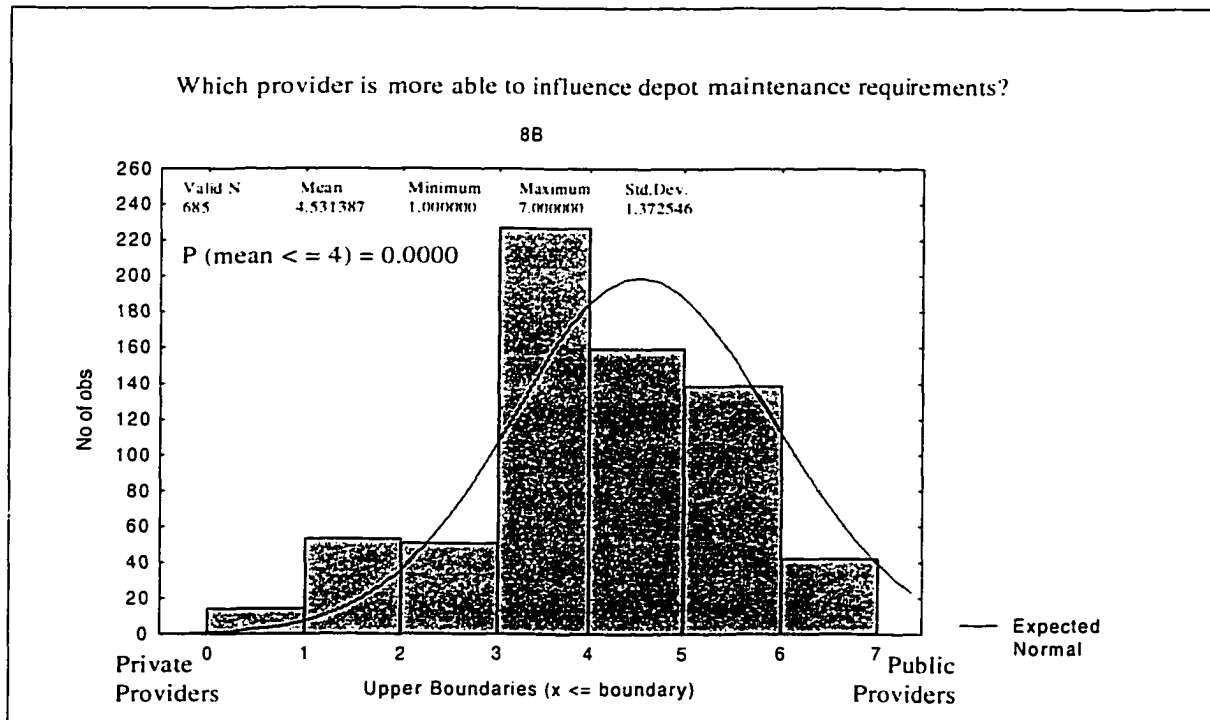
Hypothesis H20 has one associated item, 493 (question 8B). The histogram for this item is at Figure 4-43. The results indicate that respondents believe public providers are more able than private providers to influence depot maintenance requirements. hypothesis H20, which predicted that the two sectors would differ in this respect, is supported.



**FIGURE 4-42**  
ITEM 492 HISTOGRAM



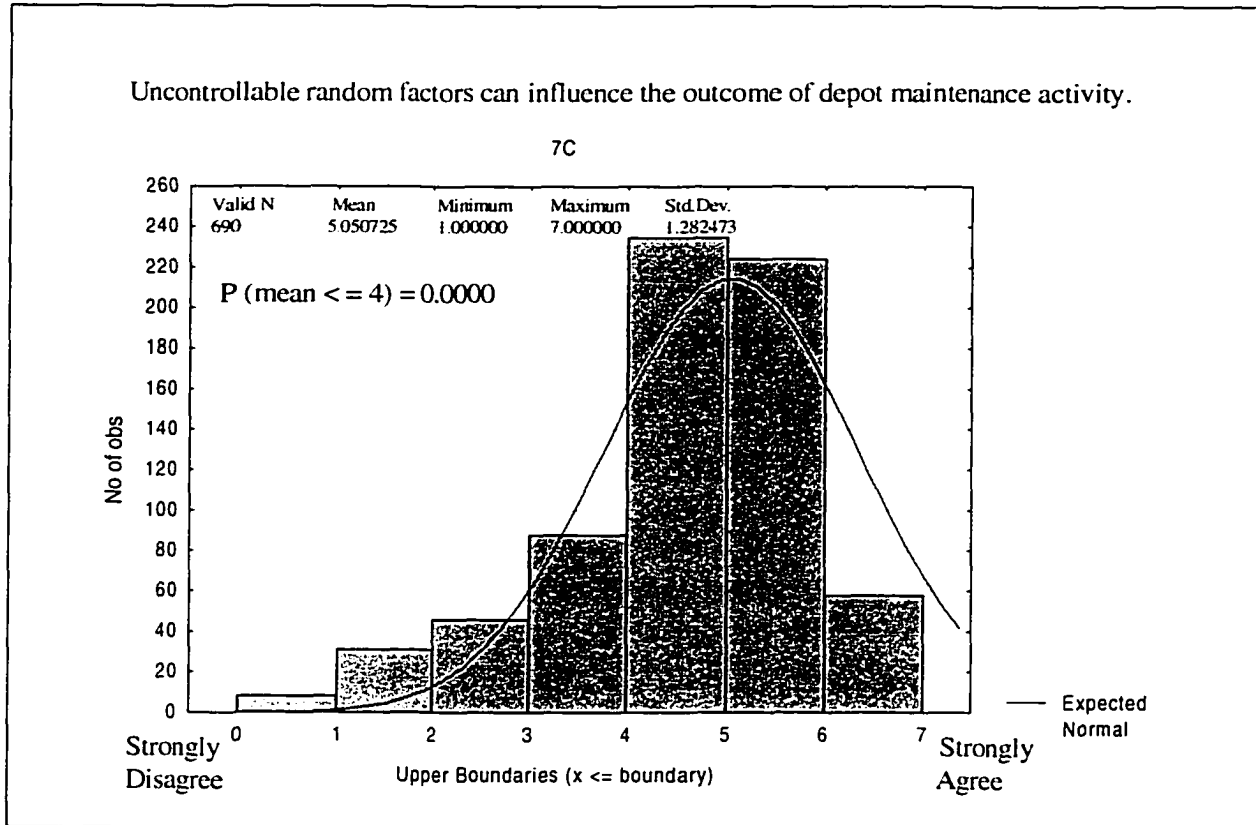
**FIGURE 4-43**  
ITEM 493 HISTOGRAM



### *H21 Influence of random factors on the outcome of depot maintenance*

Hypothesis H21 has one associated item, 494 (question 7C). The histogram is at Figure 4-44. Respondents appear to agree with the premise of item 494. Therefore hypothesis H21 is supported.

**FIGURE 4-44**  
ITEM 494 HISTOGRAM



### *H22 Observability of depot maintenance*

Hypothesis H22 has three associated items: 495 (question 7D), 553 (question 7E) and 591 (question 7F). The results of factor analysis are summarized in Table 4-38, which also shows the Cronbach alpha value. Since Cronbach alpha is greater than 0.6, the scale is reliable. Confirmatory factor analysis supported convergent validity, with all three items loading significantly.

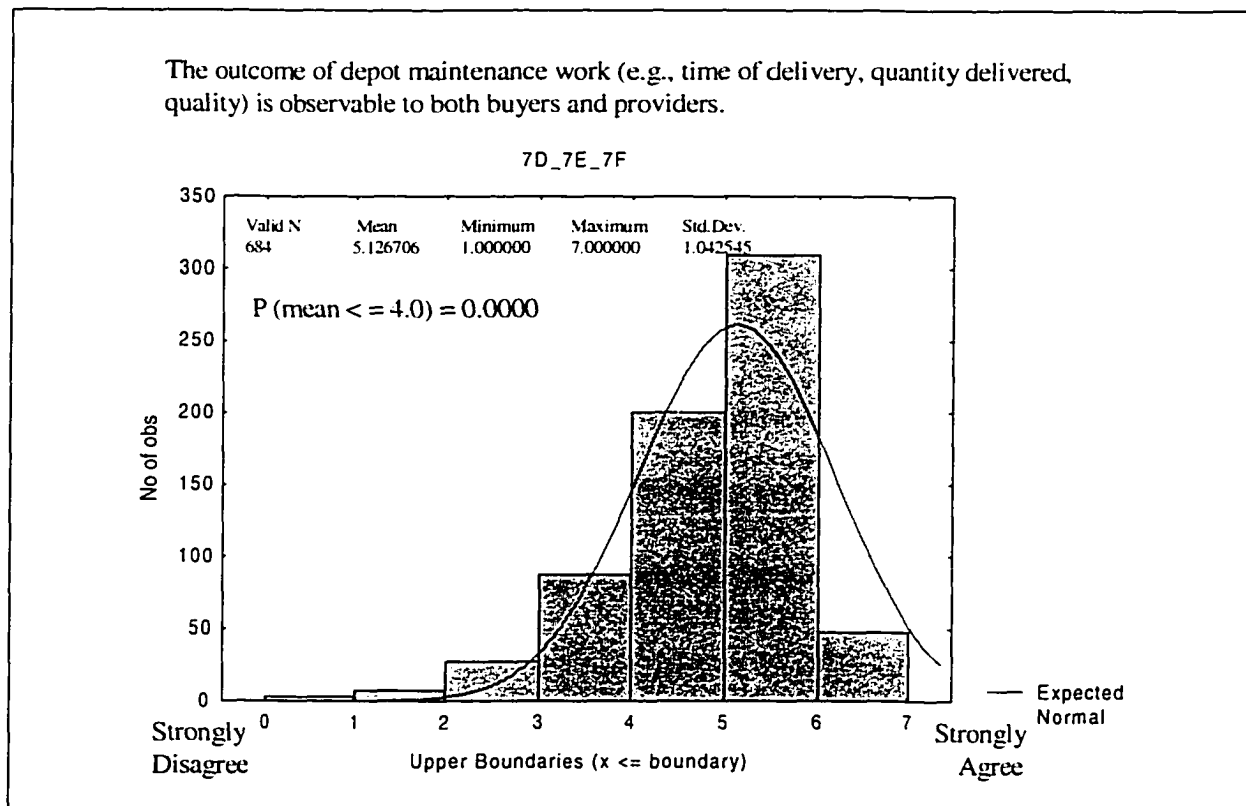
**TABLE 4-38**  
**H22 FACTOR ANALYSIS RESULTS**

<b>Factor Loadings (Unrotated)</b>		
Extraction: Principal components		
Cronbach alpha = 0.72		
Item	Question	Factor 1
495	7D	0.812
553	7E	0.827
591	7F	0.765
Expl. Var		1.929
Prp. Totl		0.643

Underlined loadings are > 0.70.

Because the three items load on a single factor, the author linearly combined them by summing the three results and then dividing by 3 so that the results were in the range of 1 to 7. The histogram of the combined results is at Figure 4-45. The combined results

**FIGURE 4-45**  
ITEMS 495, 553, AND 591 TOGETHER



indicate that survey respondents viewed public providers, private providers, and government buyers all as able to observe the outcome of depot maintenance work. The hypothesis was that the outcome of depot maintenance would be perceived as observable to both providers of depot maintenance and government managers of depot maintenance. It is supported.

*H23 Information about the degree of care exercised*

Hypothesis H23 had three associated items: 496 (question 7G), 634 (question 8C), and 635 (question 8D). Factor analysis results are summarized in Table 4-39. Items 634 and 635 assert that public providers and private providers, respectively, have better information about the degree of care they exercise than do buyers of depot maintenance. The two load with very nearly the same value. Item 496 approached the same question a different way by asking if providers (public or private) had better information than buyers. Although the loading is less than the typical cutoff of 0.7, the sign is the same as those for 634 and 635 and the value is close to 0.7.

**TABLE 4-39**  
**H23 FACTOR ANALYSIS RESULTS**

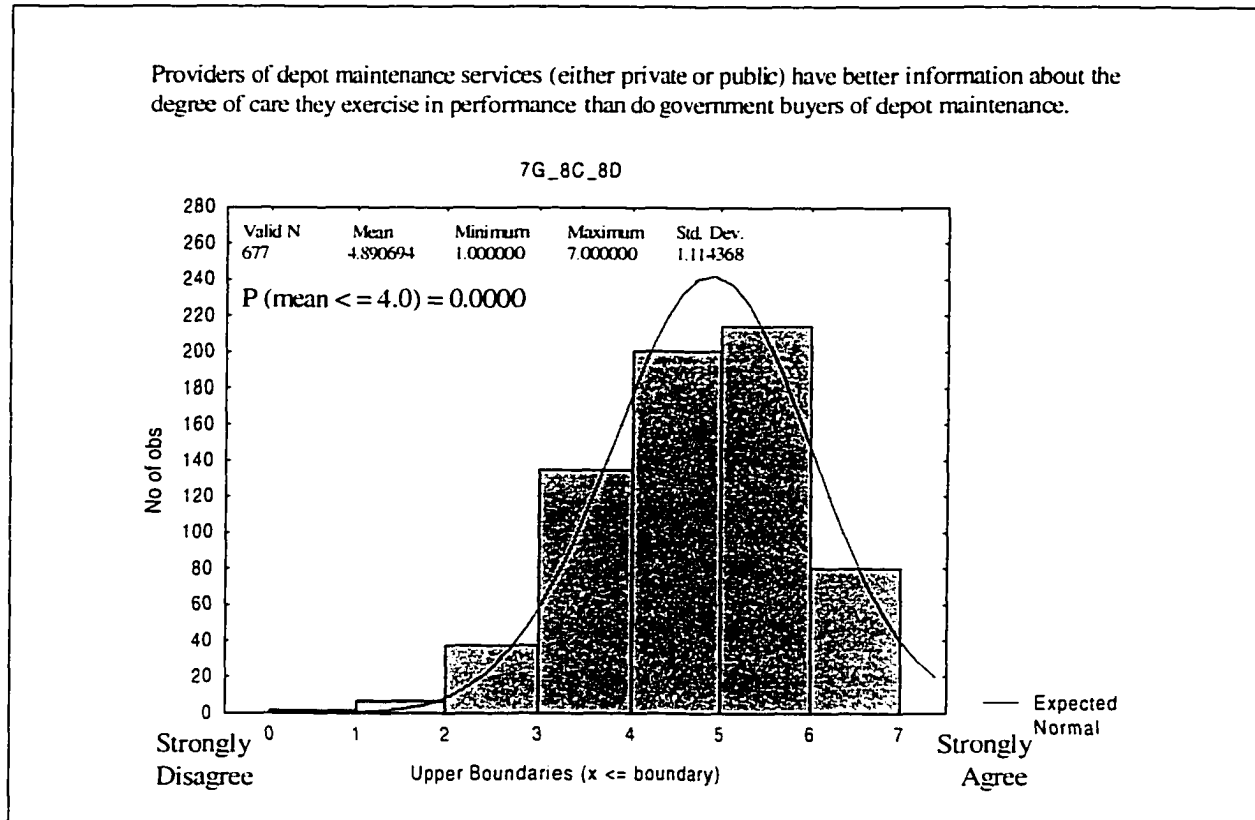
<b>Factor Loadings (Unrotated)</b>		
Extraction: Principal components		
<b>Item</b>	<b>Question</b>	<b>Factor 1</b>
496	7G	0.627
634	8C	<u>0.820</u>
635	8D	<u>0.826</u>
Expl. Var		1.748
Prp. Totl		0.583

Underlined loadings exceed 0.70

Further, confirmatory factor analysis supported convergent validity, with all three items loading significantly. The author summed the responses to the three items and then divided by 3 so that the results were in the range of 1 to 7. The combined result is at Figure 4-46. The results support the hypothesis that providers of depot maintenance will be per-

ceived as having better information than government managers of depot maintenance about the degree of care exercised during the performance of depot maintenance.

**FIGURE 4-46**  
HISTOGRAM OF ITEMS 496, 634, & 635 COMBINED



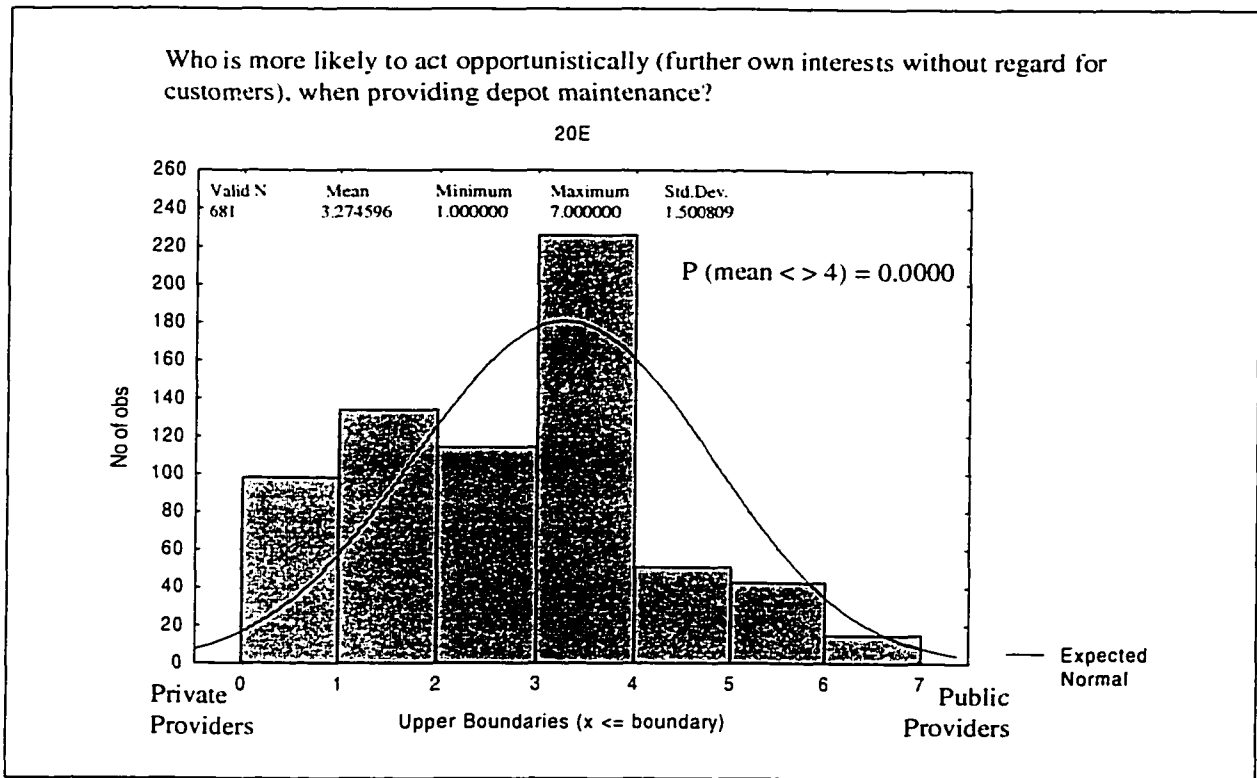
#### *H24 Differing potential to act opportunistically*

Hypothesis H24 had one associated item, number 633 (question 20E). The histogram is at Figure 4-47. The results are consistent with the hypothesis that public and commercial providers would be perceived as having different potential to act opportunistically, and the hypothesis is supported. (Note that the appropriate test in this case is two-tailed, because we are interested in knowing if the mean is different from 4.)

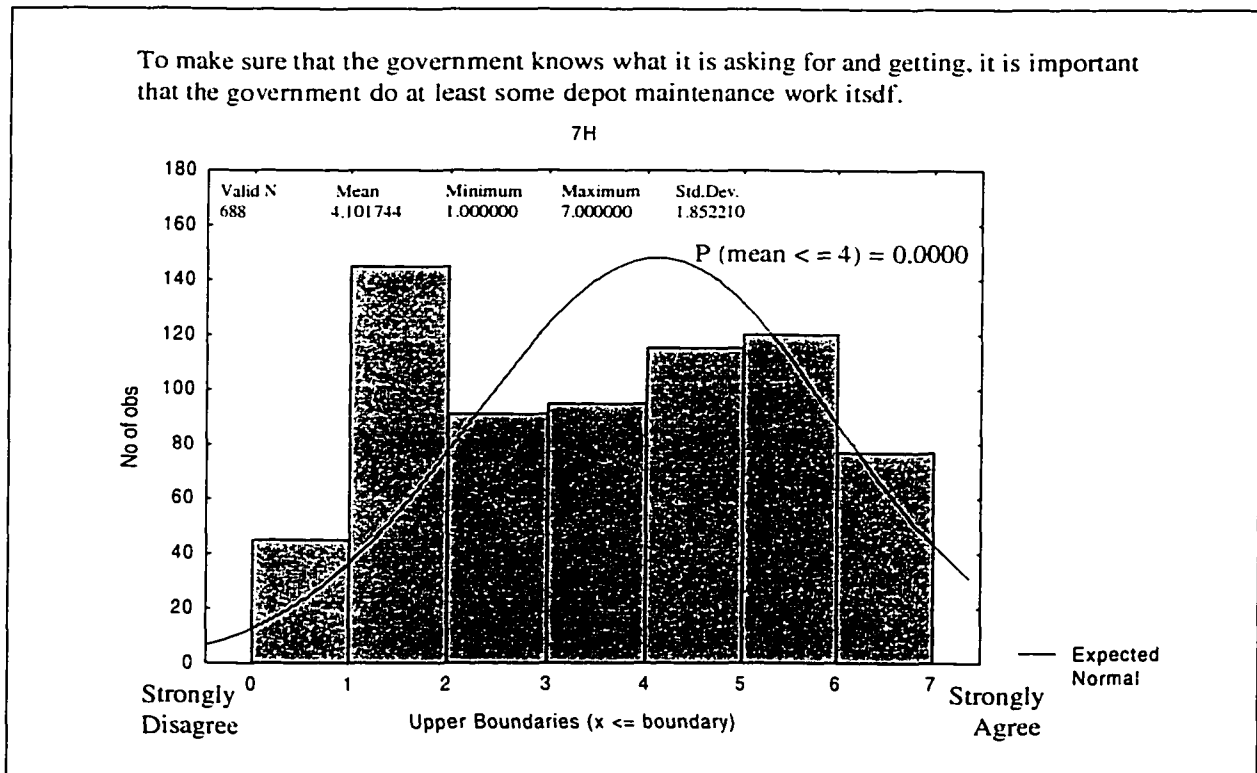
#### *H25 Importance of smart buyer capability*

Hypothesis H25 has one associated item, 560 (question 7H). The histogram is at Figure 4-48. Although the probability of the mean being less than 4 is 0.0, the normality

**FIGURE 4-47**  
ITEM 633 HISTOGRAM



**FIGURE 4-48**  
ITEM 560 HISTOGRAM



assumption integral to this test is questionable. Therefore the researcher used ANOVA to gain additional insight.

The differences among means were significant on all six dimensions. However, when further examined using post hoc analysis, it was the three dimensions of sector, function, and maintenance level that were important. Table 4-40 shows the difference of means for the sector dimension. Whereas those in DoD see the need for DoD to do some work itself, those in industry do not.

**TABLE 4-40**  
**ITEM 560 ANOVA FOR SECTOR DIMENSION**

<b>ANOVA Results</b>	
<b>F(1,686) = 26.35; p <math>\equiv</math> 0.0000</b>	
Sector	Mean
DoD	4.198
Industry	2.787

Table 4-41 provides the results of ANOVA post hoc analysis on the function dimension. Those outside the support fields would agree with industry that DoD does not need to perform some of the work itself. Those in maintenance, logistics, and materiel management, however, do see such a need. Although there are fields, such as acquisition, where the mean is less than 4, the differences involving these fields are not statistically meaningful.

**TABLE 4-41**  
**ITEM 560 ANOVA POST HOC ANALYSIS: FUNCTION**

<b>Unequal N HSD; variable 7H</b>								
Probabilities for Post Hoc Tests								
<b>MAIN EFFECT: FUNCTION</b>								
	{1}	{2}	{3}	{4}	{5}	{6}	{7}	{8}
Means	4.6256	3.9118	4.3182	4.5398	3.8077	3.3643	4.0000	3.0000
Maintenance {1}		0.7167	0.9465	1.0000	0.7147	<u>0.0000</u>	0.9657	0.9529
Logistics {2}	0.7167		0.9819	0.8309	1.0000	0.9104	1.0000	0.9985
Operations {3}	0.9465	0.9819		0.9917	0.9692	<u>0.0090</u>	0.9995	0.9855
Materiel Mgt. {4}	1.0000	0.8309	0.9917		0.8164	<u>0.0000</u>	0.9852	0.9648
Acquisition {5}	0.7147	1.0000	0.9692	0.8164		0.9863	1.0000	0.9993

TABLE 4-41  
ITEM 560 ANOVA POST HOC ANALYSIS: FUNCTION (CONTINUED)

Unequal N HSD; variable 7H								
Probabilities for Post Hoc Tests								
MAIN EFFECT: FUNCTION								
	{1}	{2}	{3}	{4}	{5}	{6}	{7}	{8}
Other nonsupport {6}	<u>0.0000</u>	0.9104	<u>0.0090</u>	<u>0.0000</u>	0.9863		0.9626	1.0000
Support other {7}	0.9657	1.0000	0.9995	0.9852	1.0000	0.9626		0.9973
Indeterminate {8}	0.9529	0.9985	0.9855	0.9648	0.9993	1.0000	0.9973	

Significance at 0.05 underlined.

Table 4-42 provides the results of ANOVA post hoc analysis on the maintenance level dimension. Consistent with the results above, it is those outside maintenance who do not see the need for the government to retain some work itself.

TABLE 4-42  
ANOVA POST HOC ANALYSIS: MAINTENANCE LEVEL

Unequal N HSD; variable 7H				
Probabilities for Post Hoc Tests				
MAIN EFFECT: MAINTENANCE LEVEL				
	{1}	{2}	{3}	{4}
Means	5.1875	3.5714	5.0313	4.5315
Field Maintenance {1}		<u>0.0479</u>	0.9945	0.7203
N/A {2}	<u>0.0479</u>		<u>0.0053</u>	<u>0.0000</u>
Depot Maintenance {3}	0.9945	<u>0.0053</u>		0.6706
HHQ Management {4}	0.7203	<u>0.0000</u>	0.6706	

Significance at 0.05 underlined.

Hypothesis H25 is partially supported. Those in industry and in DoD who are outside the support fields do not see a need to retain some work.

### Disconfirming Hypotheses

The same disconfirming hypotheses apply here as to transaction cost economics: H48, H49, and H50. They were previously analyzed under the topic of transaction cost economics. All were supported.



## Summary of Results for Construct 6, Principal-Agent Theory

TABLE 4-43  
CONSTRUCT 6 RESULTS

	Narrative Description	Result	Discussion of Corresponding Items
H18	Organic and commercial providers of depot maintenance are perceived as differing in the extent to which they have conflicts of interest with the users of depot maintenance.	Not supported. Perceived differences appeared related to who was doing perceiving rather than to difference between organic and commercial providers.	Item 491. Those most directly involved in performance of depot maintenance perceive private providers as having conflicts of interest that get in way of effective depot maintenance. Those involved in field-level maintenance and not involved in maintenance do not. How respondents scored this item also related to experience with commercial providers, experience with public providers, and overall sector preference.  Item 549. OSD/JCS respondents disagreed with those in field by perceiving public depots as having conflicts of interest that get in way of effective depot maintenance. Differences in views also appear related to overall sector preference.
H19	Organic and commercial providers of depot maintenance are perceived as differing in their degree of carefulness, industriousness, and trustworthiness.	Not supported	Item 492. Respondents did not perceive a difference in degree of carefulness, industriousness, and/or trustworthiness between public and private providers.
H20	Organic and commercial providers of depot maintenance are perceived as differing in the degree to which they can influence the desired outcome of depot maintenance activity.	Supported	Item 493. Public providers are perceived as more able than private providers to influence depot maintenance requirements.

**TABLE 4-43**  
**CONSTRUCT 6 RESULTS (CONTINUED)**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H21	Random factors, under neither the control of depot maintenance providers nor managers, are perceived as being able to influence the outcome of depot maintenance.	Supported	Item 494. Premise of item—that uncontrollable random factors can influence the outcome of depot maintenance activity—was supported.
H22	The outcome of depot maintenance is perceived as observable to both providers of depot maintenance and to government managers of depot maintenance.	Supported	Items 494, 553, and 591 loaded on single factor. Respondents perceive outcome of depot maintenance work as observable to both buyers and providers.
H23	The providers of depot maintenance will be perceived as having better information than government managers of depot maintenance about the degree of care exercised during the performance of depot maintenance.	Supported	Items 496, 634, and 635 load on single factor. Respondents perceive providers (private or public) of depot maintenance services as having better information about degree of care than do government buyers.
H24	Public and commercial providers are perceived as having different potential to act opportunistically.	Supported	Item 633. Private providers are perceived as more likely to act opportunistically when providing depot maintenance.
H25	Retention by the government of smart buyer capability will be perceived as important.	Partially supported	Item 560. Respondents in maintenance, logistics management, and operations perceive need for the government to do at least some depot maintenance work itself to make sure it knows what it is asking for and getting. Other DoD respondents and industry respondents do not see the need.
H48	Long-term alliances between users of depot maintenance and commercial firms will be perceived as important to effective depot maintenance support.	Supported	See discussion under topic of transaction cost economics.

**TABLE 4-43**  
**CONSTRUCT 6 RESULTS (CONTINUED)**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H49	Long-term alliances between organic depots and their customers will be perceived as important to effective depot maintenance support.	Supported	See discussion under topic of transaction cost economics.
H50	Building and sustaining trust will be perceived as important to effective long-term depot maintenance alliances.	Supported. However, whereas respondents would expect long term relationships with public providers, would not necessarily expect long term relationships with commercial providers.	See discussion under topic of transaction cost economics.

Out of the eight confirming hypotheses, five were supported, one (H25) was partially supported, and two (H18 and H19) were not (Table 4-43). Additionally, the evidence indicates that the respondents held views that were simultaneously consistent with the precepts of principal-agent theory and relational exchange theory. As was the case with TCE, this is an unexpected result, since the literature reviewed suggests that the principal-agent and relational exchange theories are in opposition.

## Construct 7—Public Choice Theory

### Related Hypotheses

There were two hypotheses for public choice theory, as shown in Table 4-44.

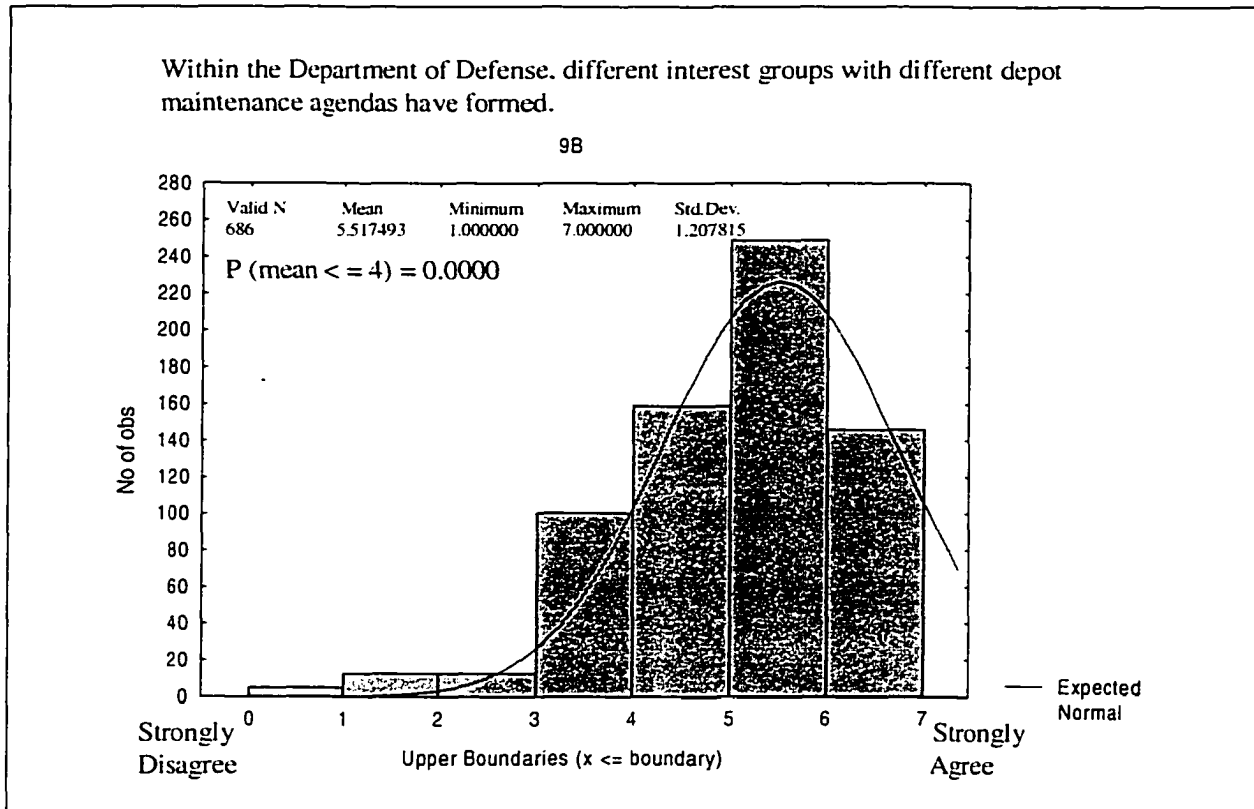
**TABLE 4-44**  
**PUBLIC CHOICE THEORY HYPOTHESES**

H26	Interest groups internal to government (i.e., Department of Defense, ministry of defense, or other government agency as applicable) will be perceived as influencing the choice of public versus commercial provision of depot maintenance.
H27	Interest groups external to government (i.e., Department of Defense, ministry of defense, or other government agency as applicable) will be perceived as influencing the choice of public versus commercial provision of depot maintenance.

*H26 Internal interest groups influence the public versus commercial choice*

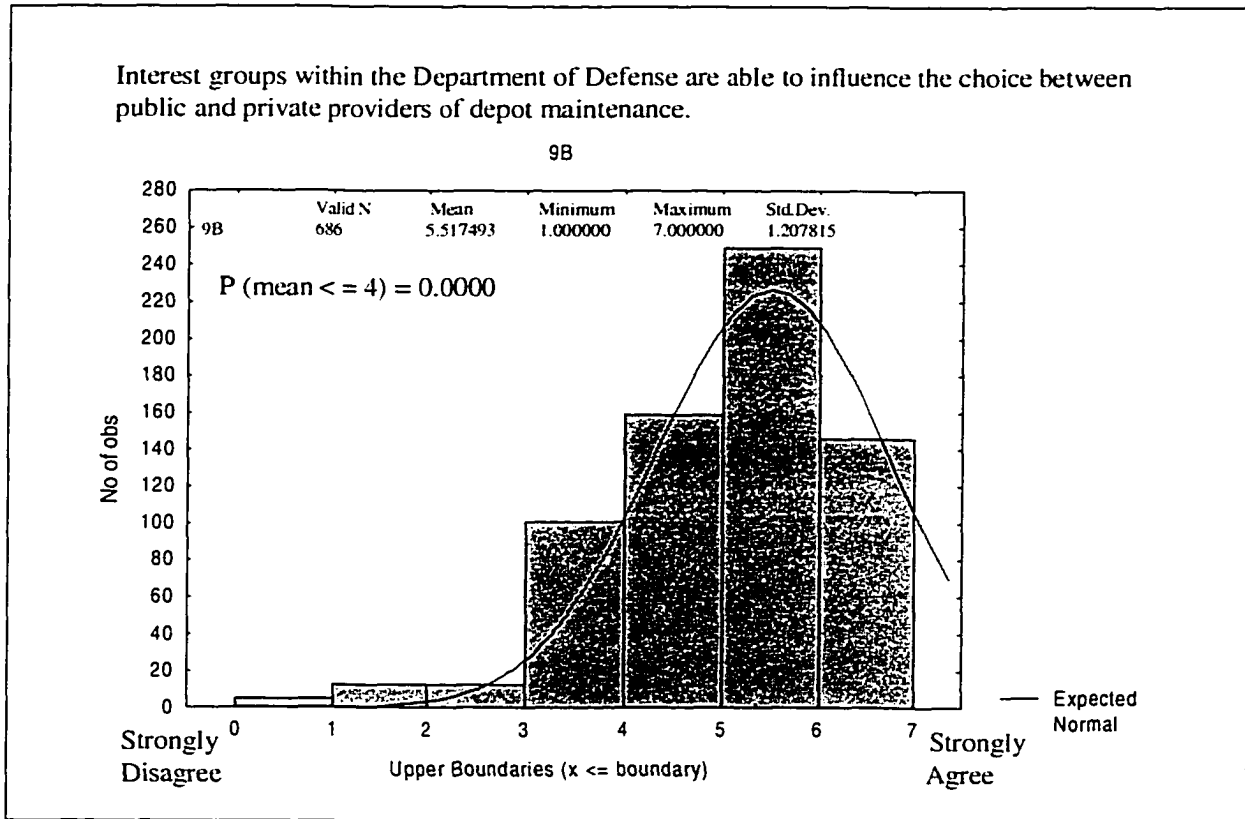
Hypothesis H26 had two related items, 498 (question 9A) and 556 (question 9B). The histogram for item 498 is at Figure 4-49. The responses are consistent with the premise of the item.

**FIGURE 4-49**  
ITEM 498 HISTOGRAM



The histogram for item 556 is at Figure 4-50. The responses in this case are also consistent with the premise of the item. Responses to the two items are also correlated ( $r = 0.6$ ,  $p = 0.0$ ). The results support the hypothesis.

FIGURE 4-50  
ITEM 556 HISTOGRAM

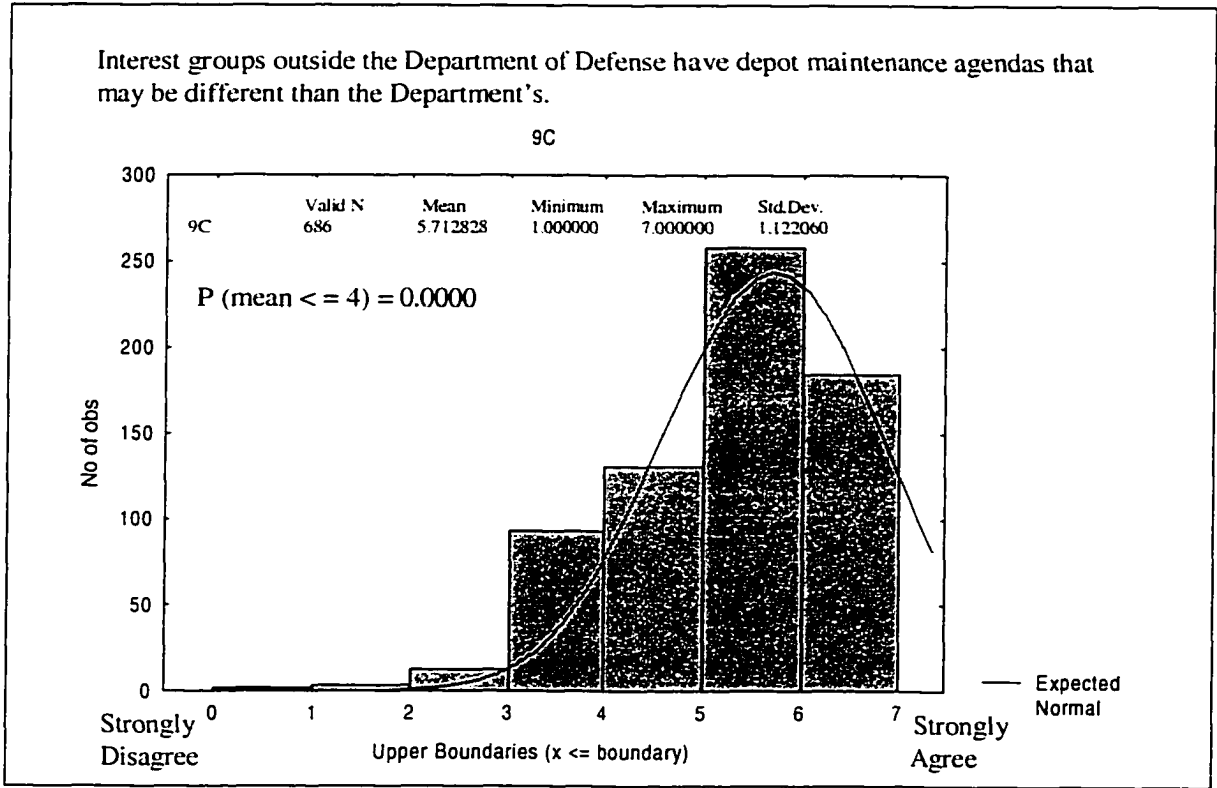


*H27 External interest groups influence the public versus commercial choice*

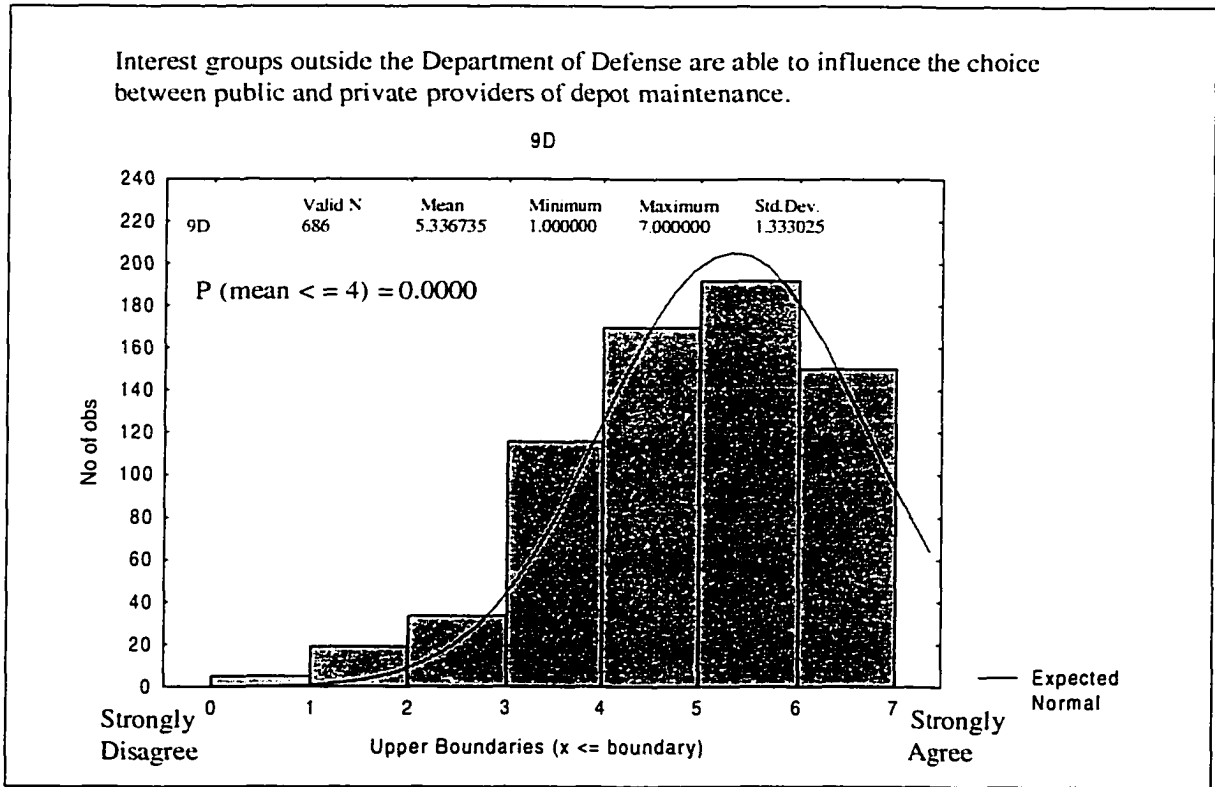
This hypothesis had two related items, 499 (question 9C) and 557 (question 9D). The histogram for item 499 is at Figure 4-51, and the histogram for item 557 at Figure 4-52

In both cases the response is consistent with the premise of the respective hypothesis. The responses in this case are also correlated ( $r = 0.6$ ,  $p = 0.0$ ). The results support the hypothesis.

**FIGURE 4-51**  
ITEM 499 HISTOGRAM



**FIGURE 4-52**  
ITEM 557 HISTOGRAM



## Summary of Results for Construct 7, Public Choice Theory

Both of the hypotheses drawn from public choice theory are supported (Table 4-45).

**TABLE 4-45**  
**CONSTRUCT 7 RESULTS**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H26	Interest groups internal to government (i.e. Department of Defense, ministry of defense, or other government agency as applicable) will be perceived as influencing the choice of public versus commercial provision of depot maintenance.	Supported	Item 498. Premise—that within DoD different interest groups with different agendas have formed—was supported.  Item 556. Premise that interest groups inside DoD are able to influence the choice between public and private providers—was supported
H27	Interest groups external to government (i.e. Department of Defense, ministry of defense, or other government agency as applicable) will be perceived as influencing the choice of public versus commercial provision of depot maintenance.	Supported	Item 499. Premise—that interest groups outside the DoD have depot maintenance agendas that may be different from the department's—was supported.  Item 557. Premise—that interest groups outside DoD are able to influence the choice between public and providers—was supported.

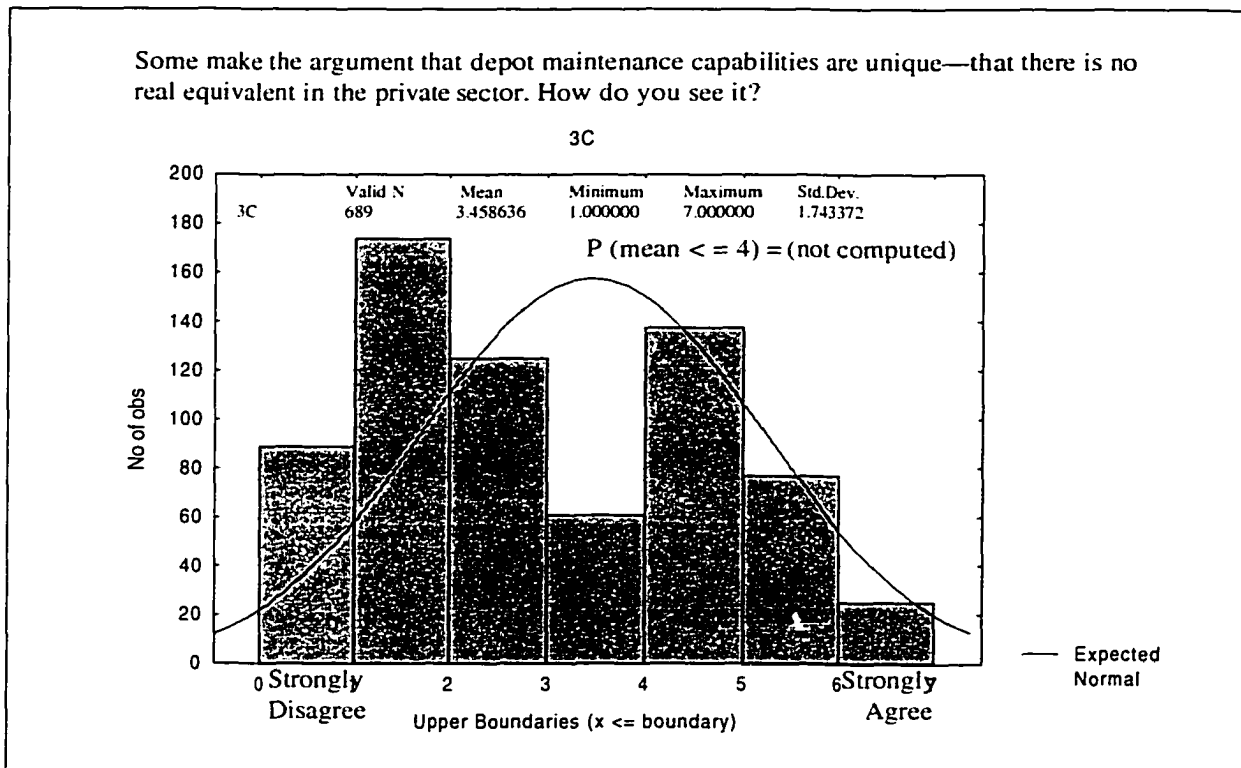
## Analysis of Apparent Bimodal Responses

### The Problem

In 17 cases, histograms of responses showed evidence of bimodality rather than central tendency. An example is the pattern of responses to item 477, in Figure 4-53.

When performing ANOVA using the six dimensions coded a priori (system, sector, component, organizational level, maintenance level, and function), the bimodal patterns persisted across most or all of the dimensions (excepting sector). Thus there appeared to be some other factor (or factors) not coded in the data that was important.

**FIGURE 4-53**  
**BIMODAL RESPONSE PATTERN**



The relatively strong opinions on the part of some survey participants, as reflected in their written responses to questions 21 and 22, suggested that specific experiences, both positive and negative, might be coloring the responses to items such as number 477. Of the 694 individuals who responded to the survey before data cutoff, 406 provided written comments to question 21, question 22, or both. Some representative sample comments follow. (The intent of question 21 was to gather information on particular circumstances the respondents had in mind when completing section II of the survey, and the intent of question 22 was to gather general comments, but the respondents did not always observe these instructions. Therefore the two were considered together.) Ellipses by the author to remove specific identifying information are enclosed in square brackets.

**Comment 1** We have established a great relationship with our depot—it has taken a while. There are times when the depot appears to not move fast enough for us, but usually that comes down to tooling limitations.



- Comment 2 I work with both private and public depot maintenance on a daily basis. DoD depots have the concern and urgency of the soldier's mission as priority one. Kosovo & Bosnia are good example of the DoD depot support we got and continue to receive. The private sector goes bankrupt, then what? It happened twice and we went back to depot for help.
- Comment 3 We also have several private industries doing depot level maintenance. The response from the commercial sector is excellent: however, it has CALS. I think the key is responsiveness. Whether commercial or government, the compensation should be based on "performance," as well as quality.
- Comment 4 The best comparison and results are the [aircraft] programmed depot maintenance. The commercial site in [city and state] is providing an outstanding product in a faster time frame than [DoD depot at location].
- Comment 5 The [aircraft] program depot maintenance line and [specific engine] engine depot are perfect examples where we needed to go to private provider because the depot was a failure at meeting workload quantity and quality. New weapon systems should be supported by the private manufacturer of the item.
- Comment 6 I was once the maintenance officer of a naval aviation squadron that had its depot maintenance requirements outsourced to a private company. The company had extremely few people with any significant knowledge of the airframe. The result was delays in depot repairs and, in one case, the return to the squadron of an aircraft that did not have the maintenance conducted as required. This incident resulted in the development of damage to the aircraft that nearly caused the loss of the aircraft and crew. Later inspection of the aircraft revealed the section of the aircraft painted over, hiding the fact that a requirement to sand down to bare metal and inspect for cracks had not been performed. Needless to say, I am not a fan of outsourcing. My experience saw the lowest bidder get the contract followed by cost and production overruns that cost the government more in the long run. The company referred to above eventually lost the contract. At a considerable cost to my squadron, the customer.

Note that the first four comments show relatively strong recollections of specific positive experiences with either public or commercial providers of depot maintenance. The

fifth and sixth are negative experiences and explicitly tie these experiences to an overall preference.

Therein lies a clue. It is held (Meyer and Booker 1991, 41-42) that because of cognitive limitations people start with a first impression, reach a "solution" based on that impression, and will probably not take later data sufficiently into account when generating a final answer. This is known as anchoring bias. A related problem is availability bias, in which conclusions are based on catastrophic, familiar, concrete, or recent events that are relatively easy to recall. Evidence of both forms of bias occurs in the comments above.

### Approach

To explore if such biases were operating, the author reviewed the written comments and coded them, using the scheme in Table 4-46, for expressed experience with public depots, expressed experience with commercial sources, and overall preference for one sector or the other. It was possible to code 50 responses with regard to public depot experience, 54 with regard to commercial experience, and 111 for sector preference. In the balance of survey instruments with comments, experience with or preference for one sector or the other either was not reported or was not sufficiently clear for the author to encode.

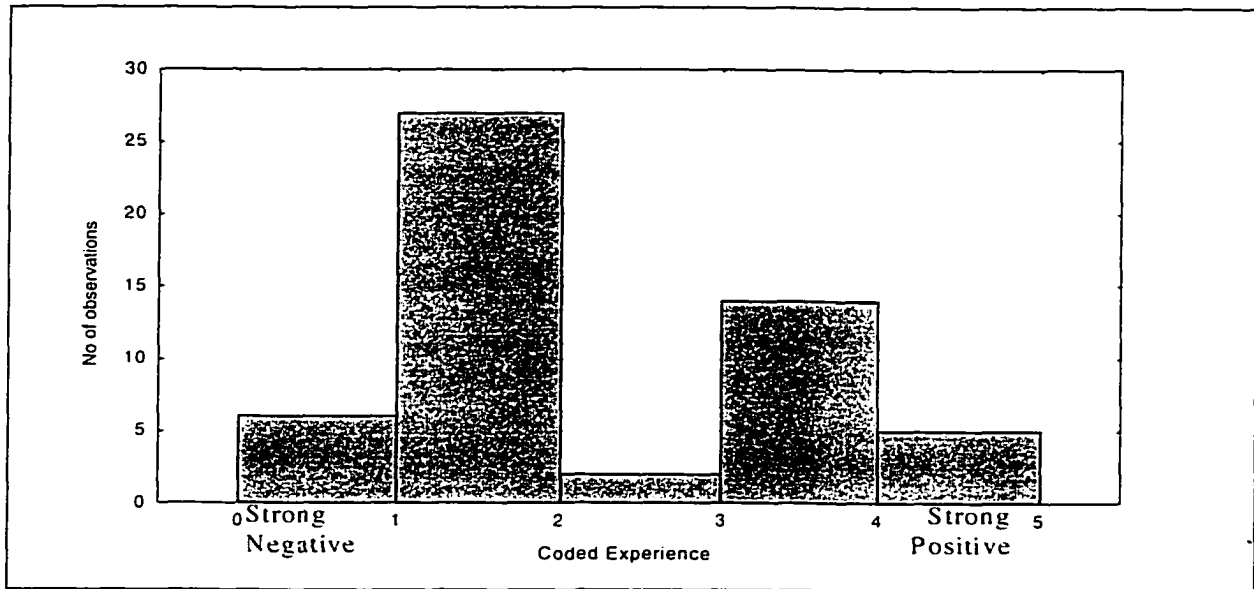
**TABLE 4-46**  
**SCORING SCHEME FOR NARRATIVE COMMENTS**

Score	Type of Comment	
	Expressed Experience	Expressed Sector Preference
1	Strongly negative	Strong preference for public
2	Negative	Preference for public
3	Neutral	Neutral
4	Positive	Preference for commercial
5	Strongly positive	Strong preference for commercial

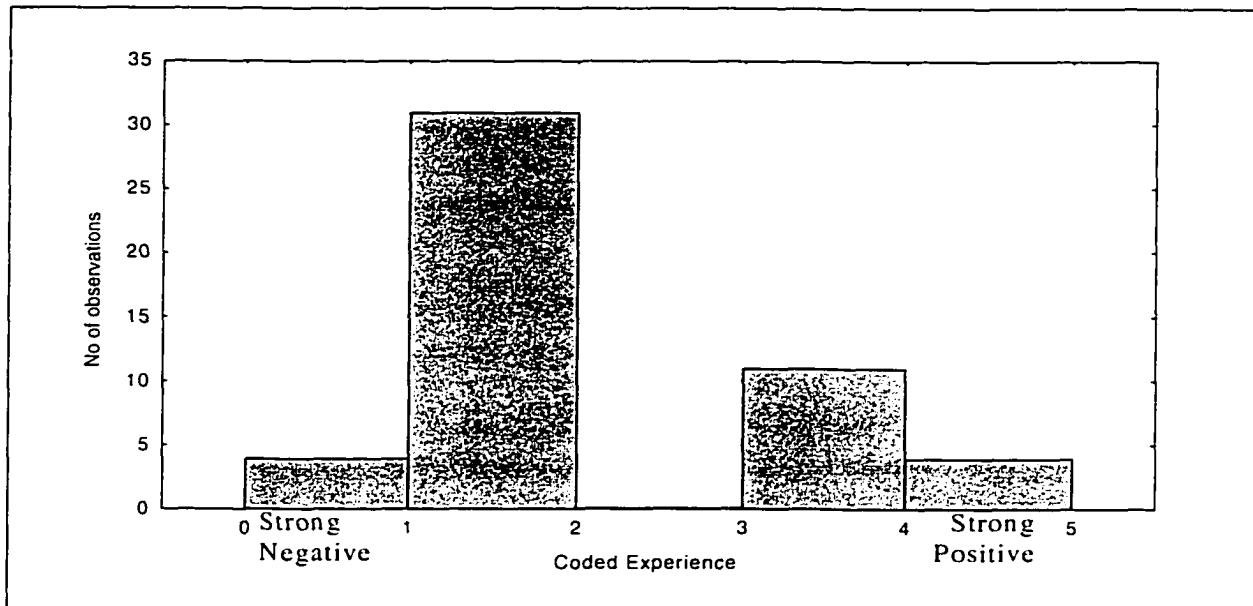
### Results.

Figure 4-54 is a plot of the coded commercial experiences and Figure 4-55 is a similar plot of coded public experiences. Note the virtual absence of neutral responses in the case of commercial experience and the complete absence of neutral responses in the case

**FIGURE 4-54**  
**PLOT OF CODED COMMERCIAL EXPERIENCE**



**FIGURE 4-55**  
**PLOT OF CODED PUBLIC EXPERIENCE**

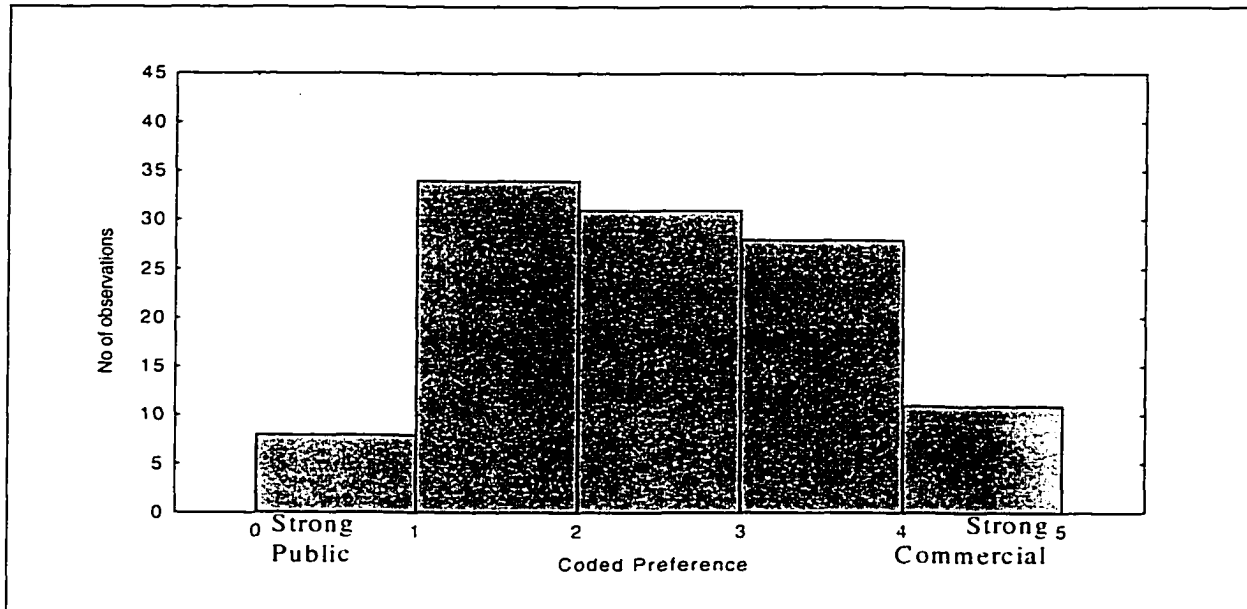


of public experience. Figure 4-56 is the plot for sector preference, which reveals a middle ground.

Figure 4-54 and Figure 4-55 are clearly bimodal. Further, negative experiences dominate positive ones. Because of the nearly total absence of perceived neutral experiences in these two histograms, the author simplified the analysis further by aggregat-

ing positive responses (4 and 5) and negative responses (1 and 2), and ignoring the very few neutral responses (3). By similarly treating the responses to item 477 (aggregating all 1, 2, and 3 responses, all 5, 6, and 7 responses, and ignoring 4), it was then possible to construct a two-by-two contingency table and test for a relationship between perceived experience and perceived uniqueness of public depot capabilities. The results are at Table 4-47. The

**FIGURE 4-56**  
PLOT OF CODED SECTOR PERFORMANCE



relationship between coded experience with the commercial sector and responses to item 477 is statistically significant at the  $\alpha = 0.10$  level. The result in this table is interpreted to indicate that

- If respondents expect private firms to be able to deliver needed depot maintenance work without a start-up delay then prior experience with private firms will have been negative about half the time but positive nearly 80% of the time.
- Similarly, if the expectation is that private firms cannot deliver needed work without a start-up delay then prior experience with private firms will have been positive only about 20% of the time.

Note that there was about a 50/50 chance of negative experiences. In this instance, it is the presence or absence of positive experiences that appears to determine expectations..

**TABLE 4-47**  
**RELATING EXPERIENCE WITH PRIVATE FIRMS TO EXPECTED ABILITY OF PRIVATE FIRMS TO DELIVER NEEDED WORK WITHOUT DELAY**

		Experience with Private Firms	
		Negative (1-2) (N = 32)	Positive (4-5) (N = 19)
Private firms are expected to deliver needed work without delay.	Yes (1-3)	46.9%	78.9%
	No (5-7)	53.1%	21.1%
		100.0%	100.0%

Chi square statistically significant a 0.10 level.

The author prepared similar contingency tables for commercial experience, public experience, and sector preference for the 17 items whose histograms appeared to be bimodal. In preparing the contingency tables for sector preference, the author intentionally filtered out neutral (3) responses in order to emphasize polar positions. The results are summarized in Table 4-48. For the first five items in Table 4-48, experience with commercial providers, experience with public providers, and sector preference are clearly related to the responses to the items themselves. These five items, when examined using exploratory factor analysis, also load on a single factor.

**TABLE 4-48**  
**CONTINGENCY ANALYSIS SUMMARIZED**

Item	Question	Commercial Experience		Public Experience		Sector Preference		Dimensions Significant	Also load on Single Factor
		$\chi^2$	Sig. Level	$\chi^2$	Sig. Level	$\chi^2$	Sig. Level		
477	3C	3.83	0.10	6.23	0.05	24.96	0.005	3	◆
547	5E	11.34	0.005	5.51	0.05	44.02	0.005	3	◆
491	7A	14.17	0.005	4.41	0.05	22.60	0.005	3	◆
515	12A	18.24	0.005	3.82	0.10	39.28	0.005	3	◆
489	19F	12.54	0.005	6.37	0.05	31.58	0.005	3	◆
483	3B	4.15	0.05	1.77		21.27	0.005	2	
586	5D	1.63		1.65		0.22			
490	5G	3.62	0.10	0.07		0.01		1	

TABLE 4-48  
CONTINGENCY ANALYSIS SUMMARIZED (CONTINUED)

Item	Question	Commercial Experience		Public Experience		Sector Preference		Dimensions Significant	Also load on Single Factor
		$\chi^2$	Sig. Level	$\chi^2$	Sig. Level	$\chi^2$	Sig. Level		
503	5H	1.18		2.41		13.11	0.005	1	
549	7B	0.70		3.86	0.05	8.86	0.005	2	
560	7H	0.88		0.03		13.67	0.005	1	
572	12E	0.57		0.22		0.40			
571	12F	1.43		4.68	0.05	0.32		1	
594	20C	1.33		1.58		4.71	0.05	1	
612	20D	1.69		5.63	0.05	5.73	0.05	2	
518	12I	0.04		0.04		0.01			
573	12J	0.01		0.01		0.76			
Number significant			7	—	8	—	11	13	

Table 4-49 recalls the text for these five items. That item 515 is related to sector preference as found in the comments is no surprise, since it is a statement of sector preference itself. The other four require a different kind of understanding. In the light of the Chapter 2 literature review—as it pertains to DoD depot maintenance literature specifically—these appear to be among the central issues that define the debate over public versus commercial depot maintenance.

TABLE 4-49  
BIMODAL ITEMS WITH COMMON FACTOR

Item	Text
477	Some make the argument that depot maintenance capabilities are unique—that there is no real equivalent in the private sector. How do you see it?
547	The military would experience a loss of control by outsourcing depot maintenance to the private sector.
491	Private providers of depot maintenance have conflicts of interest (e.g., between their objectives and their government customer's objectives) that get in the way of effective depot maintenance.
515	All things considered, the Department of Defense is better served if it does most depot maintenance itself.
489	Outsourcing of depot maintenance to private providers increases DoD's risk because private providers cannot respond fast enough when requirements change.

Accordingly, we will refer to the underlying factor as the central issues factor. The author believes it is noteworthy that the response patterns for these central issues are bimodal, because it suggests that there are two underlying populations (call them the public sector proponents and private sector proponents) whose overall preference for a sector and specific, sharply recalled experiences shape their views of the central issues.

There were four items (586, 572, 518, 573) in Table 4-48 for which contingency table analysis did not reveal a relationship. Table 4-50 recalls the text for these items, which differ in kind from the items in Table 4-49. Whereas the items in Table 4-49 all directly relate to differences between public and private providers, none of the items in Table 4-50 do. Further, reexamination of the histograms—particularly for items 586, 572, and 518—suggests that what appeared to be possible bimodality may have simply been unavoidable noise in the data.

**TABLE 4-50**  
**ITEMS WITH NON-SIGNIFICANT CONTINGENCY TABLE RESULTS**

Item	Text
586	There are well-defined criteria to measure the performance level of depot maintenance providers.
572	Generally speaking, most people who work with depot maintenance understand the purpose of increasing the amount of depot maintenance that is outsourced.
518	Top-level management is interested in seeing more depot maintenance outsourced.
573	Depot maintenance managers know that top-level management is interested in seeing more depot maintenance outsourced.

The remaining 8 out of the original 17 potentially bimodal items are recalled in Table 4-51, beginning with the 3 items that had significant contingency analysis results on two dimensions and the 5 that were significant on one dimension. Within these two groupings, the items are sorted by overall chi square value for the dimensions that were significant.

**TABLE 4-51**  
**CONTINGENCY ANALYSIS ITEMS WITH ONE OR TWO SIGNIFICANT DIMENSIONS**

<b>Item</b>	<b>Significant Dimensions</b>	<b>Text</b>
483	2	How often would you expect to be able to find private firms who can deliver the quantity of depot maintenance work that is needed without an initial start-up delay?
549	2	Public depots have conflicts of interest (e.g., between their objectives and their government customer's objectives) that get in the way of effective depot maintenance.
612	2	How difficult is it (or would it be) to create a competitive marketplace for depot maintenance work?
560	1	To make sure that the government knows what it is asking for and getting, it is important that the government do at least some depot maintenance work itself.
503	1	The choice between public and private providers should depend on the relative cost to the government.
594	1	How difficult is it (or would it be) to determine the existence of a competitive marketplace for depot maintenance work?
571	1	Generally speaking, most people who deal with depot maintenance understand the benefits of increasing the amount of depot maintenance that is outsourced.
490	1	Most of the jobs in depot maintenance are routine. Unique and one-of-a-kind repairs are unusual.

The first three items in Table 4-51, like those in Table 4-49, are assertions about the commercial marketplace, public marketplace, or both. The remaining five (excepting 490) are more related to the process for choosing or managing providers. In that sense it is probably not surprising that these five are less tightly tied to perceived commercial experience,



perceived public experience, or overall sector preference. However, they do remain statistically tied to the coded responses for these three dimensions.

### Check for Encoding Bias

The findings in this section depend on the process for encoding the written comments. Relying on the encoding of a single person could unintentionally introduce personal bias into the results. To help ensure that the process was reasonably free from such bias, the author arranged for a knowledgeable analyst from the Logistics Management Institute to independently replicate the process. The two efforts did not result in exactly the same comments being encoded, or always agree on the choice between, say, “positive” and “strong positive.” However, for items that both reviewers encoded there was a high degree of agreement on the binary choice between “negative” and “positive” or “commercial” and “public” (Table 4-52). Thus the author concluded that the binary encoding process was reasonably free from personal bias. Since it is the binary choices that are the basis for contingency table analysis reported above, the results in this section are also reasonably free from the effects of personal bias.

**TABLE 4-52**  
COMPARISON OF ENCODED COMMENTS

<b>Encoding of:</b>	<b>Code</b>	<b>Person A</b>	<b>Person B</b>
Experience with commercial providers	Negative	29	29
	Positive	17	17
	Total	46	46
Experience with public providers	Negative	29	30
	Positive	12	11
	Total	41	41
Sector preference	Public	16	17
	Commercial	13	12
	Total	29	29



# CHAPTER 5

## ANALYSIS OF SURVEY RESULTS: CONSTRUCTS 8 THROUGH 14

### Introduction

This chapter is a continuation of analysis of the survey results. Whereas Chapter 4 covered economic constructs, this chapter covers constructs 8 through 14—those from fields other than economics.

As stated in Chapter 4, at the highest level in the present research are the 14 broad theoretical constructs such as rational action, transaction cost economics, and principal-agent theory. Associated hypotheses will act to either confirm or disconfirm that the constituencies surveyed hold values and norms consistent with the constructs. Table 5-1 summarizes the relationship between the theoretical constructs and hypotheses. We begin the present chapter with construct 8, privatization.

**TABLE 5-1**  
**RELATIONSHIP BETWEEN CONSTRUCTS AND HYPOTHESES**

Theoretical Construct	Related Confirming Hypotheses	Related Disconfirming Hypotheses
1. Rational model	H01	H56, H57
2. Imperfect competition	H02, H03, H04, H05, H06, H30	
3. Market failure	H07, H08	

**TABLE 5-1**  
**RELATIONSHIP BETWEEN CONSTRUCTS AND HYPOTHESES (CONTINUED)**

<b>Theoretical Construct</b>	<b>Related Confirming Hypotheses</b>	<b>Related Disconfirming Hypotheses</b>
4. Economy of scale and scope	H09, H10	
5. Transaction cost economics	H11, H12, H13, H14, H15, H16, H17	H48, H49, H50
6. Principal-agent theory	H18, H19, H20, H21, H22, H23, H24, H25	H48, H49, H50
7. Public choice theory	H26, H27	
8. Privatization and theory of non-market failure	H17, H25, H28, H29, H30, H31, H32, H33, H37	
9. Resource/competency-based theory	H35, H36, H37, H38, H39, H40, H41, H42	H34
10. Administrative innovations and isomorphism	H43, H44, H45, H46, H47	
11. Relational/social exchange theory	H48, H49, H50, H51, H52	H11, H12, H13, H14, H24
12. Logistics and supply chain management	H51, H52, H53, H54, H55	
13. Garbage can model	H21, H42, H53, H56, H57	H01
14. Political economy and bureaucratic politics	H47, H58, H59, H60	

### **Construct 8—Privatization**

#### Related Hypotheses

There are nine hypotheses for the privatization construct, all of which are confirming. These hypotheses are restated in Table 5-2.

**TABLE 5-2**  
**PRIVATIZATION HYPOTHESES**

H17	The choice between public and commercial providers of depot maintenance will be perceived to depend on the total cost where total cost is the sum of production cost and transaction costs.
H25	Retention by the government of smart buyer capability will be perceived as important.
H28	Private provision of goods and services will be preferred, in general, to public provision.
H29	Private providers of depot maintenance will be perceived as more efficient at depot maintenance than their public counterparts.
H30	The availability of a competitive marketplace will be perceived as mattering if government is to benefit from commercial capabilities.
H31	Compared to government, commercial firms will be perceived as having better dynamic efficiency—the ability to develop new technology that lowers cost functions, improves product quality, and creates new and marketable products
H32	Compared to government, commercial firms will be perceived as having better technological efficiency—the ability to find and employ the best technology currently available, thus producing at lower cost and higher quality
H33	Compared to government, commercial firms will be perceived as having better X-efficiency—the ability, given a specific technology, to reduce cost, raise productivity, and improve quality through changes in organization, management practices, and worker motivation.
H37	Government depot maintenance capability is perceived to be a core government logistics competency.

*H17 Choice between public and commercial providers depends on sum of production and transaction costs*

We examined this hypothesis previously in Chapter 4 (page 195) under the section on transaction cost economics and found that the hypothesis was supported.

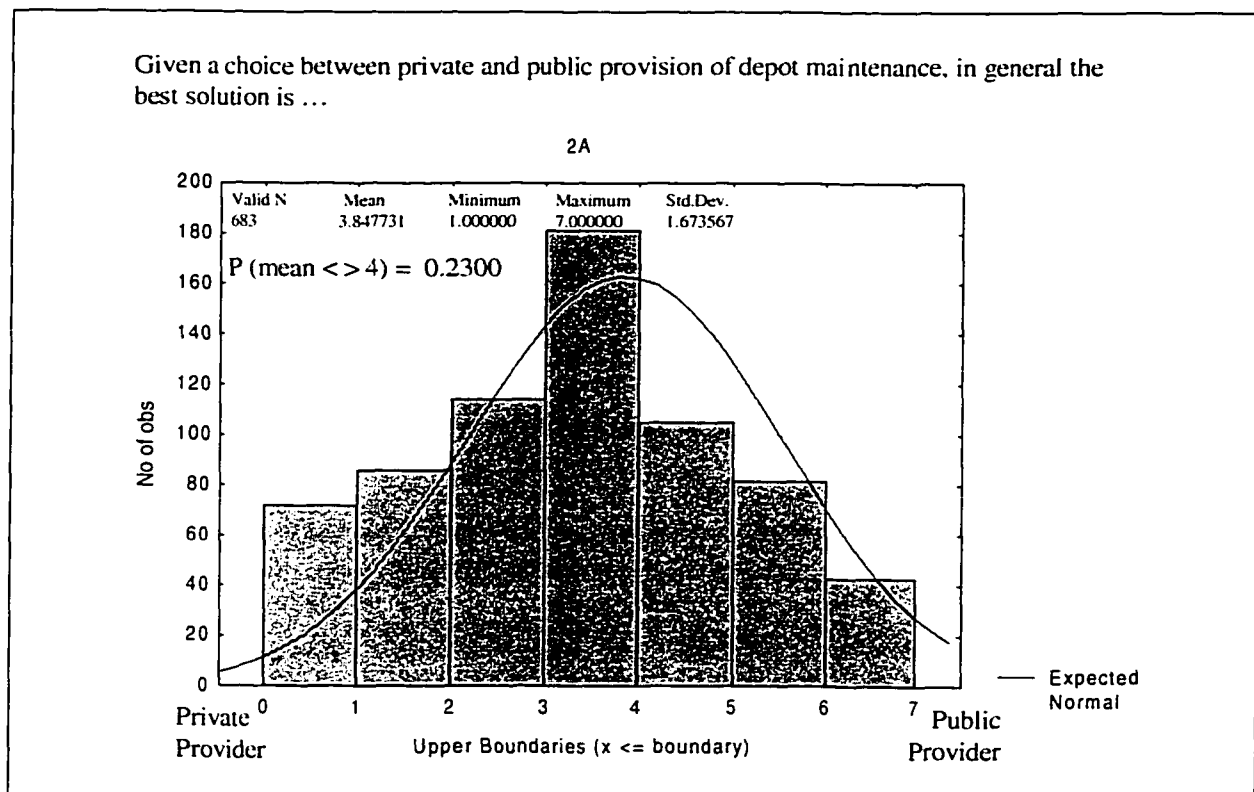
*H25 Importance of smart buyer capability*

We also previously examined this hypothesis in Chapter 4 (page 215) under the section on transaction cost economics and found that the hypothesis was supported.

*H28 Private provision will be preferred, in general, to public provision*

This hypothesis has one associated item, 532 (question 2A). The histogram for item 532 is at Figure 5-1. The mean of the responses for the aggregated data is not statistically different from 4, i.e., there is no particular preference for either public or private providers of depot maintenance. However, this is not to say that there is consensus on the subject, because the aggregated data shown in Figure 5-1 hide disagreement that can be made more visible through ANOVA.

**FIGURE 5-1**  
ITEM 532 HISTOGRAM



ANOVA showed significant differences among means on all six dimensions considered (function, component, organizational level, maintenance level, system, and sector). In the case of the sector dimension, although there was a difference between DoD and industry, both means were less than 4 (DoD only slightly so); thus, this difference is more one of degree than direction. The other dimensions reveal more interesting differences. On the functional dimension (Table 5-3), those in acquisition, who do appear to prefer private providers, are in statistically significant disagreement with those in maintenance, who prefer public providers.

TABLE 5-3  
ITEM 532 ANOVA POST HOC ANALYSIS: FUNCTION

Unequal N HSD; variable 2A								
Probabilities for Post Hoc Tests								
MAIN EFFECT: FUNCTION								
	{1}	{2}	{3}	{4}	{5}	{6}	{7}	{8}
	4.2249	4.2353	4.0674	3.6455	4.2692	3.6099	3.5882	3.5000
Maintenance {1}		1.0000	0.9981	0.1346	1.0000	<u>0.0301</u>	0.9457	0.9998
Support other {2}	1.0000		0.9999	0.8045	1.0000	0.7525	0.9409	0.9998
Logistics {3}	0.9981	0.9999		0.6587	0.9998	0.5578	0.9890	1.0000
Operations {4}	0.1346	0.8045	0.6587		0.8609	1.0000	1.0000	1.0000
Materiel Mgt. {5}	1.0000	1.0000	0.9998	0.8609		0.8225	0.9233	0.9998
Acquisition {6}	<u>0.0301</u>	0.7525	0.5578	1.0000	0.8225		1.0000	1.0000
Other non-support {7}	0.9457	0.9409	0.9890	1.0000	0.9233	1.0000		1.0000
Indeterminate {8}	0.9998	0.9998	1.0000	1.0000	0.9998	1.0000	1.0000	

Significance at 0.05 underlined

As Table 5-4 illustrates, on the component dimension Army respondents, who prefer public providers, are in disagreement with respondents from the Navy and OSD/JCS, who prefer private providers.

When considering the organizational level (Table 5-5), respondents belonging to OSD/JCS, again, show up as preferring the choice of private providers. Respondents belonging to component headquarters appear to prefer public providers.

**TABLE 5-4**  
**ITEM 532 ANOVA POST HOC ANALYSIS: COMPONENT**

<b>Unequal N HSD; variable 2A</b>							
Probabilities for Post Hoc Tests							
<b>MAIN EFFECT: COMPONENT</b>							
	{1}	{2}	{3}	{4}	{5}	{6}	{7}
Means	4.0046	4.3442	3.7857	3.7260	3.1667	3.7273	3.7000
Air Force {1}		0.5141	0.9961	0.7584	0.2916	0.9976	0.9996
Army {2}	0.5141		0.6897	<u>0.0180</u>	<u>0.0317</u>	0.8657	0.9736
USMC {3}	0.9961	0.6897		1.0000	0.6625	1.0000	1.0000
Navy {4}	0.7584	<u>0.0180</u>	1.0000		0.7609	1.0000	1.0000
OSD/JCS {5}	0.2916	<u>0.0317</u>	0.6625	0.7609		0.9110	0.9901
Other {6}	0.9976	0.8657	1.0000	1.0000	0.9110		1.0000
DLA {7}	0.9996	0.9736	1.0000	1.0000	0.9901	1.0000	

Significance at 0.05 underlined.

**TABLE 5-5**  
**ITEM 532 ANOVA POST HOC ANALYSIS: ORGANIZATIONAL LEVEL**

<b>Unequal N HSD; variable 2A</b>			
Probabilities for Post Hoc Tests			
<b>MAIN EFFECT: ORGANIZATIONAL LEVEL</b>			
	{1}	{2}	{3}
Means	4.1111	3.9814	3.1667
Component {1}		0.9092	<u>0.0360</u>
Field {2}	0.9092		0.0836
OSD/JCS {3}	<u>0.0360</u>	0.0836	

Significance at 0.05 underlined.



On the maintenance level dimension (Table 5-6) there is a relatively clear distinction between respondents in depot maintenance, who appear to prefer public providers, and those who are either at the field level or not involved in maintenance. Here again, although there is also a distinction involving field maintenance, the author is inclined to make less a point of it because the mean is so close to 4.

**TABLE 5-6**  
**ITEM 532 ANOVA POST HOC ANALYSIS: MAINTENANCE LEVEL**

<b>Unequal N HSD; Variable 2A</b>				
Probabilities for Post Hoc Tests				
<b>MAIN EFFECT: MAINTENANCE LEVEL</b>				
	{1}	{2}	{3}	{4}
Means	4.8000	3.7440	5.0313	3.9547
HHQ Management {1}		0.2729	0.9792	0.4733
N/A {2}	0.2729		<u>0.0074</u>	0.4577
Depot Maintenance {3}	0.9792	<u>0.0074</u>		<u>0.0368</u>
Field Maintenance {4}	0.4733	0.4577	<u>0.0368</u>	

Significance at 0.05 underlined.

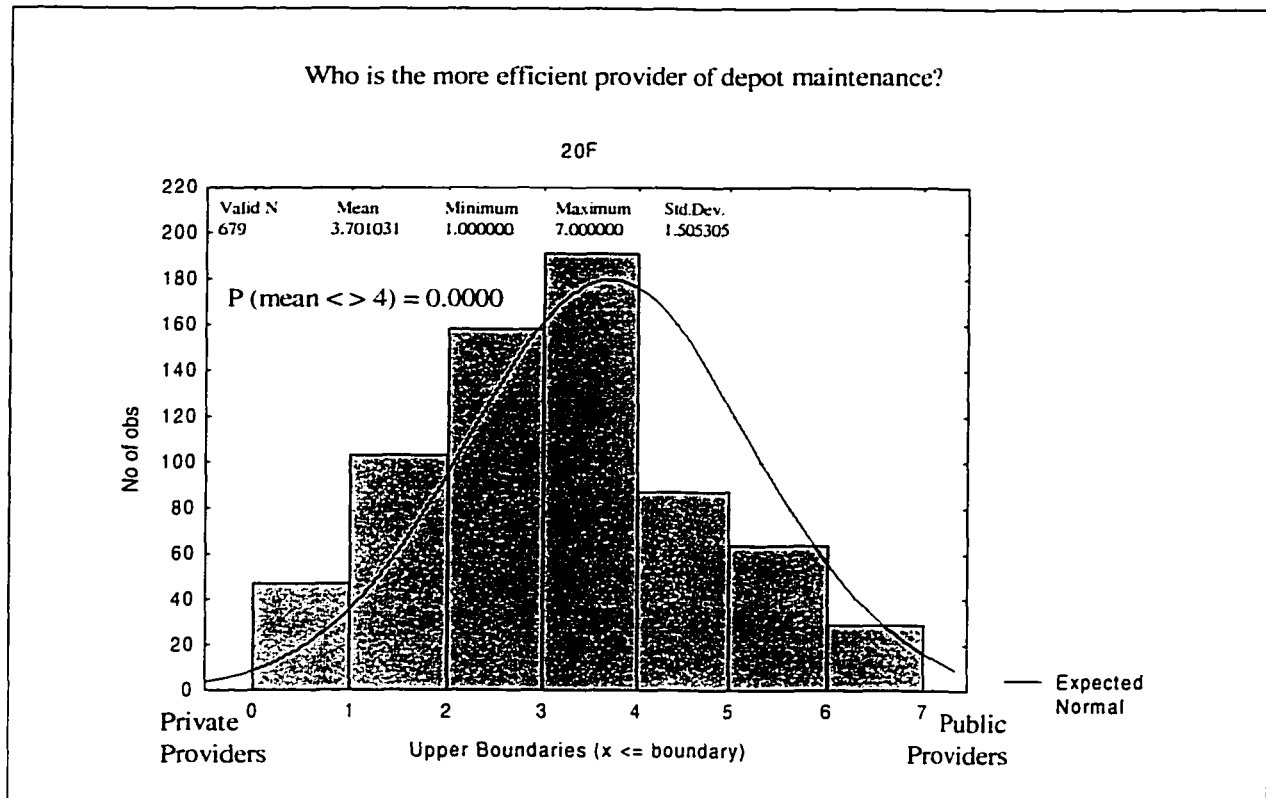
Summarizing, those not involved in maintenance appear to prefer private providers. Those involved in maintenance prefer public providers, with those most directly involved in depot maintenance (either in depot maintenance itself or in higher headquarters management of depot maintenance) the most likely to do so. Additionally, as discussed in Chapter 4 under the heading of "Analysis of Apparent Bimodal Responses," responses to this item are also related to specific (often negative) prior experiences with public providers, private providers, or both. Considering all of the evidence above, hypothesis H28 is partially supported.

*H29 Private providers of depot maintenance will be perceived as more efficient than public*

This hypothesis has two associated items, 500 (question 20F) and 558 (question 1F). The histogram for item 500 is at Figure 5-2. This question was phrased so that respondents indicated which provider was more efficient (not whether they agreed that one

specific provider was efficient). Therefore the author computed a two-tailed probability. We can reject the notion that respondents were indifferent. Further, the results indicate that respondents tend to view private providers as the more efficient.

FIGURE 5-2  
ITEM 500 HISTOGRAM

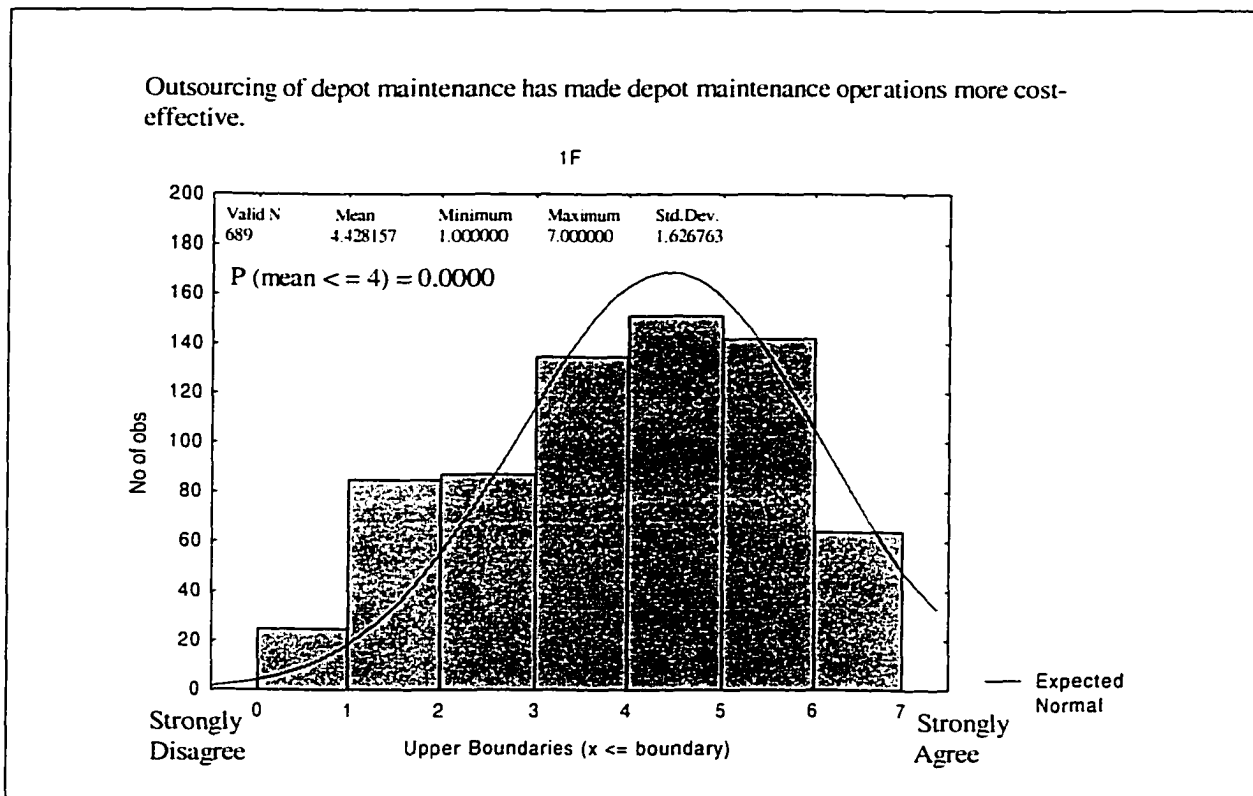


The second item under this hypothesis was number 558. This histogram for this item is at Figure 5-3. Respondents to the survey tended, on average, to agree with the statement. The responses to both items, then, support hypothesis H29.

### *H30 Importance of availability of a competitive marketplace*

Hypothesis H30 has four associated items: 559 (question 3D), 624 (question 1B), 594 (question 20C), and 612 (question 20D). We previously discussed this hypothesis in Chapter 4 (page 166) under the topic of imperfect competition. There we noted that respondents perceive that it is difficult to establish that a competitive marketplace exists or to create one. Further they perceive that it is both important to avoid being in a sole-source

FIGURE 5-3  
ITEM 558 HISTOGRAM



situation and that one of the rationales for government depots is to prevent sole-source situations. The hypothesis—the availability of a competitive marketplace will be perceived as mattering if government is to benefit from commercial capabilities—was supported.

### *H31 Dynamic efficiency*

Hypothesis H31 has three associated items: 504 (question 2D), 562 (question 2F), and 595 (question 2D). All three items load strongly on a single factor (Table 5-7) and Cronbach's alpha is 0.878, so scale reliability is supported. Factor analysis confirmed that all three items were significantly related to the postulated factor, supporting convergent validity. The three items deal respectively with which sector (private or public) is better able to develop new technology to lower cost, improve product quality, and create new products. Because the items loaded on a single factor, the author summed the responses and then divided by 3 so that the results were in the range of 1 to 7. The histogram is at Figure

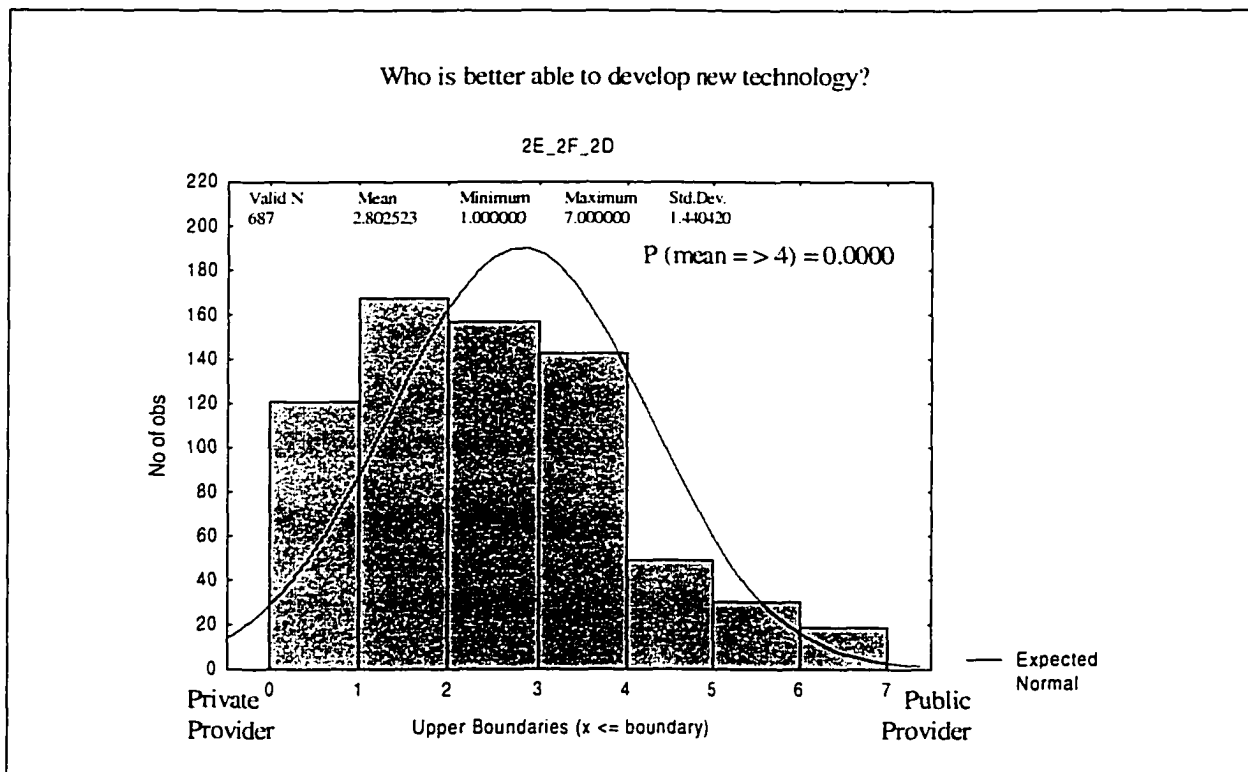
5-4. This is a relatively strong affirmation of a belief in the private sector's better ability to develop new technology. The hypothesis is supported.

**TABLE 5-7**  
**H31 FACTOR ANALYSIS**

Factor Loadings (Unrotated)		
Extraction: Principal components		
Item	Question	Factor 1
595	2D	<u>0.890</u>
504	2E	<u>0.904</u>
562	2F	<u>0.896</u>
Expl. Var		2.412
Prp. Totl		0.804

Significance at 0.05 underlined.

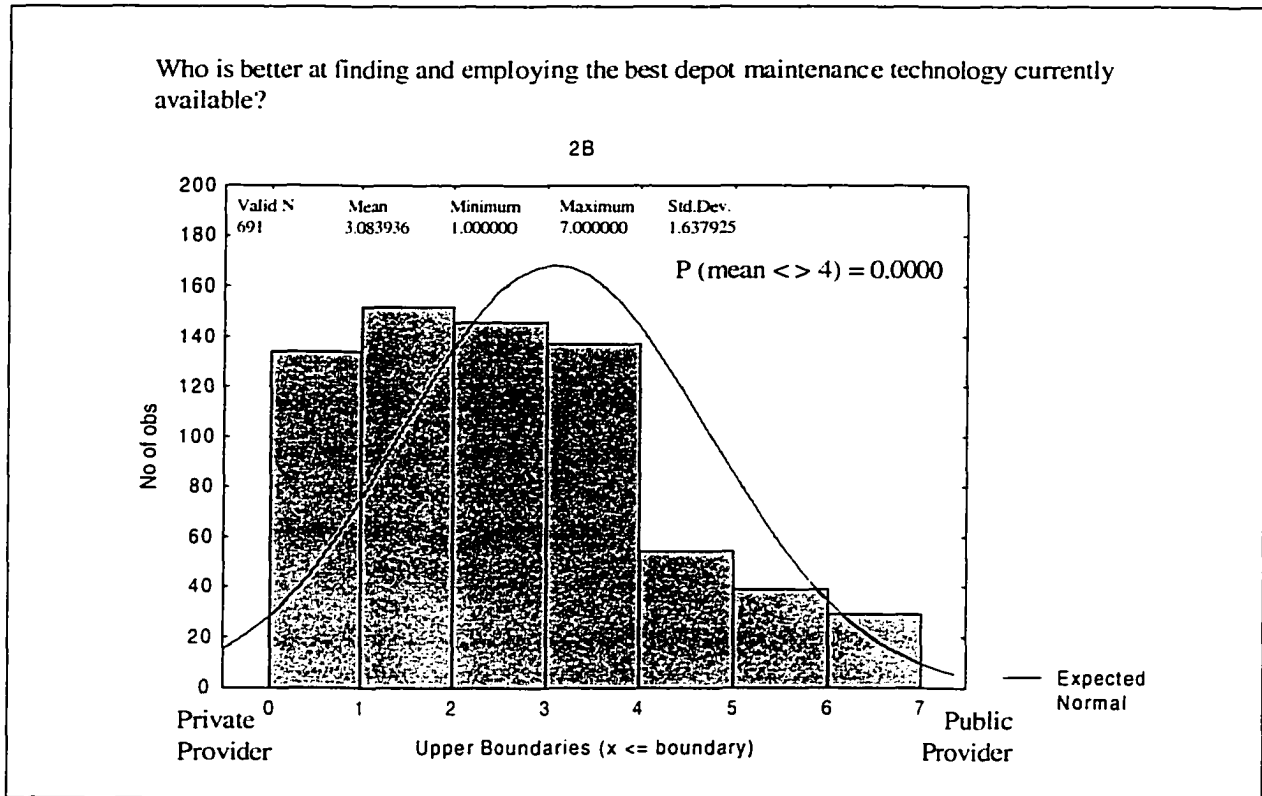
**FIGURE 5-4**  
**HISTOGRAM FOR SUM OF 504, 562, AND 595**



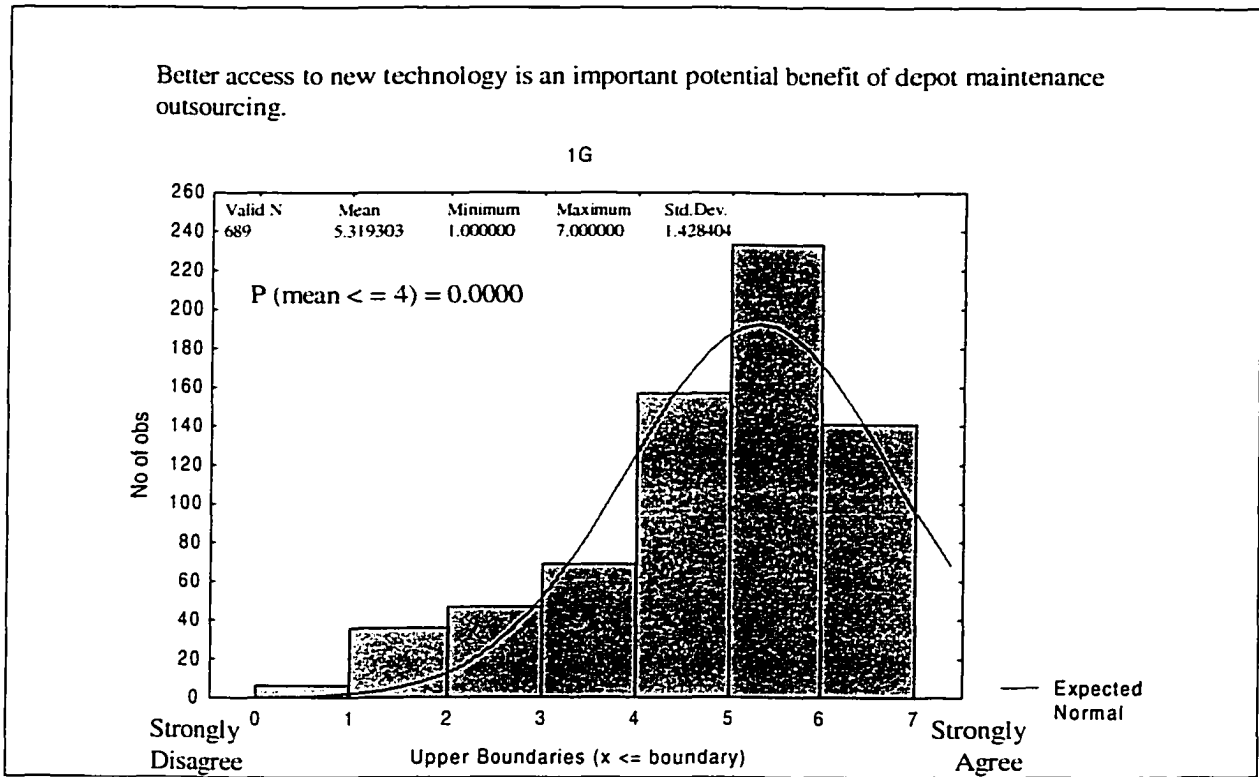
*H32 Technological Efficiency*

Hypothesis H32 also has three items: 505 (question 2B), 563 (question 1G), and 596 (question 3A). The histograms for the individual items, which also show the wording of each question, are at Figure 5-5, Figure 5-6, and Figure 5-7. Factor analysis results are at Table 5-8.

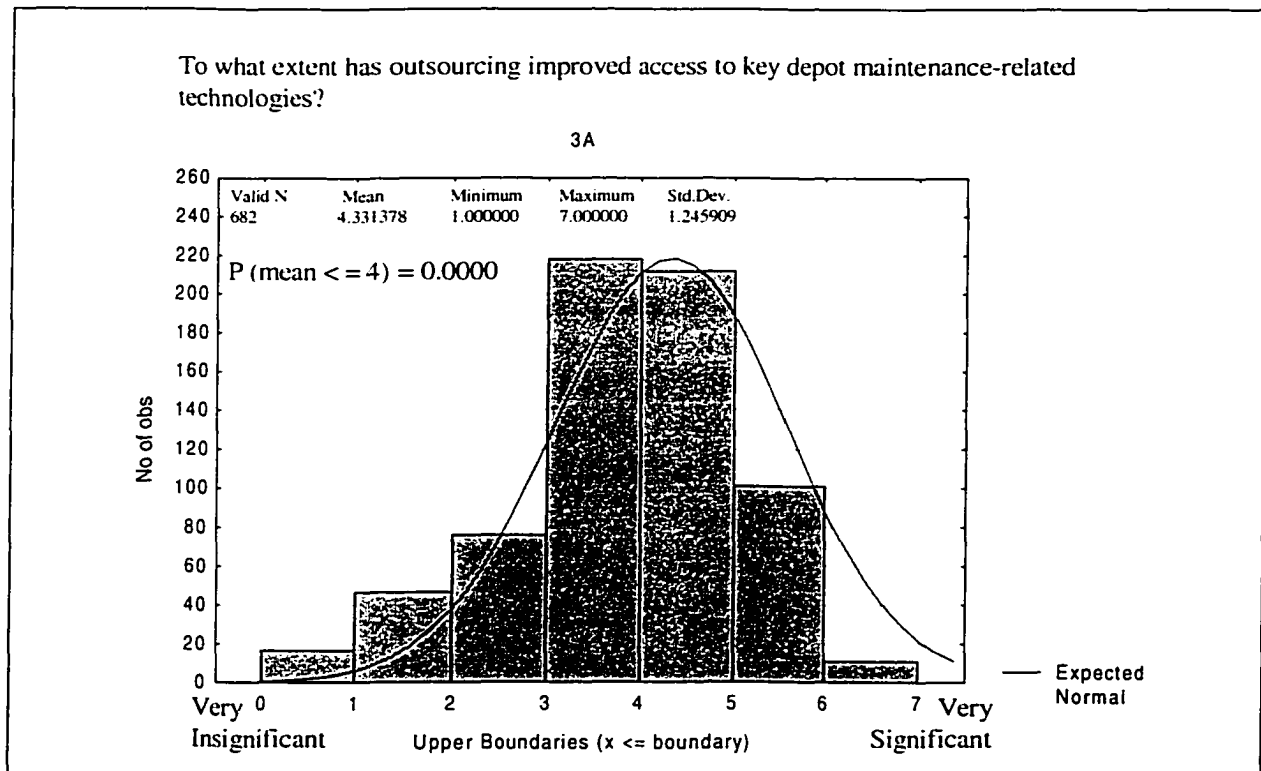
**FIGURE 5-5**  
ITEM 505 HISTOGRAM



**FIGURE 5-6**  
ITEM 563 HISTOGRAM



**FIGURE 5-7**  
ITEM 596 HISTOGRAM



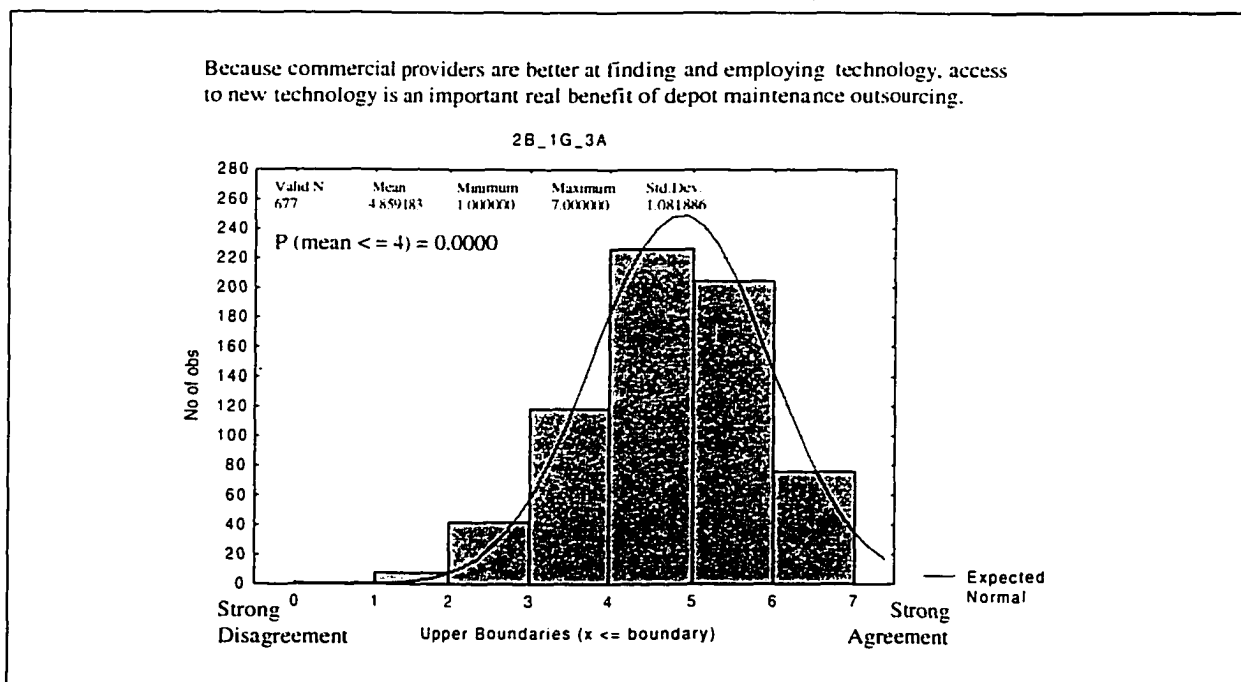
**TABLE 5-8**  
**H32 FACTOR ANALYSIS**

Factor Loadings (Unrotated)		
Extraction: Principal components		
Item	Question	Factor 1
563	1G	<u>-0.838</u>
505	2B	0.655
596	3A	<u>-0.767</u>
Expl. Var		1.719
Prp. Totl		0.573

Underlined loadings exceed 0.70/

The reversed sign for 505 makes sense when one examines the form for each question and the associated scale. Because item 505 nearly reached the 0.7 cutoff point, the author linearly combined the scores by summing the three items while reversing the sense of the scores for 505 (i.e., by subtracting the raw scores from 8) and then dividing by three. This choice is supported because Cronbach's alpha was 0.61 (with the sense of variable 2B reversed), supporting scale reliability. Additionally, confirmatory factor analysis supported convergent validity, with all three items loading significantly on the postulated factor. The histogram of the combined scores is at Figure 5-8. Given this result, the hypothesis is supported.

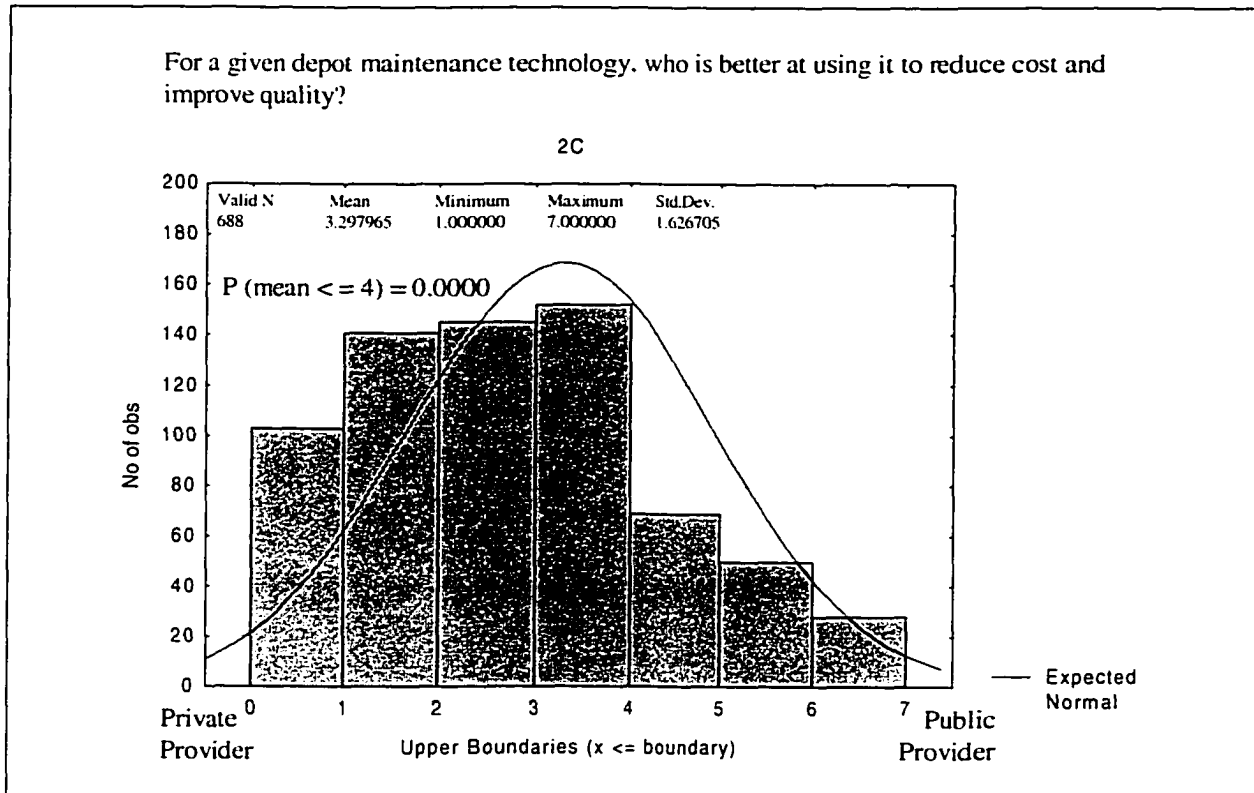
**FIGURE 5-8**  
**HISTOGRAM FOR SUM OF ITEMS 505, 563, AND 596**



### H33 X-efficiency

Hypothesis H33 has one associated item, 506 (question 2C). The histogram is at Figure 5-9. The results indicate that the private sector is regarded as better able to use technology to reduce cost and improve quality. Therefore the hypothesis is supported.

**FIGURE 5-9**  
ITEM 506 HISTOGRAM



As an additional note, the literature reviewed in Chapter 2 made a distinction among dynamic efficiency (technology development), technological efficiency (technology employment), and X-efficiency. That was the reason for having three technology hypotheses. Examination of the histograms for items 505, 595, 504, 562, and 506 led the researcher to wonder whether all five of these items might load on a single factor. They did, as is shown in the factor analysis in Table 5-9. Cronbach's alpha was 0.88, indicating this is also a reliable scale. Convergent validity is also supported, with all five items loading significantly on the postulated factor. It appears that the respondents to this survey, at least



in the context of the public vs. private comparison, saw dynamic, technology, and X-efficiency as behaving together. That is, those who saw the private or public sector as being more likely to exhibit one element of technological competence also saw that sector as being more likely to exhibit all five.

**TABLE 5-9**  
**MULTIPLE TECHNOLOGY ITEM FACTOR ANALYSIS**

<b>Factor Loadings (Unrotated)</b>		
Extraction: Principal components		
Item	Question	Factor 1
505	2B	<u>0.761</u>
506	2C	<u>0.795</u>
595	2D	<u>0.837</u>
504	2E	<u>0.872</u>
562	2F	<u>0.866</u>
Expl. Var		3.42135
Prp. Totl		0.68427

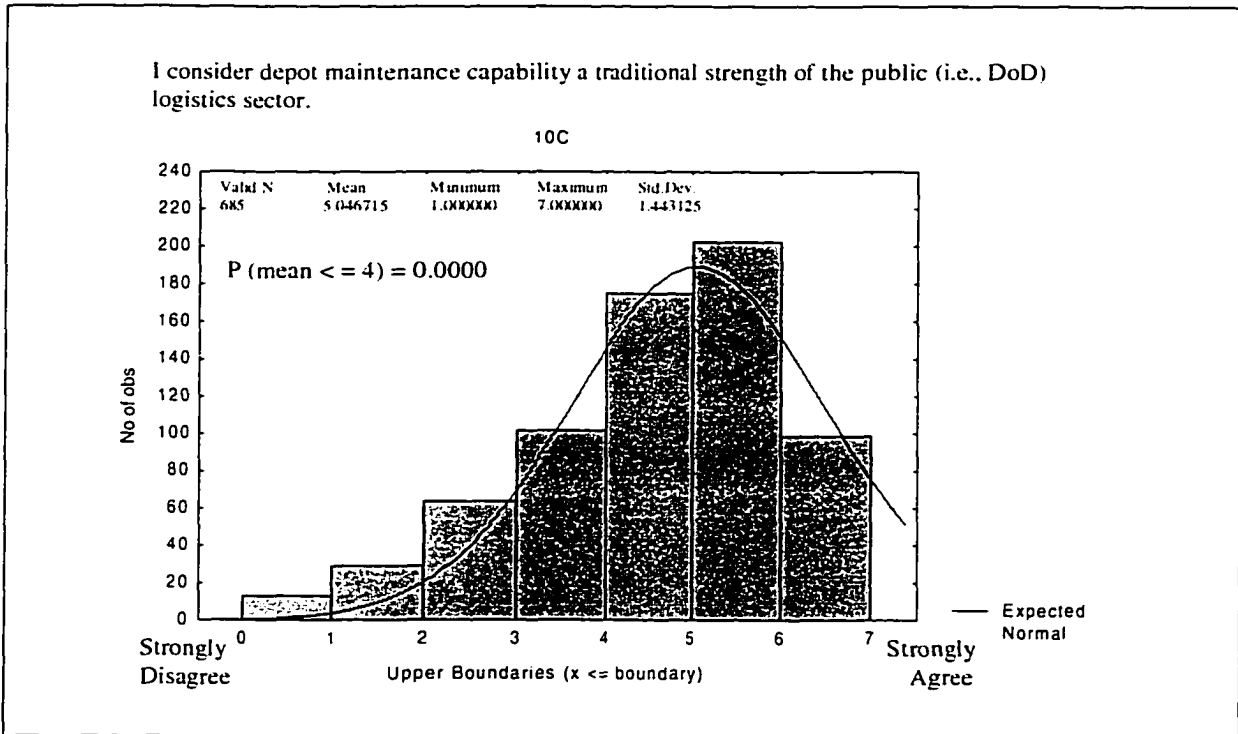
Underlined loadings exceed 0.70.

Given the results for each of the items under hypothesis H33, the hypothesis is supported.

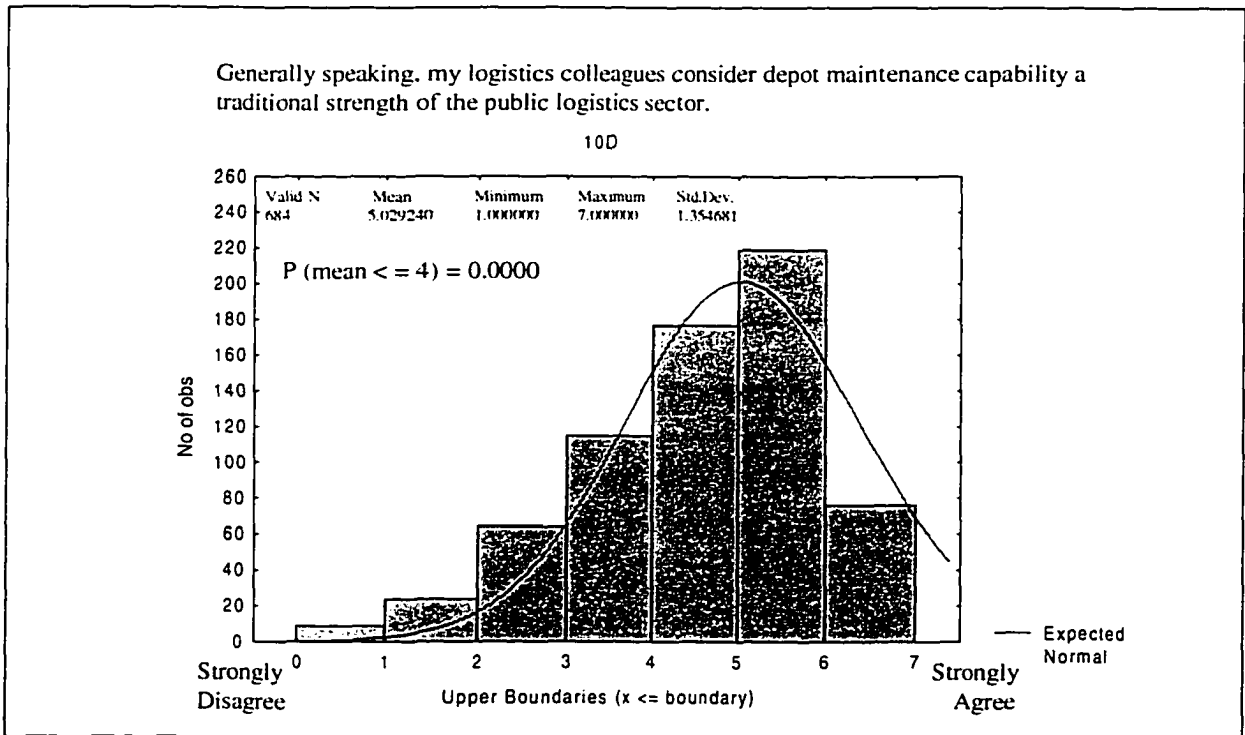
*H37 Depot maintenance capability as a core government logistics competency*

Hypothesis H37 had two associated items, 533 (question 10C) and 578 (question 10D). The histograms are at Figure 5-10 and Figure 5-11. The results for both items show that depot maintenance is perceived as a core competency. The responses are also, and not surprisingly, correlated ( $r = 0.67$ ,  $p = 0.0$ ). The hypothesis is supported.

**FIGURE 5-10**  
ITEM 533 HISTOGRAM



**FIGURE 5-11**  
ITEM 578 HISTOGRAM



## Summary of Results for Construct 8—Privatization

Of the nine hypothesis under this construct, six were supported and three were partially supported (Table 5-10).

**TABLE 5-10**  
**CONSTRUCT 8 RESULTS**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H17	The choice between public and commercial providers of depot maintenance will be perceived to depend on the total cost where total cost is the sum of production cost and transaction costs.	Supported. However there is lack of consensus that choice should depend on cost alone.	See discussion under topic of transaction cost economics.
H25	Retention by the government of smart buyer capability will be perceived as important.	Partially supported	See discussion of item 560 under principal-agent theory. Respondents in maintenance, logistics management, and operations perceive need for the government to do at least some depot maintenance work itself to make sure it knows what it is asking for and getting. Other DoD and industry respondents do not see the need.
H28	Private provision of goods and services will be preferred, in general, to public provision.	Partially supported	Item 532. Those not involved in maintenance appear to prefer private providers. Those involved in maintenance prefer public providers—with those most directly involved most likely to prefer public providers.
H29	Private providers of depot maintenance will be perceived as more efficient at depot maintenance than their public counterparts.	Supported	Item 500. Respondents perceive private providers as more efficient.  Item 558. Respondents perceive outsourcing of depot maintenance as having made depot maintenance operations more cost-effective.

**TABLE 5-10**  
**CONSTRUCT 8 RESULTS (CONTINUED)**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H30	The availability of a competitive marketplace will be perceived as mattering if government is to benefit from commercial capabilities.	Partially supported	See discussion under imperfect competition topic.  The role of public depots in preventing a sole-source situation is affirmed.  However, perceived difficulty determining the existence of a competitive marketplace or creating a competitive marketplace appears to be related to overall sector preference and experience with public providers.
H31	Compared to government, commercial firms will be perceived as having better dynamic efficiency—the ability to develop new technology that lowers cost functions, improves product quality, and creates new and marketable products	Supported	Items 504, 562, and 595 loaded on a single factor. Analysis of that factor indicated that private providers are perceived as being better able to develop new technology.
H32	Compared to government, commercial firms will be perceived as having better technological efficiency—the ability to find and employ the best technology currently available, thus producing at lower cost and higher quality	Supported	Items 505, 563, and 596 loaded on a single factor. Analysis of that factor indicated that because commercial providers are better at finding and employing technology, access to new technology is an important real benefit of depot maintenance outsourcing.

**TABLE 5-10**  
**CONSTRUCT 8 RESULTS (CONTINUED)**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H33	H33 Compared to government, commercial firms will be perceived as having better X-efficiency—the ability, given a specific technology, to reduce cost, raise productivity, and improve quality through changes in organization, management practices, and worker motivation.	Supported	Item 506. Private providers are perceived as better than public providers at using technology to reduce cost and improve quality.
H37	H37 Government depot maintenance capability is perceived to be a core government logistics competency.	Supported	Item 533. Premise of item—that depot maintenance capability is a traditional strength of the public logistics sector—is supported.  Item 578. Premise of item—that respondents' colleagues also consider depot maintenance capability to be a traditional strength of the public logistics sector—is supported.

### **Construct 9—Resource/Competency-Based Theory**

#### **Related Hypotheses**

In Chapter 2, and as also reflected in Table 5-1 above, the author proposed eight confirming hypotheses and one disconfirming hypothesis for the resource/competency-base construct. The author dropped two items, 507 and 508, as a result of feedback from the pilot study. These were the only items associated with hypotheses H34 and H35, respectively. Since dropping the items meant also dropping the hypotheses, six confirming hypotheses and no disconfirming remained. The confirming hypotheses are shown in Table 5-11.

**TABLE 5-11**  
**RESOURCE/COMPETENCY HYPOTHESES**

H36	Members of an organization perceive themselves as able to articulate their organization's core competencies.
H38	Employee knowledge and skills are perceived as an important component of a depot maintenance organization's core competencies.

**TABLE 5-11**  
RESOURCE/COMPETENCY HYPOTHESES (CONTINUED)

H39	Technical systems are perceived as an important component of a depot maintenance organization's core competencies.
H40	Managerial systems are perceived as an important component of a depot maintenance organization's core competencies.
H41	Values and norms are perceived as important components of a depot maintenance organization's core competencies.
H42	There will be differing interpretations of the concept of core.

*H36 Ability to articulate organization's core competencies*

Hypothesis H36 had two associated items, 509 (question 10A) and 565 (question 10B). Histograms are at Figure 5-12 and Figure 5-13. The two items are also correlated ( $r = 0.76$ ,  $p = 0.0$ ). Since the results for both items are consistent with the hypothesis it is supported.

**FIGURE 5-12**  
ITEM 509 HISTOGRAM

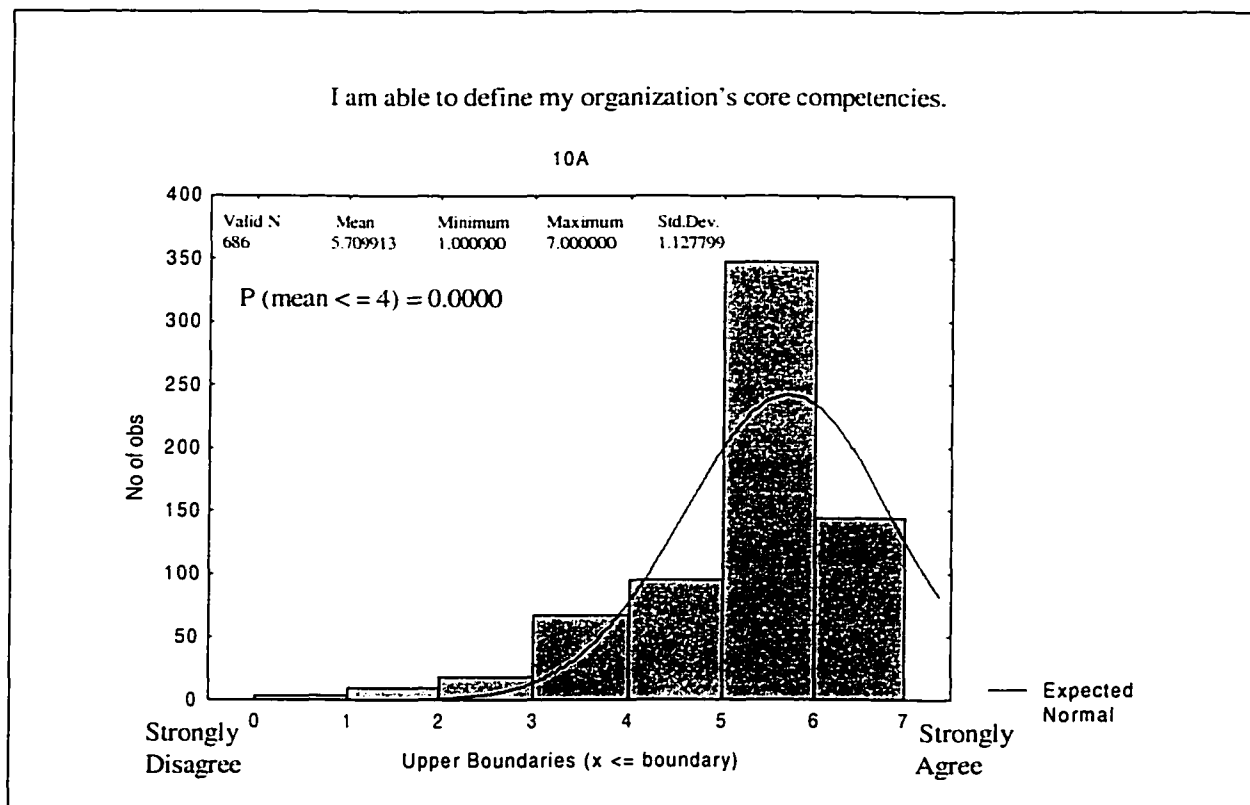
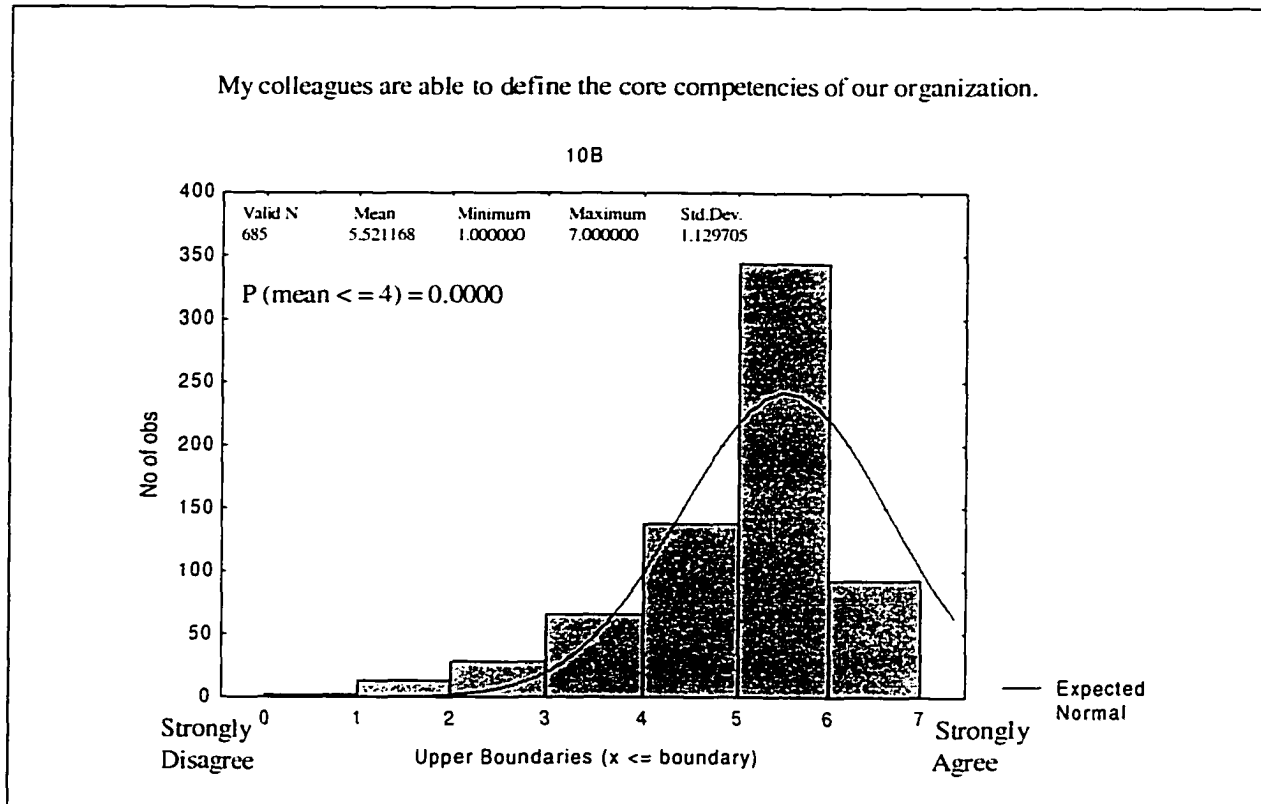


FIGURE 5-13  
ITEM 565 HISTOGRAM



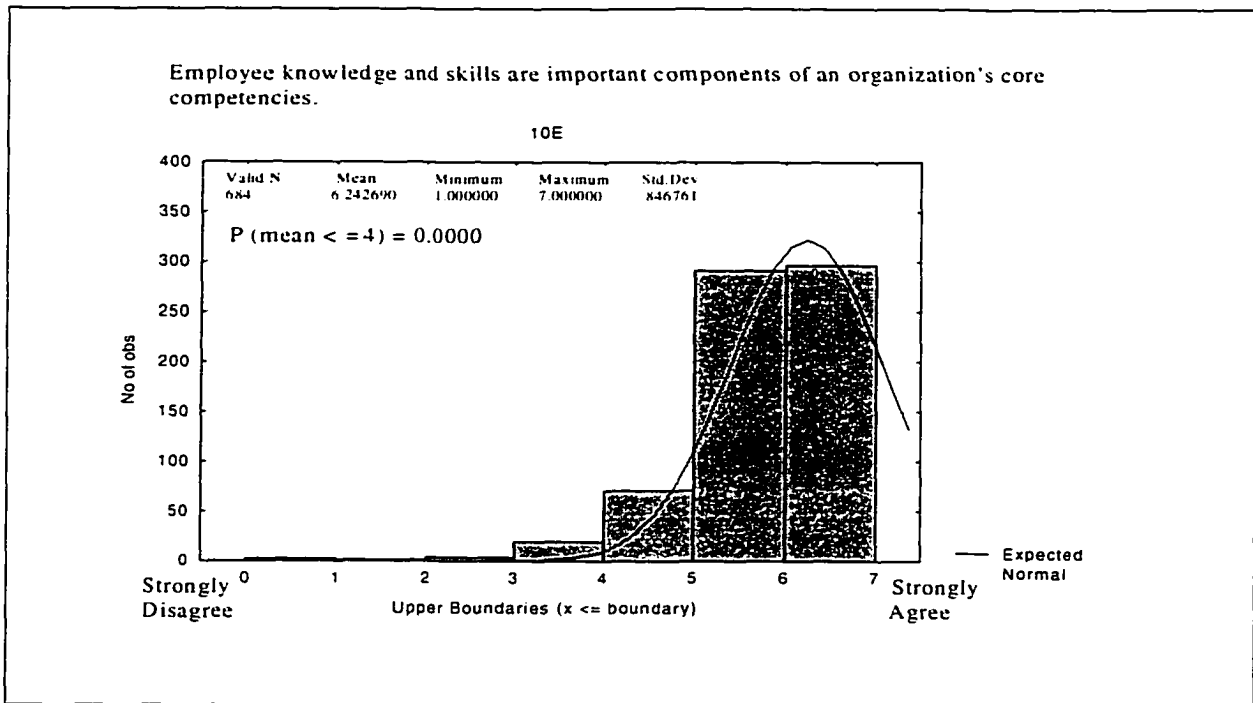
*H37 Depot maintenance capability as a core government logistics competency*

This hypothesis was discussed above, under the topic of privatization, where it was supported.

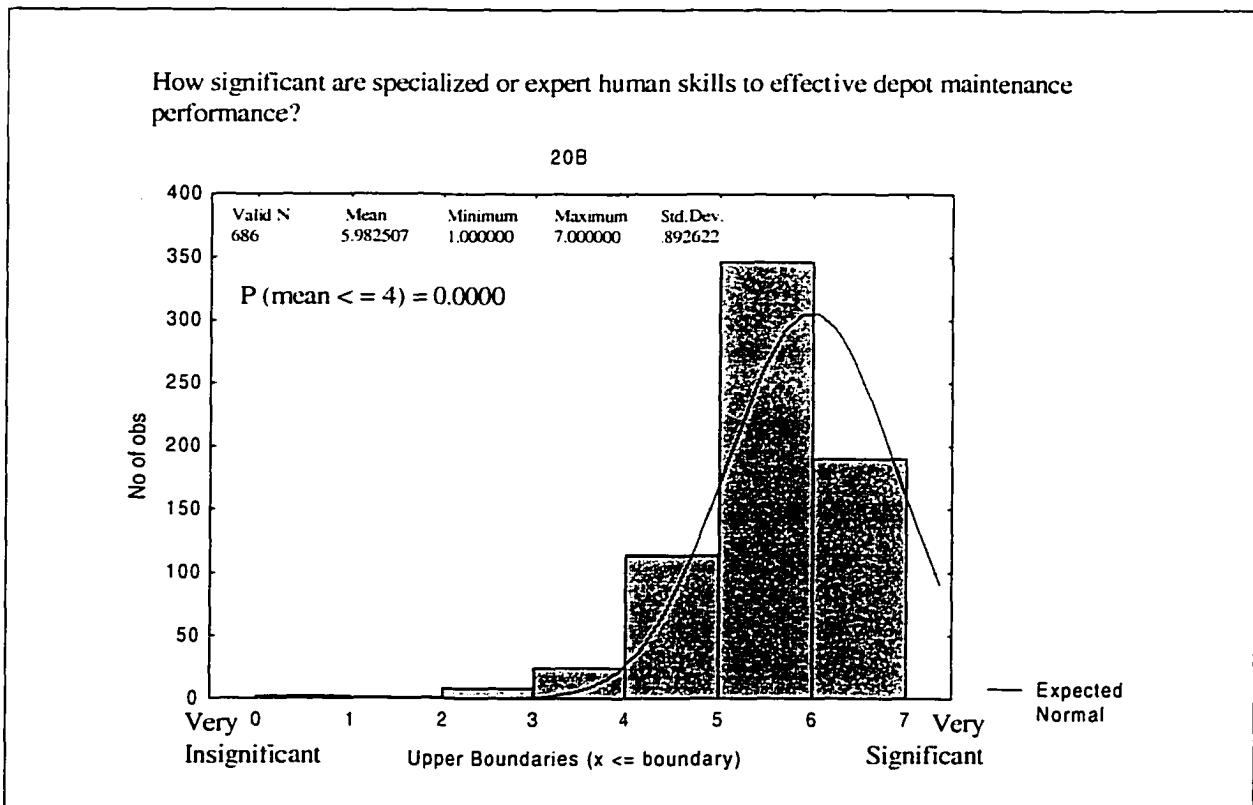
*H38 Employee knowledge and skills*

Hypothesis H38 has two items associated with it, 510 (question 10E) and 598 (question 20B). Histograms are at Figure 5-14 and Figure 5-15. The results indicate that employee knowledge and skills are perceived as an important component of a depot maintenance organization's core competencies. Although the two items are correlated, the correlation is relatively modest ( $r = 0.14$ ,  $p = 0.0$ ).

**FIGURE 5-14**  
**ITEM 510 HISTOGRAM**



**FIGURE 5-15**  
**ITEM 598 HISTOGRAM**

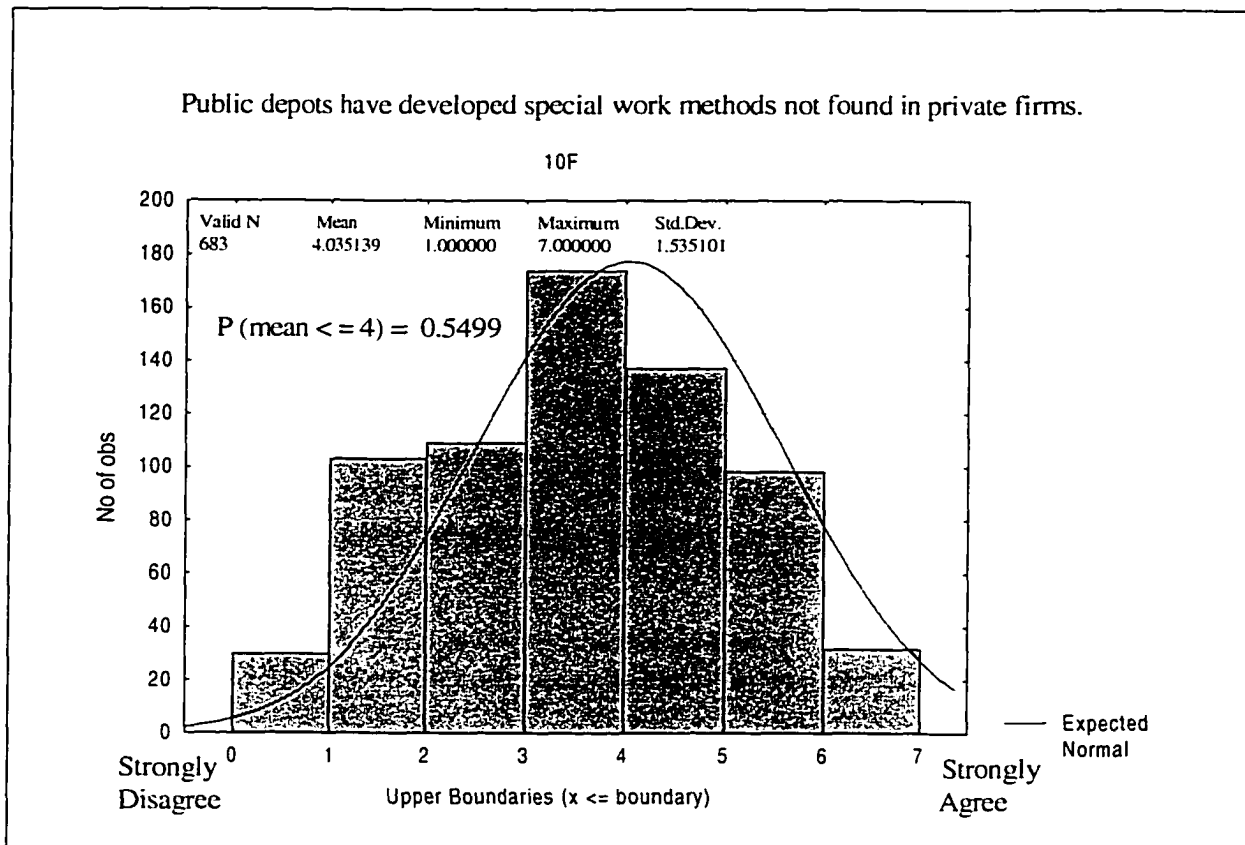




### H39 Technical systems

Hypothesis H39 has one associated item, 567 (question 10F). The histogram is at Figure 5-16. The results for this item do not indicate a perception of public depots as having developed work methods not found in private firms. Therefore the hypothesis is not supported.

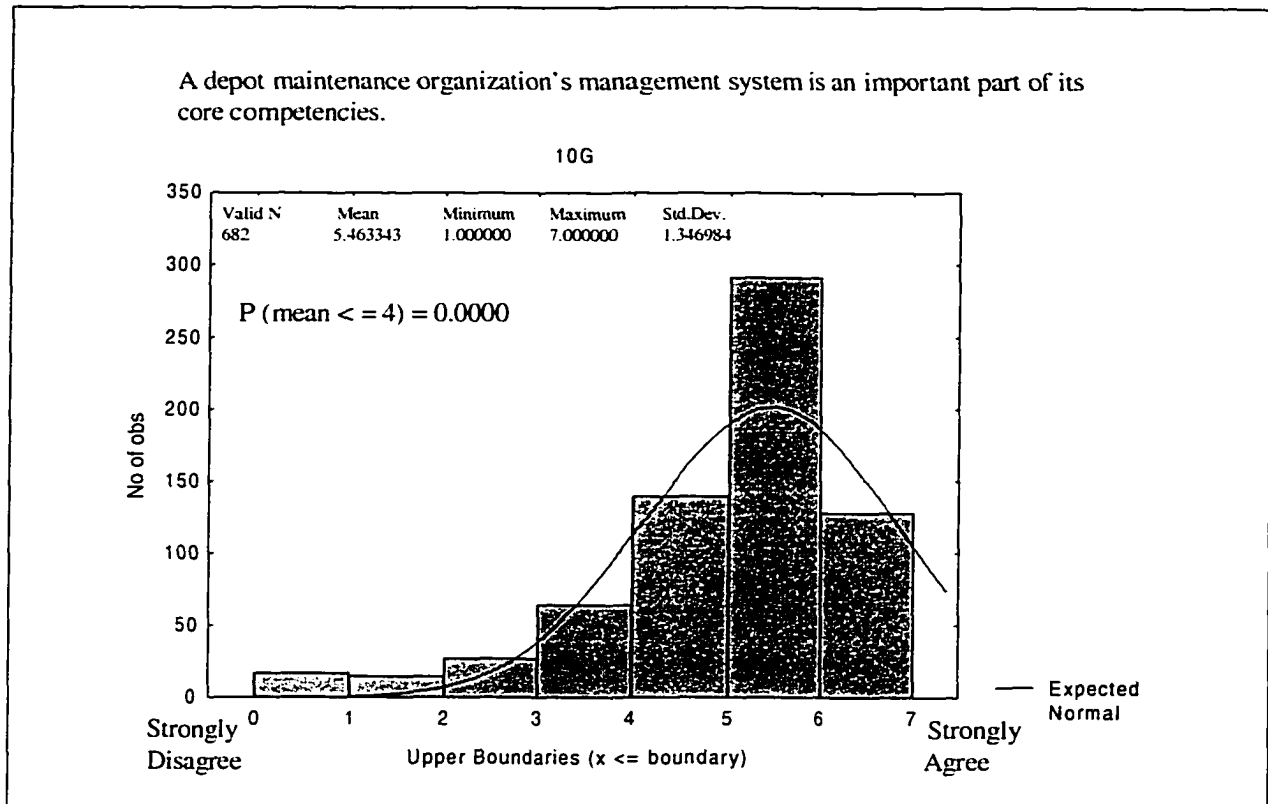
**FIGURE 5-16**  
ITEM 567 HISTOGRAM



### H40 Managerial systems

Hypothesis H40 has one associated item, 512 (question 10G). The histogram is at Figure 5-17. The results support hypothesis H40, that management systems are regarded as an important element of a depot maintenance organization's core competency.

FIGURE 5-17  
ITEM 512 HISTOGRAM



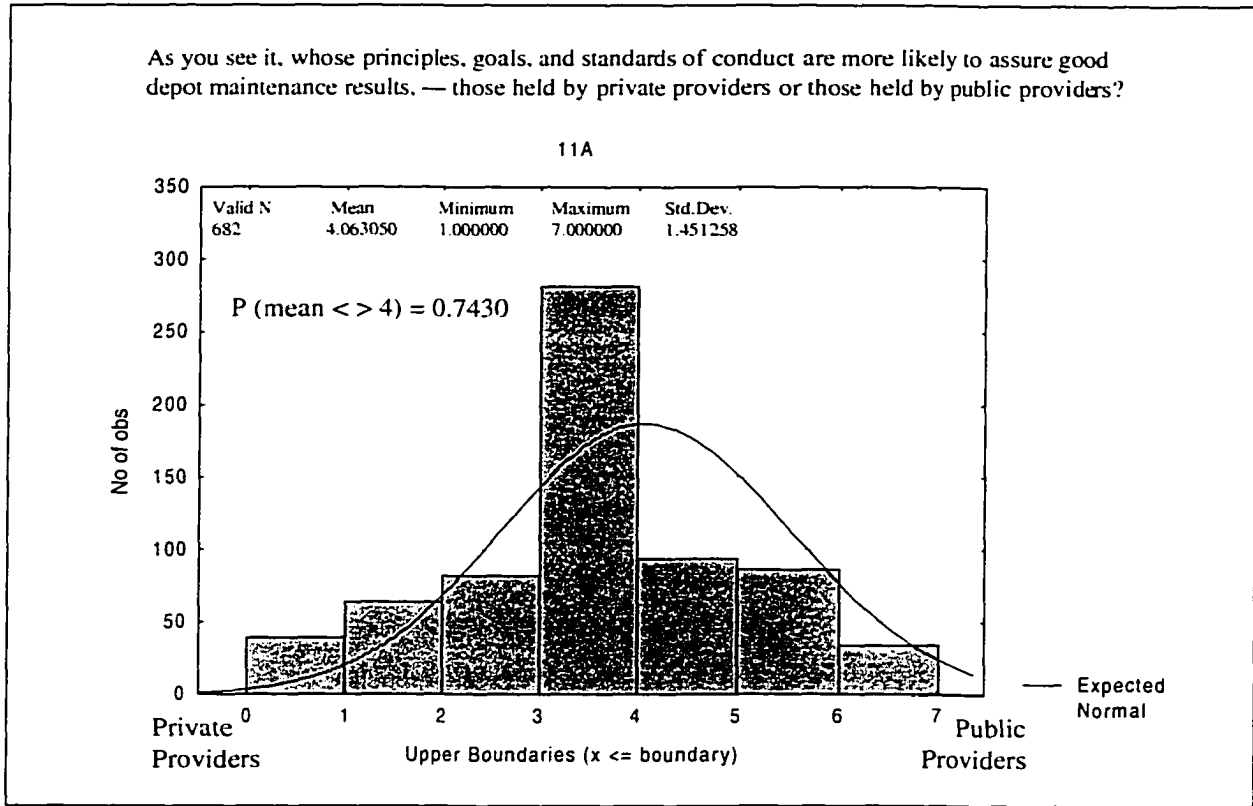
#### *H41 Values and norms*

Hypothesis H41 has one associated item, 632 (question 11A). The histogram is at Figure 5-18. The hypothesis was that values and norms would be perceived as important components of a depot maintenance organization's core competencies. In creating the survey instrument, the researcher translated "values and norms" into the more everyday "principles, goals, and standards of conduct" and anticipated that if principles, goals, and standards of conduct were held to be an important part of an organization's core competencies, then there would be a perceived difference between public and private providers. Figure 5-18 does not indicate that this is the case.

The author believes that the central tendency in Figure 5-18 reflects the central limit theorem at work. Additional insight is available using ANOVA. As Table 5-12 reveals, there are differences of perception on three dimensions: function, maintenance level, and

sector. The difference of perception by sector is probably not surprising. The differences by function and maintenance level are explored below using post hoc analysis.

**FIGURE 5-18**  
ITEM 632 HISTOGRAM



**TABLE 5-12**  
ITEM 632 ANOVA RESULTS

Item 632, Survey Question 11A					
Component		Function		System	
F(6,620)=1.70 p<.1192		F(7,619)=3.79; p<.0005		F(6,620)=.82; p<.5574	
	Means		Means		Means
Other	4.500	Materiel Mgt.	4.458	Aviation	4.079
DLA	4.333	Logistics Mgt.	4.443	Other	4.032
Army	4.316	Maintenance	4.362	Multiple	4.273
Air Force	4.205	Support-other	4.353	Ground	4.200
Navy	3.973	Indeterminate	4.000	Ordnance	4.467
OSD/JCS	3.889	Other non-support	3.944	Ship	4.046
USMC	3.810	Acquisition	3.871	N/A	4.057
		Operations	3.748		

**TABLE 5-12**  
ITEM 632 ANOVA RESULTS (CONTINUED)

Item 632, Survey Question 11A					
Level		Maintenance Level		Sector	
F(2,624)=.66; p<.5168		F(3,623)=6.81; p<.0002		F(1,680)=42.80; p<.0000	
	Means		Means		Means
Component	4.196	Depot Maintenance	5.094	DoD	4.159
Field	4.157	HHQ Management	4.813	Industry	2.766
OSD/JCS	3.889	N/A	4.076		
		Field Maintenance	4.073		

Underlined results significant at 0.05 level.

Table 5-13 provides the post hoc results for the function dimension. What it indicates is that those in operations—in contrast to those in maintenance or logistics—perceive private providers as having principles, goals, and standards of conduct more likely to ensure good depot maintenance results.

**TABLE 5-13**  
ITEM 632 ANOVA POST HOC TEST: FUNCTION

Unequal N HSD; variable 11A								
Probabilities for Post Hoc Tests								
MAIN EFFECT: FUNCTION								
	{1}	{2}	{3}	{4}	{5}	{6}	{7}	{8}
Means	4.3619	4.3529	4.4432	3.7477	4.4583	3.8714	3.9444	4.0000
Maintenance {1}		1.0000	0.9999	<u>0.0201</u>	1.0000	0.0579	0.9853	1.0000
Support other {2}	1.0000		1.0000	0.6117	1.0000	0.8377	0.9870	1.0000
Logistics {3}	0.9999	1.0000		<u>0.0184</u>	1.0000	0.1068	0.9598	1.0000
Operations {4}	<u>0.0201</u>	0.6117	<u>0.0184</u>		0.6285	0.9978	0.9999	1.0000
Materiel {5}	1.0000	1.0000	1.0000	0.6285		0.8202	0.9527	1.0000
Acquisition {6}	0.0579	0.8377	0.1068	0.9978	0.8202		1.0000	1.0000
Other nonsupport {7}	0.9853	0.9870	0.9598	0.9999	0.9527	1.0000		1.0000
Indeterminate {8}	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	

Significance at 0.05 underlined.

Table 5-14, which looks at the maintenance level dimension, shows a contrast between those in depot maintenance and those in field maintenance or outside maintenance. Here, however—where all means are greater than 4—the difference is one of degree.

**TABLE 5-14**  
**ITEM 632 ANOVA POST HOC TEST: MAINTENANCE LEVEL**

<b>Unequal N HSD; variable 11A</b>				
Probabilities for Post Hoc Tests				
<b>MAIN EFFECT: MAINTENANCE LEVEL</b>				
	{1}	{2}	{3}	{4}
Means	4.8125	4.0763	5.0938	4.0727
HHQ Management {1}		0.4315	0.9391	0.4271
N/A {2}	0.4315		<u>0.0167</u>	1.0000
Depot Maintenance {3}	0.9391	<u>0.0167</u>		<u>0.0162</u>
Field Maintenance {4}	0.4271	1.0000	<u>0.0162</u>	

Significance at 0.05 underlined.

With respect to principles, goals, and standards of conduct, there are perceived differences between the private and public sectors. Not surprisingly, these perceptions differ in terms of who is doing the perceiving. The hypothesis, then, is supported.

#### *H42 Differing interpretations of the concept of core*

Hypothesis H42 does not have an item related to it per-se. Instead this hypothesis was proposed in Chapter 2 to be addressed in conjunction with hypotheses H34, H35, H37, H38, H39, H40, and H41. Hypotheses H34 and H35, as discussed above, were dropped after the pilot test. Here we will summarize ANOVA results for the remaining hypotheses and then reach a conclusion regarding H42.

As is evident in Table 5-15, there were statistically significant differences among means for each item on at least two of the dimensions shown. (The system dimension did not have any significant differences and is omitted from the table.) However, in most instances the means of responses are greater than 4, showing respondents' agreement with the assertions. The differences thus are more in degree of agreement rather than between agreeing and disagreeing.

The exceptions are for items 567 and 632. In the first case industry did not agree that technical systems are an important part of a depot maintenance's core competencies; neither did those who are outside the maintenance functional area. In the case of item 632, industry did not agree that values and norms are important components of a depot

maintenance organization's core competencies. Neither did those in operations or acquisition. Overall, and with the above observations, the hypothesis—that there would be differing interpretations of the concept of core—is supported.

TABLE 5-15  
H42 ANALYSIS

	Hypothesis	Item	Sector	Component	Function	Org. Level	Maint. Level
H37	Government depot maintenance capability is perceived to be a core government logistics competency.	533	0.000(**)	0.000(**)	0.001(**)	0.002(**)	0.000(**)
		578	0.000(**)	0.013(*)	0.007(*)	0.001(**)	0.000(**)
H36	Members of an organization perceive themselves as able to articulate their organization's core competencies.	509	0.021(*)	0.141	0.047(*)	0.536	0.090
		565	0.002	0.231	0.019(*)	0.379	0.072
H38	Employee knowledge and skills are perceived as an important component of a depot maintenance organization's core competencies.	510	0.024(*)	0.049	0.596	0.055	0.046(*)
		598	0.018(*)	0.020(*)	0.093	0.001(**)	0.042(*)
H39	Technical systems are perceived as an important component of a depot maintenance organization's core competencies.	567	0.006(*) Industry ( $\mu = 3.12$ )	0.327	0.158	0.084	0.01(*) N/A ( $\mu = 3.92$ )
H40	Managerial systems are perceived as an important component of a depot maintenance organization's core competencies.	512	0.030(*)	0.061	0.278	0.015(*)	0.030(*)

**TABLE 5-15**  
**H42 ANALYSIS (CONTINUED)**

	<b>Hypothesis</b>	<b>Item</b>	<b>Sector</b>	<b>Component</b>	<b>Function</b>	<b>Org. Level</b>	<b>Maint. Level</b>
H41	Values and norms are perceived as important components of a depot maintenance organization's core competencies.	632	0.002(**) Industry ( $\mu = 2.77$ )	0.119	0.000(**) Operations ( $\mu = 3.75$ ) Acquisition ( $\mu = 3.87$ )	0.517	0.000(**)

\*Significant at 0.05 level

\*\*Significant at 0.005 level

All means ( $\mu$ ) were greater than 4.0 except where indicated.

### Summary of Results for Construct 9—Resource/Competency-Based Theory

Seven hypotheses relate to this construct. Six of the seven were supported (Table 5-16). One hypothesis, H39, was not supported.

**TABLE 5-16**  
**CONSTRUCT 9 RESULTS**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H35	An organization's core competencies are perceived as defined by what it knows and what it can do.	Hypothesis dropped after pilot test	—
H36	Members of an organization perceive themselves as able to articulate their organization's core competencies.	Supported	Item 509. Premise of item—that respondents would perceive themselves as able to define their organization's core competencies—is supported.  Item 565. Premise of item—that a respondent's colleagues would be perceived as able to define their organization's core competencies—is supported.
H37	Government depot maintenance capability is perceived to be a core government logistics competency.	Supported	See discussion on page under topic of privatization.

**TABLE 5-16**  
**CONSTRUCT 9 RESULTS (CONTINUED)**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H38	Employee knowledge and skills are perceived as an important component of a depot maintenance organization's core competencies.	Supported	Item 510. Employee knowledge and skills are perceived as important components of an organization's core competencies.  Item 598. Specialized or expert skills are perceived as significant in relation to effective depot maintenance performance.
H39	Technical systems are perceived as an important component of a depot maintenance organization's core competencies.	Not supported	Item 567. Public depots are not perceived as having developed work methods not found in private firms.
H40	Managerial systems are perceived as an important component of a depot maintenance organization's core competencies.	Supported	Item 512. A depot maintenance organization's management system is perceived as an important part of core competencies.
H41	Values and norms are perceived as important components of a depot maintenance organization's core competencies.	Supported.	Item 632. Based on ANOVA results, there are perceived differences in principles, goals, and standards of conduct between private and public sectors. However, these differences are related to who is doing the perceiving rather than a distinction between the sectors, per se.
H42	There will be differing interpretations of the concept of core.	Supported	This hypothesis addressed in conjunction with hypotheses H34, H35, H37, H38, H39, H40, and H41. Results indicate that there are differing interpretations of concept of core.
H34	An organization's core competencies are perceived as being defined by the products it makes, services it provides, and markets it serves.	Hypothesis dropped after pilot test	—

## Construct 10—Administrative Innovation

### Related Hypotheses

Five hypotheses are related to the administrative innovation construct, as summarized in Table 5-17. All are confirming hypotheses.



**TABLE 5-17**  
ADMINISTRATIVE INNOVATION HYPOTHESES

H43	Professional managers in government will prefer in-sourcing.
H44	Managers of and others with an interest in the depot maintenance public versus private workload allocation decision will be uncertain of the definition of depot maintenance.
H45	Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive themselves as having unclear expectations of the benefits of outsourcing.
H46	Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive themselves as having a unclear understanding of the purpose of outsourcing.
H47	Government managers will perceive themselves as under pressure from top-level management to outsource depot maintenance.

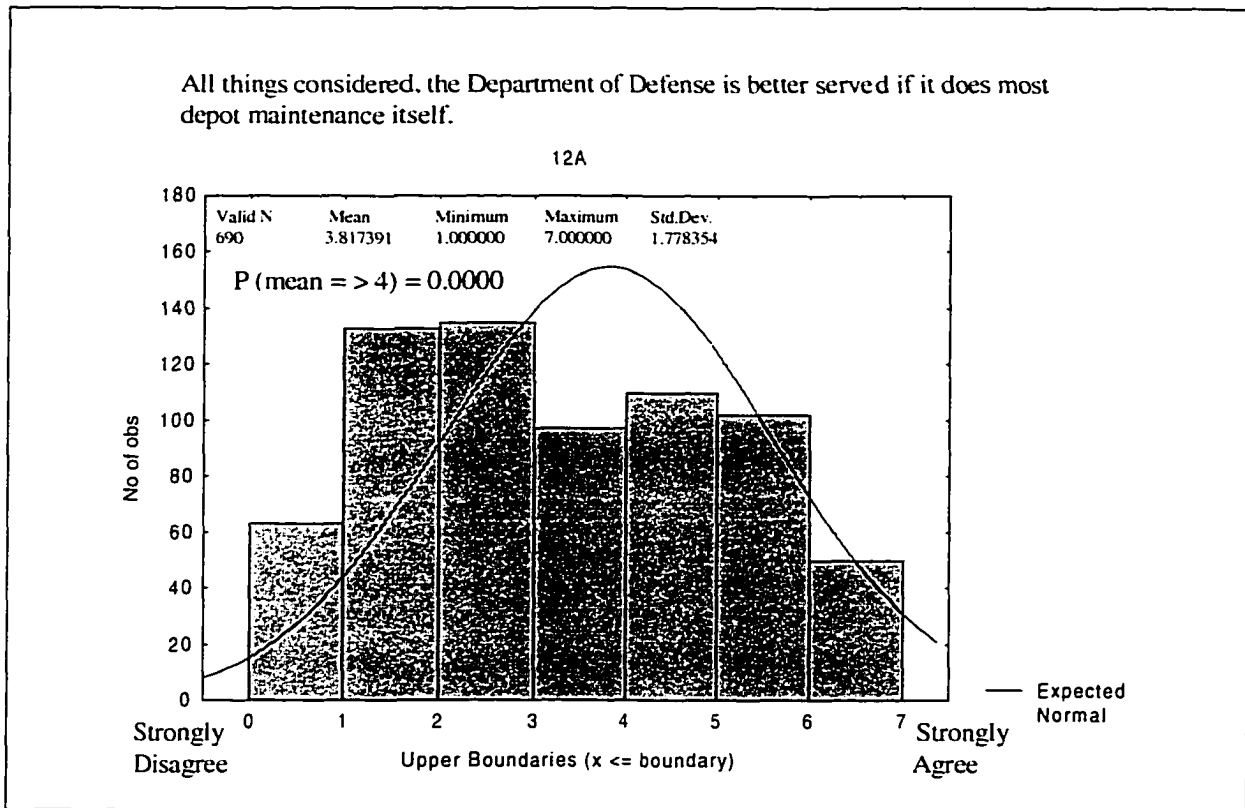
#### *H43 Preference for in-sourcing*

This hypothesis has two associated items, 515 (question 12A) and 570 (question 13A). The histogram for item 515 is at Figure 5-19. Although the probability is that the mean is less than 4, the shape of the histogram suggests that the normality assumption is problematic. For this reason, the author used ANOVA to examine the behavior of means along the six pre-defined dimensions.

ANOVA indicated significant differences among means on all six dimensions.

Table 5-18 shows the post hoc analysis results for the function dimension. Here it is those in acquisition who—in not agreeing that DoD should do its own depot maintenance—differ with those who are in maintenance and logistics. (Although there is also a statistically significant difference with those in operations, the mean for operations is 4.0.)

**FIGURE 5-19**  
**ITEM 515 HISTOGRAM**



**TABLE 5-18**  
**ITEM 515 ANOVA POST HOC ANALYSIS: FUNCTION**

Unequal N HSD; variable 12A								
Probabilities for Post Hoc Tests								
MAIN EFFECT: FUNCTION								
	{1}	{2}	{3}	{4}	{5}	{6}	{7}	{8}
Means	4.4789	4.0000	4.0674	4.0000	4.2308	3.0426	3.3889	3.0000
Maintenance {1}		0.9309	0.7195	0.3859	0.9995	<u>0.0000</u>	0.5051	0.9593
Support other {2}	0.9309		1.0000	1.0000	0.9997	0.2372	0.9566	0.9959
Logistics {3}	0.7195	1.0000		1.0000	1.0000	<u>0.0010</u>	0.9251	0.9939
Operations {4}	0.3859	1.0000	1.0000		0.9997	<u>0.0005</u>	0.9566	0.9959
Materiel Mgt. {5}	0.9995	0.9997	1.0000	0.9997		0.1647	0.7978	0.9856
Acquisition {6}	<u>0.0000</u>	0.2372	<u>0.0010</u>	<u>0.0005</u>	0.1647		0.9986	1.0000
Other non support {7}	0.5051	0.9566	0.9251	0.9566	0.7978	0.9986		1.0000
Indeterminate {8}	0.9593	0.9959	0.9939	0.9959	0.9856	1.0000	1.0000	

Significance at 0.05 underlined.

When viewed from the perspective of the component dimension (Table 5-19), the respondents in OSD/JCS clearly do not agree with the Air Force and the Army that DoD is better served by doing its own maintenance. The Navy respondents appear to hold a position more consistent with OSD/JCS than with the Air Force and the Army. Although the data are not displayed here, the alignment of the Navy and OSD/JCS is statistically significant ( $p = 0.05$ ) when the analysis is performed in terms of homogeneous groups rather than significant differences.

**TABLE 5-19**  
ITEM 515 ANOVA POST HOC ANALYSIS: COMPONENT

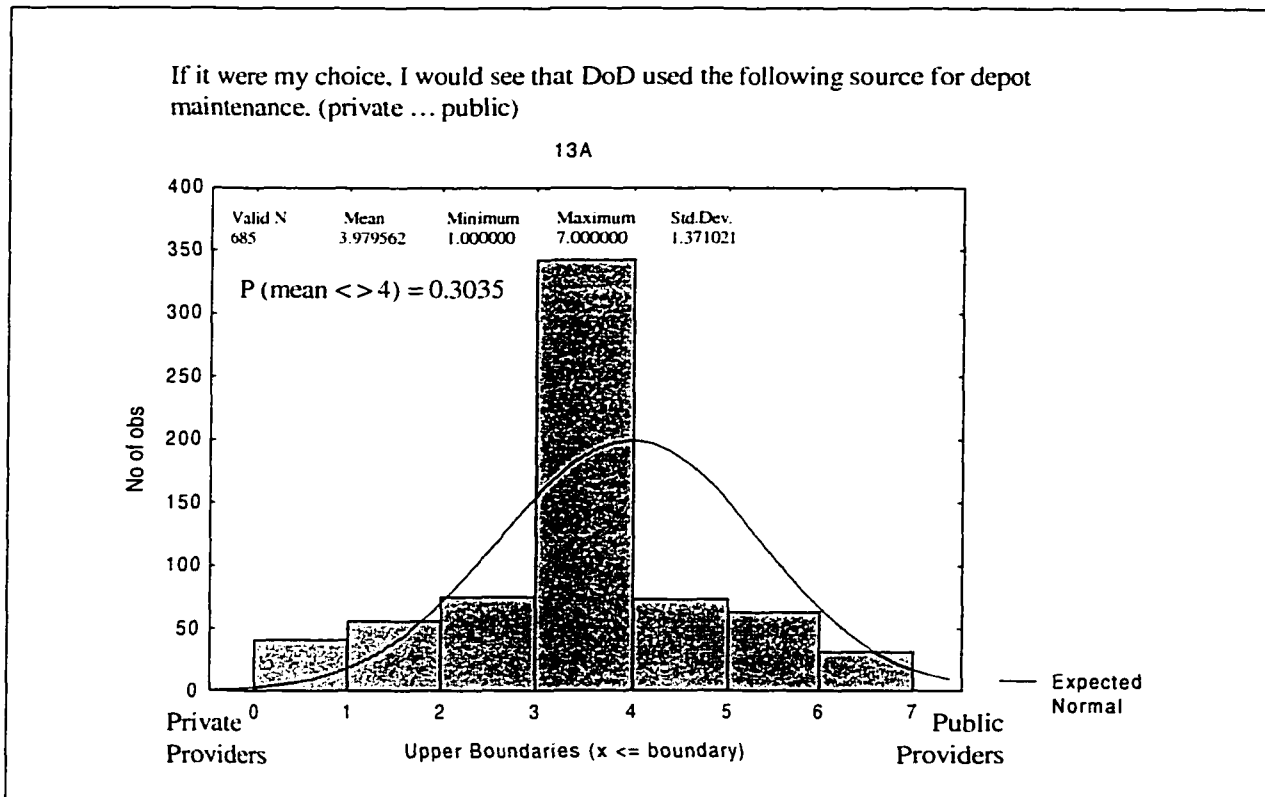
<b>Unequal N HSD; variable 12A</b>							
Probabilities for Post Hoc Tests							
<b>MAIN EFFECT: COMPONENT</b>							
	{1}	{2}	{3}	{4}	{5}	{6}	{7}
Means	4.1216	4.3226	3.6190	3.7383	2.8056	3.4545	3.8000
Air Force {1}		0.9457	0.8286	0.4547	<u>0.0185</u>	0.8541	0.9996
Army {2}	0.9457		0.4879	<u>0.0491</u>	<u>0.0031</u>	0.6252	0.9935
USMC {3}	0.8286	0.4879		0.9999	0.4007	0.9999	1.0000
Navy {4}	0.4547	<u>0.0491</u>	0.9999		0.2351	0.9980	1.0000
OSD/JCS {5}	<u>0.0185</u>	<u>0.0031</u>	0.4007	0.2351		0.8697	0.8510
Other {6}	0.8541	0.6252	0.9999	0.9980	0.8697		0.9994
DLA {7}	0.9996	0.9935	1.0000	1.0000	0.8510	0.9994	

Significance at 0.05 underlined.

Differences when viewed from the perspective of organizational level were more a matter of degree than kind—varying from disagreement to neutrality. For that reason a detailed display is not provided. Examination from the perspective of maintenance level indicated that those within maintenance agreed with the premise of the item, and those outside maintenance—consistent with other findings above—disagreed with it. Although there were significant differences on the system dimension, they appeared between ordnance and “multiple,” or between ordnance and “not applicable.” Since the categories of “multiple” and “not applicable” generally indicate higher headquarters positions, DoD respondents outside logistics and maintenance, or industry, they are probably consistent with the other results reported here.

Item 570 tested essentially the same opinion as item 515 in an alternate form. The histogram is at Figure 5-20. This histogram is leptokurtic, and there is no clear preference for one sector or the other.

**FIGURE 5-20**  
ITEM 570 HISTOGRAM



The ANOVA results, displayed in Table 5-20, indicate differences among means that are significant on five of the six dimensions. Further, examination of any one of the dimensions where differences were significant shows a pattern generally similar to that for item 515 (or in some cases essentially identical, such as the contrast between OSD/JCS and the Army or Air Force). The hypothesis that professional managers in government will prefer in-sourcing appears to be valid for managers who work in maintenance and logistics, but it is not valid for all managers. The hypothesis that professional managers in government will prefer in-sourcing is partially supported.

TABLE 5-20  
ITEM 570 ANOVA RESULTS

Item 570		Survey question 13A			
Component		Function		System	
<u>F(6,624)=3.69; p&lt;0.0013</u>		<u>F(7,623)=3.94; p&lt;0.0003</u>		F(6,624)=1.80; p<0.0975	
	Means		Means		Means
DLA	4.400	Maintenance	4.348	Ordnance	4.400
Army	4.273	Support other	4.257	Aviation	4.158
Air Force	4.155	Materiel Mgt.	4.192	Multiple	4.000
Other	4.136	Logistics Mgt.	4.135	Ship	3.874
Navy	3.871	Other non-support	3.833	Ground	3.833
USMC	3.667	Operations	3.757	Other	3.813
OSD/JCS	3.361	Acquisition	3.707	N/A	3.686
		Indeterminate	3.500		
Level		Maintenance Level		Sector	
<u>F(2,628)=5.98; p&lt;0.0027</u>		<u>F(3,627)=5.85; p&lt;0.0006</u>		<u>F(1,683)=28.56; p&lt;0.0000</u>	
	Means		Means		Means
Field	4.109	Depot Maintenance	4.844	DoD	4.053
Component	3.839	HHQ Management	4.375	Industry	2.957
OSD/JCS	3.361	Field Maintenance	4.088		
		N/A	3.861		

Results significant at 0.05 level are underlined.

#### *H44 Definition of depot maintenance*

Hypothesis H44 had three associated items, 535 (question 12B), 580 (question 12C), and 603 (question 12D). To begin analysis for this hypothesis the author performed a factor analysis on the three items. Results are in Table 5-21. Two of the items, 535 and 603, had loadings greater than 0.7 on a single factor. Confirmatory factor analysis supported convergent validity for these two items. The factor is essentially a statement about the consistency of the definition of depot maintenance. The author dropped item 580 because of its low loading, linearly combined the responses to items 535 and 603 by summing them, and then divided by 2 so that the combined result was in the range of 1 to 7.

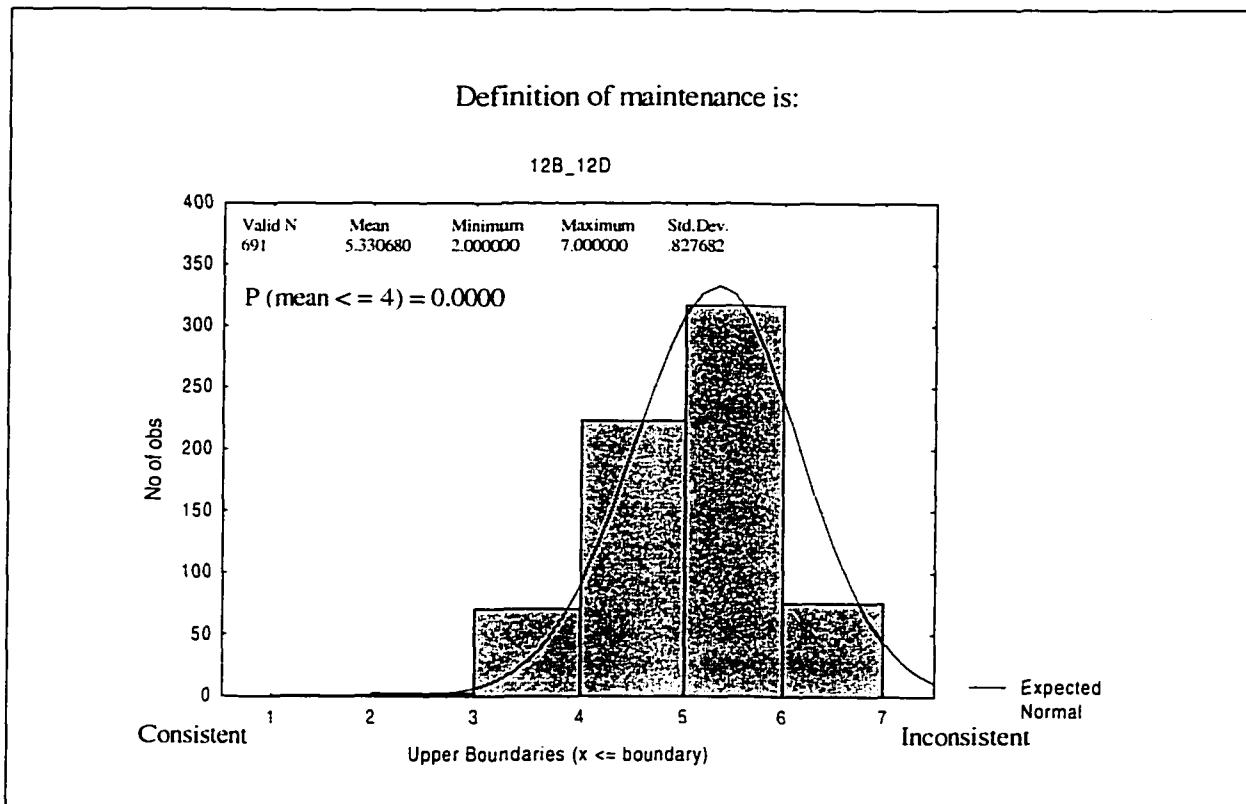
The histogram for the combination of items 535 and 603 is at Figure 5-21. It is evident that the respondents to this survey do not regard the definition of depot maintenance as consistent. The hypothesis is supported.

**TABLE 5-21**  
**H44 FACTOR ANALYSIS**

<b>Factor Loadings (Unrotated)</b>		
Extraction: Principal components		
Item	Question	Factor 1
535	12B	<u>-0.824</u>
580	12C	0.201
603	12D	<u>-0.828</u>
Expl. Var		1.406
Prp. Totl		0.469

Underlined loadings exceed 0.70.

**FIGURE 5-21**  
**ITEMS 535 AND 603 COMBINED HISTOGRAM**

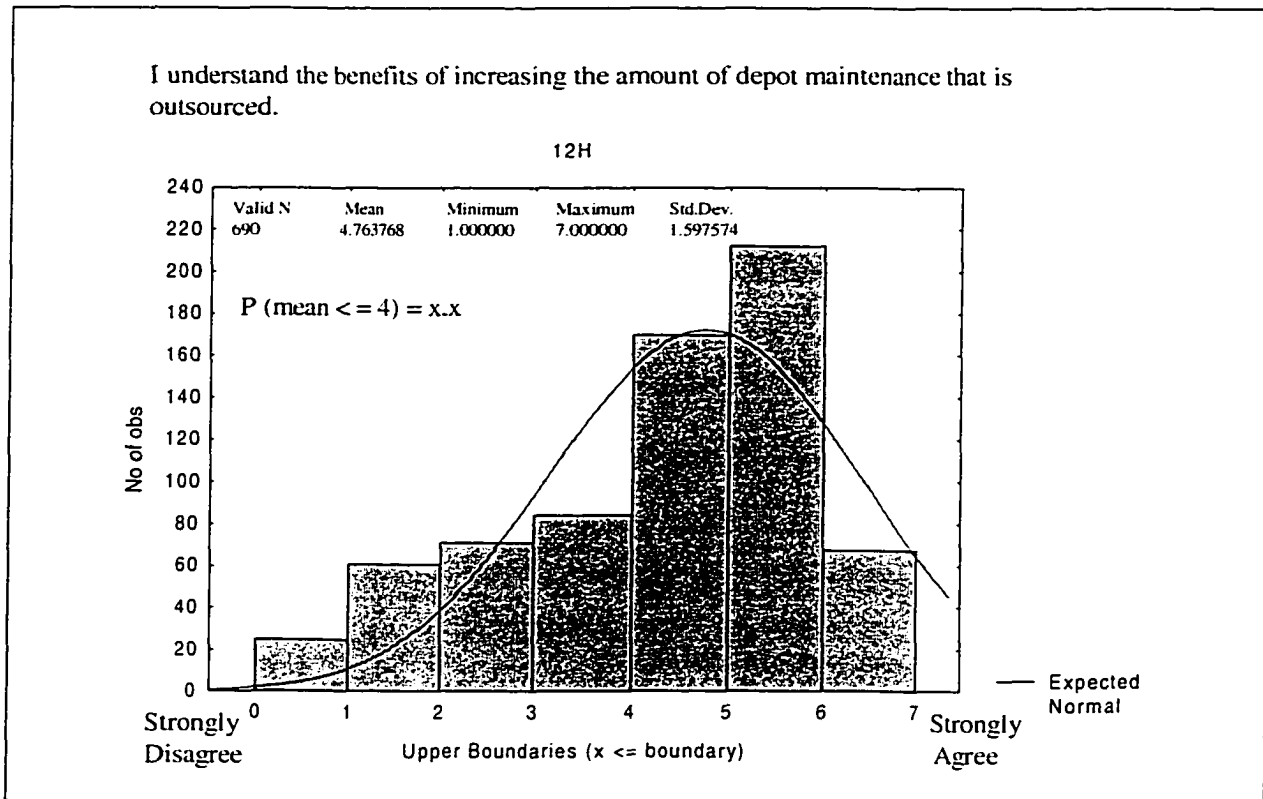


### *H45 Benefits of outsourcing*

Hypothesis H45 had two items, 516 (question 12H) and 571 (question 12F). The two items are correlated ( $r = 0.43$ ,  $p = 0.0$ ), but because the correlation between them is moderate they will be examined individually rather than in combination.

The histogram for item 516 is at Figure 5-22. The results indicate that respondents feel they do understand the benefits of increasing the amount of depot maintenance that is outsourced.

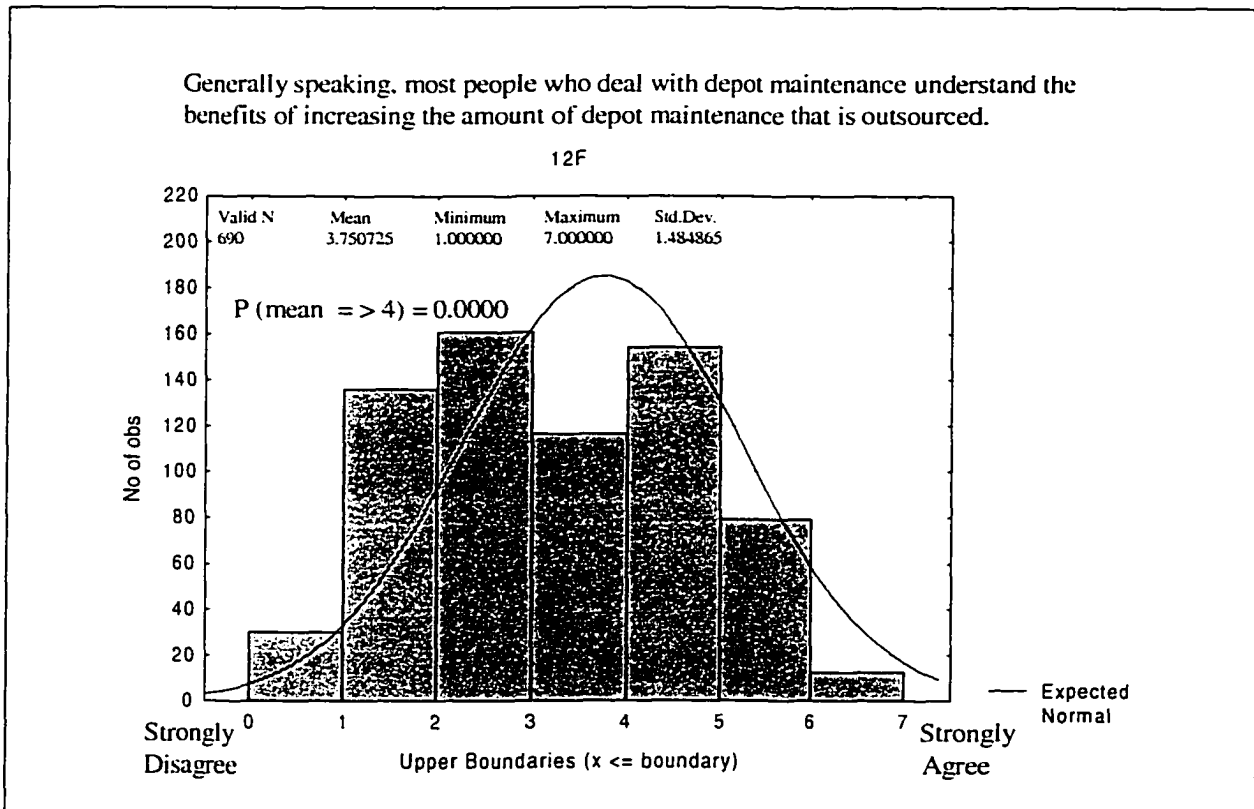
FIGURE 5-22  
ITEM 516 HISTOGRAM



The histogram for item 571 is at Figure 5-23. Because the responses appear to be multimodal the author did not compute the probability of the mean being more than 4 and, instead, turned to ANOVA for further insight.

ANOVA for item 571 responses showed statistically significant differences among means on four of the six dimensions (function, system, organizational level, and maintenance level). Post hoc analysis did not provide any particularly useful insights, however. Either the differences among means were trivial or, as in the case of the maintenance level dimension (Table 5-22), the differences were among groups that were generally on the same side of the mean—i.e., differences in degree rather than kind.

**FIGURE 5-23**  
**ITEM 571 HISTOGRAM**



**TABLE 5-22**  
**ITEM 571 POST HOC ANALYSIS: MAINTENANCE LEVEL**

<b>Unequal N HSD; variable 12F</b>				
Probabilities for Post Hoc Tests				
<b>MAIN EFFECT: MAINTENANCE LEVEL</b>				
	{1}	{2}	{3}	{4}
Means	2.3750	3.7283	2.7188	4.0060
HHQ Management {1}		<u>0.0358</u>	0.9034	<u>0.0065</u>
N/A {2}	<u>0.0358</u>		<u>0.0234</u>	0.1232
Depot Maintenance {3}	0.9034	<u>0.0234</u>		<u>0.0017</u>
Field Maintenance {4}	<u>0.0065</u>	0.1232	<u>0.0017</u>	

Significance at 0.05 underlined.

As discussed in Chapter 4 under “Analysis of Apparent Bimodal Responses,” this is one of the items where responses appeared related to experience—especially negative experience—with public-sector providers.

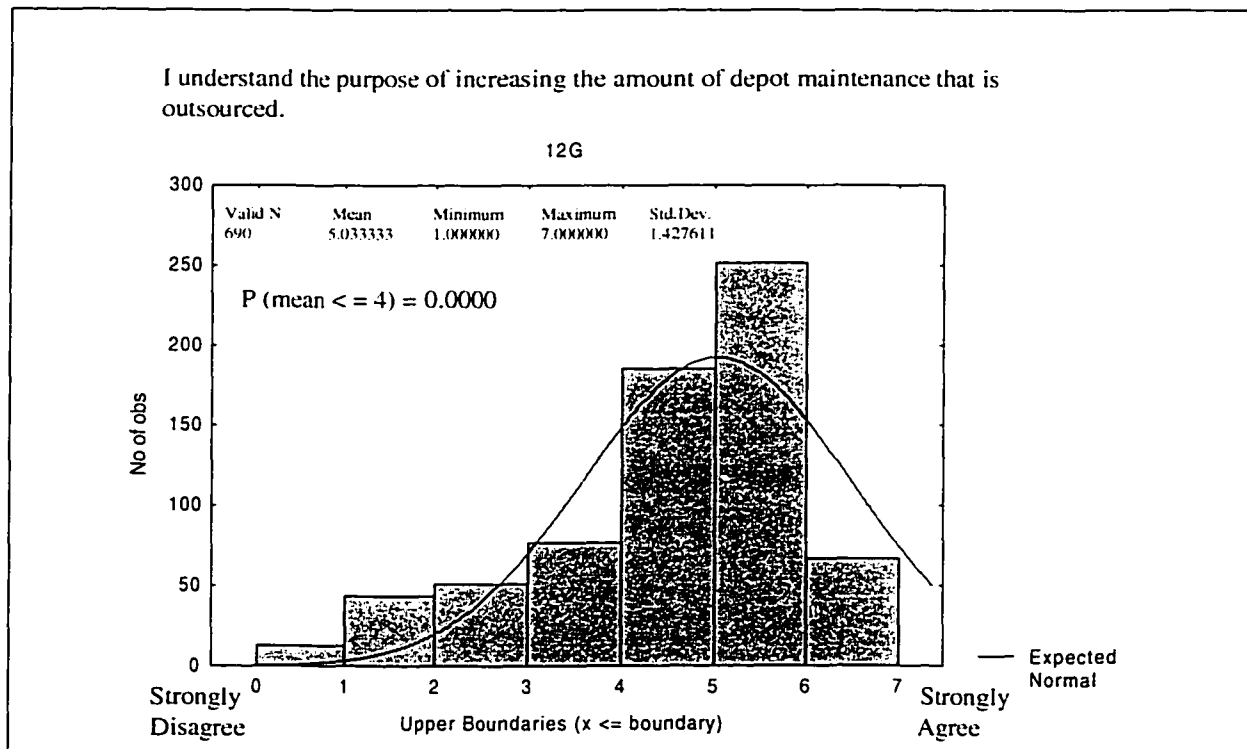


Hypothesis H45 stated that “Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive themselves as having unclear expectations of the benefits of outsourcing.” The results from item 516, which deals with respondents’ personal perceptions of benefits, are contrary to the hypothesis. The results from item 571, which deals with respondents’ perception of others’ understanding of benefits, partially support the hypothesis. Overall, the results for this hypothesis are ambiguous.

#### *H46 Purpose of outsourcing*

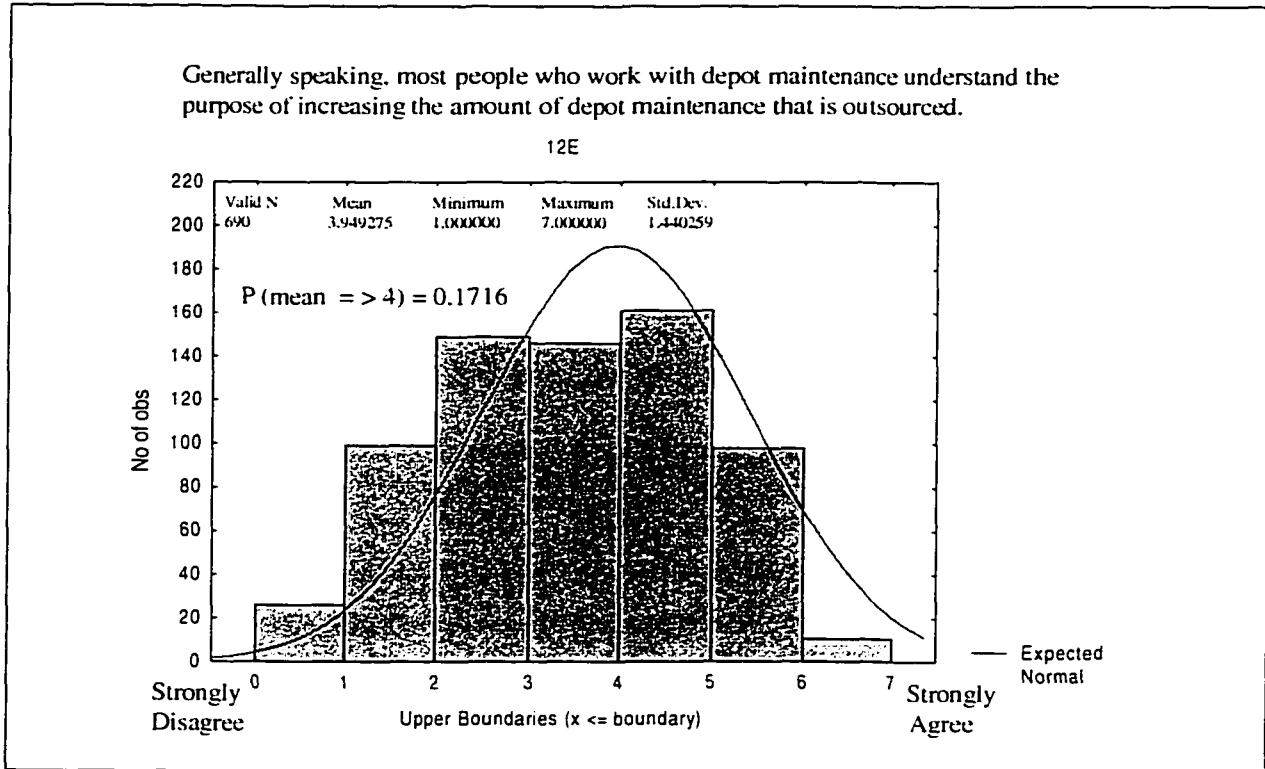
Hypothesis H46 had two related items, 517 (question 12G) and 572 (question 12E). Responses to the items are correlated ( $r = 0.36$ ,  $p = 0.0$ ), but because the correlation is modest the author examined each item independently. The histogram for item 517 is at Figure 5-24. The results, similar to those for item 516 under hypothesis H45, are contrary to the hypothesis.

**FIGURE 5-24**  
ITEM 517 HISTOGRAM



The histogram for item 572 is at Figure 5-25. The mean of the sample is very close to 4, and we cannot say whether respondents agree or disagree with the item 572 statement. The author used ANOVA to gain further insight into this item as well (Table 5-23).

**FIGURE 5-25**  
ITEM 572 HISTOGRAM



**TABLE 5-23**  
ITEM 572 ANOVA POST HOC ANALYSIS: MAINTENANCE LEVEL

Unequal N HSD; variable 12E				
Probabilities for Post Hoc Tests				
MAIN EFFECT: MAINTENANCE				
	{1}	{2}	{3}	{4}
Means	3.1250	4.0079	3.2188	4.1168
HHQ Management {1}		0.2808	0.9976	0.1862
N/A {2}	0.2808		0.1086	0.8168
Depot Maintenance {3}	0.9976	0.1086		0.0503
Field Maintenance {4}	0.1862	0.8168	0.0503	

No results significant at 0.05 level.

Differences among means were significant for two of the dimensions: maintenance level and sector. Since the means for both sectors were less than 4, this difference did not reflect opposing perceptions. Post hoc analysis on the maintenance level dimension was uninformative, except for finding a near significant difference between those in depot maintenance (who would reject the statement) and those in field maintenance (who would accept it). As examined in Chapter 4 in the context of bimodal responses, this item did not appear to be related to perceived experience with commercial providers, experience with public providers, or overall sector preference. The best that can be said is that there are differences of perception that are not well understood

Overall, results for item 572 remain ambiguous. Since the results for item 517 were contrary to the hypothesis, hypothesis H46 is not supported.

#### *H45 and H46—Alternative analysis*

Items 516 and 517 are correlated ( $r = .43$ ,  $p = 0.0$ ), as are 571 and 572 ( $r = 0.36$ ,  $p = 0.0$ ). The author performed factor analysis on 516, 571, 517, and 572. As displayed in Table 5-24, items 516 and 517 load on one factor, while 571 and 572 load on a second.

**TABLE 5-24**  
**H45 AND H46 FACTOR ANALYSIS**

<b>Factor Loadings (Varimax raw)</b>			
Extraction: Principal components			
Item	Question	Factor 1	Factor 2
572	12E	0.148	<u>0.916</u>
571	12F	0.253	<u>0.883</u>
517	12G	<u>0.912</u>	0.184
516	12H	<u>0.914</u>	0.203
Expl. Var		1.753	1.694
Prp. Totl		0.438	0.424

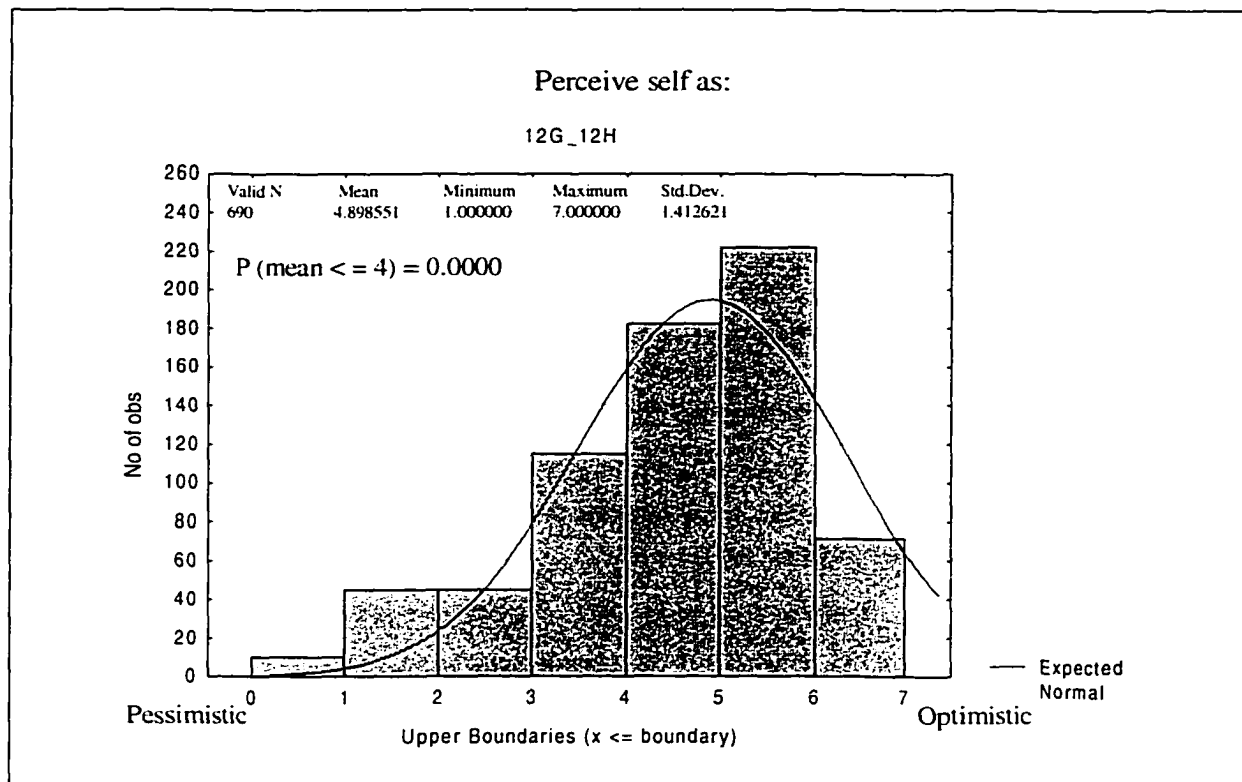
Underlined loadings exceed 0.70.

Confirmatory factor analysis supported convergent validity. Although there is some correlation between the two factors, the parameter estimate was less than one-third of any of the other parameter estimates, providing reasonable support for discriminate validity.

Model fit, however, is possibly suspect. The Bentler comparative fit index at 0.97 was excellent, but the Bentler Bonett non-normed fit index at 0.84 was below the 0.9 threshold, and the Joreskog adjusted goodness of fit index, at 0.74, was well short of the 0.9 threshold

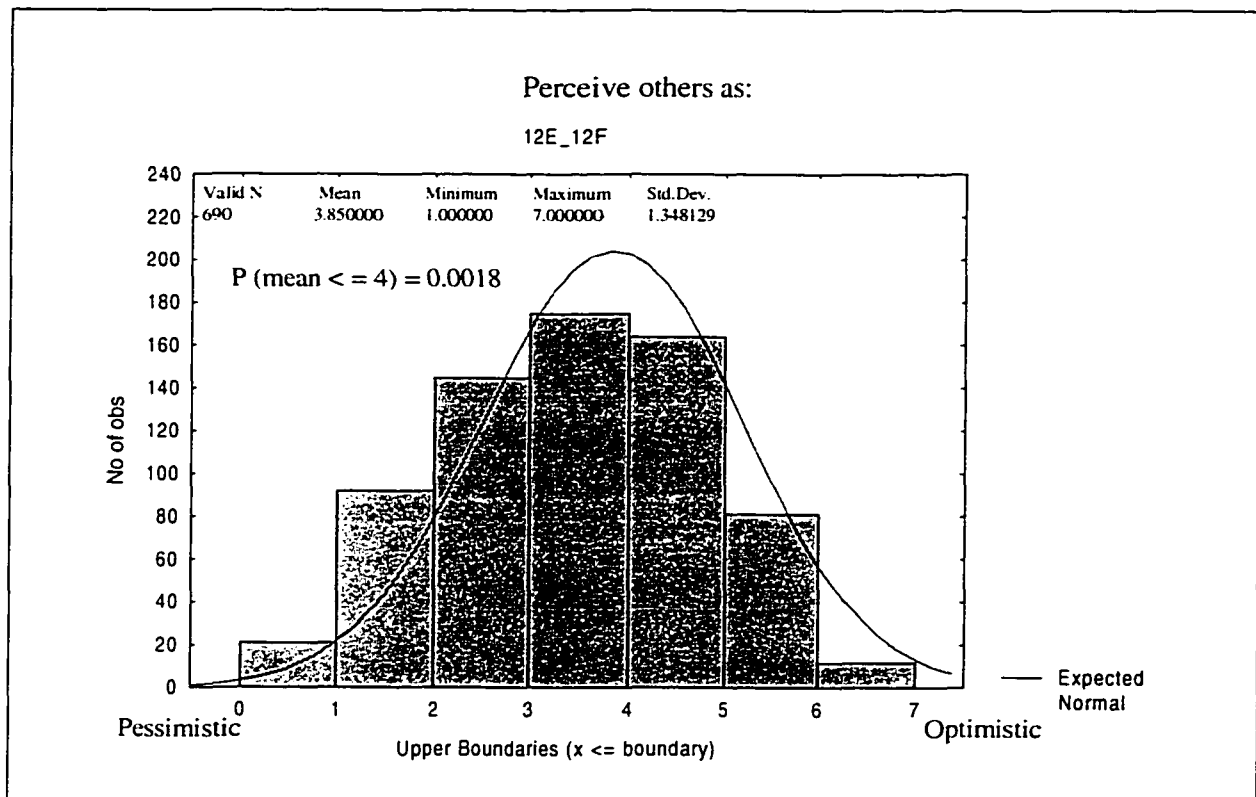
The author interprets factor 1 as respondents' personal optimism toward outsourcing and factor 2 as their perception of others' optimism. Assuming that it is reasonable to linearly combine the items for each factor, the author summed the scores in each case and then divided by 2 to stay in the range between 1 and 7. The histogram for factor 1 items, combined this way, is at Figure 5-26.

**FIGURE 5-26**  
PERSONAL OPTIMISM ABOUT OUTSOURCING



The histogram for items 571 and 572 is at Figure 5-27. It appears that respondents perceive themselves as optimistic about outsourcing of depot maintenance but perceive others as ambiguous.

**FIGURE 5-27**  
PERCEPTION OF OTHERS' OPTIMISM ABOUT OUTSOURCING

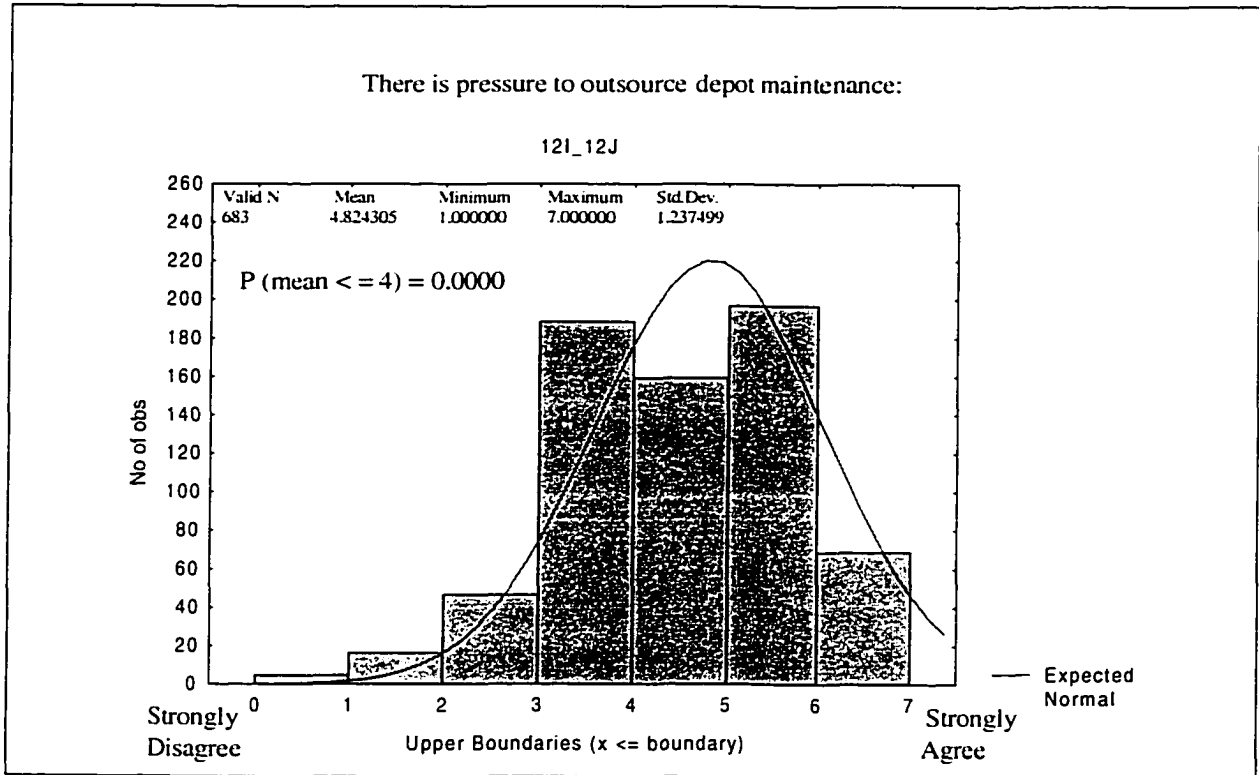


#### *H47 Perceived pressure to outsource depot maintenance*

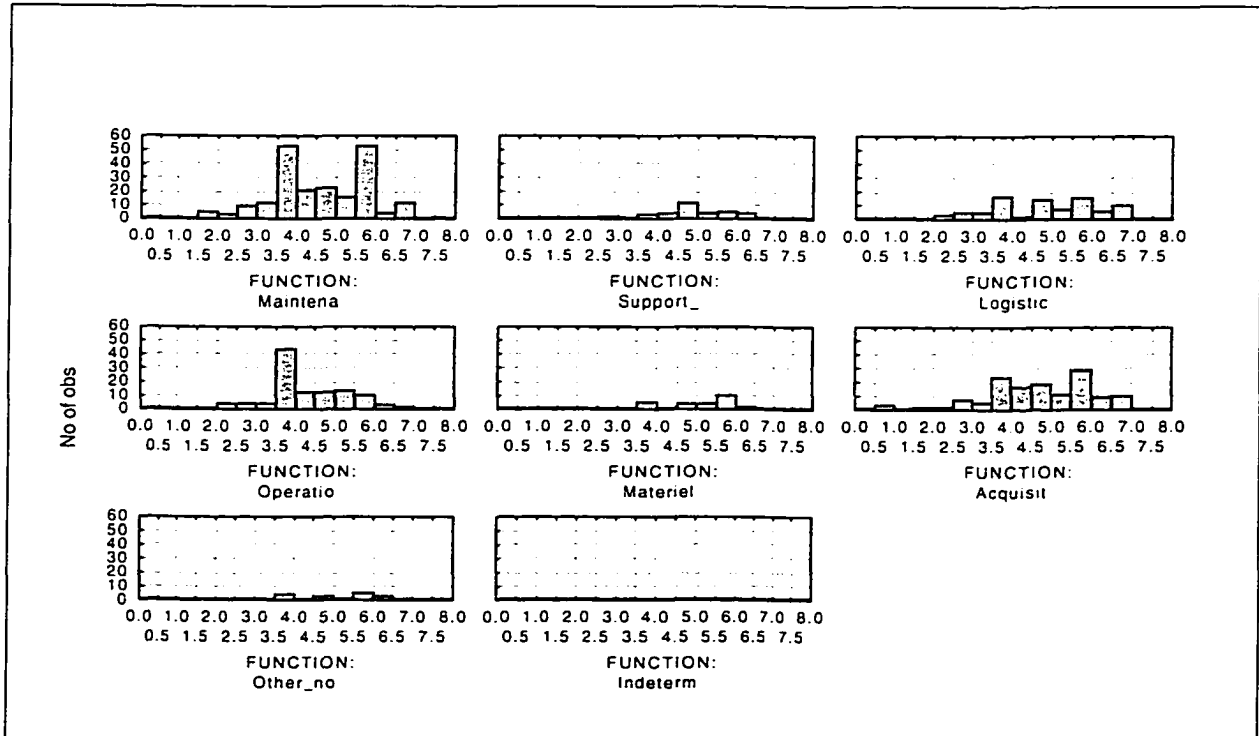
Hypothesis H47 had two items, 518 and 573. Responses to these two items are correlated ( $r = 0.65$ ,  $p = 0.0$ ). Because of the correlation the author elected to linearly combine the two items by summing their individual scores and then dividing by 2 to stay in the range of 1 to 7. The author interprets this single item as “existence of pressure to outsource depot maintenance.” The histogram, at Figure 5-28, indicates that there is perceived pressure to outsource depot maintenance, supporting the hypothesis.

Since the histogram in Figure 5-28 is not especially well behaved—with peaks at both 4 and 6—the author used ANOVA to gain additional insight. Although differences among means were significant on all six dimensions, these differences may not be all that meaningful. As illustrated in Figure 5-29 for the case of the functional dimension, there is significant variability and multimodality even within dimensions. The two items involved (518 and 573) were also examined in the context of apparently bimodal responses in

**FIGURE 5-28**  
ITEMS 518 AND 573 HISTOGRAM



**FIGURE 5-29**  
RESPONSES TO ITEMS 518 AND 573 CATEGORIZED BY FUNCTION



Chapter 4. There, no relation was found to perceived experience with commercial providers, experience with public providers, or overall sector preference. The two peaks may be nothing more than noise in the data. Further, one peak is at the neutral value (4) and other is to the right of it. Overall, there is perceived pressure to outsource depot maintenance; the hypothesis is supported.

### Summary of Results for Construct 10—Administrative Innovation

The overall results for construct 10 are summarized in Table 5-25. Two hypotheses were supported, one was partially supported, one was partially rejected, and one remained undetermined.

**TABLE 5-25**  
CONSTRUCT 10 RESULTS

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H43	Professional managers in government will prefer in-sourcing.	Partially supported. Statement is valid for managers in maintenance and logistics generally; not valid for all government managers.	Item 515. Respondents within the maintenance field and within logistics generally support the premise of the item—that DoD is better served if it does most depot maintenance itself. However, those in other fields—such as in the acquisition field—do not support the premise of the item.  Item 570. Alternate form to item 515. Asked respondents to state, if it were their choice, which source (private or public) they would see DoD use. Results are generally consistent with those from item 515
H44	Managers of and others with an interest in the depot maintenance will be uncertain of the definition of depot maintenance.	Supported	Item 535 and item 580 load on a single factor—a statement of the consistency of depot maintenance. This result supports the contention that the definition is not consistent.  Item 580 was not used because of low loading in factor analysis.

TABLE 5-25  
CONSTRUCT 10 RESULTS (CONTINUED)

	Narrative Description	Result	Discussion of Corresponding Items
H45	Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive themselves as having unclear expectations of the benefits of outsourcing.	Undetermined.  An alternative analysis, looking at H45 and H46 simultaneously, indicated that respondents were personally optimistic about outsourcing of depot maintenance but perceived others as ambiguous.	Item 516. Respondents perceive themselves as understanding the benefits from increasing the amount of depot maintenance that is outsourced.  Item 517. Asked if most people who deal with depot maintenance understand the benefits of increasing the amount of depot maintenance that is outsourced. Response was bimodal. Differences in perception appear related to respondents' specific experiences (especially negative experiences) with public-sector providers.
H46	Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive themselves as having an unclear understanding of the purpose of outsourcing.	Partially rejected	Item 517. Premise of item is supported, that respondents perceive themselves as understanding the purpose of outsourcing.  Item 572. Item requested respondents to state if they agreed that most people who work with depot maintenance understand the purpose of outsourcing. Mean of responses was not significantly different from 4.0. Statistical analysis did not reveal nature of differences in perception.
H47	Government managers will perceive themselves as under pressure from top-level management to outsource depot maintenance.	Supported	Items 518 and 573 were correlated and examined as a single scale. Respondents do perceive pressure to outsource depot maintenance.

### Construct 11—Relational Exchange

The relational exchange construct has five confirming and five disconfirming hypotheses. We present the confirming hypotheses first.



## Confirming Hypotheses.

The five confirming hypotheses are in Table 5-26.

**TABLE 5-26**  
**CONSTRUCT II CONFIRMING HYPOTHESES**

H48	Long-term alliances between users of depot maintenance and commercial firms will be perceived as important to effective depot maintenance support.
H49	Long-term alliances between organic depots and their customers will be perceived as important to effective depot maintenance support.
H50	Building and sustaining trust will be perceived as important to effective long-term depot maintenance alliances.
H51	Building and sustaining trust will be perceived as difficult.
H52	Supply chain integration will be perceived as important to providing effective depot maintenance.

### *H48 Importance of long term alliances with commercial firms*

This hypothesis is examined in Chapter 4 (page 198) under the topics of transaction cost economics and principal agent theory, where it is supported.

### *H49 Importance of long term alliances with organic depots*

This hypothesis is examined in Chapter 4 (page 199) under the topics of transaction cost economics and principal agent theory, where it is supported.

### *H50 Importance of building and sustaining trust*

This hypothesis is examined in Chapter 4 (page 201) under the topics of transaction cost economics and principal agent theory, where it is supported.

### *H51 Difficulty building and sustaining trust*

This hypotheses has six associated items: 577 (question 14E), 616 (question 14F), 625 (question 14G), 630 (question 14H), 531 (question 15A), and 637 (question 15B).

Factor analysis revealed the six items can be reduced to three factors (Table 5-27). Confirmatory factor analysis indicated that convergent validity is well supported, with all items loading significantly on the appropriate factors. Discriminate validity is also reasonable, with the exception of correlation between the first and third factors. Model fit, however, was not especially good: all three goodness of fit indicators were below the 0.9 threshold.

**TABLE 5-27**  
**H51 ITEM FACTOR ANALYSIS**

<b>Factor Loadings (Varimax raw)</b>				
Extraction: Principal components				
Item	Question	Factor 1	Factor 2	Factor 3
577	14E	<u>0.920</u>	0.061	0.000
616	14F	<u>0.916</u>	0.111	0.050
625	14G	0.078	<u>0.909</u>	0.045
630	14H	0.077	<u>0.897</u>	0.148
531	15A	0.529	-0.174	<u>0.740</u>
637	15B	-0.199	0.393	<u>0.822</u>
Expl.Var		2.017	1.832	1.250
Prp.Totl		0.336	0.305	0.208

Underlined loadings exceed 0.70.

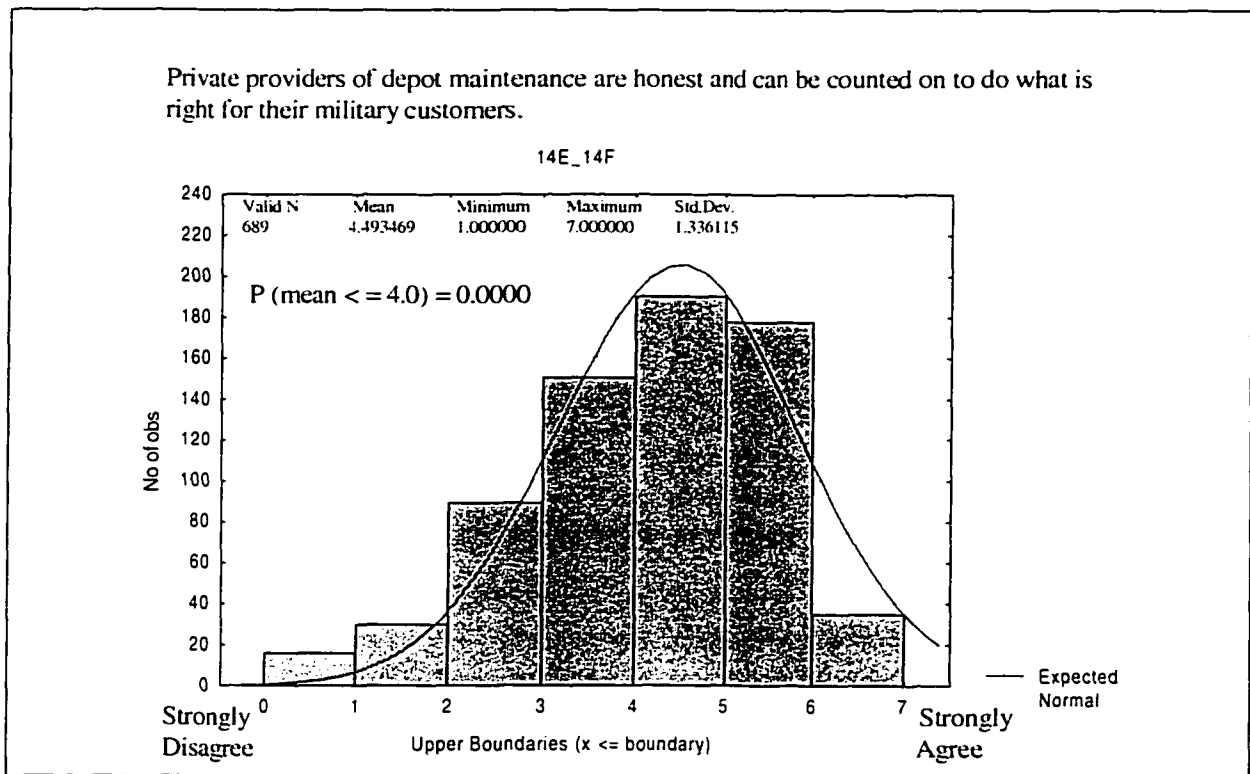
Although the problem with model fit is recognized, the author interprets the three factors to have meaning as shown in Table 5-28.

**TABLE 5-28**  
**HYPOTHESIS H51 FACTOR DEFINITIONS**

Factor	Definition	Scale Anchors	
		Left (1)	Right (7)
1	Private providers of depot maintenance are honest and can be counted on to do what is right for their military customers.	Strongly Disagree	Strongly Agree
2	Public providers of depot maintenance are honest and can be counted on to do what is right for their military customers.	Strongly Disagree	Strongly Agree
3	How hard is it to build and sustain trust between government buyers and public or private providers of depot maintenance?	Very Difficult	Very Easy

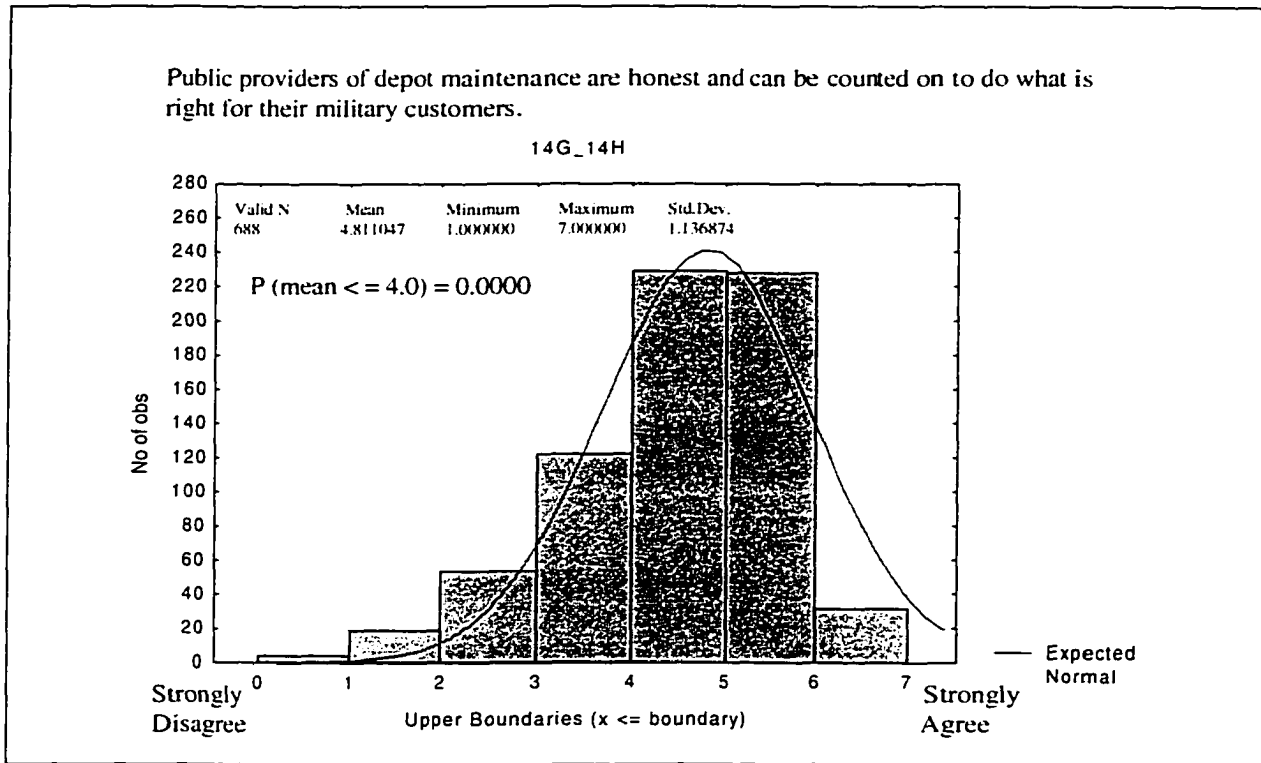
The histogram for factor 1 (a linear combination of items 577 and 616) is at Figure 5-30. The results indicate respondents to the survey perceived that private providers of depot maintenance are honest and can be counted on to do what is right. The histogram for factor 2 (a linear combination of items 625 and 630) is at Figure 5-31. Similarly, the results indicate respondents also perceived that public providers of depot maintenance are honest and can be counted on to do what is right.

**FIGURE 5-30**  
H51 FACTOR 1 HISTOGRAM



To determine if there is a difference in degree, if not in polarity, the author performed tests on the data from these two factors for difference of means, difference of medians, and Kruskal-Wallis ANOVA by ranks. The means, given the standard deviations and numbers of responses shown in Figure 5-30 and Figure 5-31, are statistically different ( $p = 0.0000$ ), with public providers being the more trusted. The median test and Kruskal-Wallis results were also significant (both at  $p = 0.0000$ ; median of factor 1 is 4.5 and median of factor 2 is 5.0).

**FIGURE 5-31**  
H51 FACTOR 2 HISTOGRAM



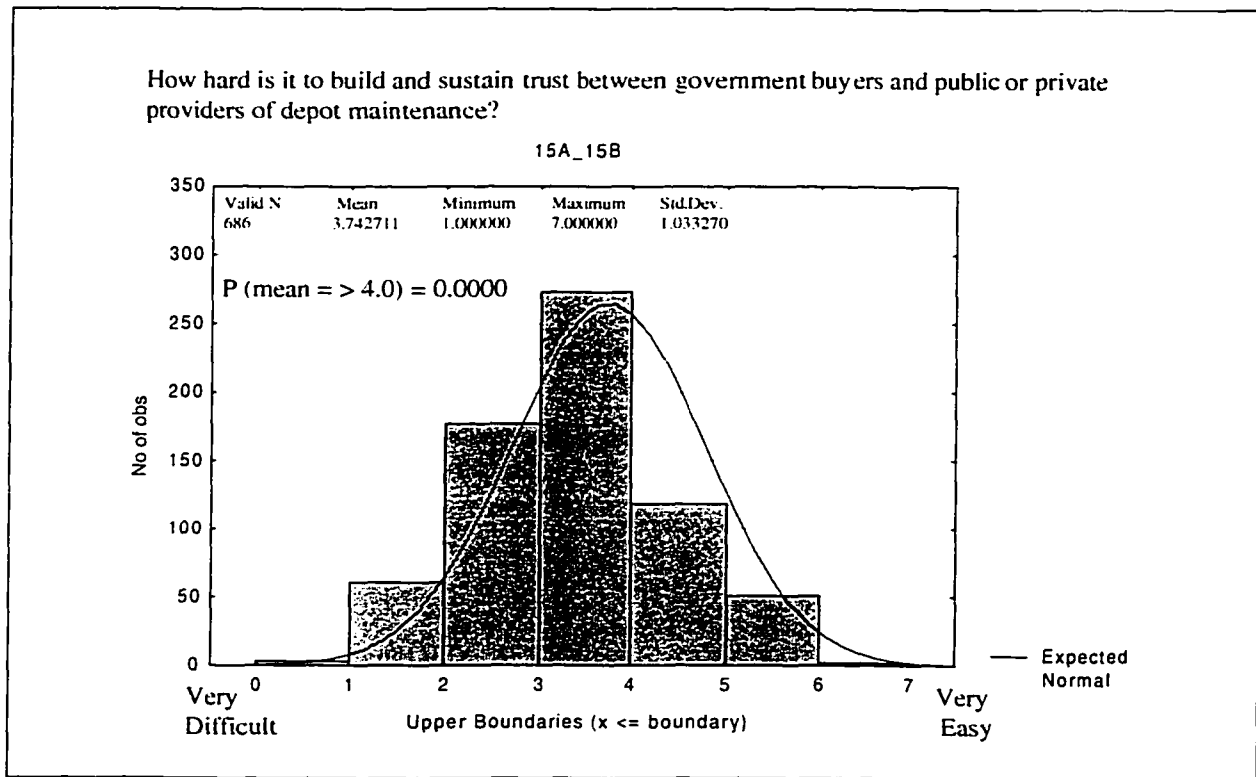
Factor three (Figure 5-32) addresses the difficulty of building and sustaining trust directly. Results for this factor, which is a linear combination of items 531 and 637, suggest a perception that building and sustaining trust are difficult.

Overall the results support the hypothesis that building and sustaining trust will be perceived as difficult. However, although building and sustaining trust are perceived as difficult, both public and private providers were perceived as trustworthy, with public providers somewhat more so.

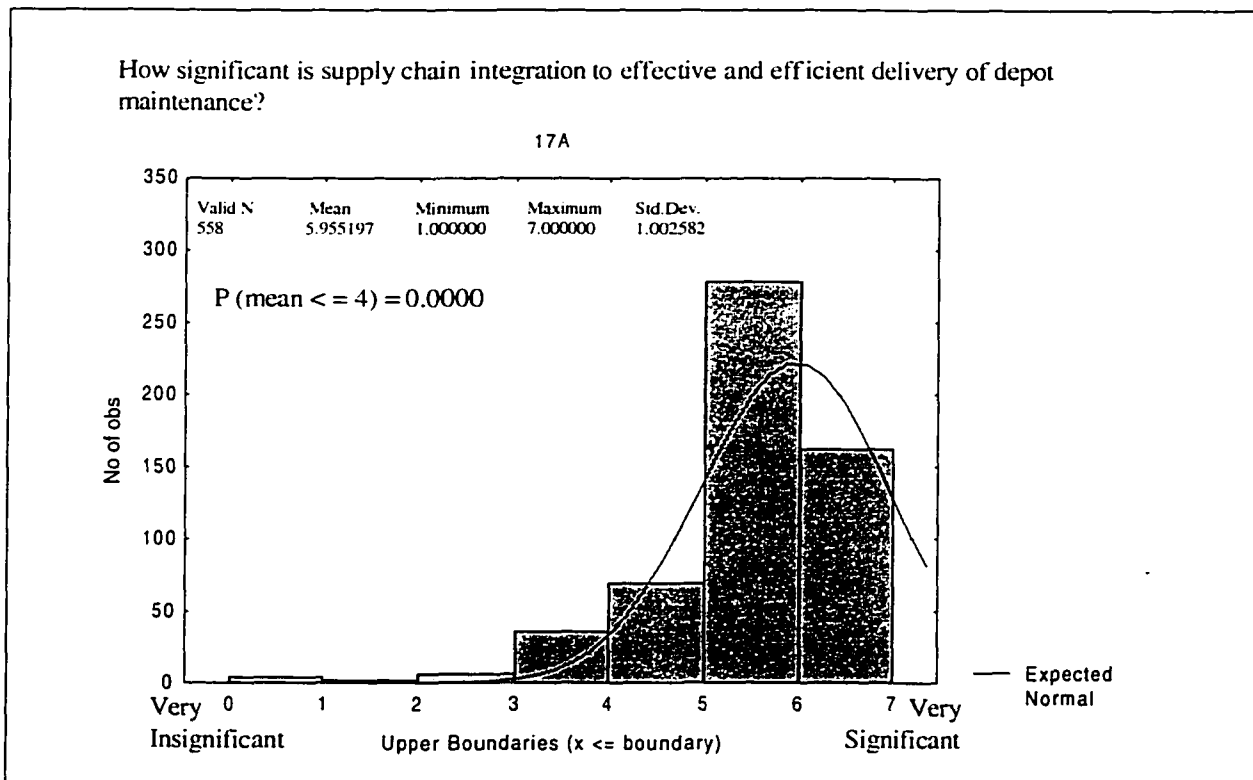
#### *H52 Importance of supply chain integration*

Hypothesis H52 has a single associated item, 522 (question 17A). The histogram is at Figure 5-33. The results clearly support the hypothesis that supply chain integration will be perceived as important to providing effective depot maintenance.

**FIGURE 5-32**  
H51 FACTOR 3 HISTOGRAM



**FIGURE 5-33**  
ITEM 522 HISTOGRAM



## Disconfirming Hypotheses

There were five disconfirming hypotheses for the relational exchange construct, as summarized in Table 5-29.

**TABLE 5-29**  
**CONSTRUCT II DISCONFIRMING HYPOTHESES**

H11	Managers of and other persons with an interest in depot maintenance will perceive tight linkage among stages in the depot maintenance repair process as important to deciding between organic and commercial sources of repair.
H12	Managers of and other persons with an interest in depot maintenance will perceive specificity of production equipment as important to deciding between organic and commercial sources of repair.
H13	Managers of and other persons with an interest in depot maintenance will perceive the difficulty of stating all contingencies in advance as important to deciding between organic and commercial sources of repair.
H14	Managers of and other persons with an interest in depot maintenance will perceive the need to monitor shirking as important to deciding between organic and commercial sources of repair.
H24	Public and commercial providers are perceived as having different potential to act opportunistically.

### *H11 Importance of tight linkage among stages in the depot maintenance repair process*

This hypothesis is examined in Chapter 4 (page 181) under transaction cost economics, where it is supported.

### *H12 Importance of specificity of production equipment*

This hypothesis is examined in Chapter 4 (page 182) under transaction cost economics, where it is supported.

### *H13 Importance of difficulty of stating all contingencies in advance*

This hypothesis is examined in Chapter 4 (page 183) under transaction cost economics, where it is supported.

*H14 Importance of need to monitor shirking*

This hypothesis is examined in Chapter 4 (page 183) under transaction cost economics, where it is supported.

*H24 Importance of differing potential to act opportunistically*

This hypothesis is examined in Chapter 4 (page 215) under principal agent theory, where it is supported.

### Summary of Results for Construct 11—Relational Exchange

Of the five confirming hypotheses, all were supported (Table 5-30). All five disconfirming hypotheses, however, were also supported. Thus we have the somewhat disconcerting situation where both confirming and disconfirming hypotheses are simultaneously supported.

**TABLE 5-30**  
**CONSTRUCT 11 RESULTS**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H48	Long-term alliances between users of depot maintenance and commercial firms will be perceived as important to effective depot maintenance support.	Supported	See discussion under topics of transaction cost economics and principal agent theory in Chapter 4.
H49	Long-term alliances between organic depots and their customers will be perceived as important to effective depot maintenance support.	Supported	See discussion under topics of transaction cost economics and principal agent theory in Chapter 4.
H50	Building and sustaining trust will be perceived as important to effective long-term depot maintenance alliances.	Supported	See discussion under topics of transaction cost economics and principal agent theory in Chapter 4.

**TABLE 5-30**  
**CONSTRUCT II RESULTS (CONTINUED)**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H51	Building and sustaining trust will be perceived as difficult.	Supported. However, both public and private providers perceived as trustworthy.	Items 531, 577, 616, 625, 630, and 637 reduced to three factors.  Factor 1—private providers of depot maintenance were perceived as honest and able to be counted on to do what is right for their military customers.  Factor 2—public providers of depot maintenance were perceived as honest and able to be counted on to do what is right for their military customers, and are perceived as more trustworthy than private providers  Factor 3—building and sustaining trust were perceived as difficult.
H52	Supply chain integration will be perceived as important to providing effective depot maintenance.	Supported	Item 522. Supply chain integration is perceived as important to effective and efficient delivery of depot maintenance.
H11	Managers of and other persons with an interest in depot maintenance will perceive tight linkage among stages in the depot maintenance repair process as important to deciding between organic and commercial sources of repair.	Supported	See discussion under topic of transaction cost economics in Chapter 4.
H12	Managers of and other persons with an interest in depot maintenance will perceive specificity of production equipment as important to deciding between organic and commercial sources of repair.	Supported	See discussion under topic of transaction cost economics in Chapter 4.
H13	Managers of and other persons with an interest in depot maintenance will perceive the difficulty of stating all contingencies in advance as important to deciding between organic and commercial sources of repair.	Supported	See discussion under topic of transaction cost economics in Chapter 4.



TABLE 5-30  
CONSTRUCT 11 RESULTS (CONTINUED)

	Narrative Description	Result	Discussion of Corresponding Items
H14	Managers of and other persons with an interest in depot maintenance will perceive the need to monitor shirking as important to deciding between organic and commercial sources of repair.	Supported	See discussion under topic of transaction cost economics in Chapter 4.
H24	Public and commercial providers are perceived as having different potential to act opportunistically.	Supported	See discussion under topic of principal agent theory in Chapter 4.

## Construct 12—Logistics and Supply Chains

### Related Hypotheses

Five hypotheses related to the logistics and supply chain construct, all confirming, were given in Table 5-1. Hypothesis H55 had one related item, 524, which was dropped based on feedback from the pilot test. The hypothesis itself was, therefore, also dropped. The remaining four hypotheses are summarized in Figure 5-31.

TABLE 5-31  
CONSTRUCT 12 HYPOTHESES

H51	Building and sustaining trust will be perceived as difficult.
H52	Supply chain integration will be perceived as important to providing effective depot maintenance.
H53	Managers and others interested in depot maintenance will perceive themselves as uncertain of the meaning of supply chain integration.
H54	Supply chain integration will be perceived as difficult to achieve.

### *H51 Building and sustaining trust will be perceived as difficult*

This hypothesis was discussed on page 283 under the topic of relational exchange, where it was supported.

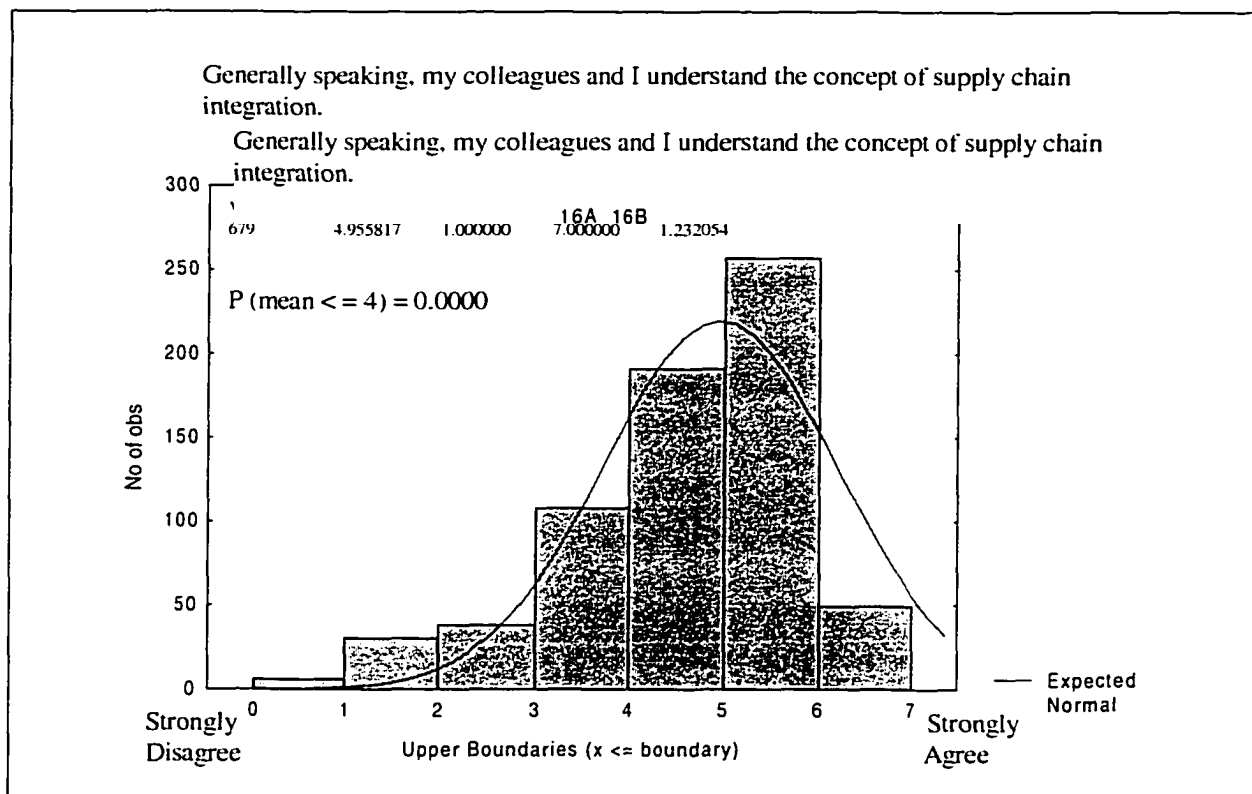
*H52 Supply chain integration will be perceived as important*

This hypothesis was discussed on page 286 under the topic of relational exchange, where it was supported.

*H53 Perceive themselves as uncertain of the meaning of supply chain integration*

This hypothesis had two related items, 534 (question 16A) and 579 (question 16B). The responses to the items are correlated ( $r = 0.67$ ,  $p = 0.0$ ). Therefore the author chose to linearly combine them by summing the responses and dividing by 2 to stay in the range 1 to 7. The histogram is at Figure 5-34. The hypothesis is not supported by this result.

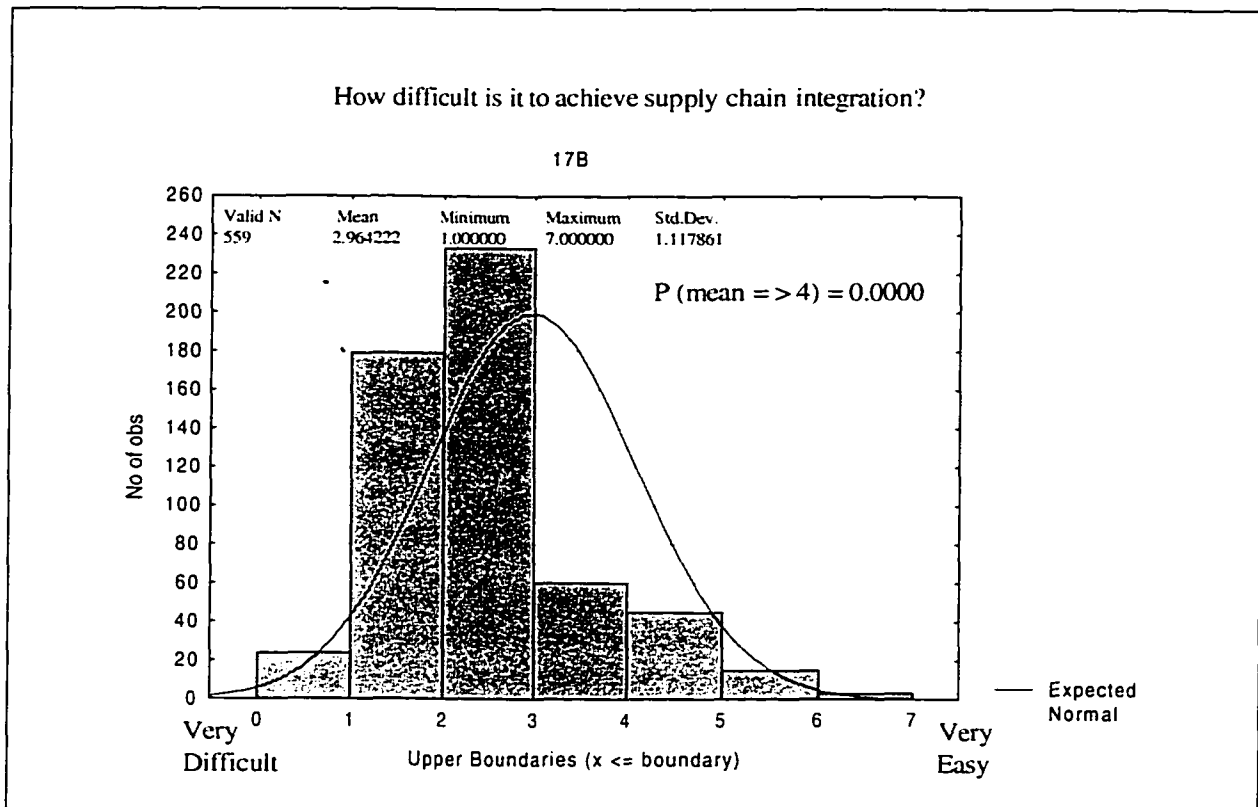
**FIGURE 5-34**  
ITEMS 534 AND 579 HISTOGRAM



*H54 Supply chain integration will be perceived as difficult to achieve*

This hypothesis has one associated item, number 523 (question 17B). The histogram is at Figure 5-35. The hypothesis was supported.

**FIGURE 5-35**  
ITEM 523 HISTOGRAM



## Summary of Results for Construct 12—Logistics and Supply Chains

Of the four hypotheses under this construct, three were supported (Table 5-32). The hypothesis that was not supported was that respondents would perceive themselves as uncertain of the meaning of supply chain integration.

**TABLE 5-32**  
**CONSTRUCT 12 RESULTS**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H51	Building and sustaining trust will be perceived as difficult.	Supported	See discussion under topic of relational exchange.
H52	Supply chain integration will be perceived as important to providing effective depot maintenance.	Supported	See discussion under topic of relational exchange.
H53	Managers and others interested in depot maintenance will perceive themselves as uncertain of the meaning of supply chain integration.	Not supported	Items 534 and 579 were correlated and treated as a single scale. Respondents perceive themselves and their colleagues as understanding the concept of supply chain integration.
H54	Supply chain integration will be perceived as difficult to achieve.	Supported	Item 523. Premise of item—that supply chain integration would be perceived as difficult to achieve—is supported.
H55	Supply chain integration will be perceived as more difficult to achieve with commercial (i.e., external) sources than with organic (i.e., internal) sources.	Hypothesis dropped after pilot test.	—

## Construct 13—Garbage Can Model

### Confirming Hypotheses

The garbage can model had five confirming hypotheses, as summarized in Table 5-33.

**TABLE 5-33**  
**CONSTRUCT 13 CONFIRMING HYPOTHESES**

H21	Random factors, under neither the control of depot maintenance providers nor managers, are perceived as being able to influence the outcome of depot maintenance.
H42	There will be differing interpretations of the concept of core.
H53	Managers and others interested in depot maintenance will perceive themselves as uncertain of the meaning of supply chain integration.
H56	Participants in the depot maintenance public versus private allocation decision will be perceived as continually changing.
H57	Chance occurrences rather than a rational process will be perceived as important to outcomes of depot maintenance public versus private allocation decision situations.

*H21 Random factors are perceived as being able to influence the outcome of depot maintenance*

This hypothesis has one related item, number 494 (question 7C). The histogram is at Figure 5-36. The responses to the survey support the hypothesis.

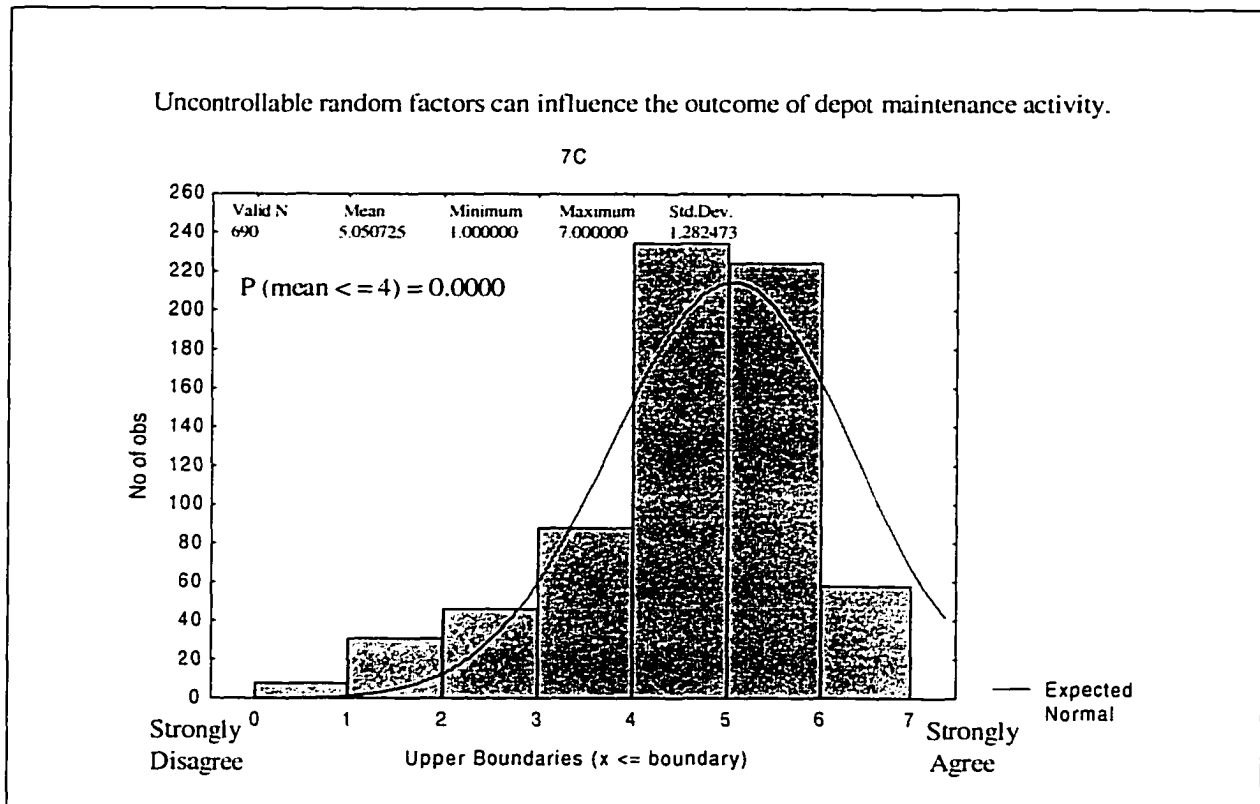
*H42 There will be differing interpretations of the concept of core*

This hypothesis is discussed under the topic of resource/competency-based theory on page 263 where it is supported.

*H53 Meaning of supply chain integration will be perceived as uncertain*

This hypothesis is discussed on page 292, where it is not supported.

**FIGURE 5-36**  
ITEM 494 HISTOGRAM



*H56 Participants in depot maintenance sourcing decisions will be perceived as continually changing*

This hypothesis is discussed in conjunction with the rational model in Chapter 4 (page 156). It is not supported.

*H57 Chance occurrences will be perceived as important to depot maintenance public versus private decisions*

This hypothesis is discussed in conjunction with the rational model in Chapter 4 (page 150). It is supported.

### Disconfirming Hypothesis

There was one disconfirming hypothesis, H01. The hypothesis asserts that persons with an interest in depot maintenance will perceive themselves as following the dictates of

the rational model when making depot sourcing decisions. This hypothesis is discussed in Chapter 4 in conjunction with the rational model. The results indicate that:

- The proposed definition of a rational process was accepted (For a decision process to be rational, it needs to have a well defined problem, a means for telling good alternatives from bad, a comparison of alternatives, and selection of the best alternative).
- The statement was also accepted that “Managers and others with an interest in depot maintenance should use rational processes to allocate workload between the public and private sectors.”

Further, the results indicate a perception that a rational process is used to allocate workload between the public and private sectors. However, such a rational process could consist of finding an alternative that is at least better than other possibilities—as opposed to an exhaustive search among possible alternatives. Putting this all together, the hypothesis is supported.

#### Summary of Results for Construct 13—Garbage Can Model

Of the five confirming hypotheses for this construct, three are supported and two were not supported; the one disconfirming hypothesis was also supported (Table 5-34). Overall, the idea that depot maintenance sourcing decisions are following the precepts of the garbage can model is partially supported.

TABLE 5-34  
CONSTRUCT 13 RESULTS

	Narrative Description	Result	Discussion of Corresponding Items
H21	Random factors, under neither the control of depot maintenance providers nor managers, are perceived as being able to influence the outcome of depot maintenance.	Supported	Item 494. The premise of the item—that uncontrollable random factors can influence the outcome of depot maintenance activity—is supported.
H42	There will be differing interpretations of the concept of core.	Supported	See discussion under topic of resource/competency-based theory.

**TABLE 5-34**  
**CONSTRUCT 13 RESULTS (CONTINUED)**

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H53	Managers and others interested in depot maintenance will perceive themselves as uncertain of the meaning of supply chain integration.	Not supported	See discussion under topic of logistics and supply chains, .
H56	Participants in the depot maintenance public versus private allocation decision will be perceived as continually changing.	Not supported	See discussion under topic of rational model in Chapter 4.
H57	Chance occurrences rather than a rational process will be perceived as important to outcomes of depot maintenance public versus private allocation decision situations.	Supported	See discussion under topic of rational model in Chapter 4.
H01	Persons with an interest in the depot maintenance will perceive themselves as following the dictates of the rational model when making depot sourcing decisions.	Supported. Although ideal rational process was highly desired, in-use rational process could consist of finding alternative at least better than other possibilities.	See discussion under topic of rational model in Chapter 4.

### **Construct 14—Political Economy**

#### **Related Hypotheses**

Four hypotheses are related to the political economy construct, all confirming (Table 5-35).



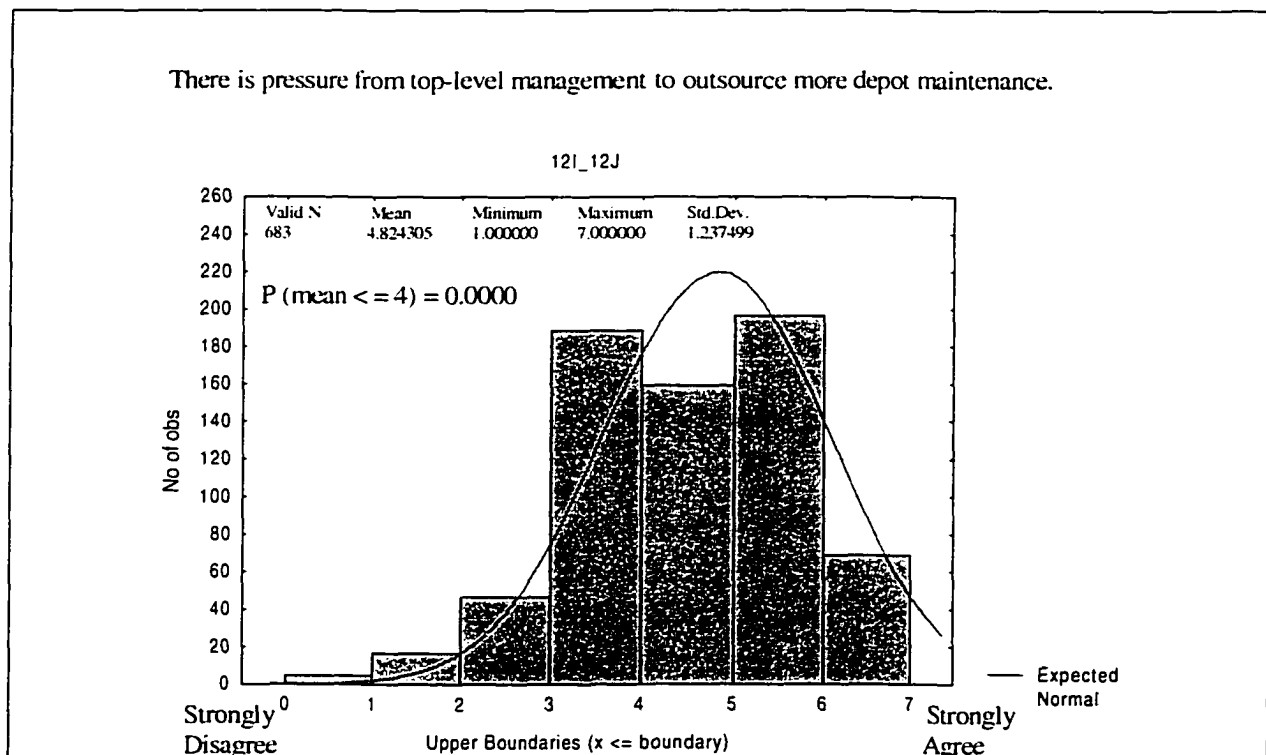
**TABLE 5-35**  
**CONSTRUCT 14 HYPOTHESES**

H47	Government managers will perceive themselves as under pressure from top-level management to outsource depot maintenance.
H58	Managers of and others with an interest in the depot maintenance public versus private workload allocation decision will perceive that decision makers have conflicting preferences with regard to the depot maintenance organic versus commercial source of repair allocation decision.
H59	Persons with a an interest in the depot maintenance public versus private workload allocation decision will perceive powerful people, defined as higher managerial levels, as getting what they want with regard to the depot maintenance organic versus commercial source of repair decision.
H60	Persons with a an interest in the depot maintenance public versus private workload allocation decision will perceive coalition formation.

*H47 Managers perceive pressure to outsource depot maintenance*

This hypothesis has two related items, 518 (question 12I) and 573 (question 12J). Because the responses to the two items are correlated ( $r = 0.68$ ,  $p = 0.0$ ), the author linearly combined them by summing the responses and then dividing by 2 to remain in the range 1 to 7. A histogram of the resulting combined scores is at Figure 5-37.

**FIGURE 5-37**  
**ITEMS 518 AND 573 HISTOGRAM**

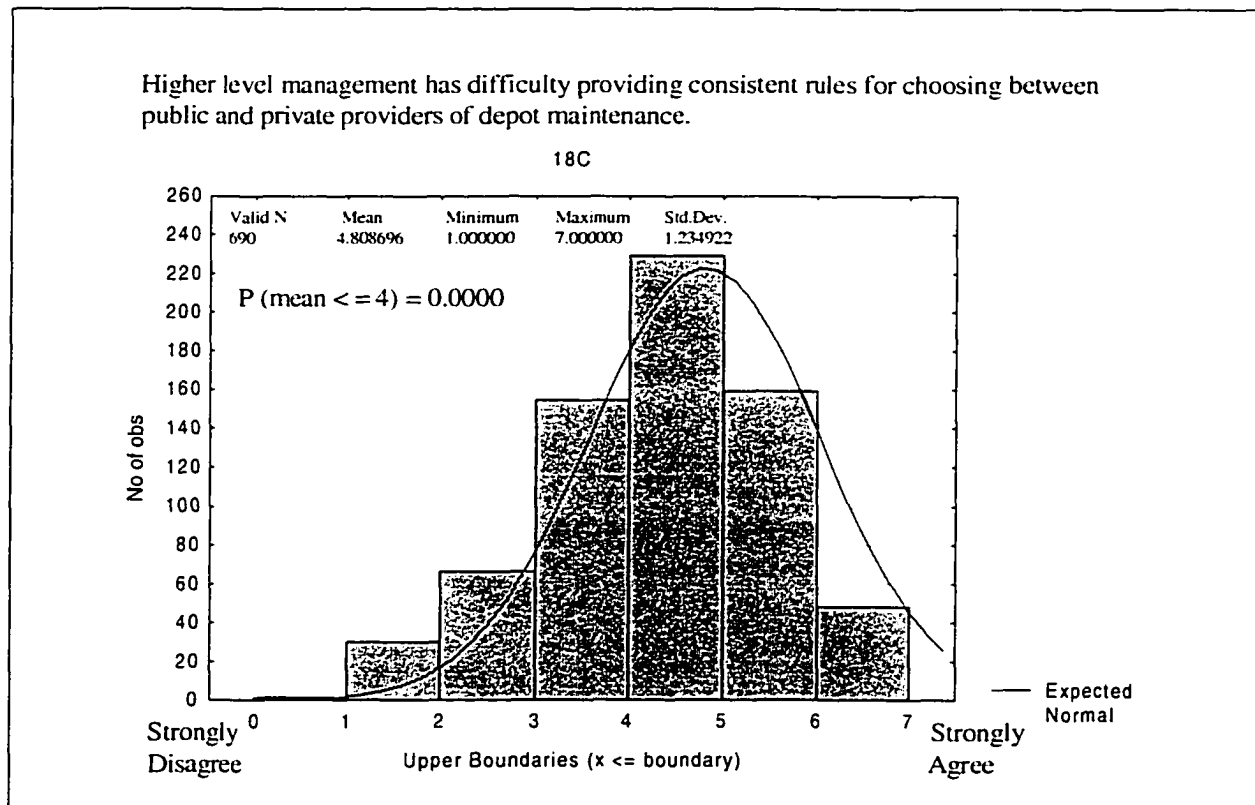


The histogram indicates that the distribution of responses to items 518 and 573, taken together, is potentially bimodal. ANOVA indicated significant differences of means on all six dimensions. However, examination of the various elements within each dimension found no case where one element was less than 4. Therefore the overall results are consistent with the sense of the statement associated with this item. Contingency table analysis (see Chapter 4 under "Analysis of Apparent Bimodal Responses") with experience with commercial sector, experience with public sector, and overall sector preference did not reveal a statistically significant relationship between any of these three dimensions and items 518 and 573 when taken together. The hypothesis is supported.

*H58 Decision makers perceived to have conflicting preferences*

Hypothesis H58 has one related item, 527 (question 18C). The histogram is at Figure 5-38. The responses to the survey support the hypothesis.

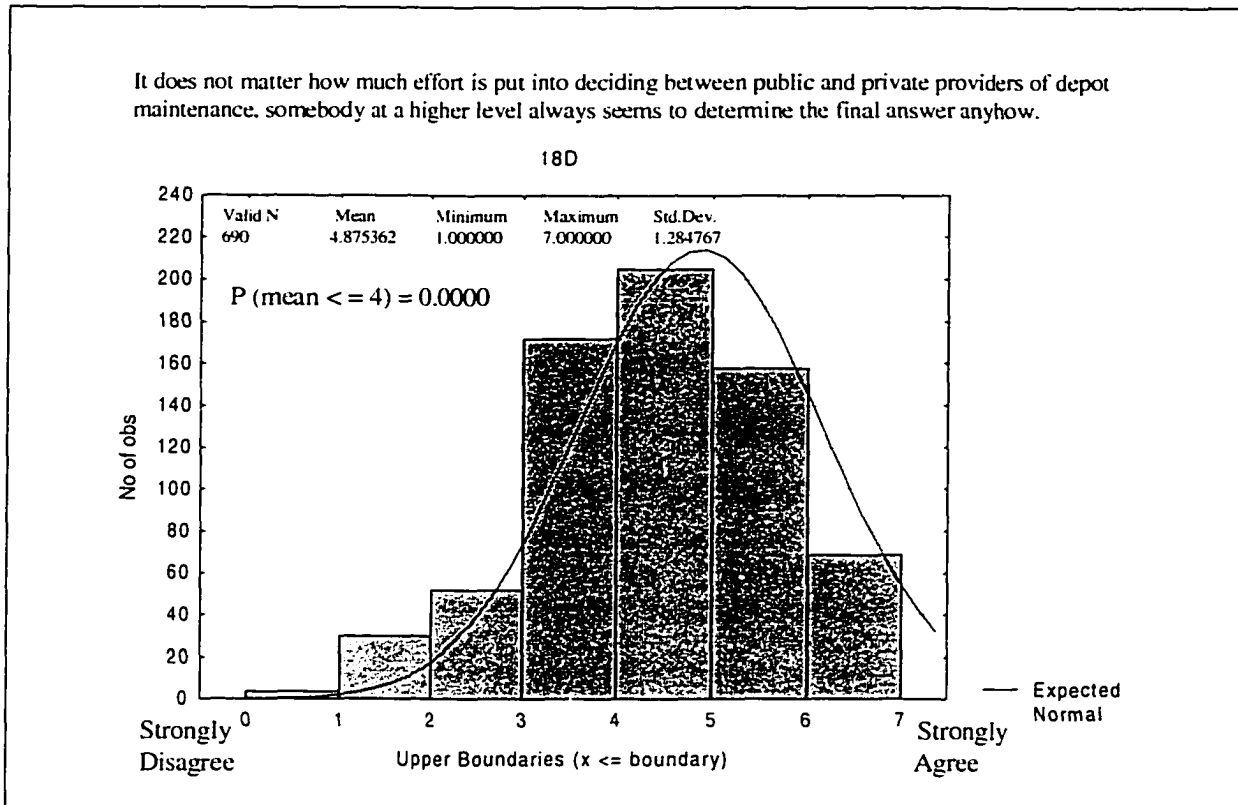
**FIGURE 5-38**  
ITEM 527 HISTOGRAM



*H59 Higher managerial levels perceived as getting what they want with regard to depot maintenance source of repair decisions*

Hypothesis H59 has one related item, 528 (question 18D). The histogram is at Figure 5-39. The responses to the survey support the hypothesis.

**FIGURE 5-39**  
ITEM 528 HISTOGRAM



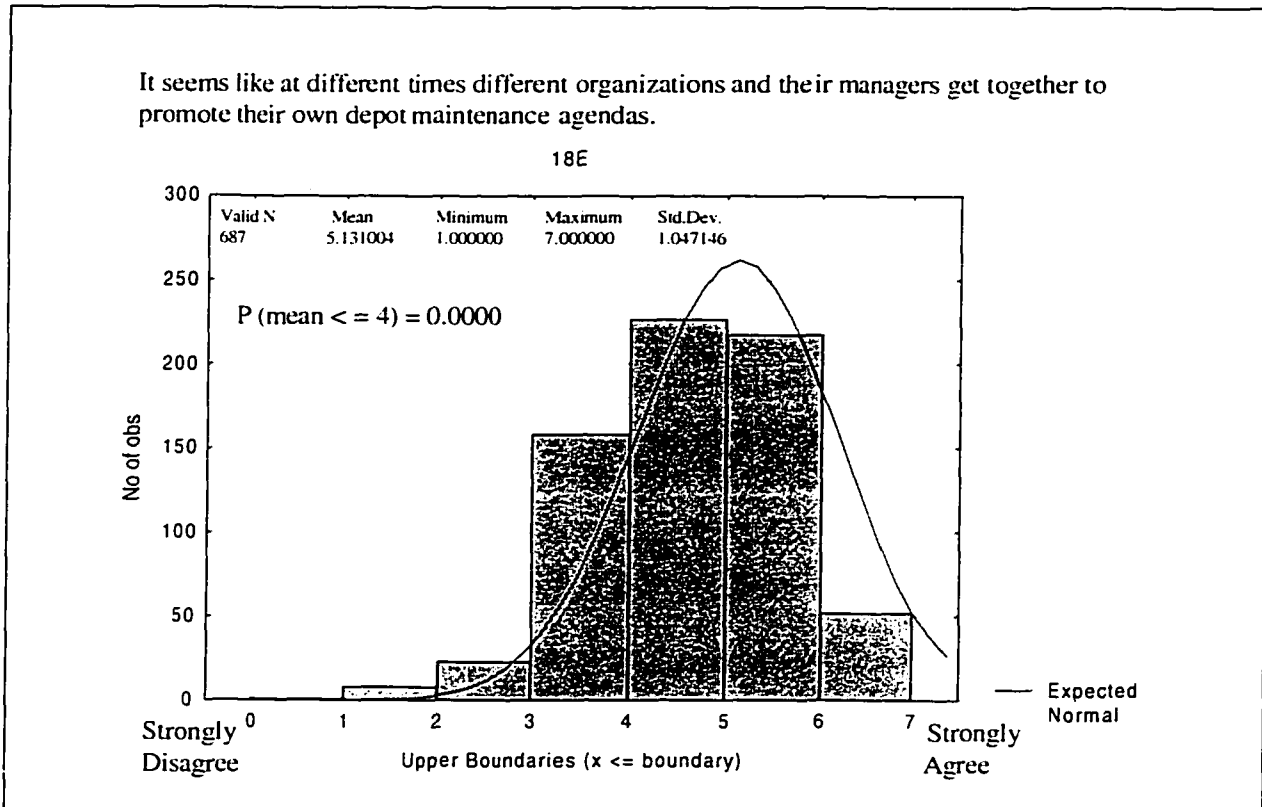
*H60 Perceived coalition formation*

Hypothesis H60 has one related item, 529 (question 18E). The histogram is at Figure 5-40. The responses to the survey support the hypothesis.

**Summary of Results for Construct 14—Political Economy**

The above results support all four hypotheses for the political economy construct (Table 5-36).

**FIGURE 5-40**  
ITEM 529 HISTOGRAM



**TABLE 5-36**  
CONSTRUCT 14 RESULTS

	<b>Narrative Description</b>	<b>Result</b>	<b>Discussion of Corresponding Items</b>
H47	Government managers will perceive themselves as under pressure from top-level management to outsource depot maintenance.	Supported	Item 518 and 573 were correlated and treated as a single scale. Results indicate that there is pressure from top management to outsource more depot maintenance.
H58	Managers of and others with an interest in the depot maintenance public versus private workload allocation decision will perceive that decision makers have conflicting preferences with regard to the depot maintenance organic versus commercial source of repair allocation decision.	Supported	Item 527. Premise of item—that higher level management has difficulty providing consistent rules for choosing between public and private providers of depot maintenance—is supported.

**TABLE 5-36**  
**CONSTRUCT 14 RESULTS (CONTINUED)**

H59	Persons with a and interest in the depot maintenance public versus private workload allocation decision will perceive powerful people, defined as higher managerial levels, as getting what they want with regard to the depot maintenance organic versus commercial source of repair decision.	Supported	Item 528. Premise of the item—that regardless of how much effort is put into deciding between public and private providers of depot maintenance, somebody at a higher level always seems to determine the final answer—is supported.
H60	Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive coalition formation.	Supported	Item 529. Premise of the item—that at different times different organizations and their managers get together to promote their own depot maintenance agendas—is supported.



DECIDING BETWEEN PUBLIC AND PRIVATE PROVIDERS OF HIGH  
TECHNOLOGY COMMERCIAL-LIKE ACTIVITIES:  
THE CASE OF WEAPON SYSTEM DEPOT MAINTENANCE

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# **CHAPTER 6**

## **INDIRECT ELICITATION: EXAMINATION OF WEAPON SYSTEM-RELATED DATA**

### **Introduction**

As described in Chapter 3, the present research uses the choice between public and private performance of depot maintenance as a specific focal point around which to elicit values. Further, it elicits those values using two different methodologies—indirect elicitation and a survey. Chapters 4 and 5 analyzed the responses to the survey. The present chapter pursues the indirect elicitation methodology.

The DoD services had developed data showing the choice of public or private depot maintenance provider by weapon system along with reasons for the choice, where the “menu” of choices was established in advance. The menu of choices corresponded well with many of the concepts and hypotheses summarized in Chapter 2—hence making it potentially possible to infer underlying norms, attitudes, and values. Further, the resulting data were comprehensive: the services generated 139 individual datapoints (a data point being a weapon system source of repair choice along with the associated factors) covering all of their major weapon systems.



## Weapon System-Related Data Elements as Scale Items

As indicated in Chapter 3, the model behind the weapon system-related data, when read fairly literally, is as shown at Figure 6-1. However, it is not clear whether the variables listed in that figure were anticipated to act

- independently of one another (i.e., combined using “or” logic) or
- in conjunction with one another (combined using “and” logic).

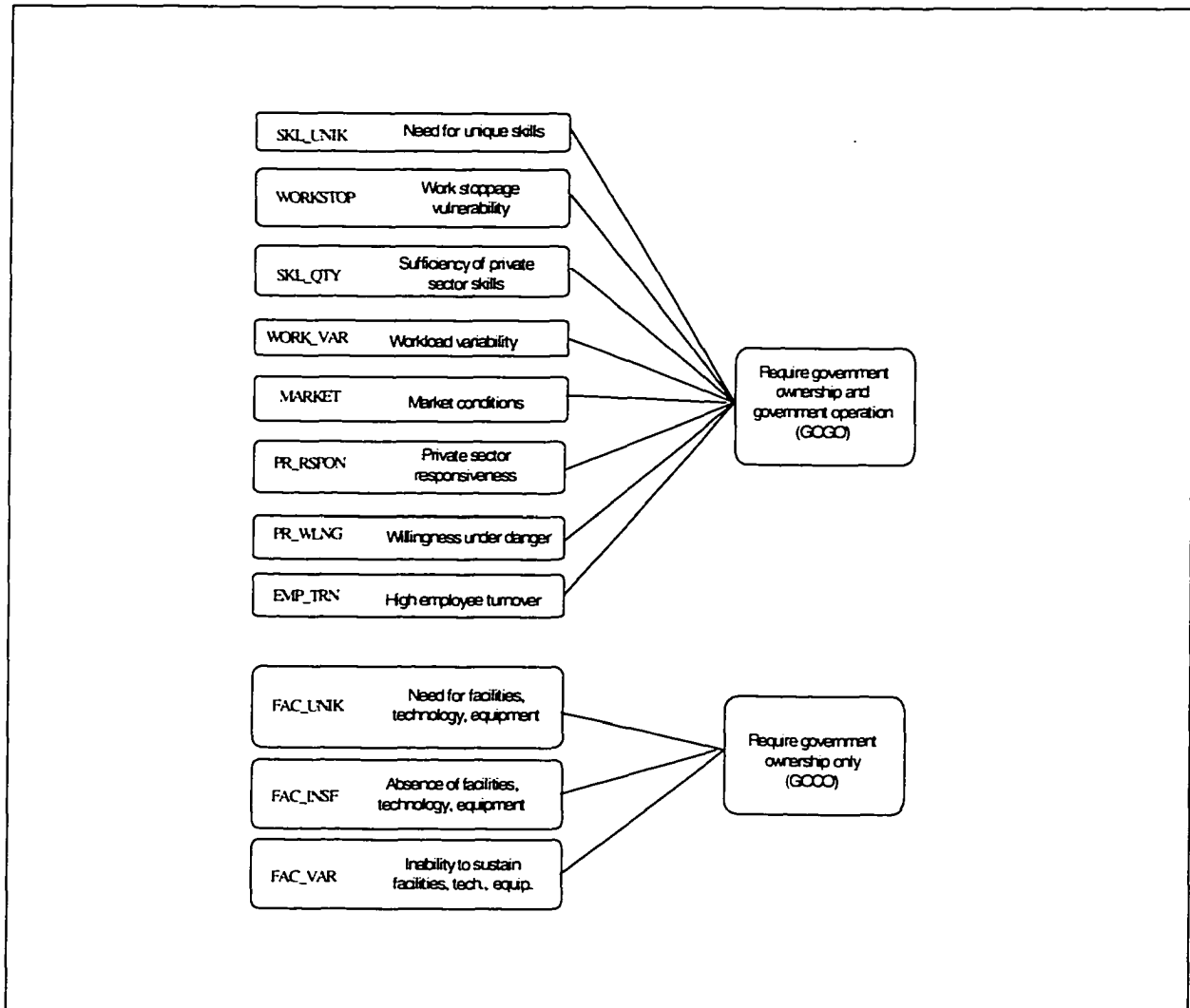
Further, the intended relationship between the two implied constructs (GOGO selection and GOCO selection) and the percentage of work performed by DoD is not clear. The reporting requirement could be read as requesting a binary (all or nothing) choice for each system and an overall percentage for the Department, or as desiring reporting of percentage by system. The DoD services evidently treated the requirement as a percentage reported by system, since they reported percentage of work between zero and 100 percent for 62 out of 139 systems. Here we will examine the variables two ways: in relation to the two constructs and as determinants of the percentage of work performed by DoD.

Before proceeding with the analysis, we should note that none of the DoD services perceived willingness to work under danger as an issue, and no data were collected on the variable PR\_WLNG. Hence the discussion that follows does not address this variable.

Chapter 3 discussed both content validity and substantive validity in relation to the weapon system-related data. Reprising that discussion, it is reasonably straightforward to relate the variables in Figure 6-1 to the concepts and hypotheses presented in Chapter 2. The scale items possess substantive validity—in the sense of being conceptually linked to the construct they are intended to measure. From the perspective of the present research, they do not possess content validity, because they do not fully cover any of the constructs from Chapter 2.

Here we will continue to follow the research process model outlined in Chapter 3, beginning with scale refinement. The author used exploratory factor analysis to refine the scale. Exploratory factory analysis (and confirmatory factor analysis as well) are problematic for these data, because all of the independent variables are binary and the dependent

**FIGURE 6-1**  
WEAPON SYSTEM-RELATED MODEL



variables are a combination of continuous and binary. Essentially what the scale purports to do is to classify workloads as requiring

- government ownership of facilities and equipment and government operation (GOGO),
- government ownership of facilities and equipment and commercial operation (GOCO), or
- commercial ownership of facilities and equipment and commercial operation (COCO).

As Johnson and Wichern (1992, 553) note, there is limited theory to handle the classification case where some variables are continuous and some qualitative. Further, the data

that result from attempts to do so are not necessarily well-behaved. Following their suggestion, the author also employed a logistic regression (a particular form of nonlinear regression appropriate when the dependent variables are binary) and then, as a third approach, used a step-wise multivariate regression. In all three cases the independent variables—because they are restricted to “0” or “1”—are considered as dummy variables. The three approaches will be discussed below and the results integrated at the end of the chapter.

## Factor Analysis Approach

### Scale Refinement

The Kaiser criterion provides for retaining factors when the associated eigenvalues are greater than 1. Figure 6-2 is a scree plot of eigenvalues resulting from exploratory factor analysis. Since there are four eigenvalues greater than 1, four factors were retained.

**FIGURE 6-2**  
EXPLORATORY FACTOR ANALYSIS SCREE PLOT

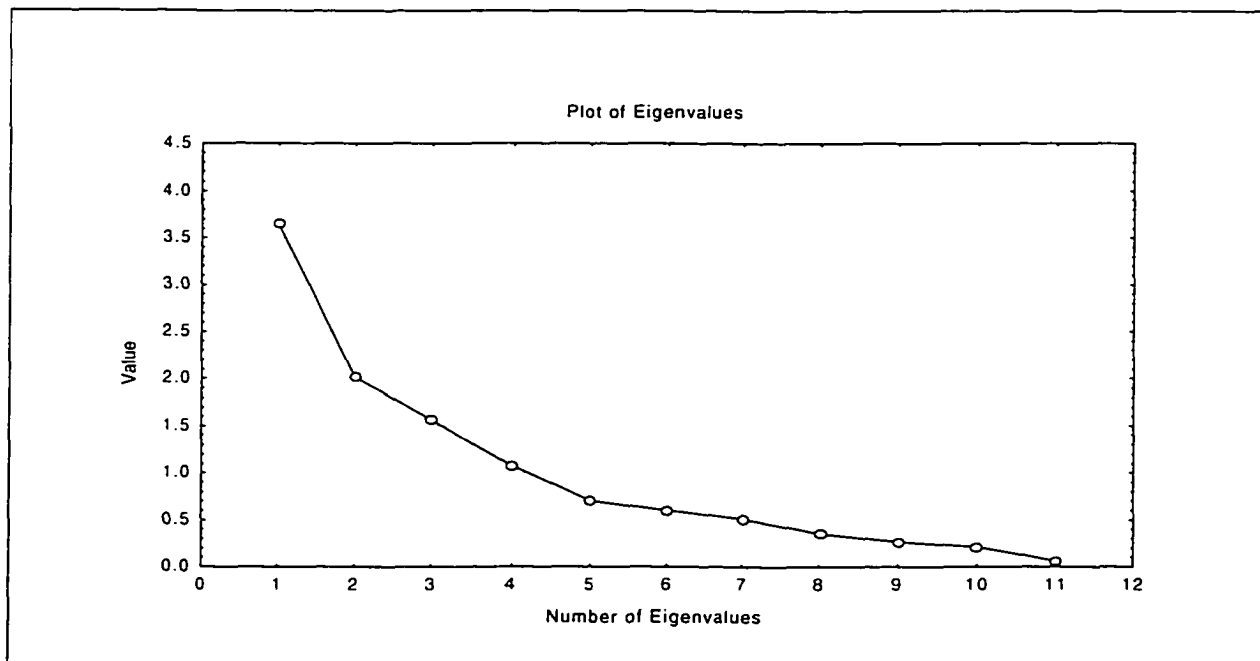


Table 6-1 displays the results of exploratory factor analysis. The variables in this table were previously defined in Table 6-1 with the exception of “GOV\_PCNT” which is

the percentage of a weapon system's depot maintenance that was reported as performed in DoD facilities. The four factors explain 75.4 percent of the variability in the data.

**TABLE 6-1**  
**EXPLORATORY FACTOR ANALYSIS RESULTS**

<b>Factor Loadings (Varimax raw)</b>				
Extraction: Principal Components				
Variable	Factor 1	Factor 2	Factor 3	Factor 4
SKL_UNIK	<u>0.8878</u>	0.0628	0.0083	-0.1362
WORKSTOP	0.5913	0.0214	-0.6929	-0.0943
SKL_QTY	<u>0.8230</u>	-0.1004	0.1375	-0.1123
WORK_VAR	-0.0649	-0.0116	0.0841	<u>0.9008</u>
MARKET	0.5264	0.1592	-0.4221	0.3947
PR_RSPON	0.0703	<u>0.8489</u>	-0.0811	0.0047
EMP_TRN	0.0358	0.2617	0.1962	<u>0.7449</u>
FAC_UNIK	<u>0.8736</u>	0.0247	0.0446	0.0814
FAC_INSF	0.0045	<u>0.8578</u>	0.0257	0.1459
FAC_VAR	0.2478	-0.0194	<u>0.8825</u>	0.1594
GOV_PCNT	<u>0.7846</u>	0.1347	-0.0957	0.2014
Expl. Var.	3.5428	1.5840	1.5200	1.6560
Prp. Totl.	0.3221	0.1440	0.1382	0.1505

Underlined loadings exceed 0.70

The exploratory factor analysis, however, indicated that only three of the variables (SKL\_UNIK, SKL\_QTY, AND FAC\_UNIK) load on the same factor with GOV\_PCNT. The other variables, at least as seen through this procedure, are unrelated to the amount of work performed in government facilities.

### Unidimensionality

As proposed in Chapter 3, unidimensionality was explored via confirmatory factor analysis. Note that confirmatory factor analysis as used here suffers from acknowledged limitations. One is that there are 139 cases in the dataset. Although there is some argument about the number of cases needed for confirmatory factor analysis, the minimum appears to be somewhere between 150 and 200 (Anderson and Gerbing 1988, 415-416; Bearden, Sharma, and Teel 1982, 429). A second limitation is that a researcher should use one set of

data in exploratory factor analysis and then a second set of data in confirmatory factor analysis (Breckler 1990, 267). Otherwise there is risk of confirming the consequent. That risk is present here, since there is only one set of data and splitting it into two parts would have made the problem with number of cases worse.

With those caveats, confirmatory factor results are shown in Table 6-2. All four variables that loaded on factor 1 are significant on one factor, as expected, confirming unidimensionality. However, it is still necessary to determine whether the model offers a good fit to the data.

TABLE 6-2  
CONFIRMATORY FACTOR ANALYSIS RESULTS

Model Estimates				
	Parameter Estimate	Standard Error	t Statistic	Prob. Level
(Factor_1)-1->[SKL_UNIK]	<u>0.3698</u>	<u>0.0305</u>	<u>12.1164</u>	<u>0.0000</u>
(Factor_1)-2->[SKL_QTY]	<u>0.3233</u>	<u>0.0386</u>	<u>8.3640</u>	<u>0.0000</u>
(Factor_1)-3->[FAC_UNIK]	<u>0.3539</u>	<u>0.0256</u>	<u>13.8018</u>	<u>0.0000</u>
(Factor_1)-4->[GOV_PCNT]	<u>0.2892</u>	<u>0.0298</u>	<u>9.7182</u>	<u>0.0000</u>
(DELTA1)—>[SKL_UNIK]				
(DELTA2)—>[SKL_QTY]				
(DELTA3)—>[FAC_UNIK]				
(DELTA4)—>[GOV_PCNT]				
(DELTA1)-5-(DELTA1)	<u>0.0493</u>	<u>0.0089</u>	<u>5.5729</u>	<u>0.0000</u>
(DELTA2)-6-(DELTA2)	<u>0.1392</u>	<u>0.0180</u>	<u>7.7166</u>	<u>0.0000</u>
(DELTA3)-7-(DELTA3)	<u>0.0187</u>	<u>0.0063</u>	<u>2.9764</u>	<u>0.0029</u>
(DELTA4)-8-(DELTA4)	<u>0.0718</u>	<u>0.0098</u>	<u>7.3514</u>	<u>0.0000</u>

Significance at 0.05 or better underlined.

There is no single, generally accepted goodness-of-fit measure for methods such as this that are based on structural equation modeling (Hartwick and Barki 1994, 448). Accordingly, as do other researchers generally, the author used multiple measures. The measures that were both available in Statistica and for which threshold values were found in the literature are shown in Table 6-3 along with the values generated by the above model. The threshold values for the first two measures are from Hartwick and Barki (1994, 448-449). The third is from Ghani and Deshpande (1994, 385).

**TABLE 6-3  
MODEL FIT INDICES**

Index	Range	Threshold for Good Fit	Value Achieved
Bentler-Bonett non-normed fit index (a transformation of chi-square that takes degrees of freedom into account)	0-1	> 0.9	0.605
Bentler comparative fit index	0-1	> 0.9	0.868
Joreskog adjusted goodness of fit index	0-1	> 0.9	0.413

None of the measures in Table 6-3 indicates a good fit, although the comparative fit index is close.

### Convergent Validity and Discriminant Validity

The guidance that resulted in development of the weapon system-related data provided for two constructs: GOGO and the elements that determine it; and GOCO and the elements that determine it. However there is no stated or obvious implied relationship between these two constructs and the “output” measure GOV\_PCNT, the percentage of work that is done by DoD. Additionally, exploratory factor analysis showed that GOV\_PCNT loaded on a single factor, and it was the only exogenous dependent variable. For these reasons, convergent validity and discriminant validity were not pursued. They are not necessarily not satisfied; there is insufficient information to perform the analysis.

### Criterion-Related Validity

Given the poor model fit, criterion-related validity is not satisfied.

## Logistic Regression Approach

### Regression Against Fraction of Work Performed by DoD

In pursuing this approach, the author first regressed the independent variables (i.e., elements) against the reported percentage of work performed by DoD, after converting all to integers by rounding the reported fractions up to 1 (100%) or down to 0 (0%). (Although

an extension of logistic regression permitting dependent variables that are non-binary is available in the Statistica Visual Generalized Linear Model, that model was not computable from these data.) Results are displayed two ways: in terms of an odds table (Table 6-4) and in terms of the regression coefficients (Table 6-5).

**TABLE 6-4**  
**ODDS WITH INTEGERIZED FRACTION OF WORK PERFORMED BY DOD**

<b>Classification of Cases</b>			
Odds ratio: 85.313			
Observed	Predicted		Percent Correct
	0	1	
0	30	16	65.2
1	2	91	97.8

As Table 6-4 indicates, the elements will, as scored by the DoD services, correctly predict 98 percent of the time that over half of the work on a weapon system will be performed by DoD personnel. Similarly, 65 percent of the time the elements will correctly predict that less than half of the work on a weapon system will be performed by DoD personnel. As Table 6-5 indicates, when all of the elements were included in the regression, only three of the elements make a difference in the resulting regression equation. They are EMP\_TRN, FAC\_UNIK, and FAC\_INSF. The author would argue that this result could be questionable from a criterion-related validity standpoint, since it is not clear why insufficient facilities in the private sector would require performance of the work by DoD employees rather than just performance in a DoD facility (this could be a case where GOCO would make sense).

**TABLE 6-5**  
**LOGISTIC REGRESSION EQUATION WITH DOD WORK AS DEPENDENT VARIABLE**

	Const.B0	MARKET	PR_RSPON	EMP_TRN	FAC_UNIK	FAC_INSF
Estimate	-12.97	2.29	-1.96	22.27	35.6867	27.33
Odds ratio (unit change)	0.00	9.84	0.14	$4.7 \times 10^9$	—	$7.4 \times 10^{11}$

Note: Variables that did not improve odds ratio are not shown.

## Regression Against GOGO and GOCO Indicators

To pursue the issue of GOGO and GOCO facilities further, the author regressed the weapon system-related data elements against the GOGO and GOCO indicators as reported in the DoD services' data. (The term "indicator" rather than "decision" is used here, since what was reported was the indication of whether work should be performed in a GOGO or GOCO facility. It was not necessarily a decision to do so.) The results of a regression with GOGO-related elements and the GOGO indicator as the dependent variable are in Table 6-6. The equivalent GOCO results are in Table 6-7.

**TABLE 6-6**  
**REGRESSION OF GOGO ELEMENTS AGAINST GOGO INDICATOR**

<b>GOGO Indication Regressed Against GOGO Elements</b>			
Classification of Cases			
Odds ratio: infinite			
Observed	Predicted		Percent Correct
	0	1	
0	37	0	100
1	0	102	100

**TABLE 6-7**  
**REGRESSION OF GOCO ELEMENTS AGAINST GOCO INDICATORS**

<b>GOCO Indication Regressed Against GOCO Elements</b>			
Classification of Cases			
Odds ratio: infinite			
Observed	Predicted		Percent Correct
	0	1	
0	103	0	100
1	0	36	100

In both cases the related regression equations correctly predict the outcomes 100 percent of the time. This is not to say, however, that all of the elements have the same predictive importance. Additionally, as it turns out, GOGO related elements have some predictive power for GOCO indicators, and GOCO elements will also predict GOGO



indicators. Table 6-8 shows the regression beta coefficients for all four cases. Beta values associated with an improvement in odds ratio unit change greater than an arbitrary value of 10 are underlined.

**TABLE 6-8**  
**GOGO AND GOCO REGRESSION SUMMARY**

Construct	Element	Beta Values			
		GOGO Indicator	GOCO Indicator	GOGO Indicator	GOCO Indicator
GOGO-Related	SKL_UNIK	8.61			1.92
	WORKSTOP	<u>12.59</u>			-5.59
	SKL_QTY	<u>12.67</u>			1.75
	WORK_VAR	<u>11.81</u>			0.82
	MARKET	6.76			2.78
	PR_RSPON	6.99			2.00
	EMP_TRN	2.77			<u>23.99</u>
GOCO-Related	FAC_UNIK		-1.42	<u>61.31</u>	
	FAC_INSF		<u>25.68</u>	<u>32.84</u>	
	FAC_VAR		<u>21.75</u>	1.63	

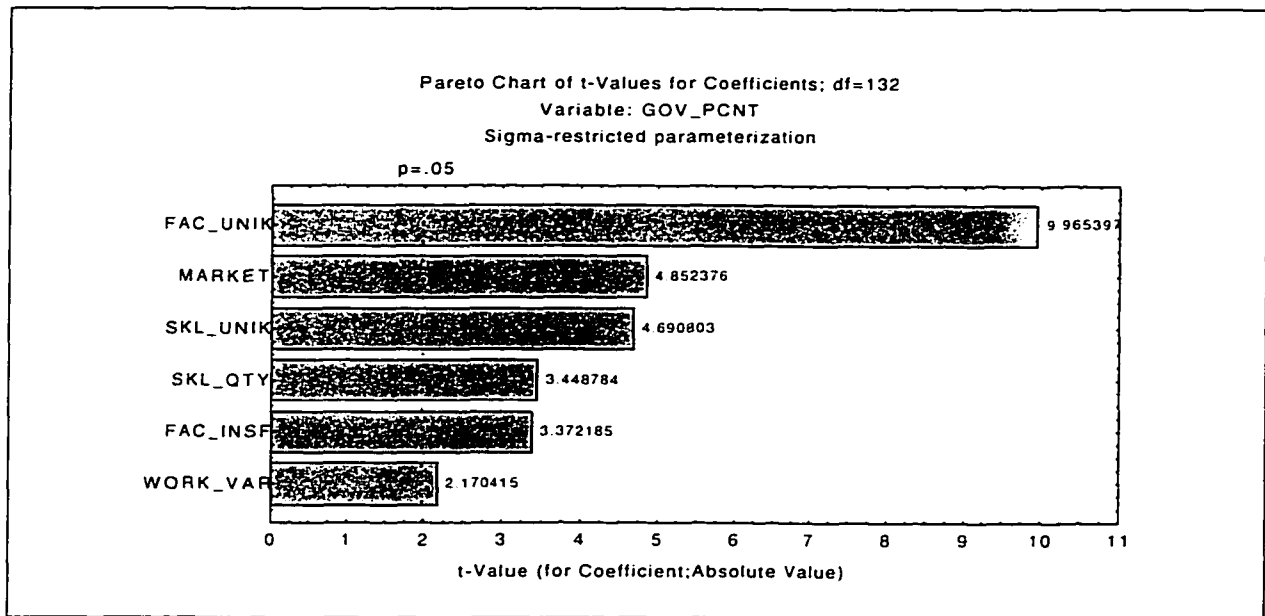
Improvement in odds ratio unit change > 10 underlined.

The author concludes from the display in Table 6-8 that all of the elements excepting SKL\_UNIK, MARKET, and PR\_RSPON seem to be useful in deciding if work should be performed in GOGO or GOCO facilities. However, the particular constructs relating the elements to the GOGO and GOCO indicators lack discriminate validity and would probably benefit from additional thought before being used for this purpose.

### Step-wise Multiple Regression Approach

As a third approach, the author performed a step-wise multiple regression using the percentage of work performed in DoD as the dependent variable and the elements as independent variables. The final adjusted  $R^2$ , with six independent variables retained, was 0.67 ( $F = 48.9$ , 6 degrees of freedom). The six retained variables are shown in Figure 6-3.

**FIGURE 6-3**  
STEP-WISE MULTIPLE REGRESSION RESULTS



## Summary

Table 6-9 integrates the results by element for the three statistical approaches used in this chapter. The multiple regression results partly agree with the results of the logistic regressions. Four of the six retained variables appear in both step-wise regression equations and at least one of the logistic regression equations. Three of these four variables also loaded on a single factor with GOV\_PCNT when the elements were examined in exploratory factor analysis, although confirmatory factor analysis did not show a good fit. Only one of the elements, private sector responsiveness (PR\_RSPON), did not appear as significant in any of the three approaches. Thus there is reasonable confirmation that the others are important to the choice of public or private performance.

It is reasonably clear from both the logistic regressions and the step-wise regression, however, that the GOGO and GOCO constructs appear to be mis-specified. Additionally, the literature that the author has reviewed, at least as he interprets it, suggests that the issues are more complex than the binary choices that were provided.

**TABLE 6-9**  
**SUMMARY RESULTS OF THREE APPROACHES**

Construct	Element	Approach in Which Supported			Related Hypotheses
		Logistic Regression (in at least one model)	Step-wise Regression	Factor Analysis	
GOGO Related	SKL_UNIK		√	√	H38
	WORKSTOP	√			H15
	SKL_QTY	√	√	√	H38, H08
	WORK_VAR	√	√		H16
	MARKET		√		H03
	PR_RSPON				H13
	EMP_TRN	√			None
GOCO Related	FAC_UNIK	√	√	√	H11, H12
	FAC_INSF	√	√		H08, H15
	FAC_VAR	√			H16

# CHAPTER 7

## DISCUSSION AND CONCLUSIONS

### Purpose of This Research

The purpose of this study was to understand the factors that are perceived by stakeholders within and outside the U.S. Department of Defense as important to deciding whether or not to outsource weapon system depot maintenance to the commercial sector. In pursuing this research it was recognized that the choice between public and private providers of depot maintenance is an instance of a broader issue—the choice between public and private providers of high-technology commercial-like activities generally. Thus results here might also have broader implications.

### Research Questions and Approach

The research questions were as follows:

1. What factors are perceived as important to the choice between public and private providers of depot maintenance?
2. What is the relative importance of the factors compared to one another?
3. Where is there consensus between different constituencies, and where are there differences?
4. To what extent are the perceptions consistent with or inconsistent with received theory?

To address these questions, this research employed indirect elicitation and survey methods. In the indirect elicitation approach, the research analyzed weapon system-related data the DoD services had already collected: the DoD services had developed data showing the choice of public or private depot maintenance provider by weapon system along with reasons for the choice, where the “menu” of choices was established in advance. In the survey approach, the researcher created a survey instrument and conducted a survey of stakeholders both in and outside the DoD to determine their perceptions related to depot maintenance outsourcing decisions. The balance of this chapter will summarize the research, compare the results to those of other researchers, and place the results in the context of received theory. It is most straightforward to summarize while comparing to the results of others first, and then proceed to the research questions. After addressing the research questions, this chapter will offer conclusions and suggestions for further research.

## **Summary of Research Results**

The summary that follows is organized in terms of the major theoretical constructs introduced in Chapter 2—one section per theoretical construct. The summary begins with discussion of the rational model.

### **Rational Model**

The rational model construct had three associated hypotheses as shown in Table 7-1.

There was sharp agreement among survey participants on the strong form of the rational model (well-defined problem, means for telling good alternatives from bad, a comparison of alternatives, and selection of the best alternative) and that this process should be used to make depot maintenance sourcing decisions.

Participants held two conflicting views about the process in use, however. The first was that a rational process is used to make sourcing decisions—albeit in a weaker form (finding an alternative that is at least better than the other possibilities). Carver (1988), Davis (1996), Low (1993), and Sink (1995) found similar results. The second view was that

**TABLE 7-1  
RATIONAL MODEL**

	Type	Narrative	Survey Results	Weapon System Results
H01	C	Persons with an interest in depot maintenance will perceive themselves as following the dictates of the rational model when making depot sourcing decisions.	Supported. Although ideal rational process was highly desired, in-use rational process could consist of finding alternative at least better than other possibilities.	—
H56	D	Participants in the depot maintenance public versus private allocation decision will be perceived as continually changing.	Not supported	—
H57	D	Chance occurrences rather than a rational process will be perceived as important to outcomes of depot maintenance public versus private allocation decision situations.	Supported	—

Note: C=confirming, D=disconfirming

chance occurrences, rather than a rational process, are important to outcomes of sourcing decisions. Although about 10 percent of the survey respondents held both conflicting views simultaneously, in general the participants took a middle ground, held one, or held the other. Overall, just under 30 percent perceived the process as rational, and just over 40 percent perceived chance occurrences as determining outcomes.

A rational process was perceived as important to the choice between public and private providers of depot maintenance. When viewed in terms of constituency, there was one statistically significant difference—between industry and DoD, with DoD more likely than industry to perceive sourcing outcomes as determined by something unexpected. The perceptions recorded in response to this survey are more consistent with an incrementalist view of decision making than the rationalist view. However, they are simultaneously consistent, at least in part, with the garbage can model of organizational decision making. Sink (1995) was the only researcher noted to have examined sourcing decisions from the perspective of the garbage can model. His findings were partially consistent with the garbage can model.

## Imperfect Competition

The imperfect competition construct had six related hypotheses (Table 7-2).

**TABLE 7-2**  
**IMPERFECT COMPETITION**

	Type	Narrative	Survey Results	Weapon System Results
H02	C	Depot maintenance workload will be perceived as unique and outside the commercial mainstream.	Indeterminate. Responses appeared to depend on respondent's perceived experience with commercial providers, experience with public providers, and overall sector preference.	—
H03	C	Availability of more than one source will be perceived as important to the organic versus commercial workload allocation decision.	Supported	Supported in step-wise regression (MARKET)
H04	C	Existence of proprietary data will be perceived as important to the organic versus commercial workload allocation decision.	Supported	—
H05	C	Managers of and other persons with an interest in depot maintenance will perceive organic depot maintenance capability to be an internal monopoly.	Supported	—
H06	C	Managers of and other persons with an interest in depot maintenance will perceive of public versus private competition for depot maintenance as being conducted on a playing field that is not level.	Supported	—

**TABLE 7-2**  
**IMPERFECT COMPETITION (CONTINUED)**

	Type	Narrative	Survey Results	Weapon System Results
H30	C	The availability of a competitive marketplace will be perceived as mattering if government is to benefit from commercial capabilities.	Partially Supported. The role of public depots in preventing a sole source situation was affirmed. However, perceived difficulty determining the existence of a competitive marketplace or creating a competitive marketplace appears to be related to overall sector preference and experience with public providers.	—

Note: C=confirming, D=disconfirming

Weapon system-related data elements shown in parentheses.

Four of the six hypotheses under the topic of imperfect competition were supported by the survey, one was indeterminate, and one was partially supported. The weapon system-related data results spoke to one of the hypotheses, H03, which was supported. It is reasonably clear that depot maintenance is perceived as a case of an imperfect market. This is consistent with the findings of Warren (1998a) and Parker (1994) when they examined depot maintenance. The idea that having more than one source is important was well supported by both the survey and the weapon system-related results—and is consistent with the Forbes et al. (1997) study of depot maintenance. The degree to which competition is lacking, however, was not well characterized.

Respondents to the survey, when asked if depot maintenance is outside the commercial mainstream, provided conflicting responses. These responses appeared to depend on their perceived experience with commercial providers, their perceived experience with public providers, and overall sector preference. A similar situation arose when the respondents were asked if the availability of a competitive marketplace mattered to the government's ability to benefit from commercial capabilities. The role of public depots in preventing a sole source situation was affirmed, and organic depot maintenance capability was recognized as an internal monopoly. However, the perceived existence (or perceived nonexistence) of a competitive marketplace appeared to be related to overall sector preference and experience with public providers.



## Market Failure

The market failure construct had two related hypotheses. The idea that depot maintenance is a case of market failure was generally supported and is consistent with other empirical findings (Forbes, Hutcheson, and Timko 1997). The survey results provided qualified support for a conclusion that for some depot workloads there is a lack (or at least a perceived lack) of commercial firms with adequate capacity to avoid start-up delays. The analysis of weapon system-related data provided fairly strong support.

**TABLE 7-3  
MARKET FAILURE**

	Type	Narrative	Survey Results	Weapon System Results
H07	C	For at least some depot maintenance workloads there will be a perceived lack of commercial firms willing to do the work.	Supported	—
H08	C	For at least some depot maintenance workloads there will be a perceived lack of commercial firms with the scope of capability to respond in the quantity necessary without an initial start-up delay	Supported with qualifications. Perceived ability to provide quantity of work needed without startup delay depended on who was doing perceiving (their overall sector preference, specific experience with commercial providers, organization, and sector to which they belonged).	Supported in all three approaches. (SKL_QTY). Supported in logistic regression and step-wise regression (FAC_INSF)

Note: C=confirming; D=disconfirming  
Weapon system-related data elements shown in parentheses.

## Economy of Scope and Scale

This construct originally had two hypotheses but one, H10, was dropped after the pilot survey. The results (Table 7-4) however, support the idea that economies of scope and scale are important to the depot maintenance outsourcing decision. As noted in Chapter 2, attempts to establish empirical validity for scale and scope economy in the context of depot maintenance have produced conflicting results.

**TABLE 7-4**  
**ECONOMY OF SCOPE AND SCALE**

	Type	Narrative	Survey Results	Weapon System Results
H09	C	Managers of and other persons with an interest in depot maintenance will perceive ability to achieve economies of scale and or scope as important to the depot maintenance outsourcing decision.	Supported. Premise that depot maintenance takes large capital investment was supported. Which sector has better economy of scale also perceived as important to public-private choice.	—
H10	C	Outsourcing depot maintenance improves depot maintenance economy of scale.	Hypothesis dropped after pilot survey.	—

Note: C=confirming; D=disconfirming

### Transaction Cost Economics

The transaction cost economics construct had 10 associated hypotheses, 7 of which were confirming and 3 disconfirming (Table 7-5). Excepting hypothesis H16, all of the hypotheses—both confirming and disconfirming—were supported by the survey. Of the five hypotheses to which the analysis of weapon system-related data applied, three were supported, one (H13) was not, and one (H15) was partially supported. In these two cases, the weapon system-related data analysis results and survey results also differ—as they also do for H16.

It appears that the difference between the survey and weapon system-related results for H15 is attributable to, in the case of the element “WORKSTOP,” their having tested different issues. The survey asked if the military would experience a loss of control through outsourcing because commercial providers could not respond fast enough. Here, the results from the survey and the weapon system-related data FAC\_INSF element are in agreement. The weapon system-related data WORKSTOP element asked if the base of private-sector sources able to perform depot maintenance includes sources that are vulnerable to work stoppages. Since this issue—in particular, concern over strikes—came up a number of

times in the written comments, the reason why it does not show up in the weapon system-related data is uncertain.

The different results for H13 are not easily explained. When responding to the survey, respondents perceived it as difficult to state all contingencies in advance when arranging for depot maintenance work. In contrast, the weapon system-related data revealed no particular concerns about whether private-sector sources could respond to changes in the mix or priority of previously scheduled workload without additional contractual negotiations. Ambiguity over this issue was also found during the literature review, when authors such as Keenan et al. (1994) and Camm (1993) were found to take opposing positions. The issue remains unresolved.

In the instance of hypothesis H16, the idea that a combination of low task frequency and high uncertainty would lead to high transaction costs was statistically supported by the weapon system-related data but indeterminate in the survey data. However, visual examination of the weapon system-related data revealed sub-populations with different perspectives there, as well. The Air Force and Navy seldom indicated a concern that work was too infrequent, cyclical, or variable to sustain a reliable base of private-sector sources with the necessary facilities, technology, or equipment. By contrast the Army did so, for almost all of its workloads. Probably the fairest assessment is that—in contrast to what the survey results suggested—perceptions here appear to be organizationally dependent.

With the exceptions noted above, the perceptions of the respondents to the survey and those who created the weapon system-related data accord well with the tenets of transaction cost economics. What was unexpected, however, is that they also accord well with hypotheses H48, H49, and H50, which come from relational/social exchange theory. This school of thought holds that neoclassical economic theory provides an under-socialized explanation of the behavior organizations adopt to obtain critical resources. Based on these results we could expand on that statement to suggest that transaction cost economics does also.

**TABLE 7-5**  
**TRANSACTION COST ECONOMICS (TCE)**

	Type	Narrative	Survey Results	Weapon System Results
H11	C	Managers of and other persons with an interest in depot maintenance will perceive tight linkage among stages in the depot maintenance repair process as important to deciding between organic and commercial sources of repair.	Supported.	Supported in all three approaches (FAC_UNIK)
H12	C	Managers of and other persons with an interest in depot maintenance will perceive specificity of production equipment as important to deciding between organic and commercial sources of repair.	Supported	Supported in all three approaches (FAC_UNIK)
H13	C	Managers of and other persons with an interest in depot maintenance will perceive the difficulty of stating all contingencies in advance as important to deciding between organic and commercial sources of repair.	Supported	Not supported in any approach (PR_RSPON)
H14	C	Managers of and other persons with an interest in depot maintenance will perceive the need to monitor shirking as important to deciding between organic and commercial sources of repair.	Supported. Ability to make sure work is actually done is perceived as important to public-private source of repair choice. Additionally, respondents perceived well-defined criteria for measuring performance of depot maintenance providers as available.	—

**TABLE 7-5**  
**TRANSACTION COST ECONOMICS (TCE) (CONTINUED)**

	<b>Type</b>	<b>Narrative</b>	<b>Survey Results</b>	<b>Weapon System Results</b>
H15	C	Managers and others with an interest in depot maintenance will perceive increased risk if crucial contingencies are left to the market.	Supported. More particularly, managers and others with the most direct interest in depot maintenance perceive risk, while others do not.	Work stoppage (WORKSTOP) not supported in any of three approaches. Problem with start-up delays supported in logistic regression and step-wise regression (FAC_INSF)
H16	C	Managers of and others with an interest in depot maintenance will perceive the combination of low task frequency and high uncertainty as leading to high transaction costs if depot maintenance is outsourced.	Indeterminate. Evidence of two different sub-populations—most likely related to complexity of technology with which respondents were familiar.	Supported in logistic regression and step-wise regression (WORK_VAR) Supported in Logistic regression (FAC_VAR)
H17	C	The choice between public and commercial providers of depot maintenance will be perceived to depend on the total cost where total cost is the sum of production cost and transaction costs.	Supported. However there is lack of consensus that choice should depend on cost alone.	—
H48	D	Long-term alliances between users of depot maintenance and commercial firms will be perceived as important to effective depot maintenance support.	Supported	—
H49	D	Long-term alliances between organic depots and their customers will be perceived as important to effective depot maintenance support.	Supported	—

TABLE 7-5  
TRANSACTION COST ECONOMICS (TCE) (CONTINUED)

	Type	Narrative	Survey Results	Weapon System Results
H50	D	Building and sustaining trust will be perceived as important to effective long-term depot maintenance alliances.	Supported. However, respondents perceived long-term relationships with public providers as more likely than long-term relationships with private providers.	—

Note: C=confirming; D=disconfirming

Weapon system-related data elements shown in parentheses.

### Principal-Agent Theory

Principal-agent theory had 11 associated hypotheses, of which 8 were confirming and 3 disconfirming (Table 7-6). There were no weapon system-related data elements that related to principal-agent theory. Five of the confirming hypotheses were supported by the survey results, one partially supported, and two not supported. The exception to support for the tenets of principal-agent theory that is probably particularly worth noting is H18. The expectation was that organic and commercial providers would differ in the extent to which they have conflicts of interest with their customers. Although the survey results do reflect differences in perception, they appear more related to who was doing the perceiving than to differences between organic and commercial providers.

With the exception of H18 and, to a lesser extent, H25, the perceptions of the respondents to the survey accord with the ideas from principal-agent theory. They tend to support those of Davis (1996); Low (1993); McCray (1996); Shiang (1995); and, specifically with regard to depot maintenance; Forbes et al. (1997). The disconfirming hypotheses were the same noted above when discussing transaction cost economics, and the conclusion—that economic concepts alone provide an under-socialized view of what is going on—is the same.

**TABLE 7-6  
PRINCIPAL-AGENT THEORY**

	Type	Narrative	Survey Results	Weapon System Results
H18	C	Organic and commercial providers of depot maintenance are perceived as differing in the extent to which they have conflicts of interest with the users of depot maintenance.	Not supported. Perceived differences appeared related to who was doing perceiving rather than to difference between organic and commercial providers.	—
H19	C	Organic and commercial providers of depot maintenance are perceived as differing in their degree of carefulness, industriousness, and trustworthiness.	Not supported.	—
H20	C	Organic and commercial providers of depot maintenance are perceived as differing in the degree to which they can influence the desired outcome of depot maintenance activity.	Supported	—
H21	C	Random factors, under neither the control of depot maintenance providers nor managers, are perceived as being able to influence the outcome of depot maintenance.	Supported	—
H22	C	The outcome of depot maintenance is perceived as observable to both providers of depot maintenance and to government managers of depot maintenance.	Supported	—
H23	C	The providers of depot maintenance will be perceived as having better information than government managers of depot maintenance about the degree of care exercised during the performance of depot maintenance.	Supported	—
H24	C	Public and commercial providers are perceived as having different potential to act opportunistically.	Supported	—

**TABLE 7-6**  
**PRINCIPAL-AGENT THEORY (CONTINUED)**

	Type	Narrative	Survey Results	Weapon System Results
H25	C	Retention by the government of smart buyer capability will be perceived as important.	Partially supported. Respondents in maintenance, logistic management, and operations perceive need for the government to do at least some depot maintenance work itself to make sure it knows what it is asking for and getting. Other DoD and industry respondents do not see the need.	—
H48	D	Long-term alliances between users of depot maintenance and commercial firms will be perceived as important to effective depot maintenance support.	Supported	—
H49	D	Long-term alliances between organic depots and their customers will be perceived as important to effective depot maintenance support.	Supported	—
H50	D	Building and sustaining trust will be perceived as important to effective long-term depot maintenance alliances.	Supported. However, whereas respondents would expect long-term relationships with public providers, they would not necessarily expect long-term relationships with commercial providers.	—

Note: C=confirming; D=disconfirming

### Public Choice Theory

Public choice theory had two associated hypotheses, the results for which are summarized in Table 7-7. Both hypotheses were supported. As noted in Chapter 2, not many studies were found that related outsourcing to public choice theory. Those that did had results generally consistent with H27. The only study that provided evidence related to depot maintenance was that by Kiebler et al. (1996), who had results consistent with H26.



**TABLE 7-7**  
**PUBLIC CHOICE THEORY**

	<b>Type</b>	<b>Narrative</b>	<b>Survey Results</b>	<b>Weapon System Results</b>
H26	C	Interest groups internal to government (i.e., Department of Defense, ministry of defense, or other government agency as applicable) will be perceived as influencing the choice of public versus commercial provision of depot maintenance.	Supported	—
H27	C	Interest groups external to government (i.e., Department of Defense, ministry of defense, or other government agency as applicable) will be perceived as influencing the choice of public versus commercial provision of depot maintenance.	Supported	—

Note: C=confirming; D=disconfirming

### Privatization and Theory of Non-Market Failure

Nine hypotheses, all confirming, were related to privatization and the theory of non-market failure. No weapon system-related data elements relate to this area. Six of the nine hypotheses were supported, and three were partially supported. As indicated in Table 7-8, two of the three that were partially supported have in common differences that appeared to depend on functional specialty. In the case of H30 the differences appeared to be related to experience with public providers and overall sector preference.

The author would call particular note to the results for H31, H32, and H33, which deal from three perspectives with invention and innovation. The perceptions of survey respondents were consistent with findings of Wolf (1994) and Boardman and Vining (1989)—that commercial firms are better able to develop new technology; find and employ technology; and use technology to reduce cost, raise productivity, and improve quality. H37 asserted that government depot capability would be perceived to be a core government logistics competency. Even though this hypothesis was supported, difficulties need to be acknowledged. As will be discussed later under the topic of resource/competency-based theory, there are differing core concepts. Thus, while the survey respondents may agree that depot maintenance is a core competency, they may not all be defining the term “core competency” the same way.

**TABLE 7-8**  
**PRIVATIZATION AND THEORY OF NON-MARKET FAILURE**

	Type	Narrative	Survey Results	Weapon System Results
H17	C	The choice between public and commercial providers of depot maintenance will be perceived to depend on the total cost where total cost is the sum of production cost and transaction costs.	Supported. However there is lack of consensus that choice should depend on cost alone. See discussion under topic of transaction cost economics.	—
H25	C	Retention by the government of smart buyer capability will be perceived as important.	Partially supported. See discussion under topic of principal-agent theory. Respondents in maintenance, logistics management, and operations perceive need for the government to do at least some depot maintenance work itself to make sure it knows what it is asking for and getting. Other DoD respondents and industry respondents do not see the need.	—
H28	C	Private provision of goods and services will be preferred, in general, to public provision.	Partially supported. Those not involved in maintenance appear to prefer private providers. Those involved in maintenance prefer public providers—with those most directly involved most likely to prefer public providers.	—
H29	C	Private providers of depot maintenance will be perceived as more efficient at depot maintenance than their public counterparts.	Supported	—
H30	C	The availability of a competitive marketplace will be perceived as mattering if government is to benefit from commercial capabilities.	Partially supported. See discussion under topic of imperfect competition.  The role of public depots in preventing a sole-source situation was affirmed.  However, perceived difficulty determining the existence of a competitive marketplace or creating one appears to be related to overall sector preference and experience with public providers.	—

**TABLE 7-8**  
**PRIVATIZATION AND THEORY OF NON-MARKET FAILURE (CONTINUED)**

	Type	Narrative	Survey Results	Weapon System Results
H31	C	Compared to government, commercial firms will be perceived as having better dynamic efficiency—the ability to develop new technology that lowers cost functions, improves product quality, and creates new and marketable products	Supported	—
H32	C	Compared to government, commercial firms will be perceived as having better technological efficiency—the ability to find and employ the best technology currently available, thus producing at lower cost and higher quality	Supported	—
H33	C	Compared to government, commercial firms will be perceived as having better X-efficiency—the ability, given a specific technology, to reduce cost, raise productivity, and improve quality through changes in organization, management practices, and worker motivation.	Supported	—
H37	C	Government depot maintenance capability is perceived to be a core government logistics competency.	Supported.	—

Note: C=confirming; D=disconfirming

### Resource/Competency-Based Theory

Nine hypotheses were associated with resource/competency-based theory, of which eight were confirming and one disconfirming (Table 7-9). The weapon system-related data related to one hypothesis, H38, which the data supported. Hypotheses H34, which was disconfirming, and H35 were dropped after the pilot survey. All of the remaining seven except

H39 were supported by the full survey. The survey data did not support the H39 premise that that technical systems would be perceived as an important component of a depot maintenance organization's core competencies. Thus the present research can join with a number of others (Cooley 1997; Loh 1993; Sink 1995) in that regard.

**TABLE 7-9**  
**RESOURCE/COMPETENCY-BASED THEORY**

	Type	Narrative	Survey Results	Weapon System Results
H35	C	An organization's core competencies are perceived as defined by what it knows and what it can do.	Hypothesis dropped after pilot survey	—
H36	C	Members of an organization perceive themselves as able to articulate their organization's core competencies.	Supported	—
H37	C	Government depot maintenance capability is perceived to be a core government logistics competency.	Supported. See discussion under topic of privatization.	—
H38	C	Employee knowledge and skills are perceived as an important component of a depot maintenance organization's core competencies.	Supported	Supported in terms of both skill uniqueness (SKL_UNIK) and skill quantity (SKL_QTY)
H39	C	Technical systems are perceived as an important component of a depot maintenance organization's core competencies.	Not supported	—
H40	C	Managerial systems are perceived as an important component of a depot maintenance organization's core competencies.	Supported	—
H41	C	Values and norms are perceived as important components of a depot maintenance organization's core competencies.	Supported.	—
H42	C	There will be differing interpretations of the concept of core.	Supported	—

**TABLE 7-9**  
**RESOURCE/COMPETENCY-BASED THEORY (CONTINUED)**

	Type	Narrative	Survey Results	Weapon System Results
H34	D	An organization's core competencies are perceived as being defined by the products it makes, services it provides, and markets it serves.	Hypothesis dropped after pilot survey.	—

Note: C=confirming; D=disconfirming

Weapon system-related data elements shown in parentheses

It was noted earlier that survey respondents did perceive the existence of differing interpretations of the concept of core. In creating the survey instrument the author intentionally did not attempt to elicit information about these various concepts, believing that any such questions would have been too open ended to incorporate in a mail survey.

However, additional information became available during the course of this research that provides insight into these differing concepts. The author participated as member of a PricewaterhouseCoopers and Logistics Management Institute team that conducted a study of DoD depot maintenance core capability requirements (Thompson Forthcoming). As part of the effort, the study team interviewed senior managers in all of the DoD services, the Coast Guard, and selected commercial firms. The interviews provided evidence that there were three different meanings of the term "core" (Table 7-10)).

Some interviewees (group A in Table 7-10) thought that the term core represents the capabilities that DoD must retain internally. This concept is consistent with the definitions in 10 USC 2464, DoD internal policy on core (Thompson Forthcoming), as well as the views of Teece, Pisano, and Shuen (1997). Other managers (group B) thought that the term core represents the capabilities that DoD needs to be able to reliably have access to. This is more a definition of critical capabilities than of core capabilities, at least as generally understood. A third group (group C) thought that the term core encompassed the management of the process by which work is performed and the process for selecting sources to perform it, but not the actual performance of work itself. This definition would be consistent with the concept of core competencies if management is the only capability that DoD could not find in the commercial sphere.

**TABLE 7-10**  
ALTERNATIVE PERSPECTIVES ON CORE

<b>Core Means:</b>			
	<b>Group A</b>	<b>Group B</b>	<b>Group C</b>
Synopsis	Capabilities DoD needs to retain internally	Capabilities DoD needs to be able to draw on	Management of the process by which the work gets done
Representative interview quotations	<p>We should retain sufficient organic DM capabilities to support contingencies, but these capabilities should be defined in terms of critical functions rather than specific weapon systems.</p> <p>Core capabilities are defined as skills, equipment and facilities that we need to support JCS scenarios.</p> <p>Strictly on the DM side, I would consider a traditional definition [of core], in terms of surge.</p>	<p>Core should be smaller—if it exists at all. Increase reliance on war reserve materiel rather than repair capabilities.</p> <p>Core comprises the critical capabilities needed to maintain ... readiness. These capabilities may be provided by either organic or commercial facilities.</p> <p>Core is whatever it takes to ensure that critical equipment and capabilities are fully operational. These capabilities may be provided by either internal or commercial vendors.</p> <p>Core capabilities are where we get best value for price paid.</p> <p>As long as the customer is satisfied and we can guarantee continued performance, we have a ready and controlled source.</p> <p>If the support source is transparent to the end user, who cares?</p>	<p>Most logistics functions are not core because we can establish performance-based contracts for those functions that will incentivize contractors to provide adequate support regardless of whether there is a competitive marketplace.</p> <p>Logistics management is a core capability for DoD, but logistics execution is not.</p> <p>That's the focus of core analysis, to define what can't be bought at a reasonable price or what carries an unacceptably high risk.</p>

### Administrative Innovations and Isomorphism

Five hypotheses, all confirming, were associated with the concepts of administrative innovations and isomorphism (Table 7-11). The weapon system-related data did not apply to these hypotheses. Only two of these hypotheses—that the definition of depot

maintenance would be uncertain and that government managers would perceive themselves as under pressure to outsource depot maintenance—were well supported by the survey data. The responses to items related to H45 and H46 appeared to be related to optimism. As indicated in the summary for H45, respondents appeared to be personally optimistic about outsourcing of depot maintenance but perceived others as ambiguous. Further, as summarized for H46, respondents perceived themselves as understanding the purpose of outsourcing, but there was not a clear pattern of responses with regard to how they perceived others. Finally, the expectation that professional managers would prefer in-sourcing was only partially supported. As discussed in Chapter 2, others (Harris 1996; Poudier 1993) who have attempted to examine the concepts of administrative innovations and isomorphism in the context of outsourcing found only partial support.

**TABLE 7-11**  
**ADMINISTRATIVE INNOVATIONS AND ISOMORPHISM**

	Type	Narrative	Survey Results	Weapon System Results
H43	C	Professional managers in government will prefer in-sourcing.	Partially supported. Statement valid for managers in maintenance and logistics generally; not valid for all government managers.	—
H44	C	Managers of and others with an interest in the depot maintenance will be uncertain of the definition of depot maintenance.	Supported	—
H45	C	Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive themselves as having unclear expectations of the benefits of outsourcing.	Undetermined. An alternative analysis, looking at H45 and H46 simultaneously, indicated that respondents were personally optimistic about outsourcing of depot maintenance but perceived others as uncertain.	—
H46	C	Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive themselves as having a unclear understanding of the purpose of outsourcing.	Partially rejected. Respondents did perceive themselves as understanding the purpose of outsourcing. However, when asked if others had a clear understanding the results showed differences of opinion. Source or nature of these differences could not be determined from the available data.	—

**TABLE 7-11**  
**ADMINISTRATIVE INNOVATIONS AND ISOMORPHISM (CONTINUED)**

	Type	Narrative	Survey Results	Weapon System Results
H47	C	Government managers will perceive themselves as under pressure from top-level management to outsource depot maintenance.	Supported	—

Note C=confirming; D= disconfirming

### Relational/Social Exchange Theory

There were 10 hypotheses related to relational/social exchange theory (Table 7-12), divided evenly among confirming and disconfirming. The weapon system-related data applied to three, of which two were supported. The survey data supported all 10, both confirming and disconfirming. This is an unexpected result: transaction cost economics and relational/social exchange constructs are both supported. On the basis of the literature review they were understood to be in opposition.

**TABLE 7-12**  
**RELATIONAL/SOCIAL EXCHANGE THEORY**

	Type	Narrative	Survey Results	Weapon System Results
H48	C	Long-term alliances between users of depot maintenance and commercial firms will be perceived as important to effective depot maintenance support.	Supported. See discussion under topics of transaction cost economics and principal agent theory.	—
H49	C	Long-term alliances between organic depots and their customers will be perceived as important to effective depot maintenance support.	Supported. See discussion under topics of transaction cost economics and principal agent theory.	—
H50	C	Building and sustaining trust will be perceived as important to effective long-term depot maintenance alliances.	Supported. See discussion under topics of transaction cost economics and principal agent theory.	—



**TABLE 7-12**  
**RELATIONAL/SOCIAL EXCHANGE THEORY (CONTINUED)**

	Type	Narrative	Survey Results	Weapon System Results
H51	C	Building and sustaining trust will be perceived as difficult.	Supported. However, both public and private providers perceived as trustworthy.	—
H52	C	Supply chain integration will be perceived as important to providing effective depot maintenance.	Supported	—
H11	D	Managers of and other persons with an interest in depot maintenance will perceive tight linkage among stages in the depot maintenance repair process as important to deciding between organic and commercial sources of repair.	Supported. See discussion under topic of transaction cost economics.	Supported in all three approaches (FAC_UNIK)
H12	D	Managers of and other persons with an interest in depot maintenance will perceive specificity of production equipment as important to deciding between organic and commercial sources of repair.	Supported. See discussion under topic of transaction cost economics.	Supported in all three approaches (FAC_UNIK)
H13	D	Managers of and other persons with an interest in depot maintenance will perceive the difficulty of stating all contingencies in advance as important to deciding between organic and commercial sources of repair.	Supported. See discussion under topic of transaction cost economics.	Not supported in any approach (PR_RSPON)
H14	D	Managers of and other persons with an interest in depot maintenance will perceive the need to monitor shirking as important to deciding between organic and commercial sources of repair.	Supported. See discussion under topic of transaction cost economics.	—
H24	D	Public and commercial providers are perceived as having different potential to act opportunistically.	Supported. See discussion under topic of principal-agent theory.	—

Note C=confirming; D=disconfirming

Weapon system-related data elements shown in parentheses.

### Logistics and Supply Chain Management

Originally five hypotheses were associated with logistics and supply chain management (Table 7-13). H55 was dropped after the pilot survey. Three of the remaining four

were supported by the survey data. H51 and H52 were previously discussed under the topic of relational exchange. What was not supported was the contention (H53) that the meaning of supply chain integration would be perceived as uncertain. Having said that, there was support for supply chain integration being both important and difficult to achieve. Difficulty in achieving effective supply chain integration for depot maintenance has been found by a number of studies (Kiebler et al. 1996; Kiebler, Klapper, and Frank 1990; Klapper, Jordan, and McGrath 1996; Klapper and Kiebler 1997; Perry, Silins, and Kiebler 1987).

TABLE 7-13  
LOGISTICS AND SUPPLY CHAIN MANAGEMENT

	Type	Narrative	Survey Results	Weapon System Results
H51	C	Building and sustaining trust will be perceived as difficult.	Supported. See discussion under topic of relational exchange.	—
H52	C	Supply chain integration will be perceived as important to providing effective depot maintenance.	Supported. See discussion under topic of relational exchange.	—
H53	C	Managers and others interested in depot maintenance will perceive themselves as uncertain of the meaning of supply chain integration.	Not supported. Respondents perceived themselves as understanding the concept of supply chain integration.	—
H54	C	Supply chain integration will be perceived as difficult to achieve.	Supported	—
H55	C	Supply chain integration will be perceived as more difficult to achieve with commercial (i.e., external) sources than with organic (i.e., internal) sources.	Hypothesis dropped after pilot survey.	—

Note: C=confirming; D=disconfirming

### Garbage Can Model

The garbage can model of organizational choice had six associated hypotheses, of which five were confirming and one disconfirming (Table 7-14). The results were mixed, with three confirming hypotheses supported, the one disconfirming hypothesis supported, and two confirming hypotheses not supported. Random factors and other chance

occurrences were perceived as important to both depot maintenance outcomes and the process for making depot maintenance source of repair decisions. The expectation that there would be differing interpretations of the concept of core was also born out, as discussed earlier.

But, with those exceptions, it would be difficult to characterize the perceptions of the survey respondents as consistent with the garbage can model. As indicated in Chapter 2, Sink (1995) was the only researcher found to have applied the garbage can model to outsourcing, and his research supported the model more strongly than does this research.

**TABLE 7-14**  
**GARBAGE CAN MODEL**

	Type	Narrative	Survey Results	Weapon System Results
H21	C	Random factors, under neither the control of depot maintenance providers nor managers, are perceived as being able to influence the outcome of depot maintenance.	Supported	—
H42	C	There will be differing interpretations of the concept of core.	Supported. See discussion under topic of resource/competency-based theory	—
H53	C	Managers and others interested in depot maintenance will perceive themselves as uncertain of the meaning of supply chain integration.	Not supported. See discussion under topic of logistics and supply chains.	—
H56	C	Participants in the depot maintenance public versus private allocation decision will be perceived as continually changing.	Not supported. See discussion under topic of rational model.	—
H57	C	Chance occurrences rather than a rational process will be perceived as important to outcomes of depot maintenance public versus private allocation decision situations.	Supported. See discussion under topic of rational model.	—

**TABLE 7-14  
GARBAGE CAN MODEL (CONTINUED)**

	Type	Narrative	Survey Results	Weapon System Results
H01	D	Persons with an interest in the depot maintenance will perceive themselves as following the dictates of the rational model when making depot sourcing decisions.	Supported. Although ideal rational process was highly desired, in-use rational process could consist of finding alternative at least better than other possibilities. See discussion under topic of rational model.	—

Note: C=confirming; D=disconfirming

### Political Economy and Bureaucratic Politics

Four hypotheses were associated with the concepts of political economy and bureaucratic politics (Table 7-15). All were supported by the survey data, demonstrating that respondents' perceptions agreed with the expectations from those concepts. The results here can probably be viewed as adding support to the earlier findings of McCray (1996), Daugherty (1988), and Sink (1995).

**TABLE 7-15  
POLITICAL ECONOMY AND BUREAUCRATIC POLITICS**

	Type	Narrative	Survey Results	Weapon System Results
H47	C	Government managers will perceive themselves as under pressure from top-level management to out-source depot maintenance.	Supported	—
H58	C	Managers of and others with an interest in the depot maintenance public versus private workload allocation decision will perceive that decision makers have conflicting preferences with regard to the depot maintenance organic versus commercial source of repair allocation decision.	Supported	—
H59	C	Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive powerful people, defined as higher managerial levels, as getting what they want with regard to the depot maintenance organic versus commercial source of repair decision.	Supported	—

**TABLE 7-15**  
**POLITICAL ECONOMY AND BUREAUCRATIC POLITICS (CONTINUED)**

	Type	Narrative	Survey Results	Weapon System Results
H60	C	Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive coalition formation.	Supported	—

Note: C=confirming; D=disconfirming

Weapon system-related data elements shown in parentheses

### Relative Importance of Factors

The discussion just completed found that most hypotheses, both confirming and disconfirming, were supported. Unfortunately that is all that we know—that in the case of the survey, for instance, the means of responses are statistically different from the midpoint of the scale. (To some extent this is a statistical artifact: because of the large number of responses, the standard errors of the estimates are small.) We do not know if the statistically significant differences are managerially meaningful or important.

To provide a more discriminating view, the author looked to the survey results, defined the items from the survey as “factors” for this purpose, and took strength of agreement or disagreement with an item as an indicator of its relative salience or importance (Ajzen and Fishbein 1980, 67-68). Chapters 4 and 5 reviewed results for a total of 84 individual or compound items that were not bimodal. (A compound item is one that was formed by combining items which loaded on a single factor. An example of a compound item is the combination of items 572 and 571 [questions 12E and 12F], both of which were found in Chapter 5 to load on a single factor.) Bimodal items were eliminated because of the disparate responses they elicited. Bimodal items are discussed below when addressing differences between constituencies.

In order to prepare the 84 items for analysis, the author did the following:

- For compound items, crafted a narrative that represented the sense of the items when combined.

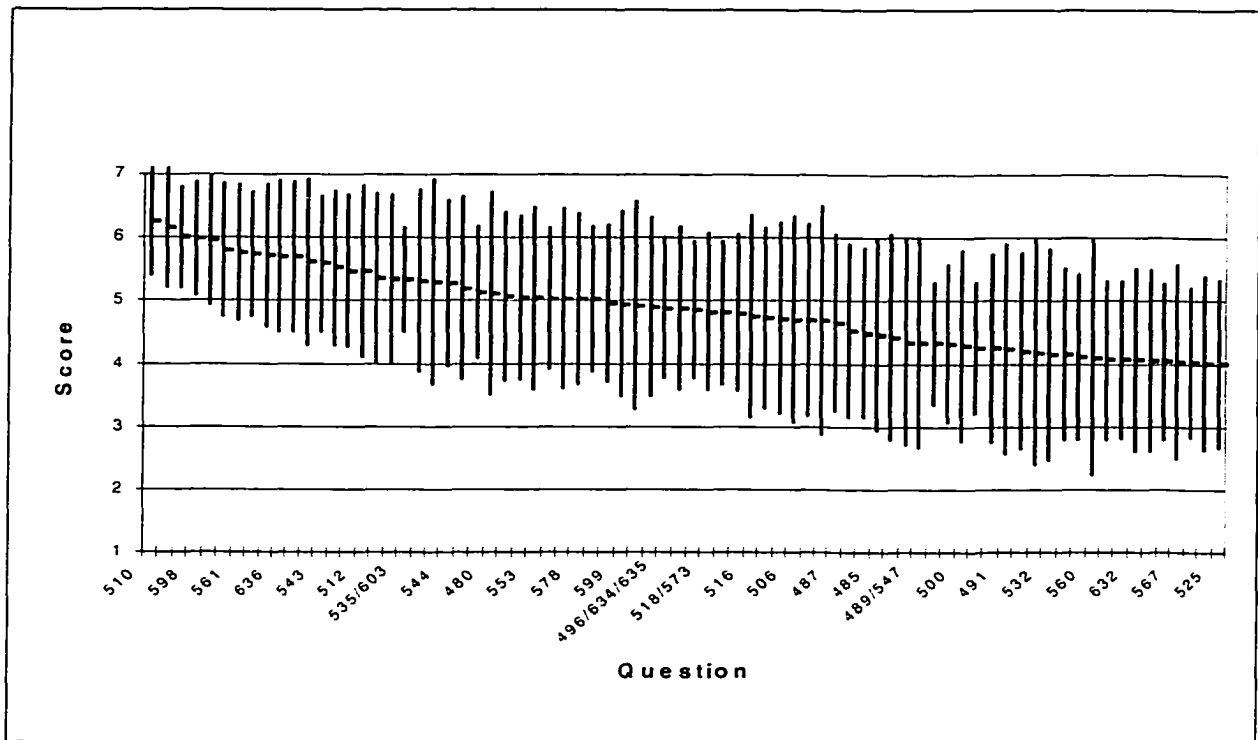
- Reversed the sense of the narrative for items where the mean of responses indicated disagreement with the original statement. At the same time the author reversed the average score (e.g., so that 1 became 7, 2 became 6, etc.). The purpose for doing this was so that all items could be ranked in terms of degree of agreement. There is some risk in this procedure related to response mode bias: if questions themselves had been reversed the survey responses would not have necessarily behaved in a way consistent with this simple transposing of scores.
- Ranked the resulting list by mean.

The results of the above procedure are shown in Figure 7-1. The means are indicated by the dark line ranging from just greater than 6 on the left side of the figure to 4 on the right. (Only every third item number is shown on the X axis. A complete listing is at Appendix L.) The means are relatively well characterized, as a result of the relatively large sample sizes, with a standard error of the estimate on the order of 0.05. The error bars on Figure 7-1 indicate plus or minus one standard deviation. Since the trend on Figure 7-1 is relatively gradual, lacks a sharp inflection point, and standard deviations overlap, there is no obvious discriminator between important factors and those that are not important. As a rough rule of thumb, the author chose those items to the left of the point where the lower standard deviation bars cross over the neutral (4) point on the scale as more important than those to the right of that point. For items to the left of this point, assuming a normal distribution, roughly 80 percent of respondents agree with the questions as stated in the survey (or are presumed to agree, when the sense was reversed).

There were 28 items to the left of the point where the lower standard deviation bars started consistently crossing over the neutral score of 4. Of these 28, 4 were not—under even a relatively broad interpretation—reasonably construable as factors in the choice between public and private sources of repair. An example would be item 509 (question 10A), which asserted: “I am able to define my organization’s core competencies.” The remaining 24 items, which the author takes as the most important factors in the source of repair decision, are plotted in Figure 7-2.

For each of the 24 items in Figure 7-2, the mean of the responses was greater than 5. In view of the variability around the mean of each of these items, it is more reasonable to treat them as a group with generally equivalent relative importance than to attempt to make fine distinctions between those on the left side of the figure and those on the right.

**FIGURE 7-1**  
AVERAGE SCORES ON SURVEY ITEMS



**FIGURE 7-2**  
TWENTY FOUR MOST IMPORTANT FACTORS

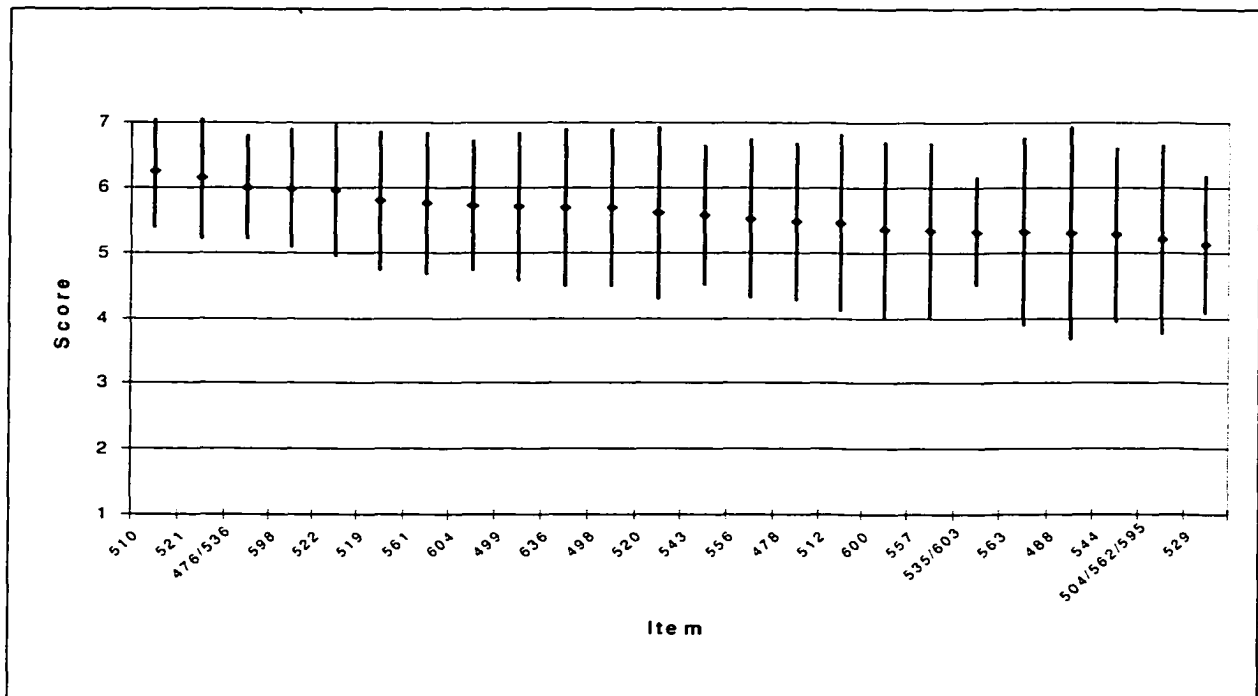


Table 7-16 lists the factors, along with their narratives, in the same order as they are plotted in Figure 7-2.

**TABLE 7-16**  
**MOST IMPORTANT 24 FACTORS**

<b>Item</b>	<b>Question</b>	<b>Narrative</b>
510	10E	Employee knowledge and skills are important components of an organization's core competencies.
521	14I	Successful long-term alliances between depot maintenance providers (public or private) and their customers depend on building and sustaining trust.
476/536	18F_18G	Managers and others with an interest in depot maintenance should use rational processes (well defined problem, a means for telling good alternatives from bad...) to allocate workload between the public and private sectors.
598	20B	Specialized or expert human skills are significant to effective depot maintenance performance.
522	17A	Supply chain integration is significant to effective and efficient delivery of depot maintenance.
519	14C	Long-term relationships between private depot maintenance providers and their military customers are important to effective depot maintenance support.
561	5I	When determining who is the least costly provider of depot maintenance—public depot or private firm—both the cost to produce repairs and the cost to initially arrange for and then monitor production should be considered.
604	20A	Availability of specialized equipment is significant to effective depot maintenance performance.
499	9C	Interest groups outside the Department of Defense have depot maintenance agendas that may be different than the Department's.
636	5A	It is hard to build and sustain trust between government buyers and private providers of depot maintenance.
498	9A	Because it is hard to analyze all alternatives in advance, a reasonable way to solve a problem is to find an alternative that is at least better than other possibilities.
520	14A	Long-term relationships between public depots and their customers are important to effective depot maintenance support.
543	19D	Doing depot maintenance work takes a large capital investment.
556	9B	Interest groups within the Department of Defense are able to influence the choice between public and private providers of depot maintenance.
478	19B	Maintaining availability of more than one source of depot maintenance is important.



**TABLE 7-16**  
**MOST IMPORTANT 24 FACTORS (CONTINUED)**

<b>Item</b>	<b>Question</b>	<b>Narrative</b>
512	10G	A depot maintenance organization's management system is an important part of its core competencies.
600	14B	I expect established relationships between public depots and their military customers to last a long time.
557	9D	Interest groups outside the Department of Defense are able to influence the choice between public and private providers of depot maintenance.
535/603	12B_12D	The definition of depot maintenance is inconsistent.
563	1G	Better access to new technology is an important potential benefit of depot maintenance outsourcing.
488	5C	Ability to make sure the required work is actually done is important when deciding between public and private sources of repair.
544	19E	Requirements for unique equipment are important when deciding between public and private sources of depot repair.
504/562/595	2E_2F_2D	The private provider is better able to provide new technology.
529	18E	It seems like at different times different organizations and their managers get together to promote their own depot maintenance agendas.

The common themes in the above factors appear to center on:

- The importance of employee knowledge and skills
- The value of long-term alliances—and supply chain integration generally—as well as the difficulties involved
- Use of rational processes for reaching sourcing decisions (even if only identifying a preferable rather than a best choice)
- The importance of specialized equipment and large capital investments
- The ability of private providers to facilitate access to technology
- Transaction cost factors, including ability to make sure the work is actually done
- Maintaining availability of more than one source
- The role of interest groups both inside and outside the Department of Defense.

An alternative way to look at these 24 items is in terms of the theoretical constructs to which they relate. For each construct Table 7-17 shows the number of items from the top 24 that relate to it. Where two constructs have the same number of items (as is the case for public choice and transaction cost economics), the constructs are sorted on the sum of the

means of the corresponding items. This portrayal then, at least in a rough sense, indicates which constructs appear to encompass factors that have high salience when choosing between public and private providers.

**TABLE 7-17**  
**TOP 24 ITEMS BY CONSTRUCT**

Construct	Number of Items				Sum of means
	1	2	3	4	
Public choice	499	498	556	557	22.26
Transaction cost economics	561	604	488	544	22.08
Resource/competency	510	598	512		17.69
Relational/social exchange	521	519	520		17.56
Rational model	476/536	600			11.36
Imperfect competition	636	478			11.17
Non-market failure	563	504/562/595			10.52
Logistics & supply chain	522				5.96
Scale and scope economy	543				5.58
Administrative innovation	535/603				5.33
Political economy	529				5.13
Market failure					
Principal-agent theory					
Garbage can					

Note: entries in cells are item numbers

Public choice theory and transaction cost economics dominate the theoretical constructs. The prominence of public choice theory is especially noteworthy, since there were only four candidate items to begin with and all four are in the top 24 items. What the author also finds noteworthy is that factors such as competition and scale economy that typically get the most attention in the formal decision making process (see for instance Warren (1998b)) are not near the top of the list.

Public choice theory and transaction cost economics dominate the theoretical constructs. The prominence of public choice theory is especially noteworthy, since there were only four candidate items to begin with and all four are in the top 24 items. What the author also finds noteworthy is that factors such as competition and scale economy that typically get the most attention in the formal decision making process (see for instance Warren

(1998b)) are near the bottom of the list. It is as if there are two independent processes at work, one formal, explicit and of limited importance, the other tacit and of considerable importance. So long as this is the case there is little wonder that the explicit, formal methods for making such decisions create rather than reduce frustration: they create the illusion of a rational (in fact, almost mechanical) process when another process entirely is controlling.

Finally, three theoretical constructs—market failure, principal agent theory, and the garbage can model, the first two of which were supported when examining the means of responses—appear to be of little aid. The limited relevance of the garbage can model has been noted by others. The author interprets the absence of any market failure-related items as indicating that this is not of special concern for DoD depot maintenance.

The positions of the relational/social exchange and principal-agent constructs near opposite ends of Table 7-17 are of particular interest. These two constructs are paradigmatically distinct, as is illustrated in Table 7-18. The author views the position of relational/social exchange theory in Table 7-17 as an indicator that such principal-agent concepts as economic exchange, reduction of uncertainty, decision, distrust, and conflict are much less important than are such concepts as relational exchange, reduction of equivocality, enactment of shared meaning, trust, and reciprocal dependency.

If the observations in the previous paragraph and Table 7-18 are considered fair, then the present approach to public and private provision of depot maintenance services—which arguably does cast the issues in principal-agent terms—may deserve reframing in terms of enactment of shared understanding. Among other considerations, however, this is tantamount to substitution of action theory for decision theory (Harmon 1989). This would be a shift with interesting implications: decision theory is well established in mainstream management literature, action theory is less so, and they differ on both ontological and epistemological grounds.

Before leaving this discussion of important and non-important factors, there were four statements, mentioned above, that were not factors in the above sense but that did elicit broad agreement. They are shown in Table 7-19.

The responses to items 509 and 565 are consistent with the premise of H36—that respondents would perceive themselves as able to define their own core competencies. This

**TABLE 7-18**  
**PRINCIPAL-AGENT AND RELATIONAL-EXCHANGE CONSTRUCTS CONTRASTED**

<b>Construct</b>	<b>Principal-agent</b>	<b>Relational-exchange</b>
Nature of exchange	Economic	Economic and social
Unit of analysis	Economic transaction (e.g., contract)	Relationship Individual transaction is set in context of history of relationship and expectations about its future.
Key information issue	<p>Uncertainty.</p> <p>Outcome is usually observable to both the agent and to the principal. However, the agent and the principal have asymmetrical information: the agent has better information on his or her degree of care, industriousness, trustworthiness, ability, and how he or she is attempting to influence desired outcome.</p> <p>Random factors over which neither the principal nor agent has control influence the outcome. Leads to search for objective information (e.g., information with which to monitor for shirking).</p>	<p>Equivocality.</p> <p>Multiple and conflicting interpretations of situation exist. Leads to social exchange of opinions and beliefs in order to define problems, resolve conflicts, enact shared interpretations.</p>
Role of the decision	Humans are hyper-rational—they can make difficult decisions quickly.	Rather than make decisions per se, humans enact shared meanings.
Expected behavior by other party	Guile: both principal and agent, but particularly the agent, act with guile, and are opportunistic.	Both parties make investments to establish trust, where trust is a measure of extent with which one party judges that another will intend to and be able to fulfill its commitments and that exchange between parties is equitable.
Conflicts of interest	<p>Principals and agents have conflicts of interest (different utility functions).</p> <p>The agent has some contribution to and influence over the desired outcome of the relationship. E.g., other things being equal, the agent will try to influence the desired outcome to minimize his or her task performance time.</p>	Although conflicts exist, achieving business objectives requires cooperation because of reciprocal dependencies.
Relationship between choices of one actor and choices of another.	Independent	Interdependent

**TABLE 7-19**  
**OTHER QUESTIONS THAT ELICITED BROAD AGREEMENT**

<b>Item</b>	<b>Question</b>	<b>Narrative</b>
587	5F	Depot maintenance is critically important in achieving the primary mission.
509	10A	I am able to define my organization's core competencies.
565	10B	My colleagues are able to define the core competencies of our organization.
495/553/591	7D_7E_7F	Both buyers and providers (public and private) are able to observe the outcome of depot maintenance.

finding was already discussed under the topic of Resource/Competency-Based Theory. However, as noted at that time, since there were also differing interpretations of the concept of core among DoD managers, strong agreement with items 509 and 565 is probably more problematic than salutatory. The support for the statement associated with the combination of items 495, 553, and 591 was discussed under the topic of Principal Agent Theory in Chapter 4 (page 206).

The support for item 587 was not previously discussed in this chapter and is probably important for the implications that flow from it. If depot maintenance is perceived as critically important in achieving the primary mission and, depot maintenance is perceived as a DoD core competency, then it is not difficult to understand why some DoD managers are invested in the idea of DoD doing depot maintenance for itself.

### **Consensus Among Constituencies**

In the broad sense of unanimity this research did not find consensus. In a more limited sense, however, there appeared to be general agreement for the 24 factors and 4 additional questions just discussed. To determine if any constituency was not in agreement with the 24 factors, the author defined constituencies as the subgroups within the six dimensions (function, component, organizational level, maintenance level, system, and sector), and for each of the six dimensions:

- Performed median and Kruskal-Wallis ANOVA by ranks tests;

- Performed ordinary ANOVA. When the variance was significant for a dimension, checked to make sure one or more pairs of groups within the dimension was also significant when examined using the Tukey honest significant difference (HSD) test for unequal N.

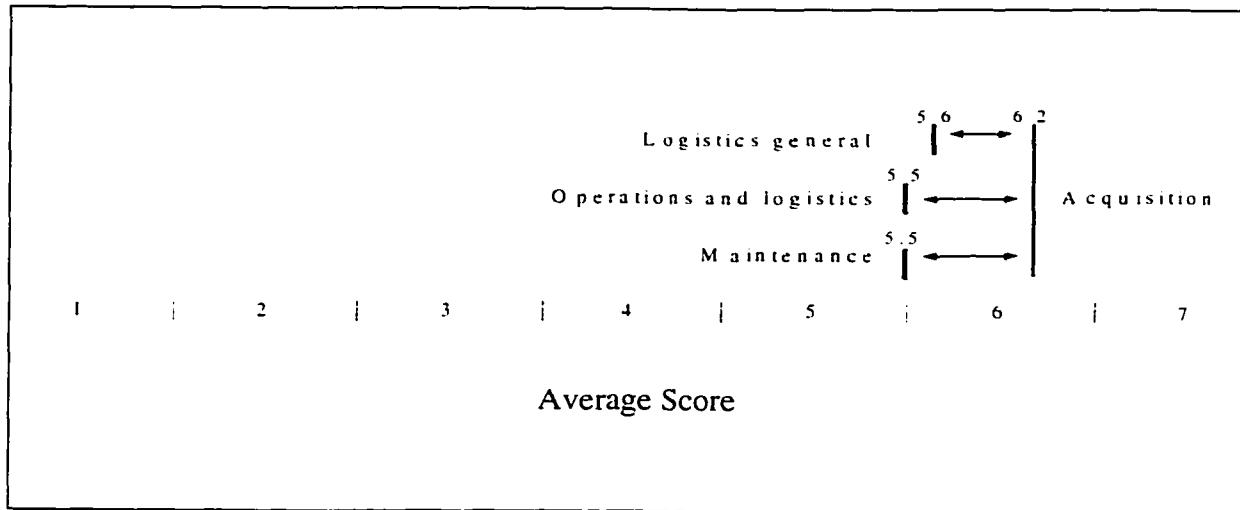
ANOVA is a parametric test and depends on the assumption of a normal distribution. The median and Kruskal-Wallis tests are non-parametric and do not involve any assumed distribution. The author performed both parametric and non-parametric tests to gain the statistical power of ordinary ANOVA while guarding against being misled by results in the case where the normal assumption might not be reasonable.

There were a total of 144 (24 times 6) such analyses. Cases where the ANOVA-Tukey HSD was significant and either the median test or Kruskal-Wallis test was significant were accepted as indicating a potential difference of opinion among two or more groups within a dimension. (In general the median, Kruskal-Wallis, and ANOVA-Tukey HSD results were simultaneously significant, although there were a few exceptions.). Of the 144 cases, there were 45 instances where there was a potential difference of opinion.

For each of those 45 instances, the author then analyzed all pairs of sub-groups where the ANOVA and Tukey HSD indicated a significant difference. There were 73 such pairs. A typical result is shown in Figure 7-3, which provides an illustration for item 499 (question 9C) and the functional dimension. This item stated: "Interest groups outside the Department of Defense have depot maintenance agendas that may be different than the Department's." ANOVA and the Tukey HSD test indicated potentially significant differences on four of the dimensions (function, level, maintenance level, and system.) On the functional dimension, illustrated in this figure, the mean for the acquisition function subgroup was statistically different from the means for logistics general, operations and logistics, and maintenance. For all four subgroups the mean was greater than the mid-point (4). Thus respondents belonging to all four subgroups, on average, agreed with the statement, and the differences lay in relative strength of agreement.

This was the case for all 45 instances where there were statistically significant differences. Thus, for the 24 items, it is a reasonably safe statement that there is no indication of disagreement between the various subgroups (constituencies) along any of the six

**FIGURE 7-3**  
**ITEM 499: FUNCTIONS WITH STATISTICALLY SIGNIFICANT DIFFERENCES BETWEEN MEANS**



dimensions. Alternatively, all constituencies examined in this research appear to be in agreement with the premises of these 24 items.

### Differences Among Constituencies

It will be recalled from Chapters 4 and 5 as well as earlier discussion in this chapter that respondents to the survey were classified along six dimensions: military component, function, organizational level, maintenance level, system, and sector. (DoD respondents were categorized along all six dimensions; industry respondents were classified only on the sector dimension, as “industry.”) The subcategories within each dimension are summarized in Table 7-20.

**TABLE 7-20**  
**SURVEY RESPONDENT CLASSIFICATION DIMENSIONS**

Component	Function	System
Army	Maintenance	Aviation
Navy	Logistics management general	Ship
Air Force	Material management	Ground
USCM	Operations and logistics	Ordnance
DLA	Support, other	Multiple
OSD/JCS	Acquisition	Other
Other	Other non-support	Not applicable
	Indeterminate	

**TABLE 7-20**  
**SURVEY RESPONDENT CLASSIFICATION DIMENSIONS (CONTINUED)**

<b>Organizational level</b>	<b>Maintenance level</b>	<b>Sector</b>
OSD/JCS	Higher headquarters management	DoD
Component headquarters	Depot maintenance	Industry
Field	Field maintenance	
	Not applicable	

For eight of the individual questionnaire items and for one of the combined items, relatively clear differences between subcategories showed up on one or more dimensions. Differences for these nine are described below.

Item 483 (question 3B) asserted: "Firms are available that can deliver the quantity needed without a startup delay." OSD/JCS, the Defense Logistics Agency, and industry agree with this statement. All others along any of the six dimensions, including DoD when looked at as a whole, do not agree.

Items 489 and 547, because they loaded on a single factor, were combined in Chapter 4 into one item that was interpreted to assert: "Outsourcing leads to increased risk." For this item, differences showed up on four dimensions (Table 7-21). (This and subsequent tables summarizing differences show only the statistically significant differences.)

**TABLE 7-21**  
**COMBINED ITEM 489-548 RESULTS**

<b>Dimension</b>	<b>Agree with statement</b>	<b>Do not agree with statement</b>
Component	Army	OSD/JCS
Function	Maintenance Logistics general	Acquisition
Organizational level	Field	OSD/JCS
Maintenance level	Depot maintenance	Field maintenance

Item 491 (question 7A) asserted: "Private providers of depot maintenance have interests that get in the way of effective depot maintenance." For this item a pattern of disagreement showed up on the maintenance dimension: those in depot maintenance agreed



with the statement. Those in field-level maintenance and those not involved in maintenance (coded not applicable) did not agree.

Item 549 (question 7B) was the reverse of item 491 and stated: "Public providers of depot maintenance have interests that get in the way of effective depot maintenance. Here the difference followed organizational level rather than maintenance level. Those in OSD/JCS agreed with the assertion, and those at the field level did not.

Item 560 (question 7H) made the assertion: "It is important that the government do at least some depot maintenance work itself." This item evoked disagreements on three dimensions (Table 7-22).

**TABLE 7-22  
ITEM 560 RESULTS**

<b>Dimension</b>	<b>Agree with statement</b>	<b>Do not agree with statement</b>
Function	Maintenance, logistics general, material management	Outside support fields (e.g., acquisition)
Maintenance level	All	Outside maintenance (i.e., coded N/A)
Sector	DoD	Industry

The remaining four items (532, 632, 515, and 570) all deal directly with a preference for either public or private providers.

Item 532 (question 2A) asserted: "Given a choice between private and public providers, in general the best solution is..." The responses are summarized in Table 7-23.

**TABLE 7-23  
ITEM 532 RESULTS**

<b>Dimension</b>	<b>Prefer Public</b>	<b>Prefer Private</b>
Function	Maintenance	Acquisition
Component	Army	Navy and OSD/JCS
Organizational level	Component headquarters	OSD/JCS
Sector	DoD	Industry

Item 632 (question 11A) asked: "Whose principals, goals, and standards of conduct are more likely to assure good depot maintenance results?" Here the results showed disagreement along two dimensions (Table 7-24).

TABLE 7-24  
ITEM 632 RESULTS

Dimension	Prefer Public	Prefer Private
Function	Logistics general, maintenance	Operations and logistics
Sector	DoD	Industry

Item 515 (question 12A) asserted: "All things considered, the Department of Defense is better served if it does most depot maintenance itself." Differences appear along two dimensions (Table 7-25).

TABLE 7-25  
ITEM 515 RESULTS

Dimension	Agree	Disagree
Function	Logistics general, maintenance	Acquisition, others outside maintenance and logistics
Component	OSD/JCS, Navy	Air Force, Army

Finally, item 570 (question 13A) asked: "If it were my choice I would see that DoD used the following source for depot maintenance." Differences showed up on the functional dimension where those respondents who worked in maintenance and logistics would choose the public sector and those outside of these two functional areas would choose the private sector.

The differences for the nine items just discussed form a pattern that is not that difficult to discern and is summarized in Table 7-26. The difference by sector is unsurprising. The differences on the functional dimension are consistent with findings that were previously developed in the literature review (Chapter 2). For instance, the internally inconsistent language in the 1996 version of DoDR 5000.2R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPS) and Automated Information Systems (MAIS)

Acquisition Programs” described in Chapter 2 reflected an attempt to accommodate acquisition and logistics views that were in opposition.

**TABLE 7-26**  
**SUMMARY OF DIFFERENCES BY DIMENSION**

<b>Dimension</b>	<b>Lean Toward Public Providers</b>	<b>Lean Toward Private Providers</b>
Function	Maintenance and logistics	Acquisition and support fields outside logistics
Component	Army and Air Force	OSD/JCS, Defense Logistics Agency, and Navy
Organizational level	Component headquarters and field	OSD/JCS
Maintenance level	Depot maintenance	Field maintenance and those who work outside maintenance
Sector	DoD	Industry
System	No statistically significant differences on this dimension	

There are three sets of differences in Table 7-26 that, to the author’s knowledge, have not been described elsewhere: by component, organizational level, and maintenance level. Based on the comments that were provided with the survey instruments, the position of field maintenance reflects a pragmatic view (any source is acceptable as long as it works) and dissatisfaction with present support—which is primarily provided by the public sector. The differences on the organizational level dimension reflect the uneven distribution of responses by function within the OSD/JCS subgroup. There were 22 acquisition responses and 4 logistics responses within OSD/JCS. Given the differences by function already discussed, what appears to be a difference by level is probably better viewed as a difference by function. On the component level dimension, the position of OSD/JCS is the same as it was on the organizational level dimension, since the individuals included are identical. The component level dimension contrast between Army and Air Force on the one hand and Defense Logistics Agency, Navy, and OSD/JCS on the other is not explainable in terms of artifacts of the sampling process. Hence, it should be viewed as indicating that the Army and Air Force lean toward the public sector, while the Defense Logistics Agency, the Navy, and OSD/JCS lean toward the private sector.

If there is a common thread that ties some (though not all) of the results in Table 7-26 together, it is that defenders of public providers (maintenance and logistics on the functional dimension, depot maintenance on the maintenance level dimension, DoD on the sector dimension) are those who would be most personally and directly affected by a shift of work from public to private providers. By contrast, defenders of private providers (e.g., acquisition and support fields other than logistics) would be less affected by the choice toward which they lean. Public choice theory would suggest such an outcome.

### **Non-Constituency Differences**

The presence of disagreement was also discussed earlier from a different vantage point—the 17 questions for which there were bimodal response patterns. Here, however, the differences of opinion were generally not constituency-based. As discussed in Chapter 4, the bimodal patterns persisted across most or all of the constituency-related dimensions (except sector) that were examined. Rather, the differences in perception appeared to be related to sharply recalled experience with commercial providers, equivalent sharply recalled experience with public providers, or overall sector preference. It is the author's contention that these differences reflect the operation of motivational and cognitive bias, discussed next.

### **Motivational and Cognitive Biases**

Based on a review of the applicable literature related to elicitation of expert opinion, Chapter 3 identified a number of potential motivational and cognitive biases that might be found in this research. The clearest evidence for existence of bias is in the bimodal responses. Here there is substantial evidence of misrepresentation bias, failure to take into account base rates, anchoring without adequate adjustment, availability bias, and failure to seek evidence to the contrary. In addition, when examining the issue of infrequent and cyclical work, the alignment of weapon system-related results by branch of armed service is evidence of wishful thinking bias.

Other sought-for biases—such as outright selfishness and guile, or impression management—are not clearly evident in the data. Nonetheless, the evidence of both motivational and cognitive biases corroborates the findings of Forbes et al. (1997) when they used focus groups to examine the decision on depot maintenance source of repair. Other than potential for selfishness and guile, which shows up in the context of principal/agent theory, the problem with bias is generally not addressed in the literature on make-or-buy decisions, outsourcing, or privatization.

### **Implications of This Research**

Viewed in terms of the recapitulation of statistical analysis outcomes in Table 7-1 through Table 7-15, all constructs examined in this research were supported as relevant to the choice between public and private providers, with the exception of the garbage can model and administrative innovation and isomorphism constructs. Even those two were partially supported.

A more discriminating view is offered by Table 7-17, which showed public choice theory and transaction cost economics as having dominating importance. Also of interest, as discussed earlier, is the position of relational exchange near the top of Table 7-17, while principal agent is near the bottom.

The idea that neoclassical economics would provide an undersocialized account of the dynamics of the public-private choice is not a surprise; the work of others suggested that it would. Based on the findings of this research, however, the author suggests that the assertion is too narrow. Economic constructs (neoclassical economics, transaction cost economics, principal-agent theory, and public choice theory), even when taken together, provide an undersocialized account. Principal-agent theory especially seems to lack relevance. In addition to principal-agent theory factors having low salience, guile, a central assumption of principal-agent theory, did not appear when examining the biases related to bimodality.

The implication is that any model of the public versus private choice for commercial-like activities that pretends to be useful will need to go beyond economic constructs

defined generally. Specifically, it needs to address resource/competency issues, the nature of relational exchanges, as well as the pervasive influence of cognitive and motivational bias. The reverse is also worth noting: an explanation that fails to include economic constructs is also incomplete.

### **Recommendations for Further Research**

Obviously, the notion that a multi-disciplinary, multi-construct approach to choosing between public and private providers is appropriate deserves replication. Implementing such an approach is bound to be more expensive and time-consuming than simpler approaches.

Beyond that, the author would suggest that the problem with bias deserves serious attention. With the exception of Forbes et al. (1997), none of the previous research the author uncovered on the depot maintenance choice or on the broader issue of public versus private performance of commercial-like activities has addressed this problem. Different players see things differently, but the source of disparate views includes idiosyncratic factors such as sharp, personal experiences with one sector. So long as there is a lack of awareness that such a mechanism is operating, attempts to find common ground or even understand why others are standing on different ground will be an illusory goal.

### **Conclusions**

This research addressed four related questions: what factors are important to the choice between public and private providers of depot maintenance, the relative importance of those factors, where there is consensus and where there is not, and to what extent perceptions are consistent or inconsistent with received theory.

Generally speaking, public choice, transaction cost economics, resource/competency, and relational/social exchange factors are the most important. Within this group, public choice and transaction cost economics factors dominate. These factors were important across all dimensions and constituencies examined. It is with the received theory relating to these constructs, therefore, that the present research is most consistent.

Additionally, this research suggests two conclusions that go beyond the research questions. First, cognitive and motivational biases related to particular experiences with one sector or the other play a significant role, one that appears to have generally not been previously addressed in the context of the choice between public and private providers. Second, as noted earlier, there appear to be two sets of processes at work. One, principally centered in neoclassical economic considerations such as competition and scale economy, is explicit (it underpins formal depot maintenance core policy or audits of the public-private decision process) but of limited importance. The other, grounded in a combination of public choice theory, resource/competency theory, and relational/social exchange theory—but under the influence of the cognitive and motivational biases just discussed—is tacit and considerably more important. It is this presently-tacit process that is deserving of more attention in both research and policy.

# APPENDIX A

## RELATIONSHIPS BETWEEN CONCEPTS AND HYPOTHESES

### Hypothesis Number H01

Where Introduced: Rational action and rational model

Hypothesis: Persons with a vested interest in the depot maintenance will perceive themselves as following the dictates of the rational model when making depot sourcing decisions.

Theoretical Concepts

Consistent with: Rational model

Inconsistent with: Garbage can model

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### Hypothesis Number H02

Where Introduced: Imperfect competition

Hypothesis: Depot maintenance workload will be perceived as unique and outside the commercial mainstream.

Theoretical Concepts

Consistent with: Imperfect competition

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**Hypothesis Number H03**

Where Introduced: Imperfect competition

Hypothesis: Availability of more than one source will be perceived as important to the organic versus commercial workload allocation decision.

Theoretical Concepts

Consistent with: Imperfect competition

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**Hypothesis Number H04**

Where Introduced: Imperfect competition

Hypothesis: Existence of proprietary data will be perceived as important to the organic versus commercial workload allocation decision.

Theoretical Concepts

Consistent with: Imperfect competition

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**Hypothesis Number H05**

Where Introduced: Imperfect competition

Hypothesis: Managers of and other persons with an interest in depot maintenance will perceive organic depot maintenance capability to be an internal monopoly.

Theoretical Concepts

Consistent with: Imperfect competition

---

**Hypothesis Number H06**

Where Introduced: Imperfect competition

Hypothesis: Managers of and other persons with a vested interest in depot maintenance will perceive of public versus private competition for depot maintenance as being conducted on a playing field that is not level.

## Theoretical Concepts

Consistent with: Imperfect competition

---

**Hypothesis Number H07**

Where Introduced: Market failure

Hypothesis: For at least some depot maintenance workloads there will be a perceived lack of commercial firms willing to do the work.

Theoretical Concepts

Consistent with: Market failure

---

**Hypothesis Number H08**

Where Introduced: Market failure

Hypothesis: For at least some depot maintenance workloads there will be a perceived lack of commercial firms with the scope of capability to respond in the quantity necessary without an initial start-up delay

Theoretical Concepts

Consistent with: Market failure

---

**Hypothesis Number H09**

Where Introduced: Economy of scale and scope

Hypothesis: Managers of and other persons with a vested interest in depot maintenance will perceive ability to achieve economies of scale and or scope as important to the depot maintenance outsourcing decision.

Theoretical Concepts

Consistent with: Economy of scale and scope

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**Hypothesis Number H10**

Where Introduced: Economy of scale and scope

Hypothesis: Outsourcing depot maintenance improves depot maintenance economy of scale.

Theoretical Concepts

Consistent with: Economy of scale and scope

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**Hypothesis Number H11**

Where Introduced: Transaction cost economics

Hypothesis: Managers of and other persons with an interest in depot maintenance will perceive tight linkage among stages in the depot maintenance repair process as important to deciding between organic and commercial sources of repair.

Theoretical Concepts

Consistent with: Transaction cost economics

Inconsistent with: Relational/social exchange theory

---

**Hypothesis Number H12**

Where Introduced:: Transaction cost economics

Hypothesis: Managers of and other persons with an interest in depot maintenance will perceive specificity of production equipment as important to deciding between organic and commercial sources of repair.

Theoretical Concepts

Consistent with: Transaction cost economics

Inconsistent with: Relational/social exchange theory

---

**Hypothesis Number H13**

Where Introduced: Transaction cost economics

Hypothesis: Managers of and other persons with an interest in depot maintenance will perceive the difficulty of stating all contingencies in advance as important to deciding between organic and commercial sources of repair.

Theoretical Concepts

Consistent with: Transaction cost economics

Inconsistent with: Relational/social exchange theory

---

**Hypothesis Number H14**

Where Introduced: Transaction cost economics

Hypothesis: Managers of and other persons with an interest in depot maintenance will perceive the need to monitor shirking as important to deciding between organic and commercial sources of repair.

Theoretical Concepts

Consistent with: Transaction cost economics

Inconsistent with: Relational/social exchange theory

---

**Hypothesis Number H15**

Where Introduced: Transaction cost economics

Hypothesis: Managers and others with an interest in depot maintenance will perceive increased risk if crucial contingencies are left to the market.

Theoretical Concepts

Consistent with: Transaction cost economics

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**Hypothesis Number H16**

Where Introduced: Transaction cost economics

Hypothesis: Manager of and others with an interest in depot maintenance will perceive the combination of low task frequency and high uncertainty as leading to high transaction costs if depot maintenance is outsourced.

Theoretical Concepts

Consistent with: Transaction cost economics

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**Hypothesis Number H17**

Where Introduced: Transaction cost economics

Hypothesis: The choice between public and commercial providers of depot maintenance will be perceived to depend on the total cost where total cost is the sum of production cost and transaction costs.

Theoretical Concepts

Consistent with: Transaction cost economics

Also consistent with: Theory of non-market failure

**Hypothesis Number H18**

Where Introduced: Principal-agent theory

Hypothesis: Organic and commercial providers of depot maintenance are perceived as differing in the extent to which they have conflicts of interest with the users of depot maintenance.

Theoretical Concepts

Consistent with: Principal-agent theory

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**Hypothesis Number H19**

Where Introduced: Principal-agent theory

Hypothesis: Organic and commercial providers of depot maintenance are perceived as differing in their degree of carefulness, industriousness, and trustworthiness.

Theoretical Concepts

Consistent with: Principal-agent theory

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**Hypothesis Number H20**

Where Introduced: Principal-agent theory

Hypothesis: Organic and commercial providers of depot maintenance are perceived as differing in the degree to which they can influence the desired outcome of depot maintenance activity.

Theoretical Concepts

Consistent with: Principal-agent theory

---

**Hypothesis Number H21**

Where Introduced: Principal-agent theory

Hypothesis: Random factors, under neither the control of depot maintenance providers nor managers, are perceived as being able to influence the outcome of depot maintenance.

Theoretical Concepts

Consistent with: Principal-agent theory

Also consistent with: Garbage can model

---

**Hypothesis Number H22**

Where Introduced: Principal-agent theory

Hypothesis: The outcome of depot maintenance is perceived as observable to both providers of depot maintenance and to government managers of depot maintenance.

## Theoretical Concepts

Consistent with: Principal-agent theory

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**Hypothesis Number H23**

Where Introduced: Principal-agent theory

Hypothesis: The providers of depot maintenance will be perceived as having better information than government managers of depot maintenance about the degree of care exercised during the performance of depot maintenance.

## Theoretical Concepts

Consistent with: Principal-agent theory

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**Hypothesis Number H24**

Where Introduced: Principal-agent theory

Hypothesis: Public and commercial providers are perceived as having different potential to act opportunistically.

## Theoretical Concepts

Consistent with: Principal-agent theory

Inconsistent with: Relational/social exchange theory

---

**Hypothesis Number H25**

Where Introduced: Principal-agent theory

Hypothesis: Retention by the government of smart buyer capability will be perceived as important.

## Theoretical Concepts

Consistent with: Principal-agent theory

Also consistent with: Theory of non-market failure

---

### **Hypothesis Number H26**

Where Introduced: Public choice theory

Hypothesis: Interest groups internal to government (i.e., Department of Defense, ministry of defense, or other government agency as applicable) will be perceived as influencing the choice of public versus commercial provision of depot maintenance.

Theoretical Concepts

Consistent with: Public choice theory

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### **Hypothesis Number H27**

Where Introduced: Public choice theory

Hypothesis: Interest groups external to government (i.e., Department of Defense, ministry of defense, or other government agency as applicable) will be perceived as influencing the choice of public versus commercial provision of depot maintenance.

Theoretical Concepts

Consistent with: Public choice theory

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### **Hypothesis Number H28**

Where Introduced: Privatization literature

Hypothesis Private provision of goods and services will be preferred, in general, to public provision.

Theoretical Concepts

Consistent with: Theory of non-market failure

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**Hypothesis Number H29**

Where Introduced: Privatization literature

Hypothesis: Private firms will be perceived as more efficient at depot maintenance than their public counterparts.

Theoretical Concepts

Consistent with: Theory of non-market failure

---

**Hypothesis Number H30**

Where Introduced: Privatization literature

Hypothesis: The availability of a competitive marketplace will be perceived as mat-  
tering if government is to benefit from commercial capabilities.

Theoretical Concepts

Consistent with: Theory of non-market failure

Also consistent with: Imperfect competition

---

**Hypothesis Number H31**

Where Introduced: Theory of non-market failure

Hypothesis: Compared to government, commercial firms will be perceived as having better dynamic efficiency—the ability to develop new technology that lowers cost functions, improves product quality, and creates new and marketable products

Theoretical Concepts

Consistent with: Theory of non-market failure

---

**Hypothesis Number H32**

Where Introduced: Theory of non-market failure

Hypothesis: Compared to government, commercial firms will be perceived as having better technological efficiency—the ability to find and employ the best technology currently available, thus producing at lower cost and higher quality and

Theoretical Concepts

Consistent with: Theory of non-market failure

---

**Hypothesis Number H33**

Where Introduced: Theory of non-market failure

Hypothesis: Compared to government, commercial firms will be perceived as having better X-efficiency—the ability, given a specific technology, to reduce cost, raise productivity, and improve quality through changes in organization, management practices, and worker motivation.

Theoretical Concepts

Consistent with: Theory of non-market failure

---

**Hypothesis Number H34**

Where Introduced: Resource/competency-based theory

Hypothesis: An organization's core competencies are perceived as being defined by the products it makes, services it provides, and markets it serves.

Theoretical Concepts

Inconsistent with: Resource/competency-based theory

---

**Hypothesis Number H35**

Where Introduced: Resource/competency-based theory

Hypothesis: An organization's core competencies are perceived as defined by what it knows and what it can do.

## Theoretical Concepts

Consistent with: Resource/competency-based theory

---

**Hypothesis Number H36**

Where Introduced: Resource/competency-based theory

Hypothesis: Members of an organization perceive themselves as able to articulate their organization's core competencies.

## Theoretical Concepts

Consistent with: Resource/competency-based theory

---

**Hypothesis Number H37**

Where Introduced: Resource/competency-based theory

Hypothesis: Government depot maintenance capability is perceived to be a core government logistics competency.

## Theoretical Concepts

Consistent with: Theory of non-market failure

---

**Hypothesis Number H38**

Where Introduced: Resource/competency-based theory

Hypothesis: Employee knowledge and skills are perceived as an important component of a depot maintenance organization's core competencies.

## Theoretical Concepts

Consistent with: Resource/competency-based theory

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**Hypothesis Number H39**

Where Introduced: Resource/competency-based theory

Hypothesis: Technical systems are perceived as an important component of a depot maintenance organization's core competencies.

Theoretical Concepts

Consistent with: Resource/competency-based theory

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#### **Hypothesis Number H40**

Where Introduced: Resource/competency-based theory

Hypothesis: Managerial systems are perceived as an important component of a depot maintenance organization's core competencies.

Theoretical Concepts

Consistent with: Resource/competency-based theory

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#### **Hypothesis Number H41**

Where Introduced: Resource/competency-based theory

Hypothesis: Values and norms are perceived as important components of a depot maintenance organization's core competencies.

Theoretical Concepts

Consistent with: Resource/competency-based theory

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#### **Hypothesis Number H42**

Where Introduced: Resource/competency-based theory

Hypothesis: There will be differing interpretations of the concept of core.

Theoretical Concepts

Consistent with: Resource/competency-based theory

Also consistent with: Garbage can model

---

**Hypothesis Number H43**

Where Introduced: Administrative innovations and

Hypothesis: Professional managers in government will prefer in-sourcing.

Theoretical Concepts

Consistent with: Administrative innovations and isomorphism

---

**Hypothesis Number H44**

Where Introduced: Administrative innovations and

Hypothesis: Managers of and others with an interest in the depot maintenance public versus private workload allocation decision will be uncertain of the definition of depot maintenance.

Theoretical Concepts

Consistent with: Administrative innovations and isomorphism

---

**Hypothesis Number H45**

Where Introduced: Administrative innovations and

Hypothesis: Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive themselves as having unclear expectations of the benefits of outsourcing.

Theoretical Concepts

Consistent with: Administrative innovations and isomorphism

---

**Hypothesis Number H46**

Where Introduced: Administrative innovations and isomorphi

Hypothesis: Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive themselves as having an unclear understanding of the purpose of outsourcing.

Theoretical Concepts

Consistent with: Administrative innovations and isomorphism

---

**Hypothesis Number H47**

Where Introduced: Administrative innovations and isomorphism

Hypothesis: Government managers will perceive themselves as under pressure from top-level management to outsource depot maintenance.

Theoretical Concepts

Consistent with: Administrative innovations and isomorphism

Also consistent with: Political economy and bureaucratic politics

---

**Hypothesis Number H48**

Where Introduced: Relational/social exchange theories

Hypothesis: Long-term alliances between users of depot maintenance and commercial firms will be perceived as important to effective depot maintenance support.

Theoretical Concepts

Consistent with: Relational/social exchange theory

Inconsistent with: Transaction cost economics

Also inconsistent with: Principal-agent theory

---

**Hypothesis Number H49**

Where Introduced: Relational/social exchange theories

Hypothesis: Long-term alliances between organic depots and their customers will be perceived as important to effective depot maintenance support.

Theoretical Concepts

Consistent with: Relational/social exchange theory

Inconsistent with: Transaction cost economics

Also inconsistent with: Principal-agent theory

---

**Hypothesis Number H50**

Where Introduced: Relational/social exchange theories

Hypothesis: Building and sustaining trust will be perceived as important to effective long-term depot maintenance alliances.

Theoretical Concepts

Consistent with: Relational/social exchange theory

Also consistent with: Logistics and supply chain management

Inconsistent with: Transaction cost economics

Also inconsistent with: Principal-agent theory

---

**Hypothesis Number H51**

Where Introduced: Relational/social exchange theories

Hypothesis: Building and sustaining trust will be perceived as difficult.

Theoretical Concepts

Consistent with: Relational/social exchange theory

Also consistent with: Logistics and supply chain management

---

**Hypothesis Number H52**

Where Introduced: Logistics and supply chain management

Hypothesis: Supply chain integration will be perceived as important to providing effective depot maintenance.

Theoretical Concepts

Consistent with: Logistics and supply chain management

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**Hypothesis Number H53**

Where Introduced: Logistics and supply chain management

Hypothesis: Managers and others interested in depot maintenance will perceive themselves as uncertain of the meaning of supply chain integration.

Theoretical Concepts

Consistent with: Logistics and supply chain management

Also consistent with: Garbage can model

---

**Hypothesis Number H54**

Where Introduced: Logistics and supply chain management

Hypothesis: Supply chain integration will be perceived as difficult to achieve.

Theoretical Concepts

Consistent with: Logistics and supply chain management

---

**Hypothesis Number H55**

Where Introduced: Logistics and supply chain management

Hypothesis: Supply chain integration will be perceived as more difficult to achieve with commercial (i.e., external) sources than with organic (i.e., internal) sources.



### Theoretical Concepts

Consistent with: Logistics and supply chain management

---

#### **Hypothesis Number H56**

Where Introduced: Organizational rationality and the garbage

Hypothesis: Participants in the depot maintenance public versus private allocation decision will be perceived as continually changing.

### Theoretical Concepts

Consistent with: Garbage can model

Inconsistent with: Rational model

---

#### **Hypothesis Number H57**

Where Introduced: Organizational rationality and the garbage

Hypothesis: Chance occurrences rather than a rational process will be perceived as important to outcomes of depot maintenance public versus private allocation decision situations.

### Theoretical Concepts

Consistent with: Garbage can model

Inconsistent with: Rational model

---

#### **Hypothesis Number H58**

Where Introduced: Political economy and bureaucratic

Hypothesis: Managers of and others with an interest in the depot maintenance public versus private workload allocation decision will perceive that decision makers have conflicting preferences with regard to the depot maintenance organic versus commercial source of repair allocation decision.

Theoretical Concepts

Consistent with: Political economy and bureaucratic politics

---

**Hypothesis Number H59**

Where Introduced: Political economy and bureaucratic

Hypothesis: Persons with a vested interest in the depot maintenance public versus private workload allocation decision will perceive powerful people, defined as higher managerial levels, as getting what they want with regard to the depot maintenance organic versus commercial source of repair decision.

Theoretical Concepts

Consistent with: Political economy and bureaucratic politics

---

**Hypothesis Number H60**

Where Introduced: Political economy and bureaucratic

Hypothesis: Persons with a vested interest in the depot maintenance public versus private workload allocation decision will perceive coalition formation.

Theoretical Concepts

Consistent with: Political economy and bureaucratic politics

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**APPENDIX B**  
**EMPIRICAL RESEARCH BY STREAM**  
**OF LITERATURE**

### Empirical Research by Stream of Literature

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Rational model			
Sink 1995	(Logistics) Buyers of 3rd party logistics services followed rational model, but with much cycling and iteration. (292-293)	—	—
Riley 1993	(Logistics) Hypotheses supported where performance ratios (return on assets, fixed asset turnover, total asset return, inventory turns, profit margin, debt ratio) used as measures of asset position. Hypotheses not supported where expressed in dollar figures (215-216)	—	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Carver 1988	—	(Property Tax Assessment) Concluded that rational model was supported; "...decision-makers act more rationally than one might guess." Interprets reliance on previous choices as rational in sense that if have only minor changes in situation and decision was correct earlier then is inefficient to devote resources to decide again. (192-193)	—
Price-coordinated economic activity			
Sink 1995	(3rd Party Commercial Logistics) Cost, price, reliability make up a factor that segments buyers. Buyers followed rational model but with much cycling and iteration (292-293).	—	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Davis 1996	(Information Technology) At sites studied price controls were well understood, used in contracts. But, price controls interfered with partnership formation because uncertainty overwhelmed ability to apply price mechanisms alone. (277-278)	—	—
Loh 1993	(Information Technology) 1) Production and procurement costs important to make-buy decision—cannot just look at transaction costs (103). 2) Stock price reacts favorably to IT outsourcing when cost structure high (190), performance low-implications unclear.	—	—
Rogerson 1995	—	—	(Depot Maintenance) Users reacted to price signals but internal transfer prices set incorrectly, not achieving available efficiency. (x-xi)

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Forbes et al. 1997	—	—	(Depot Maintenance) Results of field tests support conclusion that more than price information is required to make depot maintenance source of repair decisions. (4-7 — 4-14)
Imperfect competition			
None			
Market failure			
Forbes et al. 1997	—	—	(Depot Maintenance) Market failure is concern. Interest by potential sources is factor bearing on public vs. commercial source of repair decision. (2-19 — 2-20)
Scale and scope economy			
Gray 1993	—	—	(Depot maintenance) Econometrically related naval aviation depot capacity utilization to scale economy. (all)



**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Shetterly and Kise 1994	—	—	(Depot maintenance) Using Gray methodology attempted to relate depot capacity utilization to scale economy; not useful for U.S. Army. (all)
Forbes et al. 1997	—	—	(Depot maintenance) Economy of scale and scope important to choice between public and private providers of depot maintenance. However, capacity hard to operationalize or measure. (4-8 – 4-9)
Transaction Cost Economics			
Borchers 1996	(Information Technology) Supported TCE. IT outsourcing is based on tradeoff between within firm and between firms (dyadic) costs. (85)	—	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references as indicated)	Department of Defense (page references as indicated)
Chung 1996	(Information Technology) Asset specificity negatively influenced success of outsourcing. Uncertainty was not statistically significant in model employed. (109-114)	—	—
Davis 1996	(Information Technology) As predicted by TCE, firms responded to uncertainty by invoking intra-organizational authority mechanisms—but not inter-organizational. TCE could not explain use of trust-based forms such as allegiances when uncertainty was high. (277-278)	—	—
Loh 1993	(Information Technology) Unusual TCE result. High probability of obsolescence decreases profit from opportunistic behavior, mitigates reasons for internalizing transactions (104). Empirical support for influence (bureaucratic) costs of internal production (103).	—	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
McCray 1996	(Information Technology) Incorporated TCE assumptions into systems-dynamics model of make-or-buy decision. Influence of TCE not visible in results – dominated by market stability, management pressure to contain costs, management pressure to retain internal control. (281)	—	—
Jenson 1993	(Banking) Related product market strategy to production strategy. Strategic choice consistent with TCE. Full-line banks use specialized bank products as marketing tool. These firm-specific assets increase transaction costs. (54-71)	—	—
Jenson 1993	(Nuclear power industry) Supported TCE. Where tasks hard to monitor and production is critical then tasks are internalized. Of two factors, monitoring the more important. (20)	—	—

### Empirical Research by Stream of Literature (Continued)

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Lever 1997	(Human resource management) TCE was not an important factor in HR outsourcing decision. (150) Possible contributing reason is low overall asset specificity in HR. (153) Findings indicate risk is important consideration—firms will outsource more if risk is low but unable to test theory that organizations will outsource to reduce risk due to scale unreliability. (148)	—	—
Spee 1994	(Human resource management.) Cost and quality key issues. Extended TCE model supported—asset specificity, uncertainty, equivocality, availability of alternatives, symbolism, and particularism predicted 14% of variance. (131)	—	—
Daugherty 1998	(Logistics) External factors having most influence on logistics outsourcing are associated with quality. (171)	—	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Maltz 1992	(Logistics, finished goods warehousing) Results supported asset specificity but not uncertainty (however, study design may have been faulty). Results went opposite to the expected direction for transaction frequency—firms were less inclined to use company-owned facilities to service frequent transactions. (250-151)	—	—
Pouder 1993	—	(Local government services) Uncertainty decreased likelihood of contracting. Two sources of uncertainty: task related and level of market competition. Managers avoided transaction costs associated with unavailable suppliers by using local governments to provide service. Because, in this instance, suppliers were not associated with specialized assets, opportunism was not a predictor of decision not to privatize. (90-91)	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Coopers and Lybrand, TASC 1994	—	—	(Depot Maintenance)  Estimated that contractor's compliance costs and impact of regulations and oversight on contractor's processes, but not including DoD's direct oversight costs, amounted to 18% of the final cost of a DoD contractor's products and services. (94)
Kettl 1993	—	—	(A-76 program)  OMB's cost savings did not take into account cost of A-76 program itself. In 1990, Senator Sasser stated DoD had 1,700 people assigned to A-76 studies at cost of \$150M to \$300M—greater than the estimated savings. (56) Agencies that issued contracts after A-76 study did not monitor contracts to see if savings were achieved. DoD acknowledged that no one knew what actual savings were achieved. (57)

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references. as indicated)	Department of Defense (page references as indicated)
Forbes et al. 1997	—	—	(Depot maintenance) DoD managers act consistent with TCE. Uncertainty (demand, design stability), dependence on specific skills and equipment, flexibility of relationship, and incentive structure important to repair source selection. (4-8 — 4-9)
Principle-Agent Theory			
Davis 1996	(Information Technology) Managers at Xerox and EDS initially attempted to use contracts to protect from uncertainties. Soon realized that uncertainties in relationship overwhelmed ability to apply price mechanisms alone (i.e., strict reliance on contractual agreement). (278) However, there was much greater difficulty building and relying on trust mechanisms. (278)	—	—

### Empirical Research by Stream of Literature (Continued)

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Loh 1993	(Information Technology) Empirical support for inclusion of bargaining and agency costs in make-buy decision. (103)	—	—
McCray 1996	(Information Technology) Under conditions of IT market instability (rapid technology advance), a firm will outsource more as way to gain access to more current technology than it can procure internally (281)	—	—
Shiang 1995	—	(Community Health Services) Contrary to expectation, found negative relationship between information activities and success of outsourcing, but not clear why. Incentive and independence policies had a positive relationship with outcomes. Competition policies also demonstrated a positive relationship. (290)	—



**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references as indicated)	Department of Defense (page references as indicated)
Forbes et al. 1997	—	—	(Depot Maintenance) DoD managers act consistent with principal-agent theory. Non-value added work, extraordinary profits, earnings, work stoppage protection, output quality are important to repair source selection. (2-23, 4-8 — 4-9)
<b>Public Choice Theory</b>			
Schlomach 1996	—	(Texas Highway Construction and Maintenance) Supported. With government provision of roads, costs are not kept as low as possible. Even with monopolistic private provider, desire for profits is an important disciplining mechanism. (183)	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references as indicated)	Department of Defense (page references as indicated)
Ward 1998	—	(Local Government Services) Principal factor that appeared to account for differences (between 2 states) in contracting out was location. Contracting out much more pervasive in Ohio than Mississippi. Higher level of affluence in Ohio and political culture more attuned to concern with quality than to opportunity to create public sector employment. (246)	—
Public Administration/ Privatization			
None (but see meta-analyses)	—	—	—
Non-market failure			
None	—	—	—
Resource/Competency-Based Theory			

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references as indicated)	Department of Defense (page references as indicated)
Borchers 1996	(Information Technology) Concept of core competency not supported. Hypothesized that concept of core competency may not be understood or employed by medium sized manufacturing firms. (86)	—	—
Cheon 1992	(Information Technology) Tested "integrated" models. Contribution of resource-based theory not separately identifiable. (156-166)	—	—
Loh 1993	(Information Technology) Supported concept that management costs (intangible assets and capabilities, collective learning and ability to coordinate diverse production skills, etc.) are an important make-buy factor. (79, 103)	—	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Cooley 1997	(Acute Care Hospitals) Expected 1) hospitals with more outsourcing of "core" activities would have worse long-term growth/profitability; and 2) hospitals that shifted to outsourcing would show similar results. Some support for 1), weak for 2) (69-71, 79, 103)	—	—
Lever 1997	(Human Resource Management) In 3 of 5 areas, found predicted negative relationship between skill level of activity and outsourcing levels. However, also found use of outsourcing to build core competencies by shedding low-skill, but necessary, work. (158)	—	—
Maltz 1992	(Logistics) Incorporating concept of generic strategies was not helpful. (252)	—	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Sink 1995	(Logistics) Largest of two market segments (60% of total) differentiated among suppliers based on synergistic benefits of ILS (298). Distinguishing feature of this segment.	—	—
Technology Diffusion			
Loh 1993	(Information Technology) Treated outsourcing as administrative innovation. Examined both internal and external influences on diffusion of outsourcing. Internal influence model had better explanatory power. Results also consistent with isomorphism. (159-160)	—	—
Pouder 1993	—	(Local Government Services) Efficiency concerns are stronger predictors of privatization than are inter-organizational norms. Unions have significant, negative effects on privatization (coercive isomorphism). Professional managers more likely than elected to privatize. (87)	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references as indicated)	Department of Defense (page references as indicated)
Harris 1996	—	(State and Local Government Information Technology) Concept 1, contract flexibility will reflect organization flexibility, was supported. Concept 2, contract flexibility is related to outcome, was not supported. (137-138)	—
Relational/Social Exchange/Resource Dependency Theories			
Cheon 1992	(Information Technology) Tested "integrated" models. Contribution of resource-dependency theory not separately identifiable. (156-166) Contribution of network/interaction theory not separately identifiable. (156-166)	—	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Jap 1995	(Fortune 50 firms) Common goals can act as substitutes for trust. Trust is important but not entirely necessary; if trust is low, idiosyncratic assets can act as credible commitments during early phases of relationship. Complementary competencies are important factor in decision to work together. There are clear payoffs, sustainable over time, from working together. (ii)	—	—
Chung 1996	(Information Technology) Except for role integrity, all dimensions of relational exchange theory were positively and strongly correlated with at least 1 of 3 success measures. (110)	—	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Davis 1996	(Information Technology) Trust-based relations are used when uncertainty high. They are difficult to implement since higher-level mgt. tended to ask for economic, price-based justification of trust-based relationship. (275-278)	—	—
Moore 1996	(Logistics) Trust and commitment related to effectiveness but could not show relation between trust and commitment. (121-122)	—	—
Sink 1995	(Logistics) Once cost and service were ascertained, most salient factors were trust and degree of cultural compatibility. (300)	—	—
Logistics/Supply Chain Mgt.			



**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Rao and Young 1994	(Logistics) Found five key and interrelated factors in decision to either utilize third parties or retain in-house capabilities: centrality of the logistics function to core competency, risk liability and control, operating cost/service tradeoffs, information and communication systems, and market relationships.	—	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references as indicated)	Department of Defense (page references as indicated)
Lieb 1992	<p>(Third Party Logistics)</p> <p>37% of the respondents' companies used third party logistics services. 11% of non-users were considering such services. More than 60% of the users of such services had done so for more than five years. Most frequently outsourced functions were warehouse management, shipment consolidation, information systems, fleet management and operations, and order fulfillment. Common implementation concerns and problems were potential loss of direct control, uncertainty about level of service, trust of third party, and job security. 59% indicated that they gave less than 10% of the related budget to such services with balance remaining in-house. Contract duration was generally for one to three years (86%) and only 6% were for more than five years. 57% indicated they were at least satisfied with third-party logistics services.</p>	—	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Chenoweth and Abell 1994	—	—	(Depot Maintenance) Examined contractual component repair policy for avionics contractual repair. Found very long flow times (59 days where negotiated flow was 30 days, 77 days if negotiated flow was 45 days). Attributed to lack of concern with supplier responsiveness and requirement that contractor obtain repair parts from government. (xi-xiii)
Forbes et al. 1997	—	—	(Depot Maintenance) All factors affecting nature of relationship retained after field testing. (4-9, D-5)
Sink 1995	(Logistics) Buyers emphasized reliability and integration of logistics services. (298)	—	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references as indicated)	Department of Defense (page references as indicated)
Daugherty 1998	(Logistics) Strategic orientation (channel, market, or process) not a significant factor in anticipated usage of outside logistical services. (158)	—	—
<b>Garbage Can Model</b>			
Sink 1995	(Logistics) Garbage can model supported. Industrial buyers often do not have clear conceptualization of solution alternatives; data are routinely lacking to guide preliminary cost and service analysis. (300)	—	—
<b>Political Econ./ Bureaucratic Politics</b>			
Borchers 1996	(Information Technology) Role of power was not supported. Probably because survey instrument used— inappropriate tool for this construct. (87)	—	—

**Empirical Research by Stream of Literature (Continued)**

Topic Reference	Empirically Examined In Context of		
	Outsourcing (page references as indicated)	Privatization (page references, as indicated)	Department of Defense (page references as indicated)
Chung 1996	(Information Technology) In general, and with some exceptions, aspects of both TCE and relational exchange theory supported in study of satisfaction with outsourcing. (110-111)	—	—
Daugherty 1998	(Logistics) Found that strongest explanatory factor for anticipated usage of outside logistics services was management level of senior logistics executive. (170)	—	—
McCray 1996	(Information Technology) Defined power as management pressure to retain internal control. Simulation model replicated expected behavior: Less pressure resulted in increased outsourcing. (281-282)	—	—
Sink 1995	(Logistics) Politics, power, and personality play important roles. (294)	—	—





# APPENDIX C

## SYNOPSIS OF EMPIRICAL STUDIES CITED

### **Outsourcing**

#### Information Technology Outsourcing

#### *Borchers*

Borchers (1996) attempted to replicate the work done earlier by Low and described below. He tested organizational, economic, strategic, and political models in the context of information technology outsourcing by firms of at least 100 employees, but who were not members of the Fortune 500, in Southeastern Michigan manufacturing businesses. His theoretical constructs, as were Low's, included organizational economics (agency theory, transaction cost economics), the political theory of organizational behavior, core competencies, diffusion of innovations (in this case, outsourcing as an administrative innovation), and Low's IT governance model—which is a composite of much of the above.

His methodology was a mail survey supplemented with a small convenience sample to achieve an  $n > 100$ . The unit of analysis was the outsourcing decision and statistical approach was LISREL structural equation modeling. Results were generally congruent with Low's results. They supported transaction cost economics and indicated that IT outsourcing is based on a tradeoff between within firm and between firm (dyadic) costs. He was not able to support all of Low's hypotheses—two constructs (organizational politics and core competence) had low validity and reliability—and concluded that Low's model



was overspecified. The role of power was not supported, which he attributed to inappropriate use of a survey instrument for that construct. He also suggested that the concept of core competency may not be understood or employed by medium-sized manufacturing firms.

### *Cheon*

Cheon (1992) also examined outsourcing of information systems support. Her theoretical constructs included

- Resource-based theory where resources are physical capital, human capital, and organizational capital;
- Resource dependence theory
- Network/interaction theory from the literature on industrial marketing and
- Structural contingency theory

Using these constructs, she created a research model that rested on five postulates: 1) gaps in information systems resources and capabilities are important considerations, 2) the gap in financial performance is also an important element, 3) strategic orientation dictates the degree of dependence on external organizations, 4) information technology can take on different roles for information technology in an organization—hence the need to match the situational specific information technology role with outsourcing strategy, and 5) service quality and partnership quality will vary from firm to firm and are likely to moderate the relationship between outsourcing and success of outsourcing. Transaction cost economics was not included in this dissertation.

She used a mail survey with organization as the unit of analysis, performed factor analysis to determine if her constructs loaded as anticipated, followed by correlation analysis and multiple regression. Her proposed relationships were generally supported, leading her to interpret the results as supporting the particular mix of theories she had proposed. However, the contributions of resource-based theory and network/interaction theory, if any, were not separately identifiable.

### *Chung*

Chung (1996) examined information system outsourcing in the context of U.S. commercial organizations. In this case, the theoretical constructs were transaction cost economics (especially uncertainty and asset specificity), resource dependency theory, the political economy paradigm, and relational exchange theory. The methodology involved a mail questionnaire to 2,200 firms in 12 mid-western and central states who were in a directory of top computer executives. The unit of analysis was the relationship between client firm and vendor. Based on multiple regression analysis, Chung concluded that there was full or partial support for 11 out of 15 hypotheses which led him to conclude that partnership, flexibility, monitoring of vendors, participation, and joint problem solving were positively related to success of outsourcing. Role integrity, persuasion, use of harsh words, and asset specificity were negatively related to success of outsourcing. Except for role integrity, all relational exchange characteristics positively influenced success. Among communication behavior variables, participation was the only variable significantly related to success. Asset specificity negatively influenced success—as expected from transaction cost economics. The strong influence of vendor capability confirmed the value of selecting a quality vendor.

### *Davis*

In another look at outsourcing of information technology work, Davis (1996) used a case study approach to examine control (or governance) mechanisms and relationships in two firms. His unit of analysis was the control mechanism. In the two firms he studied, he found that managers used a range of governance mechanisms. Price controls were well understood and used in contracts. However, price controls interfered with partnership formation because uncertainty overwhelmed the ability to apply contract and price mechanisms alone. Trust was used where uncertainty was high and there were many deliberate mechanisms to create and sustain trust—examples being exchanges of managers and both partners taking courses in negotiation. Managers experienced much greater difficulty building and relying on trust mechanisms than they did price mechanisms, especially since

higher-level managers, relying on rules associated with market-based relationships, tended to ask for economic, price-based justification for trust-based relationships.

Davis' work is notable for how he approached the literature review. He acknowledged that his literature review results as much from interpreting the case studies as it does from research prior to them. He asserted that a useful theory of outsourcing includes elements of:

- Contingency theory including, by extension, the role of ambiguity as articulated by Carl Weick.
- Transaction cost economics—where he placed emphasis on the uncertainty considerations of transaction cost economics and showed less interest in asset specificity or the availability of alternatives. As predicted by transaction cost economics, firms did respond to uncertainty by invoking intra-organizational authority mechanisms but not inter-organizational. However, Davis found transaction cost economics wanting because it runs into problems attempting to explain why contract-based, hybrid forms of governance such as alliances exist when uncertainty is high. In this circumstance, contracts are normally thought of as problematic and transaction cost economics would cause us to expect reliance on hierarchies or markets. In fairness to transaction cost economics theory, it should be noted that he quotes Oliver Williamson to the effect that transaction cost economics is best used in conjunction with other ways of examining governance phenomena.
- Agency theory, which he criticizes for overemphasis on the rationality assumption and the implied result that, lacking monitoring, an agent will attempt to extract excess fees from the principal.
- Price, authority, and trust governance level control constructs—which he described as a) including sociological mechanisms and b) providing a basis for moving away from the notion of instrumentally rational individuals as actors and to collections of individuals as actors.

### *Low*

Low (1993) examined U.S. firms' outsourcing of information technology (IT) related work. He incorporated a number of constructs in his proposed model of outsourcing. They included:

- Make or buy using two constructs: 1) the microeconomics of vertical integration/disintegration and 2) transaction cost economics

- IT governance with two different meanings: 1) mediation of business relationships through an IT-based network and 2) choices among structural mechanisms used to obtain required IT capabilities
- game theory
- principle-agent theory, to which he refers simply as “agency”
- influence costs or the inferred costs of bureaucracy that result from an organization's differential propensity to manage complexity, forgive error, and engage in logrolling when they occur internally as compared to how it would treat an external organization
- management costs—the cost of producing, maintaining, and using knowledge in a firm
- core competency—which he held to be the source of sustainable competitive advantage—and defined in line with resource-based theory as the ability to coordinate diverse production skills and integrate multiple streams of technologies
- technological imperative—the technology (information, equipment, techniques, and processes) used to transform inputs into outputs. The “technology imperative” concept incorporates the idea that, under some circumstances, it is more costly for a firm to attempt to maintain a leading edge technology IT status on its own than to simply buy innovation
- decision information costs, the idea that decision information costs increase if decision authority is located high in organization in contrast to agency costs which increase if decision authority is located low in an organization
- domain integration, the fit between business and IT strategies
- production versus procurement costs, i.e., internal factor costs versus market prices
- innovation, by which in this case he means IT outsourcing as an administrative innovation that is subject to diffusion like any other innovation

To examine how well his model was supported, Low conducted three quantitative studies using three different methodologies. In the first approach, he conducted a survey of US Fortune 500 firms. In this effort, his unit of analysis was the IT area within a firm (i.e., application development, data center management, telecommunications/ network management) and he used LISREL structural equation modeling to examine a proposed path model. Low interpreted his results to indicate that organizational economics [dyadic and firm costs in the form of bargaining costs; agency costs; influence costs; management costs (intangible assets and capabilities, collective learning, ability to coordinate diverse production skills); and decision information costs] is a useful construct for understanding IT out-

sourcing decision. By contrast, transaction cost economics did not help. He found, contrary to transaction cost economics predictions, that high probability of obsolescence, because it decreases profit from opportunistic behavior, mitigates the reasons for internalizing transactions. He found empirical support for the influence of bureaucratic costs on the overall cost of internal production.

In his second methodology, he compared a white-noise, linear model to three non-linear diffusion models of outsourcing decisions. His data were as he found them recorded in the media and the unit of analysis in this case was the outsourcing decision. The results supported the concept that diffusion is a function of internal (i.e., internal to community) influences and that there was an upward jump in diffusion of IT outsourcing behavior after Kodak's decision to outsource IT. He felt that his results also lent credence to the idea, from technology diffusion theory, that a key event can trigger imitation and accelerate diffusion and that an internal influence model had better explanatory power than an external influence model.

In the third methodology, Low examined existing data on outsourcing decisions as reported in media and then related those decisions via time-series analysis to the stock market performance of the firms. The unit of analysis, in this instance, was the firm. The results indicated that the stock market reacts favorably to outsourcing decisions. Further, if stock price is taken as a good measure of value, then the choice of outsourcing increases the value of firm.

### *McCray*

McCray (1996), in something of a break with the many survey-based approaches to IT outsourcing decisions, created a systems dynamics model. He incorporated concepts from basic microeconomics, transaction cost economics, classical/ neoclassical contract law, relational contracting, agency theory, and political (power) theory. He found that the model he created had the anticipated behavior: given the assumptions that outsourcing is less expensive than in-sourcing and that there is low pressure to retain work in-house then outsourcing is a more likely outcome than retaining the work in-house. He also found that under conditions of IT market instability the firm will outsource as a way to gain access to

more current technology than it can procure internally. The influence of transaction cost economics was not visible in the results—which he concluded were dominated by market stability, management pressure to contain costs, and management pressure to retain internal control.

### Logistics Outsourcing

#### *Daugherty*

In one of a modest number of efforts that have examined outsourcing in the area of logistics, Daugherty (1988) examined outsourcing of logistics services by U.S. manufacturing firms. She relied on network/interaction theory, political economy theory, theories of organizational structure, and the literature on strategic orientation. She conducted interviews at 25 firms and developed a questionnaire based on those interviews. She then surveyed, via mailed questionnaires, 3,002 logistics executives from US manufacturing firms that were represented on mailing lists maintained by the Council of Logistics Management, Traffic Management Magazine, and A.T. Kearney Management Consultants. Her unit of analysis appears to have been the *intention* to outsource logistics services. She used analysis of variance (ANOVA), a t-test for dichotomous variables, and analysis of covariance (ANCOVA). She found significant relations between intent to outsource and the level at which a senior logistics executive is placed in the firm. She also found that strategic orientation (which she defined as channel, market, or process) was not a significant factor in anticipated usage of outside logistic services. She interpreted these results to indicate that outsourcing was more related to managerial behavior than structure—the strongest explanatory factor for anticipated usage of outside logistics services was the management level of the senior logistics executive. She also found that the external factors having most influence on outsourcing decision relate to quality (i.e., firms look at more than cost). It should be noted in interpreting her research that, in contrast to theories such as transaction cost economics, for which structure is an effect to be explained, Daugherty treats structure as an independent variable. Similarly, strategic orientation is an independent variable rather than a result.

*Forbes, Hutcheson, and Timko*

Forbes, Hutcheson, and Timko (1997) created a model of the depot maintenance outsourcing decision for new depot maintenance workloads (i.e., those introduced by weapon systems still in acquisition). Their model—based on concepts from neo-classical economics, transaction cost economics, principal-agent theory, and supply chain management—comprised 22 factors related to three constructs: the nature of the work to be performed, the nature of the provider, or the nature of the relationship between the buyer and provider. The results of field tests using the model supported all three constructs and supported assertions that:

- DoD managers act in ways consistent with transaction cost economics. Uncertainty (of demand, design stability), dependence on specific skills and equipment, flexibility of relationships, and incentive structures are important to the source of repair decision.
- DoD managers also act consistent with principal-agent theory. Non-value added work, anticipation of extraordinary profits on the part of depot maintenance providers, protection against work stoppage, and output quality were all important.
- Economy of scope and scale is also important to the choice between public and private providers of depot maintenance, however capacity was hard to operationalize or measure
- Market failure is a concern as is
- Interest by potential sources

Overall, they concluded that more than price information is required to make depot maintenance source of repair decisions. They proposed that a broader, balanced view of the maintenance workload allocation decision, incorporating more than price information, was needed to address the need for consistency and comprehensiveness.

*Lieb*

Lieb (1992) surveyed chief logistics executives of the 500 largest manufacturing companies in the United States (26% response rate) to develop aggregate data about the use of third-party logistics in American Industry. He found that 37% of the respondents indicated their companies used third party logistics services. Among non-users, 11% were con-

sidering such services. More than 60% of the users of such services had done so for more than five years. The most frequently outsourced functions were warehouse management, shipment consolidation, information systems, fleet management and operations, and order fulfillment. During initial implementation, common concerns were potential loss of direct control and uncertainty about level of service. The most common implementation problem, which clearly relates to these concerns, was getting buy in from operating personnel and managers, a problem that traced to lack of trust in the third party and concerns over job security. Of the companies using third-party services, 59% indicated that they gave less than 10% of the related budget to such services with the balance remaining in-house. Contract duration was generally for one to three years (86%) and only 6% were for more than five years. The majority of companies (57%) indicated they were at least satisfied with third-party logistics services.

### ***Maltz***

Maltz (1992) examined outsourcing of logistics services by U.S. firms in the food, chemical, pharmacy/health, and auto parts industries. He combined theories from transaction cost economics and the literature on competitive strategy. He gathered data for analysis using a survey. With a unit of analysis that appears to have been the outsourcing decision, he used confirmatory factor analysis for factor loadings and logit regression for model testing. The results supported transaction cost economics predictions concerning asset specificity, uncertainty, and firm size but contradicted transaction cost economics hypotheses concerning transaction frequency (companies were less inclined to use company-owned facilities to service frequent transactions) and product value. No significant relationship was found that would support transaction cost economics' contingency predictions or the role of generic competitive strategies. Maltz interpreted the results as indicating that transaction cost economics is relevant to outsourcing of logistics services but that incorporating the concept of competitive strategies did not prove helpful. Even though this research was specific to logistics there are at least two cautions with regard to its informing research into outsourcing of depot maintenance. First, Maltz defined logistics to exclude manufacturing, that is it includes material flows only and, for that reason, is conceptualized as the perfor-



mance of services. (Depot maintenance is sometimes considered a form of *remanufacturing*.) Second, he did not examine or control for differences in production cost between internal and external producers of services. Although this was by intent, it confounded the interpretation of the results since his post-hoc review indicated it was probably important.

### ***Moore***

Moore (1996) examined the relationships between firms (mostly in manufacturing) and third party logistics providers of such services as warehousing and other materials management, transportation, and distribution. He relied principally on the constructs of trust and commitment as found in social exchange theory. He sent a survey questionnaire to all members of the Council of Logistics Management. His unit of analysis was the firm, as represented by one informant. He performed a three-stage statistical analysis. In the first step, he tested for correlation, normality, and linearity of hypothesized relationships. He followed this step with a confirmatory factor analysis and then structural equation analysis. The results provided support for the notion that trust and commitment are important to effectiveness but many of his proposed paths were not supported. As an example, he was not able to demonstrate a direct relationship between commitment and trust. Despite this, he concluded that trust and commitment are useful constructs for understanding the relationships between firms and third-party logistics providers.

### ***Rao and Young***

Rao and Young (1994) used a case study approach to study 44 firms engaged in export import. For shippers, Rao and Young sought information on industry characteristics, the characteristics of the firms themselves, and their international trading partners. For logistics service providers, they focused on capabilities, services offered, tie-ins (i.e., partnerships and alliances) with other logistics firms, and major customers. They found that there were five key and interacting factors in the decision to utilize third parties or retain in-house capabilities to perform international logistics functions. Those factors were centrality of the logistics function to core competency, risk liability and control, operating cost/service tradeoffs, information and communication systems, and market relationships.

***Riley***

Riley (1993) applied a model of asset utilization to the outsourcing of logistics. Although the title of her dissertation indicates she was interested only in the marketing function, she actually defined logistics fairly broadly, to include warehouse management, shipment consolidation, logistics information systems, fleet management, order fulfillment, carrier selection, rate negotiation, order processing, production assembly installation, and product returns for US firms in 20 different standard industrial codes. Her hypotheses was that outsourcing would improve asset utilization.

She mailed a questionnaire ( $n = 523$ ) to senior logistics managers in 333 companies yielding 93 responses for a 28% return rate of which 66 were usable. Her unit of analysis was the company or major division, She examined correlations between performance ratios (return on assets, fixed asset turnover, total asset return, inventory turnover, profit margin, debt ratio) and the fraction of the logistics function that was outsourced. She also looked for similar correlations when results were expressed in dollar figures rather than performance ratios. Her results provided support for improvement in performance ratios when logistics functions were outsourced but did not provide similar support when expressed in dollars. She held that the lack of support when expressed in dollars was due to the relatively larger size of firms which outsourced logistics. Riley admitted to an important problem with construct validity and she also indicated that 25 percent of targeted managers said it was impossible to answer the questionnaire because logistics was decentralized in their firms.

***Sink***

Sink (1995) examined third party logistics services (transportation, warehousing, logistics information systems, and packing) by and for United States firms. On the basis of a broad literature review, he identified a number of theories as relevant to the selection of third party logistics services. These included (stated here in his terms) the strategic decisions: rational model, Cyert and March model, bureaucratic politics model, decision phase theory (essentially the rational model), Mintzberg's general model of strategic decisions,

the garbage can model, industrial buyer behavior theories, transportation purchasing theories, and theories of supplier selection. (Despite the breadth of his literature review, for reasons not evident in his dissertation, he did not include transaction cost analysis.) On the basis of the theories he examined, he postulated that individual, organizational, and environmental factors influence the decision to use third-party sources and choose among those sources.

He used a combination of focus groups, case studies, and a mailed survey (unit of analysis was the firm) to empirically examine his model. His statistical analysis (correlation to determine if factor analysis was appropriate; principle components analysis and cluster analysis to segment buyers of logistics services) indicated that three main factors were important to buyers: economy, synergy (i.e., integrated logistics support), and service reliability. On the basis of his analysis, he held that the purchasing process for third party logistics services followed the rational model (which he described as comprising five stages or phases: awareness, solution development, supplier selection, service adoption, and service assessment) although there was much cycling among these phases. The results also supported the garbage can model since industrial buyers often did not have a clear conceptualization of solution alternatives and data were routinely lacking to guide preliminary cost and service analysis as they did the role of politics and power. He also concluded that the market has two major segments, which he named traditional and innovative. He found that these segments were defined by buyer's preferences for the synergistic effects of integrated logistics performance on cost, price, and service reliability. Once cost and service were ascertained the most salient factors were trust and degree of cultural compatibility.

#### Outsourcing in Other Contexts

##### *Cooley*

Cooley (1997) examined outsourcing of "core" activities in acute care hospitals in California. His theoretical bases included transaction cost economics, the resource based view of the firm, organizational rationality, resource dependency theory, and legitimization (i.e., institutional theory or mimetic isomorphism). He expected that hospitals with more outsourcing of "core" activities would have worse long term growth/profitability and hos-

pitals that shifted to outsourcing would also show similar results. For data, he relied on annual reports that are submitted in accordance with state of California requirements. The unit of analysis, not stated in the dissertation, is the hospital. He performed both cross-sectional and timewise regression. He found mixed support for the hypothesis that outsourcing of core activities will negatively effect profitability and weak support for his second proposition. For public and church hospitals outsourcing was negatively correlated with profitability. For nonprofit hospitals the results were also statistically significant but the sign went the other way. He concluded that the inconsistencies in results indicated the hypothesized effects, if they exist, may have been obscured by other noise in the data.

### *Jenson*

Jenson (1993) examined contracting out of services in the nuclear power industry and the banking industry. His theoretical constructs were transaction cost economics (for the nuclear power industry) and strategic choice (for the banking industry). In both cases he used location-specific units of analysis (the power plant and the bank) in conjunction with ordinary least squares and logit regressions on existing empirical data to test the prescriptions of transaction cost economics. His results supported transaction cost economics in the sense that monitoring problems had the largest influence on outsourcing decisions. In his results from the nuclear power industry, 24% fewer worker equivalents were outsourced if tasks were hard to verify, were production critical, used transaction-specific assets, were related to plant idiosyncrasies, or involved economies of scale in terms of both size and frequency. The results from the banking industry supported the notion that outsourcing is related to strategic choices such as marketing strategy and production strategy. In particular, banks use specialized bank products as a marketing tool with the results that these firm-specific assets increase transaction costs.

### *Lever*

Lever (1997) looked at outsourcing in the management of human resources. Lever's theoretical construct incorporated three perspectives: cost, risk, and skills. His cost perspective is that of transaction cost economics. His risk perspective, which he also refers to

as an organizational theory, incorporates two theories of risk. In the first, it is assumed that firms will keep activities in-house (i.e., vertically integrate) if they would be crucial contingencies when outsourced. In the second, it is assumed that firms will outsource if in-house performance is too risky. The skill perspectives are drawn from the literature on the resource-based view of the firm and the literature on trust-based transactions. He conducted a survey of firms found in two data bases: one was a database from a human resource professional institution, the second was a database maintained by the Outsourcing Institute. He performed exploratory factor analysis, principle components analysis, and confirmatory factor analysis with the individual firm as a unit of analysis. He tested a total of 12 hypotheses as shown in the Table below.

**TABLE C-1**  
**LEVER'S HYPOTHESES**

Number	Hypotheses	Result
H1	External risk negatively related to outsourcing	Supported
H2	Internal risk positively related to outsourcing	Not supported
H3	Production costs positively related to outsourcing	Marginal support
H4	Asset specificity negatively related to outsourcing	Not supported
H5	Competition is positively related to outsourcing	Most important factor in explaining outsourcing levels in human resources
H6	Volume uncertainty is negatively related to outsourcing	Mixed results
H7	Skilled activities are outsourced to a lesser degree	Supported in 3 of 5 areas
H8	Core activities are outsourced to a lesser extent	Limited support
H9	Large organizations outsource to a greater degree	Not supported
H10	Organizations outsource greater amounts of an activity to compete	Supported
H11	Organizations that are downsizing outsource to a greater degree	Mixed
H12	When vendors are more trustworthy, organizations outsource to a greater degree	Support for 2 out of 5 areas

Lever interpreted the results as supporting many of assertions made in organization theory (as he defined it) but conflicting with some of the main tenets of transaction cost economics and resource-based views of the firm. As an example, he found evidence that outsourcing was used to build core competencies by shedding low-skill, but necessary work. He concluded that transaction cost economics was not an important factor in human resource management outsourcing decisions and felt that a contributing reason could be the low overall asset specificity of the human resource management function. He was not able to test the second risk theory (firms will outsource if in-house performance is too risky) due to scale unreliability.

### *Spee*

Spee (1994) relied on transaction cost economics and extended it to include factors such as equivocality (disagreement over meaning) and symbolism to examine the restructuring of corporate staff functions through outsourcing. He conducted a survey of 2600 companies listed in the Claremont Graduate School Placement Office with 167 responses (8% response rate) and employed correlation analysis to examine relationships among variables. Cost and quality were key issues. The results partially supported his extended transaction cost economics model in that he was able to predict 14% of population variance (measured as adjusted R squared).

### **Privatization**

There are informative results from studies that examined privatization both inside and outside the United States.

#### Privatization Outside the United States

### *Al-Homeadan*

Al-Homeadan (1996) examined privatization in Saudi Arabia. In an a-theoretical research effort, he sent a mail survey to 200 randomly selected department heads in Saudi Arabian government (unit of analysis was the department head). He then used logit regression of dichotomized Likert-scaled responses (as an alternative to structural equation mod-

eling because the number of manifest independent variables was large) in order to extract latent factors. He found a relatively long list of factors and concluded that the elite of the Saudi Arabian public sector generally hold favorable attitudes toward privatization. He further asserted that their attitudes have been influenced by two groups of factors: those that emphasize satisfaction with privatization and those that emphasize some degree of dissatisfaction with government performance.

### *Owen*

Owen (1995), relying on public choice theory, used the case study method to compare privatization of state owned enterprises in Great Britain and Hungary during the period 1979 through 1994. He concluded that privatization in Britain and Hungary were not incremental, that a supermajority was not necessary to prevent government growth and that, in fact, a requirement for a supermajority could make it more difficult to privatize. Owen's work relied solely on secondary sources (those regarding Hungary were in translation) and he acknowledges this as a limitation.

### Privatization Inside the United States

### *Carver*

Carver (1988) examined property tax assessment in Massachusetts using the construct of organizational decision making. He relied on existing data on tax assessments for Massachusetts communities. The unit of analysis, which is not specifically described in his dissertation, appears to be the community-year. He performed event-horizon analysis using logit regression. He concluded that use of the rational model was supported. His way of interpreting this support was to suggest that if there is only a minor change in situation or the decision was correct earlier then it is inefficient to devote resources to decide again. He had hoped to identify circumstances under which either public or private entities were more efficient and did find that some times private entities were more efficient, sometimes public, but he was not able to link results to causative factors.

***Denes***

Denes (1996), in study of U.S. Army Core of Engineers dredging contracts, proposed five reasons why barriers should exist to achieving least-cost provision of goods and services through contracting with private firms. They were protectionism, equity programs, inefficient risk allocation, post-award opportunism, collusion, lack of access to capital markets, and incumbency. Denes found support in the literature for all of these—although he did not indicate why he was interested in those particular five “barriers.” His analysis was largely anecdotal and supported only one of the constraints, protectionism. In particular, he found that the Jones act raised the cost of dredging by between 7 and 29 percent.

***Harris***

Harris (1996) looked at outsourcing of information services by state and local government agencies. His theoretical foundation comprised contingency theory, the concept of flexibility from transaction cost economics, and contract law as it regards incomplete contracts. He performed a mail survey of public agencies in eight states that were identified in *Government Technology* as issuing outsourcing contracts during 1992 - 1995. His unit of analysis was the contract. He accomplished both a factor analysis and regression analysis to test his hypothesized models. Four of 18 hypotheses were supported in his primary model and none supported in secondary model. The four constructs with support were contract flexibility, re-negotiation flexibility, price flexibility, and termination flexibility—all of which related to information systems organization flexibility. He interpreted these results as indicating that flexibility of a contract instruments will mirror the flexibility of the organization that writes it. However he was not able to show that contract flexibility was related to outcome.

***Miller***

Miller (1996) described outsourcing in Phoenix, Arizona. Working from existing city data, she used multiple regression to attempt to uncover the factors that led to savings (defined as the difference between the lowest and next lowest bid) through outsourcing. She



concluded that it seems likely that the rules of the game that are embedded in the competitive process caused observed savings. However, lacking a theoretical base, it is not clear why Miller examined the variables (year of contract, length of contract, number of bidders, and interactions between these variables) she did or how to interpret the significance of variables that were significant.

### *Pouder*

Pouder (1993) studied services such as grounds maintenance, data processing, fleet maintenance, garbage removal, and animal control provided by and or for local governments in Connecticut. He relied on two theoretical constructs: transaction cost economics and institutional theory. Institutional theory advances the idea that a corporation's structure, rather than being efficiency based, instead simply reflects isomorphism—adopting the structure that prevails among other organizations. He discusses trust and cooperation in conjunction with transaction cost analysis and makes the claim, based on his review of the literature, that transaction costs are essentially static, whereas trust and cooperation act dynamically over time. To obtain data, he mailed a questionnaire to one manager in each of 169 local governments in Connecticut, achieving a 52% response rate. Although his unit of analysis was not specified, it appears to be the service provided.

Using multiple regression to examine anticipated relationships among variables, he was able to support transaction cost economics but not always with the direction of relationship that transaction cost economics theory would propose. Uncertainty, both task related and related to the level of market competition, decreased the likelihood of outsourcing. Managers avoided transaction costs associated with unavailable suppliers by using local governments to provide service. Because the suppliers were not associated with specialized assets, opportunism was not a predictor of the decision not to privatize. There was weak support for institutional theory. He interpreted these results to indicate that decisions to privatize or not privatize made by managers in Connecticut local governments more nearly conform to precepts of transaction cost economics than to institutional theory; that is, efficiency concerns are stronger predictors of privatization than are inter-organizational norms. A possible concern in interpreting his results is that Pouder's operationalization of

variables appears remote in some instances. As an example, his measure for mimetic isomorphism was operationalized as membership or non-membership in the Connecticut Conference of Municipalities.

### *Schlomach*

Schlomach (1996) examined construction and maintenance of roads in Texas. Working from within public choice theory, he assembled historical data, anecdotal data, and statistical data on Texas roadways. The unit of analysis for statistical analysis (multiple regression) was the category of area, urban or rural. He was able to find anecdotal evidence in support of the public choice theory contention that bureaucrats are budget maximizing. Similarly, he was able to find some statistical results consistent with the hypothesis that more maintenance is done on rural roads than is economically necessary. He interpreted his results as being consistent with public choice theory but also indicated that, even with a monopolistic private provider, the desire for profits is an important disciplining mechanism.

### *Shiang*

Shiang (1995), in the context of Ohio community health service boards that had made a prior decision to contract out, attempted to determine the effects of different contractual arrangements on the service performance of a contractor. Shiang relied on two theoretical constructs, transaction cost economics and principal-agent theory. He performed a survey of Ohio mental health boards (unit of analysis was the mental health board) to determine policies. He then linked those policies to outcome measures and used factor analysis to confirm constructs. He used contingency tables and regression analysis to examine relationships between policies (independent variables) and outcomes (dependent variables). Contrary to his expectation, he found a negative relationship between information activities and success of outsourcing but the reasons for this relationship were not clear. He also found that incentive & independence policies had a positive relationship on service performance as did competition policies. His regression results generally lacked statistical signif-

icance. He concluded that the results reflected the presence of confounding influences such as political control.

### ***Ward***

Ward (1988), using a case study methodology, examined provision of local government services by eight municipalities, four in Mississippi, four in Ohio. Contracting out was much more pervasive in Ohio than Mississippi. The principal factor that appeared to account for the difference in the amount of contracting out between the municipalities in the two states was the state to which a municipality belonged. In particular, he ascribed the difference to a higher level of affluence in Ohio and a political culture more attuned to concern with quality than to opportunity to create public sector employment. Thus his research is supportive of public choice theory.

### ***Weber***

Weber (1996) surveyed Ohio public school superintendents (612 mailed, 370 returned and usable for a 61% response rate) to determine their willingness to adopt privately provided pupil transportation. His unit of analysis, though not explicitly described, appears to be the superintendent. On the basis of chi square and Wilcoxon rank sums tests, he concluded that of 34 relationships that he hypothesized, 10 were significant at the five percent level or better. Those were: classification of board membership, labor/management perspective of the board, age of superintendent, years as a superintendent, years as a superintendent in the current district, business coursework taken, superintendent's educational certification, superintendent's experience in contracting services, services contracted, and number of students transported.

### ***Woodward***

Woodward (1992) looked at variables that determined the Department of the Army's success in implementing Office of Management and Budget Circular A-76. Of 17 hypotheses, he was able to support 5: priority by implementing office; dispositions of

implementing officials; attitudes and resources of constituency groups over time; support by superordinate officials; and commitment and leadership skill of the implementing officials. He concluded that human factors rather than technical factors determine success or lack of it in implementing OMB A-76.

#### Other Empirical Studies

##### *Chenoweth and Abell*

Chenoweth and Abell (1994) examined DoD depot maintenance contractual component repair policy for avionics contractual repair. They found very long flow times (59 days where negotiated flow was 30 days, 77 days if negotiated flow was 45 days) and attributed these long flow times to lack of concern with supplier responsiveness and a requirement that the contractor obtain repair parts from government.

##### *Coopers & Lybrand and TASC*

Coopers & Lybrand and TASC (1994) using an activity-based costing approach to estimate DoD contractor's costs resulting from compliance with DoD-specific requirements, the impact of DoD regulations, and oversight on contractor's processes. They concluded that such costs, exclusive of the cost to DoD to do actual monitoring, amounted to 18% of the final cost of products and services provided to the department.

##### *Gray*

Gray (1993) econometrically related naval aviation depot capacity utilization to scale economy (operationalized as cost per direct labor hour). His data clearly show loss of scale economies when naval aviation depots lost maintenance workload in the aftermath of the Cold War.

##### *Jap*

In order to explore how strategic relationships can affect buyer-supplier outcomes, Jap (1995) used three classes of variables (partner firm characteristics such as goal

compatibility and complementary competencies; environmental characteristics such as demand for supplier's products, level of dynamism, and level of complexity; and interpersonal trust to examine outsourcing in Fortune 50 firms. He applied structural equation modeling to 200 buyer-supplier dyads within the firms over a one-year time period. His results, as he interpreted them, suggest that common goals can act as substitutes for trust, trust is important but not entirely necessary, complementary competencies are an important factor in the decision to work closely together, there are clear payoffs from working closely together, and those payoffs are sustainable over time.

### ***Shetterly and Kise***

Shetterly and Kise (1994) attempted to use the Gray methodology to relate depot maintenance capacity utilization to scale economy for U.S. Army workloads. The concluded that the methodology was not useful for the U.S. Army.

### ***Rogerson***

Rogerson (1995), as part of a larger examination of transfer prices within the DoD, examined the breakdown of costs for the Air Force depot level reparable supply system for DoD fiscal year 1994. He concluded that users of the supply system were reacting to the price signals, as intended, but that the price information presented by the price signals was distorted as a result of the prices being set incorrectly (equal to average rather than marginal costs). As a result, available efficiencies were not being achieved.

# **APPENDIX D SOCIAL SCIENCE RESEARCH PROCESS MODEL: SUMMARY OF THEORETICAL AND PRACTICAL CONSIDERATIONS**

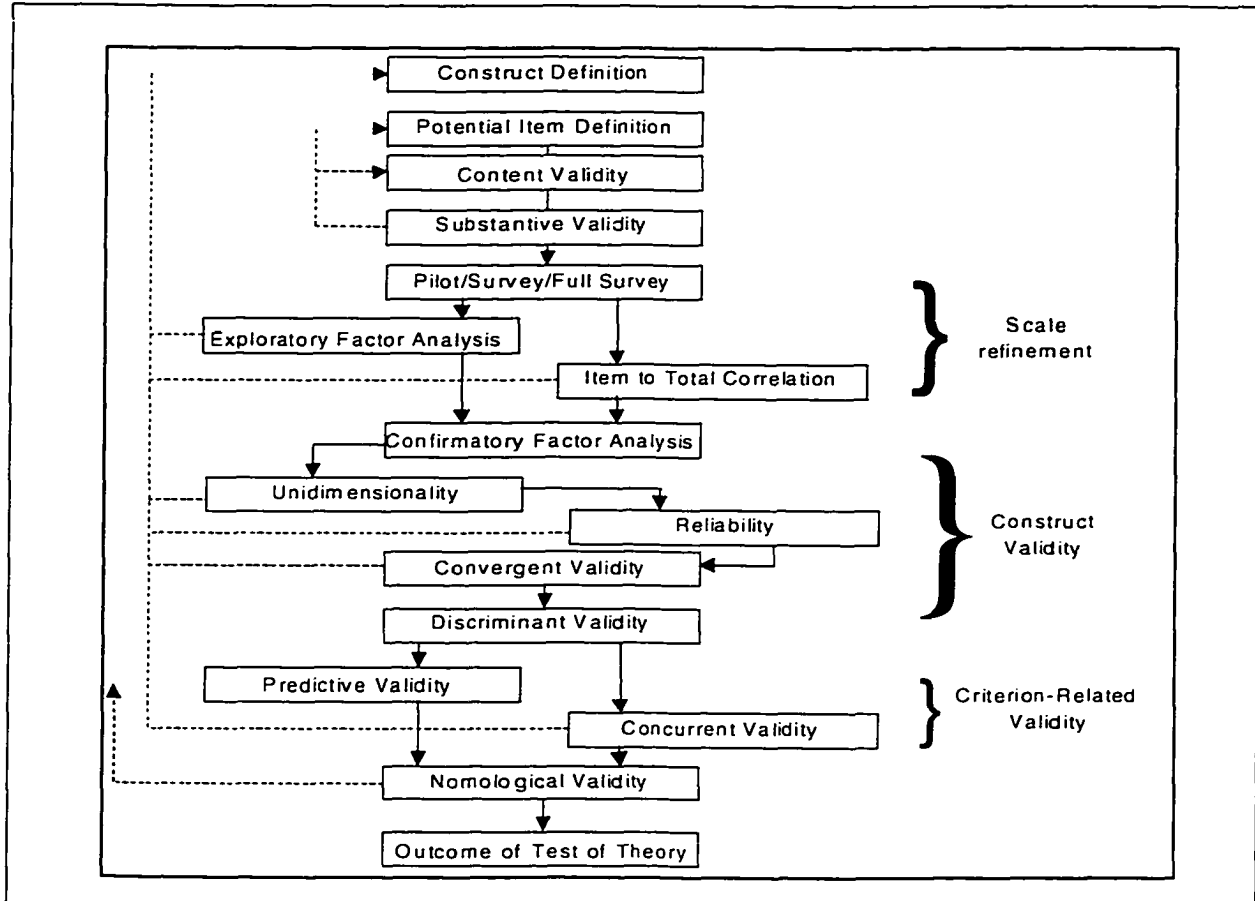
## **Introduction**

The purpose of this appendix is to describe the research process model that was employed in Chapters 3 through 6. In order to help ensure that the results of the present research have the characteristics of generalizability, internal validity, and simplicity, the author applied Dunn, Seaker, and Waller's (1994) social science research process model (Figure E-1). The general flow of steps in this process is from top to bottom. Since iteration is generally required, some of the main iteration paths are indicated by dashed lines. This appendix will explain each component of the model beginning with content validity. The basis for the first step, definition of constructs, was completed in Chapter 2—where nine streams of research were reviewed. Additionally, the hypotheses from Chapter 2 formed a basis for selecting items by which to explore constructs. (In the discussion that follows, in the interest of avoiding unnecessary clutter, page references will be given once in the discussion of each model component.)

## Scale Development

Assuming that constructs have been defined, related hypotheses constructed, and a decision made to determine if the hypotheses are supported, it is necessary to develop measurement scales. There are at least two major approaches to the task—the Thurstone and Likert methods (Oppenheim 1996, 191-200).

**FIGURE D-1.**  
FORMS OF RELIABILITY



### Thurstone Method

Discussions of the Thurstone method are available in Oppenheim (1996, 191-195), Thurstone (1929), and Thurstone (1974, 59-79). Basically, this method, known as the method of equal-appearing intervals, requires

- The creation of a large pool of items based on a review of the literature and pilot interviews

- Reproduction of the items on individual cards or pieces of paper
- Creation of an ordered scale (e.g., least favorable to most favorable) divided into a fixed number of sections
- Presentation of the items in random order to a group of judges
- Assignment of each of the items by each of the judges to one of the sections of the scale based on each judge's judgment of the section in which each item most properly belongs
- Assembly of all of the judgments for each item
- Selection, from the original item pool, of those items that have the least spread among judges and are most representative of each of the intervals
- Calculation of the median of judgments for each retained item to create the final scale.

The Thurstone methodology has the desirable attribute of leading to good unidimensionality, as well as adequate reliability and validity. Unfortunately, it also requires a large number of judges to operate (perhaps one-third as many judges as items), and for the present research would have to be repeated for each scale to be created, a total of 60 scales (one per hypothesis). It was unlikely that the necessary number of judges could be found, and for this reason the Thurstone method was not used.

#### Likert Method

The Likert scale is an attractive alternative in that it is less laborious and has been found experimentally to correlate well with Thurstone scales (Oppenheim 1996, 195). The Likert scale procedure is described in Oppenheim (1996, 195-201) and Likert (1974, 233-243). It is the approach that was used in the present research. To create a Likert scale, the general procedure (and the one the author followed) is as follows:

- Creation of an item pool—also the first step in the Thurstone methodology—but with attention to avoiding too many neutral or extreme items. Judges during the trial and full applications are asked to place themselves on an attitude continuum running from strongly agree to strongly disagree for each item (or on some other appropriate continuum, depending on the nature of the item). The typical number of choices is five, seven, or nine.
- Trial application using a sample of respondents
- Numerical recording of trial respondent scores after arbitrarily assigning “1” to one end and “5,” “7,” or “9” to the other
- Addition of the item scores to obtain a total score



- Purification of the item pool to eliminate those that do not tend to produce consistency and homogeneity when the items are considered together.
- Full-scale application and analysis of the purified scale

### **Content Validity**

A scale possesses content validity when the scope of a construct is reflected in the items intended to measure it (Dunn, Seaker, and Waller 1994, 157). Content validity begins with a careful review of the literature in order to understand how constructs are defined—a requirement that Chapter 2 addressed. Although there is no rigorous way to test for content validity, the usual approach is to base the instrument on previous theory and research (Bausell 1986, 211) and include multiple items on a scale to help ensure that the measurement of the construct is thorough. Dunn, Seaker, and Waller illustrate what is meant by content validity using the example of customer service. A researcher interested in the construct “customer service” might not capture the full scope of the construct with the single measure “number of stock outages.” However, counting the number of stock outages could well measure the narrower construct “number of stockouts.”

### **Substantive Validity**

A scale possesses substantive validity when the items used in the scale are conceptually or theoretically linked to the construct being measured (Dunn, Seaker, and Waller 1994, 157-159). Content validity presupposes substantive validity. It applies to an entire scale, whereas substantive validity applies to individual items. There are a number of potential ways to test for substantive validity, including Cronbach’s coefficient alpha (see Cronbach 1951 for discussion of coefficient alpha) against pretest data, exploratory factor analysis of pretest data, and an item sort (matching items with constructs) using experts. The difficulty with using either Cronbach’s alpha or exploratory factor analysis on pretest data is that there are probably not enough data for statistical significance. Hence it is easy to remove items that should remain and retain items that should be removed.

The method used in the present research was the item sort. For this method, the author used Anderson and Gerbing’s proportion of substantive agreement (PSA) and substantive validity coefficient (CSV) indices.

The PSA index indicates how well items are assigned to the constructs they are intended to measure and is defined as the number of participants assigning an item to its hypothesized construct divided by the number of participants. PSA, therefore, resides in the interval  $[0 \dots 1]$ , and a high value indicates agreement with the correct construct. The author did not find a suggested critical value for PSA. The value 0.67 was used, since it seems reasonable to retain an item if two-thirds of the participants associated it with the hypothesis it was intended to measure.

CSV is expressed as (number of participants assigning item to the hypothesized construct—highest number of assignments to any other construct)/number of observations and is a member of the interval  $[-1 \dots +1]$ . Dunn, Seaker, and Waller, following Gerbing and Anderson, suggested a critical value of 0.5.

### **Scale Refinement**

Scale refinement, or item purification, is the process of eliminating items from a scale that do not statistically agree with other items on the scale (Dunn, Seaker, and Waller 1994, 159-161). Two tools for doing this are exploratory factor analysis and Cronbach's coefficient alpha.

Exploratory factor analysis assists in determining what latent variables a group of observed items represents (Bohrnstedt 1993, 175)—that is, detecting the structure in the relationships between variables. The basic approach is to determine the squared multiple correlation of an item with all other items as an estimate of the communality among the items. Items that show low relationship with other factors or represent more than one dimension (i.e., more than one construct) are removed. The author used principal components analysis and principal factors analysis as implemented in Statistica (StatSoft 1994, 3190-3192) to perform this task. Where it was necessary to determine how many factors to retain, the author followed the suggestions in the Statistica documentation, applied the Kaiser criterion, and retained factors with eigenvalues greater than 1. The basic rationale behind this criterion is to keep an extracted factor only if it extracts at least as much as the equivalent of one original variable. In conjunction with the Kaiser criterion, the author also used what is known as a scree test—a plot of the eigenvalues—to determine the place

where the decrease of eigenvalues from one factor to the next appears to level off. Factors beyond the level-off point were ignored.

The second approach is Cronbach's coefficient alpha, which is expressed as

EQUATION 1

$$\alpha = Np / [1 + p(N - 1)]$$

N in Equation 1 is the number of items and p is the average inter-item correlation. Cronbach's alpha is in the interval [0...1]. Higher coefficients indicate higher reliability of a scale, with a value of 0.7 or higher indicating internal consistency for established scales and 0.6 being acceptable for new scales such as those created in this research. Cronbach's alpha is also implemented in Statistica.

### **Construct Validity**

Whereas item purification helps ensure that the items on the selected scales measure the constructs they are intended to, it is still necessary to ensure construct validity (Dunn, Seaker, and Waller 1994, 161-164). Construct validity is held to be present if a scale measures the magnitude and direction of characteristics of a construct and is not contaminated with characteristics of other constructs. The most frequently used criteria for establishing construct validity are convergent and discriminant validity. However, because these criteria are of limited value if scale unidimensionality and reliability are not established, the latter two characteristics will be discussed first.

#### Unidimensionality

A scale cannot possess construct validity unless it is unidimensional (constructs can be multidimensional; scales cannot). That is, unidimensionality is a necessary but not sufficient condition for construct validity. The author used confirmatory factor analysis to assess unidimensionality and to eliminate items that loaded weakly on scales. As is anticipated in the literature, there was a tradeoff between unidimensionality and content validity: by eliminating some items scale unidimensionality could be improved, but at the same time the act of eliminating an item might result in poorer coverage of the scope of the construct

being measured. Deciding where to place the balance was informed by the literature review in Chapter 2.

### Reliability

Once unidimensionality was established, it was then necessary to ensure scale reliability. Following Bausell (1986, 180) there are at least five aspects of reliability, as shown in Table D-1 (descriptions are quoted verbatim from Bausell).

**TABLE D-1. FORMS OF RELIABILITY**

<b>Form</b>	<b>Description</b>
1. Alternate forms	Would the same group of respondents score similarly on two equivalent forms of the same measure?
2. Internal consistency	Would the same group of respondents score similarly on two parts of the same measure?
3. Test-retest	Would the same group of respondents score similarly on the same measure at two different points in time?
4. Inter-rater	Would two different scorers assign the same group of respondents similar scores on the same instrument?
5. Intra-rater	Does the same scorer assign scores in a consistent manner?

As Bausell (1986, 182) has noted, alternate forms reliability, because it involves the construction of two parallel instruments, is too unwieldy to be of much use. It was not pursued in the present research. Internal consistency is, in some sense, a more practical variation of alternate forms reliability. To demonstrate internal consistency, a single test is administered to a single group of subjects, but the test is treated as if it were two separate forms. Then the correlation between the two “sub-tests” is computed, while adjusting for the fact that each subtest is shorter than the full test. Reliability is established if the subtests are correlated. A difficulty with this approach is that the splitting of the test into halves is arbitrary. Accordingly, the author used Cronbach’s coefficient alpha, which can be thought of as an average of all the potential half-split reliabilities (Bausell 1986, 183). Cronbach’s alpha was previously discussed.

Test-retest reliability was not used, because there was not an opportunity to test the same group of respondents twice.

Inter-rater reliability was not believed to be an issue, since the survey instrument was self-scored by the individuals completing the survey. No external observer was involved.

Intra-rater reliability was an issue for the weapon system-related data and was checked in that context.

### **Convergent and Discriminant Validity**

Construct validity is supported when both convergent and discriminant validity are present. Convergent validity is a measure of the extent to which dissimilar methods of measuring a construct achieve similar results (Dunn, Seaker, and Waller 1994, 163-164). Discriminant validity is a measure of the degree to which scales intended to measure distinct constructs achieve distinct results, i.e., that constructs are distinct. The author tested for convergent validity using confirmatory factor analysis. If the appropriate factors loaded on the appropriate constructs, then convergent validity was supported. To test for discriminant validity, it was necessary to compare the correlations between the constructs of a model to a hypothetical model without correlation; correlation in the empirical results indicating a limitation on discriminant validity.

### **Criterion-Related Validity**

Criterion-related validity indicates if a scale correlates with the criterion it is intended to predict. There are two types of criterion-related validity: concurrent and predictive. Concurrent validity applies when the criterion exists in the present, and predictive when the criterion exists in the future. In this research, all criterion-related validity was concurrent. Dunn, Seaker, and Waller (1994, 165) note that in the social sciences it is often difficult, if not impossible, to find a way to establish criterion-related validity.

In the present case, when analyzing the weapon system-related data, it was intended to use structural equation modeling to establish a model of the process by which the choice of public or private providers of depot maintenance is made. If the model, using the pre-established menu of factors, could successfully predict the choices that the armed services actually made for the reported weapon systems, then criterion-related validity would be held to be supported for that model. The author used the structural equation modeling

module in Statistica to perform confirmatory factor analysis but did not pursue a path model per-se for a number of reasons, not the least of which was the limited number of cases—well below the thresholds normally recommended in the literature. The author augmented confirmatory factor analysis with a logistic regression and a step-wise multiple linear regression.

### **Objectivity, Nomological Validity, and Test of Theory**

The processes used to make the choice between public and private providers, whether they be explicit and mechanical (e.g., the decision tree analysis, CORE process, or the model linking criteria and choices for the weapon system-related data) or implicit and more difficult to explicate are, of course, repeated actions when they are accomplished more than once. Repeated (more properly, habituated) actions provide benefit by narrowing the number of choices (Berger and Luckmann 1966, 53) and reducing the overall amount of work required to make a choice. The DoD procedures for choosing between public and private sources of depot maintenance, the model underlying the weapon system-related data, and the various theories described in Chapter 2 are attempts to make explicit the habituated actions related to the insourcing versus outsourcing choice and to describe how they work.

This dissertation is primarily interpretive. Rather than holding that the habituated actions used to make the public versus private choice follow general laws—and that the purpose of the research is to discover those laws—the underlying motivation is to describe this inherently social activity in a way that is adequate at the level of meaning (Burrell and Morgan 1979, 230), more simply to make it understandable. Accordingly, the approach was to strive for objectivity, where objective knowledge is established when there is reciprocal typification of conduct (Berger and Luckmann 1966, 58). By reciprocal typification in this instance it is meant that many persons (academic researchers, depot maintenance managers, industry managers) understand the habituated methods for making the public versus private choice in much the same way—for instance, when many persons accept a particular theory on or approach to selecting public or commercial providers of depot maintenance. By contrast, conduct to which a person attaches his or her *own* meaning, not shared by others, is what constitutes the subjective (Harmon and Mayer 1995, 294-297). The

present researcher sees objectivity defined in this way as identical in all essential aspects with nomological validity, because a construct is nomologically valid when it relates to other research in such a way that it is consistent with the received theory (Dunn, Seaker, and Waller 1994, 165).

With that background, how to interpret results when they are consistent with the received theory was fairly straightforward. The rules for nomological validity applied; the theory and the construct being examined were mutually supported; and objectivity was supported. How to interpret results that were not consistent with established theory was not as clear, other than the obvious conclusion that objectivity had not been aided. Lack of consistency could have been because the construct did not measure the intended latent variables; it could also indicate that the underlying theory was a flawed characterization of the habituated actions. It was the author's responsibility to examine these possibilities.

# APPENDIX E

## SUMMARY ANALYSIS OF EMPIRICAL STUDIES

The following four tables provide a summary analysis of the 27 empirical studies used by the author in preparation of this dissertation.

The studies were performed by

*Table E-1*

- Borchers
- Cheon
- Chung
- Davis
- Low
- McCray

*Table E-2*

- Daugherty
- Lieb
- Maltz
- Moore
- Rao and Young
- Riley
- Sink

*Table E-3*

- Cooley
- Jenson
- Lever
- Spee
- Carver
- Denes
- Harris

*Table E-4*

- Miller
- Pouder
- Schlomach
- Shiang
- Ward
- Weber
- Woodward



**TABLE E-1**  
**BORCHERS TO MCCRAY**

Sources of Concepts	Borchers	Cheon	Chung	Davis	Low	McCray
Neoclassical economics						
Price-coordinated economy						‡
Imperfect competition						
Market failure						
Scale and scope					‡	
Transaction cost economics	‡		‡		‡	‡
Principal-agent theory	‡				‡	‡
Public Administration						
Political economy						
Privatization, non-market failure						
Technology, strategic management						
Competency-based theory (core)	‡	‡		‡	‡	
Innovation, technology diffusion	‡				‡	
Relational/social exchange, partnering		‡	‡		‡	‡
Logistics/supply chain management						
Garbage can model			‡	‡		
Bureaucratic politics				‡		‡
Other						‡

**TABLE E-1  
BORCHERS TO MCCRAY (CONTINUED)**

Sources of Concepts	Borchers	Cheon	Chung	Davis	Low	McCray
Elicited values and norms?	Yes	For expected and perceived service quality	Yes	Yes	Yes	No
Methodology	Survey	Survey	Survey	Case study	Indirect: structural equation modeling; diffusion model; time series analysis	Systems dynamics model
Data obtained from/by	Mail questionnaire	Mail questionnaire	Mail questionnaire	Interviews	Public media (e.g., published decisions, stock prices)	Generated by model
List of analysis	Outsourcing decision	Organization	Firm-vendor relationship	Control mechanism	Outsourcing decision; firm	Outsourcing decision
General area of emphasis	Information technology	Information technology	Information technology	Information technology	Information technology	Information technology
Outsourcing or privatization	Outsourcing	Outsourcing	Outsourcing	Outsourcing	Outsourcing	Outsourcing
Dominant paradigm	Functionalist	Functionalist	Functionalist	Interpretivist	Functionalist	Functionalist

**TABLE E-2  
DAUGHERTY TO SINK**

Sources of Concepts	Daugherty	Lieb	Maltz	Moore	Rao and Young	Riley	Sink
Neoclassical economics							
Price-coordinated economy							
Imperfect competition							
Market failure							
Scale and scope							
Transaction cost economics		‡	‡				
Principal-agent theory							
Public Administration							
Political economy							
Privatization, non-market failure							
Technology, strategic management							
Competency-based theory (core)			‡		‡		
Innovation, technology diffusion							
Relational/social exchange, partnering	‡	‡		‡			‡
Logistics/supply chain management					‡		‡
Garbage can model	‡						‡
Bureaucratic politics	‡						‡

**TABLE E-2**  
**DAUGHERTY TO SINK (CONTINUED)**

Sources of Concepts	Daugherty	Lieb	Maltz	Moore	Rao and Young	Riley	Sink
Other							Rational model
Elicited values and norms?	??	Yes	Yes	??	Yes	No	Yes
Methodology	Survey	Survey	Survey	Survey	Case study	Survey	Focus group; case study; survey
Data obtained from/by	Mail questionnaire	Mail questionnaire	Mail questionnaire	Mail questionnaire	Interviews (44 firms)	Mail	Focus group; interviews; mail survey
List of analysis	Intent to out-source or retain in-house	Firm or division	Outsourcing decision	Firm	Decision to use 3rd party	Company or division	Outsourcing decision
General area of emphasis	Logistics	Logistics	Logistics	Logistics	Logistics	Logistics	Logistics
Outsourcing or privatization	Outsourcing	Outsourcing	Outsourcing	Outsourcing	Outsourcing	Outsourcing	Outsourcing
Dominant paradigm	Functionalist	Interpretivist	Functionalist	Functionalist	Functionalist	Functionalist	Interpretivist

**TABLE E-3  
COOLEY TO HARRIS**

Sources of Concepts	Cooley	Jenson	Lever	Spee	Carver	Denes	Harris
Neoclassical economics							
Price-coordinated economy							
Imperfect competition							
Market failure							
Scale and scope							
Transaction cost economics	‡	‡	‡	‡			‡
Principal-agent theory						‡	
Public Administration							
Political economy							
Privatization, non-market failure							
Technology, strategic management							
Competency-based theory (core)	‡	‡	‡				
Innovation, technology diffusion	‡						
Relational/social exchange, partnering			‡				
Logistics/supply chain management							
Garbage can model							
Bureaucratic politics							

**TABLE E-3  
COOLEY TO HARRIS (CONTINUED)**

Sources of Concepts	Cooley	Jenson	Lever	Spee	Carver	Denes	Harris
Other					Rational model		
Elicited values and norms?	No	Yes	Yes	Yes, in part	No	No	In part
Methodology	Indirect: cross-sectional and auto-regressive linear models	Indirect: linear and logit models	Survey	Survey	Indirect: event horizon analysis	Descriptive	Survey
Data obtained from/by	Annual reports to state of California	Existing reports	Mail questionnaire	Mail questionnaire	Tax assessment data	Anecdotal	Mail questionnaire
List of analysis	Hospital	Power plants and banks	firm	Staff function	Community year	Contract	Contract
General area of emphasis	Hospitals	Power plants, banking	Human resources	Corporate staff functions	Project tax assessment	Decision to contract	Information technology
Outsourcing or privatization	Outsourcing	Outsourcing	Outsourcing	Outsourcing	Privatization	Privatization	Privatization
Dominant paradigm	Functionalist	Functionalist	Functionalist	Functionalist	Functionalist	Functionalist	Functionalist

**TABLE E-4**  
**MILLER TO WOODWARD**

Sources of Concepts	Miller A-	Pouder	Schlomach	Shiang	Ward	Weber	Woodward
Neoclassical economics	Theoretical						
Price-coordinated economy			‡				
Imperfect competition							
Market failure							
Scale and scope							
Transaction cost economics		‡		‡			
Principal-agent theory				‡			
Public Administration							
Political economy			‡		‡		‡
Privatization, non-market failure							
Technology, strategic management							
Competency-based theory (core)							
Innovation, technology diffusion		‡					
Relational/social exchange, partnering		‡					
Logistics/supply chain management							
Garbage can model							
Bureaucratic politics							
Other						‡	‡

**TABLE E-4**  
**MILLER TO WOODWARD (CONTINUED)**

<b>Sources of Concepts</b>	<b>Miller</b>	<b>Pouder</b>	<b>Schlomach</b>	<b>Shiang</b>	<b>Ward</b>	<b>Weber</b>	<b>Woodward</b>
Elicited values and norms?	Yes	Yes	Yes	No	Yes	No	No, but did address
Methodology	Descriptive	Survey	Indirect: linear model	Survey with factor analysis	Case study	Survey	Case Study
Data obtained from/by	Existing city data	Mail questionnaire	Historical data	Mail questionnaire	Interview	Mail questionnaire	Interviews
List of analysis	Bid	Service provided	Category of road	Mental health board	Municipality	Superintendent	A-76 study
General area of emphasis	City services	Local government services	Road maintenance	Mental health services	local government services	Public school transportation	A-76 process
Outsourcing or privatization	Privatization	Privatization	Privatization	Privatization	Privatization	Privatization	Privatization
Dominant paradigm	Functionalist	Functionalist	Functionalist	Functionalist	Functionalist	Functionalist	Functionalist





# APPENDIX F

## SURVEY ITEM FORMS

Type A: Disagree - Agree

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

Example

	Strongly disagree						Strongly agree
1. Deciding if organic depots or commercial firms should do depot maintenance follows a rational process. That is, management determines what the requirements are and what the alternatives are and then makes a choice based on the merits.	1	2	3	4	5	6	7
2. Existence of proprietary data is important to the organic versus commercial workload allocation decision.	1	2	3	4	5	6	7

**Type B: Insignificant - Significant**

Example

Very Insignificant	In significant	Somewhat Insignificant	Neutral	Somewhat Significant	Significant	Very Significant
1	2	3	4	5	6	7

Example

						<b>Very insignificant</b>						<b>Very Significant</b>
3. How significant would leakage of confidential information be?	1	2	3	4	5	6	7					

**Type C: Difficult - Easy**

Very Difficult	Difficult	Somewhat Difficult	Neutral	Somewhat Easy	Easy	Very Easy
1	2	3	4	5	6	7

Example

								<b>Very Difficult</b>									<b>Very Easy</b>
4. How difficult is it (or would it be) to determine availability of a contractor?	1	2	3	4	5	6	7										

Type D: Never - Always

Never	Almost Never	Seldom	Neutral	Sometimes	Almost Always	Always
1	2	3	4	5	6	7

Example

	<b>Never</b>					<b>Always</b>	
5. Did a private depot maintenance provider ever claim to be doing the job better than you thought they were?	1	2	3	4	5	6	7

Type E: Low – High

Very Low	Low	Somewhat Low	Neutral	Somewhat High	High	Very High
1	2	3	4	5	6	7

Example

	<b>Very Low</b>					<b>Very High</b>	
6. To best of your knowledge, how would you rate the costs for monitoring depot maintenance contractor performance?	1	2	3	4	5	6	7

Type F: Poor - Good

Very Poor	Poor	Somewhat Poor	Neutral	Somewhat Good	Good	Very Good
1	2	3	4	5	6	7

Example

						<b>Very Poor</b>						<b>Very High</b>
7. To best of your knowledge, how would you rate the costs for monitoring depot maintenance contractor performance?	1	2	3	4	5	6	7					

Type G: Item-specific scale (Example)

Commer- cial Pro- vider			Neutral				Govern- ment Buyer
1	2	3	4	5	6	7	

Example

						<b>Commercial Provider</b>						<b>Government Buyer</b>
8. Who has the better information about the degree of care exercised in performance of depot maintenance?	1	2	3	4	5	6	7					

Type X: No Scale Assigned

Evaluated using scales assigned to other items.

# APPENDIX G

## HYPOTHESES AND SURVEY ITEMS BY MAJOR CONSTRUCT WITH ITEM SORT RESULTS

The displays in this appendix indicate, for each hypothesis:

- The major construct from which the hypothesis was derived
- The final hypothesis number as well as the initial hypotheses number prior to item sort.
- The text of the hypothesis
- The number of items that were retained in the final survey
- The individual items associated with that hypothesis, including
  - The form of the item (forms are described in Appendix F)
  - The text of each item
  - The proportion of substantive validity (PSA) and substantive validity coefficient (CSV) values
  - The item number
  - The disposition of each item. (The key to item dispositions is included with each hypothesis.)
- Additional explanatory notes.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Rational model

Hypothesis #	H01	Initial Hypothesis #	H01
Hypothesis	Persons with an interest in the depot maintenance will perceive themselves as following the dictates of the rational model when making depot sourcing decisions.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 4

Form	Items	PSA/ CSV	Item # Disp.
A	For a decision process to be rational, it needs to have a well defined problem, a means for telling good alternatives from bad, a comparison of alternatives, and selection of the best alternative.	1.00 1.00	476 K
A	Managers and others with an interest in depot maintenance should use rational processes to allocate workload between the public and private sectors.	1.00 1.00	536 K
A	A rational process is used to allocate workload between the public and private sectors.	1.00 1.00	581 K
A	Because it is hard to analyze all alternatives in advance, a reasonable way to solve a problem is to find an alternative that is at least better than other possibilities.		631 K

### Notes

Added the 4th item, number 1005, after item sort [and pilot survey] to provide an alternative definition of rationality. This definition is consistent with Lindblom's incrementalist view of policy making. Revised for clarity per DMDC review.

### Hypthotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Imperfect competition

Hypothesis # H02 Initial Hypothesis # H02

Hypothesis Depot maintenance workload will be perceived as unique and outside the commercial mainstream.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
G	Some make the argument that depot maintenance capabilities are unique—that there is no real equivalent in the private sector. How do you see it?	1.00 1.00	477 K

Notes

Revised for clarity per DMDC review.



## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Imperfect competition

Hypothesis #	H03	Initial Hypothesis #	H03
Hypothesis	Availability of more than one source will be perceived as important to the organic versus commercial workload allocation decision.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	Maintaining availability of more than one source of depot maintenance is important.	1.00	478
		1.00	K
A	It is better to have multiple vendors than a single vendor since competition will bring better performance, better quality, and/or lower cost.	1.00	538
		1.00	DP
A	Competition brings better performance, better quality, and/or lower cost.		636
			K

### Notes

Revised for clarity per DMDC review.

### Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Imperfect competition

Hypothesis #	H04	Initial Hypothesis #	H04
Hypothesis	Existence of proprietary data will be perceived as important to the organic versus commercial workload allocation decision.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	Problems with proprietary data make a difference when deciding between public and private sources of depot maintenance.	1.00	479
		1.00	K
B	How significant would leakage of confidential information be?	1.00	539
		1.00	DR
A	The data and information in the depot maintenance area are sometimes proprietary. (OK)	1.00	582
		1.00	DA

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Imperfect competition

Hypothesis #	H05	Initial Hypothesis #	H05
Hypothesis	Managers of and other persons with an interest in depot maintenance will perceive organic depot maintenance capability to be an internal monopoly.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
A	In the absence of a viable "competitor," public maintenance depots may take on the characteristics of a monopoly.	1.00	480
		1.00	K

**Notes**

Revised for clarity per DMDC review.

## Hypthotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Imperfect competition

Hypothesis #	H06	Initial Hypothesis #	H06
Hypothesis	Managers of and other persons with an interest in depot maintenance will perceive of public versus private competition for depot maintenance as being conducted on a playing field that is not level.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	When public depots and private firms compete for depot maintenance workloads the "playing field" is level. (OK)	1.00 1.00	481 DA
A	When public depots and private firms compete for depot maintenance work, the rules of the game favor one side over the other (private over public or public over private).	1.00 1.00	541 K

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Market failure

Hypothesis #	H07	Initial Hypothesis #	H07
Hypothesis	For at least some depot maintenance workloads there will be a perceived lack of commercial firms willing to do the work.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	For some workloads there is a lack of private firms willing to do the work.	1.00	482
		1.00	K
A	(*) From a depot maintenance perspective, there are many acceptable commercial vendors from whom to choose. (otherwise OK)	1.00	542
		1.00	DA
C	How difficult is it (or would it be) to determine availability of a contractor (very low ... very high)?	0.67	583
		0.33	DW

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Market failure

Hypothesis #	H08	Initial Hypothesis #	H08
Hypothesis	For at least some depot maintenance workloads there will be a perceived lack of commercial firms with the scope of capability to respond in the quantity necessary without an initial start-up delay		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
D	How often would you expect to be able to find private firms who can deliver the quantity of depot maintenance work that is needed without an initial start-up delay (OK)	1.00 1.00	483 K

### Notes

Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Economy of scale and scope

Hypothesis # H09 Initial Hypothesis # H09

Hypothesis Managers of and other persons with an interest in depot maintenance will perceive ability to achieve economies of scale and or scope as important to the depot maintenance outsourcing decision.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	Which sector has the better economy of scale is important when choosing between public and private providers of depot maintenance.	1.00 1.00	484 K
A	Doing depot maintenance work takes a large capital investment. .	0.83 0.67	543 K

### Notes

Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Economy of scale and scope

Hypothesis # H10 Initial Hypothesis # H09a/b  
 Hypothesis Outsourcing depot maintenance improves depot maintenance economy of scale.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 3

Form	Items	PSA/ CSV	Item # Disp.
A	(*) Outsourcing enhances economy of scale for depot maintenance human resources.	1.00	530
		1.00	DA
A	(*) Outsourcing enhances economy of scale for depot maintenance technological resources.	0.83	576
		0.67	DA
A	(*) Outsourcing enhances economy of scale for depot maintenance managerial resources.	1.00	601
		1.00	DA

Notes



## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Transaction cost economics

Hypothesis #	H11	Initial Hypothesis #	H10
Hypothesis	Managers of and other persons with an interest in depot maintenance will perceive tight linkage among stages in the depot maintenance repair process as important to deciding between organic and commercial sources of repair.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
A	The need for close coordination among sequential steps in depot maintenance repair processes make a difference when deciding between public and private sources of repair.	1.00 1.00	485 K

### Notes

Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Transaction cost economics

Hypothesis #	H12	Initial Hypothesis #	H11
Hypothesis	Managers of and other persons with an interest in depot maintenance will perceive specificity of production equipment as important to deciding between organic and commercial sources of repair.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 3

Form	Items	PSA/ CSV	Item # Disp.
A	(*) The equipment used to accomplish depot maintenance work is generally unique to depot maintenance.	1.00 1.00	486 DA
A	Requirements for unique equipment are important when deciding between public and private sources of depot repair.	1.00 1.00	544 K
A	Specialized facilities or technologies are required to accomplish depot maintenance.	1.00 1.00	584 DR
B	How significant is availability of specialized equipment to effective depot maintenance performance?	1.00 1.00	604 K
A	Depot maintenance providers require specialized skills (or invest in specialized tools, hardware, and software) for which it is difficult to find alternative uses?	0.83 0.67	617 DR

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Transaction cost economics

Hypothesis #	H13	Initial Hypothesis #	H12
Hypothesis	Managers of and other persons with an interest in depot maintenance will perceive the difficulty of stating all contingencies in advance as important to deciding between organic and commercial sources of repair.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	When arranging for performance of depot maintenance work, how difficult or easy is it to state contingencies (for instance, potential changes in the kind and amount of work) in advance.	1.00 1.00	487 K
A	Ability to state all contingencies in advance is important to the choice between organic and commercial sources of repair.	0.67 0.33	545 DW
C	How easy is it to resolve the following issues during the contract negotiation process: contract price, operating performance, staff employment, dispute settlement, renewal/termination options?	0.33 -0.33	585 DW
A	Depot maintenance work is stable and doesn't fluctuate much month to month.	0.67 0.33	605 DW
A	How difficult is it to predict depot maintenance workload? (combined with 487)	0.83 0.67	618 DA
C	How difficult is it to specify the tasks that are necessary for satisfactory depot maintenance results?	0.50 0.33	626 DW

### Notes

Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Transaction cost economics

Hypothesis #	H14	Initial Hypothesis #	H13
Hypothesis	Managers of and other persons with an interest in depot maintenance will perceive the need to monitor shirking as important to deciding between organic and commercial sources of repair.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	Ability to make sure the required work is actually done is important when deciding between public and private sources of repair.	1.00 1.00	488 K
C	How difficult is it to monitor an organic maintenance depot with respect to operating performance, investments for technological innovation, or investments in staff development?	0.50 0.17	546 DW
A	There are well-defined criteria to measure the performance level of depot maintenance providers.	0.67 0.50	586 K
D	Did a private depot maintenance provider ever claim to be doing the job better than you thought they were?	1.00 1.00	606 DR
D	Did a public depot maintenance provider ever claim to be doing the job better than you thought they were?	1.00 1.00	619 DR

### Notes

Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Transaction cost economics

Hypothesis #	H15	Initial Hypothesis #	H14
Hypothesis	Managers and others with an interest in depot maintenance will perceive increased risk if crucial contingencies are left to the market.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 3

Form	Items	PSA/ CSV	Item # Disp.
A	Outsourcing of depot maintenance to private providers increases DoD's risk because private providers cannot respond fast enough when requirements change.	1.00 1.00	489 K
A	The military would experience a loss of control by outsourcing depot maintenance to the private sector.	1.00 1.00	547 K
A	Depot maintenance is critically important in achieving the primary mission.	1.00 1.00	587 K

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Transaction cost economics

Hypothesis #	H16	Initial Hypothesis #	H15
Hypothesis	Manager of and others with an interest in depot maintenance will perceive the combination of low task frequency and high uncertainty as leading to high transaction costs if depot maintenance is outsourced.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 3

Form	Items	PSA/ CSV	Item # Disp.
A	Most of the jobs in depot maintenance are routine. Unique and one-of-a-kind repairs are unusual.	0.83 0.67	490 K
A	Depot maintenance requirements are difficult to predict and unexpected requirements are the norm rather than the exception. (OK)	1.00 1.00	548 DA
A	Given the actual extent to which depot maintenance work is routine and predictable, the cost to arrange for and monitor commercial providers should not be a problem.	0.67 0.50	588 DR
E	How would you rate the costs for monitoring depot maintenance private performance (i.e., performance by a commercial firm) when compared to the costs of production? (low..high)	1.00 1.00	607 K
E	How would you rate the costs for monitoring depot maintenance public performance (i.e., performance by DoD) when compared to the costs of production? (low...high)		638 K

### Notes

Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Transaction cost economics

Hypothesis #	H17	Initial Hypothesis #	H28			
Hypothesis	The choice between public and commercial providers of depot maintenance will be perceived to depend on the total cost where total cost is the sum of production cost and transaction costs.					
Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised					Number of retained items.	2
Form	Items			PSA/ CSV	Item # Disp.	
A	The choice between public and private providers should depend on the relative cost to the government.			1.00 1.00	503 K	
A	When determining who is the least costly provider of depot maintenance — public depot or private firm — both the cost to produce repairs and the cost to initially arrange for and then monitor production should be considered.			1.00 1.00	561 K	

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Principal-agent theory

Hypothesis #	H18	Initial Hypothesis #	H16
Hypothesis	Organic and commercial providers of depot maintenance are perceived as differing in the extent to which they have conflicts of interest with the users of depot maintenance.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	Private providers of depot maintenance have conflicts of interest (e.g., between their objectives and their government customer's objectives) that get in the way of effective depot maintenance.	1.00 1.00	491 K
A	Public depots have conflicts of interest (e.g., between their objectives and their government customer's objectives) that get in the way of effective depot maintenance.	1.00 1.00	549 K
A	Flexibility in response to requests for changes is a characteristic of the relationship with organic depot maintenance providers.	0.17 -0.67	589 DW
A	Flexibility in response to requests for changes is a characteristic of the relationship with commercial depot maintenance providers.	0.17 -0.50	608 DW
G	Do commercial providers of depot maintenance services change their methods in ways that are unfair?	0.00 -0.33	620 DW
G	Do public providers of depot maintenance services change their methods in ways that are unfair?	0.00 -0.50	627 DW

### Notes

Revised for clarity per DMDC review.



## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Principal-agent theory

Hypothesis # H19 Initial Hypothesis # H17

Hypothesis Organic and commercial providers of depot maintenance are perceived as differing in their degree of carefulness, industriousness, and trustworthiness.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
G	Which provider is most likely to be careful, industrious, and/or trustworthy? (private public)	1.00	492
		1.00	K
A	I would put more confidence in the carefulness, industriousness, and trustworthiness of organic depots than their commercial counterparts. (OK)	1.00	550
		1.00	DA

### Notes

Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Principal-agent theory

Hypothesis #	H20	Initial Hypothesis #	H18			
Hypothesis	Organic and commercial providers of depot maintenance are perceived as differing in the degree to which they can influence the desired outcome of depot maintenance activity.					
Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised				Number of retained items.	1	
Form	Items			PSA/CSV	Item #	Disp.
H	Which provider is more able to influence depot maintenance requirements? (private public)			0.83	493	
				0.67	K	
A	Rather than responding to customer needs, organic providers of depot maintenance often decide on their own what to work on, when to deliver the work, or what level of quality to deliver.			0.17	551	DW
				-0.33		
A	Rather than responding to customer needs, commercial providers of depot maintenance often decide on their own what to work on, when to deliver the work, or what level of quality to deliver.			0.33	590	DW
				0.00		

### Notes

Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Principal-agent theory

Hypothesis # H21 Initial Hypothesis # H19

Hypothesis Random factors, under neither the control of depot maintenance providers nor managers, are perceived as being able to influence the outcome of depot maintenance.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	Uncontrollable random factors can influence the outcome of depot maintenance activity.	1.00	494
		1.00	K
D	Do you expect efforts of depot maintenance providers to be hampered by events beyond anybody's control? (OK)	0.83	552
		0.67	DA

### Notes

Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Principal-agent theory

Hypothesis #	H22	Initial Hypothesis #	H20
Hypothesis	The outcome of depot maintenance is perceived as observable to both providers of depot maintenance and to government managers of depot maintenance.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 3

Form	Items	PSA/ CSV	Item # Disp.
A	Government buyers of depot maintenance are able to observe the outcome (e.g., time of delivery, quantity delivered, quality) of depot maintenance work.	0.83 0.67	495 K
A	Public providers of depot maintenance are able to observe the outcome (e.g., time of delivery, quantity delivered, quality) of depot maintenance work.	1.00 1.00	553 K
A	Private providers of depot maintenance are able to observe the outcome (e.g., time of delivery, quantity delivered, quality) of depot maintenance work.	0.67 0.50	591 K
C	How difficult is it (or would it be) to define the quality of performance?	0.33 0.00	609 DW
F	Reliability, relevance, accuracy, precision, and completeness of information on depot maintenance outcomes is (very poor ... very good).	0.67 0.50	621 DR

### Notes

Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Principal-agent theory

Hypothesis #	H23	Initial Hypothesis #	H21	
Hypothesis	The providers of depot maintenance will be perceived as having better information than government managers of depot maintenance about the degree of care exercised during the performance of depot maintenance.			
Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised				Number of retained items. 3
Form	Items		PSA/CSV	Item # Disp.
A	Providers of depot maintenance services (either private or public) have better information about the degree of care they exercise in performance than do government buyers of depot maintenance.		1.00 1.00	496 K
A	The buyers and providers of depot maintenance feel that it is important not to use any proprietary information to the other party's disadvantage.		0.17 -0.33	554 DW
A	It is expected that buyers and providers of depot maintenance keep each other informed about events or changes that affect the other party.		0.50 0.02	592 DW
A	If problems such as schedule delays arise, commercial providers of depot maintenance are honest about the problems.		0.17 -0.67	610 DW
A	If problems such as schedule delays arise, organic providers of depot maintenance are honest about the problems.		0.17 -0.33	622 DW
G	When a government manager obtains depot maintenance from a public provider, who has the better information about the degree of care exercised in performance of depot maintenance – the manager or the provider?			634 K
G	When a government manager obtains depot maintenance from a private provider, who has the better information about the degree of care exercised in performance of depot maintenance – the manager or the provider?			635 K

### Notes

Added items 1001 and 1002 to provide for alternate form. Kept essentially same language as 496 to retain construct validity. Split into two items to distinguish between commercial and government sources. Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Principal-agent theory

Hypothesis #	H24	Initial Hypothesis #	H22
Hypothesis	Public and commercial providers are perceived as having different potential to act opportunistically.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 3

Form	Items	PSA/ CSV	Item # Disp.
A	Commercial providers of depot maintenance are more apt to act opportunistically than are government providers. (OK)	1.00 1.00	497 DA
A	Government providers of depot maintenance are more apt to act opportunistically than are commercial providers.	1.00 1.00	555 DR
A	A characteristic of the relationship with organic providers of depot maintenance is that nobody is expected to make demands that might be damaging to the other.	0.50 0.33	593 DW
A	A characteristic of the relationship with commercial providers of depot maintenance is that nobody is expected to make demands that might be damaging to the other.	0.50 0.33	611 DW
A	In the context of commercially provided depot maintenance, the buyers and providers of depot maintenance expect the more powerful party, no matter which one is more powerful, to restrain the use of power in attempting to get its way.	0.33 -0.17	623 DW
A	In the context of organically provided depot maintenance, the buyers and providers of depot maintenance expect the more powerful party, no matter which one is more powerful, to restrain the use of power in attempting to get its way.	0.33 -0.17	628 DW
H	Who is more likely to act opportunistically (further own interests without regard for customers), when providing depot maintenance?		633 K

### Notes

Added item 1003 to provide for alternate form. Kept essentially same language as 497 and 555 to retain construct validity.

## Hypthotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Principal-agent theory

Hypothesis # H25 Initial Hypothesis # H27

Hypothesis Retention by the government of smart buyer capability will be perceived as important.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	It is important for the government to retain "smart buyer" knowledge. (delete this question, who would argue?)	1.00 1.00	502 DR
A	To make sure that the government knows what it is asking for and getting, it is important that the government do at least some depot maintenance work itself.	1.00 1.00	560 K

### Notes

Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Public choice theory

Hypothesis #	H26	Initial Hypothesis #	H23
Hypothesis	Interest groups internal to government (i.e., Department of Defense, ministry of defense, or other government agency as applicable) will be perceived as influencing the choice of public versus commercial provision of depot maintenance.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	Within the Department of Defense, different interest groups with different depot maintenance agendas have formed	1.00	498
		1.00	K
A	Interest groups within the Department of Defense are able to influence the choice between public and private providers of depot maintenance.	1.00	556
		1.00	K

Notes



### Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Public choice theory

Hypothesis # H27 Initial Hypothesis # H24

Hypothesis Interest groups external to government (i.e., Department of Defense, ministry of defense, or other government agency as applicable) will be perceived as influencing the choice of public versus commercial provision of depot maintenance.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	Interest groups outside the Department of Defense have depot maintenance agendas that may be different than the Department's.	1.00	499
		1.00	K
A	Interest groups outside the Department of Defense are able to influence the choice between public and private providers of depot maintenance.	1.00	557
		1.00	K

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Theory of non-market failure

Hypothesis #	H28	Initial Hypothesis #	H25a
Hypothesis	Private provision of goods and services will be preferred, in general, to public provision.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
H	Given a choice between private and public provision of depot maintenance, in general the best solution is ... (public ..... private).	0.83 0.67	532 K

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Theory of non-market failure

Hypothesis #	H29	Initial Hypothesis #	H25b
Hypothesis	Private firms will be perceived as more efficient at depot maintenance than their public counterparts.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
H	Who is the more efficient provider of depot maintenance? (private – public)	0.67 0.33	500 K
A	Outsourcing of depot maintenance has made depot maintenance operations more cost-effective.	0.83 0.67	558 K

### Notes

Kept 500 even with low CSV. Reason for low CSV was conceptual overlap between H25b and H31 (ability to reduce cost using available technologies). Two evaluators assigned 500 to H31. Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Theory of non-market failure

Hypothesis #	H30	Initial Hypothesis #	H26
Hypothesis	The availability of a competitive marketplace will be perceived as mattering if government is to benefit from commercial capabilities.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 4

Form	Items	PSA/ CSV	Item # Disp.
A	The availability of a competitive marketplace matters when it comes to government benefiting from commercial capabilities.	1.00 1.00	501 DR
E	How important is having more than one potential source of depot maintenance? (low...high)	1.00 1.00	559 K
C	How difficult is it (or would it be) to determine the existence of a competitive marketplace for depot maintenance work?	1.00 1.00	594 K
C	How difficult is it (or would it be) to create a competitive marketplace for depot maintenance work?	1.00 1.00	612 K
A	An important reason for maintaining public depots is to keep the government from getting into a sole-source situation.	0.83 0.67	624 K

### Notes

Although 501 and 624 are similar in form and point of view they tap into potentially different issues. 624 is more specific. For that reason both are retained.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Theory of non-market failure

Hypothesis # H31 Initial Hypothesis # H29

Hypothesis Compared to government, commercial firms will be perceived as having better dynamic efficiency—the ability to develop new technology that lowers cost functions, improves product quality, and creates new and marketable products

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 3

Form	Items	PSA/ CSV	Item # Disp.
H	Who is better able to develop new technology that can lower cost? (commercial ... government)	0.67 0.33	504 K
H	Who is better able to develop new technology that can improve product quality? (commercial ... government) (OK)	0.83 0.67	562 K
H	Who is better able to develop new technology that can create new products?	1.00 1.00	595 K

### Notes

Kept 504 to span scope of hypothesis. Reason for low CSV value is that 2 evaluators chose H31 (ability to use new technology) rather than H29 (develop new technology). Hence their item choice had less connection to the construct represented by the hypothesis than did the proposed item. Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Theory of non-market failure

Hypothesis #	H32	Initial Hypothesis #	H30			
Hypothesis	Compared to government, commercial firms will be perceived as having better technological efficiency—the ability to find and employ the best technology currently available, thus producing at lower cost and higher quality and					
Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised				Number of retained items.	3	
Form	Items			PSA/ CSV	Item # Disp.	
H	Who is better at finding and employing the best depot maintenance technology currently available? (commercial...government)			0.67 0.33	505 K	
A	Better access to new technology is an important potential benefit of depot maintenance outsourcing.			0.83 0.67	563 K	
B	To what extent has outsourcing improved access to key depot maintenance-related technologies?			1.00 1.00	596 K	

### Notes

Regarding 505, two evaluators assigned the item to H31, which has to do with using rather than finding and employing the best depot maintenance technologies. Since this clearly has less construct validity than the proposed hypothesis-item relationship, 505 is retained. Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Theory of non-market failure

Hypothesis #	H33	Initial Hypothesis #	H31			
Hypothesis	Compared to government, commercial firms will be perceived as having better X-efficiency—the ability, given a specific technology, to reduce cost, raise productivity, and improve quality through changes in organization, management practices, and worker motivation.					
Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised					Number of retained items.	1
Form	Items			PSA/CSV	Item #	Disp.
H	For a given depot maintenance technology, who is better at using it to reduce cost and improve quality? ? (commercial...government)			0.67 0.50	506	K
B	How relevant is outsourcing to an increase in depot maintenance performance?			0.17 -0.50	564	DW
G	Imagine services performed out if in; how would cost behave (much lower ... much higher)?			0.00 -0.83	597	DW
G	Who is better at improving organization, management practices, and worker motivation (government depots ... commercial firms)?			0.33 -0.33	613	DW

### Notes

Revised for clarity per DMDC review.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Resource/competency-based theory

Hypothesis # H34 Initial Hypothesis # H32

Hypothesis An organization's core competencies are perceived as being defined by the products it makes, services it provides, and markets it serves.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
A	By an organization's core competencies is meant the products it makes, services it provides, and markets it serves. (drop this question)	1.00	507
		1.00	DA

Notes



## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Resource/competency-based theory

Hypothesis # H35 Initial Hypothesis # H33

Hypothesis An organization's core competencies are perceived as defined by what it knows and what it can do.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
A	By an organization's core competencies is meant what it knows and what it can do. (drop this question)	1.00	508
		1.00	DA

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Resource/competency-based theory

Hypothesis #	H36	Initial Hypothesis #	H34a
Hypothesis	Members of an organization perceive themselves as able to articulate their organization's core competencies.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	I am able to define my organization's core competencies.	1.00	509
		1.00	K
A	My colleagues are able to define the core competencies of our organization.	0.67	565
		0.33	K

### Notes

Regarding 565, two evaluators assigned the item to H39. Since this hypothesis was not intended to have uniquely assigned items the result is spurious and 565 is retained.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Resource/competency-based theory

Hypothesis # H37 Initial Hypothesis # H34b  
 Hypothesis Government depot maintenance capability is perceived to be a core government logistics competency.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	I consider depot maintenance capability a traditional strength of the public (i.e., DoD) logistics sector.	1.00	533
		1.00	K
A	Generally speaking, my logistics colleagues consider depot maintenance capability a traditional strength of the public logistics sector.	0.83	578
		0.67	K

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Resource/competency-based theory

Hypothesis #	H38	Initial Hypothesis #	H35
Hypothesis	Employee knowledge and skills are perceived as an important component of a depot maintenance organization's core competencies.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 3

Form	Items	PSA/ CSV	Item # Disp.
A	Employee knowledge and skills are important components of an organization's core competencies.	1.00	510
		1.00	K
A	Depot maintenance is an area that generally requires a lot of expertise or training. (revised)	1.00	566
		1.00	DA
B	How significant are specialized or expert human skills to effective depot maintenance performance?	1.00	598
		1.00	K

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Resource/competency-based theory

Hypothesis # H39 Initial Hypothesis # H36

Hypothesis Technical systems are perceived as an important component of a depot maintenance organization's core competencies.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	A depot maintenance organization's technical systems are important components of its core competencies. (delete – "technical systems" is not clear concept)	1.00 1.00	511 DA
A	Public depots have developed special work methods not found in private firms.	0.83 0.67	567 K

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Resource/competency-based theory

Hypothesis #	H40	Initial Hypothesis #	H37
Hypothesis	Managerial systems are perceived as an important component of a depot maintenance organization's core competencies.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
A	A depot maintenance organization's management system is an important part of its core competencies.	1.00 1.00	512 K
A	Government depots are better than their commercial counterparts at managing the depot maintenance activity.	0.17 -0.33	568 DW

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Resource/competency-based theory

Hypothesis #	H41	Initial Hypothesis #	H38
Hypothesis	Values and norms are perceived as important components of a depot maintenance organization's core competencies.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	A depot maintenance organization's values and norms are an important part of its core competencies.	1.00 1.00	513 DW
A	The preferences, objectives, and standards of conduct of government depots give them an advantage over their commercial counterparts. (revised)	1.00 1.00	569 DA
H	As you see it, whose principles, goals, and standards of conduct are more likely to assure good depot maintenance results, — those held by private providers or those held by public providers? (private — public)		632 K

### Notes

Introduced 1004 because of potential bias presented by form of 596. Kept text essentially the same to preserve construct validity.

## Hypthotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Resource/competency-based theory

Hypothesis # H42 Initial Hypothesis # H39  
 Hypothesis There will be differing interpretations of the concept of core.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
x	No additional, unique scale item for this hypothesis. (This hypothesis will be addressed in conjunction with hypotheses H34, H35, H37, H38, H39, H40, and H41.)	1.00 1.00	514 K

Notes



## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Administrative innovations and isomorphism

Hypothesis # H43 Initial Hypothesis # H40a  
 Hypothesis Professional managers in government will prefer in-sourcing.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	All things considered, the Department of Defense is better served if it does most depot maintenance itself.	1.00	515
		1.00	K
H	If it were my choice, I would see that DoD used the following source for depot maintenance. (private ... public)	1.00	570
		1.00	K

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Administrative innovations and isomorphism

Hypothesis #	H44	Initial Hypothesis #	H40b
Hypothesis	Managers of and others with an interest in the depot maintenance public versus private workload allocation decision will be uncertain of the definition of depot maintenance.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 3

Form	Items	PSA/ CSV	Item # Disp.
A	It seems like different organizations and different managers have different definitions of depot maintenance.	1.00	535
		1.00	K
A	In my own mind, I am fairly clear on the definition of depot maintenance.	1.00	580
		1.00	K
A	It seems like the definition of what is and what is not depot maintenance is changing.	1.00	603
		1.00	K

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Administrative innovations and isomorphism

Hypothesis #	H45	Initial Hypothesis #	H41
Hypothesis	Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive themselves as having unclear expectations of the benefits of outsourcing.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	I understand the benefits of increasing the amount of depot maintenance that is outsourced.	1.00	516
		1.00	K
A	Generally speaking, most people who deal with depot maintenance understand the benefits of increasing the amount of depot maintenance that is outsourced.	0.83	571
		0.67	K

Notes

**Hypotheses and Survey Items by Major Construct With Item Sort Results**

Major Construct Administrative innovations and isomorphism

Hypothesis #	H46	Initial Hypothesis #	H42
Hypothesis	Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive themselves as having a unclear understanding of the purpose of outsourcing.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	I understand the purpose of increasing the amount of depot maintenance that is outsourced.	1.00 1.00	517 K
A	Generally speaking, most people who work with depot maintenance understand the purpose of increasing the amount of depot maintenance that is outsourced.	1.00 1.00	572 K

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Administrative innovations and isomorphism

Hypothesis #	H47	Initial Hypothesis #	H43
Hypothesis	Government managers will perceive themselves as under pressure from top-level management to outsource depot maintenance.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	Top-level management is interested in seeing more depot maintenance outsourced.	1.00	518
		1.00	K
A	Depot maintenance managers know that top-level management is interested in seeing more depot maintenance outsourced.	1.00	573
		1.00	K

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Relational/social exchange theory

Hypothesis #	H48	Initial Hypothesis #	H45
Hypothesis	Long-term alliances between users of depot maintenance and commercial firms will be perceived as important to effective depot maintenance support.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 3

Form	Items	PSA/ CSV	Item # Disp.
A	Long-term relationships between private depot maintenance providers and their military customers are important to effective depot maintenance support.	1.00 1.00	519 K
A	I consider the customers of depot maintenance and commercial providers of depot maintenance in my country to be partners. (delete, redundant and imprecise)	0.67 0.50	574 DA
A	I expect established relationships between private depot maintenance providers and military customers to last a long time.	1.00 1.00	599 K
A	As I see it, there is a commitment in my country to the preservation of good working relationships between customers of depot maintenance and commercial providers of depot maintenance.	0.83 0.67	614 DR

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Relational/social exchange theory

Hypothesis # H49 Initial Hypothesis # H46

Hypothesis Long-term alliances between organic depots and their customers will be perceived as important to effective depot maintenance support.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 3

Form	Items	PSA/ CSV	Item # Disp.
A	Long-term relationships between public depots and their customers are important to effective depot maintenance support.	0.83 0.67	520 K
A	I consider the customers of depot maintenance and the organic depots in my country to be partners. (delete, redundant and imprecise)	1.00 1.00	575 DA
A	I expect established relationships between public depots and their military customers to last a long time.	0.83 0.67	600 K
A	As I see it, there is a commitment in my country to the preservation of good working relationships between customers of depot maintenance and organic depots.	0.83 0.67	615 DR

### Notes

Revised per DMDC comments for clarity.

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Relational/social exchange theory

Hypothesis #	H50	Initial Hypothesis #	H47a
Hypothesis	Building and sustaining trust will be perceived as important to effective long-term depot maintenance alliances.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
A	Successful long-term alliances between depot maintenance providers (public or private) and their customers depend on building and sustaining trust.	1.00	521
		1.00	K

Notes



## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Relational/social exchange theory

Hypothesis # H51 Initial Hypothesis # H47b  
 Hypothesis Building and sustaining trust will be perceived as difficult.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 5

Form	Items	PSA/ CSV	Item # Disp.
C	How hard is it to build and sustain trust between government buyers and private providers of depot maintenance?	1.00 1.00	531 K
A	Private providers of depot maintenance can be counted on to do what is right for their military customers.	0.33 -0.17	577 K
A	Commercial (organic) providers of depot maintenance are open in dealing with their customers.	0.50 0.00	602 DW
A	Private providers of depot maintenance are honest about problems.	0.83 0.67	616 K
A	Public providers of depot maintenance can be counted on to do what is right for their military customers.	1.00 1.00	625 K
C	How hard is it to build and sustain trust between government buyers and public providers of depot maintenance?	0.50 0.00	637 K
A	Public providers of depot maintenance are honest about problems.	0.50 0.00	630 K

### Notes

Difficult to understand pattern presented by H47B item sort results – where statements that differ only by substitution of organic for commercial differ so dramatically in PSA and CSV score. Potentially it is because the evaluators are ex military officers—although this is only hypothesis where this difference shows up. Since 625 had PSA and CSV of 1.00 and 577 differs only by substitution of commercial for organic it is retained despite low scores. Similarly 630 is retained.

## Hypthotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Logistics and supply chain management

Hypothesis #	H52	Initial Hypothesis #	H48a
Hypothesis	Supply chain integration will be perceived as important to providing effective depot maintenance.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
B	How significant is supply chain integration to effective and efficient delivery of depot maintenance?	1.00 1.00	522 K

Notes

## Hypthotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Logistics and supply chain management

Hypothesis #	H53	Initial Hypothesis #	H48b
Hypothesis	Managers and others interested in depot maintenance will perceive themselves as uncertain of the meaning of supply chain integration.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 2

Form	Items	PSA/ CSV	Item # Disp.
A	I understand the concept of supply chain integration.	1.00	534
		1.00	K
A	Generally speaking, my colleagues understand the concept of supply chain integration.	1.00	579
		1.00	K

Notes

## Hypthotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Logistics and supply chain management

Hypothesis # H54 Initial Hypothesis # H49

Hypothesis Supply chain integration will be perceived as difficult to achieve.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
C	How difficult is it to achieve supply chain integration?	1.00	523
		1.00	K

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Logistics and supply chain management

Hypothesis #	H55	Initial Hypothesis #	H50
Hypothesis	Supply chain integration will be perceived as more difficult to achieve with commercial (i.e., external) sources than with organic (i.e., internal) sources.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
A	Supply chain integration is more difficult to achieve when commercial firms are involved than when organic depots are involved. (delete, probably can't bound cleanly)	1.00	524
		1.00	DA

Notes

## Hypthotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Garbage can model

Hypothesis # H56 Initial Hypothesis # H51

Hypothesis Participants in the depot maintenance public versus private allocation decision will be perceived as continually changing.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
A	The participants in the public versus private depot maintenance controversy always seem to be changing.	1.00 1.00	525 K

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Garbage can model

Hypothesis #	H57	Initial Hypothesis #	H52
Hypothesis	Chance occurrences rather than a rational process will be perceived as important to outcomes of depot maintenance public versus private allocation decision situations.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/CSV	Item # Disp.
A	It does not matter how much effort is put into deciding between public and private providers of depot maintenance, something unexpected always seems to determine the final outcome.	1.00 1.00	526 K

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Political economy and bureaucratic politics

Hypothesis # H58 Initial Hypothesis # H53

Hypothesis Managers of and others with an interest in the depot maintenance public versus private workload allocation decision will perceive that decision makers have conflicting preferences with regard to the depot maintenance organic versus commercial source of repair allocation decision.

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
A	Higher level management has difficulty providing consistent rules for choosing between public and private providers of depot maintenance.	1.00	527
		1.00	K

Notes



## Hyphotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Political economy and bureaucratic politics

Hypothesis #	H59	Initial Hypothesis #	H54
Hypothesis	Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive powerful people, defined as higher managerial levels, as getting what they want with regard to the depot maintenance organic versus commercial source of repair decision.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
A	It does not matter how much effort is put into deciding between public and private providers of depot maintenance, somebody at a higher level always seems to determine the final answer anyhow.	1.00 1.00	528 K

Notes

## Hypotheses and Survey Items by Major Construct With Item Sort Results

Major Construct Political economy and bureaucratic politics

Hypothesis #	H60	Initial Hypothesis #	H55
Hypothesis	Persons with an interest in the depot maintenance public versus private workload allocation decision will perceive coalition formation.		

Item Disposition Key: DW = weak, DR = reduced items, K = keep, R = revise then keep, RD = revised

Number of retained items. 1

Form	Items	PSA/ CSV	Item # Disp.
A	It seems like at different times different organizations and their managers get together to promote their own depot maintenance agendas.	1.00	529
		1.00	K

Notes



# APPENDIX H

## ITEMS RETAINED AFTER ITEM SORT

Hypothesis Number at time of Proposal	Item ID	Item
H01	476	Using a rational process means defining the problem, choosing criteria, comparing alternatives against the criteria, and selecting an optimal solution.
H01	536	Managers and others with an interest in depot maintenance should use rational processes to allocate workload between the public and private sectors.
H01	581	Managers of and others with an interest in depot maintenance use rational processes to allocate workload between the public and private sectors.
H02	477	Depot maintenance is unique and outside the commercial mainstream
H03	478	Availability of more than one source is important to the organic versus commercial workload allocation decision.
H03	538	It is better to have multiple vendors than a single vendor since competition will bring better performance, better quality, and/or lower cost.
H04	479	Existence of proprietary data is important to the organic versus commercial workload allocation decision.
H04	582	The data and information in the depot maintenance area are sometimes proprietary.

## Items Retained After Item Sort (Continued)

Hypothesis Number at time of Proposal	Item ID	Item
H05	480	An organic depot maintenance capability is an internal monopoly.
H06	481	When public depots and private firms compete for depot maintenance workloads the "playing field" is level.
H06	541	When public depots and private firms compete for depot maintenance workloads, the rules of the game favor one side over the other (private over public or public over private).
H07	482	For some workloads there is a lack of commercial firms willing to do the work.
H07	542	From a depot maintenance perspective, there are many acceptable outsourcing vendors to choose from.
H08	483	For some depot maintenance workloads there is a lack of commercial firms with the scope of capability to respond in the quantity necessary without an initial start-up delay.
H09	484	Economy of scale is important when choosing between public and commercial providers of depot maintenance.
H09	543	A large investment is required in order to have the capability to do depot level maintenance.
H09a/b	530	Outsourcing enhances economy of scale in depot maintenance human resources.
H09a/b	576	Outsourcing enhances economy of scale in depot maintenance technological resources.
H09a/b	601	Outsourcing enhances economy of scale in depot maintenance managerial resources.
H10	485	Tight linkage among stages in the depot maintenance repair process is an important consideration when deciding between organic and commercial sources of repair.
H11	486	The equipment used to accomplish depot maintenance work is generally unique to depot maintenance.
H11	544	Uniqueness of equipment required to accomplish depot maintenance is important to deciding between organic and commercial sources of repair.
H11	604	To what extent do depot maintenance providers require specialized equipment for effective performance (very low ... very high)?

## Items Retained After Item Sort (Continued)

Hypothesis Number at time of Proposal	Item ID	Item
H12	487	When arranging for performance of depot maintenance work it is difficult to state all contingencies in advance.
H12	618	Depot maintenance workload is predictable.
H13	488	Ability to monitor for potential shirking is important to deciding between organic and commercial sources of repair.
H13	586	There are well-defined criteria to measure the performance level of depot maintenance vendors.
H14	489	Outsourcing of depot maintenance to commercial providers will increase risk as a result of crucial contingencies being left to the market.
H14	547	The military would experience a loss of control by outsourcing depot maintenance.
H14	587	Depot maintenance is critically important in achieving the primary mission.
H15	490	Most of the jobs in depot maintenance are routine. Unique and one-of-a-kind repairs are unusual
H15	548	Depot maintenance requirements are difficult to predict and unexpected requirements are the norm rather than the exception.
H15	607	To best of your knowledge, how would you rate the costs for monitoring depot maintenance contractor performance (very low ... very high)?
H16	491	Commercial providers of depot maintenance have conflicts of interest that get in the way of effective depot maintenance.
H16	549	Organic depots have conflicts of interest that get in the effective depot maintenance.
H17	492	Organic and commercial providers of depot maintenance differ in their degree of carefulness, industriousness, and/or trustworthiness.
H17	550	I would put more confidence in the carefulness, industriousness, and trustworthiness of organic depots than their commercial counterparts.
H18	493	Organic and commercial providers of depot maintenance differ in the degree to which they can influence the desired outcome of depot maintenance activity.

## Items Retained After Item Sort (Continued)

Hypothesis Number at time of Proposal	Item ID	Item
H19	494	There are random factors, which neither those who buy depot maintenance nor those who provide it can control, that can influence the outcome of depot maintenance activity.
H19	552	Do you expect efforts of depot maintenance providers to be hampered by events beyond anybody's control?
H20	495	Government buyers of depot maintenance are able to observe the outcome (e.g., time of delivery, quantity delivered, quality) of depot maintenance work.
H20	553	Government providers of depot maintenance are able to observe the outcome (e.g., time of delivery, quantity delivered, quality), of depot maintenance work.
H20	591	Commercial providers of depot maintenance are able to observe the outcome (e.g., time of delivery, quantity delivered, quality), of depot maintenance work.
H21	496	Providers of depot maintenance services have better information about the degree of care they exercise in performance than do government buyers of depot maintenance.
H21	1001	Who has the better information about the degree of care exercised in performance of depot maintenance (commercial provider .... About same .... Government buyer)?
H21	1002	Who has the better information about the degree of care exercised in performance of depot maintenance (government depot .... about same .... government buyer)?
H22	497	Commercial providers of depot maintenance are more apt to act opportunistically than are government providers.
H22	555	Government providers of depot maintenance are more apt to act opportunistically than are commercial providers.
H22	1003	Who is more likely to act opportunistically when providing depot maintenance (commercial providers .... About the same .... government providers)?
H23	498	Within the Department of Defense (ministry of defense or other government agency as applicable), different interest groups have formed who have different depot maintenance agendas.

## Items Retained After Item Sort (Continued)

Hypothesis Number at time of Proposal	Item ID	Item
H23	556	Interest groups within the Department of Defense (ministry of defense or other government agency as applicable) are able to influence the choice between public and commercial providers of depot maintenance.
H24	499	Outside the Department of Defense (ministry of defense or other government agency, as applicable), different interest groups have formed who have depot maintenance agendas that may be different than the Department's (ministry's).
H24	557	Interest groups outside the Department of Defense (ministry of defense or other government agency, as applicable) are able to influence the choice between public and commercial providers of depot maintenance.
H25a	532	Given a choice between private and public provision of depot maintenance, in general the best solution is (public ..... private).
H25b	500	Private providers of depot maintenance are more efficient than their public counterparts.
H25b	558	Outsourcing of depot maintenance has made depot maintenance operations more cost-effective.
H26	559	How important is having more than one potential source of depot maintenance. (very low ... very high)?
H26	594	How difficult is it (or would it be) to determine the existence of a competitive marketplace among depot maintenance bidders (very low ... very difficult)?
H26	612	How difficult is it (or would it be) to create a competitive marketplace among depot maintenance bidders (very easy .... very difficult)?
H26	624	An important reason for maintaining government depots is to keep the government from getting into a sole-source situation.
H27	502	It is important for the government to retain smart buyer capability.
H27	560	Assurance of smart buyer capability requires that the government do at least some of the work itself.
H28	503	The choice between public and commercial providers should depend on the relative cost to the government.



## Items Retained After Item Sort (Continued)

Hypothesis Number at time of Proposal	Item ID	Item
H28	561	When determining which is the most costly provider of depot maintenance—public or private providers—both the cost to produce repairs and the cost to arrange for and monitor production should be counted.
H29	504	Commercial firms are better able than government organizations to develop new technology that can lower cost
H29	562	Commercial firms are better able than government organizations to develop new technology that can improve product quality,
H29	595	Commercial firms are better able than government organizations to develop new technology that can create new products.
H30	505	Commercial firms are better than their government counterparts at finding and employing the best depot maintenance technology currently available.
H30	563	Increased access to new technology is an important potential benefit of depot maintenance outsourcing.
H30	596	Please evaluate the extent to which outsourcing has increased access to key depot maintenance-related technologies.
H31	506	For a given technology, commercial firms are better than their government counterparts at reducing cost, raising productivity, and improving quality.
H32	507	By an organization's core competencies is meant the products it makes, services it provides, and markets it serves.
H33	508	By an organization's core competencies is meant what it knows and what it can do.
H34a	509	I am able to define my organization's core competencies.
H34a	565	My colleagues are able to define the core competencies of our organization.
H34b	533	I consider government depot maintenance capability a traditional strength of the government logistics function.
H34b	578	Generally speaking, my logistics colleagues consider government depot maintenance capability a traditional strength of the government logistics function.
H35	510	Employee knowledge and skills are an important component of an organization's core competencies.

## Items Retained After Item Sort (Continued)

Hypothesis Number at time of Proposal	Item ID	Item
H35	566	Depot maintenance is an area that requires a lot of expertise or training.
H35	598	To what extent does depot maintenance require specialized or expert human skills for effective performance?
H36	511	A depot maintenance organization's technical systems are an important part of its core competencies.
H36	567	The way work is performed by government depots is unique to those organizations.
H37	512	A depot maintenance organization's management systems are an important part of its core competencies.
H38	569	The values and norms of government depots give them an advantage over their commercial counterparts.
H38	1004	Which set of value and norms, those held by commercial firms or those held by government depots, provide the greater advantage when it comes to performing depot maintenance (commercial .... government)
H39	514	No additional, unique scale item for this hypothesis. (This hypothesis will be addressed in conjunction with hypotheses H25 through H31.)
H40a	515	All things considered, my government is better served if it does depot maintenance itself.
H40a	570	If it were my choice, I would see that my government used the following source(s) for depot maintenance (all commercial ...approximately 50/50... all organic)
H40b	535	It seems like different organizations and different managers have different definitions of depot maintenance.
H40b	580	In my own mind, I am fairly clear on the definition of depot maintenance.
H40b	603	It seems like the definition of what is and what is not depot maintenance is changing.
H41	516	The benefits of outsourcing depot maintenance are clear to me.
H41	571	Generally speaking, most people who work in the area understand the benefits of outsourcing depot maintenance.
H42	517	The purpose of depot maintenance outsourcing is clear to me.

## Items Retained After Item Sort (Continued)

Hypothesis Number at time of Proposal	Item ID	Item
H42	572	Generally speaking, most people who work in the area understand the purpose of outsourcing depot maintenance.
H43	518	In my government, top-level management is interested in seeing depot maintenance outsourced.
H43	573	In my government, depot maintenance managers know that top-level management is interested in seeing depot maintenance outsourced.
H45	519	Long-term relationships (e.g., partnering) between depot maintenance customers and specific commercial firms will be important to effective depot maintenance support.
H45	574	I consider the present users of depot maintenance and commercial providers of depot maintenance in my country to be partners.
H45	599	I expect the relationships between users of depot maintenance services and the present set of commercial depot maintenance providers in my country to last a long time.
H46	520	Long-term relationships (e.g., partnering) between depot maintenance customers and organic depots will be important to effective depot maintenance support.
H46	575	I consider the present users of depot maintenance and the organic depots in my country to be partners.
H46	600	I expect the relationships between users of depot maintenance services and the present set of organic depots in my country to last a long time.
H47a	521	Building and sustaining trust are important to long-term alliances between depot maintenance providers and users.
H47b	531	It is hard to build and sustain trust between the buyers and providers of depot maintenance.
H47b	577	Commercial providers of depot maintenance can be counted on to do what is right.
H47b	616	Commercial providers of depot maintenance are honest about problems.
H47b	625	Organic providers of depot maintenance can be counted on to do what is right.
H47b	630	Organic providers of depot maintenance are honest about problems.

## Items Retained After Item Sort (Continued)

Hypothesis Number at time of Proposal	Item ID	Item
H48a	522	Supply chain integration is important to providing effective depot maintenance.
H48b	534	I have a clear understanding of the concept of supply chain integration.
H48b	579	Generally speaking, my logistics colleagues have a clear understanding of the meaning of supply chain integration.
H49	523	Supply chain integration is difficult to achieve.
H50	524	Supply chain integration is more difficult to achieve when commercial firms are involved than when organic depots are involved.
H51	525	The participants in the public versus private depot maintenance controversy always seem to be changing.
H52	526	It does not matter how much effort is put into deciding between organic and commercial providers of depot maintenance, something off the wall always seems to determine the final outcome.
H53	527	Higher level management can never seem to get its act together and provide consistent rules for choosing between organic and commercial providers of depot maintenance.
H54	528	It does not matter how much effort is put into deciding between organic and commercial providers of depot maintenance, somebody at a higher level always seems to determine the final answer anyhow.
H55	529	It seems like at different times different organizations and different managers get together to jointly promote their own depot maintenance agendas.



# **APPENDIX I WEAPON SYSTEM DEPOT MAINTENANCE SOURCE OF REPAIR DECISION FACTORS SURVEY**

This appendix provides the content of the survey instrument as well as the general layout. The actual format of the DoD survey instrument was a mailed 24 page, 5 ½ inch by 8 inch booklet. The content of the industry survey instrument was identical to that mailed to DoD. In the industry instance, distribution was by electronic (e-mail and world wide web) means. There were two formats for industry, a Microsoft Word file that could be printed locally and a Microsoft Excel worksheet that could be returned by e-mail. Industry recipients were encouraged to use either of the two formats, at their discretion.

# Weapon System Depot Maintenance Source of Repair Decision Factors Survey (DoD ver 1b)

The decision whether or not to outsource depot maintenance to the private sector is important from national security, economic, and many other vantage points. This questionnaire is part of a research project designed to better understand the factors that are perceived as important to the outsourcing decision.

Your views and those of others also responding are the most important sources of information. The enclosed survey should take you about 20 minutes to complete. All of the questions in this survey use a simple, 7-point response scale. Please circle the responses that you believe best reflect your personal understanding and viewpoint.

The survey has two major sections. Your responses to the questions in section I, in general, should not depend on specific circumstances or the characteristics of specific workloads. Your responses to the questions in section II probably will depend on the specifics of circumstances and/or workloads.

Please answer all of the questions by circling the number of the response category which most closely reflects your opinion. If you wish to make additional remarks on any aspect of the survey or want to qualify your answer to any question, please use the comments section at the end of the questionnaire.

Please return your completed questionnaire in the enclosed postage-paid envelope to:  
Depot Survey, Department of Management Science, The George Washington University,  
School of Business and Public Management, Washington, DC, 20052.

# Section I

## Market Considerations

This section deals with differences between public (i.e., government) and private (commercial) provision of depot maintenance.

Q-1. With regard to depot maintenance, to what extent do you agree or disagree with the following statements?

	Strongly Disagree	Disagree	Some-what Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
(a) For some workloads there is a lack of private firms willing to do the work.	1	2	3	4	5	6	7
(b) An important reason for maintaining public depots is to keep the government from getting into a sole-source situation.	1	2	3	4	5	6	7
(c) When public depots and private firms compete for depot maintenance work, the rules of the game favor one side over the other (private over public or public over private).	1	2	3	4	5	6	7
(d) Which sector has the better economy of scale is important when choosing between public and private providers of depot maintenance.	1	2	3	4	5	6	7
(e) In the absence of a viable "competitor," public maintenance depots may take on the characteristics of a monopoly.	1	2	3	4	5	6	7



	Strongly Disagree	Disagree	Some-what Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
(f) Outsourcing of depot maintenance has made depot maintenance operations more cost-effective.	1	2	3	4	5	6	7
(g) Better access to new technology is an important potential benefit of depot maintenance outsourcing.	1	2	3	4	5	6	7

Q-2. Each of the following questions poses a choice between private and public providers. With regard to depot maintenance, please select the choice that makes most sense to you.

	Private Providers	Private Providers	Private Providers	About the Same	Private Providers	Private Providers	Public Providers
(a) Given a choice between private and public provision of depot maintenance, in general the best solution is ...	1	2	3	4	5	6	7
(b) Who is better at finding and employing the best depot maintenance technology currently available?	1	2	3	4	5	6	7
(c) <i>For a given depot maintenance technology</i> , who is better at using it to reduce cost and improve quality?	1	2	3	4	5	6	7
(d) Who is better able to develop new technology that can <i>create new products</i> ?	1	2	3	4	5	6	7

	Private Providers			About the Same			Public Providers
(e) Who is better able to develop new technology that can <i>lower cost</i> ?	1	2	3	4	5	6	7
(f) Who is better able to develop new technology that can <i>improve product quality</i> ?	1	2	3	4	5	6	7

Q-3. Using the scales provided please respond to the following questions.

(a) To what extent has outsourcing improved access to key depot maintenance-related technologies?

Very In- significant	In- significant	Somewhat In- significant	Neutral	Somewhat Significant	Significant	Very Significant
1	2	3	4	5	6	7

(b) How often would you expect to be able to find private firms who can deliver the quantity of depot maintenance work that is needed without an initial start-up delay?

Never	Almost Never	Seldom	Neutral	Sometimes	Almost Always	Always
1	2	3	4	5	6	7

(c) Some make the argument that depot maintenance capabilities are unique—that there is no real equivalent in the private sector. How do you see it?

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

(d) How important is having more than one potential source of depot maintenance?

Very Low	Low	Somewhat Low	Neutral	Somewhat High	High	Very High
1	2	3	4	5	6	7

## Cost to Arrange for and Monitor Production

Whether depot maintenance is performed by DoD or by a private firm, it is generally acknowledged that there is an “administrative” cost to make the initial arrangements, work out new arrangements if requirements change, and monitor performance.

Q-4. Recognizing that the administrative costs are probably hard to measure, please respond to the following questions using the scales provided.

(a) How would you rate the costs for monitoring depot maintenance *private* performance (i.e., performance by a commercial firm) when compared to the costs of production?

Very Low	Low	Somewhat Low	Neutral	Somewhat High	High	Very High
1	2	3	4	5	6	7

(b) How would you rate the costs for monitoring depot maintenance *public* performance (i.e., performance by DoD) when compared to the costs of production?

Very Low	Low	Somewhat Low	Neutral	Somewhat High	High	Very High
1	2	3	4	5	6	7

Q-5. Using the scale below, please indicate the extent you agree or disagree with the following statements.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
(a) Competition brings better performance, better quality, and/or lower cost.	1	2	3	4	5	6	7
(b) The need for close coordination among sequential steps in depot maintenance repair processes make a difference when deciding between public and private sources of repair.	1	2	3	4	5	6	7
(c) Ability to make sure the required work is actually done is important when deciding between public and private sources of repair.	1	2	3	4	5	6	7
(d) There are well-defined criteria to measure the performance level of depot maintenance providers.	1	2	3	4	5	6	7
(e) The military would experience a loss of control by outsourcing depot maintenance to the private sector.	1	2	3	4	5	6	7
(f) Depot maintenance is critically important in achieving the primary mission.	1	2	3	4	5	6	7
(g) Most of the jobs in depot maintenance are routine. Unique and one-of-a-kind repairs are unusual.	1	2	3	4	5	6	7

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
(h) The choice between public and private providers should depend on the relative cost to the government.	1	2	3	4	5	6	7
(l) When determining who is the least costly provider of depot maintenance — public depot or private firm — both the cost to produce repairs and the cost to initially arrange for and then monitor production should be considered.	1	2	3	4	5	6	7

Q-6. Please respond to the following question using the scale provided.

- (a) When arranging for performance of depot maintenance work, how difficult or easy is it to state contingencies (for instance, potential changes in the kind and amount of work) in advance.

Very Difficult	Difficult	Somewhat Difficult	Neutral	Somewhat Easy	Easy	Very Easy
1	2	3	4	5	6	7

## Principals and Agents

Q-7. With regard to depot maintenance, please indicate the extent to which you agree or disagree with the following statements.

	Strongly Disagree	Disagree	Somewhat	Neutral	Somewhat Agree	Agree	Strongly Agree
(a) Private providers of depot maintenance have conflicts of interest (e.g., between their objectives and their government customer's objectives) that get in the way of effective depot maintenance.	1	2	3	4	5	6	7
(b) Public depots have conflicts of interest (e.g., between their objectives and their government customer's objectives) that get in the way of effective depot maintenance.	1	2	3	4	5	6	7
(c) Uncontrollable random factors can influence the outcome of depot maintenance activity.	1	2	3	4	5	6	7
(d) Government <i>buyers</i> of depot maintenance are able to observe the outcome (e.g., time of delivery, quantity delivered, quality) of depot maintenance work.	1	2	3	4	5	6	7
(e) <i>Public providers</i> of depot maintenance are able to observe the outcome (e.g., time of delivery, quantity delivered, quality) of depot maintenance work.	1	2	3	4	5	6	7
(f) <i>Private providers</i> of depot maintenance are able to observe the outcome (e.g., time of delivery, quantity delivered, quality) of depot maintenance work.	1	2	3	4	5	6	7

	Strongly Disagree	Disagree	Somewhat	Neutral	Somewhat Agree	Agree	Strongly Agree
(g) <i>Providers</i> of depot maintenance services (either private or public) have better information about the degree of care they exercise in performance than do <i>government buyers</i> of depot maintenance.	1	2	3	4	5	6	7
(h) To make sure that the government knows what it is asking for and getting, it is important that the government do at least some depot maintenance work itself.	1	2	3	4	5	6	7

Q-8. Please respond to the following questions using the scales provided.

(a) Which provider is most likely to be careful, industrious, and/or trustworthy?

Private Providers	About the Same			Public Providers		
1	2	3	4	5	6	7

(b) Which provider is more able to influence depot maintenance requirements?

Private Providers	About the Same			Public Providers		
1	2	3	4	5	6	7

(c) When a government manager obtains depot maintenance from a *public* provider, who has the better information about the degree of care exercised in performance of depot maintenance – the manager or the provider?

Manager	About the Same			Provider		
1	2	3	4	5	6	7

(d) When a government manager obtains depot maintenance from a *private provider*, who has the better information about the degree of care exercised in performance of depot maintenance – the manager or the provider?

Manager			About the Same			Provider
1	2	3	4	5	6	7

### Interest Groups

Q-9. Please indicate the extent to which you agree or disagree with the following statements.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
(a) Within the Department of Defense, different interest groups with different depot maintenance agendas have formed	1	2	3	4	5	6	7
(b) Interest groups <i>within</i> the Department of Defense are able to influence the choice between public and private providers of depot maintenance.	1	2	3	4	5	6	7
(c) Interest groups <i>outside</i> the Department of Defense have depot maintenance agendas that may be different than the Department's.	1	2	3	4	5	6	7



	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
(d) Interest groups <i>outside</i> the Department of Defense are able to influence the choice between public and private providers of depot maintenance.	1	2	3	4	5	6	7

## Core Competencies

Q-10. With regard to depot maintenance, please indicate the extent to which you agree or disagree with the following statements.

	Strongly Disagree	Disagree	Somewhat	Neutral	Somewhat Agree	Agree	Strongly Agree
(a) I am able to define my organization's core competencies.	1	2	3	4	5	6	7
(b) My colleagues are able to define the core competencies of our organization.	1	2	3	4	5	6	7
(c) I consider depot maintenance capability a traditional strength of the public (i.e., DoD) logistics sector.	1	2	3	4	5	6	7
(d) Generally speaking, my logistics colleagues consider depot maintenance capability a traditional strength of the public logistics sector.	1	2	3	4	5	6	7
(e) Employee knowledge and skills are important components of an organization's core competencies.	1	2	3	4	5	6	7

- |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| (f) Public depots have developed special work methods not found in private firms.                       | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| (g) A depot maintenance organization's management system is an important part of its core competencies. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Q-11. Using the scale provided, please respond to the following question.

- (a) As you see it, whose principles, goals, and standards of conduct are more likely to assure good depot maintenance results, — those held by private providers or those held by public providers?

Private Providers			About the Same			Public Providers
1	2	3	4	5	6	7

## Outsourcings

Q-12. With regard to depot maintenance, please indicate the extent to which you agree or disagree with the following statements.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
(a) All things considered, the Department of Defense is better served if it does most depot maintenance itself.	1	2	3	4	5	6	7
(b) It seems like different organizations and different managers have different definitions of depot maintenance.	1	2	3	4	5	6	7
(c) In my own mind, I am fairly clear on the definition of depot maintenance.	1	2	3	4	5	6	7
(d) It seems like the definition of what is and what is not depot maintenance is changing.	1	2	3	4	5	6	7
(e) Generally speaking, most people who work with depot maintenance understand the <i>purpose</i> of increasing the amount of depot maintenance that is outsourced.	1	2	3	4	5	6	7
(f) Generally speaking, most people who deal with depot maintenance understand the <i>benefits</i> of increasing the amount of depot maintenance that is outsourced.	1	2	3	4	5	6	7
(g) I understand the <i>purpose</i> of increasing the amount of depot maintenance that is outsourced.	1	2	3	4	5	6	7

- |  |   |   |   |   |   |   |   |
|--|---|---|---|---|---|---|---|
| (h) I understand the <i>benefits</i> of increasing the amount of depot maintenance that is outsourced.                   | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| (l) Top-level management is interested in seeing more depot maintenance outsourced.                                      | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| (j) Depot maintenance managers know that top-level management is interested in seeing more depot maintenance outsourced. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Q-13. Using the scale provided, please respond to the following question.

- (a) If it were my choice, I would see that DoD used the following source for depot maintenance.

Private Providers				Both			Public Providers
1	2	3	4	5	6	7	

## Trust

Q-14. Please indicate the extent to which you agree or disagree with the following statements.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
(a) Long-term relationships between public depots and their customers are important to effective depot maintenance support.	1	2	3	4	5	6	7
(b) I expect established relationships between public depots and their military customers to last a long time.	1	2	3	4	5	6	7
(c) Depot maintenance providers and their military customers are important to effective depot maintenance support.	1	2	3	4	5	6	7
(d) I expect established relationships between private depot maintenance providers and military customers to last a long time.	1	2	3	4	5	6	7
(e) Private providers of depot maintenance can be counted on to do what is right for their military customers.	1	2	3	4	5	6	7
(f) Private providers of depot maintenance are honest about problems.	1	2	3	4	5	6	7
(g) Public providers of depot maintenance can be counted on to do what is right for their military customers.	1	2	3	4	5	6	7

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
(h) Public providers of depot maintenance are honest about problems.	1	2	3	4	5	6	7
(l) Successful long-term alliances between depot maintenance providers (public or private) and their customers depend on building and sustaining trust.	1	2	3	4	5	6	7

Q-15. Using the scales provided, please respond to the following questions.

(a) How hard is it to build and sustain trust between government buyers and private providers of depot maintenance?

Very Difficult	Difficult	Somewhat Difficult	Neutral	Somewhat Easy	Easy	Very Easy
1	2	3	4	5	6	7

(b) How hard is it to build and sustain trust between government buyers and public providers of depot maintenance?

Very Difficult	Difficult	Somewhat Difficult	Neutral	Somewhat Easy	Easy	Very Easy
1	2	3	4	5	6	7

## Logistics and Supply Chains

Q-16. Please indicate the extent to which you agree or disagree with the following statements.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
(a) I understand the concept of supply chain integration.	1	2	3	4	5	6	7
(b) Generally speaking, my colleagues understand the concept of supply chain integration.	1	2	3	4	5	6	7

Q-17. If you indicated you understand the concept of supply chain integration (circled 5, 6, or 7), please respond to the following questions using the scales provided.

(a) How significant is supply chain integration to effective and efficient delivery of depot maintenance?

Very In-significant	In-significant	Somewhat In-significant	Neutral	Somewhat Significant	Significant	Very Significant
1	2	3	4	5	6	7

(b) How difficult is it to achieve supply chain integration?

Very Difficult	Difficult	Somewhat Difficult	Neutral	Somewhat Easy	Easy	Very Easy
1	2	3	4	5	6	7

## Decision Processes

Q-18. Please indicate the extent to which you agree or disagree with the following statements.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
(a) The participants in the public versus private depot maintenance controversy always seem to be changing.	1	2	3	4	5	6	7
(b) It does not matter how much effort is put into deciding between public and private providers of depot maintenance, something unexpected always seems to determine the final outcome.	1	2	3	4	5	6	7
(c) Higher level management has difficulty providing consistent rules for choosing between public and private providers of depot maintenance.	1	2	3	4	5	6	7
(d) It does not matter how much effort is put into deciding between public and private providers of depot maintenance, somebody at a higher level always seems to determine the final answer anyhow.	1	2	3	4	5	6	7



	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
(e) It seems like at different times different organizations and their managers get together to promote their own depot maintenance agendas.	1	2	3	4	5	6	7
(f) For a decision process to be rational, it needs to have a well defined problem, a means for telling good alternatives from bad, a comparison of alternatives, and selection of the best alternative.	1	2	3	4	5	6	7
(g) Managers and others with an interest in depot maintenance <i>should use</i> rational processes to allocate workload between the public and private sectors.	1	2	3	4	5	6	7
(h) A rational process <i>is used</i> to allocate workload between the public and private sectors.	1	2	3	4	5	6	7

## Section II

When responding to the questions in this section, please think about circumstances or workloads with which you are familiar (e.g., that you presently encounter or have encountered frequently in your work) or that are important to you. Try to keep in mind the same circumstances or workloads throughout this section. At the end of the section you will be presented with an opportunity to briefly sketch the circumstances.

Q-19. Please indicate the extent to which you agree or disagree with the following statements.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
(a) Because it is hard to analyze all alternatives in advance, a reasonable way to solve a problem is to find an alternative that is at least better than other possibilities.	1	2	3	4	5	6	7
(b) Maintaining availability of more than one source of depot maintenance is important.	1	2	3	4	5	6	7
(c) Problems with proprietary data make a difference when deciding between public and private sources of depot maintenance.	1	2	3	4	5	6	7
(d) Doing depot maintenance work takes a large capital investment.	1	2	3	4	5	6	7

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
(e) Requirements for unique equipment are important when deciding between public and private sources of depot repair.	1	2	3	4	5	6	7
(f) Outsourcing of depot maintenance to private providers increases DoD's risk because private providers cannot respond fast enough when requirements change.	1	2	3	4	5	6	7

Q-20. Using the scales provided, please respond to the following questions.

(a) How significant is availability of specialized equipment to effective depot maintenance performance?

Very In-significant	In-significant	Somewhat In-significant	Neutral	Somewhat Significant	Significant	Very Significant
1	2	3	4	5	6	7

(b) How significant are specialized or expert human skills to effective depot maintenance performance?

Very In-significant	In-significant	Somewhat In-significant	Neutral	Somewhat Significant	Significant	Very Significant
1	2	3	4	5	6	7

(c) How difficult is it (or would it be) to determine the existence of a competitive marketplace for depot maintenance work?

Very Difficult	Difficult	Somewhat Difficult	Neutral	Somewhat Easy	Easy	Very Easy
1	2	3	4	5	6	7

(d) How difficult is it (or would it be) to create a competitive marketplace for depot maintenance work?

Very Difficult	Difficult	Somewhat Difficult	Neutral	Somewhat Easy	Easy	Very Easy
1	2	3	4	5	6	7

(e) Who is more likely to act opportunistically (further own interests without regard for customers), when providing depot maintenance?

Private Providers			About the Same			Public Providers
1	2	3	4	5	6	7

(f) Who is the more efficient provider of depot maintenance?

Private Providers			About the Same			Public Providers
1	2	3	4	5	6	7







# **APPENDIX J**

## **SURVEY TRANSMITTAL**

### **CORRESPONDENCE**

Survey forms were accompanied by the following Letter of Transmittal signed by Robert T. Mason, Assistant Deputy Under Secretary of Defense (Maintenance Policy, Programs and Resources) and by the accompanying privacy statement.



## Letter of Transmittal



## OFFICE OF THE UNDER SECRETARY OF DEFENSE

3000 DEFENSE PENTAGON  
WASHINGTON DC 20301 3000

12 SEP 2001

## MEMORANDUM FOR DISTRIBUTION

Subject: Source of Repair Decision Factors Survey

Dear Survey Participant:

About three weeks ago, I asked for your opinions on the factors that are important to determining when depot maintenance should be accomplished by the Department and when it should be accomplished by the commercial sector. We have not yet received your completed questionnaire.

Please help us understand the factors you perceive to be important by completing and returning a questionnaire. You are one of a limited number of people being asked to give your opinion on this matter. As a result, your reply is very important. The results of this research will enhance our understanding of the factors that are important to the depot maintenance source of repair decision and will help us craft new and revised policy.

The questionnaire should require about 20 minutes of your time to complete. It is important that you return the survey booklet to ensure truly representative results.

In the event that your questionnaire has been misplaced, I have attached a replacement. Your cooperation is greatly appreciated. My staff and I would be most happy to answer any of your questions on this research. My point of contact is Hollis Hunter (703) 695-4037 or 697-7980; e-mail: hunterhb@acq.osd.mil

Robert I. Mason  
Assistant Deputy Under Secretary  
of Defense (Maintenance Policy  
Programs and Resources)

Attachment(s):  
Survey



## Privacy Act Notice

In accordance with the Privacy Act of 1974 (public Law 93-579), this notice informs you of the purpose of the survey and how the findings will be used. Please read it carefully.

**AUTHORITY:** 10 United States Code, Sections 133b and 2358.

**PRINCIPAL PURPOSE:** Information collected in this survey will be used to assess the factors that are perceived as important to determining when depot maintenance should be accomplished by DoD and when it should be accomplished by the commercial sector.

The information resulting from the survey will enhance understanding of the factors that are important to the depot maintenance source of repair decision and will be used in conjunction with other research to craft new and revised policy.

Consistent with its purpose, the survey asks for your perceptions regarding the factors that are important to the source of repair decision. The survey has two major sections. Responses to the questions in section I, in general, should not depend on specific circumstances or the characteristics of specific workloads. Responses to the questions in section II probably will depend on the specifics of circumstances and/or workloads.

**ROUTINE USES:** The general results of this research will be made available to Government officials, members of Congress, and interested citizens. Findings may be used in reports and provided to Congress. Some findings may be used in doctoral research, published by professional journals, or reported in manuscripts presented at conferences, symposia, and scientific meetings. In no case will the data for identifiable individual(s) be reported or used.

**DISCLOSURE:** Providing information on this survey is voluntary. There is no penalty if you choose not to respond. However, maximum participation is encouraged so that the data will be complete and representative. Your survey instrument will be treated as confidential. Identifying information will be used only by persons engaged in, and for the purposes of, the survey. Only group statistics will be reported.



# APPENDIX K

## OPERATIONAL DEFINITIONS OF VARIABLES USED TO STRATIFY THE SAMPLING FRAME

Variable	Statistica Name	Definition
<b>Components</b>		
Army	Army	Person or position assigned to the United States Army
Navy	Navy	Person or position assigned to the United States Navy
Marine Corps	USMC	Person or position assigned to the United States Marine Corps
Air Force	Air Force	Person or position assigned to the United States Air Force
Defense Logistics Agency	DLA	Person or position assigned to the Defense Logistics Agency
Office of the Secretary of Defense or Joint Chiefs of Staff	OSD/JCS	Person or position assigned to the Office of the Secretary of Defense or Joint Chiefs of Staff organization.
Other	Other	Person or position assigned to a component other than Army, Navy, Air Force, United States Marine Corps, Office of the Secretary of Defense, or Joint Chiefs of Staff

(Continued)

Variable	Statistica Name	Definition
<b>Function</b>		
Maintenance	Maintenance	Person or position assigned to manage or work in maintenance at any organizational or maintenance level
Logistics Management General	Logistics Mgt. General	Person or position assigned to manage or work in general logistics management at any organizational level
Materiel Management	Materiel Mgt.	Person or position assigned to manage or work in materiel management (i.e., supply chain management)
Operations	Operations	Person or position assigned to manage or work in operations
Support, other	Support_other	Person or position assigned to manage or work in a support area other than general logistics management, maintenance, or materiel management
Acquisition	Acquisition	Person or position assigned to manage or work in acquisition (i.e., research, development, engineering, procurement, manufacturing, and test of new weapon systems and components)
Other non-support	Other_non-support	Person or position assigned to manage or work in a field other than those listed above.
Indeterminate	Indeterminate	Function could not be determined from available information
<b>System</b>		
Ordnance	Ordnance	Person or position associated with ordnance systems (e.g., guns and munitions)
Ground	Ground	Person or position associated with ground systems such as tanks and vehicles
Ship	Ship	Person or position associated with ships
Aviation	Aviation	Person or position associated with aviation systems
Multiple	Multiple	Person or position associated with two or more kinds of systems
Other	Other	Person or position not associated with any kind of system
N/A	N/A	Could not determine what kind of system the person or position was associated with from the available data

(Continued)

Variable	Statistica Name	Definition
<b>Level</b>		
OSD/JCS	OSD/JCS	Person or position assigned to the Office of the Secretary of Defense or Joint Chiefs of Staff organization.
Component Headquarters	Component	Person or position assigned to the headquarters of one of the components.
Field	Field	Person or position below the level of component headquarters. Could be in a subordinate headquarters.
<b>Maintenance Level</b>		
HHQ_Management	HHQ_Management	Person or position assigned in a higher headquarters maintenance position (e.g., materiel command headquarters, component headquarters, OSD, or JCS).
Depot_Maintenance	Depot_Maintenance	Person or position assigned to work in depot maintenance
Field_Maintenance	Field_Maintenance	Person or position assigned to work in field maintenance
N/A	N/A	Person or position not assigned to maintenance
<b>Sector</b>		
DoD	DoD	Person or position assigned to the Department of Defense
Industry	Industry	Person or position assigned to an industry firm



# APPENDIX L

## SURVEY ITEMS ORDERED BY MEAN OF RESPONSES<sup>1</sup>

Item	Question	Mean	Narrative
510	10E	6.243	Employee knowledge and skills are important components of an organization's core competencies.
521	14I	6.151	Successful long-term alliances between depot maintenance providers (public or private) and their customers depend on building and sustaining trust.
476/536	18F_18G	6.004	Managers and others with an interest in depot maintenance should use rational processes (well defined problem, a means for telling good alternatives from bad...) to allocate workload between the public and private sectors.
598	20B	5.983	Specialized or expert human skills are significant to effective depot maintenance performance.
522	17A	5.955	Supply chain integration is significant to effective and efficient delivery of depot maintenance.
519	14C	5.799	Long-term relationships between private depot maintenance providers and their military customers are important to effective depot maintenance support.

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<sup>1</sup>. For items such as 504/562/596 (2E-2F-2D) that appear to be out of order the sense of the mean was reversed prior to sorting, as described in Chapter 7.



## Survey Items Ordered by Mean of Responses (Continued)

Item	Question	Mean	Narrative
561	5I	5.762	When determining who is the least costly provider of depot maintenance — public depot or private firm — both the cost to produce repairs and the cost to initially arrange for and then monitor production should be considered.
604	20A	5.733	Availability of specialized equipment is significant to effective depot maintenance performance.
499	9C	5.713	Interest groups outside the Department of Defense have depot maintenance agendas that may be different than the Department's.
636	5A	5.696	It is hard to build and sustain trust between government buyers and private providers of depot maintenance?
498	9A	5.691	Because it is hard to analyze all alternatives in advance, a reasonable way to solve a problem is to find an alternative that is at least better than other possibilities.
520	14A	5.605	Long-term relationships between public depots and their customers are important to effective depot maintenance support.
543	19D	5.578	Doing depot maintenance work takes a large capital investment.
556	9B	5.517	Interest groups within the Department of Defense are able to influence the choice between public and private providers of depot maintenance.
478	19B	5.473	Maintaining availability of more than one source of depot maintenance is important.
512	10G	5.463	A depot maintenance organization's management system is an important part of its core competencies.
600	14B	5.351	I expect established relationships between public depots and their military customers to last a long time.
557	9D	5.337	Interest groups outside the Department of Defense are able to influence the choice between public and private providers of depot maintenance.
535/603	12B_12D	5.331	The definition of depot maintenance is inconsistent
563	1G	5.319	Better access to new technology is an important potential benefit of depot maintenance outsourcing.

## Survey Items Ordered by Mean of Responses (Continued)

Item	Question	Mean	Narrative
488	5C	5.306	Ability to make sure the required work is actually done is important when deciding between public and private sources of repair.
544	19E	5.275	Requirements for unique equipment are important when deciding between public and private sources of depot repair.
504/562/ 595	2E_2F_2D	2.803	The private provider is better able to provide new technology.
529	18E	5.131	It seems like at different times different organizations and their managers get together to promote their own depot maintenance agendas.
480	1E	5.107	In the absence of a viable "competitor," public maintenance depots may take on the characteristics of a monopoly.
479	19C	5.077	Problems with proprietary data make a difference when deciding between public and private sources of depot maintenance.
494	7C	5.051	Uncontrollable random factors can influence the outcome of depot maintenance activity.
553	10C	5.047	I consider depot maintenance capability a traditional strength of the public (i.e., DoD) logistics sector.
523	17B	2.964	Achieving supply chain integration is difficult.
517	12G	5.033	I understand the purpose of increasing the amount of depot maintenance that is outsourced.
578	10D	5.029	Generally speaking, my logistics colleagues consider depot maintenance capability a traditional strength of the public logistics sector.
559/624	3D_1B	5.023	One of the rationales for government depots is to prevent sole-source situations and that avoiding a sole-source situation is important
534/579	16A_16B	4.956	Generally speaking, my colleagues and I understand the concept of supply chain integration.
599	14D	4.952	I expect established relationships between private depot maintenance providers and military customers to last a long time.

## Survey Items Ordered by Mean of Responses (Continued)

Item	Question	Mean	Narrative
505	2B	3.084	The private provider is better at finding and employing the best depot maintenance technology currently available.
516/517	12G_12H	4.899	I am personally optimistic about outsourcing.
496/634/ 635	7G_8C_8D	4.891	Providers of depot maintenance have better information than government managers of depot maintenance about the degree of care exercised during the performance of depot maintenance.
528	18D	4.875	It does not matter how much effort is put into deciding between public and private providers of depot maintenance, somebody at a higher level always seems to determine the final answer anyhow.
505/563/ 596	2B_1G_3A	4.859	Because commercial providers are better at finding and employing technology, access to new technology is an important real benefit of depot maintenance outsourcing.
518/573	12I_12J	4.824	There is pressure to outsource depot maintenance
625/630	14G_14H	4.811	Public providers of depot maintenance are honest and can be counted on to do what is right for their military customers.
527	18C	4.809	Higher level management has difficulty providing consistent rules for choosing between public and private providers of depot maintenance.
516	12H	4.764	I understand the benefits of increasing the amount of depot maintenance that is outsourced.
484	1D	4.729	Which sector has the better economy of scale is important when choosing between public and private providers of depot maintenance.
633	20E	3.275	The private provider is more likely to act opportunistically (further own interests without regard for customers), when providing depot maintenance.
506	2C	3.298	the private provider is better at using technology to reduce cost and improve quality.
541	1C	4.693	When public depots and private firms compete for depot maintenance work, the rules of the game favor one side over the other (private over public or public over private).

## Survey Items Ordered by Mean of Responses (Continued)

Item	Question	Mean	Narrative
482	1A	4.691	For some workloads there is a lack of private firms willing to do the work.
487	6A	3.353	When arranging for performance of depot maintenance work, It is difficult to state contingencies (for instance, potential changes in the kind and amount of work) in advance.
493	8B	4.531	Which provider is more able to influence depot maintenance requirements? (private public)
577/616	14E_14F	4.493	Private providers of depot maintenance are honest and can be counted on to do what is right for their military customers.
485	5B	4.469	The need for close coordination among sequential steps in depot maintenance repair processes make a difference when deciding between public and private sources of repair.
558	1F	4.428	Outsourcing of depot maintenance has made depot maintenance operations more cost-effective.
586	5D	4.353	There are well-defined criteria to measure the performance level of depot maintenance providers.
489/547	19F_5E	3.663	The military would not experience a loss of control of depot maintenance through outsourcing because of commercial providers inability to respond fast enough.
581/631	18H_19A	4.333	A rational process is used to allocate workload between the public and private sectors. However, such a rational process could consist of finding an alternative that is at least better than other possibilities
596	3A	4.331	To what extent has outsourcing improved access to key depot maintenance-related technologies?
500	20F	3.701	Private providers of depot maintenance are the more efficient.
531/637	15A_15B	3.743	It is difficult to build and sustain trust between buyers and providers of depot maintenance.
571	12F	3.751	Most people who deal with depot maintenance do not understand the benefits of increasing the amount of depot maintenance that is outsourced

## Survey Items Ordered by Mean of Responses (Continued)

Item	Question	Mean	Narrative
491	7A	3.769	Private providers do not have conflicts of interest that get in the way of effective depot maintenance.
549	7B	3.793	Public depots do not have conflicts of interest (e.g., between their objectives and their government customer's objectives) that get in the way of effective depot maintenance.
515	12A	3.817	All things considered, the Department of Defense is better served if it does not do most depot maintenance itself.
532	2A	3.848	Given a choice between private and public provision of depot maintenance, in general the best solution is the private provider.
572/571	12E_12F	3.850	Generally speaking, most people who work with depot maintenance do not understand the purpose and benefits of increasing the amount of depot maintenance.
526	18B	4.122	It does not matter how much effort is put into deciding between public and private providers of depot maintenance, something unexpected always seems to determine the final outcome.
560	7H	4.102	To make sure that the government knows what it is asking for and getting, it is important that the government do at least some depot maintenance work itself.
607	4A	4.068	How would you rate the costs for monitoring depot maintenance private performance (i.e., performance by a commercial firm) when compared to the costs of production? (low..high)
638	4B	4.066	How would you rate the costs for monitoring depot maintenance public performance (i.e., performance by DoD) when compared to the costs of production? (low...high)
632	11A	4.063	As you see it, whose principles, goals, and standards of conduct are more likely to assure good depot maintenance results, — those held by private providers or those held by public providers? (private -- public)
572	12E	3.949	Generally speaking, most people who work with depot maintenance do not understand the purpose of increasing the amount of depot maintenance that is outsourced.

## Survey Items Ordered by Mean of Responses (Continued)

Item	Question	Mean	Narrative
492	8A	3.953	Private providers are more likely to be careful, industrious, and/or trustworthy?
567	10F	4.035	Public depots have developed special work methods not found in private firms.
612/594	20D_20C	3.969	It is difficult to create or determine if there is a competitive marketplace for depot maintenance.
570	13A	3.980	If it were my choice, I would see that DoD used private providers for depot maintenance.
525	18A	3.994	The participants in the public versus private depot maintenance controversy always seem to be changing.



# APPENDIX M

## LIST OF ABBREVIATIONS

A-76	Office of Management and Budget circular A-76
AFMC	Air Force Materiel Command
AIA	Aircraft Industries Association
ANCOVA	Analysis of covariance
ANOVA	Analysis of variance
AVDLR	Aviation depot level reparable
BRAC	Base Realignment and Closure
CBO	Congressional Budget Office
CNA	Center For Naval Analysis
COCO	Contractor owned, contractor operated
CSV	Substantive validity coefficient
DoD	Department of Defense
DoDR	DoD regulation
DSB	Defense Science Board
ECRC	Electronic Commerce Resource Center
ELEX/WEP	Ship electronics and weapons
Expl. Var	Explained variation
FAR	Federal acquisition regulation
GAO	General Accounting Office
GEIA	Government Electronics and Information Technology Association



GOCO	Government owned, contractor operated
GOGO	Government owned, government operated
HR	Human resources
HSD	Honest significant difference
ILS	Integrated logistics support
IS	Information services
IT	Information technology
K-S	Kolmogorov-Smirnov test
LISREL	A commercial computer code used to evaluate structural equation networks
LMI	Logistics Management Institute
Maint. Level	Maintenance level
MAIS	Major automated information system
MAUT	Multi-attribute utility theory
MDA	Milestone decision authority
MEO	Most efficient organization
NADEP	Naval aviation depot
NDIA	National Defense Industrial Association
OEM	Original equipment manufacturer
Org. level	Organizational level
Prp. Totl	Proportion of total variation
PSA	Proportion of substantive agreement
SA-ALC	San Antonio Air Logistics Center
SEPATH	Structural equation path modeling (a module within the Statistica statistical software package)
SOEs	State owned enterprises
TCA	Transaction cost analysis (see TCE)
TCE	Transaction cost economics
Varimax	Variation maximizing
WR-ALC	Warner Robins Air Logistics Center

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