

An Analytic Inventory of DHS Headquarters Business Processes

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Preface

The mission of the U.S. Department of Homeland Security (DHS) includes protecting the nation against threats to the homeland (both terrorism-related and otherwise); strengthening national preparedness, response, and resilience; preserving and upholding the nation's prosperity and economic security; securing the nation's borders while facilitating legitimate trade and travel; and supporting the personnel who contribute to DHS mission execution. An important DHS goal is to identify, develop, improve, share, and align its capabilities in support of strategic decisionmaking.

To guide this effort, DHS is establishing an Analytic Agenda. As a primary step in the Analytic Agenda, DHS requires an inventory of its analytic capabilities, including the data, tools, special skills, and human resources necessary to carry out the department's mission. This report documents the method used to inventory the analytic capabilities at DHS Headquarters (DHS-HQ), including the current capabilities used to support decisionmaking, and provides some recommendations on how DHS could enhance its analytic capabilities.

This report should be helpful to those in DHS who are involved in developing strategies; clarifying how analyses are produced and how they will be used; and determining which elements of analysis are important for strategy and requirements development, acquisition, and evaluation. It should also be of interest to those involved in requirements development, illustrating how strategy products—and the elements of those products—could inform and drive decisions during the acquisition and evaluation processes. Beyond these two audiences, however, this report should be broadly useful to those who seek to understand DHS-HQ operations, including DHS-HQ offices, DHS components, and non-DHS stakeholders.

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About the Homeland Security Operational Analysis Center

The Homeland Security Act of 2002 (Section 305 of Public Law 107-296, as codified at 6 U.S.C. § 185), authorizes the Secretary of Homeland Security, acting through the Under Secretary for Science and Technology, to establish one or more FFRDCs to provide independent analysis of homeland security issues. The RAND Corporation operates the Homeland Security Operational Analysis Center (HSOAC) as an FFRDC for the U.S. Department of Homeland Security (DHS) under contract HSHQDC-16-D-00007.

The HSOAC FFRDC provides the government with independent and objective analyses and advice in core areas important to the department in support of policy development, decisionmaking, alternative approaches, and new ideas on issues of significance. The HSOAC FFRDC also works with and supports other federal, state, local, tribal, and public- and private-

sector organizations that make up the homeland security enterprise. The HSOAC FFRDC's research is undertaken by mutual consent with DHS and is organized as a set of discrete tasks. This report presents the results of research and analysis conducted under HSHQDC-17-J-00336, Analytic Inventory and Store.

The results presented in this report do not necessarily reflect official DHS opinion or policy. For more information on HSOAC, see <u>www.rand.org/hsoac</u>.

For more information on this publication, visit www.rand.org/t/RR2652.

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Summary

The U.S. Department of Homeland Security Headquarters (DHS-HQ) is developing an Analytic Agenda that defines key actions that DHS-HQ organizations will take to

- execute cross-cutting analytical efforts to most effectively achieve the goals, objectives, and subobjectives in the fiscal years (FYs) 2018–2022 DHS Strategic Plan
- synchronize, when appropriate, DHS-HQ's approach to analytics
- provide transparency to components and other DHS-HQ offices regarding ongoing and projected analytic efforts to meet the decision-support needs of DHS senior leadership.¹

Accordingly, the Analytic Agenda calls for an inventory of the decision-support analytics and corresponding analytic capabilities within DHS-HQ.

Although the Analytic Agenda supports all of DHS, this study focused on the agenda as it applies to DHS-HQ integrated business processes—or how departmental leadership guidance and priorities are transformed into materiel or nonmateriel mission program solutions based on identified needs. Four DHS-HQ offices oversee these processes: The Office of Strategy, Policy, and Plans (PLCY); the Joint Requirements Council (JRC); the Office of Program Accountability and Risk Management (PARM); and the Office of Program Analysis and Evaluation (PA&E).

This report helps advance the Analytic Agenda by providing a clear, functional working definition of an analytic capability; documenting the business process decision points requiring analytic inputs; listing and describing the analytic tools used by DHS-HQ business processes; and identifying potential improvements to DHS business processes, data analytics, and collaboration.

Defining and Modeling Analytic Capabilities for DHS

DHS-HQ's integrated business processes support strategic and operational decisionmaking by DHS senior leadership. Corresponding to this focus, we used the following definition for our analysis of analytic capabilities:

An analytic capability is the ability to transform the data available at hand into valuable insights and actionable directives. . .. [A]nalytic capability involves developing rules, business logics, and algorithms that process information or data into predictive insights that have operational value for the organization.²

This definition highlights two key facilitators of analytic capability maturity. First, the manipulation of data allows analysts to identify patterns and test hypotheses. This definition also

¹ U.S. Department of Homeland Security, *DHS Analytic Agenda Fiscal Years, 2018–2022*, Washington, D.C., draft, undated-a.

² Sambit Lenka, Vinit Parida, and Joakim Wincent, "Digitalization Capabilities as Enablers of Value Co-Creation in Servitizing Firms," *Psychology and Marketing*, Vol. 34, No. 1, January 2017.

emphasizes the use of *the data at hand* rather than some idealized conception of perfect data which may not exist. Finally, the definition references the process by which data analysis leads to insights and actionable directives.

Because this definition of analytic capability is predicated on data transformation, it is important to understand what we mean by *data*. For this study, we adopted a broad definition that included both structured and unstructured data because of the analytic realities in DHS. Unstructured data typically include text-heavy documents. These data sources can have structured, quantitative dimensions, such as dates and frequencies; often, however, they describe processes, risks, strategies, methods, and other difficult-to-quantify measures. Consequently, to analyze these unstructured data, analysts must manually review and assess individual documents. As we discuss in this report, this is the modal method of analysis at DHS-HQ and has led to analytic challenges in data transformation and the lack of a transparent and replicable analytic method for gaining insight and developing actionable directives.

Key Findings

To organize our analysis, we used an IBM-developed organizational construct from business intelligence and business analytics. We adapted the construct to address the value-laden, multiple-objective context of public-sector decisionmaking. This framework, shown in Figure S.1, provides a lens for evaluating the analytic capabilities that support the DHS-HQ integrated business processes detailed in Appendix B of this report.

As shown in Table S.1, we found that the demand for analysis at DHS-HQ is high, yet elements of the analytic inventory (analytic capabilities, data culture, data management, systems and technology, and data governance) lack many of the hallmarks of maturity. Analysis that involves extracting meaning from free text to determine whether a prescribed course of action will achieve its goals is a form of predictive analytics—and this characterizes much of the analysis conducted at DHS-HQ.

DHS-HQ data are predominately unstructured. In general, we found that many of the analytic tools used by business process owners were either documents containing narrative descriptions of strategy, program risk, or operational requirements or spreadsheets containing information about staffing, budgets, program costs, or outputs.



Figure S.1. Federal Government Data Maturity Model

SOURCE: Ryan Swann and Todd Coleman, "The Federal Government Data Maturity Model," in *Data Cabinet Report*, Alexandria, Va.: U.S. General Services Administration, National Technical Information Service, undated. ROI = return on investment.

In some cases, the analytic capability of a particular DHS-HQ business process includes types of analyses that are more mature than the predictive approach described earlier, according to the model in Figure S.1. However, these analyses often lack replicability, or analysts may not be able to assess whether their predictions are valid. For example, analysis is typically conducted by a single analyst, meaning that replicability is likely to be low and it is difficult to document and inventory analytic capabilities. Furthermore, analytic approaches are generally highly compartmentalized among the DHS-HQ business process owners, rather than DHS enterprise-

wide capabilities. Because these capabilities are housed in disparate systems and groups, data management occurs at the individual organization level (rather than an enterprise systems level) and data quality is highly variable.

Although there is variation across the DHS-HQ business offices, analytics at DHS-HQ reflect some level of maturity, as indicated in Table S.1. However, current analytic methods are not easily replicable, and predictive analytics often lack the reliability needed to support strategic and operational decisionmaking.

Category	PLCY	JRC	PARM	PA&E
Analytic capability	Descriptive/predictive	Descriptive/predictive	Descriptive/diagnostic/ predictive	Descriptive/diagnostic/ predictive
Data culture	Request	Request	High demand	High demand
Data management	Siloed; documentation sparse	Siloed; some documentation	Data managed with cross-functions in mind	Data managed with cross-functions in mind
Data personnel	Insufficient information	Insufficient information	Insufficient information	Insufficient information
Systems/technology	Siloed system	Siloed system; some programmatically accessed	Siloed system; some programmatically accessed	Some common data systems; key data can be programmatically accessed
Data governance	Loose affiliation of technical staff	Bureau-level collaboration	Bureau-level collaboration	Agency-level collaboration; data ownership and stewardship

Table S.1. DHS-HQ Analytic Maturity Assessment, by Business Process Owner

Recommendations

DHS-HQ has made important strides in developing an Analytic Agenda and building and maturing its analytic inventory over the past four years. The current Analytic Agenda calls for further maturation of these analytic capabilities. The observations presented here support several recommendations that could help DHS advance its Analytic Agenda.

Overall, both PLCY and the JRC would benefit from the following improvements to facilitate collaboration and the quality of analytic inputs:

- more-extensive use of SharePoint or another type of document collaboration software to allow multiparty processing of documents and repositories that are easily accessible to all authorized parties
- more structure in the highly unstructured data currently in use.

These changes would require standardizing (to the extent possible) such documents as Capability Analysis Reports and Mission Need Statements or a systematic qualitative analysis of the detailed documents that serve as the main inputs in the current analytic process (when staffing and software are available).

Both PARM and PA&E have more-mature and -structured data-driven analytics—largely owing to the personnel and cost data used in their analyses than do PLCY and the JRC. Nevertheless, we found that their processes were often siloed—that is, analyses belonged to and were developed by a single individual or study group brought together for a particular purpose. In general, these siloed analyses lacked shared data access and analytical tools, as well as the mechanisms that would allow analysts to share their methods and validate their assumptions and outcomes. This may lead to quality and replicability problems. Although there are relevant reasons why groups should own their analyses and work processes, DHS-HQ–wide analyses should use broadly shared data and analytic tools, and these data and tools should be widely validated. It is important to note that we did *not* assess the quality of the analysis; we address analytic quality only to emphasize that siloed analyses are more susceptible to error, misconception, and redundancy than work that is done collaboratively using publicly reviewable methods. Consequently, PARM and PA&E would likely benefit from the following improvements:

- producing fewer siloed analyses by implementing more collaborative systems
- providing mechanisms for sharing data on demand when requested by components.

By providing better platforms for sharing information and analytic tools and methods, promoting transparency and replicability in analysis, and improving the quality of the data available to DHS-HQ analysts, DHS would go a long way toward fulfilling its Analytic Agenda objectives and executing its crucial mission for the United States.

We thank the many individuals at DHS who gave their time for this effort, including the nearly 20 staff who sat with us for 60- to 90-minute interviews and the senior staff who provided guidance on the project. We are also grateful for the thoughtful insights of the RAND Corporation's internal quality assurance team, Mike Mazarr and Pete Schirmer. Finally, we extend special thanks to Emma Westerman of RAND, who accompanied the research team on interviews with Science and Technology Directorate personnel.

Abbreviations

ADE	Acquisition Decision Event
ADM	Acquisition Decision Memo
ALF	Acquisition Lifecycle Framework
APB	Acquisition Program Baseline
АРНА	Acquisition Program Health Assessment
ARB	Acquisition Review Board
ART	Acquisition Review Team
BFEM	Budget Formulation and Execution Manager
BI	business intelligence
CAE	Component Acquisition Executive
CAO	Chief Acquisition Officer
CASP	Capabilities Analysis Study Plan
CDS	Capability Development Support
CFO	Chief Financial Officer
CFO Council	Chief Financial Officer's Council
CGR	Capabilities Gaps Register
СНСО	Chief Human Capital Officer
CIO	Chief Information Officer
CONOPS	concept of operations
СРО	Chief Procurement Officer
CRM	Comment Resolution Matrix
CRSO	Chief Readiness Support Officer
CxO	MGMT Lines of Business Chief Executive Officer
DHS	U.S. Department of Homeland Security
DMAG	Deputy's Management Action Group
DOTmLPF+R/G/S	doctrine, organization, training, materiel, leadership and education, personnel, facilities, regulations, grants, and standards

eODMP	Electronic Organization Document Management Process
ERMS	Electronic Records Management System
FFRDC	federally funded research and development center
FOC	full operational capability
FTE	full-time equivalent
FYHSP	Future Years Homeland Security Program
HSNRC	Homeland Security National Risk Characterization
HSOAC	Homeland Security Operational Analysis Center
HSTE	Homeland Security Threat Estimate
ILSP	Integrated Logistics Support Plan
INVEST	Investment, Evaluation, Submission, and Tracking System
IPT	Integrated Product Team
ITAR	Information Technology Acquisition Review Process
JRC	Joint Requirements Council
JRIMS	Joint Requirements Integration and Management System
KMDS	Knowledge Management and Decision Support
LCCE	Life Cycle Cost Estimate
MAOL	Master Acquisition Organizational List
MGMT	DHS Management Directorate
MNS	Mission Needs Statement
OCFO	Office of the Chief Financial Officer
OMB	Office of Management and Budget
ORA	S&T Office of Operations and Requirements Analysis
ORD	Operational Requirements Document
OSE	S&T Office of Systems Engineering
PA&E	Office of Program Analysis and Evaluation
PARM	Office of Program Accountability and Risk Management
PBR	Program and Budget Review
PLANS	PLCY Office of Operational Plans

PLCY	Office of Strategy, Policy, and Plans
PPBE	Planning, Programming, Budgeting, and Execution
РТ	Portfolio Team
QHSR	Quadrennial Homeland Security Review
RAD	Resource Allocation Decisions
RAP	Resource Allocation Plan
Risk ESC	Risk Executive Steering Committee
RPG	Resource Planning Guidance
S&A	PLCY Office of Strategy and Analysis
S&P ESC	Strategy and Policy Executive Steering Committee
S&T	Science and Technology Directorate
SELC	Systems Engineering Life Cycle Tailoring Plan
SME	subject-matter expert
SOSOA	System of Systems Operational Analytics Capability
SPAR	Office of Strategy, Planning, Analysis, and Risk
SPTaaS	SharePoint as a Service
SQL BI	SQL business intelligence software
SR	Strategic Review
TEMP	Test and Evaluation Master Plan
USM	DHS Under Secretary for Management
UVI	Unified View of Investment

The mission of the U.S. Department of Homeland Security (DHS) includes protecting the nation against threats to the homeland (both terrorism-related and otherwise); strengthening national preparedness, response, and resilience; preserving and upholding the nation's prosperity and economic security; securing the nation's borders while facilitating legitimate trade and travel; and supporting the personnel who contribute to DHS mission execution.¹ An important determinant of whether DHS achieves its goals is whether the Department's analytic processes successfully identify, develop, improve, share, and align departmental and component capabilities in support of strategic decisionmaking.

To guide this analytic effort, DHS is establishing an Analytic Agenda and has convened an Analysis Subcommittee of the Risk Analysis Executive Steering Committee (Risk ESC) to oversee the agenda's development and initial implementation. The Office of Strategy and Analysis (S&A) in the Office of Strategy, Policy, and Plans (PLCY) chairs the Analysis Subcommittee, with designated representatives from each component and supporting headquarters offices serving as subcommittee members.

As a first step in developing and implementing initiatives in the Analytic Agenda, DHS asked the Homeland Security Operational Analysis Center (HSOAC) to conduct an inventory of analytic capabilities that support the agenda, including the data, tools, special skills, and human resources necessary for strategic decisionmaking at DHS-HQ.

The inventory consisted of a document analysis examining the processes and workflow of DHS-HQ component business process owners. This step allowed us to determine where analytic inputs are in demand and how they are used. After identifying critical information junctures, we interviewed key personnel about the analytic capabilities they either used in decisionmaking or generated as part of the decisionmaking process. Subsequent interviews were conducted on a referral basis and focused on strategic or operational decisionmaking or the production of analytic outputs. We presented interviewees with a summary of findings from each DHS-HQ component and asked them to provide comments, feedback, and corrections to validate our findings and conclusions.

How the DHS Analytic Agenda Drives the Analytic Inventory

DHS-HQ has long recognized that successful strategic planning requires "having the right people, policies, processes, technologies, and analytic capabilities"² to effectively and efficiently execute the Department's mission. Part of the strategic planning process requires effectively

¹ U.S. Department of Homeland Security, *DHS Strategic Plan Framework Fiscal Years 2018–2022*, Washington, D.C., draft, undated-a.

² U.S. Department of Homeland Security, undated-a.

using available data and analytics to provide decision support to senior leadership and DHS-HQ management. Consequently, the Analytic Agenda aims to advance data-driven management to facilitate performance oversight, capability development, and the implementation of strategically important goals. Although DHS has made significant progress over the past four years in aligning and maturing its strategy, requirements, budgeting, and acquisition processes, the Department must continue to enhance the analytical basis for coordinated decisionmaking.

This report helps advance the DHS-HQ Analytic Agenda in the following ways:

- It provides a clear, functional working definition of an analytic capability.
- It documents the decision points at which analytic inputs are required.
- It describes the analytic tools that are currently used in DHS-HQ business processes.
- It identifies potential improvements to business processes, data analytics, and collaboration across DHS.

Our study was guided by the following definition of an analytic capability:

An analytic capability is the ability to transform the data available at hand into valuable insights and actionable directives. . ..[A]nalytic capability involves developing rules, business logics, and algorithms that process information or data into predictive insights that have operational value for the organization.³

Although there are numerous definitions of *analytic capabilities*, we used this one because it highlights two important facilitators of analytic capability maturity. First, the manipulation of data allows analysts to identify patterns and test hypotheses. This definition also emphasizes the use of *the data at hand* rather than some idealized conception of perfect data—which may not exist. Finally, the definition references the process by which the data analysis leads to insights and actionable directives.

We were interested in the analytic capabilities that inform decisionmaking and lead to improved outcomes for DHS-HQ. The definition points to the types of capabilities to consider when developing an inventory: rules, business logic, and algorithms.

Data at Hand

DHS-HQ offices have considerably more data at hand than they are currently analyzing. The difficulty in systematically analyzing DHS-HQ data arises from the highly unstructured nature of the data.

Structured data are typically stored in relational databases—for example, fields or cells for both numeric and nonnumeric data, such as phone numbers, Social Security numbers, or zip codes and such text strings as names and addresses. This type of storage design simplifies data searches and sorting. However, PLCY and the Joint Requirements Council (JRC) store most of their data in the form of Microsoft Word documents or summarized in detailed text entries in Microsoft Excel spreadsheets. Efficiently analyzing these types of unstructured data requires

³ Sambit Lenka, Vinit Parida, and Joakim Wincent, "Digitalization Capabilities as Enablers of Value Co-Creation in Servitizing Firms," *Psychology and Marketing*, Vol. 34, No. 1, January 2017.

specialized software (and training) that DHS currently lacks. Such data have an internal structure, but it does not follow predefined data-generating processes or standardized database schema (e.g., U.S. phone numbers are known to have ten digits). Unstructured data may be textual or nontextual, human- or machine-generated. Typical examples of human-generated unstructured data include text files, emails, text messages, and video and audio files. Machine-generated data may include satellite imagery, seismic images, traffic flows, map images, and street views.

Qualitative data analysis software allows researchers to code a search of unstructured data for keywords and phrases, images, or other characteristics to expedite and increase the replicability of transcription analysis, coding and interpretation, and content analysis. These computer-assisted qualitative analysis tools are used in health care, legal research and analysis, market research, and academic disciplines (such as sociology, anthropology, geography, geology, forensics, criminology, marketing, education, theology, philosophy, and history). Typical software packages include MaxQDa, NVivo, and Atlas.ti,⁴ all of which have the capability to analyze unstructured data from Word, Excel, and PowerPoint files. Newer products that interface with Python are commonly used to analyze large, unstructured data sets. These software packages can be used to analyze .pdf documents and other media.

Actionable Directives

The second dimension of the definition of *analytic capability* is the ability to convert analyses into actionable directives. This means that information and analysis should be inputs into the existing decision process. As illustrated in Appendix C, there are numerous inputs for analysis at critical junctures. However, we note that even when a business process calls for analytic inputs at specific junctures, the source of the analysis and whether the analysis informs current decisions are not always clear.

Prioritizing capability gaps and determining the best way to deliver the required capabilities are important functions that flow from the strategic planning phase. Once capability requirements and delivery mechanisms are identified and selected, DHS-HQ programming and budgeting offices tasked with allocating resources—and preceded by the requisite DHS component programming and budgeting activities—determine the operational alternatives that are available to achieve DHS mission outcomes within the budgeted resources.⁵ The resource allocation phase must assess the relative cost and performance trade-offs with respect to various alternatives.

⁴ Atlas.ti is the preferred tool for qualitative analysis at University of California, Berkeley's D-Lab; as of 2016, D-Lab has expanded the use of MaxQDA, NVivo, and Dedoose. Additionally, recent modules for use with Python allow for the qualitative analysis of unstructured data.

⁵ U.S. Department of Homeland Security, *Planning, Programming, Budgeting, and Execution Instruction*, Instruction No. 101-01-001, Washington, D.C., July 2016e, pp. 12–13.

The event-driven phase of DHS-HQ integrated business processes, and the phase most reliant on approval in the previous phases of the Analytic Agenda, is acquisition and investment oversight. This process determines whether required capabilities can be obtained via the appropriate type of acquisition processes. It also involves overseeing the production, deployment, and support of the approved capability throughout its useful life.⁶ In support of the strategic planning and resource allocation phases, DHS-HQ acquisition and investment oversight entities assess the amount of acceptable risk for failing to achieve mission outcomes or for only partially fulfilling mission outcomes, as well as whether an acquisition program is delivering the required mission capabilities.⁷

Overall, the DHS Analytic Agenda focuses on developing or improving the Department's analytic capabilities to provide key information at the appropriate time. Developing and using these capabilities will require more than just new technologies and data management approaches. Analytic capabilities are predominantly manifested in individuals and their capacity to process information, interpret it, and turn it into actionable tasks. Consequently, DHS relies on highly qualified technical staff. It must both attract capable staff and develop the skills that meet the demands of the unique operational environment in DHS. Trained analysts and subject-matter experts (SMEs) are needed in all phases of the DHS-HQ business process, from strategy to requirements to acquisition and evaluation. Analysts must not only identify data requirements and sources, but they must also establish performance metrics and analyze data for use in timely decisionmaking.

Within the DHS Analytic Agenda, there is a call for an inventory of DHS analytic capabilities.⁸ In this report, we present an inventory of the capabilities of the following DHS-HQ business process owners: PLCY, JRC, the Office of Program Accountability and Risk Management (PARM), and the Office of Program Analysis and Evaluation (PA&E). PLCY intends to use the results of this study to develop a prototype analytic inventory with the understanding that effective coordination, sharing, and development of mature analytic capabilities will require an in-depth understanding of the status quo. This goal aligns with the DHS Analytic Agenda's call for "understanding what processes and decisions the [analytic] capabilities support, how the capabilities support those processes and decisions, and how the capabilities are generated."⁹

⁶ U.S. Department of Homeland Security, *Acquisition Management Instruction*, Instruction No. 102-01-001, Revision No. 1, Washington, D.C., March 2016b, pp. 25–26.

⁷ U.S. Department of Homeland Security, undated-a.

⁸ Conducting a DHS-wide inventory was beyond the scope of this project.

⁹ U.S. Department of Homeland Security, undated-a.

In addition to developing an inventory, the DHS Analytic Agenda calls for standardizing data structures and terms. Data maturation will be a continuing process, but standardization across DHS-HQ in the short term will likely take considerable effort to achieve.¹⁰

This report supports the following task in the Analytic Agenda: identifying the framework for an analytic inventory. In this report, we document our methodology and summarize the literature on business analytics. We focus on an analytics maturity model that can be adapted for the public sector. A key component of this type of model is its ability to support the inherently complex decisionmaking processes of government agencies, including DHS. In the chapters that follow, we discuss our primary findings—consisting of a qualitative inventory of analytic capabilities—for each phase of DHS-HQ integrated business processes.

An Analytics Maturity Model for DHS

Examining analytic capabilities requires deciding what constitutes analysis and, by our definition, determining whether that analysis is useful for decisionmaking. Because our definition of *analytic capability* (presented earlier in this chapter) is predicated on data transformation, it is important to understand what we mean by *data*.

Most researchers, when referring to data, think of quantitative measures of process outcomes—how many times something occurred, how long each iteration took, how much someone paid. Here, we use a broader definition that includes both structured and unstructured data. Unstructured data typically include text-heavy documents. These data sources can have structured, quantitative dimensions, such as dates and frequencies; often, however, they describe processes, risks, strategies, methods, and other difficult-to-quantify measures. Consequently, to analyze these unstructured data, analysts must manually review and assess individual documents. As we discuss in this report, this is the modal method of analysis at DHS-HQ and has led to analytic challenges in data transformation and the lack of a transparent and replicable analytic method for gaining insight and developing actionable directives.

Overview of Literature on Analysis and Maturity Models

As businesses, governments, and nonprofit organizations generate and collect data, they have come to realize the hidden potential of analyzing their own data (generated from past business

¹⁰ Our interviewees suggested that some DHS-HQ departments are starting to mature toward more unification and standardization. In particular, the Integrated Product Teams (IPTs) work for the DHS Management Directorate (MGMT) business intelligence (BI) that is cross-connecting data across the Acquisition Review Team (ART) and Acquisition Review Board (ARB) communities. Additionally, efforts are under way to automate Unified View of Investment (UVI) BI and Acquisition Program Health Assessment (APHA) capabilities, which are the focus of MGMT integrated priorities. UVI works to achieve Digital Accounting and Transparency Act (DATA Act 2014) standards and Open Data standards, both of which facilitate better use of shared modeling and analysis, as well as input and output data from automated capabilities in SharePoint. APHA is a capability-automation utility in SharePoint services and the SQL BI environment that seeks to normalize and standardize data capture and collective rating and justification insights from across ART stakeholders.

outcomes). Many of these data analytic processes have been used to understand the state of the world (or business environment) or to refine strategies for improving business performance. The era of business analytics is in full bloom. Beller and Barnett describe business analytics as encompassing the human capital, technology, and data capture necessary to continuously investigate and evaluate past business performance to gain insight and drive business planning.¹¹ They argue that all areas of business, including finance, sales, marketing, social media, and consumer data, are a potential focus for business analytics. If corporate for-profit, nonprofit, or government entities can take advantage of analyses of past performance, they can achieve insights to enhance and improve current business practices.¹²

One common business analytic practice is the monitoring of a process via dashboards allowing firms to easily track numerous business processes and alter them when problems or bottlenecks arise. For example, dashboards may be used to track the success (or failure) of a particular campaign or overall performance with regard to total revenue. By monitoring performance over time, managers and senior leaders can evaluate key performance indicators or identify areas in need of improvement.

Of course, business, government, and nonprofit entities have not always had data readily available. The advent of computing heralded the era of decision-support systems. An early successful example is the SABRE system of computer-based airline reservations initiated by American Airlines and the decision-support system (DSS) developed by Texas Instruments for United Airlines to prevent bottlenecks at airport gates. DSSs grew in popularity as they helped sort and filter larger quantities of data and supported data-driven business decisionmaking. Specifically, DSSs helped organize and present data from various areas of a business, such as absenteeism and personnel turnover, scrap rates, energy consumption, throughput times, and sales figures, thereby providing decisionmakers with a new, summary perspective of business processes. Analyzing data across multiple cross-tabulations (employment turnover versus scrap rates) provided new insights and gave rise to new opportunities for innovation.

Types of Analysis

The advent of DSSs and business analytics gave rise to the independent study of types of business analytics and their categorization, classification, and development. These maturity models of analytics are defined by the types of data they process and the data manipulation they perform. IBM has been at the forefront of data analytics with a maturity model for the private sector (see Figure 1.1).

¹¹ Michael J. Beller and Alan Barnett, "Next Generation Business Analytics Technology Trends: Technologies and Techniques for Business Intelligence and Performance Management," slideshow, Lightship Partners LLC, 2009.

¹² Beller and Barnett, 2009.

Figure 1.1. IBM Analytics Maturity Model



SOURCE: Jean Francois Puget, "Analytics Landscape," blog post, *IT Best Kept Secret is Optimization*, IBM Community, September 21, 2015.

The IBM model accounts for four types of analytics: descriptive, diagnostic, predictive, and prescriptive, defined by the types of data, methods, and tools involved. **Descriptive analysis** focuses on evaluating past performance and current status. This type of analysis simply allows decisionmakers to understand the current state of their business enterprise. This type of analysis is quite common and is typically presented in reports, dashboards, and data visualizations.

Diagnostic analysis focuses on analyzing historical data to determine the proximate causes of particular outcomes. Although diagnostic analytic processes often include a substantial amount of description and characterization of data elements, their primary use is to develop conclusions about the sequence and comparative outcomes of past events and states.¹³ Ultimately, the goal is to produce insights that will lead to improved performance. Put simply, a diagnostic analysis examines data to answer the question, "Why did something happen?"

Predictive analysis uses historical data to forecast the likely future course of events. This type of analysis is typically model-based and attempts to incorporate behavioral responses to changes in incentives. A simple example would be how customers respond to a 10-percent reduction in price. Data that incorporated previous price reductions could be used to estimate behavioral effects. For the purposes of our analysis, it is worth noting that extracting meaning

¹³ Tim Vlamis, "The Four Realms of Analytics," Vlamis Software Solutions, last modified June 4, 2015.

from free text and assessing the likelihood of various future outcomes is also a form of predictive analytics (e.g., How will this system perform given the specifications and operational environment?). However, there are multiple methods for extracting meaning from free text and inferring outcomes based on that information. In DHS, a common approach is for an individual analyst to read a document and assess potential outcomes (individually or in collaboration with other DHS entities). This is predictive analysis—even if it does not conform to "data scientist" definitions of the concept.¹⁴ However, there are other, more formalized, replicable, and reliable methods of text analysis that could be used.

Prescriptive analysis is the most mature form of analytics—focusing on the optimal strategy or course of action and informing decisionmaking. Typically, prescriptive analytics are presented as advanced rules in the form "if condition X occurs, then action Y is optimal." A simple example is inventory management: Wal-Mart anticipates hurricane season by positioning additional generators and plywood in warehouses throughout the coastal Southeast. In the event of a hurricane warning, supplies can be shipped quickly and efficiently. The hurricane warning triggers an action (additional supply) when the propensity to buy a product is above a threshold. For tactical and strategic decisions, optimization and simulation are the tools of choice for prescriptive analysis.

Analytic Maturity for Deliberative Governance

The IBM model, with prescriptive analytics at the pinnacle of maturity, does not necessarily lend itself to decisionmaking in the public sector. Unlike Wal-Mart (whose primary goal is the maximization of profits for shareholders), the government has no similar objective to optimize. Instead, the government is faced with competing and often conflicting objectives—for example, enforcing customs laws while facilitating the free flow of legal imports into the United States or providing emergency relief (e.g., food, water) to hurricane victims while rebuilding housing, power, and transportation infrastructure. Under these conditions, prescriptive analytics are more difficult to develop. Consequently, a more-nuanced version of a data and analytics maturity model is necessary. Ryan Swann and Todd Coleman present such a model, as shown in Figure 1.2.

¹⁴ IBM describes *predictive analytics* as follows:

Analyzes patterns found in historical and current transaction data, as well as attitudinal survey data to predict potential future outcomes. The core of predictive analytics relies on capturing relationships between explanatory variables and developing models to predict future outcomes. (IBM, "BAO Reference Architecture," January 27, 2011)

Sentiment analysis is widely understood as a text analytic outcome that reflects attitudes as part of that predictive profile. Most importantly, *Forbes* reports that "analysts at Gartner estimate that upward of 80% of enterprise data today is unstructured" (Juliette Rizkallah, "The Big [Unstructured] Data Problem," *Forbes*, June 5, 2017).



Figure 1.2. Federal Government Data Maturity Model

SOURCE: Ryan Swann and Todd Coleman, "The Federal Government Data Maturity Model," in *Data Cabinet Report*, Alexandria, Va.: U.S. General Services Administration, National Technical Information Service, undated.

Instead of using time as the x-axis, Swann and Coleman focus on the level (and sophistication) of the capability. Capabilities are made up of various components: data culture, data management, data personnel (human capital), systems/technology, and data governance.¹⁵ DHS-HQ largely occupies the "low capability" end of the maturity spectrum: disparate systems

¹⁵ Swann and Coleman, undated.

and groups, reactive data management at the individual system level, poor data quality, and little decisionmaking capability. This is not a universal assessment—cost information and acquisition information are generally of high quality—and it is not an indictment of DHS-HQ processes. It is simply a statement about the current maturity level of the DHS-HQ analytic inventory.

We also note that there are numerous pockets of diagnostic and predictive analytics across DHS-HQ, which we describe more fully in the following chapters. An analytic capability under the Swann and Coleman structure has six dimensions: type of analytics, data culture, data management, data personnel, systems and technology, and data governance. Although the type of capability generally employed by DHS-HQ (predictive analysis) may be "higher," or more complex, this does not preclude the use of lower-quality data or data management, or systems that fail to provide data-sharing capabilities. Many first-generation BI and analysis systems had technologies that that were already integrated into commercial enterprise IT systems (as seen in the Investment, Evaluation, Submission, and Tracking System [INVEST] dashboards discussed later in this report). However, future DHS systems "will require the integration of mature and scalable techniques in text mining (e.g., information extraction, topic identification, opinion mining, question answering), web mining, social media analysis, and spatial-temporal and database management systems."¹⁶

Also important in the DHS context is the recent big data revelation: Vast and growing amounts of data require extensive "domain knowledge"—that is, subject-matter expertise. Data analysts can learn how to conduct a t-test or write a Python program in a semester-long course, but domain knowledge cannot be taught as expeditiously. Additionally, the knowledge domains necessary to be a health care analyst are very different from those necessary to be a retail analyst or a DHS strategist.¹⁷

This report focuses on analytic capabilities—what is being produced with the data at hand; the data culture (how the data are collected and used); data management (how the data are documented); and the systems and technologies that facilitate analysis. Owing to the fact that many DHS-HQ data requests are directed to the DHS components, we focus less on data personnel. Documenting component-level requests and identifying the personnel responsible for fulfilling those requests was beyond the scope of this study. We did not evaluate data governance for similar reasons.

Applying the Federal Government Data Maturity Model to our main finding indicates that both PLCY and JRC rely on unstructured data (in the form of documents and spreadsheets) but that both offices have made an effort to assess whether the specifications will meet requirements. PARM and PA&E have access to more-integrated data systems and typically conduct morestructured analyses, although these analyses are often conducted in siloed ways. We define *siloed analyses* as analyses that lack shared data access and analytical tools, or that lack the

¹⁶ H. Chen., R. H. Chiang, and V. C. Storey, "Business Intelligence and Analytics: From Big Data to Big Impact," *MIS Quarterly*, 2012.

¹⁷ E. Dumbill, E. Liddy, J. Stanton, K. Mueller, and S. Farnham, "Educating the Next Generation of Data Scientists," *Big Data*, Vol. 1, No. 1, 2013.

mechanisms that would allow analysts to share their findings and validate their assumptions and outcomes. In some cases, there are relevant reasons why groups should own their analyses and work processes. However, DHS generally seeks an analytic strategy that identifies and unifies strategically "high-value" analyses—focusing on those that can improve understanding of how plans lead to particular outcomes.

Overview of This Report

In the following chapters, we present our inventory of the analytic tools, data, personnel, and methods that characterize current DHS-HQ analytic capabilities. We begin in Chapter Two by describing our methodology, which included a review of documentation and targeted interviews with key departmental staff and an interviewee-driven sample of other stakeholders and experts. Drawing on our document analysis, business process analysis, and output analysis, in conjunction with our interviews, we document the DHS-HQ analytic inventory in Chapter Three. A portion of that chapter is dedicated a discussion of each business process in DHS-HQ. Our analysis found that the Science and Technology Directorate (S&T) was integral to numerous analytic capabilities in the business process units (particularly the JRC and PARM);¹⁸ consequently, we interviewed several S&T principals to identify their analytic inputs into DHS-HQ, as discussed in Chapter Four.¹⁹ Chapter Five concludes the report and presents our recommendations.

Four appendixes provide supplemental information and background on the capability analyses presented in the report. Appendix A contains the semistructured interview protocol that guided our discussions. Appendix B presents more detail on DHS-HQ business process owner capabilities. Appendixes C and D provide an overview of findings from our business process analysis that informed our conclusions and recommendations.

¹⁸ PARM also coordinates across all the acquisition disciplines besides S&T operational test and evaluation and Office of Systems Engineering (OSE) across the MGMT Lines of Business Chief Executive Officers (CxOs) and ART community from which S&T is one of many. S&T support to PARM is generally conducted by OSE focused on technical assessments and operational test and evaluation assessments.

¹⁹ A full inventory of S&T analytic capabilities is beyond the scope and resources of this report. The technical expertise, data access, and modeling and analytic capabilities were generally more mature than those of the DHS-HQ business process owners. By relying on S&T for these more-mature analytics, DHS-HQ can reduce redundancy and focus on developing more value-added analytic tools.

2. Methodology: Collecting Information to Develop an Inventory of Analytic Capabilities

HSOAC was commissioned to conduct an inventory of DHS-HQ analytic capabilities, focusing on those that support strategic and operational decisionmaking by DHS senior leadership.¹ After defining *analytic capability*, we developed an inventory containing the following types of information:

- the name and a description of each capability
- a summary of the questions that the capability seeks to answer
- source(s) of data, including chains of custody and data-sharing requirements
- methods of data collection and analysis
- data structure, including any software required to access and manipulate the data
- data-accessing protocols, including restrictions and necessary credentials
- the party responsible for using the analytic output.

Identifying Business Process–Specific Analytic Requirements and Key Personnel

In the sections that follow, we identify DHS-HQ–specific analytic requirements and key personnel responsible for executing the necessary analytic functions and processes. We also investigated the scope and centrality of these requirements and personnel to DHS-HQ component missions. We did so by using existing DHS internal documentation to determine where and when analytic inputs are used in DHS-HQ decisionmaking. To guide this task, we developed an analytic table, shown in Appendix D.² We also conducted interviews with key leaders and analytic staff in each of the business process units. These interviews lasted 60–90 minutes (depending on interviewe availability) and followed the interview protocol in Appendix A. During our interviews, it became clear that structured data were rarely used in business processes, so we adapted our interviews to better understand the data structure, analytic techniques, and personnel used in practice. All initial interviewees (six) were asked to provide references for additional interviews. In this way, we created a chained sample of referrals, allowing us to increase the likelihood of capturing the full complement of analytic capabilities within DHS-HQ.

¹ The DHS-HQ offices included PLCY, JRC, PARM, and PA&E.

² The tables in Appendix D reflect an internally developed effort using the breadth of documentation received from DHS staff and interviewees.

Documenting Business Processes Related to Analytic Capabilities

We leveraged the aforementioned documents and interviews to inventory internal documentation (where available) and develop a process baseline to document the analytic capacity of each DHS-HQ business process owner. These business processes, summarized in Appendix B, guided the remainder of our research. We reviewed internal documentation for information about DHS analytic capabilities and data flows to and from each analytic tool. We paid particular attention to the draft Analytic Agenda developed by PLCY. Throughout this process, we identified component- and mission-specific analytic capabilities—focusing on data sources, data storage and retrieval, data access, analytic methods (including software requirements), and end-user information requirements.

Additionally, we collaborated with analytic program managers to document and identify analytic capabilities and the key personnel who oversee their execution. These managers included members of the Risk ESC, Strategy and Policy Executive Steering Committee (S&P ESC), and Analysis Subcommittee, as well as other component officials; we supplemented these interactions with additional sources of data to verify the analytic methods in use. Due to the narrow scope of our inventory, we did not interview these senior staff members. Table 2.1 shows the number of interviews conducted with each business process unit. In some cases, senior staff were able to provide an overview of the analytic inventory; in these cases, fewer staff were interviewed. The narrow scope of this project did not allow for an assessment of the quality, appropriateness, or utility of the various analytic capabilities or an assessment of their usefulness for decisionmaking. This is by design; an explicit evaluation of the analytic capabilities may have led to strategic behavior on the part of our interviewees.

Finally, we cross-referenced the analytic capabilities with DHS strategic goals, objectives, and subobjectives to identify potential gaps in the analytic inventory. Our research validation plan also included sharing our office-level analyses with our interviewees. This allowed us to make corrections, additions, and deletions, as well as to make follow-up inquiries. We sent interviewees their respective office's analysis via email and requested comments. The feedback we received is reflected in the chapters that follow.

An inventory of analytic capabilities requires both a component-specific analysis and a mission-oriented DHS-HQ analysis to ensure that gaps between the goals and objectives and the current analytic capabilities are identified (should they exist). In future research, we will identify analytic capabilities using component-based queries and provide a secondary analysis of that inventory based on goals, objectives, and subobjectives, as well as a secondary analysis of procedural documentation. In that review, we will consider gaps in capabilities. In this study, however, we did not evaluate analytic capabilities for sufficiency, adequacy, or performance.
Business Process Owner	Number of Interviews	
PLCY	6	
JRC	4	
PARM	3	
PA&E ^a	2	
S&T	3	
Total	18	

Table 2.1. Interviews, by DHS Business Process Owner

^a We interviewed one PA&E representative on two separate occasions.

Developing an Inventory of DHS-HQ Analytic Capabilities

Our initial intent was to provide a searchable database of analytic capabilities that DHS staff could update. However, the lack of systematic analytic tools prevented us from doing so. Instead, this report enumerates the analytic capabilities of each business process owner and serves as a benchmark for evaluating the analytic maturity of DHS-HQ business processes. It also provides strategic direction for DHS-HQ to improve data collection and data manipulation in what is a predominately document-driven process of strategy and requirements development, acquisition program accountability assignment, and risk analysis and evaluation.

In DHS-HQ, there are four offices with oversight and execution responsibilities as part of DHS-HQ integrated business processes: PLCY, JRC, PARM, and PA&E. To identify the analytic inputs and analytic capabilities within a DHS-HQ business process, it is helpful to understand the workflow and how decisionmaking in one office influences (or is supposed to influence) downstream decisionmaking and subsequent demand for analysis. Figure 3.1 provides an overview of DHS-HQ business process. We note that the process flows from departmental leadership guidance to strategy development and implementation, on to capability and requirements development, to programming and budgeting, and finally to acquisition and investment oversight. We present our results in the same order as shown in Figure 3.1.¹

In the following sections, we provide a brief description of departmental responsibilities. We then discuss the analytic inputs (analyses that are used at key decisionmaking junctures) and summarize the analytic inventory. Detailed summaries for each office can be found in Appendix B.



Figure 3.1. Strategy and the DHS-HQ Business Process

SOURCE: U.S. Department of Homeland Security, *FY17 Strategic Planning Guidance*, Washington, D.C., June 2017a.

NOTE: DMAG = Deputy's Management Action Group; OCFO = Office of the Chief Financial Officer.

PLCY

PLCY is DHS's mission-oriented organization and the principal advising office for the Secretary, Deputy Secretary, and component senior leadership on departmental policy and strategy. PLCY advises the Secretary and Deputy Secretary; develops, coordinates, and unifies

¹ This is how strategy is articulated in the Strategic Planning Guidance (see U.S. Department of Homeland Security, 2017a). However, interviewees indicated that this process is not linear and involves numerous feedback loops not shown in Figure 3.1.

policy positions within the Department; leads and coordinates international engagement and negotiations; and develops departmental strategic guidance and operational plans.²

We focused our investigation on PLCY offices that inform DHS-HQ integrated business processes, including the Office of Strategy and Analysis (S&A) and the Office of Operational Plans (PLANS), part of the Office of Strategy, Planning, Analysis, and Risk (SPAR). S&A develops strategic guidance for DHS, delineates senior leadership priorities to inform downstream business processes, and aligns component mission programs with DHS strategic goals and objectives. PLANS coordinates the development and execution of departmental and joint, interdepartmental operational plans to execute DHS missions and objectives.

JRC

The primary tasks of the JRC include reviewing, assessing, and evaluating DHS component capability and requirements documents. To facilitate this work, the JRC uses the Joint Requirements Integrated Management System (JRIMS).³ JRIMS ensures alignment between the Department's strategic objectives and capability investments (both materiel and nonmateriel). It also enhances DHS executive decisionmaking by validating capability needs and prioritizing needed capabilities.⁴

Additionally, the JRC provides the DMAG with materiel and nonmateriel (DOTmLPF+R/G/S)⁵ cost-informed recommendations regarding capability needs and solutions for capability development and portfolio optimization.⁶ Broadly, the JRC improves the Department's ability to make traceable, feasible, and cost-informed requirements decisions.

PARM

PARM supports the functions of the Chief Acquisition Office and is DHS MGMT's executive office for program execution. PARM serves as executive secretariat for the DHS ARB and is the MGMT Component Acquisition Executive (CAE) organization for DHS Level III HQ

² U.S. Department of Homeland Security, "Office of Strategy, Policy, and Plans," webpage, last modified July 9, 2018.

³ U.S. Department of Homeland Security, "The Joint Requirements Council (JRC)," Directive No. 071-02, February 2016a, p. 3. However, we note that the JRC analyzes requirements documents for all of DHS, not just the components. We also note that a new JRIMS manual became available in October 2018. Throughout this report, we use abbreviations and acronyms that were in use at the time of the interviews and in our follow-on communication with JRC staff.

⁴ U.S. Department of Homeland Security, *Department of Homeland Security Manual for the Operation of the Joint Requirements Integration and Management System*, Instruction Manual No. 107-01-001-01, April 2016c, p. 2.

⁵ The abbreviation DOTmLPF+R/G/S stands for "doctrine, organization, training, materiel, leadership and education, personnel, facilities, regulations, grants, and standards."

⁶ U.S. Department of Homeland Security, 2016c.

programs.⁷ PARM is also responsible for developing insights that improve the Department's program acquisition performance.

PARM works with agency partners to build, monitor, evaluate, and improve acquisition program management capabilities, as well as to sustain effective acquisition program oversight and develop decision analytics to support DHS senior leaders.⁸ PARM's objectives are to strengthen acquisition governance across the DHS Acquisition Lifecycle Framework (ALF), administer comprehensive program acquisition support, and lead and optimize the DHS acquisition enterprise to deliver capabilities and services that facilitate mission success.

In general, PARM works to mature overall acquisition program management capabilities, stakeholder management activities, acquisition governance, and operations; other goals are to improve policies, services, and capabilities that can increase the visibility, speed, performance, quality, and independence of acquisition-related assessments, risk analyses, reporting, and decision support.⁹

PA&E

PA&E is responsible for analyzing and evaluating the Department's plans, programs, and budgets; establishing policies and ensuring the integration of the Planning, Programming, Budgeting, and Execution (PPBE) system; developing and performing analyses and evaluations of alternative plans, programs, personnel levels, and budget submissions; and overseeing the development of the Future Years Homeland Security Program (FYHSP) and the Department's Annual Performance Plan.¹⁰ In these roles, PA&E reviews the components' five-year funding plans, advises DHS senior leaders on resource allocation, maintains the FYHSP database, and submits the annual FYHSP report to Congress.¹¹

During the component Program and Budget Review (PBR), PA&E conducts resource and program analysis, including evaluating five-year programming budgets to ensure that resource decisions are informed by substantive analysis and accurate data. PA&E also assesses component Resource Allocation Plans (RAPs) in coordination with programmatic issue teams during PBR; provides subject-matter expertise for analytic winter studies; and develops Resource Allocation Decisions (RADs) with input from DHS leadership, PLCY, JRC, Office of the Chief Information Officer, and the Chief Financial Officer (CFO)/Budget and Cost Analysis divisions, among others as necessary.¹²

⁷ U.S. Department of Homeland Security, "DHS Performance Work Statement (PWS) for Support Services to the Office of Program Accountability and Risk Management," Washington, D.C., June 2016d.

⁸ U.S. Department of Homeland Security, 2016d.

⁹ U.S. Department of Homeland Security, 2016d.

¹⁰ Pub. L. 108-330, Department of Homeland Security Financial Accountability Act, October 16, 2004, §§ 702.

¹¹ U.S. Government Accountability Office, *Homeland Security Acquisitions: DHS Has Strengthened Management, but Execution and Affordability Concerns Endure*, Washington, D.C., GAO-16-338SP, March 2016, pp. 12–13.

¹² U.S. Department of Homeland Security, 2016e.

Analysis Inputs

Analysis Inputs for PLCY

As illustrated in Figure C.4 in Appendix C, there are numerous junctures in the PLCY business process where analytic inputs are required for decisionmaking, but PLCY conducts two primary types of analyses: S&A strategic analysis and PLANS mission analysis.

In executing strategic analyses, S&A analysts identify broad programmatic and capability gaps in the alignment of DHS programs and objectives to develop strategies as directed by the White House, DHS leadership, or Congress. To develop strategy documents, analysts use existing DHS strategies stored in the DHS-wide Component Strategy Database; mission program budget data stored in the FYHSP database; and White House or DHS senior leadership guidance, DHS legal authorities, and input the annual DHS Strategic Planning Guidance. S&A analysts regularly collaborate with designated component staff, Department leadership, and SMEs to gain necessary operational context. They also receive regular guidance from the S&P ESC in conducting strategic analyses that align with the original scope of directives and leadership consensus.

Strategic analyses are integral to PLCY's ability to develop Department-wide strategies (such as the DHS Strategic Plan and the DHS Strategy for International Programs), issue-specific strategies (such as the DHS Cybersecurity Strategy), and component-specific strategies, including the U.S. Coast Guard's Western Hemisphere Strategy.

In executing mission analyses, PLANS analysts identify implied and specified tasks within leadership-directed planning guidance and strategies with the goal of supporting plan development for components. PLANS analysts use existing joint- and component-specific operational plans stored on the office's shared drive and consider DHS legal authorities, DHS leadership guidance, and corresponding DHS strategy objectives. The analysts also rely on inperson and electronic communication with component operational planners to provide the necessary operational context and to ensure alignment throughout the development of operational plans. We note that both strategic analysts and mission analysts use existing databases of strategies and plans; no structured data are available for analysis, other than cost data. This process requires analyzing highly unstructured data from past strategies and missions, as well as SME input from the components.

These analyses feed into the following decisions: scoping and problem definition, goal and objective setting, responsibility and capability assessments, and issue-specific strategies and operations. In all cases, these analyses are conducted using individualized data inputs, such as legislation, executive branch priorities, and directives from senior leadership. PLCY analysts assess this information and provide strategic analyses in the form of memos and recommendations. Owing to limited systematic data and analysis tools and chronic understaffing, PLCY's analytic capabilities are limited, difficult to document, and difficult to replicate. A consequence is that the effects of DHS-HQ strategy setting are similarly limited in terms of the

development of requirements for the components. We provide a more-detailed list of the analytic inputs discussed here in the section "PLCY Capabilities Summary" in Appendix B.

Analysis Inputs for the JRC

Although strategy and mission analyses from PLCY should drive requirements (at least in part), we noted that they have historically not had this effect. Instead, components are more likely to the drive this process: They initiate Capability Analysis Reports (CARs) and Mission Needs Statements (MNSs). The JRC is responsible for reviewing and analyzing inputs throughout the requirements development process. **The analytic inputs includes document review and evaluation, capability analyses, lessons-learned briefs,**¹³ as well as a separate set of analyses by S&T, discussed in Chapter Four.

Data analysis within the JRC consists primarily of assessing whether components have properly documented their requirements according to qualitative scorecards that measure the component's alignment with requirements documentation standards. JRC analysts have referred to this analytic process as evaluating capability materials against standards. Each full-time equivalent (FTE) for this task is responsible for a designated portfolio of two to three components. Each analyst also has access to a portfolio team that serves as the JRC's strategic integrator for its designated functional area. Cross-component portfolio teams (PTs) work on a combination of short-term efforts oriented to the budget cycle and focus on filling near-term capability gaps and identifying overlaps for potential reinvestment; longer-term initiatives focus on developing capabilities across DHS.

The second main analytic component within the JRC is evaluating capability analyses. Broadly, JRC evaluations look at component requirements documentation and assess whether the capability proposal will fulfill the operational gap that it was designed to fill. JRC analysts provide capability analyses for DHS-HQ's integrated business processes as part of the JRC's capability and requirements development function. To do so, they primarily use proposals within the component CARs, submitted as part of JRIMS. JRC analysts read and adjudicate comments from component staff, S&T staff, and designated SME PTs to resolve conflicting assessments and determine whether identified requirements are met by the component's proposal. Ultimately, JRC analysts populate a Capabilities Gaps Register (CGR) with the capability gaps identified in their analyses.¹⁴

Much like PLCY, data analytics in the JRC are limited, unsystematic, and rely on unstructured data in the form of Microsoft Word documents and Excel spreadsheets. The JRC's small staff means that component portfolios are large, and many analysts lack the expertise to assess the technical aspects of component requirements. JRC collaboration with other DHS-HQ offices is also limited and unsystematic. According to JRC interviewees, individual analysts may

¹³ JRC lessons-learned briefs (or quarterly metrics reports) are created by HSOAC analysts embedded within the organization. For an in-depth description of the briefs, see the section "JRC Capabilities Summary" in Appendix B.

¹⁴ The CGR catalogs operational capability gaps across DHS. The JRC uses the CGR to inform requirements prioritization, acquisition decisions, and investments for PARM and the S&T research and development office.

have horizontal interaction with PA&E and PARM to collect requirements data, but this varies by analyst. Additionally, the technical linkages between the JRC, PARM, and PA&E are lacking. As an example, the JRC's primary source capability and requirements document system, the Knowledge Management and Decision Support (KMDS) system, is not connected to PARM's primary SharePoint site or PA&E's data systems. S&T can and does provide technical assistance on these issues and (as discussed later) provides a suite of analytic tools to support this enterprise.

Analysis Inputs for PARM

PARM conducts analysis in support of DHS-HQ's integral acquisition oversight function. Broadly, **PARM analysts assess, report, and monitor acquisition program capabilities, management, staffing, planning, execution risks, and the overall program health of component acquisition programs** across the ALF and DHS-HQ's acquisition development and oversight process. PARM analysts conduct three primary types of analyses: **acquisition program planning; related staffing analyses; and risk, readiness, and health analyses.**

The main analytic inputs to PARM's analyses consist of reviews and evaluations of component acquisition program proposals found in ALF documentation, acquisition system technical reviews, and a separate but collaborative set of analyses by S&T, discussed in Chapter Four. PARM data analysis primarily involves assessing whether components have properly documented and assessed their proposed acquisition programs according to qualitative criteria measured by PARM in coordination with the ART and ARB communities. Both the ART and ARB reach out to the DHS-HQ CxOs, S&T, and the JRC for analytic reviews.

PARM analysts conduct workforce analyses on human resources deficiencies and gaps to support component staffing prioritization and planning. PARM analysts use metadata on SharePoint to extract component-submitted program staffing plans and use UVI system data transactions to retrieve cost and position billet data for relevant staff positions from Chief Human Capital Officer (CHCO) data sets. The PARM workforce analysis office collaborates with MGMT leadership to conduct gate reviews of DHS enterprise-related staffing policies.

PARM analysts conduct risk analysis using component acquisition strategies and plans; Acquisition Program Health Assessments (APHAs), which include contract analyses from the Chief Procurement Officer's (CPO's) office; and Information Technology Acquisition Reviews (ITARs). This essential analysis informs the APHA quarterly reporting assessment. The contracts are tied to multiple Level I and II acquisition programs, and PARM assesses future risks to these acquisition programs. PARM risk assessment analyses are conducted across the acquisition review process, with analysts working with ART to facilitate programs' advancement between planning and execution. PARM is generally more focused on programmatic issues; breaches, baselines, or rebaselines; and any aspects of program execution or staffing levels that could affect successful acquisition delivery.

Analysts use PARM's INVEST contract data, the cross-cutting data from OCFO's UVI system, and acquisition program data from the Master Acquisition Organizational List (MAOL)

to develop predictive analytics and assess the effect of existing DHS contracts on major proposed acquisition programs.

In support of acquisition programs, analysts use data stored in PARM's automated SharePoint tool to develop APHAs that analyze and measure the health of acquisition programs through a qualitative scorecard. PARM collaborates on APHA-related financial analysis with the DHS CFO communities at the DHS-HQ level.

PARM systems engineers conduct timeline analyses to inform the workflow management and traceability of acquisition artifacts throughout the ALF for all acquisition decision documents leading to Acquisition Decision Events (ADEs). These systems engineers extract component acquisition documents using PARM's Electronic Organization Document Management Process (eODMP), which contains the ALF documents submitted by DHS components and HQ offices. PARM analysts sort analytical comments and use eODMP to examine program health, risk, and other factors with DHS-wide implications.¹⁵

Within PARM, data collection, storage, and analysis rely on manual processing and data exchange (i.e., via emails or meetings), as well as online and offline systems (i.e., SQL BI Software, SharePoint as a Service [SPTaaS], MGMT BI environment). Analysts share data and services on SPTaaS, MGMT BI platforms, and other systems for BI reporting purposes. In all cases, these analyses are conducted using regularized quantitative data inputs, such as component staffing plans, component acquisition program proposals, and DHS contracts. We provide a more-detailed list of the analytic inputs in the section "PARM Capabilities Summary" in Appendix B.

Analysis Inputs for PA&E

As Figure C.8 in Appendix C illustrates, PA&E analytic inputs are required at numerous points in the DHS-HQ integrated business processes. **PA&E conducts two primary types of analyses: broad DHS program analyses and risk analyses**. Many of the analytic products that PA&E analysts develop are a combination of these types.

In conducting program analysis, PA&E analysts identify broad programmatic themes in program resources across DHS missions, goals, and objectives. These analyses inform resource prioritization and Secretary and Deputy Secretary decisions and support DHS Management Directorate (MGMT) leadership in developing Resource Allocation Decisions (RADs).

PA&E analysts also produce component PBRs, among other analytic outputs. They do so using component RAPs, which are submitted by components and stored in PA&E's SharePoint, the FYHSP database, and the OCFO's UVI system. They also rely on component-

¹⁵ We heard multiple descriptions of systems engineering technical assessments. Some systems engineers indicated that they conducted timeline analyses; others indicated that timeline analysis is part of the workload management process used to collect data, comments, and acquisition documents to facilitate ART and ARB activities. This is likely due to a difference in definitions, with some timeline analyses considered descriptive and others considered predictive.

submitted, PA&E-approved performance measure data¹⁶ and FYHSP five-year mission program data. PA&E analysts use the submitted RAPs and performance measures to ensure that components are applying risk-based reasoning in formulating proposed changes to their budgets. In some cases—but particularly during the PBR—PA&E analysts divide responsibility for a component's portfolio and subsequently meet with their component counterparts to verify any identified strategic performance gaps. Throughout this process, PA&E analysts rely primarily on component-facing data sets and regular collaboration with other DHS-HQ and component offices. Using program analytic capabilities, PA&E analysts develop additional analytic products in their programming and budgeting roles for DHS-HQ integrated business processes, including leading the development of DHS Strategic Reviews (SRs), winter studies, and the FYSHP report to Congress.

The second analysis type, risk analysis, allows PA&E analysts to identify broad areas of mission program effects and risk drivers to inform programmatic options to present to MGMT decisionmakers. Similar to their program analysis capabilities, PA&E analysts use component-submitted RAPs, performance measures, study plans, and planning priorities for these analyses. PA&E analysts collaborate with DHS-HQ and component programmatic issue teams to review the targeted program(s), develop an evaluation of findings and lessons learned, and submit the results to a high-level decisionmaking committee.

PA&E's program and risk analyses support key functions of the DHS-HQ integrated business processes. Winter studies, for example, are intended to inform multiple analytic processes, such as strategic planning, component PBRs, and requirements validation. In all cases, these analyses are conducted using systemized quantitative data sets, such as annually developed component budget data and self-evaluated performance measures. A detailed list of these analytic inputs and capabilities can be found in the section "PA&E Capabilities Summary" in Appendix B.

¹⁶ Component performance measures contain descriptions of the component's mission programs, a risk assessment of the programs operating under current budget levels, and a high-level summary of their performance in executing their mission programs under current budget levels. PA&E analysts approve the measures through an annual review cycle and a comprehensive verification and validation process to ensure the validity of these self-evaluated measures.

4. The Role of S&T

Unlike the DHS-HQ business process owners, S&T was established as a technical wing of DHS to provide analysis and solutions-driven responses to DHS technical problems. As noted in directorate materials, S&T delivers "effective and innovative insight, methods and solutions for the critical needs of the Homeland Security Enterprise."¹ Given S&T's mission, the Directorate has a much more developed set of analytical tools, data analysis techniques, and technical expertise—drawing on the specialized skills of both regular staff and contractors. Providing an inventory of the full range of S&T analytic methods and data was beyond the scope of this report. However, we did explore the areas in which S&T provides direct assistance to DHS-HQ business processes in PLCY, JRC, PARM, and PA&E.

S&T Capability Development Support Group

Over the course of our investigation into DHS-HQ's analytic capabilities, we discovered analytical intersections between the DHS-HQ business process owners and S&T's Capability Development Support (CDS) Group.

S&T's CDS Group consists of dedicated analytic offices that work closely with DHS components to ensure that their programs and systems reduce or mitigate the challenges that DHS faces, as well as to help these components execute their programs and systems in the safest, most-efficient, and most cost-effective way.² Analysts in the S&T CDS Group's Office of Operations and Requirements Analysis (ORA) and OSE provide need-based requirements and capability analyses in support of the JRC and PARM.

ORA analysts use technical and analytic expertise to identify, document, and prioritize cross-DHS capability gaps and find solutions for DHS component operations. In support of DHS-HQ business process owners, these analysts conduct requirements and decision analysis to assist with component capability requirements validation.

OSE systems engineers guide the development of complex or integrated technical solutions and support DHS program managers in assessing the complexity, risks, and operational and technical implications of potential solutions to determine the best courses of action for their acquisition programs.³ In support of DHS-HQ business process owners, OSE systems engineers conduct acquisition systems analysis that inform component acquisition programs.

¹ U.S. Department of Homeland Security, "Science and Technology: About S&T," webpage, undated-b.

² U.S. Department of Homeland Security, "DHS Science and Technology Directorate: Capability Development Support Group," fact sheet, December 8, 2014a.

³ U.S. Department of Homeland Security, "Science and Technology: Systems Engineering," webpage, undated-c.

S&T CDS Group Analytic Support to the JRC and PARM

ORA and OSE analysts and systems engineers support the JRC and corresponding DHS components during the JRIMS process. ORA analysts conduct capabilities or requirements analyses to assist DHS components in developing requirements. These analyses allow DHS JRC principals to address gaps, overlaps, and duplications at the enterprise level rather than at the individual component level, potentially generating significant cost savings across DHS.⁴ OSE systems engineers coordinate with components before they submit their requirements documents to JRIMS. Precoordination with component requirements offices ensures sound acquisition programmatic risk analysis that is conducted according to Component Capabilities Analysis Study Plan (CASP) and CAR guidance.

S&T OSE systems engineers support PARM analysts and review and evaluate DHS component acquisition documents throughout the phases of the ALF. Broadly, OSE engineers identify program risks for all major DHS acquisition programs. They also provide training to component staff to improve the analytic development of their concepts of operations (CONOPS), operational requirements documents (ORDs), and System Engineering Life Cycle Tailoring Plans (SELCs) for review and approval by PARM analysts.

Although some interviewees suggested that there was significant S&T ORA and OSE analytic support for the JRC and PARM, this view was not shared in our interviews with SPAR or PA&E analysts. We also did not observe the outputs of ORA and OSE technical support, but multiple interviews with JRC and S&T indicated that this support was taking place. Generally, SPAR and PA&E analysts rely primarily on internal analytic capabilities, the analytic capabilities of other DHS-HQ business process owners, or those of components' analytic offices. However, S&T ORA has supported specific initiatives in these offices. In particular, ORA assisted SPAR by conducting a Northern Border Strategy Implementation Plan analysis to develop measures and metrics for strategy implementation. ORA also analysts supported PA&E by conducting a headquarters-to-headquarters business analysis to identify efficiencies in providing centralized back-office support across DHS-HQ. Moreover, ORA is currently supporting PA&E by performing an air fleet mix analysis to determine the optimal mix of DHS air assets.

S&T ORA's System of Systems Operational Analytics Capability

S&T ORA is developing a System of Systems Operational Analytics (SOSOA) capability that will help DHS components and HQ offices improve their structured analytics, data integration, and data collaboration. SOSOA analysts are identifying cross-cutting needs for modeling and simulation (e.g., border security) and providing support to meet these needs. ORA is also introducing SOSOA to components and HQ offices in a non–cloud-based format to facilitate its use at the operational level. According to PA&E leadership, SOSOA's partnership

⁴ U.S. Department of Homeland Security, 2014a.

with its organization has been invaluable. Over time, components and HQ offices will use SOSOA to structure and share increased amounts of data internally. As the component and HQ office analytics reach maturity, ORA will introduce an enterprise version of SOSOA to drive the same improvements across DHS. The SOSOA capability's end state will be an DHS enterprise product that integrates all operational data using cloud-based software. Currently, ORA analysts are in the process of eliciting operational and lower-level requirements for SOSOA from the components and HQ offices.

5. Conclusion: Major Findings and Recommendations

This inventory of DHS-HQ (PLCY, JRC, PARM, and PA&E) analytic capabilities focused, in particular, on that the capabilities that support strategic and operational decisionmaking by DHS senior leadership. We used the following definition to operationalize our analysis of analytic capabilities:

Analytic capability is the ability to transform the data available at hand into valuable insights and actionable directives. . .. [A]nalytic capability involves developing rules, business logics, and algorithms that process information or data into predictive insights that have operational value for the organization.¹

In emphasizing the use of *the data at hand* in identifying patterns and testing hypotheses, this definition rejects the notion that an organization can or should rely on some idealized conception of perfect data that may not exist. It also states that data analysis should lead to insights and actionable directives. Our study focused on the analytic capabilities that inform decisionmaking and could lead to improved outcomes for DHS-HQ.

Table 5.1 presents our assessment of the maturity of the analytic capabilities of DHS-HQ business process units using the rubric outlined in Figure 1.2 in Chapter One. Overall, we found that demand for analysis is high, yet analytic capabilities, data culture, data management, systems and technology, and data governance lack many of the hallmarks of maturity.

In cases in which the inventory model identified more-mature capabilities (i.e., predictive analytics), these analyses often lacked replicability or external validity—that is, analysts may not be able to assess whether their predictions are valid.

Predictive analytics, when they are produced, are typically the result of a single individual or team of analysts reviewing often-unstructured data or a combination of structured and unstructured data, then devising a prediction about whether requirements meet strategic objectives, cost or staffing forecasts, or performance metrics. Much of this data work is siloed, although PARM and PA&E initiatives have provided programs with access to data. Much of the fractured analyses and data maintenance are due to the component structure of DHS, which makes it difficult for DHS-HQ staff to access data at the program and component levels.

¹ Lenka, Parida, and Wincent, 2017.

Category	PLCY	JRC	PARM	PA&E
Analytic capability	Descriptive/predictive	Descriptive/predictive	Descriptive/diagnostic/ predictive	Descriptive/diagnostic/ predictive
Data culture	Request	Request	High demand	High demand
Data management	Siloed; documentation sparse	Siloed; some documentation	Data managed with cross-functions in mind	Data managed with cross-functions in mind
Data personnel	Insufficient information	Insufficient information	Insufficient information	Insufficient information
Systems/technology	Siloed system	Siloed system; some programmatically accessed	Siloed system; some programmatically accessed	Some common data systems; key data can be programmatically accessed
Data governance	Loose affiliation of technical staff	Bureau-level collaboration	Bureau-level collaboration	Agency-level collaboration; data ownership and stewardship

Table 5.1. DHS-HQ Analytic Maturity Assessment, by Business Process Owner

Analytic Input Summaries

In this section, we present more detail on each business process owner's current level of analytic maturity, along with (in some cases) guidance for continuing to cultivate the capabilities, data culture, data management, personnel, systems and technologies, and governance practices that will facilitate future analyses and improve the quality and accuracy of insights gleaned from analytic processes. Table 5.2 summarizes the analysis types, data repositories, stored data, and analytic tools used by each business process owner.

Business Process Owner and Analysis Type	Data Repository	Stored Data	Analytic Tools
SPAR (including PLCY)			
Strategic analysis; mission analysis	Office of Management and Budget (OMB) Max	Complete and incomplete departmental strategies; Quadrennial Homeland Security Review (QHSR) developments	SharePoint; Microsoft Office Suite
JRC			
Document review and evaluation; capability analysis; lessons-learned briefs	KMDS system	All component JRIMS documents; CRMs; JRIMS Scorecards; CGR	Microsoft Office Suite

Business Process Owner and Analysis Type	Data Repository	Stored Data	Analytic Tools
JRC Continued			
Document review and evaluation; capability analysis; lessons-learned briefs	CRMs	All component and HQ comments on JRIMS documentation	Microsoft Office Suite
	JRIMS Scorecards	All qualitative evaluations of component JRIMS documents by JRC analysts	
	CGRs	Catalog all JRC component capability gaps across DHS programs	
PARM			
Program and CAE staffing analysis; acquisition program health analysis; risk analysis	UVI	ADE records; component staffing plans	SharePoint-aaS; Microsoft Office Suite; SQL BI;
	SharePoint Records Repository	All component acquisition documents: Acquisition Program Baselines (APBs); Integrated Logistics Support Plans (ILSPs); Acquisition Plans; Life Cycle Cost Estimates (LCCEs); Test and Evaluation Master Plans (TEMPs); SELC; Service Level Agreements; DHS contract records	Extract, Transform, and Load Tools with Mobius and Tableau
	INVEST	Level III HQ programs	
	MAOL	All Level I and II component acquisition and service programs	
	eODMP	All component acquisition documents, from distribution to final sign-off	
PA&E			
Program analyses; risk analyses; component PBR	UVI	Component RAPs; FYHSP data	SharePoint; Microsoft Office; Budget
	FYHSP	Seven years of present and past DHS budget data; future five-year DHS component programs and activity budget data	Formulation and Execution Manager; SAS; R; Enterprise GIS
	Issue-Studies SharePoint	Complete and develop analytic studies	
	General SharePoint	Component RAPs	

Table 5.2—Continued

PLCY

PLCY's analytic capabilities are limited. By the standards of the federal government data maturity model, PLCY's methods rely on disparate systems and groups, with reactive data management at the systems level, poor data quality, and little decisionmaking capability.

A fundamental problem with PLCY's analytic capabilities is the complexity of its process inputs (see Figure C.1 in Appendix C). PLCY relies on White House guidance, congressional legislation, DHS-generated leadership guidance, legal authorities, SRs, performance reports, and inputs from interagency and outside stakeholders. These inputs do not lend themselves easily to quantification or incorporation into data analytic methods. In the case of strategic and mission analysis, the fundamental approach relies on predictive analytics drawing on the perspectives of individual stakeholders or teams of experts. Quantitative risk assessment and strategic analysis is difficult (at best) under the current data structure.

Given that predictive analysis using foundational documents is likely to remain the primary analytic capability in PLCY, the office should develop and adequately maintain a document-sharing platform so that multiple analysts can work and share documents in real time—rather than having to collaborate via email and monitor version control.

PLCY should also work toward restructuring some of its data. This is true for both risk analysis and strategic analysis. However, it is unlikely that purely prescriptive analysis will supplant PLCY's complex and multifaceted analytic and decisionmaking processes. Instead, a quantitative approach would provide greater replicability and serve as a foundation for checking the assumptions and consistency of analyses.

JRC

The data inputs for the JRC are similar in structure to those of PLCY: predominately unstructured data in the form of Microsoft Word documents (e.g., CARs) or Excel spreadsheets (e.g., Comment Resolution Matrices [CRMs]). Data analysis is usually predictive, with analysts assessing whether platforms and programs will achieve stated requirements, but it does not rely on structured data or analytic tools.

The JRC uses CARs to develop the CGR. This list will improve as the number of CARs increases and as these reports capture a greater proportion of the DHS enterprise architecture. Additionally, there has been some coordination with S&T to address capability gaps. Ultimately, the CGR is designed to help drive S&T investment and prioritize the development of required capabilities. The JRC also manages and has access to the KMDS system, JRIMS Scorecards, and CRMs. However, little analytic work is being conducted with these unstructured data. Additional operations research staff would likely be required to conduct a systematic analysis. This would require an investment in staff development, along with software purchases.

Currently, there are multiple points in the requirements validation process that call for analytic inputs (see Appendix D). Most of these inputs are prescriptive analyses of complex documents and are developed during JRC document review and evaluation, S&T IPT analysis,

and capability analysis in the requirements validation phase. One novel output from the JRC is the quarterly lessons-learned brief. These documents, now referred to as *quarterly metrics reports*, are the only quantitative analysis conducted in the JRC and provide a numerical summary of CARs under review, which components are submitting CARs, and the duration of each phase of the JRIMS process.

PARM

Owing largely to its oversight of the ALF process and its responsibility for assessing the status of major acquisition programs, **PARM has considerably more structured data than PLCY and the JRC. PARM analysts have access to structured quantitative data for staffing and cost analysis**. Consequently, **PARM has developed more analytic tools** than PLCY and the JRC.

PARM's data exchange systems and data repositories include the UVI system, INVEST, MAOL, and eODMP. The UVI and INVEST data lend themselves to more-formalized analysis, while the organizational data are unstructured. However, **analyses are primarily conducted using spreadsheets.** The main analytic inputs for decisionmaking are (1) analysis-of-alternatives studies, (2) acquisition systems analysis, and (3) program and CAE staffing analysis. All of these analyses occur during the review and evaluation of component acquisition documents throughout the ALF process. See Appendix D for additional details.

PA&E

Apart from S&T, **PA&E has the most mature set of analytic tools and methods**. PA&E analysts regularly make use of SharePoint and Microsoft Office software, **but they also access and build models using budget formulation management and costing tools, and they execute those models using a range of software, including SAS, R, and Enterprise GIS**. PA&E's main analytic responsibilities are to conduct the annual PBR, maintain the FYHSP database, and produce the FYHSP report as mandated by Congress. These are major undertakings and require extensive expertise and analytic capability. In addition to these outputs, PA&E also undertakes budget and performance analysis in collaboration with the OCFO's Cost Assessment Division and at the request of departmental and DHS MGMT senior leadership. These requests are typically more unsystematic and require individualized data collection and analysis.

Although PA&E has robust SharePoint capabilities, it is unclear whether staff are aware of the SharePoint system documentation and other analytic software, whether they know what information is available in the SharePoint system, and whether they understand how to access the system. Other DHS business process owners could benefit from knowing that PA&E's SharePoint system includes all component RAPs and all complete and developing analytic studies.

Recommendations

Overall, both PLCY and the JRC would benefit from the following improvements to facilitate collaboration and the quality of analytic inputs:

- more-extensive use of SharePoint or other document collaboration software to allow multiparty processing of documents and repositories that are easily accessible to all authorized parties
- more structure in the highly unstructured data currently in use.

These changes would require standardizing (to the extent possible) such documents as CARs and MNSs, or when staffing and software are available, a systematic qualitative analysis of the detailed documents that serve as the main inputs in the current analytic process.

Both PARM and PA&E have more-mature and -structured data-driven analytics—largely owing to the personnel and cost data used in their analyses than do PLCY and the JRC. Nevertheless, the analyses we found that their processes were often siloed—that is, analyses belonged to and were developed by a single individual or study group brought together for particular purposes. This may lead to quality and replicability problems. Note that we did *not* assess the quality of the analysis; we addressed analytic quality in this report only to emphasize that siloed analyses are more susceptible to error, misconception, and redundancy than work that is done collaboratively using publicly reviewable methods. Consequently, PARM and PA&E would likely benefit from the following improvements:

- producing fewer siloed analyses by providing for more collaborative systems
- providing mechanisms for sharing on-demand data requested from components.

Overall, DHS-HQ has made important strides in developing an Analytic Agenda and building and maturing its analytic inventory over the past four years. The current Analytic Agenda calls for further maturation of these analytic capabilities. By providing better platforms for sharing information and analytic tools and methods, promoting transparency and replicability in analysis, and improving the quality of much of the highly unstructured data available to DHS-HQ employees, the Department would go a long way toward fulfilling its Analytic Agenda objectives.

Instructions

The following are the dimensions of the analytic inventory that we were interested in cataloging. We note that this list of questions is not exhaustive and that one-on-one interviews were semistructured to incorporate input that respondents deemed important but that was not covered by the questions listed here. Our goal was to take a holistic approach to fully capture the analytic capabilities currently in play.

Data

Most definitions of *analytic capability* involve the manipulation of data into actionable information. However, we wanted respondents to **think broadly about data sources.** Data may come from expert panels, focus groups, SMEs, gaming, situational and risk assessments, personal communications, and other sources that are not standard quantitative databases. We asked users to consider *both* the qualitative and quantitative data.

Interview Questions

Name and description of the capability:

- What is the name you use internally to reference this analytic capability?
- In one or two sentences, how would you describe the capability?

Summarize the questions that the analytic capability seeks to answer:

- State specifically the question(s) answered by this analytic capability.
- Who requested/required that that question be answered?
- Who is responsible for providing the answer?
- Is the answer produced within DHS?
 - If yes, where is the answer produced?
- How precise is the answer to the question? (e.g., Does it provide a range of options or an "optimal" solution?)

Data sources (including chains of custody and data-sharing requirements):

- What are the data sources used for this analytic capability? List all.
- Where do these data come from? List all.
 - For each data source:
 - What is the chain of custody of data?
 - What are the data-sharing requirements?

- What credentials are required to use or view data?
- How does the analyst present the necessary credentials?
- Is there a data-use agreement?
- Is there a memorandum of understanding?
- What data-sharing protocols are in place?
 - Are there better ways of accessing the data?

Data collection:

- What methods are used to collect these data (e.g., survey, data scraping)?
- Who is responsible for data cleaning and quality assurance?
- Are the data validated against published estimates?

Data structure:

- Are the data that you use structured or unstructured? (Structured data are easily searchable for such factors as numbers, true/false, names, and phone numbers. Unstructured data include such factors as human language or webpage links that do not fit well into search algorithms and searches and often return results that are not desired.)
- What types of queries do you perform with the data?
- What challenges does the structure of the data present in the queries you conduct?
- Do you look directly at the data or do you look at the results of the analytics?

Data analysis:

- What is the model or tool?
- What is the program or software used to manipulate data (e.g., R, Stata, SAS, Excel)?
- Describe the primary data analysis strategy (e.g., descriptive statistics, regression/correlation, forecasting).
- What was the learning curve like to execute this analysis?
- Was there substantial training required?
- To what extent was the training general training or subject-matter specific?
- How is the data analysis strategy altered in the face of errors or bad estimates?
- Is there feedback for model improvements built into the analysis?
- How is the data analysis presented to the final user (e.g., report, memo, briefing, slide presentation)?

Party responsible for using the analytic output:

- Who is responsible for using the analytic output?
- What office is responsible for using the analytic output?
- How frequently does the decisionmaker require updated analysis? (weekly, monthly, quarterly, yearly)

- Based on your experience, how closely does the decisionmaker adhere to the recommended analysis?
- Based on your experience, how reliable is the recommendation that comes from the analysis.
- Does the decisionmaker consider multiple streams of analysis in making a decision?
- How does this fit into the "big picture" of what you are doing?
- On a scale of 0–100 (where zero indicates no influence, and 100 indicates that the analysis completely determines the decision), how influential is the analysis to the decision?

Lexicon

Analytic capability is the ability to transform the available data into valuable insights and actionable directives for the organization.¹

Term ^a	Insight or Directive
Capability	Means to accomplish a mission, function, or objective
Data	Outputs of or inputs to assessments and analyses
Decision analysis	Techniques, body of knowledge, and professional practice used to provide analytical support for making decisions through a formalized structure
Evaluation	Process of examining, measuring and/or judging how well an entity, procedure, or action has met or is meeting stated objectives
Model	Approximation, representation, or idealization of selected aspects of the structure, behavior, operation, or other characteristics of a real-world process, concept, or system

^a Terms adapted from the DHS Risk Lexicon.

¹ Lenka, Parida, Wincent, 2017.

PLCY Capabilities Summary

Main Capabilities (What capabilities are unique to PLCY?)

S&A analysts identify broad programmatic and capability gaps by analyzing foundational strategy documents and through unsystematic collaboration with DHS components to develop DHS QHSR, DHS Strategic Plan, and issue-specific strategies. PLANS analysts initiate coordination and enable collaboration with component operational planners to support operational plan development to execute multicomponent joint-mission programs.

Data Sources (Where does PLCY extract the data from?)

SPAR analysts extract and use data from DHS components and HQ analytic products. S&A analysts use existing Department and component strategies, DHS SR findings, and component program budget data collected as part of the FYHSP to conduct analyses and develop strategic planning products. Strategy analysts use existing strategies to ensure alignment of current DHS component mission programs with new strategy goals, objectives, and subobjectives; SR findings to measure strategy performance and improve the alignment of DHS programs and strategic objectives in updated strategies; and the FYHSP to identify and align programmatic budgetary resources with strategy goals and objectives.

Data Collection (How does PLCY collect the data?)

SPAR analysts primarily use manual means to collect, manipulate, and disseminate data. Analysts typically collect data through phone calls, roundtable meetings, and email exchanges with component staffs and SMEs.

During strategy development, S&P ESC convenes intercomponent working groups with S&A and DHS component leads to enhance data collaboration and collection. The S&P ESC principals invite members with relevant expertise to participate in strategy working groups and represent their components, serving as points of contact, throughout the development process.¹

During operational plans development, PLANS analysts collect data from components manually and use email to distribute CRMs as Excel workbooks or Word documents to component planners.

¹ U.S. Department of Homeland Security, 2017a, pp. 25–26.

Data Structure (How does PLCY store and structure the data?)

SPAR analysts manually store and structure data using Microsoft Office Suite software. Documentation, data sets, and analyses take the form of Word documents, Excel spreadsheets, or PowerPoint slides.

Data Analysis (What type of data analysis does PLCY execute?)

To perform PLCY's strategic planning function, S&A analysts conduct strategic analysis identifying broad programmatic and capability gaps in the alignment between of DHS programs and strategy objectives; these analyses draw on foundational strategy documents and data collected through unsystematic collaboration with components. S&A's risk analysis section leads, advises, and recommends risk-based analyses during strategic planning, including the development of Homeland Security National Risk Characterization (HSNRC) and the Enterprise Risk Management Program initiatives.

Furthermore, PLANS analysts conduct mission analyses to identify implied and specified tasks within leadership-directed planning guidance to support components' plan development. PLANS analysts may also conduct rapid analyses by request using quantitative models for cognitive mining and collaborating with component planning teams on operational plan development.

End Users for PLCY Analytics

The following DHS elements use PLCY analytic outputs:

- 1. Secretary of DHS
- 2. Deputy Secretary of DHS
- 3. Under Secretary for Policy
- 4. JRC
- 5. PA&E
- 6. DHS support and operational components.

Gaps and Deficiencies

In our interviews, SPAR analysts described deficiencies in their access to data repositories, the lack of a user-friendly SharePoint document collaboration tool, and analyst understaffing for risk analysis.

S&A analysts do not have access to the KMDS system, which stores all componentsubmitted JRIMS requirements documents. Access to the KMDS system is limited to JRIMS gatekeepers (one per component) because of licensing and contracting costs.

S&A is the only office in PLCY that uses the OMB Max SharePoint tool. However, these analysts had varying levels of familiarity and comfort in using the tool. Moreover, PLANS analysts do not have a SharePoint software capability for document collaboration or integration. An accessible SharePoint capability would improve document collaboration and likely decrease the number of hours analysts spend on manual document integration. The risk analysis section of S&A has not been able to replace three risk analyst FTEs. Currently, S&A has a single risk analyst FTE. Understaffing in risk analysis lengthens the time spent on component coordination, document analysis, and meetings with component staffs. Because of limited staffing, the risk analyst section lost the capacity to develop a data index in R (open-source data analytic software), which was used to build risk assessments for DHS mission programs.

JRC Capabilities Summary

Main Capabilities (What capabilities are unique to JRC?)

JRC analysts provide capability gap analysis for DHS-HQ's integrated business processes in support of the JRC's capabilities and requirements development function. The JRC produces a CGR that catalogs component capability gaps across DHS and informs requirement prioritization, acquisitions decisions, and investments by the DHS PARM and the S&T research and development office.

Data Sources (Where does JRC extract the data from?)

JRC analysts extract data from component JRIMS capability and requirements documents submitted by DHS component requirements offices. DHS components submit CASPs, CARs, MNS, Non-Materiel Change Recommendations (NMCRs), CONOPS documents, ORDs, and Urgent Operational Need documents to initiate JRIMS and meet capability requirements validation requirements.

DHS component capability and requirements documents provide the necessary validation for components to fill operational requirements gaps through the Department's acquisition process.

Data Collection (How does JRC collect the data?)

JRC analysts primarily use manual means to collect, manipulate, and disseminate data. Analysts collect requirements data through phone calls, roundtable meetings, and email exchanges with component staffs and SMEs. DHS components, or sponsors, submit a CASP and CAR to the JRC to initiate the JRIMS process. JRC analysts evaluate sponsor documentation using qualitative criteria-based JRIMS Scorecards during the commenting phase of JRIMS.

After an initial review to determine the appropriate PT and community of interest, JRC analysts release the capability document to these teams, which review the document according to their issue-specific expertise and make comments in CRMs for sponsor revision and input into the KMDS system. JRC analysts review these materials concurrently. CRMs are distributed and collected through JRIMS gatekeepers (designated DHS FTEs with licensed access to the KMDS system), who manually collect and integrate the comments. JRC analysts may also reach out to other SMEs, including HSOAC FFRDC or DHS S&T CDS Group analysts.

Data Structure (How does JRC store and structure the data?)

JRC analysts use Microsoft Office Suite software to store and structure data. All component capability and requirements documents, CRMs, and analyses take the form of Word documents, Excel spreadsheets, or PowerPoint slides in the following data repositories:

- **KMDS system:** This is the JRC's centralized repository for storing and extracting JRIMS documents. JRC analysts use sponsor-submitted capability documents to align sponsor requests with current DHS missions and objectives. Analysts also extract data analytics on JRIMS document-processing times and conduct categorical comparisons using the KMDS system.
- **CRMs:** CRMs are the JRC's primary data repository for the JRIMS commenting and comment adjudication phases. CRMs are stored in the KMDS system.
- **JRIMS Scorecards:** JRC analysts evaluate sponsor documentation using qualitative, criteria-based scorecards. These scorecards measure alignment with DHS strategies, technological feasibility, cost, areas for sponsor collaboration, and alignment with DHS cybersecurity standards. All JRIMS Scorecards are stored in the KMDS system.
- CGRs: See the section "JRC" and Table 5.2 in Chapter Five for a discussion of CGRs.

Data Analysis (What type of data analysis does JRC execute?)

JRC FTE analysts conduct very little structured analysis during the JRIMS review process. However, HSOAC analysts embedded in the JRC to support analytics development produce quarterly metrics reports that update JRC principals on metrics from the JRIMS commenting phases. The quarterly metrics reports analyze JRIMS CRMs and quantify which components are making comments on requirement documents, how many comments components are making, and how components are commenting on CRMs to improve the full range of front-end dialogue with the components during JRIMS. The briefs also map the Department's enterprise architecture to highlight the DHS mission capability areas covered by existing JRIMS documentation.

End Users for JRC Analytics

The following DHS elements use JRC analytic outputs:

- 1. Under Secretary for Management (USM)
- 2. PARM
- 3. S&T research and development
- 4. S&T IPTs
- 5. S&T ORA
- 6. DHS support and operational components.

Gaps and Deficiencies

In our interviews, JRC analysts communicated deficiencies in analyst staffing and noted that a recent workforce assessment concluded that JRC analysis is short seven FTEs. Moreover, we observed highly unstructured data in the JRC's primary data repository, the KMDS system.

The JRC is unable to fulfill its capability requirements prioritization role for DHS because of operations research analyst understaffing. Lack of sufficient human capital to execute operations and systems analysis forces the JRC to focus on its JRIMS oversight role in evaluating materials against standards. Due to the frequently mentioned and self-reported shortage of staff, the JRC is also limited in its ability to facilitate the development of joint requirements for the Department. The JRC has access to staff augmentation and technical expertise via outside contracting sources, however.²

KMDS system data are not quantified, easily accessed, or organized by subcategory (e.g., cost-based comments, technology feasibility-based comments). Moreover, JRIMS documentation templates are not standardized and thus remain difficult to systemize in the KMDS system. If JRIMS documentation templates were mandatory and standardized, documents could be fully searchable (versus metadata only) using the existing capabilities in the KMDS system. Quantifying and systemizing KMDS system data could also provide useful insights to identify prevalent concerns among components regarding capability requirements or errors they are consistently making in the JRIMS process.

PARM Capabilities Summary

Main Capabilities (What capabilities are unique to PARM?)

PARM's unique capabilities including providing analytics to facilitate acquisition reviews of MAOL programs and producing comprehensive program acquisition management, health, and risk-based analytics that incorporate all major core acquisition disciplines and data sets (e.g., acquisition staffing and strategies, contracts, scheduling, costs, performance, investments in systems engineering, logistics, external factors affecting program execution).

PARM facilitates acquisition governance on behalf of the Deputy Secretary for Homeland Security (S2) or the USM, if designated by Acquisition Management Directive D102-01-001, in the following ways:

- PARM provides acquisition program management and technical and operational analytics. PARM division analysts assess, report, and monitor acquisition program capabilities, management, staffing, planning and execution risks, and the overall health of component acquisition programs across the ALF.
- PARM staff positions cut across the D102-01-001 multidisciplinary series, and PARM has a unique capability to perform analytics to determine the risks, trends, readiness, and health of acquisition programs across ALF planning and execution cycles.
- PARM analyzes program acquisitions, and its risk-based approach assesses management plans, strategies, execution, and performance across DHS MGMT, CAE organizations, and DHS component acquisition programs.

PARM is also capable of agile delivery of automation solutions, as well as providing analytical records management capabilities, data exchange services, and BI and reporting

 $^{^{2}}$ For a more complete analysis of JRC organizational and staffing issues, see Vasseur (2018).

capabilities for DHS MGMT to support D102-01-001 governance and operational decisionsupport services.

Data Sources (Where does PARM extract the data from?)

PARM analysts extract data from component acquisition documents submitted by DHS component requirements offices. DHS components submit LCCEs, ILSPs, APBs, SELC Tailoring Plans, Cost Estimating Baseline Documents, and TEMPs to meet DHS ADE requirements throughout the ALF.

PARM analysts extract data from DHS component resourcing documents, including RAPs, RADs, component staffing plans, integrated master schedules and plans, risk management plans, and Executive Steering Committee or Program Management Review PowerPoint slides.

PARM provides additional analytic support for acquisition leadership through Acquisition Decision Memos (ADMs), prebriefs, and reports, including APHAs, high-visibility presentations, and ART and ARB PowerPoint slides.

PARM extracts internal using the MAOL, which stores information on all Level I and II component acquisition costing \$1 billion or more and \$300 million or more, respectively.³

Data Collection (How does PARM collect the data?)

PARM analysts use systemized and manual means to collect, manipulate, and disseminate data. Analysts use SharePoint software and phone calls, roundtable meetings, and email exchanges with component staffs and SMEs to collect requirements data for inclusion in PARM data repositories.

Data collection, storage, and analysis rely on manual processing on data exchange (i.e., emails, meetings), as well as online and offline systems (i.e., SQL BI, SPTaaS, MGMT BI environment). PARM analysts use SPTaaS as more than a collaboration tool. They also use it to share data and services with MGMT BI platforms and other systems sources for BI reporting purposes.

Data Structure (How does PARM store and structure the data?)

PARM analysts use Microsoft Office Suite software in systemized data repositories to store and structure data. All component acquisition documentation, RAPs, RADs, and PARM analyses are contained in Word documents, Excel spreadsheets, or PowerPoint slides in the following reports, systems, and data repositories:

1. **Unified UVI System:** Incorporating data from six DHS offices (CFO, CIO, CHCO, PARM, and CPO), UVI is a cross-cutting effort that integrates data and expertise from across the organization.⁴ It seeks to provide greater insight for budget and resource

^{3.} U.S. Government Accountability Office, *Homeland Security Acquisitions: DHS Should Better Define Oversight Roles and Improve Programs Reporting to Congress,* Washington, D.C., GAO-15-292, March 2015.

⁴ U.S. Department of Homeland Security, Office of Program Accountability and Risk Management, "UVI Marketing Slick Sheet," Washington, D.C., undated.

planning and will improve DHS's efficiency in implementing and executing its goals. The UVI effort is tasked with building a centralized and authoritative view of DHS major acquisition programs, which will provide management and component personnel with a consistent set of financial, procurement, programmatic, and technical data to support reporting and decisionmaking.⁵

- 2. SharePoint Records Repository: PARM's SharePoint Records Repository is its primary source data storage system. The repository stores all component-submitted ALF documents and acquisition program contract records. In support of PARM, CAEs ensure that acquisition documents are submitted in a timely manner with monthly updates, as necessary, for all Level I and II major acquisition programs.⁶
- 3. **INVEST:** INVEST stores Level III DHS-HQ acquisition programs, and some data are exchanged into the system from PARM's SharePoint Records Repository.
- 4. MAOL: The MAOL is a report generated through an automated program tracker and a change tracker processing capability in SharePoint. The MAOL distinguishes the Department's major (Level I and Level II) programs, post–full operational capability (FOC) activities, the nonmajor (Level III) programs, and nonacquisition activities. It also delineates between each program's oversight and reporting requirements and is divided into categories, with information and basic requirements for each. The MAOL is maintained by PARM and is the sole authoritative list of data on DHS Level I and Level II acquisition and service programs. Level I and Level II acquisition and service programs (those between ADE-1 and FOC that receive funding during the FYHSP) are included on the MAOL and are considered major programs.⁷ Furthermore, to consolidate DHS reporting requirements, the MAOL also lists post-FOC programs, Level III programs, and the nonacquisition activities required to complete an OMB Business Case. The MAOL is approved by the DHS Chief Acquisition Officer.⁸
- 5. **eODMP:** eODMP is an organizational document management processing capability that PARM uses to acquire ALF documents submitted by DHS components and DHS-HQ offices for review and analysis. PARM analysts organize and group analytical comments in the tools and use eODMP to examine program health, risks, and other factors with DHS-wide implications.

Data Analysis (What type of data analysis does PARM execute?)

To perform PARM's acquisition oversight function, workforce analysts conduct three-year trend analyses on human resources deficiencies and gaps that assist component staffing

⁵ U.S. Department of Homeland Security, Office of Program Accountability and Risk Management, undated.

⁶ U.S. Department of Homeland Security, 2016b, pp. 14–18.

⁷ U.S. Department of Homeland Security, 2016b, p. 35.

⁸ U.S. Department of Homeland Security, 2016b, p. 35.

prioritization planning. The PARM workforce office also collaborates with the USM office to conduct gate reviews of DHS enterprise–related staffing policies.

Analysts also execute quarterly APHAs, an automated SharePoint tool that will analyze and measure the health of acquisition programs through a qualitative scorecard. PARM collaborates with the DHS CFO communities on APHA financial analysis.

PARM systems analysts assess acquisition strategies and plans and leverage the inputs from APHAs, which include essential contract analyses from CPO, along with the ITAR process, to inform quarterly APHA assessment reporting.

PARM systems engineers conduct timeline analysis to inform the workflow management and traceability of acquisition artifacts throughout the ALF for all acquisition decision documents leading to ADEs.

End Users for PARM Analytics

The following DHS elements use PARM analytic outputs:

- 1. Deputy Secretary
- 2. USM
- 3. MGMT CxOs (CFO, CPO, CIO, CHCO)
- 4. OSE
- 5. S&T Office of Test and Evaluation
- 6. National Protection and Programs Directorate
- 7. Component representatives across the CAEs, MAOL Program Management Offices, CxOs, and Executive Steering Committee members.

Gaps and Deficiencies

We found gaps in staffing among senior-level advanced analytical capabilities in certified skills areas and core disciplines, including program analysts, digital data analysts, systems analysts, systems engineers, or program management analysts. Developing progressive hands-on practitioner experience at the component and programmatic levels is a continuing challenge in building analytic capacity. Many analysts currently conduct the basics of oversight administration but lack the strong analytical experience needed for technical evaluations.

There are no digital data analysts on staff. PARM has one agile FTE who oversees and delivers systems engineering capabilities and manages PARM's technical environment, which provides technical analytical capabilities and reporting. Work is augmented using two FTE development contractors and a 0.5 FTE architect contractor.

Moreover, there is a lack of qualified systems engineers at PARM who specialize in acquisition systems and technical evaluation. This shortfall is forcing PARM systems engineers to use OSE for support. PARM analysts receive analytic support from OSE analysts in reviewing and validating component acquisition documents during the analyze, select, and obtain phases of the ALF.

PA&E Capabilities Summary

Main Capabilities (What analytic capabilities are unique to PA&E?)

PA&E's purview is cross-component issues of significant magnitude and/or leadership interest with an eye on the FYHSP. In addition, PA&E handles performance management and tracks strategic and management performance measures for programs across DHS. PA&E analysts perform broad DHS programmatic resource analysis and facilitate HQ collaboration and coordination between DHS components and HQ business process owners throughout the PPBE system. Specifically, PA&E analysts identify broad themes in DHS program resources across missions, goals, and objectives to inform resource prioritization and support DHS senior leadership in RAD development.

Data Sources (Where does PA&E extract the data from?)

PA&E analysts primarily extract and use data from DHS RAPs, the FYHSP database, and the collaborative Management Cube initiative. Components submit RAPs to PA&E analysts, who use annually submitted component RAPs to initiate and execute the PBR process. The PBR drives linkages between the requirements planning (strategy and requirements) validation and resourcing processes at DHS-HQ.

Data Collection (How does PA&E collect the data?)

PA&E analysts primarily use manual means to collect and distribute data. Analysts collect data through phone calls, roundtable meetings, and email exchanges with component staffs and SMEs. They also collect and use component program budget data inputs from the FYHSP database.

Data Structure (How does PA&E store and structure the data?)

PA&E analysts use Microsoft Office Suite software in structured data repositories to store and organize data. Documentation, data sets, and analyses take the form of Word documents, Excel spreadsheets, or PowerPoint slides.

PA&E uses several data repositories to store different component program and budget data:

FYHSP: The FYHSP database captures seven years of DHS budget data, with a forward-looking five-year budget for DHS component programs and activities. The FYHSP also aligns resources with the Department's strategic plan and functional capability and captures Component Strategic and Management performance measures. Components update the FYHSP three times a year: (1) the RAP phase (reflects component RAP submissions), (2) the OMB phase (reflects the Secretary's RAD), and (3) the congressional phase (reflects the President's Budget). A Strategic Context is submitted to Congress with the President's Budget submission, and an FYHSP report is submitted to Congress shortly thereafter. Performance management information is updated four times

a year to reflect the quarterly performance updates. PA&E stores all resource and performance information in the FYHSP database.

- 2. UVI System: The OCFO's UVI tool stores budget data sets, such as component RAP and FYHSP data, to improve automation in PA&E's budget and cost analyses. For more information, see the section "PARM Capabilities Summary," earlier in this appendix.
- 3. **Budget Formulation and Execution Manager (BFEM):** PA&E is collaborating with OMB to expand the current BFEM data repository system to include five years of information. The BFEM initiative will continue to strengthen the data transition between programming and budgeting and will provide the data with greater fidelity.
- 4. **Management Cube initiative:** The Management Cube initiative is a BI system that compiles data from across all MGMT CxOs (e.g., CFO, CHCO, CPO, CRSO) in a structured manner. Within this system, there is a formal procedure by which any individual can request data in the form of a report or other means.
- 5. **Issue-Studies SharePoint:** PA&E stores all completed and developing studies on its SharePoint site and shared drive. Currently, the system is not shared with other DHS-HQ offices.
- 6. **SharePoint site:** PA&E's general SharePoint site stores component RAP submissions. DHS partners and components can request access.

Data Analysis (What type of data analysis does PA&E execute?)

For resource allocation, PA&E analysts conduct program analyses using internal long-term and short-term studies, allowing them to review component RAP submissions, assess component resourcing issues, and inform decisionmaking during the PBR. Furthermore, PA&E conducts risk analysis during the component PBR to identify broad operational effects, as well as risk drivers, to inform programmatic decisions by DHS senior leadership.

PA&E analysts also execute independent program analyses and, in some cases, annual winter studies. For independent analyses, PA&E analysts survey the landscape to identify areas where decisions may be necessary or relevant and/or where there is unacceptable risk. These analyses are intended to support future decisions, whether related to policy, requirements, acquisition, or resources. Winter studies are component-resourced analytic efforts identified in the RPG involving both a component and a DHS-HQ lead to coordinate review activities. PA&E participates in winter studies and occasionally leads them. However, ultimately, components develop the study plan, priorities, and goals for the analytic effort. DHS-HQ and component teams subsequently review the program, develop an evaluation of the findings and lessons learned, and submit the finalized study. Winter studies consist of DHS programs identified within the RPG that need individual study and review to determine strategic alignment, programmatic risk, or capability gaps. Winter studies are intended to inform multiple analytic processes, such as strategic planning, component PBRs, and requirements validation.

Data Accessibility and Data-Sharing

Data integration and accessibility between DHS-HQ business process owners and PA&E are based on participation in the collaborative analytic process, such as through PBRs, SRs, and performance reviews. PLCY and the JRC receive and collaborate with PA&E analysts throughout the year and during the component PBR. PLCY, JRC, CIO, CRSO, CPO, Chief Security Officer, CHCO, PARM are all invited to the CFO Council Special Sessions—the pre-DMAG decisionmaking body during the component PBR.

Data are regularly shared with PARM and PLCY through SharePoint. PA&E analysts also have access to PARM data repositories, and all FYHSP data are available to the DHS program of record.

End Users for PA&E Analytics

The following DHS elements use PA&E analytic outputs:

- 1. DHS Secretary
- 2. Deputy Secretary of DHS
- 3. USM
- 4. CFO
- 5. PLCY
- 6. DMAG
- 7. CFO Council
- 8. ARB
- 9. JRC
- 10. CIO and Council
- 11. CRSO and Council
- 12. CHCO and Council
- 13. AGB.
Appendix C: DHS-HQ Business Process Flow Charts

The following DHS-HQ Integrated Business Process Flow Charts are the product of an effort by the study team to diagram each DHS-HQ business process phase (strategic planning, resource allocation, and requirements development and acquisition oversight) based on diagrams provided by DHS-HQ business process owners, as well as to identify the types of analysis conducted during each phase.¹



Figure C.1. Key for Interpreting DHS Business Process Flow Charts

¹ The charts were derived from a range of sources, including DHS FY 2017 Strategic Planning Guidance; 2014 DHS QHSR documentation; the draft DHS Analytic Agenda; DHS JRIMS, Acquisition Management, PPBE, and Strategic Planning directives; and PLCY, JRC, PA&E, and PARM internal documentation and briefing slides.







Figure C.3. Strategic Planning for DHS-HQ Integrated Business Processes



Figure C.4. Strategic Planning for DHS-HQ Integrated Business Processes (with analytic inputs)













Figure C.7. Resource Allocation for DHS-HQ Integrated Business Processes

Figure C.8. Resource Allocation for DHS-HQ Integrated Business Processes (with analytic inputs)



Appendix D: DHS-HQ Business Process Analytic Table

The DHS-HQ Integrated Business Process Analytic Table presented in this appendix is a product of an effort by the study team to depict the substantive analytic outputs of each of DHS-HQ business process phase: strategic planning, capabilities and requirements development, acquisition oversight, and resource allocation. The table content is informed by internal DHS-HQ documentation.¹

¹ The data used to develop the analytic table were derived from DHS FY 2017 Strategic Planning Guidance; 2014 DHS QHSR documentation; the FY 2014–2018 DHS Strategic Plan; the draft DHS Analytic Agenda; DHS JRIMS, Acquisition Management, PPBE, and Strategic Planning directives; PLCY, JRC, PA&E, and PARM internal documentation and briefing slides; and DHS-HQ staff interviews.

Table D.1. DHS-HQ Business Process Analytic Table (Panel 1: Strategic Planning)

		DHS HQ B	usiness Proce	sses Analytic	able			
			1. Strategic P	lanning				
Analytic Outputs	Description	Analysis Inputs	DHS Entities	Data Repositories	HQ Analytic Tools	HQ Analysis Types	Authorizer	Generation
Quadrennial Homeland Security Review (QHSR) DHS Strategic Plan	Establishes the Department's view of the next five-ten years future planning environment. Provides the Components protoines and specific program discrimes for resource planning	HQ and Operational Component Strategies, DHS Programs and Activities: DHS Future-Year Homeland Security Program (FYHSP) System Date: DHS Enterprise Report (DHSER)) National Risk Characterization (HSSTE); DHS Trends Review; DHS Senior Leadership Guidance; Corgressional Legalation; DHS Enaming Guidance; Corgenssional Legalation; DHS Planning Guidance; Planning Guidance;	All DHS HQ and Operational Components	DHS-wide Component Strategy Database, OMB Max FYHSP, SharePoint, Shared Drive	OMB Max, Management Cube; Microsoft Office	Strategic Analysis: Policy Analysis: Budget Analysis:	Strategy & Strategy & Policy Executive Steering Committee (S&P ESC) and ESC) and ESC) and Management	Quadrennial
Strategic Planning Guidance	Sets out broad calegories of Sets out broad calegories of minimum requirements to ensure effectiveness and clarity while enhancing alignment of strategies and corresponding implementation plans across the Department	DHS Senior Leadership Guidance: Congressional Legiation: DHS Cagal Authonities: Strategic Planning Guidance: Resource Planning Guidance:	S&A (Lead)	OMB Max: SharePoint; Shared Drive	Microsoft Office		(DMAG)	
Resource Planning Guidance (RPG)	The Department's amual resource allocation guidance, which kicks off allocation guidance, which kicks off the planning phase of the DHS planning, programming, budgeting, and execution (PPE) process	Resource Planning Priorities; Previous FV Strategic Reviews; Strategic Planning Guidance; Programmatic Guidances	Offlice of Unity of Effort (UdE): Joint Requirements Council (LAC): Offlice of Program Analysis and Evaluation (PA&E)		Microsoft Office		Chief Financial Officer's (CFO) Council and DMAG	
Operational Planning Guidance	Sets out broad categories of minimum requirements to ensure effectiveness and clarity while enhancing coordination of operational plans across the Department	Strategic Planning Guldance	PLANS (Lead)		Microsoft Office			
Issue/Topic-Specific Strategy	Delineates, describes, and relates DHS operational activities and resources toward executing a prioritized objective mandated by prioritized objective mandated by senior leadership	DHS Senior Leadership Guidance; Congressional Legislation; DHS Legal Authoritiles; Strategic Planning Guidance; Resource Planning Guidance	S&A (Lead); S&P ESC; Relevant Operational Components;	DHS-wide Component Strategy Database; OMB Max, FYHSP	Management Cube; Microsoft	Strategic Analysis; Policy Analysis; Budget Analysis; Mission Analysis	S&P ESC ESC	
Issue/Topic-Specific Implementation Plan	Establishes roles and responsibilities for activities DHS must perform for strategic success, assesses current repabilities to assesses current repabilities to address problem defined in strategy, identifies and prioritizes capability gaps, propress capability durates or these activities develops progress reports on updates on these activities	DHS Senior Leadership Guidance; Congressional Legislation; DHS Legal Authorities; Strategic Planning Guidance; Resource Planning Guidance	S&A (Lead); S&P ESC; Relevant Operational Components;	DHS-wide Component Strategy Database; OMB Max, FYHSP	Management Cube: Microsoft Office	Strategic Analysis: Policy Analysis: Budget Analysis; Mission Analysis	Implementation Plan Subcommittee	0 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9

	Generation		Need-Based	
	Authorizer	JRC/COO Counci/DMAG		JRC; PARM
	HQ Analysis Types	Capability Requirements Documents Evaluation; Capabilities-Based Assessments; Business Case Analysis; Lessons	Learned vrarysrs, invision Analysis, interoperability Assement (System integration into Component and DHS Command and Control), Mission/Objective Analysis	
nt	HQ Analytic Tools		Microsoft Office	
nents Developme	Data Repositories	Knowledge Management	uedision suppor (rwillo) System: CRMs; JRIMS Scorecards	
ilities & Require	DHS Entities	JRC (Lead); Operational Components; SkT Office of Systems Engineering	(USE); Soi Integrated Pfroduct Teams; S&T Pfroduct Teams; S&T Requirements Analysis (ORA)	
2. Capab	Analysis Inputs	Capabilities Anaysis Reports (CARs)	Capability Analysis Study Plan (CASP); CAR; Non-Materiel Change Recommendation (NMCR); Mixeston Needs Statement (MNS); Conceston And Operations (CONOPS); Operational	Requirements Document (ORD)
	Description	Catalogues 140 JRC approved validated capability gaps across the DHS and provides a tool for the DHC to crive requirements prioritization, acquisitions decisions, and drive investments in DHS Science and Technology Directorate (S&T) research and development	Details validated operational capabilities requirements to the Acquisition Review Board (ARB) to Need prases from the <i>Identify</i> and Need phases of the Analyze and Select phase of the Acquisition	Lifecycle Framework (ALF)
	Analytic Outputs	laster Capabilities and lequirements List (MCRL)	RC Capability Needs ecommendations	

Table D.2. DHS-HQ Business Process Analytic Table (Panel 2: Capabilities and Requirements Development)

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			3. Acquistion C	Dversight				
Analytic Outputs	Description	Analysis Inputs	DHS Entities	Data Repositories	HQ Analytic Tools	HQ Analysis Types	Authorizer	Generation
	Details validated operational canabilities reminements to the	Capability Analysis Study Plan (CASP); Capability Analysis Report (CAR)						
JRC Capability Needs Recommendations	Acquisition Review Board (ARB) to Acquisition Review Board (ARB) to Need phases to the Analyza and Select phases of the Acquisition Lifecycle Framework (ALF)	Mission Needs Statement (MNS); Non-Material Change Reecommertation (NMCR); Concept of Operations (CONOPS); Capability Development Plan (CDP)	JRC (Lead): Operational Components; OSE; S&T Integrated Product Teams; ORA	KMDS; JRIMS Scorecards; Comment Resolution Matrixes (CRMS);	Microsoft Office	JRC and S&T OSE Document Review and Evaluation; Program Risk Analysis;		
Acquisition Program Data; PARM Acquisition Program Recommendations	Details Component acquisition program meets, revisions, and recommendations to the Acquisition recommendations to the Acquisition from the Analyza and Selet, phase through to the Produce, Deploy	Finalized Concept of Operational Requirements Document (ORD); Alternatives Analysis (AA)-(JRC Alternatives Analysis (AA)-(JRC Atternatives Analysis (AA)-(JRC Atternatives Analysis (AA)-(JRC Atternatives Analysis (AA)-(JRC Atternations Analysis (AA)-(JRC Documents, Aquatision Pho- Documents, Aquatision Pho- Documents, Aquatision Pho- Documents, Aquatision Pho- Leviel Agreement (IEM); (SELC)71ailong Phan; Service Level Agreement (SLA)	PARM (Lead); JRC Portfolo Teams (PTs); Operational Components; ORA	Master Acquisitions Master Acquisitions (MAOUL): Investment, E-aulation, Submission, and Tracking (INVEST)	electronic Organizational Jacument Management Process (eODMP), MGMT Process (eODMP), MGMT Process (eODMP), MGMT Process (EODMP), MGMT Datherer, SOL B) Software, Joffware, SOL B) Software, Joffware, Jone Threatment	Acquisition Systems Analysis: Workforce Forecasting Analysis: Technical Assessments	Acquisition Review Boards (ARBs)	Need-Based
	and Support phase of the ALF	Finalized Acquisitions Documents: Aquisition Program Destine (APD), Integrated Logistics Support Plan (LSP); Aquisition Plan (AP), Life Cycle Cost Estimate (LCCE); Systems Engineering Life Cycle (SELC)Tailoning Plan (SELC)Tailoning Plan	PARM (Lead); Support and Operational Components; S&T OSE		(UVI) System			

Table D.4. DHS-HQ Business Process Analytic Table (Panel 4: Resource Allocation)

			4. Resource Al	location				
Analytic Outputs	Description	Analysis Inputs	DHS Entities	Data Repositories	HQ Analytic Tools	HQ Analysis Types	Authorizer	Generation
Winter Studies	Issues identified in the RPG that require additional analysis ahead of the PBR. The conclusion of Winter Studies marks the completon of the Planning phase of PPBE	Resource Planning Guidance; Programmatic Priorities; Component Program Data	PA&E (Lead); UoE; JRC; S&A	Issue-Studies Sharepoint Site; Shared Drive	Microsoft Office	Program Analysis; Risk Analysis		
Component Performance and Budget Reviews (PBRs)	Outlines key themes and focus meas as wells as programmatic issue teams, base budget review topics, and leadership issues-and aubmission of Component RAPs, and concludes with the issuance of the RAD and recording of decisions in the FYHSP systems	JRIMS Requirements Documents: OMB and DHS Fiscal Guidence to Components; Finalized Component Resource Allocation Plans (RAPs); Common Appropriations Sturcture (CAS); FYHSP System Data; Component Performance Measures; INVEST System Data	PA&E (Lead); OCFO; CAD	SharePoint	Budget Formulation and Execution Manager (BFEM); UVI; Microsoft Office	Program Analysis; Risk Analysis;	Undersecretary	Annual
DHS Strategic Reviews (SRs)	Strategic reviews identify areas for improvement, strengthens collaboration and ownership of the strategic goals, informs, as appropriate, programming and budgeting, and provides feedback to future planning efforts	Component Performance Measures; Existing DHS Strategies;	PA&E (Lead); JRC; S&A Operational Components	SharePoint	UVI, Microsoft Office	Program Analysis; Mission Analysis; Strategic Analysis; Risk Analysis	for Management (USM); CFO Council; DMAG	
Luture-Year Homeland Security Program (FYHSP) Report	Summarizes DHS programs and associated resources for the budget year plus four years in support of strategic goals, oplicitives, and planning priorities and reflects the Administration's position on the DHS top-line and the allocation of DHS resources across Component programs and DHS missions	Component Resource Allocation Plans (RAPs), Component Operational Program Budget Data; Resource Allocation Decisions (RADs); FYHSP System Data	PA&E (Lead); Operational Components	FYHSP	UVI; Microsoft Office	Trends Analysis		Triennial

NOTE: CAD = Cost Assessment Division.

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