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ACQUISITION RESEARCH PROGRAM SPONSORED REPORT SERIES

An Analysis of Category Management of Service Contracts

December 2017

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Capt Corey M. Arruda, USAF

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ABSTRACT

In an increasingly budget-constrained environment, the Department of Defense (DOD) must maximize the value of fiscal resources obligated to service contracts. According to the Government Accountability Office report "Strategic Sourcing" published in 2013, over half of procurement spending between 2008 and 2013 was obligated to service contracts. Therefore, this research focused on identifying rate, process, and demand savings for common recurring DOD service requirements. We developed a methodology to standardize analysis of service requirements to identify relevant cost drivers. Furthermore, a clustering continuum was created to organize services based on proximity between the customer-supplier base. Utilizing commercial business mapping software, we analyzed the cost driver data, produced visualizations, and illustrated strategic opportunities for Category Management initiatives. Requirements for Integrated Solid Waste Management (ISWM) within the Los Angeles area were evaluated using the software and methodology to demonstrate a model for practical application. This research resulted in two findings: rate and demand savings were inconclusive but suggested opportunities do exist, and significant opportunities for process savings exist across the DOD. Further research is needed to quantify rate and demand savings and identify other opportunities to achieve efficiencies through Category Management of service requirements. We also recommend that future research focus on proximity-independent services.

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LIST OF ACRONYMS AND ABBREVIATIONS

AF	Air Force
AFCEC	Air Force Civil Engineer Center
AFICA	Air Force Installation Contracting Agency
BICC	Business Intelligence Competency Cell
BMO	Building Maintenance and Operations
BRAC	Base Realignment and Closure
CIR	Category Intelligence Report
CE	Civil Engineering
CONUS	Continental United States
DAU	Defense Acquisition University
DOD	Department of Defense
FAR	Federal Acquisition Regulation
FPDS-NG	Federal Procurement Data System–Next Generation
FY	Fiscal Year
GAO	Government Accountability Office
GIS	Geographic Information Software
GSA	General Service Administration
ISWM	Integrated Solid Waste Management
NPS	Naval Postgraduate School
OMB	Office of Management and Budget
PWS	Performance Work Statement
PSC	Product Service Codes
SBA	Small Business Act
SCA	Service Contract Act
SSLC	Strategic Sourcing Leadership Council

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I. INTRODUCTION

A. PROJECT OBJECTIVE

This project develops a methodology to cluster Department of Defense (DOD) installations for implementing Category Management of service contracts. A service contract is defined in the Federal Acquisition Regulation (FAR) as “a contract that directly engages the time and effort of a contractor whose primary purpose is to perform an identifiable task rather than to furnish an end item of supply” (FAR 37.101). Our model targets Army, Navy, Air Force, and Marine Corps entities that require activities within the Continental United States (CONUS) and are engaged in contracting for common, recurring service requirements. For example, Integrated Solid Waste Management (ISWM), which is essentially garbage collection, is a recurring service that is typically acquired by most CONUS DOD installations and consists of identifiable tasks that are similar in scope.

While we are aware that developing a DOD enterprise-wide model may be perceived as a formidable task, we intend to establish a versatile clustering method that can be adapted for other service contract requirements. Clustering, a strategic grouping of DOD installations that acquire like services, allows the DOD to optimize its portfolio of services by identifying the best group of installations for Category Management initiatives. Implementing these initiatives at the most appropriately clustered locations promotes a best practice of effective service acquisition that yields the greatest rate, process, and demand savings achievable for a given service.

B. BACKGROUND

U.S. economic spending has dramatically evolved over recent decades as the country has moved from a goods-consuming society to a service-consuming society. This cultural movement has led to a substantial increase in the demand for services over tangible goods (see Figure 1). In 1968, economist Victor R. Fuchs published findings that more than half of the employed population in the United States was working in the services sector and thus was “not involved in the production of food, clothing, houses, automobiles, or other tangible goods” (Church, 2014). The U.S. economy, he argued, had become a “service economy” (Church, 2014).

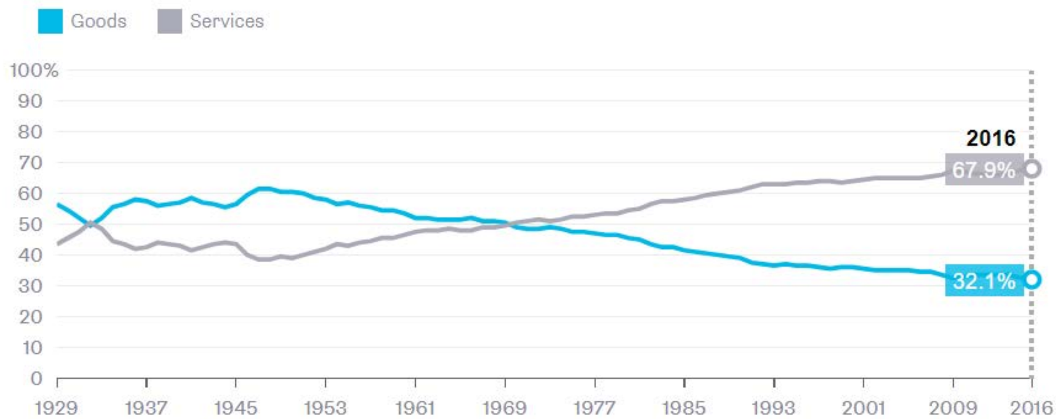

Figure 1. U.S. Spending as a Percentage of Total Personal Consumption: Services and Goods. Source: U.S. Bureau of Economic Analysis (n.d.).

Nearly 50 years later, Fuchs's analysis stands the test of time, as services continue to contribute to a significant portion of consumer spending. In early Fiscal Year (FY) 2017, U.S. citizens consumed nearly $9 trillion in services, up nearly $2.5 trillion from FY 2007 (see Figure 2). In comparison, spending on goods increased approximately $1 trillion, to a total of $4.2 trillion for FY 2017. This recent data suggests that the trend in U.S. consumer spending on services will remain the same, or more than likely, will increase in the foreseeable future.

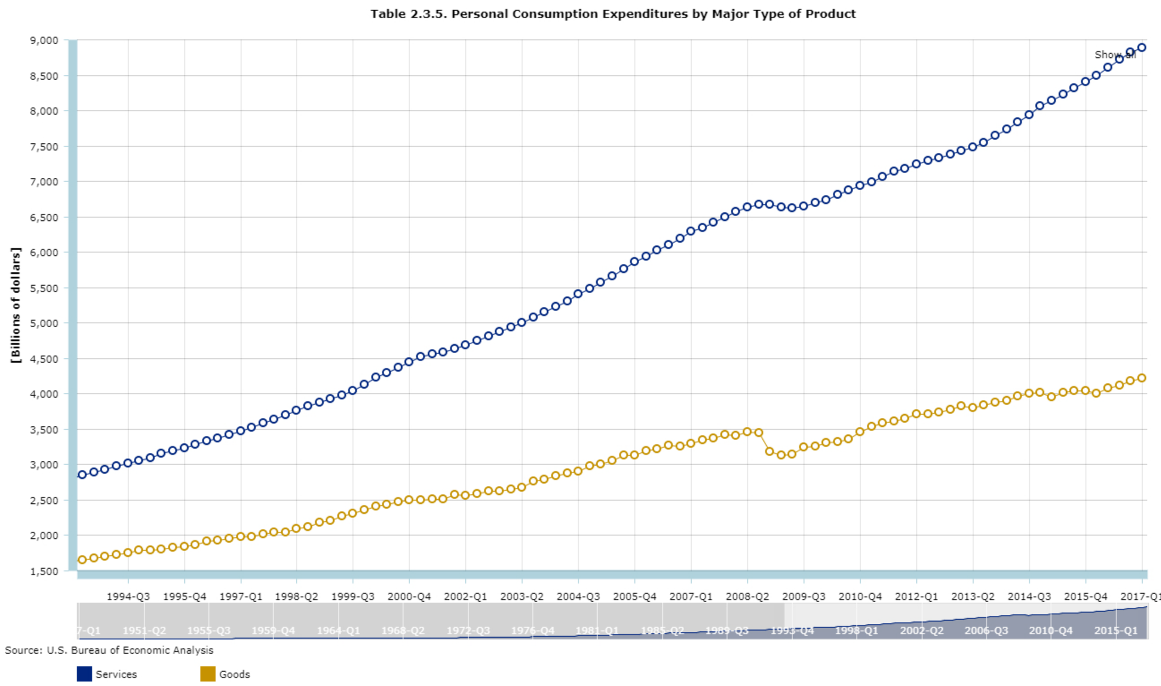

Figure 2. U.S. Consumer Expenditures through FY 2017. Source: U.S. Bureau of Economic Analysis (n.d.).

DOD procurement has mirrored consumer spending behavior; agencies have reported that a notable portion of requirements are increasingly service-based. A research article published by the Naval Postgraduate School, reported service acquisition spending significantly increased to a staggering $200 billion between FY 2000 and FY 2008 (Apte, Apte, & Rendon, 2011, p. 540). Additionally, in February 2017, the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (OUSD[AT&L]) reported to congressional committees that the DOD had obligated over $149 billion to service-related defense contracts in FY 2016 (see Figure 3). Accounting for over half of defense spending, service-related contracts deliver an exhaustive list of critical defense-sustaining capabilities, such as maintaining installations, information technology (IT) security services, and medical services. The DOD has consistently spent more than three times the fiscal resources on services than on supplies and equipment (S&E), such as investments in aircraft, ships, submarines, and land vehicles (Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics [OUSD[AT&L]], 2017).

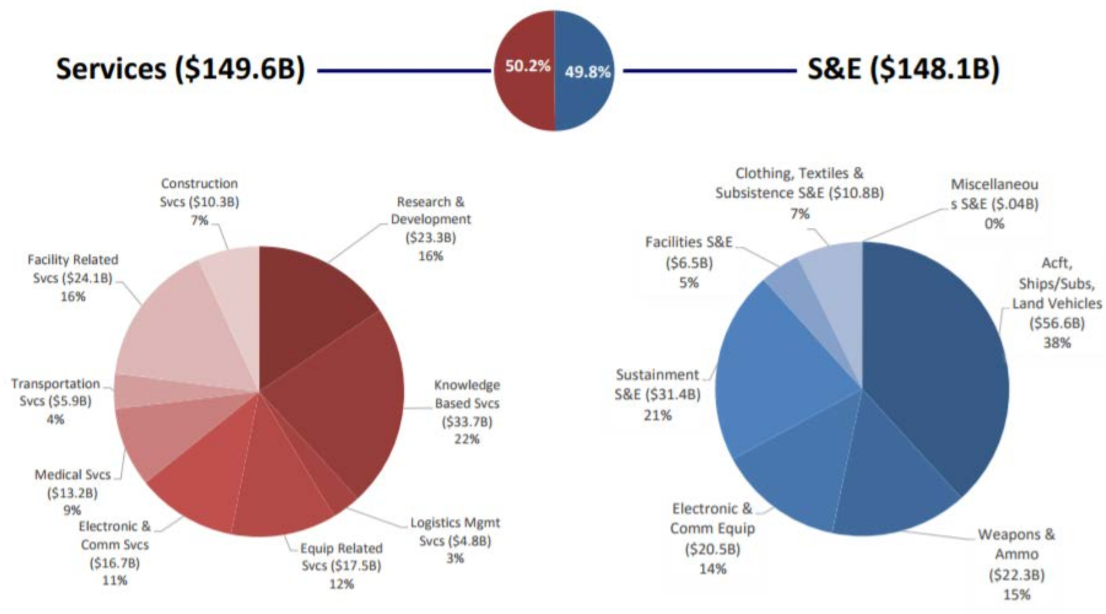

Figure 3. FY 2016 Spend—DOD as Contracting Department.
Source: OUSD[AT&L] (2017).

Historically, the DOD has struggled with the acquisition of services due to the inherently complex nature of services, relative to the seemingly straightforward procurement of commodities. This complexity, paired with the growing portfolio of services, has gained the attention of multiple government watchdog agencies, including the Government Accountability Office (GAO). In 2017, the GAO released its biannual high-risk report to Congress, which "identifies government operations with greater vulnerabilities to fraud, waste, abuse, and mismanagement or the need for transformation to address economy, efficiency, or effectiveness challenges" (Government Accountability Office [GAO], 2017, p. 2). In the report, the GAO noted that "Improving DOD's Acquisition of Services" is a recurring high-risk category that should be addressed immediately by DOD officials.

> While DOD continues to take action to improve how it manages services acquisitions, demonstrated progress was more limited. In January 2016, DOD issued a new instruction for service acquisitions that provides a management structure for acquiring services and identifies the roles and responsibilities of key leadership positions, but DOD still lacks an action plan that will enable it to assess progress toward achieving its goals, and efforts to identify goals and associated metrics are still in the early stages of development. (GAO, 2017, p. 491)

Numerous initiatives, such as Better Buying Power, have emerged to educate DOD stakeholders on best practices to improve tradecraft in services. These initiatives have inspired grassroots efforts that have led to a few attempts at enterprise-sourced, cost-saving solutions. For example, the General Service Administration's (GSA's) Building Maintenance & Operations (BMO) service contracts are an attempt at a regional-based, enterprise-sourced contract solution.

To promote strategic cost saving initiatives in the acquisition of services, the Air Force Installation Contracting Agency (AFICA) Business Intelligence Competency Cell (BICC) requested assistance to identify a methodology that optimally groups DOD installations for enterprise-sourced solutions. This project is the result of that request.

C. SCOPE

For the purposes of this research, we develop a methodology to cluster installations strategically based on relevant cost drivers of a specific service. We perceive recurring, common DOD service-related requirements to yield the greatest opportunity for implementing strategic solutions to achieve rate, process, and demand savings. Specifically, proximity-dependent requirements—that is, services that require a supplier to maintain a physical presence near the place of performance—interest us because we perceive these requirements to be a stepping-stone to achieving savings for more complex, proximity-independent services in the future. Details regarding the selection of proximity-dependent and proximity-independent services are outlined in Chapter III, Methodology.

D. RESEARCH QUESTION

In this research, we develop a methodology to cluster DOD installations optimally based on relevant cost drivers of a specific service-related requirement to achieve rate, process, and demand savings. In doing so, we aim to answer the following research question: Are there potential cost savings (rate, process, demand) through strategically clustering common DOD service contracts?

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II. LITERATURE REVIEW

This research explores the potential to generate rate, process, and demand savings through strategically clustering common, recurring DOD service contracts. This literature review focuses on (1) the evolution of Category Management in the private sector and (2) the application of Category Management in the public sector.

A. CATEGORY MANAGEMENT IN THE PRIVATE SECTOR

As outlined in a 2017 presentation by Karen Landale at the Naval Postgraduate School (NPS), Monterey, CA, it is critical to understand Category Management and its origins in the private sector in order to implement it successfully within the public sector, specifically, within the DOD. Landale summarized that Category Management has evolved through several iterations throughout its history. Its original form was Strategic Purchasing, in which an attempt was made to achieve savings by aggregating purchases of similar requirements. The next form was Strategic Sourcing, which achieved rate and process reductions, but was still mostly focused on acquisition solutions, in addition to aggregating purchases like in Strategic Purchasing. Finally, Category Management added an additional layer of analysis to the concepts included in Strategic Sourcing by looking at "near peer" organizations of similar size to identify industry best practices and opportunities for demand savings. Landale concluded that Category Management is a functionally-led (i.e., end-user led) process, whereas Strategic Purchasing and Strategic Sourcing tend to be acquisition-led processes (K. Landale, personal communication, April 4, 2017).

Historically, many organizations viewed their purchasing function as an operational entity responsible solely for handling routine transactions. Peter Kraljic (1983) asserted that organizations' top management must change this viewpoint and recognize the strategic value of their purchasing function. His philosophy was based on the practice of Strategic Purchasing. Kraljic asserted,

> A company's need for a supply strategy depends on two factors: (1) the strategic importance of purchasing in terms of the value added by product line, the percentage of raw materials in total costs and their impact on profitability, and so on; and (2) the complexity of the supply market gauged by supply scarcity, pace of technology and/or materials substitution, entry

barriers, logistics cost or complexity, and monopoly or oligopoly conditions. (Kraljic, 1983, p. 110)

He used these two factors of importance or impact (*y*-axis) and complexity of market or supply risk (*x*-axis) to create a matrix to categorize an organization's purchases (see Figure 4).

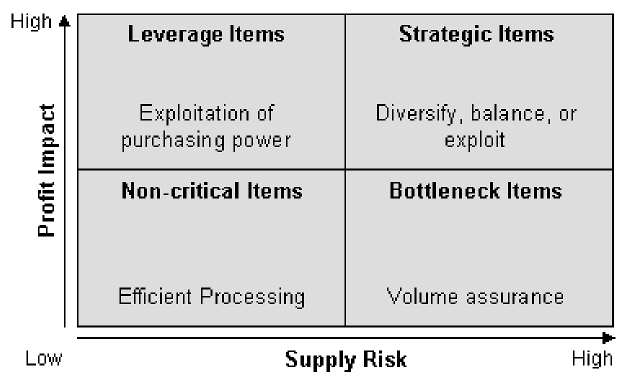

Figure 4. Kraljic Portfolio Matrix (KPM). Source: Holt (2017).

The matrix categorized supply items in Non-Critical, Bottleneck, Leverage, and Strategic quadrants. The Leverage quadrant is the most relevant to this study because it is composed of items that have a high importance to the organization and minimal supply risk. High importance to the organization and minimal supply risk are characteristics that describe most of the common, recurring DOD service requirements. Kraljic (1983) claimed:

> On items where the company plays a dominant market role and suppliers' strength is rated medium or low, a reasonably aggressive strategy ("exploit") is indicated. Because the supply risk is slight, the company has a better chance of achieving a positive profit contribution through favorable pricing and contract agreements. (pp. 113–114)

This statement suggests that supply items in the Leverage quadrant of the Kraljic Matrix provide the best opportunity to aggregate purchases by clustering common, recurring service requirements to "exploit" the enormous purchasing power of the DOD over its many, less powerful suppliers and achieve savings.

Kraljic's view that the purchasing function of an organization has strategic value was reinforced by a study performed by Carter and Narasimhan (1996). The researchers surveyed purchasing experts from industry, and the results revealed seven strategic factors that firms should focus on to improve their purchasing departments. The authors used the survey responses in a multivariate regression analysis to determine which key factors had the most significant correlation with a firm's performance. They found that the strategic importance that the firms placed on the purchasing department was the most highly correlated factor in predicting the firm's performance. Carter and Narasimhan's (1996) research provided the first data-supported evidence for elevating the importance of the purchasing function. One unexpected result of their research was the finding that as purchasing decisions became more decentralized, the firm's performance actually declined. They did not expect this result because employee empowerment usually boosts performance (Carter & Narasimhan, 1996). However, decentralization limits the firm's ability to create and enforce enterprise-level solutions, which would naturally have a deleterious effect on financial performance (K. Landale, personal communication, April 4, 2017).

To develop and implement supply management strategies as large as Category Management, an organization must have the proper governance structure in place, starting at the top (or strategic) level. Strategic purchasing decisions and policy-making needs to be centralized in order to leverage organizational buying power. While there is a need for centralized control, the goal is to simplify decentralized execution for lower level units to leverage strategic vehicles versus writing their own contracts. In an article written in 2005, David L. Reese and Douglas W. Pohlman (2005) stated that

> [T]oday's commercial procurement community is leaning heavily toward the organizational concept of centralized procurement. Although the large and medium corporations around the globe that are centralizing their purchasing efforts use several different organizational constructs, the overarching objective is typically the same. To the maximum extent possible, the entire organization should be corporately leveraging its purchasing volume and customer and supplier relationships through strategic planning and execution. Indeed, companies that are striving to ensure supply of critical goods and services are finding a decentralized strategy that promotes fragmented processes is fundamentally detrimental to their goal. (p. 6)

The private sector has practiced some level of Strategic Purchasing since the early 1980s (Kraljic, 1983). The private sector transitioned in the early 2000s to Strategic Sourcing, which would later evolve into Category Management (Reese & Pohlman, 2005).

B. CATEGORY MANAGEMENT IN THE PUBLIC SECTOR

In 2005, the Office of Management and Budget (OMB), via memorandum, officially charged all federal government agencies to begin implementing Strategic Sourcing (Johnson, 2005). The OMB issued additional guidance in 2012, establishing the Strategic Sourcing Leadership Council (SSLC) and placing additional responsibilities upon the GSA for helping to implement federal-wide strategic sourcing (Zients, 2012).

The most recent guidance, issued by the OMB in 2014, declared that Category Management was common in industry practice and would be the future approach to the federal government's acquisitions of goods and services (OMB, 2015). Category Management is a concept in which the spend associated with commonly purchased goods and services is managed by cognizant Category Managers. Category Managers are charged with managing enterprise-level spend in a way that aligns to the way industry produces and delivers the goods and services that fall into their category, in order to achieve rate, process, and demand savings. The 2014 memo appointed the GSA as the lead organization for implementing Government-Wide Category Management (Rung, 2014).

Finally, in 2015, the OMB published the *Government-Wide Category Management Guidance Document*, which provided agencies with direction for successful implementation of Category Management and established procedures for Category Management operations. For example, ISWM is a service that falls under Facility Related Services, which falls under Facilities and Construction in the Category Management hierarchy. See Figure 5 for a more detailed view of the Level I and Level II categories created by the OMB.

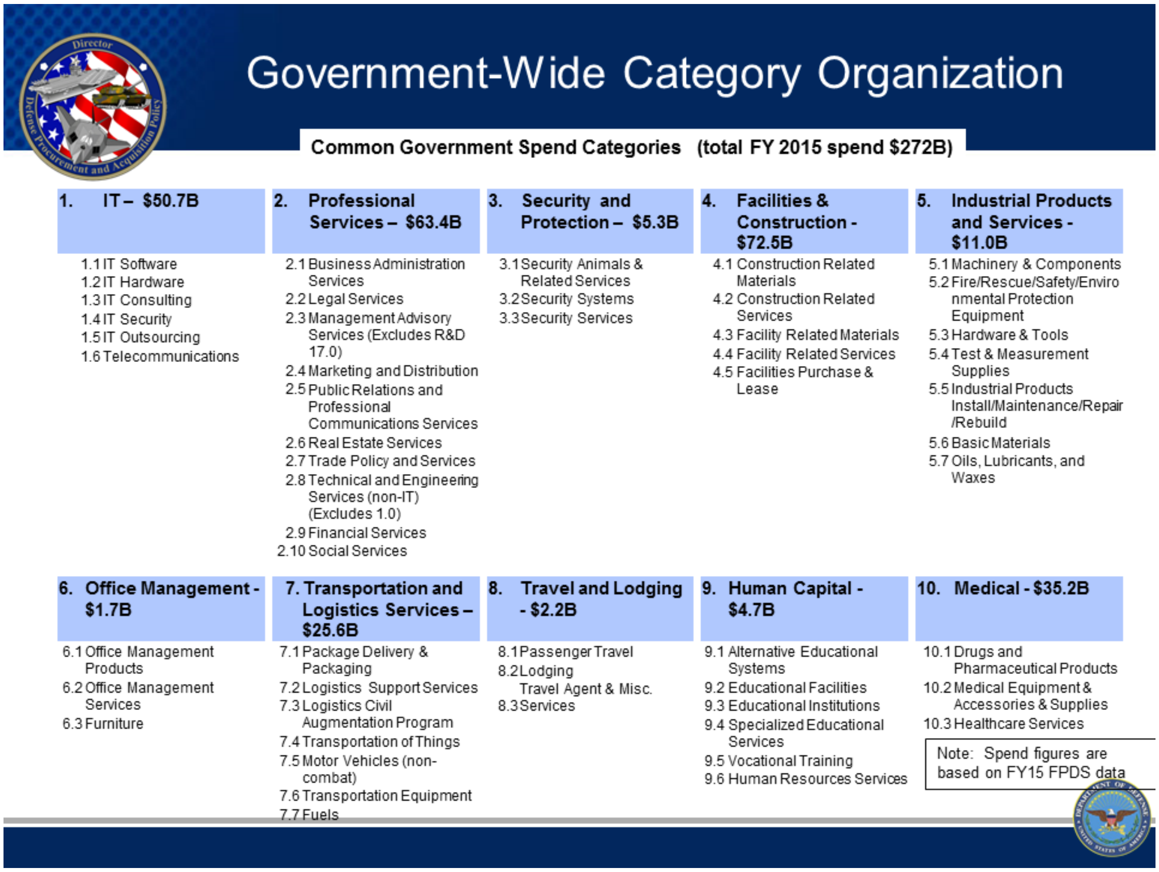

Figure 5. Government-Wide Category Organization. Source: Defense Procurement and Acquisition Policy (n.d.).

Over the past decade, federal agencies emphasized following the OMB’s lead through various Strategic Sourcing and Category Management initiatives. Acquisition professionals are the stewards of U.S. taxpayers’ dollars and must make every effort to maximize the value generated by every dollar spent. To uphold this duty, the U.S. federal government, the DOD, and the Air Force (AF) started several initiatives, policy reforms, and governance structure reforms to meet strategic sourcing, as well as category management, goals.

In 2013, the GAO issued a report that critiqued many Strategic Sourcing initiatives and provided examples of commercial best practices in acquisition. For example, many companies conduct spend analyses to understand their supply chain portfolios.

> This approach included identifying the number of suppliers, the number of contracts, and the prices paid across the company to identify inefficiencies, such as paying different rates for similar services and suppliers, or not consolidating purchases across the company to lower prices. Armed with this

> knowledge, companies were able to leverage their buying power, reduce costs, and better manage their suppliers. (GAO, 2013, p. 2)

These spend analyses translate into actionable data for executives to implement streamlined strategic sourcing initiatives which further promotes goals within category management. "As a result, companies made structural changes with top leadership support, such as establishing commodity managers—responsible for purchasing services within a category—and were better able to leverage their buying power to achieve substantial savings" (GAO, 2013, p. 6). In short, these companies implemented Kraljic's "exploit" strategy for "leverage" items.

The GAO (2013) made the following observations and recommendations to overcome key challenges and improve (at the time) Strategic Sourcing efforts:

> 1. Agency officials noted that they have been reluctant to strategically source services (as opposed to goods) for a variety of reasons, such as difficulty in standardizing requirements or a decision to focus on less complex commodities that can demonstrate success.
> 2. For less complex services, such as housekeeping and telecommunications, agencies could consolidate purchases to leverage buying power. Standardizing requirements could also help drive down costs.
> 3. For complex services, such as professional services, … agencies could apply company tactics to understand cost drivers and prequalify suppliers. (GAO, 2013, pp. 19–20, 25)

A study conducted by NPS developed an optimization model that selected proposals from prospective contractors for service requirements (Apte, Rendon, & Salmeron, 2011, p. 222). The optimization model achieves the most advantageous balance between price and past performance to identify the best value proposal (Apte et al., 2011, p. 222). Additionally, the AF partnered with the NPS and created a prioritization model of all product service codes (PSCs) that were commonly purchased in the AF in 2015. This model applied some of the best practices associated with spend analysis identified by the 2013 GAO report. The prioritization model weighted several key performance indicators to generate an overall PSC score. PSCs were ranked from highest to lowest, with the highest scores representing the optimal PSCs for Category Management initiatives because they offered the greatest potential to generate rate, process, and demand savings. A separate but concurrent study performed by an Air Force Institute of Technology (AFIT) student, Captain Robert Montgomery, plotted the optimal PSCs identified by the NPS students on the Kraljic Matrix;

nearly all of them fell within the leverage quadrant, which validated the NPS students' model and provided data-driven evidence of the PSCs that were optimal for an "exploit" strategy.

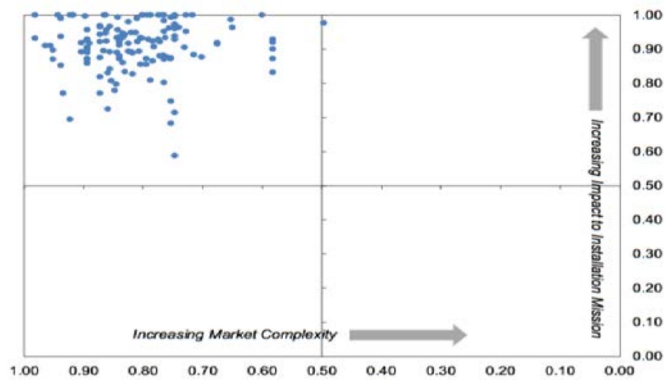

Figure 6. Analysis of Prioritized PSCs. Source: Holt (2017).

Finally, a study in 2017 from the NPS identified that "service-related variable[s], number of containers, significantly affects price; and that two contracting-related variables, one type of small business set-aside and the number of offers received, also significantly affect price" (Landale, Apte, & Rendon, 2017). This is relevant to Category Management because the acquisition team is charged with achieving public policy goals while obtaining a fair and reasonable price.

The DOD has historically taken an employee empowerment approach to common, installation-level, recurring service requirements by allowing every organization to execute their own service acquisitions, using their own acquisition strategies. The DAU published an article on tail spend management in 2017, arguing that significant opportunities for savings exist in decentralized purchases within the DOD valued below $10 million because less attention is focused on managing these acquisitions. The article described tail spending using the following characteristics:

> First, tail spending consists of low-dollar value, repeat acquisitions—typically procurements with a surprisingly large number of transactions. Second, tail spending includes acquisitions made outside of procurement norms that are rampant in noncompliance. These acquisitions also are known as maverick spending. Third, tail spending consists of fragmented acquisitions—typically repeat procurements in various parts of an organization. Generally, these types of procurements could be consolidated into a single acquisition within an organization's core spending. (Smith, 2017)

The concept of decentralized buying and empowering each DOD installation to purchase its own services promotes fragmented buying practices and a lack of visibility of total spending. In short, installation-level service procurements are "tail spending." Category Management and Kraljic's methodology of leveraging purchasing power for these types of service requirements provide a solution to the problems associated with controlling (i.e., better managing) tail spending.

The purpose of this study is to focus on the observations and recommendations made by the GAO in 2013, namely that agencies are reluctant to strategically source services and that opportunities to achieve savings in service requirements exist, even when the complexity of the service varies. To do this, we first identified all DOD installations that are engaged in contracting for common, recurring service requirements. Second, we analyzed existing market intelligence on several common DOD service requirements to identify an optimal service to demonstrate the potential opportunities associated with clustering DOD installations. Finally, we created a model using ISWM as an example service to demonstrate the concept of clustering to achieve Category Management goals. This process is described in more detail in Chapter III, Methodology.

III. METHODOLOGY

A. INTRODUCTION

Requirements analysis is at the heart of nearly all Category Management endeavors; however, traditional methods for carrying out a meaningful analysis of service requirements are primitive. This capability gap provides a unique environment for state-of-the-art approaches to emerge that align with the government's interest in category teams proposing sound business process innovations. Particular to acquisition solutions, the FAR affords contracting officers flexibility to innovate by emphasizing loose interpretation of its guidelines, as evident in FAR 1.102-4:

> The FAR outlines procurement policies and procedures that are used by members of the Acquisition Team. If a policy or procedure, or a particular strategy or practice, is in the best interest of the Government and is not specifically addressed in the FAR, nor prohibited by law (statute or case law), Executive order or other regulation, Government members of the Team should not assume it is prohibited. Rather, absence of direction should be interpreted as permitting the Team to innovate and use sound business judgment that is otherwise consistent with law and within the limits of their authority. Contracting officers should take the lead in encouraging business process innovations and ensuring that business decisions are sound.

1. The Clustering Continuum

We sought to develop an elementary framework for how PSCs (referred to as *services* in this report) could be classified and organized to align with the Category Management framework. We believe the best way to organize the distinct complexities of services into a logical clustering system is to identify how a given service typically interacts with its supplier base. For example, it is reasonable to assume that for a service like ISWM, suppliers would be opposed to taking on long-haul regional or interstate ventures because of the high costs of fuel, dumping fees, and maintenance on their truck fleets. Suppliers looking for ISWM services typically favor a short-range business model, that is, the service has *proximity dependence* between its supplier base, the buyer, and the location at which the service is performed.

Conversely, we believe some services can also be classified as exhibiting characteristics of *proximity independence,* a polar opposite to proximity-dependent services.

Proximity-independent services are those groups of services that have limited adjacency to a supplier, buyer, and place of performance. For example, information technology (IT) services encompass a wide range of end products such as day-to-day protection of base network security, network troubleshooting, and over-the-air software updates; many of these services are conducted in remote, centralized locations throughout the United States. A few services that we have organized on the clustering continuum are shown in Figure 7. The continuum allows us to logically organize services to help determine appropriate cluster size, which is discussed later in the chapter.

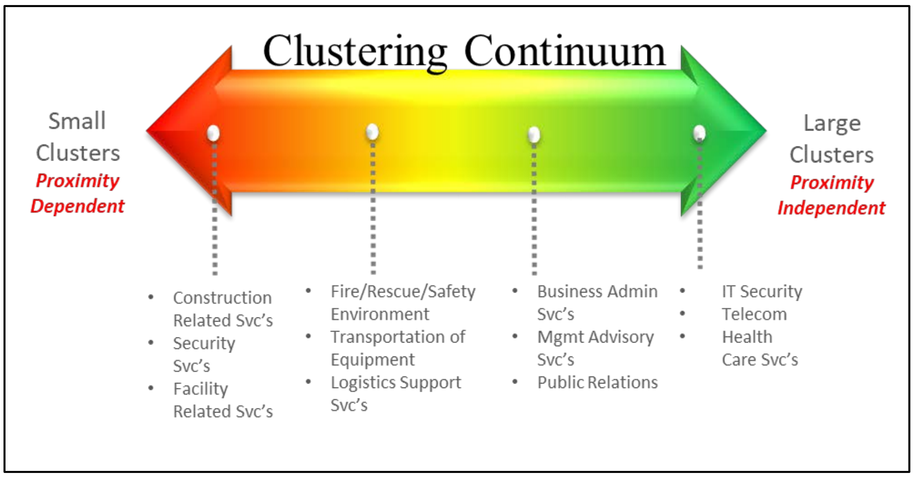

Figure 7. Clustering Continuum

2. Commercial Business Mapping Software

To facilitate the visual representation of clustering DOD installations and to employ the Category Management goal of mirroring commercial-sector best practices (or, as the case may be, developing new best-in-class practices), we explored numerous commercially available software options typically utilized for business analysis functions. One of the best contenders was the Maptitude Geographic Information Software (GIS). Maptitude GIS is robust, easy-to-use, professional business mapping software that businesses use for in-depth geographic analysis of demographic data to make data-driven decisions (Maptitude, n.d.). Maptitude provides an array of functions, such as data-integrated heat mapping, drive-time rings, geographic census data analysis, and territory creation; and it contains expandable functions to include other third-party software. We believe Maptitude is a promising suite of capabilities that would likely yield the greatest opportunities for scalable clustering analysis. We believe the capabilities of Maptitude are promising when compared to Microsoft Excel–based mathematical clustering because Maptitude provides greater information integration, including the ability to layer information (see Figure 8 for an illustration of the robust functions of Maptitude).

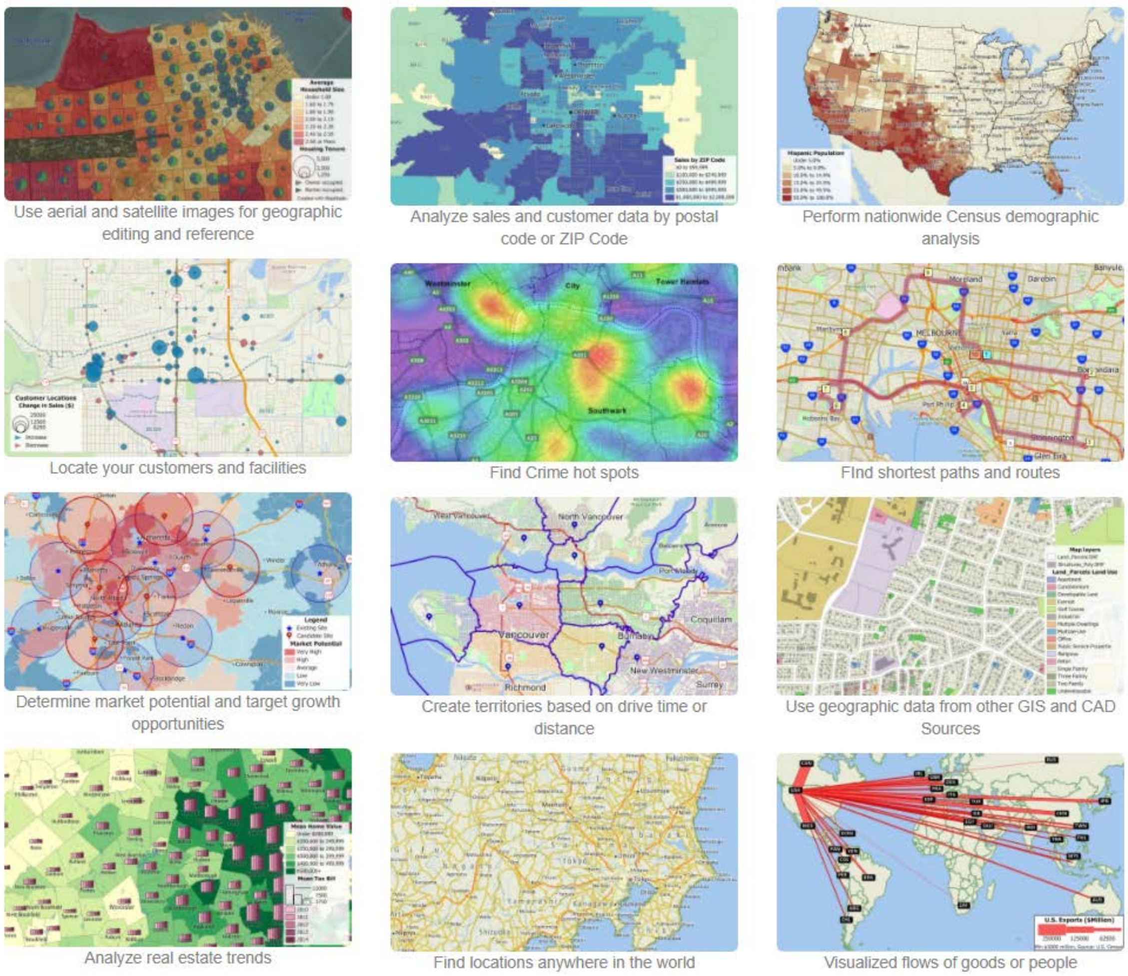

Figure 8. Maptitude Capabilities. Source: MPCluster (n.d.).

3. Integrating Installation Data

Prior to embarking on clustering analysis, we determined which requiring agencies would be involved in the procurement of services. Numerous DOD reorganizations over the past few decades, including multiple Base Realignments and Closures (BRAC), consolidated commands and assets, to include procurement units. We needed some way to decipher which areas within the United States are relevant to our analysis.

We were provided an opportunity to integrate data from the *DOD Base Structure Report* for FY 2015 (Department of Defense [DOD], 2015). This valuable report provides a snapshot of real property within the DOD, including an exhaustive list of installation specifics, such as building square footage, owned acreage, and personnel assigned. We saw opportunities for comprehensive future clustering analysis. To integrate the data, we converted the report into a readable database with Maptitude and incorporated each reported installation by pinning the location on a map. We also attached personnel assigned to each pinned location, which has benefits for the ISWM analysis (we discuss these benefits later).

4. MPCluster

MPCluster is a commercially available third-party, add-in software application that provides cluster analysis within the Maptitude GIS suite.

> MPCluster identifies groups or clusters in your Maptitude data, and then creates new layers drawing the clusters as boundary shapes and centroid points. MPCluster makes it possible to find clusters (natural groupings) in your Maptitude data. Although it is typically used with point layers, it can also be used with area layers (e.g., shaded area territories). Applications include market research, the determination of supply territories, and finding potential sales territories. (MPCluster, n.d.)

Incorporating MPCluster into our analysis was a simple solution to add depth to our analysis by considering potential parameters, such as minimum and maximum number of installations within a cluster, distance from a DOD installation within a cluster, and centroid weighting based on a certain factor, such as distance from a refuse collection station for ISWM requirements.

Employing the concepts of the clustering continuum within the Maptitude GIS suite with MPCluster software gives us the necessary toolset to develop a scalable methodology for clustering analysis for any service-related Category Management efforts. This advanced toolset offers an innovative approach that provides category management teams a way to make informed, data-driven decisions. Data-driven decisions derived from clustering not only align with Category Management strategies, but also correspond with the contracting officer's duty to "take the lead in encouraging business process innovations and ensuring that business decisions are sound" (FAR 1.102-4).

B. PROPOSED "ACF" MODEL

The challenges we encountered with our initial approach revealed that clustering based on distance alone does not account for all of the complexities of a given service requirement. Therefore, we developed the Arruda-Clark-Fuchs (ACF) methodology as an acknowledgement to Victor Fuchs. This method uses Category Management concepts, determining which installations should be clustered based on the market intelligence collected for the given service requirement. The methodology has four main steps:

1. Identify DOD requiring activities for a given service
2. Identify cost-driver market intelligence relevant to developing clusters
3. Integrate cost-driver market intelligence into commercial mapping software
4. Use cost-driver market intelligence to determine optimal cluster size.

To develop and demonstrate this methodology, we selected ISWM as a common, recurring DOD service requirement. ISWM provides a viable service for analysis because it is a service requirement that is common across all four branches of the DOD, and significant cost-driver data and market intelligence is available in the ISWM Category Intelligence Report (CIR; Brady et al., 2016). We narrowed the scope of our ISWM test case to the Southern California region for feasibility. We lacked the raw data required to import all landfill and transfer stations into Maptitude, but future research should find and include these data points in order to produce more robust clustering outcomes.

In Step 1, we identified DOD requiring activities for a given service requirement. After we identified all DOD requiring activities, we integrated them into the Maptitude software by geocoding all DOD installations contained in the 2015 *Base Structure Report* (DOD, 2015). Next, we determined which of those installations had a need for the example service requirement, ISWM. To validate which installations had an active requirement for ISWM, we collected spend data from Federal Procurement Data System–Next Generation (FPDS-NG) for all service contract awards from FY 2012–FY 2016. We used FY 2012–FY 2016 as our search parameters because the standard service contract length typically includes one base year plus four one-year option periods. We included the entire service contract spend data on the most recent five-year span to ensure that we captured all contract awards during that time period. We filtered that spend data down to contracts awarded under PSC S205 for "Trash/Garbage Collection Services" within the state of California to give us an accurate picture of which requiring activities had a valid ISWM requirement.

For Step 2, we identified cost-driver market intelligence relevant to developing clusters intended to target rate, process, and demand savings. AF CIRs are composed from extensive market research and provide significant insight into common, recurring DOD service requirements. The ISWM CIR highlighted the industry cost structure, cost drivers, and other factors that were of interest for clustering decisions. The cost structure of the ISWM industry is shown in the right-hand column in Figure 9, as compared to the overall service industry, shown on the left.

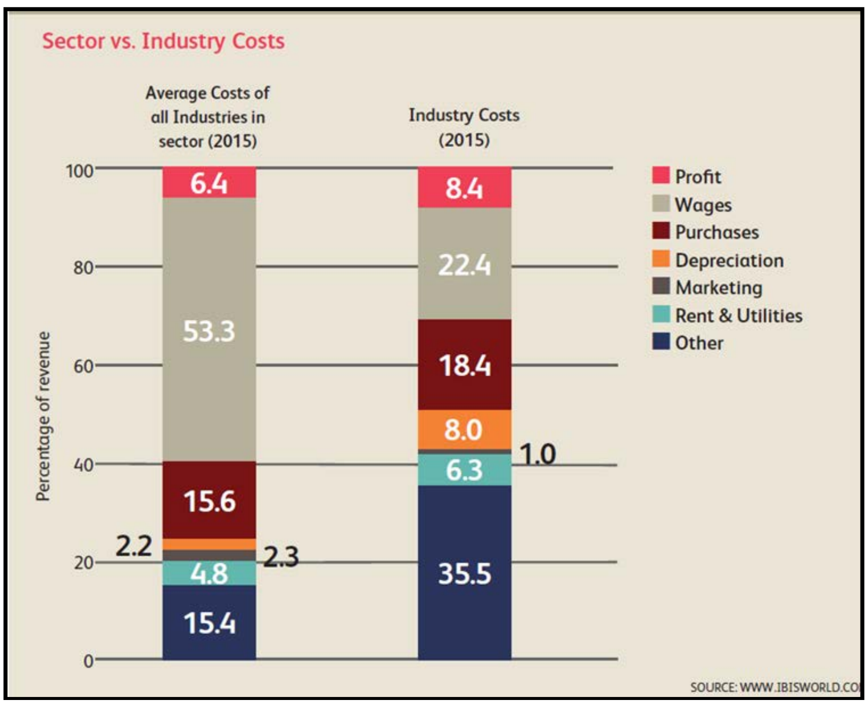

Figure 9. ISWM Cost Structure. Source: Brady et al. (2016, p. 32).

ISWM is less wage-driven, when compared to the overall service sector, because it is a capital-intensive service requirement, requiring significant investment in fixed assets, such as trucks, equipment, and dumpsters. The cost structure shows that 18.4% of the industry costs are attributed to purchases and an additional 8% to depreciation, as compared to 15.6%

and 2.3%, respectively, for the overall service sector (Brady et al., 2016, p. 32). Additionally, the garbage trucks employed during ISWM performance are not fuel-efficient. Fuel costs represented a significant amount of variable costs in the industry. Last, “other fees/expenses” are high in the industry because of the use of landfills and transfer stations, which charge fees based on usage. Fuel costs and “other fees/expenses” were referred to as “Other” in Figure 9 and represented 35.5% of the ISWM cost structure. “Other” costs were substantially higher for ISWM, whereas “Other” costs accounted for only 15.4% of costs in the overall service sector (Brady et al., 2016, p. 32).

Clustering DOD requiring activities based on cost drivers potentially drives efficiency in the utilization of fixed assets and generates savings related to fuel costs and “other fees/expenses.” Small, dense clusters would offer opportunities to utilize excess capacity of fixed assets for a proximity-dependent service such as ISWM. Additionally, these small cluster sizes would allow contractors to design optimal routes that minimize fuel expenses, as well as labor costs of employees sitting in traffic or taking unnecessarily long routes. Finally, a small cluster of bases could allow contractors to negotiate more favorable rates or fees for dumping waste at one landfill or transfer station that is centrally located among requiring activities, which could also subsequently minimize fuel expenses. This would be ideal, rather than the current fragmented nature of several contractors in close proximity negotiating varying rates with different landfill or transfer stations and different DOD bases for the same requirement.

Step 3 in the methodology is integration of cost drivers and market intelligence into the Maptitude software. Concerning ISWM, this step entailed mapping all of the landfill and transfer stations in close proximity to the DOD installations. Then we utilized a feature in Maptitude referred to as “drive time rings.” We dropped pins on the map around each grouping of installations and then applied the “drive time rings” feature. This feature produced three 25-minute drive time rings emanating from each pin, as shown in Figure 10. This allowed us to see how many DOD installations, landfills, and transfer stations were within a 75-minute radius of each pin.

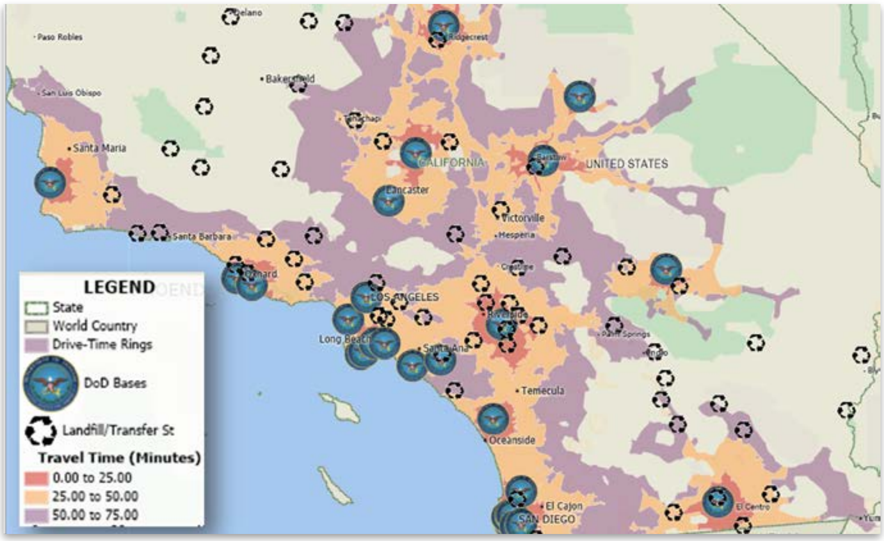

Figure 10. ISWM Drive Time Rings

Step 4 is to use cost-driver market intelligence to determine the optimal cluster size for the given service requirement. The inherently complex nature of contracting for services makes determination of the optimal cluster size challenging. This step in the methodology allows the flexibility that is required to develop an acquisition strategy that makes the most sense for the given service requirement. FAR 1.102-4(e) charges contracting officers with the responsibility to innovate, and Step 4 of this methodology allows them to do so. In particular, contracting officers should use outputs from Maptitude and MPCluster to make data-driven decisions for the optimal cluster size. These decisions may require them to adjust Maptitude and MPCluster outputs to account for factors like small business participation, competition, and other public policy goals. Under the new Category Management framework, the Category Management team should equip the contracting officer with adequate market intelligence to innovate, determine feasible cluster sizes, and parse through implementation challenges. Distance, travel time, or geographic features are some examples of factors that could determine cluster sizes. Distance and travel time were relevant for ISWM due to the proximity-dependent nature of the service, but also because of the specific cost drivers associated with ISWM. Category managers could achieve some of the savings discussed in Step 3 through clustering to create a bundled acquisition.

However, creating bundled acquisitions is not the only reason to consider clustering service requirements. Clustering could also have other applications, like demand management. For example, ISWM best practices could be applied through clustering, such as the use of weight sensors to trigger dumpster service, higher capacity dumpsters, or the use of kitchen waste dehydrators.

During Step 4, category teams should evaluate other considerations aside from cost drivers to determine clustering parameters. They should consider contracting and policy-related goals such as socioeconomic programs, the Competition in Contracting Act (CICA), and other statutes and executive orders in relation to the specific service requirement. We must assess the price premiums paid for utilization of small business set-asides. After this evaluation, category teams should establish clustering parameters such as the minimum and maximum number of installations per cluster, cluster size in terms of distance, and weight clusters using external data imported into Maptitude. MPCluster should be used to generate the optimal clusters once the clustering parameters have been established.

Utilizing Maptitude along with the principles of the ACF model, we are able to better analyze services along the clustering continuum. This methodology targets cost drivers to help create optimal strategies to foster rate, process, and demand savings. Furthermore, this methodology provides a data-driven visualization to inform sound business decisions on potential Category Management initiatives.

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IV. FINDINGS

A. RESULTS

As outlined in Chapter III, Methodology, ISWM suppliers favor a short-range business model, that is, one in which the service is proximity-dependent between its supplier base, the buyer, and the location at which the service is performed. Considering this proximity dependence, we chose to test the ACF model by first identifying significant cost drivers associated with ISWM services. With the information outlined within the Category Intelligence Report for ISWM service, we derived two key cost drivers that could be used for our model: range constraints and wage constraints (determined by the Department of Labor for all federal contracts).

To better understand the key cost driver of ISWM range constraints, we needed to understand general distance capabilities of suppliers in terms of fuel economy. As a benchmark, we estimated that the farthest distance a refuse truck could service was approximately 200 miles roundtrip. This estimate was derived based on research at North Carolina State University, which found that traditional refuse trucks have a "typical fuel economy of 2 to 3 mpg of diesel" (Sandhu, Frey, Bartelt-Hunt, & Jones, 2014). Because our model was applied to the Los Angeles area, we determined that it would be reasonable to err on a conservative estimate of 2 mpg, considering the congested traffic environment. Peterbilt, an industry manufacturer of refuse trucks, advertises fuel tank capacities ranging from 50 gallons to 150 gallons (Peterbilt, n.d.). On average, we estimated 100 gallons available for use on a typical refuse truck. Therefore, our calculated range of a refuse truck was 200 miles roundtrip, which means that all servicing locations must be within 100 miles of a central location.

Applying the cost driver of range constraint, we derived a few key findings from the Maptitude analysis output. A consolidated geographic output visualizing driving distance rings in 25-mile increments from El Segundo, CA, is shown in Figure 11. We chose El Segundo as a point of reference because of its relatively central location in the Los Angeles area. Furthermore, El Segundo is also home to Los Angeles AFB, which provides an opportunity to showcase the number of procuring agencies and places of performance contracting for a similar service, like ISWM. Examining FPDS-NG system data from FY 2012 to FY 2016, we were able to identify and validate 15 DOD installations procuring refuse collection services under the PSC S205 “Trash/Garbage Collection Services” within a 100-mile radius of El Segundo’s Los Angeles AFB (DPAP, n.d.). Moreover, data shows an additional 151 other DOD locations listed as procuring “waste collection services” working in commercial office space (DPAP, n.d.). We assume these other locations may be various program offices that consist of DOD employees, or are required by other DOD contracts. In addition, 166 adjacent locations have procured the same service over a five-year period (DPAP, n.d.). Finally, within a 100-mile driving range, 27 landfills or active transfer stations are available for use. This provides great opportunity for competition or negotiated rate savings, which are discuss later in this chapter.

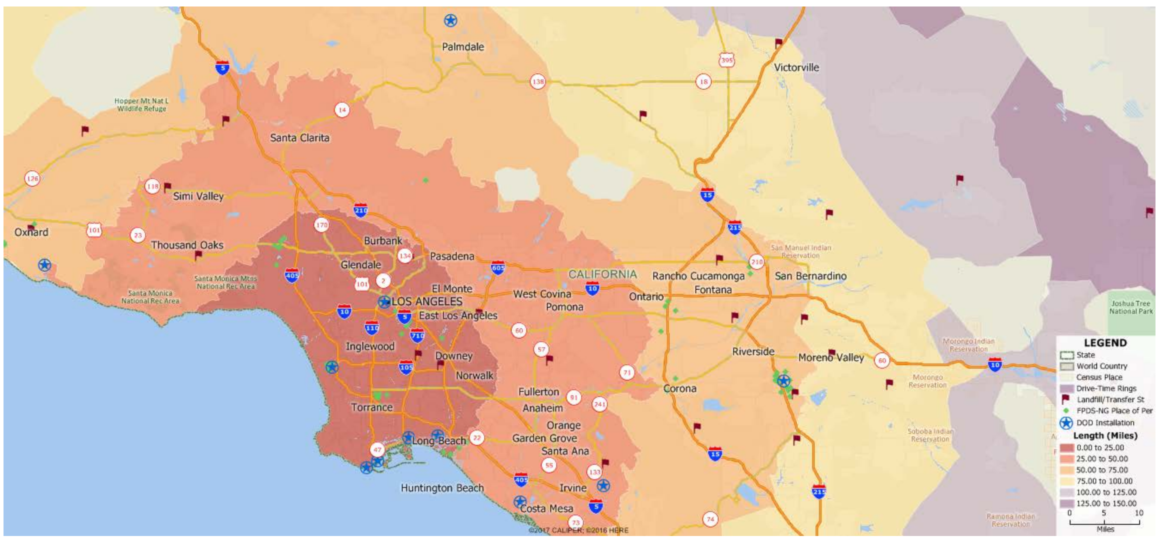

Figure 11. PSC S205 Data Shown in 25-Mile Distance Intervals from El Segundo

To add depth to our research, we decided to test our model with a rough round-table estimate that a refuse truck would likely remain within a two-hour roundtrip driving distance from its base of operations. This estimate is strictly to test our model to view clustering in terms of labor or hourly wage constraints. For example, suppose industry practice suggests the most efficient routes for refuse collection has a truck remain in a centralized location, versus servicing areas spanning great geographic distances. Viewing the data in terms of driving distance time provides an analysis of locations available to be serviced within a relatively congested location like Los Angeles, as compared to some rural areas, such as in the Midwest.

Driving distance in terms of average time in minutes from El Segundo, CA is shown in Figure 12. The rings are divided into 20-minute increments up to 60 minutes from El Segundo. From this output, we were able to derive a total of 38 locations procuring ISWM services within a 60-minute driving time. Additionally, nine landfill or transfer stations are available for use for ISWM services within the same area.

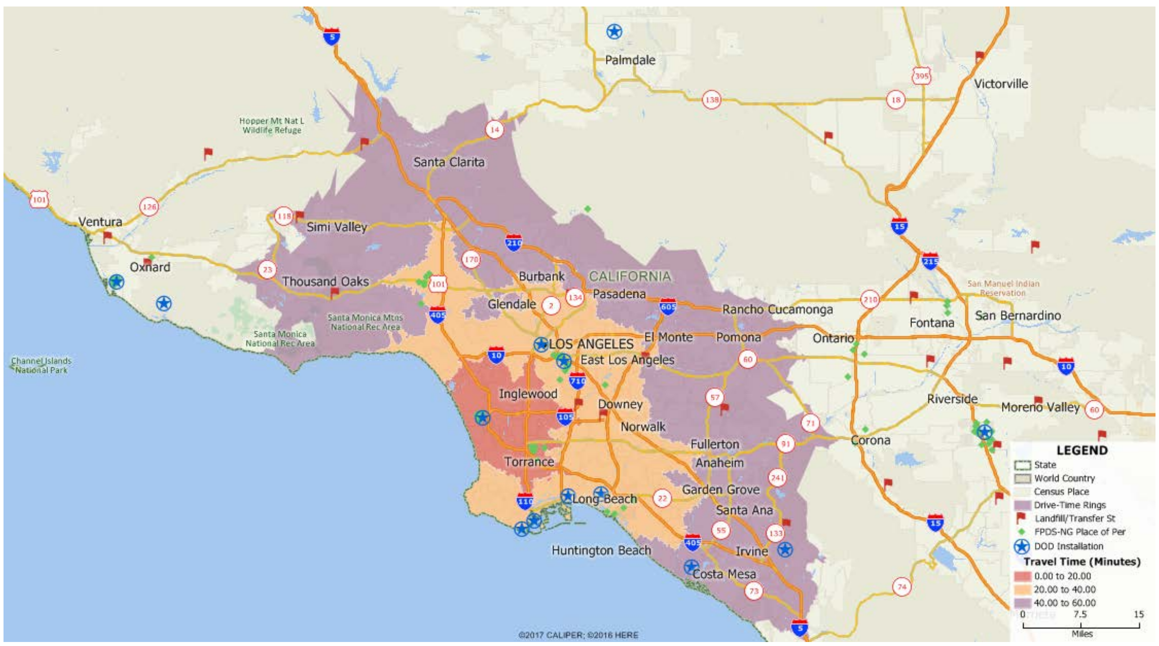

Figure 12. PSC S205 Data Shown in 20-Min. Drive Time Intervals from El Segundo

B. COMPARATIVE ANALYSIS OF COST DRIVERS

For comparative analysis, we have displayed the data found in Figure 13 and Figure 14 to show a representation of differences in driving distance analysis and driving time analysis. Determining which output to utilize depends on the type of cost savings that is being targeted. For example, if market intelligence leans toward the assumption that fuel costs are a significant factor to overall ISWM costs, then the driving distance output may provide a better visualization for decision making. If labor costs are more heavily weighted as a key cost driver, the driving time output may provide better visualization for decision making.

Figure 13. Cost Driver: Driving Distance (Miles)

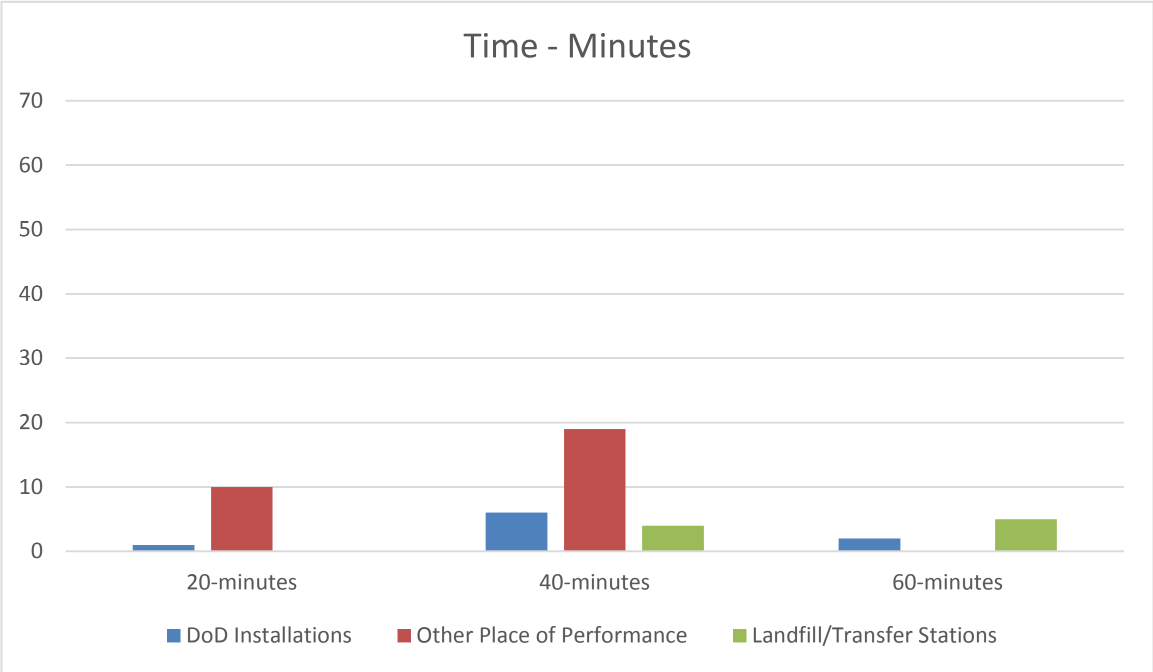

Figure 14. Cost Driver: Driving Time (Minutes)

In both Figure 13 and Figure 14, clustering constraints will vary depending on targeted cost drivers (e.g., labor or fuel).

C. RESEARCH QUESTION REVISITED

Are there potential cost savings (rate, process, demand) through strategically clustering common DOD service contracts?

AFICA published the most recent version of the *Cost Savings Tracker Guidebook* in February 2017, which outlines how organizations should verify rate, process, and demand savings achieved through Category Management initiatives (Air Force Installation Contracting Agency [AFICA], 2017). Clustering DOD-requiring activities based on cost drivers specific to the given service requirement may lead to rate savings. We used ISWM to demonstrate the potential for rate savings by promoting efficient utilization of fixed assets, saving fuel costs as well as reducing labor costs and "other fees/expenses" associated with landfills and transfer stations.

It was challenging to state the achievement of rate savings with certainty in this study, because we do not have the proper data to make a quantifiable claim. Due to the varying levels of service quality and the scope of work performed at various requiring activities across the DOD, it was difficult to quantify levels of service quality or scope of work performed by solely looking at the collected spend data, because the spend data only provides a total contract price. We could not discern the number of containers serviced on base, the volume of waste produced, or other factors related to cost (e.g., hazardous waste disposal). Without a higher level of data granularity, we are unable to make an "apples-to-apples" comparison, which prevents us from stating the rate savings that could be achieved with certainty. We recommend implementing a pilot test at a few locations to estimate potential savings before undertaking an enterprise-wide approach.

This study focused on a proximity-dependent service; however, we believe rate savings are achievable with proximity-independent services as well. With proximity-independent services, it is not as critical for contractors to maintain a physical presence in close proximity to requiring activities. For example, contractors could provide a service (e.g., IT support) from a central location that leverages skilled labor at lower wages. Maptitude and MPCluster could generate clusters to assign DOD installations to central offices performing the proximity-independent service.

Clustering DOD installations to develop large acquisition solutions like indefinite quantity-indefinite delivery (IDIQ) contracts would create significant process savings in contract administration. The use of IDIQs, where practical, would decrease the number of contract awards and subsequent administrative actions required to provide the same level of service to DOD installations.

One of the requiring activities in close proximity to Los Angeles was Edwards AFB, which has fulfilled its ISWM requirement using a "D Type" IDIQ contract since 2009. The remaining requiring activities awarded their ISWM requirement under a "C Type" firm-fixed-price (FFP) contract with one base year and four option years. The metrics from the AFICA Cost Savings Tracker prove that substantial process savings are possible. The Cost Savings Tracker uses a 2014 Operational Contracting Air Force Manpower Standard developed by the Fifth Manpower Requirements Squadron (5MRS) to measure process savings by establishing standard process times for the award and administration of various contract types (AFICA, 2017). This manpower standard requires 615.08 hours to award a service contract, and 219.66 hours to award a service task order that complies with FAR Part 37 (AFICA, 2017). This suggests that the DOD could potentially realize 5,535.88 hours of process savings—395.42 hours per contract—over a five-year period, should the 14 other DOD installations in the Los Angeles area fulfill their ISWM requirements using the IDIQ awarded at Edwards AFB. These savings are even more substantial when extrapolated to include clusters that cover all of the CONUS DOD installations.

Lastly, clustering common, recurring DOD service requirements would result in standardized levels of service at all installations. The demand savings from clustering would promote the implementation of best practices for that service requirement across the DOD, which would eliminate non-value-added activities currently performed at some installations. The Air Force Civil Engineer Center (AFCEC) gathers ISWM sub-amp data for Air Force ISWM requirements on things like the number of containers on base, number of tons of waste generated, and cost per ton to remove the waste (CIR; Brady et al., 2016). However, ISWM data for the other DOD installations in the Los Angeles area was not available. Therefore, based on the lack of data availability/granularity, we are unable to validate any demand savings specific to ISWM.

D. RECOMMENDATION

Our findings suggest that there are substantial opportunities for achieving process savings through Category Management of common, recurring DOD service requirements, but additional research is required to quantify and thus prove rate and demand savings. We narrowed the scope of this project to ISWM to provide depth of analysis and to demonstrate a methodology for a common, recurring DOD service. It was not feasible to discuss all common, recurring DOD service requirements in this research. However, ISWM spend during FY 2016 was less than 1% of the $149.6 billion total spent on all service contracts. This suggests that our research barely scratches the surface of total spend on DOD service contracts.

Our research revealed a significant number of complexities associated with Category Management of service contracts that prevented us from recommending a "one-size-fits-all" model. Each service has unique cost drivers that will determine clustering parameters. For example, drive time/distance is relevant to ISWM, but may not be relevant to clustering IT support services. We recommend additional data be gathered on service requirements procured within the DOD for future research projects related to Category Management of services.

Additionally, future research should focus on services that fall on the proximity-independent end of the continuum to test the ACF model. The delivery method of services on that end of the continuum may be less complex, allowing the DOD to demonstrate success with Category Management before applying the methodology to the more constrained, proximity-dependent end of the continuum. There are several proximity-independent services in the IT categories listed at the top of the prioritization model we described in Chapter II, which suggests they are prime candidates for Category Management initiatives. The Maptitude software will allow future research to collect data and develop visualizations to inform Category Management decisions for proximity-independent services.

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V. CONCLUSION

A. LIMITATIONS AND AREAS FOR FURTHER RESEARCH

In general, DOD service requirements are more difficult to strategically manage than commercially available commodities. With this in mind, our initial approach was to develop a macro-level, one-size-fits-all model to centralize procurement. From the beginning, we found this approach troublesome as we tried to group service requirements of wildly differing characteristics.

We further speculated that we could cluster recurring service requirements based on proximity. We hypothesized a solution that would require creating a mathematical algorithm to calculate and optimize military installation locations into clusters given a set parameter, such as a distance of 100 miles. For example, this formula would entail identifying all locations that are within 100 miles of one another, and then, subsequently, optimizing the selection to yield the maximum quantity of locations within each cluster.

In the early stages of our research, we experimented with developing an Excel-based adjacency matrix to help us identify installations given a set distance parameter (see Figure 15). We believed the Excel platform would be a straightforward approach to clustering adjacent DOD bases; however, the length of time required to develop such a database made this approach impractical. Creating a matrix of this magnitude would involve identifying the distance between each pair of bases using Google maps. We estimated that the matrix would require us to input over 23,000 distances, which would take approximately 400 man-hours to complete, an unrealistic number of hours for the time available for this research.

	Aberdeen Test Center	Air Force Academy	Altus AFB	Andrews Air Force Base	Anniston Army Depot	Arnold AFB (Engineering Dvlp Ctr)	Barksdale Air Force Base	Beale Air Force Base	Bolling Air Force Base	Brooks City-Base	Buckley Air Force Base	Camp Lejeune	Camp Pendleton	Camp Pendleton	Cannon Air Force Base	Charleston AFB	Clear Air Force Station	Coast Guard Training Ctr-Yorktown
Aberdeen Test Center																		
Air Force Academy	1696																	
Altus AFB	1508	536																
Andrews Air Force Base	73	1655	1491															
Anniston Army Depot	802	1324	891	744														
Arnold AFB (Engineering Dvlp Ctr)	738	1215	887	679	186													
Barksdale Air Force Base	1268	925	418	1209	506	611												
Beale Air Force Base	2783	1195	1578	2758	2431	2363	1968											
Bolling Air Force Base	74	1650	1484	12	741	659	1204	2750										
Brooks City-Base	1683	883	418	1624	921	1021	401	1792	1619									
Buckley Air Force Base	1703	63	573	1678	1326	1220	962	1188	1671	930								
Camp Lejeune	464	1792	1443	399	563	663	1058	2944	394	1450	1799							
Camp Pendleton	281	1762	1531	216	686	707	1181	2914	211	1578	1768	234						
Camp Pendleton	2688	1115	1223	2675	2072	2072	1570	514	2671	1318	1074	2619	2718					
Cannon Air Force Base	1737	431	254	1725	1125	1121	621	1342	1720	507	492	1672	1768	1018				
Charleston AFB	600	1681	1291	534	411	511	906	2833	529	1268	1688	229	449	2472	1527			
Clear Air Force Station	4276	3232	3747	4251	4261	4088	4017	2947	4245	4104	3181	4487	4440	3442	3662	4442		
Coast Guard Training Ctr-Yorktown	214	1717	1486	146	690	662	1206	2869	166	1582	1723	253	53	2700	1723	458	4392	
Columbus Air Force Base	941	1192	760	882	179	251	395	2298	878	792	1200	726	852	1961	997	578	4101	856

Figure 15. Sample Excel-Based Adjacency Matrix

The first attempts at the adjacency matrix led us to a critical research course correction within our research. Keying in some 20,000-plus distances helped us realize that the results of this matrix would likely have a limited its application to any end-user. Even if we could complete the matrix and subsequent optimization formula, the product we provided would not be very user-friendly for future Category Management efforts. The matrix would not allow us input of unique cost drivers for the service being examined (i.e., location of landfills/transfer stations). Additionally, this distance-based mathematical algorithm did not account for contracting goals and socioeconomic programs, which can be contradictory to achieving cost savings. We needed to return to Category Management concepts of trying to identify a commercial best-practice solution, which resulted in our discovery and use of commercial software.

We experienced other significant limiting factors related to data availability and data collection. Before we relied solely on FPDS-NG, we attempted to use the Air Force Business Intelligence Tool (AFBIT) to collect ISWM spend data for the Los Angeles area. However, we realized that AFBIT categorized the spend data output by the contracting activities that awarded the contracts, and not by place of performance. This was problematic because the Navy awards contracts regionally at its Fleet Logistics Centers, and, therefore, AFBIT spend data was not isolated to the Los Angeles region. Additionally, by using Place of Performance to categorize spend data, we found additional data we originally omitted. We identified contracting activities outside of the Los Angeles area (e.g., Wright-Patterson AFB) that awarded ISWM contracts for performance within the Los Angeles region, likely as part of a major program office.

B. SUMMARY

Service contract requirements need to garner additional focus in future DOD Category Management efforts. Service-related contracts deliver critical defense-sustaining capabilities and account for over half of defense spending. Historically, the DOD has struggled with the acquisition of services due to the inherently complex nature of services, compared to the seemingly straightforward procurement of commodities. This reality makes improvements in Category Management of service contracts vital to future mission success of the DOD. The current service contract acquisition environment demonstrates the need for improvements and was the impetus for this study.

We developed a methodology that clusters installations strategically, based on relevant cost drivers of a specific service. We recognize that recurring, common DOD service-related requirements yield the greatest opportunity for implementing strategic initiatives to achieve rate, process, and demand savings. A one-size-fits-all mathematical model will not generate optimal clusters for every service acquisition scenario. Rather, a flexible solution was needed to allow contracting officers to uphold their charge to innovate and enact best-in-class solutions for their category. Our solution was a versatile, commercial-off-the-shelf software that provides the capability to map DOD requiring activities and cluster them based on virtually any type of Excel-based data inputs. The intent was to provide a flexible solution to category management teams that offered the benefit of continuous improvements through software upgrades, rather than use our initial approach to create an Excel-based mathematical model, which would become obsolete shortly after our research was complete.

We created a process comprised of four steps to guide future category management teams in analyzing data and applying Category Management principles through the use of Maptitude or MPCluster software. The four main steps of the ACF methodology aid category management teams in identifying DOD requiring activities for a given service, identifying cost-driver market intelligence relevant to developing clusters, integrating cost-driver market intelligence into commercial mapping software, and using cost-driver market intelligence to determine optimal cluster size.

To demonstrate the ACF methodology, we analyzed data related to ISWM within the Los Angeles area and came away with two findings: (1) rate and demand savings were inconclusive, but suggested opportunities do exist, and (2) significant opportunities for process savings exist across the DOD. We lacked the data required to quantify savings precisely; further research is needed to quantify these savings and identify other opportunities to achieve savings through Category Management of service requirements. We also recommend that future research focus on proximity-independent services.

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