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Commercial Best Practices in Contracting for Knowledge-Based and Equipment-Related Services

Julie C. Kelly, Project Leader
Caroline R. Earle
Michael J. Lippitz
Brandon A. Shapiro
Richard H. Van Atta

August 2015
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IDA Paper P-5257
Log: H 15-000450

INSTITUTE FOR DEFENSE ANALYSES
4850 Mark Center Drive
Alexandria, Virginia 22311-1882

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About This Publication

The work was conducted by the Institute for Defense Analyses (IDA) under contract HQ0034-14-D-0001, Project AR-6-3801, "Services Contracting," for the Office of Defense Procurement and Acquisition Policy, Services Acquisition (DPAP/SA). The views, opinions, and findings should not be construed as representing the official position of either the Department of Defense or the sponsoring organization.

Acknowledgments

The authors wish to thank Dr. David Graham and Mr. Paul Ketrick for their review of the paper. Special thanks to Mr. Ken Brennan and Ms. Emily Clarke for their guidance and input in shaping our research.

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Executive Summary

The Office of Defense Procurement and Acquisition Policy, Services Acquisition (DPAP/SA) asked the Institute for Defense Analyses (IDA) to evaluate private sector service contracting practices in the areas of Knowledge-Based Services (KBS) and Equipment-Related Services (ERS). IDA performed a literature review (including previous IDA reports) and interviewed representatives from commercial companies.

The literature review highlighted key factors in a company's decisions about outsourcing KBS or ERS:

- **Closeness** to core competencies and competitive advantages;
- **Capability**, including whether the firm has competency in a particular area relative to others, and whether such a capability should be maintained;
- **Capacity**, including whether the firm has the necessary scale in this area and whether such scale should be maintained; and
- **Cost**, including both production and transaction costs.

These key factors map to three strategic outcomes, highlighted in the interviews, that drive decisions to use external service providers:

- **Enhance competitiveness**,
- **Reduce costs**, and
- **Adjust to rapid change**.

A key notion from the literature is the centrality of the definition and assessment of core competencies to decisions regarding whether to perform a service internally or outsource it. In general, companies maintain core competencies in-house, as they are often the foundation of their competitive advantage. However, IDA's research revealed certain circumstances under which companies engage with external vendors in areas close to their core. For instance, companies may require surge capacity to meet unexpected demand. Specialized or rapidly-changing skill sets may be difficult or uneconomical to maintain in-house. And external partners may offer opportunities for innovation ("open innovation") that provide competitive advantage. Such decisions are regularly tested against existing reality; at any point in time, assessments regarding key factors may change with fluctuations in markets, customers, and technology.

Strategic Outcomes

Our findings on commercial best practices are organized in terms of the three strategic outcomes.

A. Enhance Competitiveness

- **Finding A1 – Services outsourcing supports core capabilities**. The companies interviewed differentiated between their core and peripheral functions and then used that delineation to determine their make vs. buy decisions. This core analysis is a corporate-level, strategic business decision that is regularly revisited during formal reviews.
- **Finding A2 – Internal talent development and knowledge transfer are key considerations**. Work with outside vendors is turned into corporate institutional memory through documentation of work, data reporting requirements, data repository capabilities, talent management/development, and rotation of talent throughout the organization. Companies have special programs to identify and train promising employees. Intellectual property sharing with customers and original equipment manufacturers is critical and often formalized as part of contractual agreements.
- **Finding A3 – "Smart buyer" approaches are essential in accessing technical and specialized knowledge**. Internal "smart buyer"-type organizations (sometimes called "strategic sourcing" offices or the like) support enterprise-wide procurements and serve as a corporate repository of best practices and lessons learned, including serving as relationship managers. Visibility and authority over purchases of services is often managed at the enterprise level in order to optimize and reduce cost. When expertise does not exist internally, companies may engage with an external sourcing advisory firm.
- **Finding A4 – Vendor incentives and metrics need to be closely coupled**. Service suppliers are evaluated with a scorecard assessment process employing both qualitative and quantitative key performance indicators. Vendor evaluation criteria are built into service contracts in order to set mutual expectations. Leading buyers of services manage selected vendors through a collaborative review process which, in some cases, includes improvement plans linked to performance parameters.

B. Reduce Costs

- **Finding B1 – Cost of services is managed for overall value**. While cost is a driving factor in the make vs. buy decision, it is not the only or necessarily dominating criterion. As noted in Finding A4, companies evaluate multiple criteria when choosing to purchase and/or continue using a particular vendor.

Quality, improved readiness, and faster turnaround time were noted by the companies interviewed. (Turnaround time is particularly important in commercial aviation.)

- **Finding B2 – Multiple vendors are used to maintain competition and reduce risk**. Companies create and maintain "preferred supplier lists" of vendors that have been pre-screened for high-quality service delivery in specific categories. Validated vendors are known to be able to meet corporate standards, safety guidelines, and required supply chain processes—all of which reduce risk to internal buyers. Doing so also provides reliability and backup, allows tailoring for regional markets, and provides leverage for negotiating lower prices.
- **Finding B3 – Data and predictive analytics can achieve substantial savings**. Predictive analytics is becoming an important business tool for making more well-informed maintenance decisions. Such analytics are increasingly being offered on an "as a service" basis (Appendix A). In the aviation industry, predictive maintenance solutions for engines and other critical aircraft components can achieve substantial savings in just a short amount of time. Collaboration with the vendor is essential for such offerings.

C. Adjust to Rapid Change in Dynamic Markets

- **Finding C1 – Responsiveness to demand changes facilitated by using service vendors—"it's not just cost."** Companies can respond to demand changes cost-effectively through strategic use of service vendors, leveraging relationships with networks of approved suppliers. In some cases, firms negotiate explicit standby arrangements with vendors, to ensure priority access during surges or to assist with projects that require a quick turnaround. The right contracting approach can support flexibility, allowing movement of requirements and price based on evolving needs assessments.
- **Finding C2 – Buying services can enhance operational capacity and increase agility**. Organizational learning and knowledge transfer are important elements in a company retaining its ability to adjust rapidly and maintain a competitive edge in dynamic markets, beyond simple changes in quantitative demand. Hence, leading companies value vendor flexibility and adaptability, often including it as an explicit part of their vendor assessment scorecards. Honest dialogue is essential, as is an iterative and interactive problem-solving approach; sometimes the contract is even "put in the drawer" so that partners can work together to resolve the problems at hand.

Importance of Relationships

Increasingly, services outsourcing engagements are viewed as long-term, not transactional relationships; these relationships often last a decade or even longer. Recurring interactions and continual dialogue can lead to long-term, trusted relationships with mutual benefits, such as the sharing of risk. Successful, long-term relationships require an ongoing and continuing dialogue throughout the life of the customer relationship, not something that only occurs when the contract terms are being discussed and put into place. Both parties need to maintain an honest and ongoing dialogue about the initial scope of work and have frequent communication to keep the other party updated on the progress of the service. The best companies recognize that both parties need to make money and both rely on the other for long-run sustainment of the market.

Relevance to the Department of Defense (DOD)

Commercial BPs in services acquisition may be thought of as three levels:

1. Consolidating requirements and/or purchases,
2. Utilizing internal "smart buyer" organizations and practices, and
3. Building/maintaining long-term relationships with key partners.

Companies typically begin at the first level: consolidating requirements and/or purchases. Doing so is relatively straightforward but can take time in complex organizations with many buyers that may not use common terminology or acquisition approaches. As companies evolve in their services acquisition strategies, they move into the second level—"smart buyer" organizations. The third level is achieved by only the most evolved companies practicing services acquisition. Commercial best practices exist within each of these stages, and many should be considered for applicability within DOD.

The table on page vii summarizes IDA's view of DOD's ability to implement commercial BPs, based on the research team's experience with various DOD services acquisition improvement efforts in recent years. Green-shaded cells represent areas where the research team has identified DOD's demonstrated ability to execute a particular category of commercial BPs. Yellow-shaded cells represent areas where DOD could improve through adaptation of commercial best practices but is limited in certain important respects. Red-shaded cells represent areas where DOD faces significant obstacles to adopting commercial BPs and has not made substantial progress to date.

Leadership is required to make investments—sometimes enterprise-wide—in resources and capabilities to change the provision of services. DOD is forced to develop a case for change both within the Executive branch and the Congress. Doing so requires a demonstration of cost savings and performance, as well as clear approaches for how the

changes will be made and what is required to make them—including, if necessary, legislation. Steps toward implementation would include:

1. Analysis of organizational, legal, and other challenges;
4. Setting priorities for which best practices to pursue, through an analysis of current spending, implementation complexity, and potential impact;
5. Solicitation of viewpoints and a drive toward consensus on priorities among the most critical stakeholders;
6. Candidate areas for demonstration, based on stakeholder consensus and focus/willingness of required leaders; and
7. Enterprise rollout requirements (for successful demonstrations).

"Quick Look" Assessment of DOD's Ability to Implement Commercial Best Practices under Each Strategic Outcome

Level	Enhance Competitiveness	Reduce Costs	Rapidly Adjust
Centralize	Ongoing DOD effort to analyze and centralize oversight of services spending	Multiple suppliers used in particular cases, but practice is not widespread	Not observable/ applicable.
Smart Buyer	DOD smart buyer organizations exist in certain domains and places; results have been good, opportunities for expansion exist; vendor metrics must offer real-time feedback	Overall enterprise value considerations most relevant for non-commodity outsourcing decisions. Some progress in leveraging commercial economies of scale, data analytics, and vendor management	Some DOD organizations have contingency relationships for surge and quick reaction capabilities (e.g., SOCOM)
Relationships	Organizational policies should reinforce internal capture and transfer of knowledge to build institutional learning	Not observable/ applicable.	Interaction with vendors often constrained by letter of the contract; ability for flexible dialogue with key vendors more limited than in commercial world

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Contents

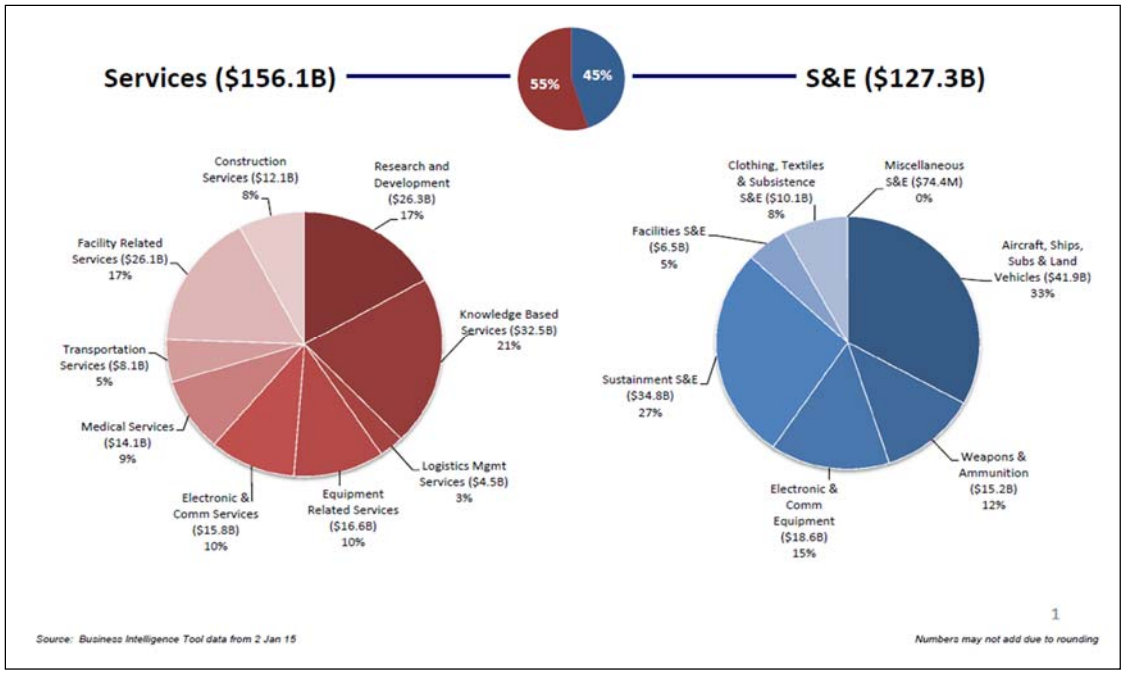
1. Services Contracting Environment

In recent years, the Department of Defense (DOD) has paid increased attention to achieving efficiencies in contracting for services. This involves understanding where money is spent, assessing underlying strategies and principles employed across DOD components (including the determination as to whether to contract for particular services or perform them in-house), and using contracting management approaches that have been demonstrated to improve both effectiveness and efficiency.

A. DOD Acquisition of Services

DOD's acquisition of services ranges from routine tasks to skilled analyses. DOD spending to acquire services has increased significantly over the past twenty years and now represents more than half of all DOD acquisition spending. Figure 1 displays DOD acquisition spending in fiscal year (FY) 2014, categorized by Federal Procurement Data System (FPDS) portfolio group.[1]

[1] FPDS is the repository for all US government procurement data and contains detailed information on contract actions related to the acquisition of goods and services.



Source: Defense Procurement Acquisition Policy, http://www.acq.osd.mil/dpap/sa/docs/learnmore/Services_Spending_by_Fiscal_Year.pdf.

Figure 1. DOD Acquisitions for FY2014

Within the Office of the Secretary of Defense, the Office of Defense Procurement Acquisition Policy, Services Acquisition Directorate (DPAP/SA), was established in May 2013. DPAP/SA is responsible for developing, implementing, governing, and executing the acquisition oversight framework for services, and for championing strategic sourcing policy and initiatives, as well as ensuring proper execution of services procurement to achieve "best value."[2] In particular, DPAP/SA is charged with the following activities:

- Coordinate improvements with Military Department and Agency senior managers for acquisition of services;
- Measure productivity using the DOD services taxonomy;
- Improve requirements definition and prevent requirements creep;
- Increase effective use of market research;
- Strengthen contract management outside the normal acquisition chain; and

[2] Commercial companies' use of the term "best value" instead of "lowest cost contracting decisions" varies from DOD's use of the term. Chapter 3 will cover more detail on DOD's usage of the term in the context of a "best value continuum."

- Expand the use of requirements review boards and early warning indicators of potential acquisition problems.[3]

These activities are governed by a body of legislation, DOD instructions, and DOD policy memoranda issued since 2002, including the Better Buying Power (BBP) initiatives, the *Defense Acquisition Guidebook* and a new DOD instruction *(DODI 5000.ac*), expected to be issued before the end of FY 2015.[4]

DOD's BBP initiative[5] was launched in 2010 as a set of fundamental acquisition principles to achieve greater efficiencies. Subsequent iterations[6] are based on the principle that continuous improvement is the best approach to improving the performance of DOD's acquisition enterprise. BBP continues to evolve and shift emphasis as experience is accumulated, data is collected and analyzed, and conditions change. The most recent iteration, BBP 3.0, emphasizes achieving dominant capabilities through innovation and technical excellence. Improving tradecraft in the acquisition of services continues to be a major focus.

BBP principles are supported by the *Defense Acquisition Guidebook*, which includes best practices (BPs), tutorials, and additional information on acquisition policy. Chapter 14 of the guidebook is dedicated to the acquisition of services, providing acquisition teams with a disciplined, seven-step process. Once issued, the new DOD instruction (i.e., *DODI 5000.ac*) will supplement existing guidance by establishing policy, assigning responsibilities, and providing procedures for defining, assessing, reviewing, and validating requirements for the acquisition of services.

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3 Additional information regarding the organizational structure, roles, and responsibilities of the DPAP/SA directorate is available at http://www.acq.osd.mil/dpap/sa/index.html.

4 The first DOD policy issued regarding the acquisition of services is the Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) *Memorandum on Acquisition of Services*, May 31, 2002, http://www.acq.osd.mil/dpap/sa/docs/historicalbackground/May2002Memo.pdf.

5 USD(AT&L), Memorandum for Acquisition Professionals, *Better Buying Power: Mandate for Restoring Affordability and Productivity in Defense Spending*, June 28, 2010, https://dap.dau.mil/policy/Documents/Policy/Carter%20Memo%20on%20Defense%20Spending%2028%20Jun%202010.pdf.

6 USD(AT&L), Memorandum for Secretaries of the Military Departments, Deputy Chief Management Officer, Department of Defense Chief Information Officer, Directors of the Defense Agencies, AT&L Direct Reports, *Implementation Directive for Better Buying Power 2.0 – Achieving Greater Efficiency and Productivity in Defense Spending*, April 24, 2013, http://bbp.dau.mil/docs/USD%28AT&L%29%20BBP%202.0%20Implementation%20Directive%20%2824%20April%202013%29.pdf; USD(AT&L), Memorandum for Secretaries of the Military Departments, Deputy Chief Management Officer, Department of Defense Chief Information Officer, Directors of the Defense Agencies, AT&L Direct Reports, *Implementation Directive for Better Buying Power 3.0 – Achieving Dominant Capabilities through Technical Excellence and Innovation*, April 9, 2015, http://bbp.dau.mil/docs/BBP3.0ImplementationGuidanceMemorandumforRelease.pdf.

B. Project Approach

DPAP/SA asked the Institute for Defense Analyses (IDA) to investigate service contracting in the private sector to identify BPs with potential application to DOD. In particular, DPAP/SA asked the IDA project team to focus on the following:

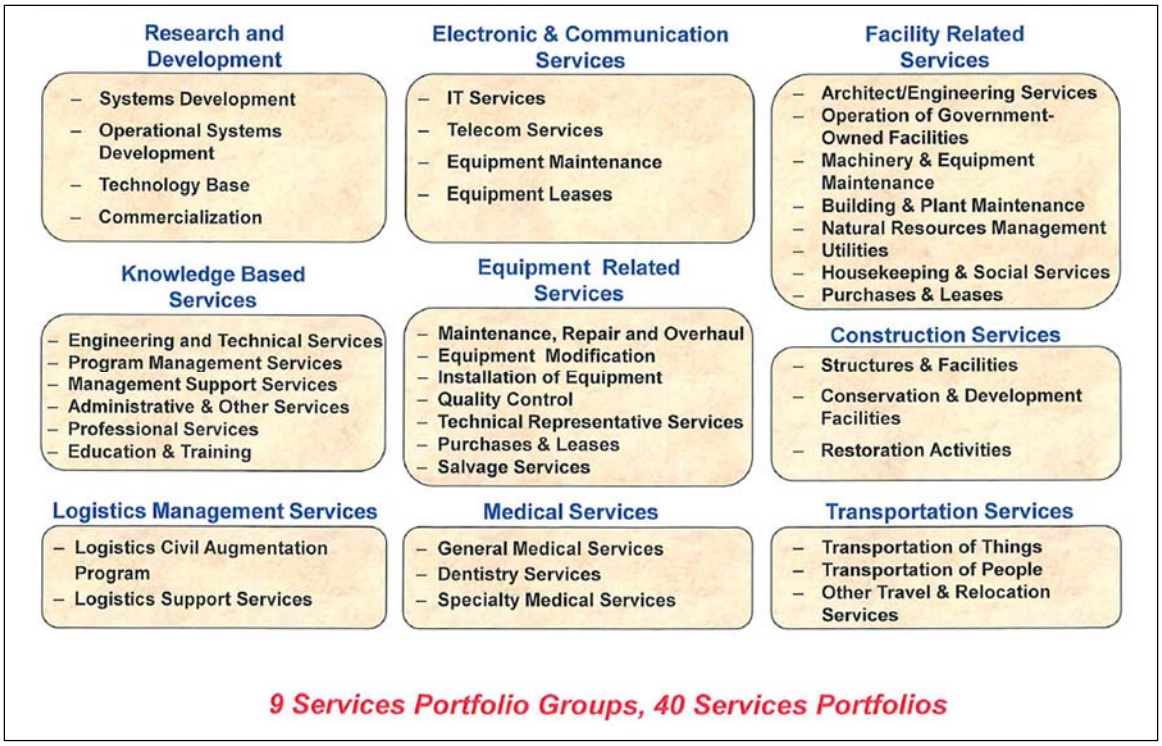
- How commercial firms identify their requirements and decide whether these requirements are supporting their strategies;
- Management processes to prioritize requirements and determine which services to outsource and which to retain in-house;
- Principles commercial firms use to manage their contracted services and how they develop and apply frameworks and criteria for improving the effectiveness of services contracting practices; and
- Management processes and systems to determine how contractor performance is measured.

In order to identify, document, and share representative commercial firm BPs and lessons learned, the IDA project team conducted eleven interviews with commercial firms. Interview questions elicited information from firms that acquire services ("users") or provide services ("vendors"). (Many firms act as both users and vendors of services.) IDA conducted a focused literature review to establish a conceptual framework that was used to analyze the information collected from the interviews. This analysis identified strategic outcomes that drive commercial industry decision making regarding the acquisition of services. The research team identified key findings and related commercial BPs from the interviews for each strategic outcome and made a preliminary assessment of the applicability of the key findings to DOD.

C. Scope

DOD uses a portfolio group taxonomy to categorize its spending on services; there are nine services portfolio groups, as shown in Figure 2. DPAP/SA identified two portfolio groups of primary interest for this research: Knowledge-Based Services (KBS) and Equipment-Related Services (ERS). In FY 2014, the largest portion of services spending was in the KBS portfolio group: $32.5 billion, or 21 percent of total spending on services. DOD spent $16.6 billion on the acquisition of ERS in FY 2014, 10 percent of total spending on services (third largest).[7]

[7] USD(AT&L), "Functional Domain Expert Structure," last accessed July 2, 2015, http://www.acq.osd.mil/dpap/sa/docs/fde/images/FDE_Structure_FY14.pdf.



Source: https://acc.dau.mil/adl/en-US/412685/file/73061/Taxonomy%20for%20the%20Acq%20of%20Svcs%20Supplies%20Equip%208-27-12.pdf.

Figure 2. DOD Acquisition of Services Taxonomy

The project team conducted research on users and vendors of KBS and ERS, reviewed historical spending data for these portfolio groups to identify the largest spending categories, and conducted interviews with subject matter experts to solicit input on potential commercial firms to target for interviews. These data were key inputs to the commercial firm selection criteria used to identify candidates. The largest ERS spending categories in FY 2014 are displayed in Table 1.

Table 1. Largest FY 2014 ERS Spending Categories by Product Service Codes (PSCs)

PSC Description	Spending ($B)
Maintenance/Repair/Rebuild – Aircraft and Airframe Structural Components	4.98
Non-Nuclear Ship Repair	2.93
Maintenance/Repair/Rebuild – Aircraft Components and Accessories	1.94
Maintenance/Repair/Rebuild – Training Aids and Devices	1.34
Maintenance/Repair/Rebuild – Engines, Turbines, and Components	0.84

Source: http://www.acq.osd.mil/dpap/sa/FDEs/equipment-related-services/historical-spending.html.

Within these largest spending categories, IDA solicited input from the U.S. Transportation Command (USTRANSCOM) regarding commercial firms vital to

maintenance, repair, and overhaul (MRO) of aircraft, ships, and ground vehicles. Within USTRANSCOM, the Enterprise Readiness Center has significant expertise in leveraging the defense industrial base, in particular those in the transportation industry, to support DOD needs. USTRANSCOM has a requirement not only to maintain an organic transportation capacity, but to couple that capacity with access to commercial capacity in order to offset costs. The Enterprise Readiness Center offered important insights into commercial firms that should be considered as interview candidates, and leveraged existing commercial contacts to facilitate interviews with firms that emerged once the IDA project team applied the commercial firm selection criteria.

KBS categories were also reviewed in conjunction with historical spending data. The largest spending categories in FY 2014 are displayed in Table 2. Many of the KBS appearing in the table are used by (or, in some cases, provided by) commercial firms active in ERS. Where applicable and possible given the time constraints, information on both ERS and KBS was targeted for solicitation during interviews with firms that emerged using the commercial firm selection criteria.

Table 2. Largest FY 2014 KBS Spending Categories by Product Service Codes (PSCs)

PSC Description	Spending ($B)
Engineering and Technical Services, Professional Support	12.10
Program Management Services, Other Professional Support	6.55
Program Management Services, Program Management Support	3.14
Program Management Services, Other Management	1.25
Education and Training, Other Education and Training	0.79

Sources: http://www.acq.osd.mil/dpap/sa/FDEs/engineering-and-technical-services/historical-spending.html; http://www.acq.osd.mil/dpap/sa/FDEs/program-management-services/historical-spending.html; and http://www.acq.osd.mil/dpap/sa/FDEs/education-and-training/historical-spending.htm.

Candidate firms were evaluated against a set of selection criteria, and more than a dozen companies surfaced as interview candidates; IDA interviewed eleven of these companies between February and May 2015, as shown in Table 3. These firms represent a cross-section of leading companies active in aerospace, logistics, technology, and other industries. Many of these firms are users of both ERS and KBS, and several firms are vendors of ERS and/or KBS. Appendix B contains additional detail on the selection criteria, each firm's roles as users and/or vendors, and the interview protocol and questions.

Table 3. Commercial Firms Interviewed

Company	Industry	ERS Provider	KBS Provider	Description/Key Considerations
AAR	Aviation/Aerospace	✓		AAR Corp: largest aviation MRO provider in North America. Provides MRO services to major commercial airlines and DOD.
American Roll-On Roll-Off Carrier, An ASL Group Company	Commercial Shipping/Marine Transportation	✓	✓	ARC: the leading U.S. roll-on-roll-off carrier operating linear services in the United States-International trades. Provides port-to-port and end-to-end transport of heavy vehicles, helicopters, and other equipment.
Atlas Air	Aviation/Aerospace	✓	✓	Atlas Air: cargo and passenger airline providing charter services, aircraft leasing, and related services.
Delta	Aviation/Aerospace	✓	✓	Delta: large global commercial airline that sources some MRO in-house while outsourcing other MRO services. Provides MRO services to commercial and military customers.
Honeywell	Technology		✓	Honeywell: provides consumer products, technology and engineering services, aerospace manufacturing and services, and industrial control systems.
IBM	Technology	✓	✓	IBM: provides technology and services in a variety of areas; uses big data and analytics to support predictive maintenance and fleet analytics.
Landstar	Logistics and Rail	✓	✓	Landstar: logistics management and operations (third-party logistics) for trucking and rail.
Menlo Worldwide Logistics, A Con-way Company	Logistics and Rail	✓	✓	Menlo: Class 1 Rail carrier, fourth-party logistics provider, integrating all functions across the supply chain.
McDonald's	Large Retailer		✓	McDonald's: large distributed food retailer. Experience with supply chain, warehousing, logistics, and distribution networks.
usbank	Other		✓	U.S. Bank: diversified financial services holding company, and the parent company of U.S. Bank National Association, the nation's fifth largest commercial bank.
Walmart	Large Retailer		✓	Walmart: retail corporation that operates a chain of discount department stores and warehouse stores.

D. Literature Review

The literature review (including recent IDA reports) focused on academic, governmental, and industry sources identifying the role of core competencies within the organization, techniques for increasing competitiveness, and strategies regarding outsourcing. The team also reviewed recent literature characterizing the nature of services contracting, highlighting its particular challenges. These key concepts from the literature are summarized below.

1. Core Competencies, Competitiveness, and Outsourcing

Each business must make assumptions about the business itself and the environment in which it operates. These assumptions are not static, nor are they simple to make. It may take years to effectively develop these assumptions and an associated corporate strategy.

Assumptions fall into three areas:

- Environment of the organization (e.g., structure, market, customers, available technology);
- Mission of the organization; and
- Core competencies needed to accomplish the organization's mission.[8]

Core competencies have been defined as "the collective learning in the organization…coordinat[ing] diverse production skills and integrat[ing] multiple streams of technologies" as well as "organiz[ing] work and deliver[ing] value."[9] True core competencies satisfy the following characteristics: provide potential access to a wide variety of markets, make a significant contribution to the perceived customer benefits of the end product, and are difficult for competitors to imitate.[10]

Understanding the company's core competencies and competitive advantages underlies an enterprise strategy for outsourcing. Outsourcing actions are selected to engage cost-effective external partners, move away from legacy systems or vendor "lock-in," and cultivate a partnership with vendors offering capabilities (e.g., efficiency, innovation, performance) that do not exist within the company. Outsourcing activities, guided by a strong enterprise strategy, increases a company's overall performance and competitiveness.

The strategy is supported by investing resources in managing outsourcing, including data collection and reporting systems to perform cost analysis, engage in market research,

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[8] Peter F. Drucker, "The Theory of the Business," *Harvard Business Review* 72, No. 5 (September-October 1994): 99.

[9] C. K. Prahalad and Gary Hamel, "The Core Competence of the Corporation," *Harvard Business Review* 68, No. 3 (May-June 1990): 81.

[10] Prahalad and Hamel, "The Core Competence of the Corporation," 83.

and track spending. Resources are invested not only in the systems themselves, but the staff required to serve as contracting experts.

2. Services are Different from Products

Product acquisition tends to be sequential, from design to manufacturing to delivery. In services acquisition, continuity is critical. Within the last decade, commercial firms have placed increasing emphasis on the acquisition of services, and began making internal organizational changes to support an effective service outsourcing strategy.

DOD recognizes the need for increased focus on the acquisition of services; however, most DOD acquisition regulations, practices, and training procedures were designed for complex products. In the acquisition of services, especially technology-based services requiring flexibility and rapid change, the traditional process is not only inappropriate but often too slow. Additional challenges associated with the acquisition of services include the following:

- Most service products cannot be inventoried (and time is often of the essence). It can be difficult to manage capacity utilization and balance between wait time and capacity.
- Operational inputs and outputs tend to vary more widely; therefore, it is more difficult to manage quality.
- Intangible elements may dominate value creation, making it difficult for customers to assess performance.
- Services are often difficult to visualize and understand; therefore, trust in providers is essential.
- Customers often are involved in co-production and are part of the service experience. Opportunities for efficiencies exist, but it is difficult to control the service experience.[11]

The delivery of services has evolved over the last few decades, most notably the evolving "as a service" model, which likely will be increasingly important for DOD, and is discussed in detail in Appendix A.[12]

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[11] C. H. Lovelock and J. Wirtz, *Service Marketing: People, Technology, Strategy*, 6th ed. (Upper Saddle River, NJ: Pearson Prentice Hall, 2007).

[12] DOD was an early implementer of the "as a service" model through initiatives such as the Navy Marine Corps Intranet and the Army Logistics Management Program.

3. The Nature of Knowledge-Based Services

Within the realm of services acquisition, KBS are particularly challenging to define, acquire, manage, and measure. When acquiring KBS, companies need to learn how to manage specialists and external providers, and integrate them into the business. Customer-vendor co-creation is, in essence, a mutual learning process. Such learning takes place through social interactions that combine explicit and tacit knowledge.

- Socialization (Tacit to Tacit): Customers and developers interact and come to understand needs and requirements by watching what people do and how they feel but may not be able to articulate.
- Externalization (Tacit to Explicit): Developers document what they saw and heard into preliminary requirements and specifications. This is considered the hardest part of the process, often accomplished by use of metaphor, since tacit knowledge is, by its nature, hard to codify.
- Combination (Explicit to Explicit): Various documented and measured perspectives are combined to create a more complete picture. This is considered the easiest part of the process, akin to everyday market research and modeling.
- Internalization: (Explicit to Tacit): Learnings are internalized by all participants, most importantly, in behavioral changes by customers, in order to realize the full value of the product/service. [13]

For services attached to innovative offerings, as is often the case in new or rapidly changing markets, customers often do not appreciate the value of a service until they experience it; then those customers will change their behaviors to maximize value. This can make it impossible to know requirements, design the best business models, or determine the right value chain partners in advance. None of this can be discovered through ordinary market research. Corporate culture and habitual practices can heavily influence service quality and efficiency.

In an analysis of more than fifty companies from different industries published in the *Harvard Business Review*, researchers examined the outsourcing of knowledge-based jobs perceived as core to business operations. Such positions were outsourced to address skill shortages, lower costs, and increase job satisfaction.[14] The *Harvard Business Review* article suggests a process for breaking down high-end knowledge work into highly specialized pieces. Steps include:

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[13] Ikujiro Nonaka and Hirotaka Takeuchi, *The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation* (New York: Oxford University Press, 1995), 284.

[14] Martin Dewhurst, Bryan Hancock, and Diana Ellsworth, "Redesigning Knowledge Work," *Harvard Business Review* 91, No. 1-2 (January-February 2013): 59–64.

- Identify the gap between what talent the firm has and what it will need,[15] and create narrower, more focused job descriptions in areas where talent is scarce;
- Redefine jobs to ensure experts devote almost all time to tasks requiring their specialized skills;
- Choose from various options for filling the skills gap; determine what should be outsourced or contracted; and
- Rewire processes for talent and knowledge management.

E. Conceptual Frameworks

Based on the literature review, the IDA team developed a new conceptual framework to address the research questions posed by DPAP/SA for this project.

The primary factor in deciding whether to perform a service internally or to outsource relies upon an assessment of core competencies. In general, companies maintain core competencies in house, as they are the foundation of their competitive advantage. However, in certain circumstances, companies engage with external vendors in areas close to their core, based on an assessment of three other factors:

- **Capability**, including whether the firm has competency in a particular area relative to vendors, and whether such a capability should be maintained;
- **Capacity**, including whether the firm has the necessary scale in this area and whether such scale should be maintained; and
- **Cost**, including both production and transaction costs.

These four factors – closeness to the core, capability, capacity, and cost – are listed along the left side of Figure 3. These factors are continuously evaluated by firms against existing reality, as assessments of these factors may change with fluctuations in markets, customers, and technology.[16]

Listed along the right side of Figure 3 are three strategic outcomes that drive companies' decisions to use external service providers: enhance competitiveness, reduce costs, and adjust to rapid change. Figure 3 illustrates how the make vs. buy factors map to strategic outcomes, with the boxes highlighting the essential logic of the decision to use vendors. The blue-shaded area indicates that, as noted above, companies usually maintain core competencies in house (top box) but may use vendors that have specialized skill sets that would be uneconomical to maintain in house (middle left box). Vendors may also enhance competitiveness by working in partnership with the client to address market

[15] Use time allocation surveys, social network analysis, and analysis of outcomes or value to assess how effectively scarce skills are used with existing talent.

[16] Drucker, "The Theory of the Business," 101.

opportunities—what is often called "open innovation." Open innovation is also a strategy for rapidly adjusting to market changes; hence, half of that box is colored green.

Certain skill sets, such as information technology competence, become obsolete rapidly; an external vendor that focuses on such capabilities may be in a better position to maintain them at the leading edge (middle right box). Companies may also require surge capacity to meet unexpected demand (middle bottom box). Surge capacity can support competitiveness, as well as rapid adjustment; in certain markets a company that is forced to turn away business due to lack of capacity may lose market share. Finally, in addition to meeting the criteria in the middle boxes of the diagram, a vendor must also be cost-effective (bottom box).

The strategic outcomes depicted in Figure 3 will be explored in detail based on commercial experiences. These experiences yield a set of key findings for services contracting, as well as a list of detailed commercial BPs. Several of the findings will, as suggested in Figure 3, highlight that "low cost" is not the sole or even primary factor in make vs. buy decisions.

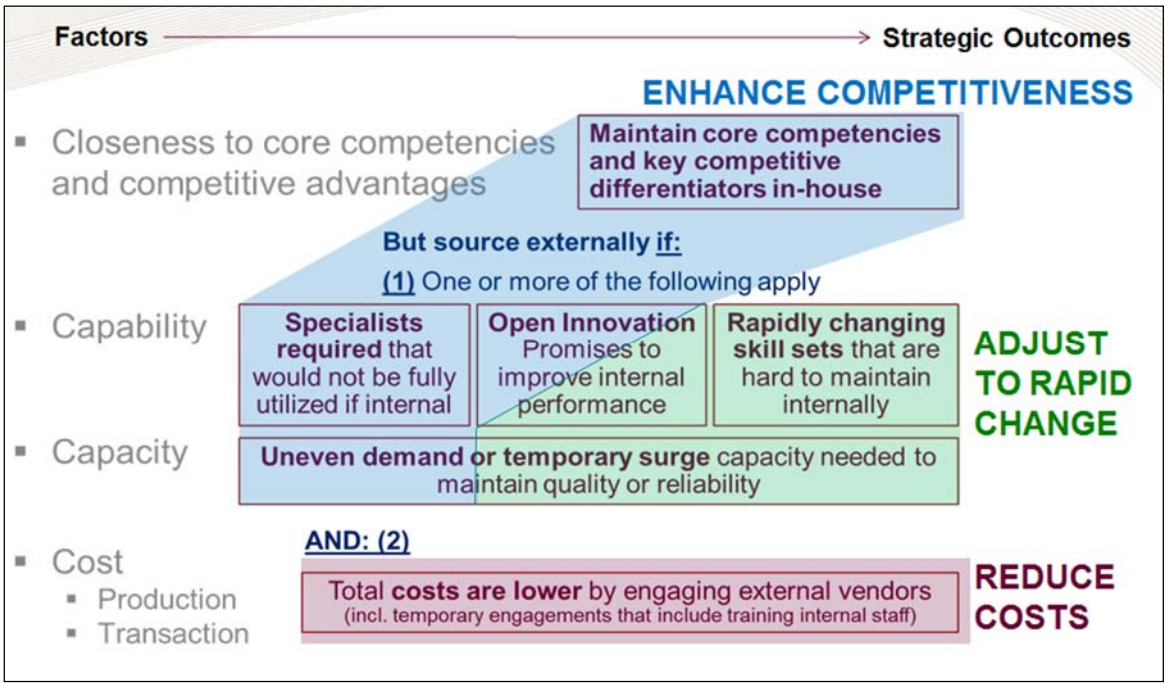

Figure 3. Outsourcing Key Factors and Strategic Outcomes

Once a decision to outsource has been reached within an enterprise strategy, a secondary set of contracting decisions must be considered. A previous IDA report[17]

[17] David R. Graham et al., "Improving Department of Defense (DOD) Contracting for Services," IDA Paper P-5010 (Alexandria, VA: Institute for Defense Analyses, July 2013).

developed a framework to represent four contracting situations, based on (1) the number of qualified vendors in the market and (2) the type of vendor relationship sought by the client. The number of qualified vendors depends on factors such as the complexity of implementing a solution, the sensitivity of the information being handled, and the novelty of the technology involved. The type of vendor relationship sought by the client depends on several judgments—most importantly, the ability of the client to anticipate and articulate their requirements.

Crossing these dimensions yields the matrix shown in Figure 4. A task that is well defined and for which there are many vendors—the lower left quadrant—is designated a Merchant relationship. Because the terms of performance are relatively standard, a contract can be given to the lowest-cost competent bidder. A task that is well defined but for which there are few vendors—upper-left quadrant—is labeled Oligopoly. There may be few vendors for a well-defined service due to costly fixed infrastructure, such as a public utility or large-scale software system, allowing a small number of legacy providers to survive in the market. Moving to the lower right quadrant—Suitor—there are times when a client will want to have a flexible contracting arrangement with a supplier, even when there is significant competition in the market. This is often the case when a company is testing out an emerging technology, for which the benefits and risks—and the ultimate survivors in the market—are not clear. Strategic partners—the upper right quadrant—may be engaged in areas where it would be difficult or not cost-effective to build a capability internally (and where there are no budget rules, laws, or regulations that discourage or forbid using external vendors).

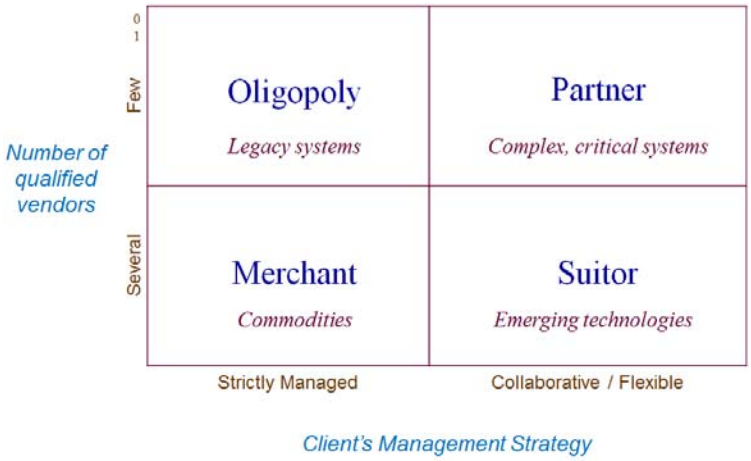

Figure 4. Framework for Distinguishing Services Acquisition Contracting Contexts

The management of strategic vendor partnerships will be a focus area in this report, as KBS and ERS are inherently complex interactions where the client often cannot forecast

exactly what it will need, when, or how much. KBS in particular often involves collective problem solving among the client and multiple vendors. The findings and BPs in this report emphasize various ways in which leading companies create and maintain these relationships.

In Chapter 3, a new framework will be introduced in order to make a preliminary assessment of the applicability of commercial BPs in the DOD context. The new framework builds on the "Client Management Strategy" dimension of the 2x2 matrix above to delineate how organizations tend to evolve toward effective partnership/relationship management:

- Consolidating requirements and/or purchases: At the first level, companies collect enterprise-wide data on what is being bought by whom and analyze it to identify potential savings (and risks) from consolidation.
- Utilizing internal "smart buyer" organizations and practices: Data collection and centralized management are enhanced with sophisticated market analyses and vendor metrics.
- Building/maintaining long-term relationships with key partners: Over time, regular interactions with vendors, characterized by listening and concern, can lead to improved goal alignment, reciprocity, and commitment, which engender trust.

Consolidation of requirements/purchases scales the benefits of a "strictly managed" relationship from small, disparate groups to large divisions or even the entire organization. Smart Buyer capabilities lay the groundwork for continuous improvement which, for more sophisticated services, requires cooperation between the client and vendor. Ultimately, in the best cases, the client and vendor truly collaborate in a flexible, trusted manner; trust is essential in relationships and is perhaps the best accelerator of innovation.

2. Findings: Best Practices at Leading Commercial Companies

Leading organizations manage contracted services in a concerted manner, with top leadership engagement and coherent governance to achieve results and realize acquisition efficiencies. An enterprise strategy guides a determination of what must be done internally to protect secrets and competitive advantage and in what areas capable and cost-effective external partners might add value. Within the framework created by strategic analysis and leadership/governance structures, companies create procedures to manage portfolios of related services, assess and select strategic partners, and allocate the internal resources needed to be effective.

The companies interviewed for this report shared aspects of their strategic analysis, governance structures, and organizational approaches to make vs. buy decisions. As noted in section E of Chapter 1, three desired strategic outcomes drive these decisions:

- Enhance competitiveness,
- Reduce costs, and
- Adjust rapidly in dynamic markets.

Additionally, the research team noted the importance of relationships to achieve each one of these three strategic outcomes. A summary of findings and BPs appears in Table 4. Each commercial BP is discussed in greater detail in sections A through C, grouped by these three strategic outcomes.[18] The chapter concludes with a discussion about the importance of relationships.

[18] These examples are drawn from IDA's interviews with commercial companies. Comments made during those discussions were provided on the basis that the identity of the individual firms would not be disclosed.

Table 4. Summary of Findings and Best Practices

Finding	Best Practices
Strategic Outcome: Enhance Competitiveness	
A1. Services outsourcing supports core capabilities	• Perform periodic reviews of core functions and business areas.
A2. Internal talent development and knowledge transfer are key considerations	• Build institutional learning via knowledge capture strategy. • Identify and train promising employees. • Regulate intellectual property sharing.
A3. "Smart buyer" approaches are essential in accessing technical and specialized knowledge	• Establish "smart buyer" groups or processes with expertise in key market segments and vendor capabilities. • Augment internal expertise with external consultants.
A4. Vendor incentives and metrics need to be closely coupled	• Use scorecards to evaluate and track vendor performance. • Provide real-time feedback to vendors on performance.
Strategic Outcome: Reduce Costs	
B1. Cost of services is managed for overall value	• Closely manage turnaround times to achieve cost savings.
B2. Multiple vendors are used to maintain competition and reduce risk	• Maintain pre-screened preferred supplier lists. • Establish corporate quality, safety, and other standards for vendors. • Encourage competition among vendors.
B3. Data and predictive analytics can achieve substantial savings	• Leverage data and predictive analytics to optimize maintenance and operations. • Collaboration with the vendor is essential for "as a service" offerings.
Strategic Outcome: Adjust Rapidly in Dynamic Markets	
C1. Responsiveness to demand changes facilitated by using service vendors	• Establish standby arrangements with vendors. • Employ appropriate contract type to support flexibility.
C2. Buying services can enhance operational capacity/increase agility	• Be willing to "put the contract in the drawer" and work together to solve problems.

A. Strategic Outcome – Enhance Competitiveness

1. Finding A1. Services outsourcing supports core capabilities

BP: Perform periodic reviews of core functions and business areas.

Companies interviewed differentiated between their core and peripheral functions and then used that delineation to determine their make vs. buy decisions. This core analysis is a corporate-level, strategic business decision that is regularly revisited.

Company A, for instance, regularly conducts strategic portfolio reviews of broad core areas across its businesses. Because its international operations sometimes require offsets or

technology transfer, local companies may be preferred. The company also uses company assets in India and Mexico for certain services.

Make vs. buy decisions for engine repair services are based on a variety of factors that change over time. For instance, Company B revisits its decision after about five years, or when the engine hits its first life-limited warranty. It will often outsource maintenance work to an original equipment manufacturer (OEM) when the engine is on the back end of its maturity curve, so that its staff can focus on newer engines, although in one case it continues to maintain an older engine because it was the only company with expertise. The company's capacity is also a factor in outsourcing decisions.

Some service providers outsource knowledge-based services for niche, surge, or limited-time requirements. Company C noted that its customers typically seek to buy a capability that they do not have or when they have tried unsuccessfully to do their own supply chain transformation work. Company A outsources specialized engineering and information technology (IT) services. Company B noted that an airline might outsource work to a commercial MRO when the vendor has a special tool needed to perform a repair or in situations in which the airline's repair workload does not justify the cost of a particular tool. Company D opts to have most services performed internally unless they are highly technical (e.g., requiring special licenses, such as electrical).

Internal capacity can also be a factor. Company D buys engineering and IT support services when it lacks sufficient personnel to undertake and/or complete projects. Company B indicated that smaller airline customers often do not have personnel to review OEM bulletins; therefore, it hires MROs to produce white papers for those customers. Similarly, smaller airline customers may not have the capacity to collect and analyze reliability data, motivating them to hire MROs to provide "troubleshooting as a service." MROs with excess capacity often support other airline carriers, and some of those airline carriers leverage line station services from their competitor airlines in cities where they do not have crews.

2. Finding A2. Internal talent development and knowledge transfer are key considerations

BP: Build institutional learning via knowledge capture strategy.

Firms work with outside vendors to develop strategic capabilities, but acquire knowledge for internal use. Several companies interviewed discussed how they seek to transfer knowledge and tools internally, emphasizing the need to be collaborative partners with service providers. Company B brought in consulting services to help develop a knowledge-based tool/data service for predictive maintenance services, but it intends to operate the system internally. ("Rather than having a consulting company think for you, you need to be able to extract the knowledge for yourself.") It will transfer knowledge and first use this tool internally, and once matured, it hopes to sell this service to others within industry.

Company C described how its experience was rooted in lessons learned from past work:

> Experiences are turned into corporate institutional memory through documentation of work, data reporting requirements, data repository capabilities, talent management/development, and rotation of talent throughout the organization. We operate as a "lean quality environment" with learning documented following each process.

BP: Identify and train promising employees.

Captured knowledge needs to be transferred and diffused across the company in order to have impact. For Company C:

> Internal talent management and development—to include rotation of staff in and out of operations to move talent throughout the organization—is a key factor for organizational learning and turning experience into institutional memory.

Company B has special programs to identify and train promising candidates and nominate candidates for additional training. Its licensed airframe and power plant maintenance workers can receive special training from OEMs. For a new OEM engine partnership, Company B will send several of its maintenance personnel to the engine OEM's "academy" for six months, who then will come back and train the rest of the maintenance staff. Alternatively, an OEM will have a presence on site at the MRO's headquarters to perform training. Company B hires candidates comfortable with digital-based systems, and sends those promising young staff to school for additional training.

BP: Regulate intellectual property sharing.

Company B highlighted the importance of the intellectual property gained from interacting directly with the OEMs. Knowledge transfer is often formalized as part of contractual agreements. Customers often want to learn from service providers and, in some cases (such as Company E), have a planned handover of process controls to the customer.

3. Finding A3. "Smart buyer" approaches are essential in accessing technical and specialized knowledge

BP: Establish "smart buyer" groups or processes with expertise in key market segments and vendor capabilities.

Internal "smart buyer"-type organizations (sometimes called "strategic sourcing" offices) support enterprise-wide procurements and serve as a corporate repository of BPs and lessons learned. Company F, for instance, created an organization that utilizes subject matter expertise from either Managed Services or the relevant business area to validate bids. Company G emphasized the importance of logistics service customers having an understanding of the carrier industry, as a lack of experts on staff often creates frustration

for both customer and vendor. In a previous report on services acquisition,[19] IDA spoke with a company whose smart buyer organization was responsible not only for market research but also for interfacing with user groups within the company and developing consistent contracting approaches.

Visibility and authority over purchases of services is often managed at the enterprise level in order to optimize and reduce cost. Purchasing and acquisition decisions are typically made at this level for the entire organization/company. Company C indicated that its centralized team has considerable interaction with both the users of services and also local providers to inform its decision-making process. Company H's corporate officers make decisions on which services to outsource. For those companies in the aviation industry, MRO outsourcing decisions typically are based on fleet type, airframes, landing gear, and engines.

BP: Augment internal expertise with external consultants.

When expertise does not exist internally, companies may engage with an external sourcing advisory firm to augment their smart buyer capacity. External advisory consultants can also be used to validate vendor bids in areas where the buyer is not knowledgeable.

4. Finding A4. Vendor incentives and metrics need to be closely coupled

BP: Use scorecards to evaluate and track vendor performance.

Companies evaluate service provider candidates in a variety of ways, utilizing common metrics to select vendors and evaluate their performance. Service suppliers are often evaluated with a scorecard assessment process employing both qualitative and quantitative key performance indicators (KPIs). Company A's selection criteria for acquired services include past performance, quality of technology, and cost. Company A noted the criteria customers typically use to evaluate its performance include—in no particular order—delivery, quality, warranty, data items, technical bulletins, technical publications, and cost. Company B evaluates potential vendors' engine maintenance performance and the effectiveness of its service bulletins. For Company D, turnaround time is the key metric. Company C noted readiness and timeliness outcomes are important drivers of vendor selection. Company I indicated the outcomes it provides are delivery, customer service, and documentation; the performance metric by which it is judged is adherence to delivery date. Company F employs a scorecard assessment utilizing KPIs with qualitative and quantitative metrics to evaluate strategic suppliers. Company F's KPIs include financial fitness, delivery/support, quality of people provided to the account, staff turnover, technology/innovation, risk/compliance, onshore/offshore mix, and flexibility/ease of doing business.

[19] Graham et al., "Improving DOD Contracting for Services."

An important practice to set the tone for vendor evaluation criteria is to build service expectations and service-level performance criteria into the service contracts. Company F annually evaluates vendors on service-level performance criteria indicated in the contracts, with reliability being a key parameter. Company E builds performance metrics into its contracts, developed through detailed and interactive dialogue with the other party, regardless of whether it is the user or vendor for that contracted service. Company E noted:

> SLAs (Service-Level Agreements under CRAF (Civil Reserve Air Fleet)) contracts can be used to incentivize or punish. If certain levels of reliability are achieved, bonuses are awarded, but if reliability dips below acceptable thresholds, the company is penalized. If there's an actual legal breach of contract, we terminate it. A lower-than-agreed level of performance would result in no follow-on work.

According to Company G:

> We collaborate with the client, evaluate their transportation strategy, and ensure that they really need (or want) the services they are asking for. Once we collectively develop the best solution, we must build the requirements into our pricing and negotiate an implementation timeline. Those timelines are often part of our response to an RFP [Request for Proposal], or provided via a written "Implementation Plan."

BP: Provide real-time feedback to vendors on performance.

Once the tone is set via the contracting process, some buyers of services manage selected vendors through a collaborative review process which, in some cases, includes improvement plans linked to performance parameters. Real-time feedback allowing adjustment of vendor performance is critical. Company C's detailed engine repair metrics are constantly updated and reviewed. (The metrics "deck" is over 200 pages in length, and is applied to both internal and outsourced MRO work.) Every year, the Company F executive who is overseeing the vendor relationship reviews all of the KPIs and comes up with action plans for improvement. Company F noted:

> While some performance indicators are built into the contracts, new suppliers' performance cannot be measured against a baseline until they have been on board for a year. Company F will look for improvement in each area from the baseline with expectations of improvement laid out in an action plan to be reviewed in the next year.

Company F also noted that for highly embedded and complex transactions, it will invest to make the vendor relationship work, including monetary incentives that increase Company F's own costs. The next section covers such relationship practices.

B. Strategic Outcome – Reduce Costs

1. Finding B1. Cost of services is managed for overall value

As noted in Finding A4, companies evaluate multiple criteria when choosing to purchase and/or continue using a particular vendor. In most cases, KBS include intangible qualities that make it difficult for users to specify requirements and evaluate vendor performance during the duration of the service contract. Hence, companies IDA interviewed for this report indicated that they look to purchase services that provide them with the best overall value. That is, while cost is a driving factor in the make vs. buy decision, it is not the only or necessarily dominating criterion. When purchasing services, companies generally are not looking for just the least cost solution.

Company I noted that it takes into account a vendor's access to key supplier networks, which is critical to being able to maintain readiness. Company E's customers are not always looking for cost savings, although some customers purchasing supply chain logistics services make their outsourcing decisions based primarily on cost. Those customers, however, emphasized that quality was a close second. Company G indicated it provides greatest value to customers who value safe, reliable transportation services and appreciate carriers who collaborate to meet their transportation needs in the most efficient and effective manner. Company I noted that both cost and quality of past work informed their selection of services, and that maintenance costs vary by situation and location, with different costs for different regions. Company I benchmarks carefully according to these factors.

BP: Closely manage turnaround times to achieve cost savings.

For others, readiness and timeliness outcomes may be a more important driver of vendor selection. In the aviation industry in particular, "time is money." Turnaround time—the time to load, unload, and service the aircraft—is as important as quality and cost when evaluating potential providers of a service. While turnaround time is, essentially, an opportunity cost, those in the aviation industry view it as separate criterion from the quoted cost of providing the service. If a company is able to reduce or minimize turnaround time, this leads to increased efficiency and potentially lower facility costs. In many cases, Company B performs repair work in-house and has its own maintenance control center for in situ repairs because it "couldn't afford to wait for the OEM." It noted that "typically a commercial aircraft sits inside a commercial MRO facility for twelve days; commercial aircraft engines can typically be turned around by a commercial MRO in twenty-one to twenty-three days, with sixty days being the longest."

For instance, Company B explained that "slower turnaround time drives up costs because we must buy more parts and components in order to keep the necessary inventory on hand." Therefore, it has invested significant time and money in the success of its technical operations. It has been able to remove $400 million in inventory by shortening the time

needed to take a part off an aircraft, bring it into the shop, make the repair, and place that part back on the aircraft—from as long as forty days down to five to ten days. Company H noted that commercial airlines use overhauled/used parts when they can, whereas DOD generally will not.[20]

2. Finding B2. Multiple vendors are used to maintain competition and reduce risk

As noted in Finding A1, firms often buy services when internal personnel, skill sets, knowledge, or tools are either absent, insufficient to meet demand, or less efficient or timely for particular circumstances. Using external vendors for services that touch core competencies creates risks that must be managed. BPs vary with circumstances and corporate strategy; often, however, accessing the vendors that specialize in a particular service can help a firm to leverage economies of scale for more efficient and cost-effective capabilities than they might be able to build internally.

BP: Maintain pre-screened preferred supplier lists.

When there are multiple possible service providers, companies may create and maintain "preferred supplier lists" of vendors that have been pre-screened for high-quality service delivery in particular categories. Company A leverages the expertise within its engineering group to identify the better vendors in the market and oversee the hiring of engineering services.

BP: Establish corporate quality, safety and other standards for vendors.

Corporate headquarters at Company F qualifies suppliers and negotiates regional vendor relationships, to provide validated options and, often, special deals for buyers across the enterprise. This reduces risk for these buyers, as the validated vendors are known to be able to meet corporate standards, safety guidelines, and required supply chain processes. Company F noted that buyers at different retail locations are free to make their own purchasing decisions, as long as they meet corporate standards and safety guidelines. Hence, the simple existence of such standards is a BP in itself.

BP: Encourage competition among vendors.

Once validated vendor relationships are established, the next level of BP is to encourage competition among vendors. Companies often utilize multiple vendors, to avoid being locked in with one provider, limit exposure to risk due to a "single point of failure," provide reliability and backup, ensure flexibility, tailor to regional markets, and, of course, to gain

[20] Company H asserts there is not a compelling safety reason for using new parts versus used ones, because Federal Aviation Administration (FAA) regulations and Title 14 of the Code of Federal Regulations (CFR) govern those safety standards. It provided an example of a new fan blade pair, which cost over $42,000, whereas a reconditioned pair cost just less than $7,000. These reconditioned fan blades would not be life limiting, as they could easily last fifty years. Fortunately, in this case, the company was able to persuade DOD to waive the rule, saving nearly $40 million.

leverage to negotiate lower prices through increased competition and bidding of services. Company F either selects one vendor to serve as the company's primary provider with a second as a backup, or the company splits its purchases across multiple service vendors. For instance, it has relationships with three global providers for point-of-sale systems. For key equipment, it has relationships with a limited number of manufacturers with overlapping regional footprints, providing both competition and backup capacity.[21]

Company D's approach is similar to that of Company F. For engine maintenance, Company E relies on a single provider with which it has a good, long-term relationship, but for some of its other work, including airframe heavy maintenance, it uses several service providers, based on geography and volume of work. As with Company F, sometimes these service providers overlap in their regional coverage. Company H provided an example in which its largest commercial customer "uses three or four MRO providers at the same time. This strategic decision on the part of [the large commercial customer] gives it leverage when negotiating and working with its MRO providers."

Finally, Company A noted that not all companies can afford to retain multiple vendors. Rather, it depends upon where a company is in the supply chain: companies higher up in the supply chain may only have one or two vendors, but those companies lower down in the supply chain may have more.

3. Finding B3. Data and predictive analytics can achieve substantial savings

BP: Leverage data and predictive analytics to optimize maintenance and operations.

Predictive analytics is becoming an important business tool for making better-informed decisions.[22] In the aviation industry, for instance, predictive maintenance allows Company B to pull parts off its airplanes that need maintenance work in advance of their ordinary maintenance schedule, which increases the reliability of its fleet. Rather than being tied to a maintenance manual, which may not apply to the operating environment of the aircraft, companies in the aviation industry can let the aircraft and the environment dictate maintenance schedules. Predictive analytics applied to the maintenance of engines and other critical aircraft components can achieve substantial savings in just a short amount of time. Company B provided an example in which it was able to save on cost by performing maintenance work on auxiliary power units (APUs) prior to their failure:

[21] Company B's exception to this approach was the choice to outsource its entire IT infrastructure to a single provider because the cost savings from volume outweighed the corporation's risk exposure.

[22] Such analytics are increasingly being offered on an "as a service" (aaS) basis. See Appendix A for additional information on the features of the "as a service" model.

> APUs are limited by cycle time. By replacing APUs early, based on predictive analytics, the cost was $200 thousand. If we wait[ed] to replace the APU once it had failed, it would have cost $500 thousand.

Company J develops predictive maintenance solutions for a variety of industries to include aerospace and automotive, serving commercial and government customers.[23] The principle behind this is to move companies from a reactive failure-based posture to a more pro-active, predictive posture. Company J contends the predictive maintenance solutions with supporting data analytics can help to maximize readiness, noting that improved data information sharing allows companies to capitalize on analytic solutions to drive maintenance decisions that reduce asset downtime and help optimize supply chains. Company J works with clients to solve operational sustainment problems by using near-real or real-time data, with equipment status obtained from embedded sensors. It then uses predictive algorithms based on the operational environment to estimate time to failure. Company J noted that the outputs of this analysis:

- Provide commanders and operators with more accurate decision support, helping to optimize availability;
- Enable more efficient supply chains as they can order parts before failure; and
- Result in shorter down-time, and more effective and targeted repairs and maintenance cycles.

Some use case examples related to responsiveness and cost reduction include:

- Helicopter Spare Parts: 10 percent reduction in maintenance forecasting errors by improving equipment uptime for a customer that wanted to know when and where parts would be needed to optimize maintenance and parts availability, reducing parts inventory by 15 percent;
- Drone manufacturer: 15 percent increase in sortie effectiveness, 93 percent accuracy in predicting sortie failures (over a 30-month period) for customer that sought to improve sortie effectiveness through mined data and predictive airframe maintenance services, results in $60 million savings in maintenance, operations, and personnel costs;
- Aircraft Company's Command Center: 100 percent accuracy in prediction of service disruptions, 95 percent accuracy in prediction of engine events for customer that wanted to mine three years of data to predict the health of the fleet, targeting markets with the most incidents of operational disruption, which

[23] This discussion is based upon a publicly releasable briefing by Company J presented at an open forum on May 5, 2015.

translates to $88 million in savings to the manufacturer and $63 million in savings passed along to the customer; and

- Global OEM manufacturer: Call resolution times in their customer support "war room" reduced from fifty minutes to fifteen minutes by applying data mining to accelerate problem diagnosis. Reduced call times resulted in fifty additional planes in the air without adding staff, a cost savings of $36 million.

BP: Collaboration with the vendor is essential for "as a service" offerings.

Company B shared its deliberate approach to developing a predictive maintenance solution, utilizing KBS provided by two different consulting companies to first determine what data should be collected and how, and, second, to examine and analyze the collected data. Once the tool is more mature, Company B would sell this service to others in the industry.

Every customer has different needs and has different maturity levels, so Company J works with the customer to develop tailored solutions based upon a collection of software tools and a deliberate methodology. Solutions feature access to real-time data for assessment from a dashboard interface and algorithms for logistics analyses, to include impact on supply chain and inventory. Implementing predictive maintenance requires a deliberate approach. According to Company J:

> Customers aren't able to transform to predictive maintenance overnight. There are costs and optimum steps to be taken depending upon their maturity level, so the embedding of analytics into a company's operations is typically a phased process.

C. Strategic Outcome – Adjust Rapidly in Dynamic Markets

1. Finding C1. Responsiveness to demand changes facilitated by using service vendors—"it's not just cost"

The more dynamic the market environments, the more difficult it is to specify service requirements. Companies can respond to demand changes cost-effectively through strategic use of service vendors, leveraging relationships with networks of approved suppliers. The vendor can meet short-term/surge customer requirements, while not incurring unneeded expenses related to re-training existing staff or hiring on additional full-time staff with specialized expertise.

BP: Establish standby arrangements with vendors.

For example, in the aircraft MRO space, unexpected surges in demand for services can occur; an external vendor can help the aircraft operator to maintain readiness and reliability. Company H explained how its internal quality and performance standards enable it to handle surge requests, leveraging multiple centers to handle one type of airframe simultaneously at different locations. In some cases, firms negotiate explicit standby arrangements with

vendors, to ensure priority access during surges; otherwise, they would need to "wait in line" behind other service orders that might have been received earlier. This strategy makes sense when there are few qualified vendors in a particular service area or when timely response is highly valuable for the customer.

Company E buys engineering services when it does not have the personnel necessary to undertake and complete its projects. Particularly for those projects with short lead times that require a quick turnaround, the company has ready bodies "on standby." Logistics provider Company C purchases specialty services to fill a niche, surge, or limited-time requirement to support work for a customer. Examples of the type of services it might procure include facility design work, drafting, and seasonal labor. Company K hires temporary employees from pre-selected and pre-approved companies in order to surge for its initiatives. When the surge has eased, companies re-evaluate whether outsourcing is still necessary.

BP: Employ appropriate contract approach to support flexibility.

Contract type is often used as a mechanism for supporting flexibility and allowing movement of requirements and price, based on evolving needs assessments. Company G indicated Firm Fixed-Price (FFP) contracts are useful for predictable and routine dedicated services but poorly suited to variable irregular services with unpredictable requirements. Company E typically uses Time and Materials contracts for non-routine services. Company H indicated that for ERS, contracts similar to Time and Material were used when a new vendor was brought on board, to allow for additional flexibility due to uncertainty about requirements. With established vendors, however, Company H indicated long-standing relationships and past performance usually allows them to use Fixed-Price contracts. KBS-provider Company C prefers contracting structures that allow vendor engagement to expand and contract to meet requirements.

2. Finding C2. Buying services can enhance operational capacity and increase agility

Organizational learning and knowledge transfer are important elements in a company retaining its ability to adjust rapidly and maintaining a competitive edge in dynamic markets, beyond just meeting demand surges. In areas in which IT supports delivery of KBS or ERS, for instance, the "as a service" approach allows clients to keep up-to-date with rapidly changing technology and adjust their operations to take advantage of technical improvements. Hence, leading companies value vendor flexibility and adaptability, often including it as an explicit part of its vendor assessment scorecards, as noted in Finding A4.

BP: Be willing to "put the contract in the drawer" and work together to solve problems.

Logistics service provider Company C identified several factors that influence flexibility, including honest dialogue with customers and the scope of the effort. They noted that dialogue with commercial firms is less rigid (and has more latitude) than with government customers. Company E has also observed a more relaxed atmosphere within the commercial industry, as compared to the government, indicating that government contracts do not have the flexibility and agility of their commercial contract counterparts. Company E pointed out that commercial organizations understand the conditions and sometimes may even "put the contract in the drawer" so that all parties can work together to solve the problem at hand.

Company C observed that their better customers are iterative and interactive with their service providers, always do a good job of determining what they want, and have a flexible mindset and deep insight based on past performance. The type of behaviors in which these "smart buyers" engage include demos, meeting with past customers, visiting locations, and observing those doing the work.

As noted earlier, data analytics can drive substantial costs savings and be an enabler of responsiveness, particularly in the realm of ERS. Based upon an agreement to serve as the sole MRO service provider for some medium and small airline carriers, Company B was able to provide KBS to them, providing analysis of fleet data to them "as a service" for a "more holistic maintenance approach." The company representative noted, "There is a synergy here; we put their reliability data into our data and we then provide them 'troubleshooting as a service'."

Service providers can also support automation of financial processes, saving both time and money for the customer and increasing both operational capacity and agility. Company K implemented an automated paperless payment system for transportation management "as a service," piloted first with DOD, then expanded to serve many commercial Fortune 500 customers.[24] In the DOD case, this service provider was able to adapt a manual system, which suffered from long delays in the payment of vendors that negatively affected freighting/shipping of goods. The result was a state-of-the-art financial electronic system that alleviated challenges associated with meeting payment obligations. The bureaucratic paper process was replaced with a vendor-developed and operated approach. Rather than waiting nearly 200 days to get paid, this new electronic system makes it possible for 90 percent of all payments to be made within twenty-four hours, and nearly 100 percent of all payments to be made within seventy-two hours. Further, Company K indicated that the goal

[24] The system captures transaction details often of importance for transportation management, with an audit trail for delivery times, dates, interim stops, shipping weights, etc. Company K noted that its commercial customers take advantage of the logistics data captured by the system in order to optimize their use of transportation services and achieve efficiencies.

is for minimal human involvement—that is, 95 to 98 percent of all transactions should be handled electronically without any human intervention.

D. Importance of Relationships

Increasingly, services outsourcing engagements are viewed as long-term, not transactional relationships. Finding C2 points to how leading companies build relationships with both their vendors and customers through communication and flexibility. Recurring interactions and continual dialogue can lead to long-term, trusted relationships with mutual benefits, such as sharing of risk. As Company E and Company C have described it, the best client is one that recognizes that both parties need to make money and both rely on the other for sustainment of the market.

Companies H and E identified several such relationships that have continued for more than a decade. Company C noted that, "Supply chain expertise services tend to require close relationships to get to the level of trust and transparency needed. For these types of customer relationships the normal contract length is five to fifteen years." In the aviation industry, Company A provides ERS for its avionics that have been integrated into airframes. As a result, it will typically service those airframes for the life of the platform, resulting in long-term relationships with both the OEMs and the carriers. Company A also certifies external service centers, which have been trained to corporate standards to perform maintenance on Company A's aircraft equipment.

These close working relationships, especially in the MRO business, are enhanced by the fact that customer personnel are often embedded in the company's facilities for purposes of quality control and consistency of service. However, the existence of long-term relationships does not mean that a company will not re-compete a contract. As noted in Finding A4, providers are continuously evaluated on performance. However, Company H stated that, "If a commercial customer is happy with our services, it can choose to renew the contract or extend the option periods; most five- to ten-year commercial contracts do get extended." (At another point in the interview, Company H indicated that, "a government contract must be re-competed when the contract period is over.")

As noted in Finding C1, the contracting approach can support flexibility. Where more certainty, greater familiarity, and longer relationships exist, Firmed-Fixed Price contracts may be more appropriate. Where there is greater uncertainty regarding the requirements of a project and there is a new customer-vendor relationship, Time and Material contracts may be more appropriate. In both cases, according to Company D, "performance metrics built into the contract are developed by detailed and interactive dialogue between us and the other party, regardless of whether we are the user or vendor of a particular service." Company F

also said mutually supportive approaches between vendors and customers in developing metrics and KPIs ensure mutual understanding of expectations.

Successful, long-term relationships require an ongoing and continuing dialogue throughout the life of the customer relationship, not something that only occurs when the contract terms are being discussed and put into place. Both parties need to maintain an honest and ongoing dialogue about the initial scope of work and have frequent communication to keep the other party updated on the progress of the service. Ongoing dialogue between vendor and customer ensures situational awareness and allows for feedback loops to address concerns. Some companies, such as Company K, conduct regular customer roundtables to encourage direct feedback.

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3. Relevance to DOD

A. DOD Context

DOD's "core competency" and primary mission is the conduct of military operations; no activities like it exist in the commercial world.[25] To enable it to conduct its primary mission, DOD also performs or contracts for supporting services in logistics, maintenance, financial, personnel, and many other areas. DOD's requirements for non-combat support services span multiple industries, some of the largest being aerospace, healthcare, transportation, information systems, and telecommunications.

While no commercial company provides or procures the same scope of services, the requirements for many of these DOD activities are not significantly different from those of large commercial companies. Thus, DOD can learn from BPs of commercial firms. In applying these lessons, however, one must consider that government acquisition of services is different from the commercial world in fundamental ways:

- External political processes, particularly those in the Congress, can play a direct and much more intrusive role, such as steering contracts to particular businesses or preventing the closure of DOD facilities.
- Related to the above, governmental budgetary processes and rules restrict DOD from making long-term commitments that could potentially enhance efficiency and promote mutually beneficial partnerships.
- Executive authorities are more dispersed in the DOD than in most commercial firms, making enterprise-level decisions more difficult to implement. Further, top leadership is replaced every few years (or promoted or rotated, in the case of uniformed military), often bringing in very different agendas, creating uncertainty and instability at the top.[26]
- Government solicitation requirements, focused on fairness and openness as a matter of public policy, differentiates it from companies, which are not required to do so and are not subject to legal protests from losing bidders.
- Companies are not mandated to allocate a percentage of contract spending to particular classes of business owners—small, minorities, women—to advance broader social goals.

[25] Certain facility security operations—such oil and gas production in unstable regions—are similar to military missions such as base defense, but the scope and lethality of threats to military installations is typically far greater.

[26] While periodic changes, often dramatic, can occur in commercial firm leadership, this is not mandated in law as it is for the federal government.

The net result is that the kinds of flexible practices and long-term relationships that large companies build and maintain with service providers—an increasingly important aspect of services acquisition—can be difficult for DOD to replicate. The combination of flexibility and long-term relationships is the hallmark of the Partnership Model described earlier (**Error! Reference source not found.** in Chapter 1, Section E, "Conceptual Framework"). In section B, we assess the BPs from Chapter 2 in detail and highlight specific feedback received from the companies interviewed for this report.

B. Strategic Outcomes in the DOD Context

Chapter 2 highlighted three strategic outcomes driving services acquisition: enhance competitiveness; reduce cost; and adjust rapidly in dynamic markets. It also noted the importance of long-term relationships for achieving these strategic outcomes, particularly for KBS. In order to assess the relevance of the associated commercial BPs for DOD—in terms of potential benefits and the ability of DOD to implement them—we begin by considering how these strategic outcomes apply in the DOD context.

1. Enhance Competitiveness: Commercial vs. DOD

DOD does not face "competitors" in a commercial sense. It has a monopoly on its core mission of deterring and, if necessary, defeating foreign militaries and paramilitaries. In conducting this mission, DOD purchases almost all of its equipment from contractors and increasingly uses contractors for equipment maintenance services, as well as the logistics associated with making sure that parts and other essential supplies are delivered to military installations worldwide. It is common to find service contractors deployed in wartime theaters.

In areas such as aircraft MRO, DOD has successfully accessed the efficient workforces of companies that specialize in airframes used both by DOD and commercial airlines. Doing so can improve turnaround time, readiness, and quality. Even for aircraft with systems and components unique to the military, DOD has been able to consolidate and rationalize services acquisition. Nevertheless, it still faces limitations, such as a congressionally mandated requirement that imposes a 50 percent ceiling on the amount of depot maintenance that may be performed externally. Like certain commercial airlines, it makes sense for DOD to maintain some internal MRO capabilities in order to address urgent needs and maintain a level of self-sufficiency. However, an arbitrary internal capability requirement is not likely to be most efficient.

It is common in commercial industry for companies to hire contractors on a temporary basis to fill in skillset and knowledge gaps while they build up their internal talent and capabilities. For instance, commercial airlines that maintain internal MRO facilities send people to engine manufacturers and commercial MRO companies for training. A major manufacturing company that was switching to a new enterprise IT system brought in external

contractors to help with implementation but included in the contract the training of internal staff to run and maintain the system. In DOD, external contractors are often brought in to fill gaps in capabilities as well, with one such function being Systems Engineering and Technical Assistance. Often such contractors become embedded in the organization for the long term, becoming effectively indistinguishable from government employees. Indeed, with emphasis both within the Executive branch and by the Congress on reducing staffs, augmentation with contractors can be the key to meeting the workload. This mixed mode of staffing raises issues in evaluating performance and avoiding lock-in. Contractors gain specialized knowledge and capabilities that make switching to a new contractor difficult and inefficient in the short term, inhibiting open competition. Given the regular rotation of DOD military staff, contractors can end up with institutional knowledge that DOD employees lack.

2. Reduce Costs: Commercial vs. DOD

Reducing costs is a common objective of commercial companies and DOD. Leading companies manage cost at the enterprise level, streamlining their requirements and consolidating purchases. Companies often accomplish this by centralizing authority for certain types and levels of purchases. DOD has also centralized purchasing in certain areas. Much of DOD's IT and communication equipment and services is procured by the Defense Information Systems Agency (DISA).[27] The Defense Logistics Agency manages purchasing, warehousing, and distribution of more than five million items (e.g., food, fuel, medical supplies, construction material, spare parts) and operates a centralized contract management function.

However, while DOD policy emphasizes "best value" thinking, commercial companies are better able, in general, at weighing long-term enterprise-wide value creation and risks against near-term cost savings.[28] Such tradeoffs are inherently simpler to make in the private sector, where value is often quantifiable as increased revenues or profits. Increased spending that pays for itself in increased profits is easier to recognize and justify. Better non-financial performance at a higher price is typically more subjective. However, when times are difficult, both commercial firms and DOD can become myopic, focusing on near-term

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[27] A recent Government Accountability Office investigation of DOD contracting for satellite communications capacity found that contracts purchased by other DOD organizations outside of DISA cost, on average, 16 percent more. See Government Accountability Office, "DOD Needs Additional Information to Improve Procurements," GAO-15-459, July 17, 2015.

[28] In the best value continuum described in the Federal Acquisition Regulation, two acquisition processes and techniques may be used to design competitive acquisition strategies: the Tradeoff Source Selection Process and Lowest Price Technically Acceptable (LPTA) Source Selection Process. The Tradeoff Source Selection Process allows for a tradeoff between non-cost factors and cost (or price), and allows the government to accept a proposal other than that with the lowest price to achieve a best-value contract award. The LPTA Source Selection Process is used when best value is expected to result from the selection of a technically acceptable proposal with the lowest price. The best value continuum allows agencies (including DOD) to obtain best value by selecting one or a combination of these approaches.

savings. Strong outside pressure to "find the savings" increases incentives to use LPTA selection criteria that simplify the solicitation process by focusing largely on cost and reduce the chances of protest, but may not generate the greatest long-term value for DOD.[29] In fact, some have argued that such practices discourage innovation, by making better capabilities irrelevant to selection. The LPTA approach is not common in commercial transactions.

As with government, large companies have bureaucracies and organizational politics that can inhibit efficient coordination; stockholder pressures can make it difficult to invest today to achieve long-term savings. Making such tradeoffs and investments in a government environment is typically even more difficult, due to more fragmented authorities. There is no one in DOD with an equivalent role to that of a corporate Chief Executive Officer who has the authority to force enterprise-level coordination, perhaps increasing costs in one area in order to realize greater savings for the enterprise. One manifestation of such "stove-pipes" is rushed spending of unobligated budget at the end of each fiscal year, as money appropriated for one agency or purpose cannot easily be applied to another, and the organization controlling that money has strong incentives to spend it in order to justify the future budget levels.[30]

Risk aversion also tends to be more prevalent in DOD than in commercial industry, due to certain acquisition practices being formalized into rules. These rules may have been formulated years earlier to address a market problem at the time, but there is no mechanism to regularly reassess them as market conditions change, and often little incentive for a program manager or contracting officer to do so. For instance, in Finding B1, Company H noted that commercial companies use overhauled parts when they can, whereas DOD typically will not, even though there is not a safety-related reason for using new parts versus used ones.[31]

3. Adjust Rapidly in Dynamic Markets: Commercial vs. DOD

Peter Drucker coined the term "knowledge worker" in his 1959 book, *The Landmarks of Tomorrow*. As described in Chapter 1, Section D.3 ("The Nature of Knowledge-Based Services"), the rise of the information economy is transforming all kinds of businesses, forcing them to become "learning organizations" that continuously evolve and adapt. Both

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[29] Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) Frank Kendall issued a memorandum in March 2015 indicating that an LPTA approach is appropriate when there are well-defined requirements. USD(AT&L), *Appropriate Use of Lowest Priced Technically Acceptable Source Selection Process and Associated Contract Type*, http://bbp.dau.mil/docs/Appropriate_Use_of_Lowest_Priced_Technically_Acceptable_Source_Selec_Process_Assoc_Con_Type.pdf.

[30] USD(AT&L) and USD(Comptroller), *Department of Defense Management of Unobligated Funds: Obligation Rate Tenets*, Memorandum for Distribution, September 10, 2012, https://acc.dau.mil/adl/en-US/533026/file/65740/2012_09_10%20DoD%20Mgt%20of%20Unobligated%20Funds%20pdf%20%20Obligation%20Rate%20Tenets.pdf.

[31] Both new and used parts must meet required FAA safety standards.

companies and governments are increasingly turning to expert service providers in order to keep up with technology and market changes.

In some of the cases covered in this paper, service providers buffer unexpected fluctuations in demand.[32] For instance, commercial MRO providers have economies of scale that permit them to maintain expensive infrastructure. They have also created options to lease additional facilities as a reserve when demand for service unexpectedly spikes. As noted earlier, DOD could likely realize savings and improved readiness by moving more work to commercial MRO providers for military airframes that are derived from airframes used by commercial airlines.

For many KBS, it is not possible for either the client or the vendor to specify all requirements in advance. Sometimes this is due to fundamental uncertainties, such as addressing unsolved problems. Other times it may be due to rapid changes in technology. Companies cope with such situations by entering into contracts that include provisions for information exchange and flexibility, with governance structures that depend on regular feedback and adjustment. While organizations within DOD have found ways to enter into such relationships—e.g., USTRANSCOM has adopted Agile software development[33]—competition rules and acquisition practices limit what DOD can (or believes it can) do.

Innovation is a key aspect of responding to dynamic environments. Firms have learned that remaining competitive means being open to change and harnessing new capabilities. In commercial business, this has meant adopting new approaches, such as the "as a service" model, in which capabilities that formerly were provided by in-house groups at significant capital cost are instead provided by outside groups as an operational expense tied to outcomes. This model is most developed in IT, where internal company servers are replaced by external computing, storage, and applications provided over the Internet. As this approach entails much more of a partnership, including the deep sharing of data between the customer and the service provider, it introduces solicitation and contracting challenges that government practices and restrictions can make difficult to implement. (See Appendix A for more details.)

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[32] For DOD, the process of "ramping up" to meet military requirements in wartime is more developed than the process of "ramping down" afterwards.

[33] Trevor Bunch, Nate Minshew, and Rory Kinney, "Standardizing the Rapid Delivery of Software to Warfighters," *Digital Signal Processing Journal* (January/March 2011).

C. "Quick Look" Assessment of Commercial Best Practices in DOD

Commercial BPs in services acquisition may be thought of as three levels:

1. Consolidating requirements and/or purchases, addressing internal disincentives or conflicts that can inhibit achievement of best overall value at the enterprise level. Can also include prequalification of multiple suppliers to maintain competition.

8. Utilizing internal "smart buyer" organizations and practices to cope with more complex contracting situations: e.g., analyzing and monitoring market dynamics, cost-drivers, and price-performance tradeoffs; devising sophisticated vendor incentives and metrics; monitoring vendors (scorecards) and encouraging continuous improvement.

9. Building/maintaining long-term relationships with key partners, including cooperative mutual capability development that reshapes the supply market.

These levels are evolutionary, with each one supporting the development of the next, akin to a Capability Maturity Model (ad hoc, repeatable, defined, managed, optimized).[34] At the first level, companies collect enterprise-wide data on spending, what is being bought by whom, and analyze it to identify potential savings (and risks) from consolidation. Data collection and centralized management can be enhanced with sophisticated market analyses and vendor management capabilities, laying the groundwork for continuous improvement. Over time, regular interactions with vendors, characterized by listening and concern can lead to improved goal alignment, reciprocity, and commitment, which engender trust. Trust is essential in relationships and is perhaps the best accelerator of innovation.

The BPs identified in Chapter 2 may be considered with this evolutionary framework. Table 5 summarizes the BPs under each strategic driver in terms of the three levels. Likewise, the applicability of BPs for DOD—and DOD's current level of maturity—may be assessed within this framework. Table 6 summarizes IDA's view, based on our experience with various DOD services acquisition improvement efforts in recent years. Green-shaded cells represent areas where we believe DOD has demonstrated the ability to execute a particular category of commercial BPs. Yellow-shaded cells represent areas where DOD could improve through adaptation of commercial BPs but is limited in certain important respects. Red-shaded cells represent areas where DOD faces significant obstacles to adopting commercial BPs and has not made substantial progress to date.

For instance, DOD has made substantial efforts to collect detailed data on services acquisition. This has required underlying efforts, started many years ago, to standardize accounting systems and business processes. While there remains much work to be done, we

[34] Watts S. Humphrey, "Characterizing the Software Process: A Maturity Framework," *IEEE Software* 5, No. 2 (March/April 1988): 73–79. doi: 10.1109/52.2014.

see few inherent limitations on DOD's ability to do so as well as a large company. Hence, we assess the upper left corner of the matrix as green.

DOD's ability to use multiple vendors is constrained in some cases by issues of classification and unique military contexts. Achieving commercial-level capabilities in maintaining multiple qualified vendors is also inhibited by distributed authorities. Much more can and should be done by DOD, but we assess this area (top row, center column) as yellow. Commercial companies interviewed for this study suggested that DOD should develop a more rigorous and streamlined processes for making such decisions about when and how to outsource services.[35] Congressional actions in certain specific areas—such as relaxation of the requirement that 50 percent of MRO work be done in DOD depots—would also help, allowing cheaper and faster commercial MRO companies to service DOD aircraft that employ commercial airframes.

The entire "smart buyer" row in Table 6 is also shaded yellow for similar reasons. The need for DOD to increase consideration of overall value rather than just lowest cost was noted by several companies interviewed for this paper. Components of DOD have demonstrated the ability to adopt such practices with excellent results, such as the Air Combat Command's Acquisition Management and Integration Center.[36] Such capabilities in the MRO space, for instance, could allow DOD to move toward more commercial-style contracts rather than relying on prime contractors as middlemen, and could streamline decision processes that, today, cause DOD aircraft to sit in MRO hangars longer than their commercial equivalents. In the area of irregular transportation services, one company interviewed critiqued DOD's use of FFP contracts as costly and inefficient. Achieving best overall value from an enterprise perspective, however, remains challenging and probably always will be so, due to distributed authorities. Further, issues with data protection and intellectual property sharing were cited by companies as inhibiting greater reliance by DOD on predictive analytics, which would allow aircraft condition and operational environment to dictate maintenance schedules rather than fixed periods specified in current manuals, improving agility while reducing costs.

[35] Consistent with Findings A1 and A3, before issuing an RFP, DOD needs to improve its understanding of what capabilities are extant in the market and what value they create for DOD as an enterprise.

[36] Graham et al., "Improving DOD Contracting for Services."

Table 5. Summary of Commercial Best Practices under Each Strategic Driver, in Terms of Increasing Levels of Maturity

Level	Enhance Competitiveness	Reduce Costs	Rapidly Adjust
Centralize	Significant effort to analyze spend and centralize oversight	Case-specific use of preferred suppliers and multiple vendors	Not observable/applicable
Smart buyer	Smart buyer organizations serve as central repository of vendor information, offer real-time feedback and provide understanding of key market segments	Overall value considerations drive selections; economies of scale leveraged, data analytics and vendor management used to ensure strong vendor performance and cost savings	Use of predictive analytics maximizes readiness; standby vendor arrangements for surge requirements
Relationships	Organizational policies reinforce internal capture and transfer of knowledge; training, sharing IP, and other collaborations achieve mutual talent development	Not observable/applicable	Flexible dialogue with key vendors; standby vendor arrangements for surge requirements

Table 6. "Quick Look" Assessment of DOD's Ability to Implement Commercial Best Practices under Each Strategic Driver

Level	Enhance Competitiveness	Reduce Costs	Rapidly Adjust
Centralize	Ongoing DOD effort to analyze and centralize oversight of services spending	Multiple suppliers used in particular cases, but practice is not widespread	Not observable/applicable
Smart buyer	DOD smart buyer organizations exist in certain domains and places; results have been good, opportunities for expansion exist; Vendor metrics must offer real-time feedback	Overall enterprise value considerations most relevant for non-commodity outsourcing decisions. Some progress in leveraging commercial economies of scale, data analytics and vendor management	Some DOD organizations have contingency relationships for surge and quick reaction capabilities (e.g., SOCOM)
Relationships	Organizational policies should reinforce internal capture and transfer of knowledge to build institutional learning	Not observable/applicable	Interaction with vendors often constrained by letter of the contract; ability for flexible dialogue with key vendors more limited than in commercial world

The ability of DOD to implement commercial BPs in relationship management would appear to be limited in fundamental ways by the requirement to maintain transparency and "fairness" in contractor relationships. However, the assessment of the relationships level of BPs as "red" in Table 6 does not mean that DOD is not capable of commercial-style partnerships. While openness in solicitation will likely remain a *sine qua non* in government acquisition, selection criteria and contracting provisions may be able to evolve toward commercial BPs. For instance, past performance is a standard selection criterion in DOD solicitations. If DOD contract governance and oversight organizations developed expertise in commercial-style vendor scorecards, these could be fed back into the solicitation process to encourage continuous improvement. Further, we are not aware of government regulations that prohibit private meetings between government and vendors after contracts are awarded. This could allow leadership in the DOD to work closely with top executives of vendors without Sunshine Act rules coming into play.

As noted earlier, achievement of commercial-style relationships will be an evolutionary process, beginning with collection and analysis of spending and increasing use of smart buyer organizations and processes. Improved vendor management capabilities—particularly the use of scorecards and regular interaction toward continuous improvement—should, over time, create true partnerships. DOD smart buyer organizations could be a testing ground for the new kinds of contract governance and oversight.

D. Applying Commercial Best Practices to DOD Services

We have noted that DOD is different from commercial industry and that constraints exist that either limit or encumber DOD from implementing certain commercial practices when acquiring services. However, there are ample opportunities for DOD to substantially improve its services contracting to both improve outcomes and reduce costs. Underlying these opportunities is a fundamental perspective of leading commercial firms: do only what you are best at and engage with others where they are better.

While a simple adage, this entails a new mindset, starting with top leadership and permeating the organization. Leadership is key to revamping how services are conducted. It implies dislodging those entrenched in how things are currently done. Leadership is usually also required to make investments in resources and capabilities to change the provision of services. Moving toward reliance on partners must be based on knowledge and analysis that guides the strategy and approach. Capabilities such as smart buyer organizations have to be fostered and developed with upfront investments and careful oversight, often including protection against those who feel threatened.

Leadership and investment in the right capabilities implies the ability to cause fundamental structural shifts. In this regard, DOD, in contrast to commercial firms, is encumbered by political processes. DOD is forced to develop a case for change within both the Executive branch and the Congress. Doing this requires demonstration of cost savings

and performance, as well as clear approaches for how the changes will be made and what is required to make them—including, if necessary, legislation.

Focused "proof of concept" demonstrations can show the prospects for improvement, but they must be replicable and scalable in order to have significant impact. Within companies, such programs are rolled out on a trial basis in one part of the company with an explicit plan to learn and grow from that to broader implementation. That is, the new approach is not seen as an aberration or experiment at the fringes of the organization but rather a means to test and develop the business case to proceed. In DOD, on the other hand, such demonstrations are typically pursued within an organization that is uniquely motivated to pursue a new approach but may not be well-connected to other related groups in the enterprise.

Most importantly, such iterative, learning-oriented approaches to services focus on innovation. Most services have been transformed by IT and related sensing technologies, leading to tremendous gains in productivity. One can see this in the delivery of packages, management of billing and payments, and even in technology development itself with "open innovation." The "as a service" model referenced in Chapter 2 and detailed in Appendix A is based on IT-based connectivity, including "big data" and predictive analytics that allow service providers to deliver much more efficient results than individual organizations could on their own. An outstanding example of this, as described in Finding C2, is the commercially based transportation billing and payment system that settles accounts within 24 hours versus the internal DOD system that was paying shippers in 180 days. This service is provided without any oversight burden on DOD and has resulted in large savings.[37] While DOD should look to increase efficiencies in all areas of services, truly innovative approaches to services that DOD does not provide well should be a particular focus of leadership, investment, and demonstration.

E. Suggestions for DOD from Firms Interviewed

In the course of our research, the eleven commercial firms interviewed offered detailed suggestions on how DOD might improve services contracting. These suggestions appear in Appendix C, mapped to the strategic outcome (or outcomes) that best relates to the suggested action.

[37] Note, however, that DOD does not take advantage of the logistics data from this system as much as the commercial customers do to drive broader efficiencies in transportation management.

4. Next Steps

This report has identified several commercial BPs and DOD areas for improvement in the acquisition of KBS and ERS. Steps toward implementation would include:

- Analysis of organizational, legal, and other challenges (perhaps using the "quick look" assessment in Table 6 for guidance)
- Setting priorities for which BPs to pursue, through an analysis of current spending,[38] implementation complexity, and potential impact
- Solicitation of viewpoints and a drive toward consensus on priorities among the most critical stakeholders
- Candidate areas for demonstration, based on stakeholder consensus and focus/willingness of required leaders
- Enterprise rollout requirements (for successful demonstrations)

Based on the research and interviews for this paper, IDA believes the following areas could be particularly promising for DOD exploration of innovative commercial approaches:

- Development of vendor scorecards and encouragement of pre- and post-contract relationships between DOD smart buyer organizations and commercial contractors;[39]
- Improved intellectual property sharing mechanisms between DOD and its vendors;
- Use of "sensorized" capabilities and predictive analytics for maintenance of DOD aircraft/fleets (enabled by improved intellectual property mechanisms);
- Organizational policies to reinforce internal capture/transfer of knowledge to build institutional learning;
- Extension of the automated electronic payments system described in Finding C2 within other parts of DOD (where applicable); and

[38] Automated text analytic techniques could help DOD better understand/classify existing DOD spending.

[39] We noted in a prior report (Graham et al., "Improving DOD Contracting for Services") that "government clients are terrified of having one-on-one conversations with commercial companies!" However, we are not aware of restrictions post-contract award on private meetings between government and vendors.

- "As a service" implementation steps identified in Appendix A (assessment of cost savings, performance metrics, industry BPs, applicability to DOD, and smart buyer practices).

This paper is the third in a series of IDA papers looking at commercial BPs in services, with the prior two focusing on the portfolio areas of Research and Development[40] and Electronic and Communications Services.[41] A possible candidate for similar research on commercial BPs in services acquisition would be the Facilities-Related Services portfolio ($26.1 billion or 17 percent of total FY 2014 DOD services expenditures).

[40] Richard H. Van Atta et al., "Commercial Industry Research & Development Management Best Practices," IDA Paper P-4814 (Alexandria, VA: Institute for Defense Analyses, Dec 2011).

[41] Graham et al., "Improving DOD Contracting for Services."

Appendix A
Exploring the "as a service" Model

The delivery of services has evolved over the last few decades. A better understanding of the evolving "as a service" model will be important for DOD in the future. The objective of this appendix is to examine this model, to better understand its attributes, benefits, and constraints, and examine its relevance to the DOD services acquisition approach.

A. Origins of "as a service" and Cloud Computing

The terminology "as a service" has been frequently used in reference to information technology (IT)-related cloud delivery services. "Software as a Service" (SaaS) is the earliest example, born out of the frustration of IT executives with the costs of enterprise software (which included purchase and implementation of the software, licensing fees, training, infrastructure, and maintenance costs). SaaS evolved from the Application Service Provider (ASP) model of the 1990s that offered applications hosted over the Internet. ASP experienced challenges with scalability and reliability, which the SaaS model has been able to better address through a multi-tenancy approach, in which the vendor offers the same software (with the same underlying code) to all customers. This approach enables the SaaS model to achieve economies of scale and lower prices. SaaS customers generally pay a flat monthly fee, and implementations are cheaper than purchasing packaged software because companies do not have to make capital expenditures to buy additional hardware or infrastructure.[1]

SaaS has since become known as one of the three primary service models associated with cloud computing. According to the National Institute of Standards and Technology (NIST) definition, these models are: SaaS, Platforms as a Service (PaaS), and Infrastructure as a Service (IaaS).[2] SaaS provides capability to the consumer through use of the provider's applications running on cloud infrastructure, often accessible via a web browser. PaaS provides the capability to "deploy onto cloud infrastructure, consumer created or acquired applications" created on services/tools supported by the provider. IaaS is a processing,

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1 Meridith Levinson, "Software as a Service (SaaS) Definition and Solutions," May 15, 2007, CIO.com, accessed January 13, 2015. http://www.cio.com/article/2439006/web-services/software-as-a-service--saas--definition-and-solutions.html.

2 Peter Mell and Timothy Grance, *The NIST Definition of Cloud Computing*, Special Publication 800-145 (Gaithersburg, MD: Computer Security, National Institute of Standards and Technology, September 2011), 2–3.

storage, network, or other computing resource capability provided to the consumer.[3] Each of these "as a service" models provides varying degrees of consumer vs. provider control, as illustrated in Table A-1.

Table A-1. Cloud Service Models: Levels of Consumer vs. Provider Control

Cloud Component	SaaS	PaaS	IaaS
Application	Provider-controlled/ managed (limited user settings)	User-provided/ limited control configurations	User-provided/ controlled
Operating System	Provider-controlled	Provider-controlled	User provided/ controlled
Storage	Provider-controlled	Provider-controlled	User-controlled
Servers	Provider-controlled	Provider-controlled	Provider-controlled
Network	Provider-controlled	Provider-controlled	Provider-controlled (user limited control- firewalls)

Source: Mell and Grance, *NIST Definition of Cloud Computing*, SP 800-145, 3.

B. Convergence and "Anything as a Service" (XaaS)

Within the IT sector, the phenomenon of "convergence" is a growing trend, in which vendors have been offering bundled products and services to offer "outcomes" to the U.S. government market, referred to as an "as-a-service" (XaaS) model.[4] A 2014 study by Market Connections Inc., in partnership with the Professional Services Council (PSC), sought to benchmark this convergence phenomenon via an online survey of 224 federal government decision makers involved in the acquisition of IT products and services and 227 government contractor employees. The federal agency survey audience consisted of 68 percent Civilian Agencies, 21 percent Defense Agencies, and 11 percent members of Congress. The survey queried respondents on their perceptions of convergence and how this might affect federal procurement. The results were released in both a briefing and a white paper.

Several sources refer to the "XaaS" model as "Anything-as-a-Service" in the context of a hybrid cloud computing delivery of IT services that can combine and/or integrate SaaS, PaaS, IaaS and other "as a service" delivery options.[5] The Market Connections/PSC

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3 Ibid.

4 Market Connections Inc., in partnership with Professional Services Council (PSC), "Research Report 'As a Service:' A Foundational Shift in Government Acquisition," October 2014, accessed January 8, 2015, http://marketconnectionsinc.com/index.php/White-Papers/convergence-white-paper.html.

5 Archie Hendryx Hendryx, "Cloudy Concepts: IaaS, PaaS, SaaS, MaaS, Caas & XaaS," ZDNet, October 31, 2011, accessed January 9, 2015, http://www.zdnet.com/article/cloudy-concepts-iaas-paas-saas-

benchmark study suggests that the convergence model goes beyond technology and will have an impact on all facets of government operations in the future. The study's findings highlight that there is a disparity between contractor and government awareness of convergence, with 90 percent of contractor respondents very familiar versus 67 percent of government respondents.[6] In terms of the impact of convergence upon government acquisition, 75 percent of contractors and 70 percent of government respondents reported a moderate to high impact.[7] Reasons cited for high impact by government contractors included (1) a shift in business model from standard purchase of products to a service and (2) plans to deliver a capability as a service rather than a product in the future, requiring bundling services with others for a complete solution. Reasons cited by one government contractor for low impact was a domination of the convergence market by larger firms such as Accenture and IBM, leaving middle tier players with supporting roles.[8] Reasons cited by federal respondents for high impact included (1) declining agency budgets driving a re-evaluation of how to acquire technology and services and (2) that it provides "state of the art technological solutions faster and lower life cycle cost" than procurement of technology without services. Reasons cited for low impact included (1) reluctance by Agency to implement principles of convergence with most system solutions siloed and (2) a slowness to consider or adopt outsourced solutions "due to regulations and security."[9]

Despite the high percentage of government responses indicating a moderate-to-high impact in the benchmark study, their responses regarding current and near-term plans to use XaaS show much lower implementation—"only 5% see XaaS model as offering great potential and solutions" and "one third of government agencies have adopted XaaS models or plan to in the next year."[10] Of those government Agencies that currently use or plan to use XaaS, the study notes areas of implementation include the following: 41 percent, communications; 39 percent, software; 35 percent, infrastructure; 33 percent, monitoring; 32 percent, platform; 29 percent, training; and 19 percent, other.[11] The study highlights five top trends for technology convergence and notes the difference of perception between

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maas-caas-xaas/; John Dixon, "X as a service (XaaS): What the future of cloud computing will bring," Cloudtech, August 18, 2014, http://www.cloudcomputing-news.net/news/2014/aug/18/x-as-a-service-xaas-what-the-future-of-cloud-computing-will-bring/; and Shane Long, "Is everything-as-a-service the future of business operations?" deverus.com, September 26, 2014, accessed January 9, 2015, http://deverus.com/is-everything-as-a-service-the-future-of-business-operations/.

6 Market Connections, "Research Report 'As a Service.'"

7 Ibid.

8 Ibid., 10.

9 Ibid., 12.

10 Ibid., 2.

11 Ibid.

government and contractors regarding these trends. These trends and the corresponding perceptions are displayed in Table A-2.

Table A-2. Government/Contractor Perceptions of Top Five Trends for Technology Convergence

Convergence Trend	Government	Contractors
Trend 1 – It is important for a federal agency to work with a company that can deliver integrated services and technology.	75%	85%
Trend 2 – The lines between technology and services are beginning to blur when looking to buy IT or mission services.	66%	79%
Trend 3 – Traditional technology vendors are now providing their products as services.	65%	68%
Trend 4 – Federal agencies/my agency are behind the curve compared to private sector.	58%	80%
Trend 5 – Companies will have fewer opportunities to sell hardware and software separately from services as consumption-based acquisition models like cloud computing take hold in government.	53%	67%

Source: Market Connections Inc., in partnership with PSC, "Research Report "As a Service:" A Foundational Shift in Government Acquisition," October 2014, 3.

For Trend 1, the survey data noted in the briefing show that defense respondents were in less agreement than civilian respondents regarding the importance of working with a company that can deliver an integrated solution: only 68 percent of defense respondents agreed, with 15 percent neutral and 17 percent disagreeing. For civilians, 78 percent agreed, 19 percent were neutral, and only 3 percent disagreed.[12]

The study asserts that several barriers and misperceptions have slowed more wide-spread adoption of XaaS solutions and that government will need to change its approach to purchasing these new types of services in order to "move toward consumption based models."[13] Four barriers to XaaS adoption are covered in the findings, with perceptions of these barriers varying between government and contractors. These barriers and the respondent perspectives are noted in Table A-3.

[12] Ibid., 19.

[13] Ibid., 4.

Table A-3. Barriers to XaaS Adoption

Barrier	Government Perception (%)	Contractors Perception (%)
Budget Constraints	45%	24%
Security Issues/Risks	60%	46%
Poorly Defined Requirements	36%	21%
Lack of Procurement Guidance	16%	31%

Source: Market Connections Inc. in partnership with PSC, "Research Report 'As a Service:' A Foundational Shift in Government Acquisition," October 2014, 4.

The study notes that these varied perceptions suggest a need to better educate government customers on security issues related to commercial delivery of government services. It also points to a lack of government awareness of funding flexibilities gained by XaaS, which include the benefit of eliminating up front capital expenditures.[14] The study suggests that while existing acquisition rules can accommodate procurement, some contracting officers will need to try new approaches. Despite the August 2014 Office of Management and Budget draft "TechFAR" guidance,[15] which addresses the flexibility to adapt that exists in the Federal Acquisition Regulation, many government decision makers remain risk averse. The study suggests government contractors should work with their customers to design performance-based contracts that focus on outcomes, with statements of objectives rather than restrictive statements of work.[16] It also emphasizes the importance of well-defined requirements to fulfilling the mission.

The study concludes with a shortlist of benefits both government and contractor respondents agreed the XaaS model may provide to government, allowing it to better respond to external factors: "Pay only for what is needed, Scalability, Ability to rapidly deploy new services, and Sharing of resources and cost."[17]

Exploring the ideas highlighted in this study in more depth, a November 2014 article on the E-Commerce Times website shares an interview of PSC's senior vice president of technology, study co-author David Wennergren.[18] The interview explores how current government contract types might work to support the convergence model, as well as the characteristic IT elements covered by convergence. Wennergren notes government contract types such as One Acquisition Solution for Integrated Services (OASIS) and

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14 Ibid..

15 Office of Management and Budget, *TechFAR Handbook for Procuring Digital Services Using Agile Processes*, August 7, 2014, https://playbook.cio.gov/assets/TechFAR%20Handbook_2014-08-07.pdf.

16 Market Connections, "Research Report 'As a Service'," 5.

17 Ibid., 6.

18 John K. Higgins, "Vendors Sow Seeds for Next Big Federal IT Thing: Convergence," E-Commerce Times, November 19, 2014, accessed January 9, 2015, http://www.ecommercetimes.com/story/81384.html.

Alliant could support government purchase of integrated solutions; however, government buying practices and techniques still need to change. He critiqued government over-reliance on rigid statements of work and Lowest Price Technically Acceptable (LPTA) evaluations rather than statements of objectives and overall value evaluations. Wennergren noted that the PSC and its member companies are working on identifying BPs and barriers to "consumption based buying" to ensure the government is "a smart buyer of Capabilities as a Service" and that they plan to highlight approaches to contract templates that could work.[19]

Wennergren characterizes the convergence market as outcome-based solutions, in which contracts require the vendor to provide technology and services, rather than separate contracts for hardware, software, and support services. He gives the examples of the management contracts for the Navy-Marine Corps Intranet and cloud computing contracts for IaaS and SaaS. According to Wennergren, pricing is based upon delivery of a service or solution, which provides the vendor flexibility to apply the best combination of people, processes, and tools to meet the mission requirements. Wennergren notes that converged solutions beyond infrastructure could include contracting with industry to provide human resources process services such as hiring or personnel transactions.[20]

C. Beyond the Cloud: Convergence of Manufacturing and Services

Beyond the cloud computing terms, another varied set of terminology is used to characterize "as a service"-type models. Examples include Product-Service Systems[21] and the Servitization of Manufacturing.[22]

Matthias Boehm and Oliver Thomas posit a core definition for Product-Service Systems as "an integrated bundle of products and services which aims at creating customer utility and generating value," based upon a meta-analysis of the varied definitions used within the IT, Business Management, and Engineering & Design disciplines.[23] The concept of servitization was coined in a 1988 article by Sandra Vandermerwe and Juan Rada in the

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19 Ibid.

20 Ibid.

21 Matthias Boehm and Oliver Thomas, "Looking beyond the rim of one's teacup: a multidisciplinary literature review of Product-Service Systems in Information Systems, Business Management, and Engineering & Design," *Journal of Cleaner Production* 51 (2013): 245–280, accessed December 31, 2014, doi: 10.1016/j.jclepro.2013.01.019; Fernanda Hänsch Beuren, Marcelo Gitirana Gomes Ferreira, and Paulo A. Cauchick Miguel, "Product-Service Systems: a literature review on integrated products and services," *Journal of Cleaner Production* 47 (2013): 222–231, accessed December 31, 2014, doi: 10.1016/j.jclepro.2012.12.028.

22 Cindy Elliott, "Why Manufacturers are Shifting their Focus from Products to Customers," Forbes *BrandVoice*, PTC*Voice*, February 20, 2014, accessed December 31, 2014, http://www.forbes.com/sites/ptc/2014/02/20/why-manufacturers-are-shifting-their-focus-from-products-to-customers/.

23 Boehm and Thomas, "Looking beyond the rim of one's teacup," 252.

European Management Journal.[24] This article characterized the trend of corporations responding to customer demand by adding value to core offering through services in order to gain competitive advantage. The authors observed corporations offering more bundles of goods, services, support, self-service, and knowledge, with a growing emphasis on service—suggesting this was a new feature of their corporate strategies.

When exploring the manufacturing sector, one can observe how some companies have sought to optimize more of the value chain by including services as part of their extended offering. According to a January 2014 article by Tim Baines, an international authority on servitization, more manufacturers offer "a portfolio of integrated products and services that deliver business capability for customers, rather than simply sales transactions."[25] The types of services manufacturers may deliver include spare parts, help desk, maintenance, repair and overhaul, availability contracting, performance contracting, and managed services and solutions. Baines lists several companies that have moved toward servitization, where product lifecycle management (PLM) is employed; these include Rolls Royce, aero engine manufacturer; Xerox; and a French industrial group, Alstrom. He offers the example of Xerox's managed print services, through which the company sells "document solutions" to British Airways and British Telecom. The contracts provide the customer a capability to "perform a business function or process" and are often "based on pay-for-use…with risks managed by the manufacturer, and commitment to provide rolling process improvement and cost savings."[26]

Baines also references a June 2013 Oxford Economics Manufacturing Transformation report that predicts increased demand for advanced services, with a global rate of 65 percent of manufacturers using performance-based service contracts by 2015 and 67 percent of manufacturers in the United States focusing on services. Of the 65 percent global use of performance-based service contracts, the article notes the areas of aerospace (74 percent) and medical devices (70 percent) will lead in use of such advanced services contracts.[27]

Oxford Economics conducted further analysis of manufacturing transformation in 2014, in which it looked at "smart connected products" (SCPs), which would operate in the context of the "internet of things."[28] This research, conducted with the company PTC,

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[24] Sandra Vandermerwe and Juan Rada, "Servitization of Business: Adding Value by Adding Services," *European Management Journal* 6, No. 4 (Winter 1988): 314–324, doi:10.1016/0263-2373(88)90033-3.

[25] Tim Baines, "Bringing Production and Service Together," *The Sunday Times of London*, January 27, 2014, accessed December 31, 2014, http://raconteur.net/business/bringing-production-and-service-together.

[26] Ibid.

[27] Ibid.

[28] Oxford Economics, "Smart, connected products: Manufacturing's next transformation," November 2014, accessed January 6, 2015, http://www.oxfordeconomics.com/my-oxford/projects/281704.

entailed surveys of 300 manufacturing executives around the world. Key findings included feedback from half of the respondents surveyed who "say the shift to SCPs increases the viability of new business models such as product-as-a-service and outcomes-based services."[29] With regard to outcomes-based services, the Oxford report shares the example of Trane (the climate control unit of Ingersoll Rand, whose service line for real-time monitoring and maintenance of climate conditions inside of customer facilities grew into its own organization, with new service relationships with customers.[30] IBM's Center for The Business of Government blog had postings about "Products as a Service" as an emerging trend back in 2012. The idea noted there by Gadi Ben-Yehuda was that the next step beyond software and the apps marketplace as a force to spur innovation and economic activity was the development and open sourcing of physical objects (simple or electric and/or networked), via 3D printing and beyond.[31]

According to a September 2014 article in ThomasNet, the PLM services market is transforming beyond installation services and connecting separate systems. For example, Accenture has changed the way it delivers services, moving beyond working for the client to working with the client, as in its joint venture with GE Aviation, Taleris. This venture provides real-time monitoring of critical equipment on aircraft; using the underlying analytics, Accenture can perform predictive maintenance, rerouting, and delaying or accelerating a plane to meet time requirements in the transportation chain. The PLM sector trend is that clients are seeking more than a solution installation; they are also seeking program/project management and supply chain management. In 2013, Accenture was second to IBM for PLM service revenues, with HP the third largest PLM systems integrator and Siemens PLM following as fourth. According to the article, the digital enterprise is the common theme for PLM services. Factors such as machine-to-machine communications, more connected products, more software in products, and more digital services linked to these products, have changed the production landscape. In the example given of Accenture, its key industry segments include automotive, industrial equipment, and aerospace and defense, with customers such as GE, Airbus, Eurocopter, Michelin, Volkswagen, and Lufthansa. It has been asked to do horizontal integration (from engineering to post sales) as well as vertical integration in manufacturing (tiers 1-4, enterprise resource planning

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29 Ibid., 13.

30 Ibid.

31 Gadi Ben-Yehuda, "Emerging Trend: Products as a Service Part I," IBM Center for The Business of Government, http://www.businessofgovernment.org/blog/business-government/emerging-trend-products-service-part-i.

(ERP) systems/manufacturing execution systems (MES), connected to the PLM systems).[32]

Predictive analytics, which can be provided as an "as a service" model for predictive maintenance solutions, is a powerful business tool. Consulting companies will often be brought in at the onset to help a customer set up the solution because there typically exists an expertise gap. The vendor and the client need to work collaboratively, as the end-user client may not be knowledgeable about the model details, and the vendor, which has expertise in the modeling, may be unfamiliar with the datasets that are to be processed.

According to results of an April 2015 Oliver Wyman survey of MRO executives from airlines, manufacturers, and service providers, "airplane health monitoring and predictive maintenance" are foreseen as "the most promising new technologies in 2020."[33] *Aviation Daily* reported on the Aviation Week Intelligence Network website that, according to Dave Marcontell, vice president of Oliver Wyman-owned Cavok, "We believe these advances could cut or redistribute 15-20% of the total MRO spend…That's $10 billion-$15 billion."[34] IBM is a predictive maintenance service provider. According to IBM studies, on aggregate, those companies that use predictive maintenance solutions, compared to those using traditional approaches:

- Attain 10 times higher return on investment;
- Achieve a 20–25 percent reduction in maintenance costs;
- Eliminate 70–75 percent of breakdowns;
- Reduce downtime by 35–45 percent; and
- Increase production output 20–25 percent.[35]

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[32] Verdi Ogewell, "Why Accenture Thinks It Can Rattle IBM in PLM," ThomasNet, September 4, 2014, accessed January 12, 2015, http://news.thomasnet.com/imt /2014/09/04/why-accenture-thinks-it-can-rattle-ibm-in-plm.

[33] Sean Broderick, "North American Re-Fleeting will Bring Technological Change to Aftermarket," Aviation Week Intelligence Network, *Aviation Daily*, April 15, 2015, accessed April 28, 2015, http://awin.aviationweek.com/ArticlesStory.aspx?id=fe0392cc-cc9b-41c9-836f-d1606ac16154.

[34] Ibid.

[35] Results are based on averaging the Return on Investment (ROI) of IBM customers utilizing predictive maintenance solutions based upon 2012 data. IBM Sales and Distribution Solution Brief, "IBM Predictive Maintenance and Quality for automotive," May 2014, 2.

According to another predictive maintenance service provider, Accenture:

> Organizations who have embarked on Predictive Maintenance initiatives have realized 15-30% reduction in total maintenance costs (ROI of 10x), while reducing breakdowns by up to 75%.[36]

These examples indicate predictive maintenance "as a service" offerings might provide DOD with some useful approaches to cut costs and improve availability of aircraft.

D. Common Themes from IT and Manufacturing Sectors

When examining the evolving approaches to service provision in the IT and manufacturing sectors noted above, several common themes emerge:

- Increased integration of products and services to offer a more outcome-focused service delivery model.
- Options for decreased capital expenditures by the customer, in which the vendor is responsible for putting together the appropriate mixture of hardware, software, staffing, and services to produce the desired outcomes.
- Sharing of resources and cost.
- Scalability and ability to rapidly deploy new services.
- Pay-per-use or performance-based contracts.
- The need for more collaborative relationships between vendor and customer to ensure requirements and desired outcomes are understood/clearly defined.
- Increasing digitization of manufacturing, linking technological solutions/digital services to industrial processes for design, engineering, production, monitoring, control, maintenance, and logistics.

E. Possible Additional Areas to Explore

Several additional areas which might merit further research to inform DOD's services acquisition approach include:

- Cost savings related to acquisition/implementation of XaaS and Product-Service Systems
- Metrics for evaluating performance of XaaS and Product-Service Systems

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[36] Accenture Federal Services, "Using Predictive Analytics to Increase Equipment Reliability and Reduce Cost," 2012, 2, accessed May 15, 2015, http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture-Federal-Services-Using-Predictive-Analytics-to-Increase-Equipment-Reliability-and-Reduce-Costs.pdf.

- Industry findings/BPs on XaaS and Product-Services Systems (from vendor and user perspective)
- Applicability of XaaS and Product-Service System implementation to KBS/ERS
- Smart Buyer attributes related to XaaS and Product-Service System acquisition

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Appendix B
Selection of Interview Candidates

IDA reviewed key KBS and ERS data inputs to assist in identifying candidate commercial firms. These firms were examined against a set of selection criteria, structured to achieve the following: comparability to DOD in the scale of outsourced services, relevance to DOD in the type of service outsourced, the ability to offer insights of potential value to DOD, and the likelihood of the firm's participation in an interview. The selection criteria applied to candidate commercial firms is shown in Table B-1.

Table B-1. Commercial Firm Selection Criteria

Category	Item Number	Criteria
Relevance to DOD	1	For a particular service type, the company is comparable to DOD in the scale of outsourced services
	2	Type of service outsourced by company falls into a significant spending category, or DOD expects significant growth in its outsourcing of these types of services
Why Company is of Interest	3	The company is recognized as having valuable potential insights in a particular service category of interest to DOD
	4	Sponsor or subject matter experts (SMEs) have identified the company as one of particular interest
Reachability	5	Sponsor, IDA, or SME has existing relationship with this company that will facilitate the IDA team's ability to obtain an interview
	6	Additional criteria as discovered during initial company identification, evaluation, and interviews

From a list of more than a dozen companies, IDA selected and interviewed eleven candidate companies. These companies are active as users and/or providers of services in the KBS and ERS areas. Table B-2 lists the companies interviewed with a description of their core business area of interest, an indication of whether the company acts as a user and/or a provider of these services; and a description of the DOD Portfolio Functional Domain discussed during the interview.

Table B-2. Commercial Firm Details

Company	Core Business (of Relevance to Project)	DOD Portfolio Group		Portfolio Functional Domain Discussed in Interview (Provider (P), User (U))
		ERS	KBS	
AAR Corp	Aviation Maintenance, Repair, and Overhaul (MRO)	Provider	Provider	MRO Services (P); Engineering and Technical Services(P)
American Roll-On Roll-Off Carrier (ARC)	U.S. Flagged Roll-on Roll-off Transportation Services	User	User and Provider	Ship Repair Services (U); Shipping Management Services (U); Other KBS (P)
Atlas Air	Air Cargo Transportation	User	User	MRO Services (U); Engineering and Technical Services (U)
Delta (TechOps)	Aviation MRO	User and Provider	User and Provider	MRO Services (P/U); Engineering and Technical Services (P/U); Education and Training Services (U)
Honeywell	Technology and Manufacturing for Aviation/Aerospace Systems and Engineering Services	Provider	User and Provider	MRO Services (P); Engineering and Technical Services (P); Program Management Services (P); Education and Training Services (P)
IBM (Global Services)	Data and Analytics for Predictive Maintenance Solutions		Provider	Engineering and Technical Services (P); Professional Support Services (P)
Landstar	Logistics Management and Operations (3PL) for Trucking and Rail	User	Provider	Engineering and Technical Support (P); Professional Support Services (P); Other ERS (U)
McDonald's	Distributed Food Retail	User	User	Other KBS (U); Other ERS (U)
Menlo	Supply Chain Management and Logistics (4PL)	User	User and Provider	Program Management Services (P); Other ERS (U)
U.S. Bank	Banking Services		User and Provider	Other KBS (P/U)
Walmart	Distributed Food and Merchandise Retail		User	Other KBS (U)

An additional mapping was performed for the companies interviewed; to demonstrate each company's relevance to a significant ERS/KBS spending category, companies were matched to individual category descriptions. This mapping is shown in Table B-3 and Table B-4.

Table B-3. ERS Mapping of Companies Interviewed

ERS Category Description	FY14 Spending ($B)	Companies Interviewed
Maintenance/Repair/Rebuild – Aircraft and Airframe Structural Components	4.98	AAR, Atlas Air, Delta
Non-Nuclear Ship Repair	2.93	ARC
Maintenance/Repair/Rebuild – Aircraft Components and Accessories	1.94	AAR, Atlas Air, Delta, Honeywell
Maintenance/Repair/Rebuild – Training Aids and Devices	1.34	N/A
Maintenance/Repair/Rebuild – Engines, Turbines, and Components	0.84	AAR, Atlas Air, Delta, Honeywell
Other ERS (and Logistics)	N/A	Landstar, McDonald's, Menlo

Table B-4. KBS Mapping of Companies Interviewed

KBS Category Description	FY14 Spending ($B)	Companies Interviewed
Engineering and Technical Services, Professional Support	12.10	AAR, ARC, Atlas Air, Delta, Honeywell, IBM, Landstar, Menlo
Program Management Services, Other Professional Support	6.55	ARC, Honeywell, Menlo
Program Management Services, Program Management Support	3.14	AAR
Program Management Services, Other Management	1.25	ARC
Education and Training, Other Education and Training	0.79	Delta, Honeywell
Other KBS	N/A	McDonald's, U.S. Bank, Walmart

These companies offered significant insights into their internal practices for acquiring services, as elicited during a series of interviews. During the course of these interviews, a variety of topics were discussed, including the review and validation of requirements for services, tracking of expenditures, implementation of performance metrics, and organizational operating models governing services acquisition. Each company representative was provided a list of interview questions in advance; the questions are displayed in Table B-5.

These questions were the launch point for more detailed discussions during the course of the interview. In most cases, interviews averaged one to two hours. Detailed notes were recorded and shared with interviewees following the interviews to provide an opportunity for corrections, adjustments, and further elaboration. Interview data were obtained on a not-for-attribution basis, and important findings were compiled across all interviews, preserving the anonymity of individual company inputs. Findings from the interviews are highlighted in Chapter 2.

Table B-5. Interview Questions

Questions for Users of Services	• Which important or costly services do you perform internally and which do you acquire? • For services that are acquired externally, which are purchased centrally, at the enterprise level, and which by business units or other sub-units? • For decentralized services contracting, how much autonomy do sub-units have on vendor selection and management? • How do those responsible for services contracting determine the best approach (fixed price, co-development, by usage, sole source, etc.)? • For a given contracting approach, what practices have been most effective in achieving quality improvement and/or cost savings, and what internal capabilities are needed to implement them? In particular, how do you incorporate agility and flexibility into your vendor relationships to cope with circumstances that were not or could not be anticipated in the original contracting approach?
Questions for Vendors of Services	• When do organizations approach you to provide services, and why? • In what situations are you positioned to provide greatest value to your clients? • What kinds of contracting relationships are most appropriate for different situations? • How do you engage in partnerships and long-term relationships with key customers? How do you incorporate agility and flexibility into your client relationships to cope with circumstances that were not or could not be anticipated in the original contracting approach? • What client engagement/ internal capabilities are required to make best use of your services? Who are some “best in class” clients for your services? • How do you deal efficiently with clients’ implementation standards and reporting requirements?

Appendix C
Suggestions for DOD from Firms Interviewed

In the course of the project, the eleven commercial firms interviewed offered focused suggestions on how DOD might improve services contracting. These suggestions appear in Table C-1, mapped to the strategic outcome (or outcomes) that best relates to the suggested action. The inputs in the far left column come directly from the commercial interviews. The strategic outcome inputs have been included by the project team, but are not intended as an endorsement of the suggested actions below. DOD must evaluate the merits and applicability of each action to meet its own requirements and priorities; the entries provided bear review and attention as DOD continues to build communication and enhance relationships with commercial industry.

Table C-1. Commercial Concerns/Suggestions for DOD

Commercial Concerns/Suggestions for DOD	Strategic Outcomes			
	Enhance Competi-tiveness	Reduce Cost	Adjust Rapidly	Relation-ships
Increase consideration of overall value (vs. lowest cost) for service contracts; readiness is important.		■	■	
DOD lacks rigorous, efficient decision process to determine whether to outsource	■		■	
Government internal processes often impede open dialogue with potential contractors; government contracts lack the flexibility/agility of commercial counterparts.	■	■	■	■
DOD needs to explore better risk-sharing in pay-for-performance contracts vs. transfer of risk.		■		■
Revisit DOD depot “50-50 rule” for commercial-derivative aircraft, to access cheaper, more efficient MROs		■	■	
Cutting out the prime contractor middleman in DOD MRO contracts would reduce cost.		■	■	
DOD should purchase refurbished/overhauled aircraft parts, to improve both cost and readiness reasons.	■	■	■	
DOD should let aircraft/environment drive maintenance schedules rather than rely only on the OEM manual.		■	■	
Consolidating parts by aircraft type (to serve more than one DOD customer) would reduce overall DOD costs.		■		
MROs can provide DOD complete fleet support (e.g., reliability, troubleshooting and engineering services).			■	■
More standardized work means more aggressive pricing, resulting in increased customer value.		■	■	
Government requirements/processes impacting MRO turnaround time and cost should be reviewed.[a]		■	■	
DOD should explore other areas to use electronic payment system to improve agility and reduce costs.		■	■	
DOD could better leverage data and predictive analytics to reduce cost and optimize readiness.		■	■	
Regulations governing bidding and contracting inhibit beneficial data/intellectual property (IP) sharing for predictive maintenance.	■		■	
DOD’s use of long-term, Firm-Fixed Price contracts for irregular route truckload services negatively impacts both pricing and available capacity.		■	■	

[a] For example, DOD aircraft sit in MRO hangars longer than commercial aircraft for maintenance/repair because O&A quotes take a long time to be approved.

Appendix D
Illustrations

Figures

Tables

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Appendix E
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Appendix F
Abbreviations

aaS	as a Service
APU	Auxiliary Power Unit
ASP	Application Service Provider
AT&L	Acquisition, Technology and Logistics
BBP	Better Buying Power
BP	Best Practice
CFR	Code of Federal Regulations
CRAF	Civil Reserve Air Fleet
DISA	Defense Information Systems Agency
DOD	Department of Defense
DODI	Department of Defense Instruction
DPAP	Defense Procurement and Acquisition Policy
DPAP/SA	Defense Procurement and Acquisition Policy, Services Acquisition
ERP	Enterprise Resource Planning
ERS	Equipment-Related Services
FAA	Federal Aviation Administration
FFP	Firm Fixed-Price
FPDS	Federal Procurement Data System
FY	Fiscal Year
IaaS	Infrastructure as a Service
IDA	Institute for Defense Analyses
IP	Intellectual Property
IT	Information Technology
KBS	Knowledge-Based Services
KPI	Key Performance Indicator
LPTA	Lowest Price Technically Acceptable
MES	Manufacturing Execution Systems
MRO	Maintenance, Repair, and Overhaul
NIST	National Institute of Standards and Technology
O&A	Over and Above
OASIS	One Acquisition Solution for Integrated Services
OEM	Original Equipment Manufacturer
PaaS	Platforms as a Service

PLM	Product Lifecycle Management
PSC	Professional Services Council
RFP	Request for Proposal
ROI	Return on Investment
SaaS	Software as a Service
SCP	Smart Connected Product
SLA	Service-Level Agreement
SME	Subject Matter Expert
SOCOM	Special Operations Command
USD(AT&L)	Under Secretary of Defense for Acquisition, Technology and Logistics
USTRANSCOM	United States Transportation Command
XaaS	Anything as a Service

REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-0188

1. REPORT DATE (DD-MM-YYYY)	2. REPORT TYPE	3. DATES COVERED (From – To)
XX-08-2015	Final	

4. TITLE AND SUBTITLE	5a. CONTRACT NO.
Commercial Best Practices in Contracting for Knowledge-Based and Equipment-Related Services	HQ0034-14-D-0001
	5b. GRANT NO.
	5c. PROGRAM ELEMENT NO(S).

6. AUTHOR(S)	5d. PROJECT NO.
Kelly, Julie C. Earle, Caroline R. Lippitz, Michael J. Shapiro, Brandon A. Van Atta, Richard H.	AR-6-3801
	5e. TASK NO.
	5f. WORK UNIT NO.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NO.
Institute for Defense Analyses Strategy, Forces and Resources Division 4850 Mark Center Drive Alexandria, VA 22311-1882	IDA Paper P-5257 Log: H 15-000450

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR'S / MONITOR'S ACRONYM(S)
Mr. Kenneth Brennan, Deputy Director Defense Procurement and Acquisition Policy/Services Acquisition, Office of the Undersecretary of Defense (AT&L), Rm 3C958, 3060 Defense Pentagon WDC 20301-3060	DPAP/SA
	11. SPONSOR'S / MONITOR'S REPORT NO(S).

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The Office of Defense Procurement and Acquisition Policy, Services Acquisition asked the Institute for Defense Analyses (IDA) to evaluate private sector service contracting practices in the areas of Knowledge-Based Services (KBS) and Equipment-Related Services (ERS). IDA performed a literature review and interviewed commercial companies. The literature review highlighted key factors in a company's decisions about outsourcing KBS or ERS: closeness to core competencies and competitive advantages; capability; capacity; and cost, including both production and transaction costs. These key factors map to three strategic outcomes that drive decisions to use external service providers: enhancing competitiveness, reducing costs, and adjusting to rapid change. A key notion from the literature is the centrality of the definition and assessment of core competencies to decisions regarding whether to perform a service internally or outsource. In general, companies maintain core competencies in-house, as they are often the foundation of their competitive advantage. However, IDA's research revealed circumstances where companies engage with external vendors in areas close to their core. Our findings on commercial best practices are organized in terms of the three strategic outcomes and detailed in the paper.

15. SUBJECT TERMS

services contracting, Knowledge-Based Services, Equipment-Related Services, core competencies, interviews, commercial best practices, acquisition, as-a-service

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NO. OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Kenneth Brennan
U	U	U	Same as Report	84	19b. TELEPHONE NUMBER (Include Area Code) 703-695-4235

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