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ORGANIZATIONAL POLICY LEVERS CAN AFFECT ACQUISITION REFORM IMPLEMENTATION IN AIR FORCE REPAIR CONTRACTS

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Research Brief

Speeding Acquisition Reform in the U.S. Air Force

The U.S. Air Force uses contractors to carry out logistics support services such as repairing major weapons systems. Recently the Air Force began to reform its methods of acquiring such services by implementing best practices from the commercial sector. To complement its other acquisition reform programs, the Air Force launched the Contract Repair and Enhancement Program (CREP) in 1996 to reduce costs and to shorten the time required for purchasing repair services to support major weapons systems. However, Air Force leaders were concerned that reforms were not being implemented as quickly as originally hoped. RAND Project AIR FORCE (PAF) was asked to identify the organizational levers that could motivate acquisition personnel to adopt CREP reforms more quickly. Analyses of recent Air Force contracts yielded the following conclusions:

- **Training, positive attitudes toward acquisition reform, close partnering with contractors, and consistent leadership appear to encourage reform implementation.** Air Force personnel who received greater training in new acquisition practices implemented more CREP reforms than their counterparts with less training. Similarly, contract teams that viewed reform positively and agreed with the goals of the initiative implemented more reforms in their contracts, as did teams that viewed their contractors as collaborative business partners. Teams that believed management was committed to improving acquisition incorporated more CREP reforms in their contracts.
- **Contrary to expectations, effective teaming and performance evaluation appear to discourage reform implementation.** Contracting teams that brought all key members together early in the contracting process and made decisions by consensus implemented fewer reforms than their counterparts with problematic team interactions. Teams that believed they would be evaluated on their reform implementation performance were also less likely to pursue contract innovations. The researchers hypothesize that smoothly functioning teams may tend to agree on less aggressive goals, and that the existing performance evaluation criteria may not have been aligned with the service's acquisition reform plans.

PAF recommends that the Air Force continue to use the organizational levers that encourage reform and modify its practices for those that discourage it. Specifically, the Air Force should

- clearly communicate to personnel that senior leadership is committed to contract reform,
- learn how to create effective teams through training in group problem-solving, and
- align performance evaluation criteria more explicitly with reform goals.

The Air Force may use the insights from this study to promote related reforms—such as purchasing and supply chain management, corporate contracting, and performance-based contracting—where behavioral changes are needed to accomplish larger transformational goals.

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Project AIR FORCE

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POLICY LEVERS
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Mary E. Chenoweth

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PREFACE

This report describes a study of the implementation of innovative practices in Air Force depot maintenance contracts. Through its Contract Repair Enhancement Program (CREP), today known as the Contract Repair Process (CRP), the U.S. Air Force has encouraged contracting personnel to formulate more innovative contracts aimed at improving contractors' performance, particularly regarding cost and schedule. Successful implementation of this reform requires a transformation in organizational structures and processes because implementation requires individuals to change fundamental business practices. This study focused on the relationship between organizational levers—those aspects of the work environment that senior leadership could affect to encourage personnel to implement reform—and contract innovation. These organizational levers were measured through a survey of contracting personnel at Warner Robins Air Logistics Center (ALC). Next, the study team designed a set of regression models to examine whether these levers were related to innovation in repair contracts.

The research reported here is one element of the RAND Corporation's ongoing work on improved contracting sponsored by the Office of the Secretary of the Air Force, Deputy Assistant Secretary for Contracting (SAF/AQC). The study was conducted in the Resource Management Program of RAND Project AIR FORCE.

This report may be of interest to those concerned with acquisition reform improvements to Air Force repair contracts, organizational transformation, and implementation of acquisition reform contracting practices.

In the last decade, RAND Project AIR FORCE has been helping the Air Force reshape its sourcing policies and practices. Readers may also be interested in the following related reports:

- *Implementing Best Purchasing and Supply Management Practices: Lessons from Innovative Commercial Firms*, Nancy Y. Moore, Laura H. Baldwin, Frank Camm, and Cynthia Cook, RAND, DB-334-AF, 2002, which can be downloaded from www.rand.org/publications/DB/DB334.
- *Implementing Performance-Based Services Acquisition (PBSA): Perspectives from an Air Logistics Center and a Product Center*, John Ausink, Laura H. Baldwin, Sarah Hunter, and Chad Shirley, RAND, DB-388-AF, 2002, which can be downloaded from www.rand.org/publications/DB/DB388.
- *Federal Contract Bundling: A Framework for Making and Justifying Decisions for Purchased Services*, Laura H. Baldwin, Frank Camm, and Nancy Y. Moore, RAND, MR-1224-AF, 2001, which can be downloaded from www.rand.org/publications/MR/MR1224.
- *Performance-Based Contracting in the Air Force: A Report on Experiences in the Field*, John Ausink, Frank Camm, and Charles Cannon, RAND, DB-342-AF, 2001, which can be downloaded from www.rand.org/publications/DB/DB342.
- *Strategic Sourcing: Measuring and Managing Performance*, Laura H. Baldwin, Frank Camm, and Nancy Y. Moore, RAND, DB-287-AF, 2000, which can be downloaded from www.rand.org/publications/DB/DB287.
- *Incentives to Undertake Sourcing Studies in the Air Force*, Laura H. Baldwin, Frank Camm, Edward Keating, and Ellen M. Pint, RAND, DB-240-AF, 1998.
- *Strategic Sourcing: Theory and Evidence from Economics and Business Management*, Ellen M. Pint and Laura H. Baldwin, RAND, MR-865-AF, 1997.

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Additional information about PAF may be found on our web site at <http://www.rand.org/paf>.

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In 1996, the Air Force adopted the Contract Repair Enhancement Program (CREP), today known as the Contract Repair Process (CRP), which consisted of a series of contracting reform measures intended to respond directly to customer demands at the same time as reducing inventory, process steps, lead time, and total system operating costs. Further, the Air Force aimed to accomplish these reform measures while maintaining or improving readiness. These new practices were modeled on earlier Air Force changes in acquisition practices that led to cost improvements and accelerated program schedules for acquiring major weapon systems. Concerned by what appeared to be the initially slow pace at which depot personnel were carrying out the CREP reforms, the Air Force asked RAND to assess what might be hindering their implementation.

PURPOSE AND APPROACH

In the Air Force, as in the private sector, senior leadership plays a vital role in instigating change in business practices. To do so, leaders generally use a range of tools, or *organizational levers*, designed to motivate personnel. Such levers might include setting new goals and objectives, communicating them throughout all levels of the organization, and changing performance evaluation and incentives in order to encourage their adoption. Particular to the set of reform measures that the Air Force planned to undertake was increased teaming among personnel. Similarly, success at the operating level, which is where most repair contracts are written, depends on how effectively senior leadership can move personnel toward continued use of new

practices after their initial introduction. The authors analyzed whether the Air Force's existing *organizational levers* resulted in the use of CREP's innovative reforms within depot-level repair contracts. We focused on Warner Robins Air Logistics Center (ALC) because it had aggressively pursued the incorporation of CREP tenets in its repair contracts. It appeared that Warner Robins represented the ALC most likely to have the largest sample size and most variation in the number of CREP tenets incorporated in repair contracts.

Our study used a three-step approach. Step one consisted of a *literature review* on organizational levers and innovation in the private sector, combined with *interviews* with personnel considered to have excelled at incorporating CREP tenets in the first CREP contracts. The literature review and interviews formed the basis for step two, a *survey* of key personnel participating on contract repair teams (CRTs), i.e., program managers, procurement contracting officers, production management specialists, and item management specialists. Step three involved regression analyses. The survey was used to measure organizational levers, which became the independent variables. Survey data were used in combination with reported CREP tenets—the dependent variables—in the regression analyses. CREP tenets were classified by tenet groups—simple modifications, key acquisition reform concepts, complete acquisition reform concepts, agile logistics, and all CREP tenets—which became the dependent variables. Regression analyses were carried out to determine the relationship between each organizational lever and the number of CREP tenets incorporated in the contract. Each step is discussed in more detail below.

Literature Review and Interviews

In step one, we reviewed the business and management science literature on the kinds of organizational levers senior leadership uses to motivate private-sector enterprises to adopt new business practices. The literature review helped to identify organizational levers to be measured in the personnel survey. In turn, the review helped structure our subsequent interviews with CREP contracting teams at Warner Robins ALC. Similarly, the interviews helped us understand how these levers operated within the ALC and the CREP initiative and influenced the development of the next phase, the survey. We

asked CRT personnel to talk about specific CREP contracts and asked them questions related to organizational levers within these examples of contract innovation. The interviews helped us to develop questions using language and context we believed were likely to resonate with potential survey participants, thus preparing us for step two.

Survey Development and Administration

In step two, based on inputs from the literature review and interviews conducted at Warner Robins ALC, we created a survey instrument designed to gather information on organizational levers. The survey asked questions in five categories that supplied data for eight organizational lever variables. Those categories were (1) attitude toward acquisition reform, (2) leadership support, (3) performance evaluation and rewards, (4) teaming and partnering, and (5) training and career development. We surveyed key members of contract repair teams. The survey was conducted first in 1998 and again in 1999 for only those participants who had missing data in the first round or failed to respond. Each participant provided only one set of responses.

Analyses

In step three, regression analyses showed that there was a relationship between organizational levers and reported CREP tenet use. Between December 1996 and September 1998, for each CREP contract, the ALCs considered the incorporation of 16 tenets identified by HQ Air Force Materiel Command (AFMC) as innovative and consistent with CREP goals. These reported tenets were used as the measure of contract innovation. The research process involved survey data, i.e., organizational levers that served as independent variables in the regression. The process also involved tenet data, which served as dependent variables in the regression analyses.

Step 3A. Prior to the regression analyses, *Principal Components Analysis (PCA)* was used to organize responses to organizational levers (the independent variables). PCA allows the analyst to examine relationships among item responses to determine whether particular questions reflect the same underlying concept. The survey con-

tained questions on organizational lever themes; thus, PCA provided a technique to group questions along these themes. The PCA technique helped identify eight organizational levers that were called:

- Attitude toward acquisition reform
- Leadership consistency
- Performance evaluation
- Performance incentives
- Effective teaming
- Contractor partnering
- Air Force partnering
- Training in acquisition reform.

Two other variables, job experience and a U-2 dummy variable for the U-2 Product Directorate, since renamed the Intelligence, Surveillance, and Reconnaissance Management Directorate, were computed directly and did not require PCA.

Step 3B. CREP Tenet Groups (the dependent variables). The study used CREP tenets as an element of the dependent variables, which were defined by AFMC as its measure of contract innovation and collected throughout the initiative. We received a record of the tenets Warner Robins ALC incorporated in their CREP contracts from HQ AFMC. Individual CREP tenets were not used as dependent variables, because they lacked policy significance by themselves. The question became one of how to group CREP tenets in ways that would have strategic policy relevance to decisionmakers, i.e., to high-level policy goals and objectives. We analyzed the tenet data using cluster analysis to discern the natural groups of tenets, but the cluster analysis showed tenet clusters that had no policy relevance. In the end, we chose to use as dependent variables groups of CREP tenets that were broadly defined by the CREP initiative itself and had strategic policy relevance, plus a fifth group that included all CREP tenets. Some tenets were included in more than one group.

The first innovation group, called *simple modifications*, included the easiest tenets to implement with still-active contracts, usually related to speeding up transportation. The second group, called *key acqui-*

sition reform concepts, consisted of reform tenets that were consistent with acquisition reform goals and could be measured more objectively. The third group, called *complete acquisition reform concepts*, measured all reform tenets included in the second group, plus other acquisition reform-related tenets that involved subjective measures. The fourth group, called *agile logistics*, included all tenets designed to reduce logistics pipelines by speeding up the repair and transportation pipeline segments, as well as improving other logistics efficiencies. The fifth group, called *all tenets*, included the complete set of CREP tenets. These five groups of tenets became the dependent variables.

Step 3C. Regression Analyses. We conducted five separate regression analyses to determine the relationship between the organizational levers used at Warner Robins and the incorporation of CREP tenets in repair contracts, designed to improve total weapon system costs and readiness. The regression analyses showed that some organizational levers help explain the incorporation of CREP tenets in repair contracts. Thus, this study demonstrated that senior leadership can influence contract innovation through organizational levers, although not always in expected ways. (See pp. 37–43.)

RESULTS: ORGANIZATIONAL LEVERS RELATED TO CONTRACT INNOVATION

Our analyses showed that organizational levers help explain the degree of tenet use that teams achieve with repair and sustainment contracts. The tenets ranged from easy-to-implement transportation improvements to more difficult acquisition reform measures, such as early contractor involvement in the contracting process. In some areas, the levers were positively related to the use of CREP tenets; in others, the levers were negative; and in a few, they had no influence at all. The findings were as follows:

- **Training in acquisition reform** had a consistent and positive statistical relationship with tenet use. The statistical analyses showed significance in all four groups of CREP tenets along with the group of all CREP tenets. CRT personnel who receive more training used more tenets in their contracts compared with personnel with less training. (See p. 38.)

- **Attitude toward acquisition reform** also had a consistent, positive statistical relationship on reported tenet use in all tenet groups, except as it related to key acquisition reform. These results suggest that contract teams that view reform more positively or agree with the goals of the initiative also implement more reform tenets in their contracts. (See p. 40.)
- **Effective teaming** had a negative statistical relationship with reported tenet use. Contract teams that reported effective teaming also implemented fewer tenets. (See p. 38.)
- **Contractor partnering** had a positive statistical relationship with simple modifications and agile logistics innovation goals. CRTs that perceived contractors to be better partners included more CREP tenets in their contracts. This result, however, did not occur with either of the two acquisition reform tenet models. (See p. 40.)
- **Leadership consistency** had a positive statistical relationship with tenet implementation. CRTs that perceived consistent messages throughout management and believed reform would be around for some time incorporated more agile logistics tenets in their contracts. (See pp. 40–41.)
- **Performance evaluation** had a surprisingly negative statistical relationship on CRT behavior with respect to agile logistics tenets and no significant relationship elsewhere. (See p. 41.)
- **Job experience** had a slight negative statistical relationship with the simple modifications and the complete acquisition reform innovation groups, but the magnitude was so minimal as to have little practical consequence.

Two variables—**performance incentives** and **Air Force partnering**—had no explanatory power in our analyses. Perhaps the types of incentives we included in the survey were not sufficiently representative of rewards offered or perhaps personnel do not perceive these rewards as effective. The lack of a relationship between Air Force partnering and the incorporation of CREP tenets, however, raises questions about the Air Force’s view of itself as a customer and its effect on innovation.

Finally, we also tested a dummy variable that took into account different contracting processes and contracts that occurred in the **U-2 Product Directorate** (now the Intelligence, Surveillance, and Reconnaissance, or ISR Management Directorate). Specifically, the U-2 Product Directorate produced sustainment contracts that included repair services rather than solely repair contracts. Our analysis found that the fact that a contract was written at the U-2 Product Directorate was positively associated with the reported incorporation of complete acquisition reform concepts and agile logistics tenets in CREP contracts. At the time of this study, the U-2 Product Directorate reported a high rate of tenet use, which has been substantiated with follow up discussions at Warner Robins ALC.

LESSONS FOR THE AIR FORCE

In general, the results suggest that the Air Force should continue to make effective use of those levers associated with positive results (especially training and fostering positive attitudes toward acquisition reform), while revisiting others associated with negative results (especially performance evaluation and teaming). Specifically, the Air Force could do more to:

- Let personnel know that senior leadership wants to see progress in achieving well-specified contracting goals
- Learn how to create effective teams. This process will require training in group problem-solving and working with others from different functional backgrounds, in addition to educating teams on legal and policy changes
- Align personal evaluation criteria with reform goals.

EXTENDING THESE RESULTS TO OTHER ALCS AND INITIATIVES

To the degree that the CREP initiative is representative of contract reform efforts in general, the Air Force should consider reinforcing the organizational levers that influence innovation and looking more closely at those that seem to have no relationship or have a negative relationship with innovation. (See pp. 42–43.)

Are the lessons from this study applicable to new contract-related initiatives or to other Air Logistics Centers? We hypothesize that it is reasonable to think the dynamics between organizational levers and contract innovation at Warner Robins ALC are similar to the dynamics of these variables at both Oklahoma City and Ogden ALCs. However, it is also possible that, because this study analyzed contracts at a center viewed by HQ AFMC as particularly innovative, these results would not apply to the other two centers. Also, senior leadership at the other ALCs may have had a different impact on personnel behavior at their particular center. One would have to conduct a similar analysis at the other ALCs to know whether Warner Robins represents a unique case.

Could the same relationship between levers and innovation that we find under the CREP initiative occur with other contract initiatives? After all, the Air Force has taken on many other contracting-related initiatives since CREP. Many of those attempt more significant change in behaviors and even organizational structure, such as the purchasing and supply chain management (PSCM) initiative.¹ If senior leadership does not address those levers identified as having no relationship or having a negative relationship with innovation, then leadership may have to work as diligently—or more, depending on the initiative—to implement other innovative practices, much as it did for CREP. (See pp. 43–44.)

As senior leadership considers the behavioral implications of contracting initiatives such as CREP in the future, this study should provide suggestions as to what leadership needs to strengthen or understand better if it wants personnel to implement contract innova-

¹The PSCM initiative, demonstrated on the F100 engine at Oklahoma City ALC in FY2002, has as its objective a strategic means of selecting and managing suppliers to provide more effective and efficient support to the warfighter. While consistent with CREP outcome goals, PSCM tries to do much more than CREP. PSCM would work with purchasing and supply chain activities from an enterprise- to operating-level perspective. It is strategic in scope and implies new processes, practices, and organizational structure. Behavioral implications for PSCM are more significant than CREP. See *Talking Paper on Adopting Improved Purchasing and Supply Chain Management*, Headquarters U.S. Air Force, Installations and Logistics, Supply Chain Integration and Logistics Transformation (HAF/IL-I), November 25, 2002. Also, see Nancy Y. Moore et al., *Implementing Purchasing and Supply Management Practices: Lessons from Innovative Commercial Firms*, RAND, DB-334-AF, 2002. Available at <http://www.rand.org/publications/DB/DB334/>.

tion. This study also provides an analytical approach to updating the relationship between organizational levers and new forms of contract innovation. Since this study began, the Air Force has added contract-related initiatives that are more complicated than CREP in their approach and expected outcomes—for example, PSCM, corporate contracting, and performance-based contracting. This study thus offers a methodology that can analyze the relationship between individual organizational levers and contract innovation. Organizational levers and their relationship with behavior and innovation continue to be of great interest to the Air Force, especially as it transforms to the changing threat environment and takes on ever more aggressive contract innovation and PSCM implementation efforts.

ACKNOWLEDGMENTS

The research described in this report was part of a larger effort led by Frank Camm and Nancy Moore that examined barriers to implementing acquisition reform initiatives for Air Force logistics contracting and sourcing. This study analyzed the relationship between the various ways senior leadership encouraged reform and innovation during the CREP initiative. This effort coincided with acquisition reform implementation in logistics contracts.

We were very grateful for the support Warner Robins ALC senior leadership, specifically, Stephen Davis (WR-ALC/CD) and George Falldine (WR-ALC/XP), gave to this effort. We appreciated the tremendous assistance that Jim Grant (WR-ALC/LKT, formerly PKP), provided us in helping set up many interviews with personnel considered by their peers as particularly innovative. We received significant support from Connie Black (WR-ALC/RE), who helped us understand how Warner Robins ALC was changing its processes under CREP and introduced us to CREP converters—those individuals responsible for leading the initiative within their respective product directorates.

Thanks to Mr. Davis' support, we had access to all product directorate chiefs for one-time interviews, to CREP converters, and to 177 personnel who participated on Contract Repair Teams and in our web-based CREP survey in 1998 and 1999. CREP converters helped us identify key members of the CRTs to include in the survey. Much of the anecdotal information that shaped both the contract design and behavioral models came from in-depth interviews with those CRTs. We thank those individuals whom we interviewed, those who

helped us identify potential survey participants, and everyone who participated in the survey.

Jason Lingel and Eric Bird provided outstanding assistance in designing and coding the web-based, online survey. Eric provided the programming expertise for the survey in 1998. Jason created an automatic means of tailoring the survey to past individual responses in 1999, so that the follow-on survey incorporated prior responses and identified missing answers. In 1999, new participants received blank survey forms. Jason and Eric made it possible for us to conduct a completely paperless survey, which greatly facilitated our data analysis efforts and we hope made it easy for CRT members to complete.

Frank Camm and Laura Baldwin contributed significantly to this study. Frank Camm supported this study throughout by providing helpful feedback on its methodology, reviewing our findings, and commenting at length, which markedly enhanced the report. Laura Baldwin also provided many insightful, helpful comments. Megan Abbott, a communications analyst, helped us convey the information effectively to a general audience.

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This effort required a great deal of data collection, scrubbing, synthesis, and modeling. Again, we are especially grateful for the comprehensive assistance Warner Robins ALC provided this study. The authors take responsibility for the analysis, content, and interpretations found in this report.

ACRONYMS

AFMC	Air Force Materiel Command
AL	Agile Logistics
ALC	Air Logistics Center
AR	Acquisition Reform
AREP	Aircraft Repair Enhancement Program
CREP	Contract Repair Enhancement Program
CRI	Consolidated Repairable Inventory
CRT	Contract Repair Team
CSI	Consolidated Serviceable Inventory
DLR	Depot Level Recoverable or Depot Level Repairable
DCAA	Defense Contract Audit Agency
DCMA	Defense Contract Management Agency
DREP	Depot Repair Enhancement Program
IMS	Item Management Specialist
IPT	Integrated Product Team
LRU	Line Replacement Unit
MICAP	Mission Capable
NIIN	National Item Identification Number
NSN	National Stock Number
PCA	Principal Components Analysis
PCO	Procurement Contracting Officer
PD	Product Directorate
PM/LO	Program Manager/Logistics Officer
PMS	Production Management Specialist
PSCM	Purchasing and Supply Chain Management
RBL	Readiness Based Leveling
SAF/AQC	Secretary of the Air Force, Deputy Assistant Secretary for Contracting

SOO	Statement of Objective
SOW	Statement of Work
SRU	Shop Replacement Unit
WR-ALC	Warner Robins Air Logistics Center

The U.S. Air Force has tried for some years to reform business and contracting practices by attempting to implement best commercial practices in its logistics support services. Many of the ideas for improving the way it purchases these products and services come under the heading of acquisition reform (AR) or more recently, acquisition excellence, which falls under the Deputy Assistant Secretary of the Air Force (Contracting) (SAF/AQC). Acquisition reform showed that best practices could lead to dramatic cost improvements and accelerated program schedules in the acquisition of major weapon systems, such as aircraft and missiles. Soon after, the Air Force tried to apply similar best practices to depot-level services to deliver products and services that were “better, faster, and cheaper.” Specifically, it wanted to bring improved savings and effectiveness to an area that has proven unusually difficult to shrink in size—depot-level maintenance and repair—while still meeting readiness goals. However, the pace of implementing its acquisition reform efforts occurred slowly. In response, the Air Force asked RAND for help in understanding what might be hindering personnel from implementing reform more quickly. If the right policies were in place but the pace of improvements in logistics support services was slower than desired, then a natural place to look for explanation is in those tools senior leadership use to foster specific personnel behavior and ultimately innovation. In the business world, these tools are frequently termed “organizational levers.” Our study thus looked closely at the organizational levers in place during the Air Force’s reform efforts and their relationship to repair contract innovation.

BACKGROUND

In 1995, the Air Force initiated efforts to improve logistics through its “lean logistics” model.¹ Lean logistics was meant to improve aircraft availability through faster repair cycle times for depot-level repairables (DLRs), prioritized repair, and faster transportation. Such improvements might also reduce the size and cost of supply inventories and thus reduce the in-place resources and assets necessary to support deployed forces, a signature goal of the efforts that followed and eventually incorporated lean logistics, today known as agile logistics. Agile logistics better captured the objective of “[restructuring] the worldwide logistics system to equip operational commanders and their combat forces with increased deployment speed, range and maneuverability.”² Over the next year, the Air Force Materiel Command (AFMC) initiated the Depot Repair Enhancement Program (DREP) and Aircraft Repair Enhancement Program (AREP). DREP’s attempts to enhance user-oriented metrics, such as “not mission-capable due to supply” and AWP (awaiting parts) time, and initial improvements seen in the performance of Air Force-owned, organic (noncontracted) repair activities made it obvious that aircraft availability objectives could not be met without also improving contract repair processes. In fact, the long contract-repair schedules for some units stymied efforts at reducing organic repair schedules for other units. As a companion to these programs, in 1995 AFMC developed the Contract Repair Enhancement Program (CREP) to mirror the agile logistics goals at the contract-repair level.

In 1996, independent of CREP, the Department of Defense (DoD) began AR efforts. Specifically, DoD extended AR goals and objectives that had been developed for the acquisition of large weapon systems to the purchasing of logistics support. In comparison with lean and agile logistics efforts, which were originally focused on improving *organic* rather than *contract* operations, AR paid more attention to specific contract design goals and processes used successfully by

¹The PACER LEAN initiative launched in 1995 applied lean logistics concepts to selected systems at each Air Logistics Center (ALC). These prototypes were supposed to identify process changes needed to speed component repair.

²Lt Gen William P. Hallin, “Agile logistics: Where we’ve been, where we’re going,” *Air Force News*, April 28, 1998.

private-sector firms. AR emphasized greater contractor participation in specifying the repair process, the elimination of unnecessary data-reporting requirements, early involvement of the supplier in contract design formulation, and other practices used in the commercial world to reduce costs and enhance support.

Because of the similarity in goals between agile logistics and acquisition reform, acquisition reform tenets were added to CREP's already existing agile logistics tenets in 1996. CREP was thus designed to incorporate the best of both AR and lean logistics, adopting the faster repair cycle time emphasis of lean logistics and the better contract design and contract process objectives of acquisition reform.

When the data for this study were collected in 1998 and 1999, CREP operated under the assumption that major changes in how contracts were written should improve cycle time, cost, and quality. To encourage Contract Repair Teams (CRTs) to consider a wide spectrum of innovations that were consistent with acquisition reform and agile logistics goals, HQ AFMC developed a checklist of 16 CREP tenets that it wanted the ALCs to consider incorporating in their CREP contracts. These tenets were based on the Air Force's original acquisition reform initiatives and on lean logistics reforms (later called agile logistics reforms).

All CREP tenets on the checklist applied to at least one of the improvement areas mentioned above, i.e., improved cycle time, cost, and quality. For example, CREP called for functional expert teaming at the outset and early contractor involvement. This teaming was ultimately supposed to lead to better coordination between requirements and contract conditions, shorter administrative lead-time, and improved contracts, along with a reduction in overall costs. In addition, as part of its AR philosophy, CREP allowed the contractor more say in how repairs were accomplished. CREP also removed non-value-added and unnecessary government requirements in contracts to reduce contractor costs; in special cases, this reform may lead to more competition for governmental contracts and the entrance of new suppliers.³ Many of the overarching objectives of

³Most repair contracts, measured in dollars, are sole source. (Sole sources of repair can arise if the contractor owns the technical data, which raises a barrier to new entrants, or if the market is limited, such as with obsolete technology or items with low

CREP were embodied in the use of innovative contract tenets that were reported to HQ AFMC by the CRTs. The tenets were a practical means of translating the strategic goals of “faster, better, cheaper” into tactical goals that could be measured and incorporated in contracts and the contracting process.

One goal of CREP—to speed repairs—has the potential benefit of cutting overall costs, provided the increased speed costs less than replenishing the inventory with new spares. AFMC developed a cost-benefit analysis tool to help personnel compare the cost of shortening repair cycle time with the cost of new inventory associated with the current repair cycle time.⁴ In sum, a number of CREP innovations are meant to ensure the Air Force provides responsive service while improving the contract itself and streamlining the contract process.

Still, as noted earlier, reform has been slow. Thus, to identify the barriers to acquisition reform implementation, this study examined the incorporation of CREP tenets in repair contracts at an Air Force Air Logistics Center. The study tried to link this incorporation to various organizational levers, or policies and practices senior leadership has at its disposal to encourage and influence individual behavior, especially behavior at the operating level where most repair contracts are written.

At present, the Air Force conducts its logistics services at three AFMC ALCs: Oklahoma City in Oklahoma, Ogden in Utah, and Warner Robins in Georgia. These ALCs provide serviceable parts to their customers through the purchase of new parts and the repair of unserviceable or recoverable items. For our study, we chose to focus on acquisition reform and agile logistics implementation at Warner Robins ALC because its senior leadership had aggressively pursued

failure rates.) Thus, this change may have an effect, albeit a minor one. Primarily commercial systems, such as business jets used by senior leadership in the field, benefit the most from the removal of military specifications and standards. Removal of standards and specifications on combat-essential weapon systems must be done carefully; the benefit here primarily reduces costs to the sole-source provider.

⁴At the time of this study, only about 10 percent of CREP items were in a buy position, which meant that most items required cycle-time reductions at no additional cost. In some cases, CRTs accomplished this through reengineering the repair process, which required ALC approval.

CREP and gave it significant attention from the beginning of the initiative. Warner Robins also officially reported the second highest number of CREP contracts to HQ AFMC, providing a large number of observations from a single center.⁵

Between December 1996 and September 1998, each ALC evaluated its repair contracts for consistency with CREP goals.⁶ The evaluation consisted of determining the number of CREP tenets incorporated using the 16-item checklist of tenets developed from the ALCs' initial experience in applying agile logistics and best practices to their first prototype CREP contracts. After the establishment of the checklist, HQ AFMC required the ALCs to report quarterly on the number of these tenets they had incorporated in DLR contracts, either through modifications or new contracts (more details about 16 goals are in Chapter Two of this report). Although the metric served as an administrative device to track the pace of acquisition reform in repair contracts, its criteria for classifying the inclusion of specific tenets in a contract were not clearly defined, as reported by interviewed Warner Robins ALC personnel.⁷ CREP tenet reporting ended in September 1998. This metric was the best available formal Air Force summary measure on contracts the ALCs consider "improved" under the tenets incorporated on those contracts.

NEEDED BEHAVIORAL CHANGES

Improvements in the contract repair processes do not come without some tradeoffs to the Air Force. There are aspects of CREP that may make repair more costly initially or locally. On the other hand, these

⁵In September 1998, the five Air Force ALCs reported the following total number of contracts that had incorporated CREP tenets: Ogden ALC, 20; Oklahoma City ALC, 54; Sacramento ALC, 82; San Antonio ALC, 229; Warner Robins ALC, 101. San Antonio stands out because it appeared to report CREP tenets on contract modifications in addition to basic contract numbers, unlike the other four ALCs. If one were restricted to contract numbers alone, San Antonio's number would have dropped from 229 to 152. Viewed this way, Warner Robins looked like a good place to study CREP contracts.

⁶*Contract Repair Enhancement Program (CREP) Phase III Implementation: A Briefing*, Warner Robins ALC, February 19, 1997.

⁷As an example, one CREP tenet is to reduce military standards and specifications. It is unclear whether the reduction of one standard or specification was enough for a CRT to report success in using this tenet.

initiatives may ultimately reduce long-term total costs. For example, CREP requires that the contractor assume some risk in terms of equipment and manpower availability—so that they may perform efficient repair work on short notice (i.e., “just-in-time” repair on demand). In turn, for work in which there is only one contractor working on items that require expensive repair, CRTs considered allowing contractors to order long-lead-time material at Air Force expense (i.e., allowing the contractor to lay in parts needed for the repair before the repair actually occurred). These concepts are not new, but their use on certain repair contracts appears to have expanded. Additionally, working toward shorter repair cycle times involves a tradeoff. Contractors may be able to provide a product more quickly—the stated goal of agile logistics—but it may come with increased unit repair cost to the Air Force. These innovations, however, are still preferable when they lead to overall reduced total ownership costs.

Implicit in some CREP tenets, such as early contractor involvement, is a change in how and when the contractor is brought into the contracting process. Laying in long-lead-time material, for instance, required senior leadership approval and also implied changes to the process. For teams to achieve the incorporation of some tenets, teams had to go beyond traditional methods and had to build business cases to meet requirements in new ways that were consistent with CREP. These differences in solving contracting problems were not specifically recorded but were implicit in many of the CREP tenets. The challenge to senior leadership was to encourage individuals to take the new practices and policies provided by acquisition reform and agile logistics and implement innovation, even though methods for achieving innovation—the incorporation of CREP tenets—had to be discovered, learned, and refined. The implementation of CREP required CRTs to behave differently. Senior leadership had instructed CRTs to implement CREP and had various tools to encourage changed behavior from CRT team members, which we turn to next.

This study took the approach that senior leadership has available organizational levers or methods by which it can influence individual behavior at the operational level for contracting. It did not address process changes brought about by this initiative. AFMC adopted the Integrated Product Team (IPT) approach of CREP with its Contract

Repair Teams, along with the early acquisition reform and agile logistics goals and approaches as standard practice.⁸ Some of the most important process changes, such as the use of the cost-benefit analysis tool and teaming, were available to all CRTs at the same time. Our study focused on differences in CREP tenet incorporation outcomes with respect to teams and organizational levers. We were particularly interested in what influenced depot-level personnel to implement CREP and what leadership could do to further encourage innovation implementation.⁹

This report considers how organizational levers are associated with change in contract design and the contract process through their relationship with personnel attitudes and behaviors. For any major change in business practice to succeed over the long run, preferred behavior must not be a temporary shift or allowed to revert to the old ways once senior leadership attention moves on to another initiative.

In a separate analysis we conducted on contracts written during the CREP initiative, we found that contracts incorporating CREP tenets had different outcomes than non-CREP contracts. Data on recoverable items on CREP and non-CREP contracts written over a similar period showed statistically unchanged repair prices for CREP items compared with non-CREP items. On average, prices increased for non-CREP items, but they held steady for CREP components. Negotiated flow days—the repair cycle time required by the contract—for items on CREP and non-CREP contracts showed real improvements, i.e., they were both less than their respective previous contract flow days. Although the flow days for non-CREP items improved more than for CREP items, i.e., they decreased from previous flow days,

⁸Before CREP, ALC personnel processed the requirements, writing and negotiating the contract in a series of sequential steps. Personnel formally assembled jointly at the end of this process at a Contract Management Review Board (CMRB) meeting. With CREP, personnel met as a Contract Repair Team at the beginning of the process to make decisions collectively. This procedure allowed teams to make major changes in contracts that otherwise might not have occurred because of the approval needed by all functional experts.

⁹Factors other than organizational levers may have accounted for the incorporation of CREP tenets. Technically, these other factors are captured in the regression residual variables. Recognizing that factors other than organizational levers can explain reform, we examined unit price and repair flow day differences in CREP and non-CREP contracts written about the same time (see Appendix A). The comparison captures the effect of all factors influencing CRT behavior during the study period.

they did so with higher prices. Flow days for CREP items decreased at the same time their prices remained essentially unchanged. Appendix A discusses these results.

Even though the introductory phase of the reform process is over, opportunities for repair contract improvements continue.¹⁰ As contracts written early in the initiative expire, CRTs have a chance to apply the lessons learned to date to write even better contracts. In addition, as best practices evolve and private-sector firms continuously improve costs, product quality, and schedule, CRTs can benefit from these greater efficiencies as successive generations of CREP contracts expire.

As senior leadership attention moves on to new problems and issues, the continued pace of reform implementation will depend on the extent to which the Air Force leadership and the organization can encourage new, desired behavior. This study's findings suggest two types of lessons from CREP. First, our results suggest that at Warner Robins ALC, many of the senior leadership's organizational levers had a positive relationship with contract innovation. These levers are a sign of success and suggest that those policies and practices AFMC and Warner Robins ALC used for CREP were constructive. Second, there are indications that other organizational levers were not related to innovation. These levers need to be investigated; if they are not understood and addressed, they could continue to have a negative or neutral relationship to contract innovation.

Having thus outlined the CREP initiative that served as the focus of our study, let us now turn to the next chapter, which describes this study's approach and, in particular, the survey conducted at Warner Robins ALC to measure organizational levers. Chapter Three presents the results of the regression analyses we conducted on the survey data with respect to tenet use and discusses the significance and implications for the implementation of acquisition reform and other Air Force initiatives. A series of appendices provides detailed discussions on technical topics. Appendix A shows several histograms describing changes in price and schedule for items in CREP and non-

¹⁰Even though the Air Force has changed its contract repair process along the lines of the CREP initiative, CREP has been a clearinghouse for contract reform and contract process changes.

CREP contracts. Appendix B provides a copy of the questions used to structure interviews conducted in April 1998 and June 1998 with CRTs. Appendix C provides a copy of the web-based survey as it appeared to participants. Appendix D discusses the principal components analyses conducted on the survey data used to create the independent variables—organizational levers—in the regression analyses. Finally, Appendix E provides the detailed results of the regression analyses.

METHODOLOGICAL APPROACH

Senior leadership can play a vital role in affecting change in business practices through its capacity to set new goals and objectives, communicate them throughout all levels of the organization, and modify performance evaluation and incentives in ways that encourage personnel to adopt those new business practices. Success at the operating level depends on how effectively senior leadership can move personnel toward changed behavior and maintain that behavior long after an initiative becomes standard operating policy. The tools leadership has to motivate line-operator personnel are what this study refers to as “organizational levers,” i.e., those means by which leadership encourages and influences individual behavior to achieve certain policy goals and objectives.

This chapter describes our study methodology; in particular, we describe our process of measuring the organizational levers in use at Warner Robins ALC—levers designed to stimulate the use of CREP tenets in repair contracts. We then outline the survey we conducted at Warner Robins ALC to assess behaviors and attitudes toward acquisition reform. Specifically, the survey measured organizational levers at Warner Robins ALC during the CREP initiative. This chapter also describes the regression models we developed to explore the relationship between these levers and number of select CREP tenets incorporated in a contract.

Achieving improvements in ALC contract repair outcomes is complex. The large variety of contracts and the number of contractors with whom ALCs work mean operating-level personnel must have significant motivation to translate senior leadership policy guidance

and directives into each repair contract. Improved repair outcomes from contractors do not happen by Air Force fiat, particularly because personnel at contract repair facilities answer to their own corporate leadership, not to the Air Force. Thus, to generate better outcomes, Air Force senior leadership faces challenges to find ways to motivate its contract repair teams to write the kinds of contracts that ultimately lead to improved performance from contractors and to manage the Air Force-contractor relationship from a mutually beneficial perspective.

How does the Air Force seek to galvanize its contract repair teams so that they write innovative contracts and manage the Air Force-contractor relationship more effectively and consistently? Senior leadership generally uses a series of levers that influence specific kinds of organizational practices and behavior. If these organizational levers are aligned and operating as Air Force senior leadership intends, one would expect to see the kind of relationship between levers and contract outcomes the Air Force wants—i.e., organizational levers help explain contract measures of success with respect to the contract initiative, such as CREP.

To examine Warner Robins ALC's use of organizational levers and the outcome on contract innovation, this study followed three steps. First, we conducted a *literature review and interviews* with key personnel at an ALC. Second, we developed a *survey* based on the review and interviews and administered it to personnel on CREP Contract Repair Teams. Third, we conducted a series of *analyses* that ultimately established through empirical means a relationship between organizational levers and a contract measure of innovation—that is, the number of CREP tenets incorporated in repair contracts. The analyses involved a three-part process. One phase of the analytical process used principal components analysis (PCA) on the survey responses to identify questions associated with specific organizational levers (the independent variables). Another phase of the analytical process developed five groups of specific kinds of CREP tenets incorporated in repair contracts (the dependent variables). The final phase of the analytical process involved *regression analyses* to determine whether organizational levers could help explain the extent to which these grouped tenets were incorporated in repair contracts. These CREP tenets were considered by AFMC as improvements to be implemented in logistics support contracts and measures of innova-

tion. The reader can refer to Appendix B for the interview questions and Appendix C for the PCA technique used to determine the organizational levers. Each of these steps is described in more detail below.

LITERATURE REVIEW AND INTERVIEWS

The Air Force's shift to acquisition reform and new business practices mirrors private-sector transformation efforts in that it requires significant changes in organizational behaviors and attitudes. The study team reviewed the literature on organizational transformation to identify those elements considered key in helping commercial firms transform their business practices and organizations. The review indicated that companies that have successfully pursued large-scale transformation have made changes to all of their major organizational subsystems, including work structures and processes, training and rewards systems, and organizational culture. The CREP initiative attempted smaller-scale changes that focused on encouraging new behaviors from the organization using new policies and slightly different processes, such as teaming, cost-benefit analyses, and early contractor involvement.

Literature Review

The literature on successful organizational change within private-sector firms argues that a key element to instituting such transformation is leadership support (Strebel, 1996; Katzenbach and Smith, 1993; Larkin and Larkin, 1994). All levels of management must openly promote a consistent platform of change in order to motivate employee working modes.

Typically, employees resist change in work behavior unless incentives are in place to reward new behaviors. The literature suggests necessary steps for incentives to change behavior successfully. First, management must provide clear standards of evaluation that are aligned with performance goals (Pfeffer, 1996; Strebel, 1996). Next, Pfeffer (1996) and Strebel (1996) suggest that leaders must provide feedback on whether employee performance is leading to better contract performance. Finally, consistent rewards and/or sanctions are needed to reinforce behavior over time (Ghoshal and Bartlett,

1996). The effectiveness of rewards will be realized only if contracting personnel are told how to achieve them (Pfeffer, 1996).

To ensure that new contracting practices continue to be implemented over time, psychological barriers of change must also be addressed. Part of leadership's responsibility is to instill the understanding that implementing new contracting practices will lead to improved contract performance. Employees need "proof" that these new methods will help them create a better contract (Larkin and Larkin, 1994). Addressing these needs can facilitate the continuation of changed behaviors and attitudes past the introductory phase.

In sum, the literature on successful organizational transformation suggests that permanent changes in contracting personnel behavior will come only through consistent, thorough support by Air Force leadership. This support may be demonstrated in a number of ways: consistent communication of support by leadership, incentives for new behaviors, training and skill development, and performance feedback. These factors should lead to changes in employee attitudes that then promote innovation. Changes in attitudes will help maintain new behaviors over time.

A review of the literature identified at the highest, general level the kinds of organizational levers that private-sector firms have found to be important in their own transformational efforts. The levers from the review became topics for discussion in interviews with Warner Robins ALC personnel who were selected by the ALC as innovative in writing CREP contracts. Interviews at Warner Robins ALC then helped the study team construct a survey that would eventually be used to measure organizational levers. We next describe the interviews.

Interviews

The interviews conducted at Warner Robins ALC provided the study team insight on how organizational levers operated at the center during the CREP initiative. We were interested in listening to the language that CRT personnel used when talking about these levers and the issues raised. These interviews influenced the way we framed our survey questions.

The study team conducted three sets of meetings at Warner Robins ALC to accomplish three objectives. During the first set of meetings (March 10–11, 1998), we met with all key CREP stakeholders to communicate our study's goals and objectives and to gain product directorate leadership approval to interview their personnel. We first met with personnel at Warner Robins ALC who could help us gain support of the product directorate chiefs to conduct a survey of their personnel. In particular, we met with the chiefs of Plans and Programs (XP), Contracts (PK), and Reengineering (RE). (Warner Robins ALC/RE was a facilitating office for processes and practices needed to implement CREP.) We also met with chiefs and/or their staff in the then-product directorates of Ground Equipment (LB), C-5 (LC), F-15 (LF), Electronic Warfare (LN), U-2 (LR), Special Operations Forces (LU), and Avionics (LY). In these meetings, we conveyed the study's goals and established contact with those CRTs considered by Warner Robins ALC/PK and Warner Robins ALC/RE as especially innovative in their CREP implementation. These high-level meetings were critical in helping us to gain access to individuals with whom we conducted in-depth interviews and ultimately surveyed.

Most of the full-scale interview data were collected during the second and third sets of meetings at Warner Robins ALC. In the second set of meetings (April 7–8, 1998), we met with CRT members in LF, LR, LN, LK, LU, and LY. In the third set of meetings (June 8–9, 1988), we met with CRT members in LN and LU. The meetings took place in groups to minimize ALC time and effort. We interviewed program managers, procurement contracting officers, production management specialists, and item management specialists. Participants were given a list of questions before the meeting. (Appendix B presents the interview questions.) We asked interviewees to think about the questions within the context of a specific contract the center considered most innovative or successful in incorporating CREP tenets.

We then asked a series of questions about the contracts they had in mind, covering such areas as:

- *Background of the contract:* general description and characteristics
- *Contracting process:* differences in the process as a result of CREP

- *CRT/IPT*: how teams were created, who participated, how the teams worked together
- *Design of the contract*: innovations considered and incorporated; challenges and methods of resolution
- *Lessons learned*: what the CRT learned, what individual team members learned, how lessons were transmitted to other teams.

Individuals discussed their experiences with particular CREP contracts. Using the context of a specific contract, we asked questions or guided discussions toward topics related to organizational levers. Individuals told us what worked and what was most difficult in incorporating CREP tenets. The information from these interviews, along with the organizational levers identified in the literature review, was used to develop the survey questions.

We next discuss the survey conducted at Warner Robins ALC. The survey asked members of CRTs how strongly they agreed with a series of statements about acquisition reform, leadership, performance evaluation and rewards, teaming and partnering, and training and career development. (The survey questions are reproduced in Appendix C.)

SURVEY OF WARNER ROBINS ALC

Data were collected on organizational levers through a survey of key members of contract repair teams. To develop the survey, we relied on the aforementioned literature review findings and on in-depth interviews conducted with CRTs identified by Warner Robins ALC as on the cutting edge of writing innovative contracts. The survey included those elements considered in the literature as important in eliciting new behaviors from individuals in private-sector organizations. For the survey, we adapted these elements to a CREP context and emphasized issues considered as key drivers or inhibitors of innovation by the individuals interviewed at the ALC. Warner Robins ALC senior leadership reviewed the survey questions; we also ran a pilot test with a few people who worked on CRTs to identify potential wording or interpretation problems. (The survey questions are in Appendix C.)

Conducted over two periods—in 1998 and 1999—the web-based survey asked questions on perceptions of acquisition reform and its implementation as well as questions concerning individual behavior and incentives. The survey was distributed to four positions in each CRT that the teams themselves considered the most significant in the design and writing of contracts—the program manager or logistics officer (PM/LO), the item management specialist (IMS), the procurement contracting officer (PCO), and the production management specialist-seller (PMS). Each person who participated provided only one set of responses.

These four CRT member positions play critical roles in the contract process. The program manager, for instance, heads the CRT and is responsible for managing weapon systems assets. The IMS is responsible for estimating requirements, such as the number of repairs for a particular group of items over a time horizon. Repair production-related issues during contract execution fall to the PMS, who works from the ALC side to anticipate and resolve issues that arise during repair actions.¹ PCOs understand contracting policy and regulations and actually write the contract. They prepare documentation to support contract review, write the contract, negotiate the terms and conditions, translate various decisions and agreements into legally binding language, and help select the contractors.

Overall, the response rate for the survey was 64 percent.² Although the survey went to four positions per contract team, many of the individuals in those positions sat on more than one CRT and were associated with more than one contract. This phenomenon had the effect of smoothing out some of the variation in the independent variables, because the responses of an individual could apply to more than one contract. In 1998, we received responses from CRTs

¹During CREP, if ALC-owned and operated organic shops also conducted some of the repair workload, two PMSs participated: the buyer PMS, who worked with the IMS to establish the requirement for contract repair, and the seller PMS, who worked with the PCO to construct a contract. Because it focused on CREP, this study's survey involved only seller PMSs.

²The sample consisted of 256 individuals: 66 PCOs, 40 PMSs, 75 PMs, and 75 IMSs. A breakdown by position revealed a 74 percent response rate from PCOs ($n = 49$), a 63 percent response rate from PMSs ($n = 25$), a 60 percent response rate from PMs ($n = 45$) and a 60 percent response rate from IMSs ($n = 45$). Data were analyzed from 79 unique CRTs that wrote 101 contracts.

responsible for 84 contracts written primarily in 1997 and 1998. In 1999, we again surveyed some of the CRT members whose first responses contained missing data. Other members who had not responded at all were again asked to participate. By asking CRT members to complete their surveys or participate if they had not responded in the first survey, the number of contracts in our sample increased from 84 to 101. Expanding the sample size to 101 contracts or observations increased the likelihood the regression analyses would detect significance in levers related to tenet implementation. The number of contracts in our sample was an important constraint in the analyses, because it limited the number of independent variables used in the regression analyses.³

ORGANIZATIONAL LEVERS (INDEPENDENT VARIABLES) IDENTIFIED PRIMARILY THROUGH PRINCIPAL COMPONENTS ANALYSES

We analyzed survey responses using a technique called Principal Components Analysis that allows one to examine relationships among item responses to determine whether particular questions reflect the same underlying concept. It is a general method of developing scales in the social sciences, used for example in personality and intelligence scales.⁴ Specifically, the PCA technique enabled us to construct eight organizational lever variables from responses to survey questions that were closely aligned and addressed a common theme. We first describe PCA and the eight independent variables that emerged from that process. Next we describe two independent variables that were computed directly. At the end of this section, we discuss the final steps in constructing the independent variables. Appendix C shows the original survey, and the next section discusses those questions that made up the independent variables.

³We would have liked to include additional variables in the regression models to help control for potential systematic bias in the survey responses, e.g., dummy variables for job title of respondents, etc.; unfortunately, the small size of our sample limited the addition of such variables.

⁴See B. G. Tabachnick and L. S. Fidell, *Using Multivariate Statistics*, Third Edition, New York: Harper Collins, 1996.

PCA showed that the survey questions consisted of eight separate themes describing organizational levers. These levers were named: attitude toward acquisition reform, leadership consistency, performance evaluation, performance incentives, effective teaming, contractor partnering, Air Force partnering, and training in acquisition reform. Details of the PCA can be found in Appendix D. Additionally, the survey questions used to construct each organizational lever variable are provided at the end of each variable's description below.

Attitude Toward Acquisition Reform

During the early part of the acquisition reform initiative in 1996 and 1997, contracting personnel throughout the Department of Defense communicated a belief that reform was generally a good idea, but perhaps not for operating-line personnel, particularly if better contracts meant the individual's workload would increase and fewer people would be needed to do the work in the future. Some people perceived that contract outcome improvements might jeopardize their jobs. Still others saw benefits in solving certain problems to free up their time to solve harder problems.

The PCA technique identified two related survey questions that asked about support for acquisition reform. The first question asked about the extent to which the person supported the goals of acquisition reform. The second question, with five subparts, asked about the person's perception of how acquisition reform would affect his or her contracts and job. The questions were:

- How supportive are you of the goals of acquisition reform? (Q25)
- How likely is acquisition reform to contribute to the following outcomes? (Q26)
 - Improve mission capability rates for end user
 - Reduce the cost of my contracts
 - Increase contractor responsiveness/flexibility
 - Increase my job satisfaction
 - Make my job more secure.

Responses to these questions formulated the attitude organizational lever variable.

Leadership Consistency

AFMC and the ALCs are under tremendous pressure to apply best practices where it makes sense, and consequently they have a large number of initiatives underway. It is natural for operating-level personnel to work more aggressively on an initiative to which they believe their immediate supervisor and senior leadership appear committed and that they expect will lead to permanent change. One would expect that the more people feel leadership is consistently calling them to enact reform, the more likely they will do so.

Principal components analysis indicated that two parts of a question on leadership support were related. These items measured the extent to which the person felt he or she was hearing the same message about reform from all levels of management and whether management appeared committed to reform over the long run. The questions were:

- How true are the following statements about acquisition reform? (Q28)
 - Different parts of the chain of command send different messages about AR.
 - Management attitudes suggest that AR is the latest “program of the month.”

Performance Evaluation

The business and management science literature suggested that individuals perform best in areas in which they are evaluated and given incentives. Thus, if the success of acquisition reform depends on better teaming, improved contract performance, and better contractor relationships, then it follows that performance evaluation criteria for these areas are important. The more people feel they will be evaluated on reform success, the more likely they will try to implement reform innovation. This organizational lever must be viewed carefully, because the CREP initiative was still ongoing when it was

measured. In interviews, we were told personnel evaluation criteria had not changed during the initiative, so we expected this variable to be weakly related to behavior for the contracts in our sample, if at all. Still, we included it, because of its importance in the literature.

PCA indicated four subparts of a question about performance evaluations were related:

- How important are the following factors in your yearly performance evaluation? (Q29)
 - Improving the timeliness of contracts processed (reduced administrative lead-time)
 - Working effectively with the members of my CRT
 - Improving contract performance (cost, reliability, cycle times)
 - Improving partnering with contractors.

Performance Incentives

Unlike performance evaluation criteria that already exist before the initiative, performance incentives often develop during an initiative, as happened at Warner Robins ALC. We identified performance rewards used by the private sector in a review of the business literature and those used by Warner Robins ALC in interviews with CRTs. Anecdotal evidence suggested center personnel used formal recognition from the organization (e.g., plaques) as a primary incentive for good performance. Several individuals we interviewed early in the study indicated positive feedback from customers (customer surveys, letters from customers) provided an effective incentive for them to continue to perform well, but others we interviewed thought voluntary customer recognition (letters or phone calls from customers) was too subjective and arbitrary. Some of the individuals we interviewed expressed concern that their hard work was not appreciated by customers or their immediate supervisors and, as a consequence, believed this lack of appreciation undermined their enthusiasm for taking on new challenges with new contracts. We expected to see more innovation as people perceived they would be rewarded for their success.

PCA found a relationship between items in a five-part survey question on performance incentives:

- How likely is the effective use of AR to lead to the following rewards? (Q30)
- Higher merit increases
- Improved opportunities for promotion
- Non-monetary rewards (e.g., time off, trips)
- Recognition from ALC/product directorate/division of a job well done
- Official acknowledgment of customer satisfaction.

Effective Teaming

As mentioned earlier, CREP emphasized the concept of bringing all key members together early in the contracting process to decide collectively on contract goals and strategy. This teaming concept allowed a better “give and take” with functional experts who, in the past, had not necessarily understood all of the practical and legal constraints by which other members were bound. CRTs also reported to us in interviews an appreciation for involving the contractor early in the process. In some cases, CRTs were able to change the contract fundamentally only after reviewing the contract repair process with the contractor, sharing information on projected requirements and learning from the contractor about particular problems in the contract repair facility to arrive at fundamental changes in the contract together. Effective teaming, however, meant that the team needed to overcome functional barriers, such as understanding primary objectives and constraints in each step of the process. As the team formulated a common strategy, team members had to agree to work toward a common performance goal and include early on anyone who had potential veto power over the proposed contract. We expected the relationship between effective teaming and innovation to be positive, i.e., as effective teaming increased, CRTs would be more innovative.

The PCA suggested these three teaming items were related:

- How true are the following statements about the CRTs (or IPTs) you have worked on? (Q32)
 - The CRT was effective in overcoming functional or disciplinary barriers to cooperation.
 - Team members worked toward a common performance goal.
 - Non-core CRT members (FM, BC, CR, EN, QA) were well integrated into the process.

Contractor Partnering

Most CRTs reported good relationships with their contractors and most had worked with those contractors for years. CREP set as its objective improvements in repair contract outcomes, which necessitated changing expectations (better performance) in repair contracts and in ways of working with contractors. We expected that innovation would occur more frequently with contractors perceived by team members to be contributing positively to the business relationship.⁵

The PCA technique found that four subquestions about contractor partnering were related:

- How true are the following statements about the relationship between the Air Force and the contractor? (Q34)
 - A positive working relationship exists with the contractor.
 - The Air Force and contractor have worked together to improve processes and reduce cycle time.
 - The contractor alerts the Air Force to anticipated problems that could affect the contractor's performance.
 - The contractor shows a willingness to assume risks in order to do business with the Air Force.

⁵Innovation can certainly occur under adversarial conditions, such as with the acquisition of new systems where the Air Force can dictate the terms unilaterally when there is competition. It is less likely to occur in an adversarial relationship with a sole-source supplier. Most of Air Force repair contracts are with sole-source suppliers.

Air Force Partnering

During interviews it appeared that PMs and PCOs were particularly concerned about the Air Force's ability to be a better customer to its suppliers. In particular, they were concerned about its willingness both to pay for the risk it expected the contractor to assume and to reward contractors who perform well. The prevailing approach in repair contracts over the years has been to put most of the risk on the contractor in the belief that it would minimize costs, because the Air Force would not pay for any workload that did not generate. Under acquisition reform and lean logistics, teams found they had to assume some risk up front to get the decreases in the repair prices and repair cycle times they wanted. Thus, we expected that as Air Force partnering increased or improved—measured as explicit treatment of risk and rewards—more innovation would occur.

PCA indicated two subquestions were related in regard to Air Force partnering:

- How true are the following statements about the relationship between the Air Force and the contractor? (Q34)
 - The Air Force shows a willingness to pay for the risks it wants the contractor to assume.
 - The Air Force shows a commitment to reward contractors who perform well.

Training in Acquisition Reform

The literature explicitly emphasizes the importance of training employees in how to integrate new practices into their jobs. Because the survey covered several topics and had resource constraints, it asked high-level questions only. For example, it measured quantity of training days but not the quality of the training received. In this study, we expected that as the number of days of training and frequency of updates people received increased, innovation would also increase.

Using results from the PCA technique, two survey questions were used to construct the “training in acquisition reform” variable. The first question asked how many days of formal training in acquisition

reform a person received in the past two years. The second asked how often they received updates in acquisition reform training. These questions were:

- How many days of formal training in acquisition reform have you received in the past two fiscal years? (Q41)
- How often do you receive formal and informal training updates on acquisition reform as it affects your job? (Q42)

Two other independent variables were computed directly. The ninth organizational lever variable—years of job experience—used data collected in the survey but did not require PCA. The tenth variable—a product directorate dummy variable—also did not require PCA. We describe them next.

Job Experience

Work experience can have a positive and negative relationship to innovation. Long experience in a position can make a person better informed on past efforts that worked or failed. Such information can make someone either risk averse or more likely to succeed by knowing the potential pitfalls. Lack of experience, in turn, can make a person more willing to try something new and challenging. Anecdotal evidence from interviews with CRT personnel suggested that younger members were more enthusiastic and willing to write more innovative contracts. Therefore, we expected those with less job experience would be more likely to write innovative contracts.

We used one survey question to construct the “job experience” variable:

- How many years of work experience do you have in your current job? (Q35–38)

Product Directorate

At the time of this study, the U-2 Product Directorate at Warner Robins used large sustainment contracts to support its classified weapon systems instead of component repair contracts used by the unclassified programs. These sustainment contracts covered a vari-

ety of goods and services, including repair, modifications, engineering, new parts procurements, and scheduled overhauls. Because of classification requirements, they used separate data systems and slightly different contracting rules than did the CRTs in the other product directorates. Funds on U-2 contracts generally came from appropriated weapon system-specific funds that did not compete with parts from other weapon systems, as do items that use revolving fund dollars. For all of these reasons, we expected that the U-2 Product Directorate had more opportunities to innovate than did the other product directorates.

We tried to control for these differences in contracts with a dummy variable, called “Product Directorate,” analogous to a commercial corporate division. If the CREP contract was written in the U-2 Product Directorate, we assigned the variable a value of 1; otherwise it received a 0.

This section described how PCA was used to identify organizational lever themes among the survey responses for eight independent variables and how two other variables were computed. We next discuss how the independent variables were computed for each organizational lever after the PCA analyses.

Independent Variable Computation

PCA indicated themes among survey questions that ultimately formed eight organizational variables. For each theme identified by PCA, such as leadership consistency, a respondent’s values were summed across all of the questions considered by PCA as related.⁶ The organizational lever variable for each contract was determined by averaging the values of individual team members across the CRT.

Because each member provided survey responses only once, responses sometimes resulted in duplicates if an individual participated in more than one CRT or contract. In most cases, CRTs consisted of a different set of members, thus making the indepen-

⁶Responses to survey questions took on values that ranged from 1 to 5 (or 1 to 3, in some cases) with a 1 assigned consistently to the lowest end of the scale. Thus, responses to survey questions associated with particular organizational lever variables were given a quantitative value.

dent variables not identical. Ideally, one would like to survey CRT members at the conclusion of each contract activity, but this study was allowed to conduct the survey once (the second survey collected responses from CRT members who had not responded during the first year of data collection or to complete missing data from the first survey). The survey responses represented an accumulated experience for CRT members. Response rates for CRT teams varied across contracts. The sample included contracts that had survey responses from at least one person on the CRT. Most of the sample contracts included responses from two or more CRT members.

We also evaluated the independent variables for the degree to which they were normally distributed, as required for ordinary least squares (OLS) regression analysis.⁷ As a result, we transformed two variables—attitude toward acquisition reform and leadership consistency—from a 1 to 5 scale to a 1 to 3 scale because of the lack of variability across the 5-point scale. Leadership consistency and effective teaming were positively skewed, but a square root transformation led to a negatively skewed distribution, so we did not transform these variables. Distributions across the rest of the independent variables were not highly skewed.

CREP TENET GROUPS (DEPENDENT VARIABLES)

Now we turn to the identification of our dependent variables. For our analysis, the dependent variables were specific groups of tenets derived from CREP policy objectives. The CREP initiative had two primary policy objectives: contract innovations consistent with acquisition reform and innovations consistent with agile logistics. The study team developed dependent variables that policymakers could interpret strategically. Our study sponsor was interested in explaining strategic, policy-level outcomes, not tactical outcomes such as the implementation of individual tenets. Once we decided to use groups of CREP tenets as dependent variables, we then faced the issue of how to develop the groups. We initially conducted a cluster analysis of the CREP tenets in our sample of 101 contracts to identify empirically groups of CREP tenets. The cluster analysis identified

⁷We tested the need for transforming variables with the PROC UNIVARIATE function in SAS system software.

tenet groups that had no meaningful policy-relevant theme, which made these groupings unusable. In the end, we decided to formulate tenet groups based on policy themes highlighted in the CREP initiative itself and in a policy emphasized at the beginning of the initiative.⁸ We next consider these policy themes in more detail.

CREP Tenets: Elements of the Dependent Variable

As noted earlier, during CREP implementation, HQ AFMC provided its ALCs with a 16-item checklist to use when considering tenets to incorporate in each CREP repair contract. For our regression analysis, we used these 16 CREP tenets in formulating our dependent variables. HQ AFMC monitored the use of this checklist, and each ALC reported the actual number of tenets incorporated in contracts on a quarterly basis. This information was the data source for the dependent variables for most of the contracts in our sample; that is, these reports became the basis for our determination of the extent of tenet incorporation. Eight contracts in the sample were written after September 1998, and thus the reporting of their tenet incorporation came directly from Warner Robins ALC.

The CREP tenets used in the analyses are listed and defined below.⁹ The tenets involve acquisition reform and agile logistics-related concepts. When necessary, we provide definitions commonly accepted by the logistics community.

- *Reduce contract repair prices:* lower repair prices from those of the same item in the previous contract.
- *Reduce repair cycle time:* shorten repair cycle time—the time an item arrives at the contractor repair facility to when it leaves—from that in the previous contract.

⁸At the beginning of the CREP initiative, Warner Robins ALC tried to implement as many CREP tenets as possible in all candidate CREP contracts, which meant only the easiest tenets could be incorporated in still-active contracts. These easy-to-incorporate tenets were related to fast transportation and did not affect any of the other parts of the contract. These tenets are included in the “simple modifications” tenet group.

⁹CREP tenet heading language came from Warner Robins ALC, circa 1998.

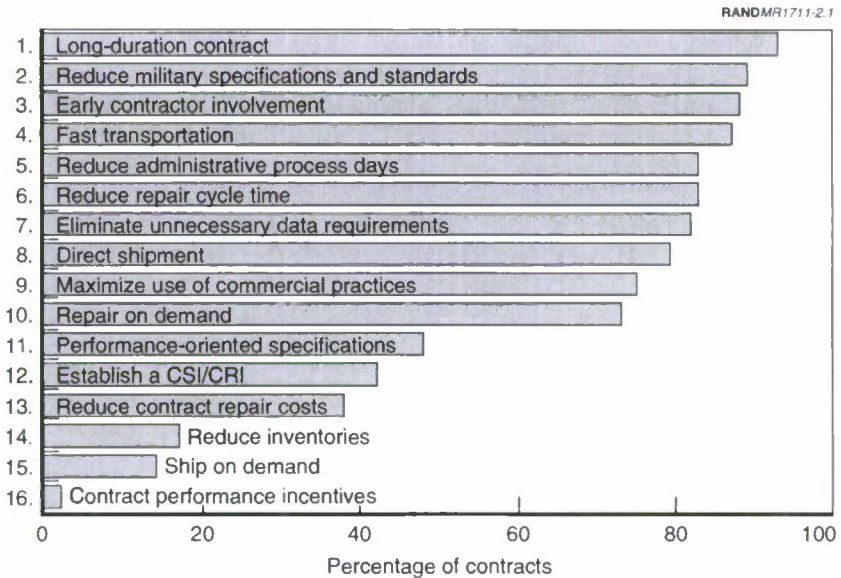
- *Reduce administrative process days:* shorten administrative lead-time or the time it takes to write a contract from the very beginning.
- *Reduce inventories:* anticipated decrease in new spare buy requirements that result from a shorter repair cycle time or reductions in other parts of the repair pipeline, such as fast transportation.
- *Repair on demand:* repair demand set by the EXPRESS system, which tries to maximize the probability that all Air Force bases meet their aircraft availability goals through its computed repair priorities that depend on demand forecasts across a planning horizon, actual asset positions, and a host of logistics considerations.
- *Establish a consolidated repairable inventory/consolidated serviceable inventory (CRI/CSI):* the depot stock level, as computed by Readiness-Based Leveling (RBL) or some other method, which puts the pool of centrally held serviceable and un-serviceable assets at the contractor facility rather than the managing ALC.
- *Direct shipment:* recoverable items sent directly from an Air Force base to a contractor and sent back to an Air Force base without passing through a Defense Logistics Agency serviceable warehouse at the managing ALC.
- *Maximize use of commercial practices:* practices used by private-sector firms with their commercial customers.
- *Performance-oriented specifications:* use of a statement of objective or a generalized set of performance goals, rather than a detailed set of work instructions that are specified by the Air Force.
- *Fast transportation:* use of expedited air transportation, as needed.
- *Shipment on demand:* shipment instructions for the newly produced serviceable that the Air Force transmits electronically to the contractor.
- *Early contractor involvement:* mainly used with sole-source contractors, although CRTs occasionally used face-to-face

meetings with prospective bidders for competitive contracts. The CRT met with the contractor early in the process and involved the supplier in constructing the new contract, developing the statement of objective, and so forth.

- *Long-duration contract:* long-term contracts, defined by AFMC as three years or more.
- *Reduce military specifications and standards:* technical requirements eliminated without increased risk to the Air Force, potentially allowing contractors to use commercial specifications and standards and reduce contractor costs.
- *Eliminate unnecessary data requirements:* reporting requirements deemed outdated, duplicative, or underutilized could be eliminated, thus potentially reducing contractor costs and repair prices.
- *Contract performance incentives:* use of a clause that rewards or penalizes performance that deviates significantly from baseline expectations.

Figure 2.1 indicates the percentage of contracts that report using each innovation. More than half the contracts in the sample included 10 of the 16 CREP tenets, with most claiming long-duration contracts. The tenets used with the least frequency in the sample of contracts were contract performance incentives, shipment on demand, and reduced inventories.¹⁰ Twenty-six percent of the sample contracts came from the U-2 Product Directorate, which we discuss at the end of the next section on the construction of the model's dependent variables.

¹⁰Anecdotal evidence from interviews suggests several reasons for the infrequent incorporation of these tenets. Performance incentives work well with objective methods of measuring performance and understanding the value of different performance criteria, e.g., the worth of getting an item returned in the five days versus ten days. Shipment on demand occurs routinely now, but at the time of the study data system changes were not available to make this occur routinely. Finally, the benefits of reduced inventories applies only to the future, so if the inventory is already plentiful for a particular item, reducing cycle time will affect responsiveness but not inventory.



NOTES: 26 percent of the contracts are from the U-2 Product Directorate. n = 101

Figure 2.1—Over 50 Percent of the Contracts in Our Sample Incorporated 10 of the 16 Innovations

CREP Tenet Groups: The Dependent Variables

As described in the last section, we grouped the CREP tenets into four policy-related groups and a fifth group that included all 16 CREP tenets. The four policy-related groups were: *simple modifications*, *key acquisition reform concepts*, *complete acquisition reform concepts*, and *agile logistics*. The fifth group—all 16 CREP tenets—was added for completeness to show whether tenets for both acquisition reform and agile logistics policies were being implemented. Each of the 101 sample contracts was evaluated according to these groups. The value of the dependent variable was the total number of tenets for a CREP innovation group that were incorporated in a contract.

We describe the four primary policy-relevant tenet groups below and provide the complete set of tenets.

- **Simple modifications:** Tenets that can be added to active contracts, usually related to speeding up transportation.
- **Key acquisition reform concepts:** The set of acquisition reform-related tenets that are clearly exhibited at the front of the contract (e.g., price and cycle time) and are relatively easy to measure.
- **Complete acquisition reform concepts:** All acquisition reform tenets included in the key acquisition reform group, plus those reform tenets not as easy to measure or identify consistently (e.g., maximize commercial practices).
- **Agile logistics:** All agile logistics or lean logistics tenets designed to reduce logistics pipelines by speeding up the repair and transportation segments of the pipeline as well as improving other logistics efficiencies (e.g., establish a CSI/CRI).
- **All CREP tenets:** These 16 tenets can also be found in the combined set of complete acquisition reform concepts and agile logistics.

Table 2.1 provides the particular tenets included in the first four groups of innovation policy objectives that we analyzed as dependent variables. The fifth group included all tenets. Figure 2.2 shows histograms of the variability in innovation across the five innovation groups or dependent variables.¹¹ Each histogram shows the percentage of contracts in our sample that included at least one tenet defined by our innovation group shown in Table 2.1.

One can observe in the first histogram in Figure 2.2 that most of the contracts in the sample ($n = 101$) included at least two *simple modifications* (that is, transportation-related) tenets.¹² The second

¹¹The five most common tenets used were early contractor involvement, long-term contracts, reduction or elimination of military specifications, fast transportation, and the elimination of unnecessary data requirements.

¹²These tenets are included also in the simple modifications and agile logistics models.

Table 2.1
CREP Tenets Formed Four Primary Types of Innovation Groups

Tenets	Type of Innovation Groups			
	Simple Modification	Key AR Concepts	Complete AR	Agile Logistics
Reduce contract repair price				
Reduce repair cycle time				
Reduce administrative process days				
Repair on demand				
Establish a CSI/CRI				
Direct shipment				
Max use of commercial practices				
Performance-oriented specs				
Reduce inventories				
Fast transportation				
Ship on demand				
Early contractor involvement				
Long-duration contract				
Reduce mil specs and stds				
Eliminate unnecessary data requirements				
Contract perform incentives				

histogram shows that the sample of contracts defined in the *key acquisition reform concepts* tenet group primarily incorporated between two and four acquisition reform tenets that were more objective to measure. The histogram labeled as *complete acquisition reform* shows that our sample of contracts typically incorporated seven or eight of the tenets involving acquisition reform. Most of the 101 contracts in our sample incorporated between three and five agile logistics tenets, shown by the histogram labeled *agile logistics*. Finally, our sample of contracts incorporated between 9 and 12 CREP tenets, shown in the last histogram labeled *all CREP tenets*.

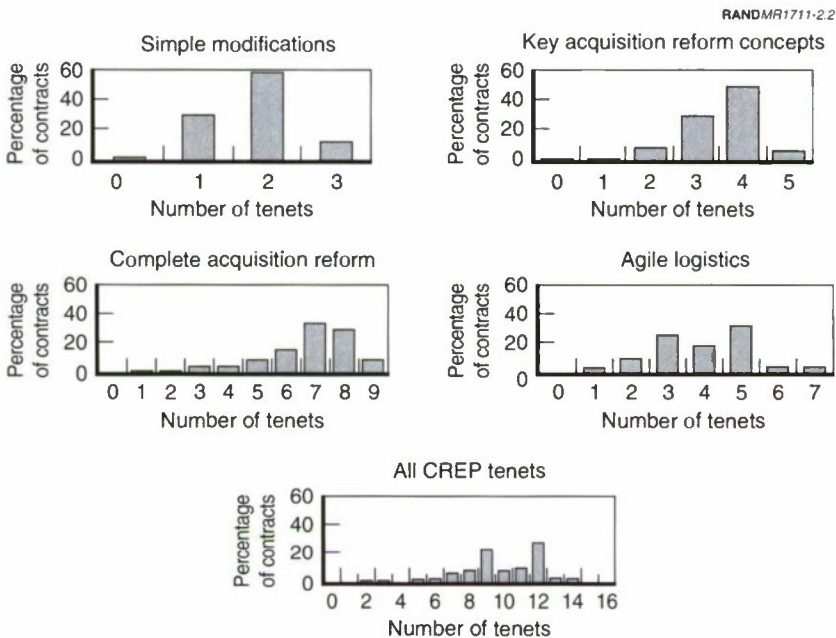


Figure 2.2—Number of Tenets Incorporated into CREP Contracts by Tenet Group

Several tenets appear in more than one dependent variable; for example, the reduction in repair cycle time is an objective shared by both acquisition reform and agile logistics and appears in both dependent variables. Groups of tenets allowed us to ask whether organizational levers could help explain the types of broad policy objectives Warner Robins ALC set for CREP contracts, namely, *simple modifications*, *acquisition reform*, *agile logistics*, or *all of the above*.

REGRESSION ANALYSES

Each of the four tenet groups, plus the fifth, complete set of tenets, became a separate regression model. We analyzed the same set of 101 CREP contracts to determine the relationship organizational levers had with the incorporation of particular tenets in each of our

defined tenet groups. According to information learned in interviews, CRTs were instructed by AFMC to apply as many of the CREP tenets as were appropriate in each contract.

In five separate multiple regression analyses, we regressed the groups of innovative contract types onto the nine organizational levers (see pages 17 to 25) and a U-2 Product Directorate dummy variable (see page 25). The dummy variable allowed us to account for any systematic differences between the U-2 contracts and the other 75 percent of the contracts in our sample.¹³ Thus, we used regression analysis to explain how organizational levers were related to reported CREP innovation. A detailed description of the regression analyses and their results can be found in Appendix E. We discuss the results of our regression analyses in the next chapter.

SUMMARY OF METHODOLOGICAL APPROACH

As this chapter highlights, our study began with a literature review on organizational levers and innovation in the private sector. We used this information to structure interviews with personnel considered to have excelled at incorporating CREP tenets in the first CREP contracts. The literature review and interviews formed the basis for the survey of key personnel participating on contract repair teams, i.e., program managers, procurement contracting officers, production management specialists, and item management specialists. Using PCA, we identified and measured organizational levers from survey questions. Using AFMC data, we classified the total number of reported CREP tenets into five tenet groups: *simple modifications*, *key acquisition reform concepts*, *complete acquisition reform concepts*, *agile logistics*, and *all CREP tenets*. We then measured the use of these tenets in each of the 101 contracts in our sample. Finally, we regressed these CREP tenet groups on the organizational levers to determine the individual relationship each organizational lever had

¹³We refer the reader to Appendix E for regression analyses for CREP contracts minus the U-2 contracts (n = 75 contracts). The resulting set of models had less explanatory power for acquisition reform policy alternatives. Excluding U-2 contracts reduces the ratio between independent or predictor variables and sample size, which can cause variables to drop in significance. We caution the reader from drawing conclusions from this smaller sample. We include these analyses because the results isolate the effects of organizational variables on CRTs writing component repair contracts.

with the number of CREP tenets incorporated in the contract, holding all other levers constant. The results of the regression analyses are discussed in the next chapter.

MAIN FINDINGS AND IMPLICATIONS

This chapter presents the results of our regression analyses and discusses their primary implications for Air Force policy. The analyses were designed to measure the statistical relationship between the different organizational levers and operating-level personnel behavior. For a complete statistical account of the regression results, we refer the reader to Appendix E, which describes two sets of regression analyses of the innovation groups, one containing our complete sample of 101 Warner Robins ALC contracts and another sample set of only 75 Warner ALC contracts. The difference between the two groups is that the former includes U-2 Product Directorate sustainment contracts, which have repair components, whereas the latter contains only repair contracts. Of the two, the set of 101 contracts has greater statistical power because of its larger sample size. Thus, the discussion below considers regression analyses results only from the larger sample.

ORGANIZATIONAL LEVERS AND THEIR RELATIONSHIP WITH INNOVATION

Several patterns emerged from our regression analyses. First, the analyses provide empirical evidence that organizational levers show significant statistical relationships with reported contract innovation. People's behavior in incorporating tenets in contracts is associated with levers such as attitude toward acquisition reform, effective teaming, performance evaluation, and so on. This finding shows that policies and practices related to personnel behavior were a factor in the extent to which CRTs incorporated tenets in repair contracts.

Second, organizational levers appeared most statistically related to the implementation of agile logistics tenets, followed by simple modifications. Conversely, they were less associated with acquisition reform goals.

Training in acquisition reform consistently was related to reported tenet use. Training in acquisition reform had a statistically significant positive relationship with four contract innovation groups and the group of all CREP tenets. CRTs who reported more training in acquisition reform also incorporated more tenets. At the highest level of significance ($p < 0.01$), the analyses showed that as CRTs reported receiving more training in acquisition reform, they incorporated more tenets in the innovation groups of simple modifications, agile logistics, and all CREP tenets. At a slightly lower level of significance ($p < 0.05$), CRTs who reported more training in acquisition reform incorporated more tenets in the complete acquisition reform innovation group. Finally, at a still lower level of significance ($p < 0.10$), CRTs who reported more training in acquisition reform incorporated more tenets in key acquisition reform concepts. Personnel on CRTs who received more training used more tenets in their contracts, compared to personnel on CRTs with less training. Because of the constraints of the survey, we could not collect information on the quality of the training; however, given the consistent relationship between training and innovation and Air Force interest in further exploring quality in training and innovation, these results suggest that additional study is warranted.

Effective teaming had the second most consistent statistical relationship with contract innovation in all tenet groups, except simple modifications. However, the relationship between effective teaming and the extent of innovation for these groups was negative. In fact, effective teaming and the key acquisition reform concepts innovation group was the most statistically significant relationship ($p < 0.01$), followed by agile logistics and all CREP tenets ($p < 0.05$), and then by complete acquisition reform innovation ($p < 0.10$). We expected teams that considered themselves effective would write more innovative contracts. Surprisingly, the opposite relationship was found. The analyses indicate that as CRTs reported more problems with teaming, they implemented more tenets in their contracts compared with teams that reported higher team effectiveness scores.

Although not a statistically significant factor in terms of adopting a simple modifications model, the negative relationship is consistent.

While this negative relationship seems counterintuitive, we hypothesize that when contracting members worked as a team under CREP reform, rather than as individuals under the old process, members had to make consensus-like decisions in a new way that required more give and take. Perhaps teams that pushed reform further pressured its members to learn new practices, take more risks, work longer hours, and spend more time trying to bring around the skeptics among its members. Perhaps innovation is occurring by fiat over the objections of other team members, leading to a sense that the team is not unified in purpose or direction. On the other hand, teams that reported an easier teaming experience may have settled for less aggressive goals. In retrospect, it is not surprising that the teaming variable was not related to the simple modification goals, because these innovations, which are simpler to incorporate and change little of the basic contractor-Air Force relationship, do not involve as much creative problem solving among team members as other goals.

A study conducted by Gerald Miller (1993) may further explain these counterintuitive findings. In a study of the relationship between team stability and learning among work teams, Miller found that unstable teams—teams whose members changed frequently—experienced higher learning rates when confronted with new problems. Work team instability encouraged members to expand alternatives and solutions. He also found that unstable teams required more complex management arrangements to keep team members on track.

The negative relationship may also be a result of the question wording in the survey. The survey asked about end-state conditions of teaming effectiveness, such as the effectiveness of the CRT to overcome barriers to cooperation or the extent to which team members worked toward a common goal. Constraints on our survey did not allow us to pursue the exact nature of CRT teamwork processes or attitude measures, such as group dynamics. Future research might clarify this.

Ultimately, the negative effective teaming result was perhaps our most surprising and potentially troublesome finding. If these negative experiences continue—and we do not know if they have because this study ended not long after the end of the CREP initiative—teams may opt for less innovation if smoother team dynamics are preferred. This result strongly suggests that AFMC and the ALCs will want to investigate teaming more thoroughly.

Attitude toward acquisition reform had the third most consistent statistical relationship with contract innovation. It had a statistically significant positive relationship in each innovation group except for key acquisition reform concepts. The regression analyses showed, with a high level of significance ($p < 0.05$), a positive relationship between attitude toward acquisition reform and simple modifications and all CREP tenets innovation groups. A positive relationship between team member attitude toward acquisition reform and the incorporation of tenets in the complete acquisition reform and agile logistics innovation groups had a slightly lower level of significance ($p < 0.10$). These results suggest that those CRTs that view reform more positively are associated with greater implementation of reform tenets in their contracts. One can also think about attitude as an approximate measure of operating-level “buy-in.” Those teams that agree with the goals of the initiative are associated with more innovative contracts.

Contractor partnering showed a positive relationship with tenets implemented for simple modifications and agile logistics goals. This result indicates that those CRTs that included more reform tenets in contracts also perceived contractors to be better partners. The significance level for the positive relationship between contractor partnering and the incorporation of tenets in an innovation group was highest with simple modifications ($p < 0.01$) and slightly less with agile logistics ($p < 0.05$). This result is encouraging, but the relationship is not statistically significant for either of the two acquisition reform models or for the model including all CREP tenets.

Leadership consistency was statistically significant only in the agile logistics ($p < 0.01$) and key acquisition reform ($p < 0.05$) innovation models. Leadership consistency had a positive, significant relationship with CRT incorporation of agile logistics and key acquisition reform tenets. CRTs that perceived consistent messages throughout

management and that believed reform would be around for some time were associated with the incorporation of these types of tenets in their contracts. According to Larkin and Larkin (1994), rank-and-file employees listen to their first-level supervisors and not just senior leadership. These employees need to hear about change repeatedly from their supervisors before they believe the change effort will have staying power. If supervisors are not committed to change, Larkin and Larkin found it is very difficult for them to win over rank-and-file employees. The survey in our study did not ask questions about middle management as an organizational lever, but the results suggest it warrants further consideration.

Performance evaluation had a negative statistical relationship with agile logistics tenets ($p < 0.05$). One would typically expect this organizational lever to have a positive relationship with innovation, so we found these results surprising and deserving of attention. The analysis indicates that those CRTs that said they were more likely to be graded on improving the timeliness of the contracts they processed, working effectively with other team members, improving contract performance, and improving partnering with contractors were less likely to incorporate agile logistics reform tenets. In addition, our results indicate no relationship between performance evaluation and the other tenet models. To explain these results, we hypothesize that those CRT members who are more likely to succeed in writing innovative contracts feel they will not be rewarded sufficiently for their effort.¹ If correct, it suggests that the ALCs will need to align performance evaluation criteria more closely to desired new behavior, to apply perhaps to all team members.

Job experience showed a negative statistical significance for the simple modifications and complete acquisition reform innovation groups ($p < 0.10$). It had no relationship with the other two innovation groups or the complete set of tenets. The negative relationship indicates that CRTs included slightly more transportation-related (simple modifications) tenets to contracts as the level of personnel experience decreased. However, the magnitude of its relationship

¹Our results suggest that the ALCs might want to align performance incentives with other contracting-related initiatives, if they have not done so already, and include criteria explicitly designed to reinforce CRT contract innovation.

with the incorporation of reform tenets is so slight as to have little practical consequence.

Two variables—**performance incentives** and **Air Force partnering**—had no explanatory power in any of the models we tested. Senior leadership indicated Warner Robins ALC has systematically and intensively tried to provide nonmonetary rewards for writing particularly innovative contracts. Perhaps the types of incentives specified in our survey were not sufficiently representative of rewards offered or perhaps personnel do not perceive these rewards as effective. We were somewhat surprised by the lack of explanatory power for Air Force partnering. It suggests that there is no consistent relationship between the role of the Air Force as customer and the number of innovative tenets included in repair contracts. This study could not delve into the complex issues involved in how the Air Force works with its suppliers. More attention needs to be given to this important issue. Many ongoing transformation initiatives, such as purchasing and supply chain management (PSCM), corporate contracting, and strategic sourcing, depend on effective contractor and Air Force partnering.

Finally, the **U-2 Product Directorate** dummy variable showed statistical significance with every innovation group except simple modifications. We included this variable to account for the important differences between sustainment and component repair contracts and their respective contracting processes and environment. The dummy variable accounts generally for binary differences within a sample set, in this case, sustainment versus repair contracts. Holding all other organizational levers constant, the dummy variable showed that the U-2 directorate incorporated more tenets in the complete acquisition reform, agile logistics, and all CREP tenet groups ($p < 0.01$). The U-2 directorate also incorporated more key acquisition reform tenets with a slightly lower significance level ($p < 0.05$). At the time of this study, the U-2 Product Directorate reported a high rate of tenet use, which has been substantiated in follow-up discussions at Warner Robins ALC.

LESSONS FOR THE AIR FORCE

In general, the results suggest that the Air Force should continue to make effective use of those organizational levers associated with

positive results, especially training in and fostering positive attitudes toward acquisition reform. In turn, it should revisit the levers associated with null or negative relationships, especially performance evaluation and teaming. Specifically, the Air Force could do more to

- Inform personnel that senior leadership wants to see progress in achieving well-specified contracting goals.
- Learn how to create effective teams through training in group problem-solving and working with others from different functional backgrounds, in addition to educating teams on legal and policy changes.
- Align personal evaluation criteria and incentives to reform goals.

EXTENDING THESE RESULTS TO OTHER AIR FORCE INITIATIVES

To the degree that the CREP initiative is representative of contract reform efforts in general, the Air Force can reinforce the organizational levers related to innovation and look closely at those that seem unrelated or are negatively related.

Are the lessons from this study applicable to other ALCs? The answer depends on how similar the CREP initiative at Warner Robins ALC is, in terms of the organizational context and policy goals, to other initiatives and at other locations. We hypothesize that it is reasonable to think the relationship between organizational levers and contract innovation at Warner Robins ALC is similar to the relationship of these variables at both Oklahoma City and Ogden ALCs. However, it is also possible, because this study analyzed contracts at a center viewed by HQ AFMC as innovative, that these results would not apply to the other two centers. Also, senior leadership at the other ALCs may have had a different impact on personnel behavior at their centers. One would have to conduct a similar analysis at these centers to know conclusively whether organizational levers could help explain innovation at those sites.²

²The inclusion of those two centers probably would have increased the sample size enough to allow for dummy variables to represent the respective centers. We tried at one point to expand this study to include contracts written at other Air Logistics

Could the same relationship between levers and innovation that we find under the CREP initiative occur with other contract initiatives? After all, the Air Force has taken on other contracting-related initiatives since CREP, many of which attempt more significant change in behaviors and even organizational structure, such as the PSCM initiative.³ If senior leadership does not address the levers identified as having no relationship or having a negative relationship with innovation implementation, then leadership may have to work as diligently—or more diligently, depending on the initiative—to implement new innovative practices, much as it did for CREP.

This study should help leadership consider the behavioral implications of contracting initiatives such as CREP and decide what to do if it wants personnel to implement contract innovation. This study also provides an analytical approach to measuring the relationship between organizational levers and forms of contract innovation other than CREP. Since this study began, the Air Force has added initiatives that are more complicated than CREP in their approach and expected outcomes, such as PSCM, corporate contracting, and performance-based contracting. The need to encourage new approaches and reinforce desired behavior at the ALCs is important to the success of the Air Force's ongoing transformation efforts—a process in which support at the operating level is essential. As such, the Air Force may want to apply this methodology to other initiatives where behavioral changes are needed to fulfill larger transformational goals.

Centers to capture potential item and cultural differences at Oklahoma City and Ogden ALCs, but repair workload backlogs in 1998 and 1999 prevented the other ALCs from participating.

³The PSCM initiative, demonstrated on the F100 engine at Oklahoma City ALC in FY2002, has as its objective a strategic means of selecting and managing suppliers to provide more effective and efficient support to the warfighter. While consistent with CREP outcome goals, it would work with purchasing and supply chain activities from an enterprise-level to an operating-level perspective. Behavioral implications for PSCM are more significant than for CREP.

**REPAIR PRICE AND NEGOTIATED FLOW DAY
DIFFERENCES IN WARNER ROBINS ALC CREP
AND NON-CREP CONTRACTS**

In a separate analysis that complements this study, we examined whether CREP made a difference in contract performance outcomes, specifically, in repair prices and negotiated flow days (the repair cycle time required by a contract).¹ The question of whether the initiative leads to a measurable improvement in outcomes was of interest to the Air Force. The results described in this Appendix suggest that CREP repair contracts written by Warner Robins ALC during the initial phase of CREP reduced repair cycle time without increasing unit repair prices.

The analysis described here collected data on CREP and non-CREP contracts, i.e., contracts written during the same period as CREP but that did not use the CREP process. We also collected data on contracts directly preceding CREP to compare item prices and negotiated flow days on CREP-period contracts with prices and flow days for the same items on the just-expired, old contracts. This method allowed us to control for technical differences across items while comparing changes in price and flow days.

In sum, we found that CREP contracts reduced flow days without increases to unit repair price in comparison with non-CREP contracts written in the same period. Non-CREP contracts also had reduced

¹Negotiated flow days or repair cycle time is the time from an item's induction into repair to its completed repair.

flow days compared with previous contracts, but unit repair prices increased. The statistical analyses that follow help to explain these findings.

Data from the Contract Depot Maintenance Production and Cost System (G072D) identified the old contract number for items on CREP and non-CREP contracts through the National Item Identification Number (NIIN). The CREP metrics worksheet Warner Robins ALC supplied to HQ AFMC provided CREP contract numbers. Non-CREP contracts were those repair contracts written during the CREP initiative that Warner Robins ALC did not classify as CREP. Only those NIINs on the CREP and non-CREP contracts that replaced a recently expired, old contract became part of the analysis. Changes in prices and flow days for CREP and non-CREP items were compared between the old and new contracts. Some NIINs had more than one just-expired contract written within the same year. A NIIN could have several CREP contracts if the first contract was written or modified early in the initiative.

Warner Robins ALC provided copies of contracts for the CREP and non-CREP contract pairs identified from G072D.² The analysis considered only items that had nonzero entries for items repaired, scheduled inputs, and repair price. All price-related data were converted into constant dollars (base year 2000) using Secretary of the Air Force Financial Management price deflators.

In all, G072D provided data on 375 unique NIINs from 182 contracts that had repairs on CREP and non-CREP contracts written during the CREP initiative and their respective older contracts. Some NIINs appeared on several CREP contracts, but all pairs of contract/NIIN data were unique. These unique pairs of contract comparisons produced 319 observations for CREP NIINs and 135 observations for non-CREP NIINs. This sample consisted of 48 CREP contracts paired with 60 older contracts and 30 non-CREP contracts paired with 44 older contracts. The data set included 48 of the 74 CREP contracts

²The contract office, headed by Jim Grant, provided this study significant assistance by copying 297 repair contracts. We extracted data from those contracts and continually referred to them to clear up questions raised by data ambiguities in other information systems.

reported to HQ AFMC or 65 percent of those awarded and reported to G072D as of September 1998.³

PRICE AND NEGOTIATED FLOW DAY DIFFERENCES FOR CREP AND NON-CREP ITEMS

The results of these comparisons of price and schedule are shown in Figures A.1 to A.4. Figure A.1 compares prices for NIINs ($n = 319$) from 48 CREP contracts with their just-expired, old contracts. About 66 percent of the CREP sample of NIINs shows a reduction in repair prices.⁴ On average, prices decreased by three percent. Half of the sample had repair price improvements of less than or equal to 18 percent. Over 8 percent of the sample showed price increases over 100 percent. Changes in contract design may account for most of the large increases in this comparison. Some contracts went from firm-fixed price to cost-plus-fixed-fee. Others had CREP contracts with a few NIINs, but the older contract had many NIINs.

The non-CREP sample of 135 NIINs came from 30 contracts. Figure A.2 shows that 62 percent of the non-CREP NIINs had repair price improvements, but the scale of those improvements differed greatly from CREP NIINs. On average, repair prices for the non-CREP sample of NIINs increased by 12 percent compared with their old contracts. Half of the NIINs in our sample showed repair price reductions of four percent or more, with very few NIINs exhibiting reductions greater than 20 percent. Over 30 percent of the non-CREP NIINs had virtually no change in unit repair prices.

³In September 1998, Warner Robins ALC reported that 101 contracts had incorporated one or more CREP tenets during the CREP initiative. Of those 101 contracts, 27 were written by the U-2 Product Directorate and primarily classified. We included U-2 contracts in the behavioral model, because the CREP tenets incorporated in those contracts were available and we were able to survey the appropriate personnel. The data set for the comparison of prices and schedule for items before and after the CREP initiative was restricted to the set of 74 unclassified contracts written by "non-U-2" product directorates for obvious reasons having to do with data availability and reporting requirements. Unclassified repair contracts paid for by the revolving fund get reported to G072D.

⁴Repair prices excluded government-furnished materiel (GFM) costs.

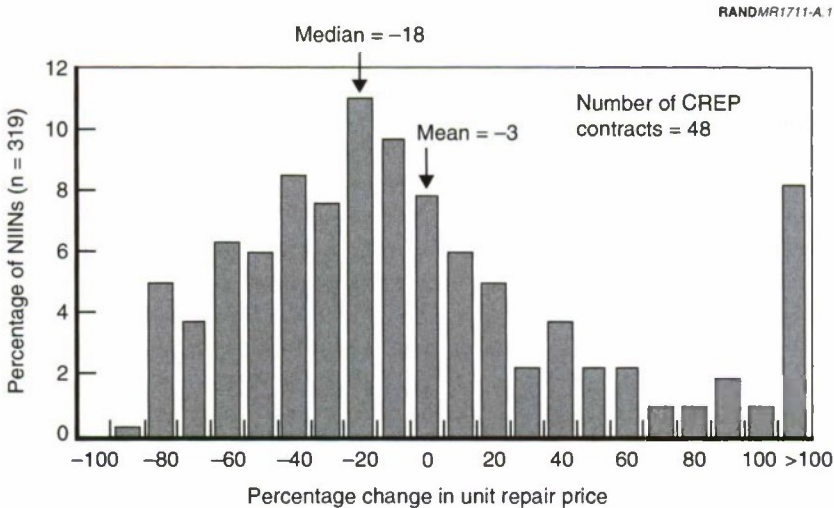


Figure A.1—Sixty-Six Percent of CREP Sample NIINs Showed Reduced Unit Repair Prices

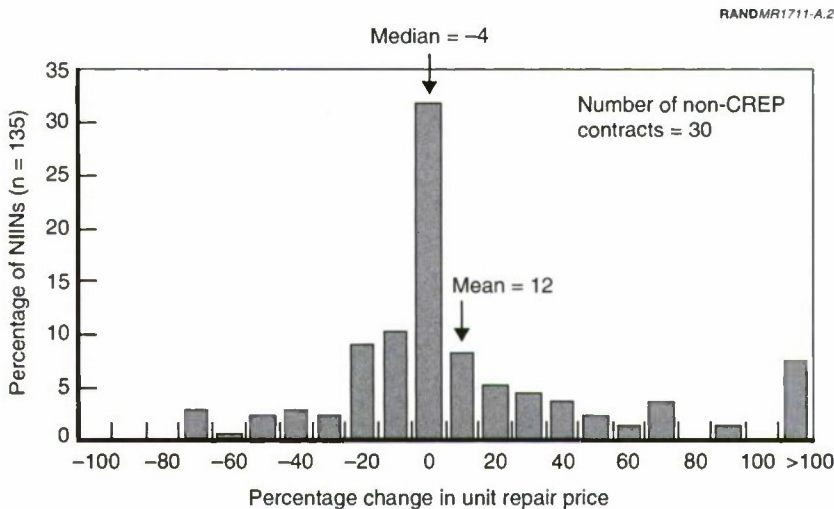


Figure A.2—Sixty-Two Percent of Non-CREP NIINs Showed Improved Unit Repair Prices, But On Average Prices Increased

The next two figures compare flow days. Figure A.3 shows the negotiated flow days for the same sample of CREP NIINs ($n = 319$). This sample revealed impressive improvement—58 percent of the sample exhibited improvements in negotiated flow days. On average, CREP NIIN negotiated flow days decreased by 14 percent or more. Half of the CREP sample showed flow day reductions of 23 percent or more.

Figure A.4 indicates that 60 percent of the non-CREP NIINs in our sample had reduced negotiated flow days. In fact, on average, negotiated flow days decreased by 24 percent for our non-CREP sample of NIINs. Half of the sample showed flow day reductions of 20 percent or more.

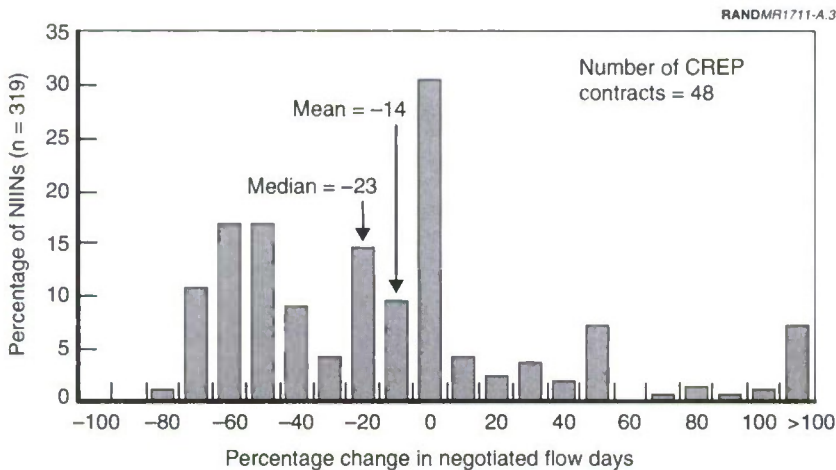


Figure A.3—Fifty-Eight Percent of CREP Sample NIINs Also Showed Reduced Negotiated Flow Days

STATISTICAL ANALYSES OF PRICE AND NEGOTIATED FLOW DAY DIFFERENCES

Are these results statistically meaningful? To examine this question, we tested whether the percentage changes for CREP and non-CREP were different from one another. We also tested whether CREP and

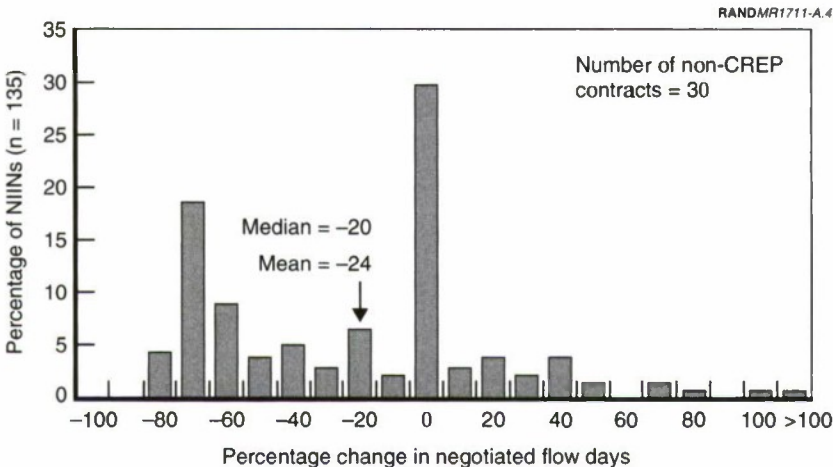


Figure A.4—Sixty Percent of Non-CREP Sample NIINs Showed Improved Negotiated Flow Days

non-CREP price and flow days were different from previous contract values, i.e., were the percentage changes different from zero? We used two-tailed t-tests to evaluate differences. Table A.1 shows the CREP and non-CREP repair price and flow day values used in our analyses.

Table A.1
Repair Price and Negotiated Flow Day Statistics
for CREP and Non-CREP Items

	CREP items (N = 319)	Non-CREP items (N = 135)	CREP vs. Non- CREP Tests
Repair price (% change)			
Average	-3.20	11.81*	*
Standard deviation	(69.78)	(62.35)	
Negotiated flow days (% change)			
Average	-13.74***	-23.85***	*
Standard deviation	(54.94)	45.21	

NOTE: Asterisks indicate significant differences from previous contracts: * denotes $p < 0.05$; ** denotes $p < 0.01$; *** denotes $p < 0.001$.

Prices

A t-test evaluating differences between CREP and non-CREP percentage change in price was significant ($t = 2.26$, $p < 0.02$). The means indicate that CREP price changes (average percentage change = -3.20) were smaller than non-CREP price changes (average percentage change = 11.81). However, CREP repair prices were not significantly different from older contracts, i.e., they were essentially unchanged ($t = 0.82$, $p > 0.05$). On the other hand, non-CREP prices were significantly different from older contracts ($t = 2.23$, $p < 0.05$). These results indicate that mean CREP repair prices were not significantly different from mean prices for the same items on previous, older contracts. Non-CREP repair prices were significantly different, with higher mean prices for items on non-CREP contracts compared with the same items on older contracts. Thus, while repair prices were statistically unchanged for CREP, they were higher with non-CREP contract items.

Next, we discuss differences in schedule or negotiated flow days for these contracts, comparing old and new contracts for the same items.

Negotiated Flow Days

A t-test evaluating the difference between CREP and non-CREP percentage change in flow days was significant ($t = 2.01$, $p < 0.05$). The means indicate that the percentage decreases in non-CREP flow days (average = -23.85) were greater than percentage decreases in CREP flow days (average = -13.74). Both CREP and non-CREP items had significant decreases in flow days from previous contracts (CREP: $t = 4.46$, $p < 0.001$; non-CREP: $t = 6.13$, $p < 0.001$). These results indicate that both CREP and non-CREP contracts showed improvements in schedules compared with their previous contracts.

In sum, the data indicate that the CREP initiative was successful at holding prices constant over time while reducing flow days. Reduction of flow days across both CREP and non-CREP contracts was strong, but price increased with improved schedule, except where CREP was implemented. We hypothesize that the primary effect of

CREP was to minimize price increases while reducing negotiated flow days, an explicit goal of agile logistics and the primary thrust of the CREP initiative at Warner Robins ALC.

INTERVIEW QUESTIONS FOR CONTRACT REPAIR TEAMS

The study team interviewed individuals who had participated in Contract Repair Teams (CRTs) or Integrated Product Teams (IPTs) for CREP contracts. Those people interviewed were identified by Warner Robins-ALC/PK and Warner Robins-ALC/RE as innovative in incorporating CREP tenets in repair contracts. Individuals, who were interviewed in groups, were sent questions before the meetings. The questions were structured but somewhat open-ended. They were meant to guide discussions, although participants were encouraged to volunteer issues the researchers had not anticipated. The interviews influenced the kinds of questions our survey included and their wording.

The interview questions for the April 1998 and June 1998 interviews are as follows. The CRT participants were asked to answer the questions in light of a specific contract the ALC considered most innovative or successful in incorporating CREP tenets.

- Contract background
- Contract number
- Contractor name
- Number of contract line items (CLINs)
- Contract duration (base year plus number of options)
- Dollar amount (estimated)
- Contract type

- Repair material used (government-furnished material [GFM] or contractor-furnished material [CFM]).

Initial process steps

- Requirements determination/identification
 - What role does the Program Manager play in this process?
 - Was the list of National Stock Numbers (NSNs) in the CREP contract similar to the previous contract(s)?
 - How did acquisition reform/lean logistics or other CREP tenets affect this part of the process?
 - Was a Statement of Objective used or a Statement of Work?
 - Was there early contractor involvement?
- Purchase Request (PR) package
 - Primary milestones (date started and completed)
- Funding
 - What funding issues were involved with the CRT's ability to achieve the contract design goal (the lay-in of long-lead-time parts/rotatable pool, etc.)?

CRT/IPT

- Who initiated the CRT or IPT and why?
- Who were the core members?
- How often did the team meet?
- Was there an advantage to using a CRT? Disadvantages?
- Were the Defense Contract Audit Agency (DCAA) and the Defense Contract Management Agency (DCMC) directly involved?
- How did the contractor participate?
- Did all members of the CRT work toward a common goal? Were there conflicts between CRT and functional goals? If so, how were they resolved?

Contract design

- In what major ways is this contract different from its predecessor?
- What innovations were incorporated in the contract? Improvements?
- What other innovations were contemplated but not incorporated?
- How was the acquisition strategy determined? Based on what goals?
- What were the primary challenges in contract design? How were they overcome?
- Was a cost benefit analysis conducted? If so, what were the results and how did they influence contract design?
- Was market research conducted? If so, what sources were consulted and who performed the analyses?
- What major “firsts” were accomplished in this contract or during the process?

Lessons learned

- What did the CRT learn from this contract experience?
- Did the CRT consult with other sources to learn from others before writing this contract? If so, what sources were consulted?
- Have the lessons learned from this contract influenced the way other contracts were written? If so, which ones and how?

CREP SURVEY CONDUCTED AT WARNER ROBINS ALC

The CREP survey conducted at Warner Robins ALC in 1998 and 1999 appears in the next six pages. Key participants in the contract repair teams (program managers, procurement contracting officers, production management specialists, and item management specialists) or those individuals who had most influence on the requirements and contract design steps of the CREP process filled out the survey online and submitted it to RAND electronically. The survey was conducted in 1998 and again in 1999 with CRT individuals who had not completed the survey the first time. Questions 24 to 44 were based on issues arising from acquisition reform and agile logistics that concerned individual behavior and factors that affected behavior.¹ Thus, they applied generally to all of the CREP contracts in which the individual had participated. The survey questions that follow provided the data for the organizational levers or independent variables. The survey is shown as it appeared to Warner Robins ALC survey participants.

¹Questions 1 to 23 (not shown) pertained to individual contracts and the contracting process. These responses were too incomplete to use in the study and were dropped from further consideration.

**Implementing Acquisition Reform in Depot Maintenance Contracts:
Survey of Warner Robins ALC**

Your Name:

A. Attitude toward Acquisition Reform

24. How well do you understand the goals of acquisition reform?

Very well	Well	Somewhat well	Not well	Not at all well
☐	☐	☐	☐	☐

25. How supportive are you of the goals of acquisition reform?

Very supportive	Supportive	Somewhat supportive	Not supportive	Not at all supportive
☐	☐	☐	☐	☐

26. How likely is acquisition reform to contribute to the following outcomes (check all that apply)?

Outcome	Very likely	Likely	Somewhat likely	Not likely	Not at all likely
Improve mission capability rates for end user	☐	☐	☐	☐	☐
Reduce the cost of my contracts	☐	☐	☐	☐	☐
Increase contractor responsiveness/flexibility	☐	☐	☐	☐	☐
Increase my workload	☐	☐	☐	☐	☐
Increase my job satisfaction	☐	☐	☐	☐	☐
Make my job more secure	☐	☐	☐	☐	☐

B. Leadership

27. How supportive of acquisition reform are the following individuals or groups?

Individual/Group	Very supportive	Supportive	Somewhat supportive	Not supportive	Not at all supportive
Headquarters AFMC	☐	☐	☐	☐	☐
Your ALC leadership	☐	☐	☐	☐	☐
Your product directorate leadership	☐	☐	☐	☐	☐
Your immediate supervisor	☐	☐	☐	☐	☐

28. How true are the following statements about acquisition reform?

Statement	Very true	True	Somewhat true	Not true	Not at all true
Air Force leadership has made a strong case for why we need acquisition reform.	☐	☐	☐	☐	☐
Different parts of the chain of command send different messages about acquisition reform	☐	☐	☐	☐	☐
Management attitudes suggest that acquisition reform is the latest "program of the month."	☐	☐	☐	☐	☐
I would be punished for a failed attempt to do something innovative with a contract.	☐	☐	☐	☐	☐
I would be rewarded for a successful attempt to do something innovative with a contract.	☐	☐	☐	☐	☐
Hard work integrating acquisition reform into a contract goes unnoticed by management.	☐	☐	☐	☐	☐

C. Performance Evaluation and Rewards

29. How important are the following factors in your yearly performance evaluation?

Factor	Very important	Important	Somewhat Important	Not Important	Not at all important
Increasing the number of all types of contracts processed	☐	☐	☐	☐	☐
Increasing the number of commercial contracts processed	☐	☐	☐	☐	☐
Improving the timeliness of contracts process (reduced administrative lead time)	☐	☐	☐	☐	☐
Working effectively with the members of my CRT	☐	☐	☐	☐	☐
Improving contract performance (cost, reliability, cycle times)	☐	☐	☐	☐	☐
Improving my educational qualifications	☐	☐	☐	☐	☐
Improving partnering with contractors	☐	☐	☐	☐	☐

30. How likely is the effective use of acquisition reform to lead to the following rewards?

Reward	Very likely	Likely	Somewhat likely	Not likely	Not at all likely
Higher merit increases	☐	☐	☐	☐	☐
Improved opportunities for promotion	☐	☐	☐	☐	☐
Non-monetary rewards (e.g., time off, trips)	☐	☐	☐	☐	☐
Recognition from ALC/product directorate/division for a job well done	☐	☐	☐	☐	☐
Official acknowledgment of customer satisfaction	☐	☐	☐	☐	☐

D. Teaming and Partnering

31. How many CRTs (or contract IPTs) have you participated in this fiscal year?

32. How true are the following statements about the CRTs (or IPTs) you have worked on?

Statement	Very true	True	Somewhat true	Not true	Not at all true
The CRT was effective in overcoming functional or disciplinary barriers to cooperation.	☐	☐	☐	☐	☐
Some team members had a poor understanding of acquisition reform.	☐	☐	☐	☐	☐
Team members worked toward a common performance goal.	☐	☐	☐	☐	☐
Non-core CRT members (FM, BC, CR, EN, QA) were well integrated into the process	☐	☐	☐	☐	☐

33. How effective and responsive were the following individuals or groups in completing their tasks for the CRTs (or IPTs) you have worked on?

Acquisition Reform Survey

Individual/Group	Very effective	Effective	Somewhat effective	Not effective	Not at all effective
Program Manager/Logistics Officer	☐	☐	☐	☐	☐
Item Manager	☐	☐	☐	☐	☐
Production Management Specialist	☐	☐	☐	☐	☐
Procurement Contracting Officer	☐	☐	☐	☐	☐
Equipment Specialist	☐	☐	☐	☐	☐
Engineering	☐	☐	☐	☐	☐
Quality Assurance	☐	☐	☐	☐	☐
Financial Management	☐	☐	☐	☐	☐
Contract DMAG	☐	☐	☐	☐	☐
Competition Advocate	☐	☐	☐	☐	☐
Small Business	☐	☐	☐	☐	☐
Acquisition Support Team (AST), formerly known as the RFP Support Office (RFP SO)	☐	☐	☐	☐	☐

34. How true are the following statements about the relationship between the Air Force and contractors for the contracts you have worked on?

Statement	Very true	True	Somewhat true	Not true	Not at all true
A positive working relationship exists with the contractors	☐	☐	☐	☐	☐
The Air Force and contractors have worked together to improve processes and reduce cycle time.	☐	☐	☐	☐	☐
Contractors alert the Air Force to anticipated problems that could affect the contractor's performance.	☐	☐	☐	☐	☐
Contractors show a willingness to assume risks in order to do business with the Air Force.	☐	☐	☐	☐	☐
The Air Force shows a willingness to pay for the risks it wants contractors to assume.	☐	☐	☐	☐	☐
The Air Force shows a commitment to reward contractors who perform well.	☐	☐	☐	☐	☐

E. Training and Career Development

35. - 38. How many years of work experience do you have in

your present job?

the Air Force?

other non Air Force government positions?

the private sector?

39. - 40. What is your current GS grade and step?

GS grade:

GS step:

41. About how many days of formal training in acquisition reform have you received in the past two fiscal years?

- ☐ None
- ☐ 1 to 2 weeks
- ☐ 3 to 4 weeks
- ☐ More than one month

42. How often do you receive formal or informal training updates on acquisition reform as it affects your job?

- ☐ Weekly
- ☐ Monthly
- ☐ Quarterly
- ☐ Biannually
- ☐ Annually
- ☐ Less than once a year

43. In what areas is a lack of training for you or your colleagues slowing the implementation of acquisition reform (*check all that apply*)?

- ☐ Requirements determination
- ☐ Market research
- ☐ Seeking industry input into RFP development
- ☐ Determining price reasonableness
- ☐ Developing the PR package as well as contract terms and conditions
- ☐ Negotiation of contract terms and conditions
- ☐ None of the above

44. How important are the following sources of information for keeping current changes and "best practices" in contracting?

Factor	Very important	Important	Somewhat Important	Not Important	Not at all important
DoD Acquisition Reform Web site	☐	☐	☐	☐	☐
My ALC Web site	☐	☐	☐	☐	☐
Web sites at other ALCs or Headquarters	☐	☐	☐	☐	☐
AFMC	☐	☐	☐	☐	☐
The "home office" for my function at the ALC	☐	☐	☐	☐	☐
The Acquisition Support Team (aka RPPSO) at the ALC	☐	☐	☐	☐	☐
Other personnel in my product directorate or at ALC	☐	☐	☐	☐	☐
Contractors	☐	☐	☐	☐	☐
Official memos, newsletters, and videos	☐	☐	☐	☐	☐
Roadshows or Acquisition Reform Stand-down Week	☐	☐	☐	☐	☐

If you have any questions or experience problems,
please contact Mary Chenoweth by e-mail
(mcc@rand.org) or telephone (310-393-0411,
x6248).

**ORGANIZATIONAL LEVER VARIABLES
FROM SURVEY DATA: PRINCIPAL COMPONENTS
ANALYSES**

The goal of the principal components analyses (PCAs) was to identify the key organizational lever factors that could be described by a linear combination of survey questions. PCAs allow one to examine relationships among responses to determine whether particular questions reflect the same underlying concept. These analyses permit data from numerous questions or items to be classified into a few factors that describe unique scales. PCAs, rather than factor analyses, are an appropriate technique to use when the analyses are exploratory in nature and one wants to account for total variance instead of shared variance. PCA is particularly appropriate here, because we had no prior experience with how people would respond to or interpret the survey questions. PCA is a technique commonly used in psychology in the development of scales of personality and intelligence (Tabachnick and Fidell, 1996).

Based on theoretical assumptions about what the survey was trying to measure, data were analyzed separately for questions addressing different organizational levers.¹ We conducted eight different PCAs to identify eight lever variables and then computed two others directly (i.e., not using PCA)—job experience and a product directorate dummy variable. PCA fundamentally assumes that all the responses

¹PCAs conducted on all 29 question subparts created factors similar to those based on eight separate PCA analyses. These results indicate that the survey respondents perceived our theoretical concepts as separate or distinct factors.

are measured on a similar continuous scale (e.g., five-point scales). The PCA technique identified eight organizational lever factors:

- Attitude toward acquisition reform
- Leadership consistency
- Performance evaluations
- Performance incentives
- Effective teaming
- Contractor partnering
- Air Force partnering
- Training in acquisition reform.

This study used PCA with varimax rotation using Kaiser's eigenvalue rule (Nunnally, 1978), which states that only factors with eigenvalues greater than one are retained. This rule means that only factors that explain more variance than a single item are computed. Eigenvalues express how much variance is explained by each factor; principal components compute factors so that the first factor represents the largest amount of variance. The correlation between the factor and specific items is reported by the factor loading of each item. The amount by which each variable "loads" on a factor is measured by its correlation with the component. Using a cutoff value of 0.60, survey items with high factor loadings were retained for further analyses, except for the training in acquisition reform variable where the two items were not highly correlated (see Table D.1).² The regression analyses retained the training in acquisition reform variable even though it failed to meet the cutoff criteria because of its importance in implementing new business practices.

Varimax rotation maximizes the variance of the squared loadings and is the most common orthogonal rotation method (DeVellis, 1991).

²Items related to job experience and training did not load on the same factor. Because we were interested in the relationship of both job experience (i.e., number of years in present job) and the amount of training Air Force personnel had received with contract innovation, items from both training and job experience were retained as distinct organizational levers, and thus independent variables for the multiple regression analyses.

Rotated factor patterns and Cronbach's coefficient alphas (Cronbach, 1951) were computed for each factor. Cronbach's coefficient alpha is a widely used measure of reliability in which alpha signifies one minus the error variance. Thus, high reliability is denoted by alpha values close to one. Table D.1 shows the results of the PCAs in identifying survey questions by organizational lever.

Table D.1
Organization Levers Measured by Survey Questions

Organizational Lever	Factor Loading	Alpha
1. Attitude toward acquisition reform		0.887
How supportive are you of the goals of acquisition reform? (Q25)	0.694	
How likely is acquisition reform to contribute to the following outcomes? (Q26)		
• Improve mission capability rates for end user	0.833	
• Reduce the cost of my contracts	0.807	
• Increase contractor responsiveness/flexibility	0.872	
• Increase my job satisfaction	0.907	
• Make my job more secure	0.684	
2. Leadership consistency		0.625
How true are the following statements about acquisition reform? (Q28)		
• Different parts of the chain of command send different messages about acquisition reform	0.853	
• Management attitudes suggest that acquisition reform is the latest "program of the month"	0.853	
3. Performance evaluations		0.887
How important are the following factors in your yearly performance evaluation? (Q29)		
• Improving the timeliness of contracts processed (reduced administrative lead-time)	0.843	
• Working effectively with the members of my CRT	0.824	
• Improving contract performance (cost, reliability, cycle times)	0.913	
• Improving partnering with contractors	0.877	

Table D.1 (continued)

Organizational Lever	Factor Loading	Alpha
4. Performance incentives		0.901
How likely is the effective use of acquisition reform to lead to the following rewards? (Q30)		
• Higher merit increases	0.873	
• Improved opportunities for promotion	0.912	
• Non-monetary rewards (e.g., time off, trips)	0.863	
• Recognition from ALC/product directorate/division of a job well done	0.776	
• Official acknowledgment of customer satisfaction	0.811	
5. Effective teaming		0.678
How true are the following statements about the CRTs (or IPTs) you have worked on? (Q32)		
• The CRT was effective in overcoming functional or disciplinary barriers to cooperation.	0.846	
• Team members worked toward a common performance goal.	0.801	
• Non-core CRT members (FM, BC, CR, EN, QA) were well integrated into the process.	0.689	
6. Contractor partnering		0.873
How true are the following statements about the relationship between the Air Force and the contractor? (Q34)		
• A positive working relationship exists with the contractor.	0.875	
• The Air Force and contractor have worked together to improve processes and reduce cycle time.	0.859	
• The contractor alerts the Air Force to anticipated problems that could affect the contractor's performance.	0.864	
• The contractor shows a willingness to assume risks in order to do business with the Air Force.	0.805	
7. Air Force partnering		0.718
How true are the following statements about the relationship between the Air Force and the contractor? (Q34)		
• The Air Force shows a willingness to pay for the risks it wants the contractor to assume.	0.883	
• The Air Force shows a commitment to reward contractors who perform well.	0.883	

Table D.1 (continued)

Organizational Lever	Factor Loading	Alpha
8. Training in acquisition reform		0.392
How many days of formal training in acquisition reform have you received in the past two fiscal years? (Q41)	0.789	
How often do you receive formal and informal training updates on acquisition reform as it affects your job? (Q42)	0.789	
9. Job experience		n/a
How many years of work experience do you have in your current job? (Q35)		
10. U-2 Product Directorate		n/a

STATISTICAL RESULTS OF THE MULTIVARIATE ANALYSES

INTRODUCTION

This appendix gives the results of an ordinary least squares (OLS) regression with the four CREP innovation groups and the fifth group that includes all CREP tenets as the dependent measures. We show two sets of results for all analyses. The first half of Table E.1 gives the results of the five regression models using 101 observations, which include component repair and U-2 sustainment contracts. The second half of the table shows the results for the sample of just the component repair contracts (without U-2 sustainment contracts, $n = 75$). Our dependent measure is the number of innovation group tenets incorporated in the contract sample. The analyses regressed the dependent variable, i.e., the number of tenets, onto the organizational lever variables. Appendix C described how the survey questions were used to construct the organizational lever variables.

Because our dependent variables in each of the five groups were not continuous, but rather limited in range, probit analyses were also performed. The probit results were strikingly similar to the results of the OLS analyses and indicate that our conclusions are robust across both estimation methods. The OLS analyses offer results that are

Table E.1
Results from the OLS Regression Analyses: Standardized Coefficients (β) by Contract Innovation Group

Organizational Levers	Contract Innovation Groups (n = 101; component repair and sustaniment contracts)						Contract Innovation Groups (n = 75; component repair contracts only)					
	Simple Mods	Key AR Concepts	Complete AR	Agile Logistics	All CREP Tenets		Simple Mods	Key AR Concepts	Complete AR	Agile Logistics	All CREP Tenets	
Intercept	0.28	3.82	7.28	1.19	7.38		1.03	3.97	8.58	2.18	9.57	
Attitude toward AR ^a	0.39	0.31	0.83	0.52	1.27		0.75	0.23	1.41	0.81	2.20	
Leadership consistency ^a	0.20	0.32	0.32	0.44	0.64		-0.01	0.33	0.07	0.17	0.11	
Performance evaluation	-0.11	-0.24	-0.21	-0.65	-0.74		-0.26	-0.33	-0.34	-1.21	-1.32	
Performance incentives	-0.14	0.09	-0.19	0.11	-0.12		-0.32	0.32	-0.81	0.53	-0.46	
Effective teaming	-0.27	-0.77	-0.91	-0.75	-1.51		-0.40	-0.93	-0.96	-1.12	-1.93	
Contractor partnering	0.34	0.11	-0.12	0.48	0.47		0.46	0.22	-0.26	0.87	0.68	
Air Force partnering	-0.18	0.07	-0.04	0.19	0.08		-0.26	0.09	0.07	0.06	0.05	
Training in AR	0.42	0.28	0.53	0.73	1.20		0.58	0.30	0.69	0.92	1.54	
Job experience	-0.04	-0.04	-0.10	-0.01	-0.09		-0.09	-0.05	-0.18	-0.05	-0.21	
Product Directorate, U-2	0.02	0.63	1.47	1.32	2.47							
Adjusted R ²	0.37	0.20	0.26	0.55	0.48		0.50	0.14	0.15	0.52	0.39	
F-ratio	6.76	3.54	4.45	13.4	10.12		9.15	2.37	2.39	9.66	6.21	
Pr > F	<.0001	.0006	<.0001	<.0001	<.0001		<.0001	.0222	.0207	<.0001	<.0001	

NOTE: Coefficients marked white with a black background have $p < 0.01$. Coefficients that are shaded medium have $p < 0.05$. Coefficients that are shaded lightly have $p < 0.10$.

^aVariable reported on a three-point scale. All other survey variables reported on a five-point scale.

easier to interpret in terms of variation explained by R^2 and sr^2 ; therefore, only they are presented here.¹

ORDINARY LEAST SQUARES REGRESSION RESULTS

The left-hand column of Table E.1 shows the independent variable names and other statistical labels for the analyses. The columns to the right show the values of the standardized coefficients or β s, which indicate the marginal effect each organizational lever has with the number of tenets incorporated in CREP contracts, holding all other levers constant. For example, with the "simple modification" model ("simple mods"), on average, a CRT that had a highly positive attitude toward acquisition reform incorporated 0.39 more tenets in their contracts than did a CRT that had a mid-range attitude (a scale difference of one). The same CRT with a highly positive attitude toward acquisition reform incorporated 0.78 more tenets than did a CRT with a highly negative attitude (a scale difference of two or two times 0.39).²

Near the bottom of Table E.1 is the F-ratio, which measures the amount of variance explained by the set of independent variables. The F-ratio indicates whether the independent variables explain a significant proportion of the variance in the dependent variables. In other words, it shows whether the organizational levers could help explain contract innovation. Indeed, they explained all four sets of contract innovation groups along with the group of all CREP tenets.

¹The range of our independent variables were: simple modifications, 0 to 3; key AR, 0 to 6; complete AR, 0 to 9; agile logistics, 0 to 7; all CREP tenets, 0 to 14. Figure 2.2 shows the histograms of these dependent variables. Compared to ordinary least squares analyses, the probit analyses showed improved levels of significance for several independent variables—performance evaluation, effective teaming, and contractor partnering.

²We note that two variables—attitude toward AR and leadership consistency—allowed only three different responses after mathematical transformation, which means CRTs can be at the most two scale intensities apart. The next five variables in Table E.1 allowed five different responses, which means CRTs can differ by as much as four scale intensities, because the variable allowed five different responses.

Also near the bottom of Table E.1 is the coefficient of determination, R^2 , adjusted for the degrees of freedom.³ R^2 measures the amount of variance in the dependent variable that the independent variables explain. Looking across the four sets of innovation groups and the group of all tenets, the agile logistics innovation group had the best fit and the organizational levers explained over half of the variance in the dependent variable (adjusted $R^2 = 0.55$). This innovation group was followed by the groups “all CREP tenets” (adjusted $R^2 = 0.48$), simple modifications (adjusted $R^2 = 0.37$), and trailed significantly by the two acquisition reform groups (adjusted $R^2 = 0.20$ and 0.26).

These results tell us that the organizational levers available to senior leadership were more related to agile logistics tenets and much less related to acquisition reform tenets. Two possible explanations are suggested. First, the organizational lever variables associated with acquisition reform may have been omitted, incomplete, or improperly measured. Second, the organizational levers the survey measured may have been intrinsically more related to agile logistics than they were to acquisition reform. We know through interviews that Warner Robins ALC emphasized two types of contract goals during the CREP initiative: (1) simple modifications for active contracts and (2) agile logistics for new contracts. Perhaps combining complicated concepts, like acquisition reform, with simpler-to-explain concepts, like agile logistics, requires a more complex approach to applying organizational levers.

T-Test Values

The t-test on the organizational lever variables in the regression analyses explains the probability that the coefficient for a particular variable is not equal to zero, i.e., it tells us whether the organizational lever had any association with the dependent variable. We considered variables as having explanatory power up to $p < 0.10$. We chose this cutoff point because our sample of 101 observations to estimate coefficients for ten independent variables is relatively small. This cutoff suggests that we risk being wrong 10 percent of the time when p-values reach 0.10.

³The R^2 value can inflate as more independent variables are added, even if they are not statistically significant. The adjusted R^2 value takes into account the addition of variables that do not have much explanatory power.

Squared Semi-Partial Correlations (sr^2)

Table E.2 shows the results for the squared semi-partial correlations (sr^2) for each of the organizational lever variables. Semi-partial correlations describe the amount by which R^2 is reduced if a particular independent variable is deleted from the regression equation. In short, they explain the unique contribution of the independent variable to R^2 (Tabachnick and Fidell, 1996). The higher the value, the greater contribution the variables make toward explaining variance in the dependent variable. Except for the product directorate dummy variable, training in acquisition reform is the organizational lever variable with the single highest explanatory power. Other organizational lever variables associated with the innovation group variables are contractor partnering (for the simple modifications model), effective teaming (for the key acquisition reform concepts and agile logistics models), and performance evaluation (for the agile logistics model).

Table E.2
Results from the OLS Regression Analyses: Semi-Partial Correlations (sr^2) by Contract Innovation Group

Organizational Lever	Contract Innovation Groups (n = 101; sustainment and component repair contracts)					Contract Innovation Groups (n = 75; component repair contracts only)				
	Simple Mods	Key AR Concepts	Complete AR	Agile Logistics	All CREP Tenets	Simple Mods	Key AR Concepts	Complete AR	Agile Logistics	All CREP Tenets
Attitude toward AR ^a	0.035	0.012	0.028	0.016	0.029	0.069	0.005	0.063	0.025	0.059
Leadership consistency ^a	0.016	0.022	0.007	0.020	0.013	0.000	0.022	0.000	0.002	0.000
Performance evaluation	0.003	0.009	0.002	0.029	0.012	0.010	0.012	0.004	0.069	0.026
Performance incentives	0.003	0.000	0.000	0.000	0.000	0.007	0.005	0.012	0.006	0.001
Effective teaming	0.013	0.057	0.026	0.025	0.032	0.014	0.055	0.022	0.036	0.033
Contractor partnering	0.027	0.001	0.000	0.013	0.004	0.028	0.005	0.002	0.032	0.006
Air Force partnering	0.008	0.000	0.000	0.002	0.000	0.014	0.001	0.001	0.000	0.000
Training in AR	0.121	0.029	0.034	0.089	0.075	0.162	0.030	0.059	0.129	0.113
Job experience	0.020	0.013	0.024	0.000	0.009	0.072	0.016	0.069	0.008	0.038
Product Directorate, U-2	0.000	0.049	0.089	0.103	0.112					

^aVariable reported on a 3-point scale. All other survey variables reported on a 5-point scale.

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To identify barriers to implementing acquisition reform, the study team examined the incorporation of Contract Repair Enhancement Program (CREP) tenets in repair contracts at Robins Warner Air Logistics Center (ALC). The study attempted to link successful incorporation of tenets in repair contracts to various organizational levers—policies and practices senior leadership can use to influence individual behavior to achieve policy objectives. After a literature review, the study team conducted a survey at Warner Robins ALC to assess behaviors and attitudes toward acquisition reform, with emphasis on the organizational levers that existed during the CREP initiative. The team then developed regression models to explore the relationship between organizational levers and the number of CREP tenets incorporated in a repair contract. The team found that organizational levers can help explain contract measures of success. Training in and fostering positive attitudes toward acquisition reform as well as effective teaming appeared to have a consistent statistical relationship with contract innovation.

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