



Subsistence Readiness and Supply Chain Innovation Assessment

Matthew C. Bishof

Patricia A. Donahoe

Greyson Finlay

Mia L. Griffiths

Carlo A. Montemayor

Matthew R. Peterson

Joshua P. Puleo

Russell S. Salley

Mark W. Warren

February 2022

NOTICE:

THE VIEWS, OPINIONS, AND FINDINGS CONTAINED IN THIS REPORT ARE THOSE OF LMI AND SHOULD NOT BE CONSTRUED AS AN OFFICIAL AGENCY POSITION, POLICY, OR DECISION, UNLESS SO DESIGNATED BY OTHER OFFICIAL DOCUMENTATION.

LMI ©2022. ALL RIGHTS RESERVED.11628.000.00L1

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.					
1. REPORT DATE (DD-MM-YYYY) 28-02-2022		2. REPORT TYPE Final		3. DATES COVERED (From - To) 04-09-2020 - 28-02-2022	
4. TITLE AND SUBTITLE Subsistence Readiness and Supply Chain Innovation Assessment			5a. CONTRACT NUMBER SP4701-20-C-0075		
			5b. GRANT NUMBER N/A		
			5c. PROGRAM ELEMENT NUMBER N/A		
6. AUTHOR(S) Bishop, Matthew Donahoe, Patricia A. Montemayor, Carlo A. Peterson, Matthew R. Puleo, Joshua P. Salley, Russell S. Warren, Mark			5d. PROJECT NUMBER N/A		
			5e. TASK NUMBER N/A		
			5f. WORK UNIT NUMBER N/A		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) LMI 7940 Jones Branch Drive Tysons, VA 22102			8. PERFORMING ORGANIZATION REPORT NUMBER N/A		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Dr. Gloria Edwards (J68) Defense Logistics Agency Andrew T. McNamara Building 8725 John J. Kingman Rd. Fort Belvoir, VA 22060-6221			10. SPONSOR/MONITOR'S ACRONYM(S) DLA R&D		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S) N/A		
12. DISTRIBUTION/AVAILABILITY STATEMENT Distribution Statement A This is approved for public release distribution is unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT The Defense Logistics Agency (DLA) tasked LMI to assess DLA's performance as the executive agent (EA) for the Department of Defense Class I-Subsistence supply chain and to evaluate how innovative practices and technologies could improve the subsistence supply chain. LMI assessed the Class I-Subsistence functions by examining current operational and technological capabilities, as well as associated gaps. LMI solicited surveys and conducted interviews with each of the military services, geographic COCOMS, and TRANSCOM. For the readiness assessment, survey respondents and interviewees generally rated DLA's EA performance and their satisfaction with DLA as the DoD EA favorably. DLA's customers, the military services and the geographic UCCs generally believe DLA is performing well in pursuing innovation as the EA. After documenting the readiness and innovation assessment findings, key supply chain gaps were summarized and a list of innovative technologies and practices that may improve the subsistence supply chain along with recommended research and development (R&D) ideas was provided for DLA consideration.					
15. SUBJECT TERMS Subsistence Readiness, Class I Supply Chain, Executive Agent, Subsistence Innovative Technology Solutions					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT SAR	18. NUMBER OF PAGES 128	19a. NAME OF RESPONSIBLE PERSON Dr. Gloria Edwards
a. REPORT U	b. ABSTRACT U	c. THIS PAGE U			19b. TELEPHONE NUMBER (Include area code) 571-767-1674

Standard Form 298 (Rev. 8/98)
Prescribed by ANSI Std. Z39.18

INSTRUCTIONS FOR COMPLETING SF 298

1. REPORT DATE. Full publication date, including day, month, if available. Must cite at least the year and be Year 2000 compliant, e.g. 30-06-1998; xx-06-1998; xx-xx-1998.

2. REPORT TYPE. State the type of report, such as final, technical, interim, memorandum, master's thesis, progress, quarterly, research, special, group study, etc.

3. DATES COVERED. Indicate the time during which the work was performed and the report was written, e.g., Jun 1997 - Jun 1998; 1-10 Jun 1996; May - Nov 1998; Nov 1998.

4. TITLE. Enter title and subtitle with volume number and part number, if applicable. On classified documents, enter the title classification in parentheses.

5a. CONTRACT NUMBER. Enter all contract numbers as they appear in the report, e.g. F33615-86-C-5169.

5b. GRANT NUMBER. Enter all grant numbers as they appear in the report, e.g. AFOSR-82-1234.

5c. PROGRAM ELEMENT NUMBER. Enter all program element numbers as they appear in the report, e.g. 61101A.

5d. PROJECT NUMBER. Enter all project numbers as they appear in the report, e.g. 1F665702D1257; ILIR.

5e. TASK NUMBER. Enter all task numbers as they appear in the report, e.g. 05; RF0330201; T4112.

5f. WORK UNIT NUMBER. Enter all work unit numbers as they appear in the report, e.g. 001; AFAPL30480105.

6. AUTHOR(S). Enter name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. The form of entry is the last name, first name, middle initial, and additional qualifiers separated by commas, e.g. Smith, Richard, J, Jr.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES). Self-explanatory.

8. PERFORMING ORGANIZATION REPORT NUMBER.

Enter all unique alphanumeric report numbers assigned by the performing organization, e.g. BRL-1234; AFWL-TR-85-4017-Vol-21-PT-2.

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES). Enter the name and address of the organization(s) financially responsible for and monitoring the work.

10. SPONSOR/MONITOR'S ACRONYM(S). Enter, if available, e.g. BRL, ARDEC, NADC.

11. SPONSOR/MONITOR'S REPORT NUMBER(S). Enter report number as assigned by the sponsoring/monitoring agency, if available, e.g. BRL-TR-829; -215.

12. DISTRIBUTION/AVAILABILITY STATEMENT. Use agency-mandated availability statements to indicate the public availability or distribution limitations of the report. If additional limitations/ restrictions or special markings are indicated, follow agency authorization procedures, e.g. RD/FRD, PROPIN, ITAR, etc. Include copyright information.

13. SUPPLEMENTARY NOTES. Enter information not included elsewhere such as: prepared in cooperation with; translation of; report supersedes; old edition number, etc.

14. ABSTRACT. A brief (approximately 200 words) factual summary of the most significant information.

15. SUBJECT TERMS. Key words or phrases identifying major concepts in the report.

16. SECURITY CLASSIFICATION. Enter security classification in accordance with security classification regulations, e.g. U, C, S, etc. If this form contains classified information, stamp classification level on the top and bottom of this page.

17. LIMITATION OF ABSTRACT. This block must be completed to assign a distribution limitation to the abstract. Enter UU (Unclassified Unlimited) or SAR (Same as Report). An entry in this block is necessary if the abstract is to be limited.



Subsistence Readiness and Supply Chain Innovation Assessment

February 2022

Executive Summary

The Defense Logistics Agency (DLA) tasked LMI to assess DLA's performance as the executive agent (EA) for the Department of Defense (DoD) Class I–Subsistence supply chain and to evaluate how innovative practices and technologies could improve the subsistence supply chain. We assessed the Class I–Subsistence functions by examining current operational and technological capabilities and associated gaps. Our aim was to recommend innovative technology solutions, automation, and commercial practices that improve customer service, increase efficiency, and synchronize data standards and interoperability to enhance the delivery of Class I supplies to the warfighter.

To assess the readiness of the global subsistence supply chain and make technology, automation, and process recommendations on the future construct of the Class I supply chain, we executed a three-phased approach for this project. In Task 1, we assessed the current state of readiness of the Subsistence supply chain through a survey. For Task 2, we interviewed Unified Combatant Command (UCC) and Service representatives to collect in-depth views on readiness, current gaps, future technology, automation, and process initiatives. In Task 3, we determined the highest-priority supply chain gaps and recommended improvement opportunities, including technology development and CONUS/OCONUS research and development (R&D) pilot initiatives. Finally, we conducted supplemental research to support a DLA request to provide an innovative contracting solution from the Army.

For the readiness assessment, survey respondents and interviewees generally rated DLA's EA performance and their satisfaction with DLA as the DoD EA favorably. However, survey respondents reported that DLA could perform better in certain areas. We gleaned supply chain improvement opportunities from the survey responses and focused our follow-up interview questions on the areas where customers offered suggestions. We organized our findings according to five categories gleaned from survey and interview results as shown in Table ES-1.

Table ES-1. Summary of Readiness Assessment Findings

Category	Findings
Policies and planning	• No policy recommendations • Positive comments on DLA reps • Consider frequency and membership of Joint Subsistence Policy Board meetings

Table ES-1. Summary of Readiness Assessment Findings

Category	Findings
Category management	• Lack of speed and transparency of new item introductions • Case minimums don't adequately support smaller units or retail model • Unwanted substitutions, inconsistent pricing, lack of DoD-wide buyer guide
Vendor management	• Perception remains that DLA supports vendors over customers • Desire for support in austere locations
Order fulfillment	• Long lead-times for OCONUS; U.S. Transportation Command (TRANSCOM) looking for better collaboration • OCONUS customers want in-transit visibility
Information and metrics	• Need common set of metrics and targets • STORES lacks integration with Service systems

Building on previous LMI studies, we researched innovative emerging and current commercial technologies that could potentially improve the Class I supply chain. We documented supply chain innovation opportunities from the survey responses and our follow-up interviews. As with the readiness assessment, we focused our follow-up questions on the areas that customers and stakeholders judged more negatively than others or showed a particular interest in. We organized these improvement opportunities according to four assessment categories: emerging technologies, innovation subsistence best practices, innovative contracting processes, and data infrastructure and standardization, as summarized in Table ES-2.

Table ES-2. Innovation Assessment Findings

Category	Findings
Emerging technology	• Most interest was focused on data analytics and process automation • Survey and interview data indicates significant demand for in-transit visibility capabilities
Innovative subsistence best practices	• Services/UCCs subsistence operations are trending toward retail (i.e., campus-style) dining models as well as kiosks, grab-and-go, food trucks, etc. • High demand for dashboard with user-based information feed to provide in-transit visibility and other data insights
Innovative contracting processes	• Overall, the Services and UCCs agreed that DLA contracts meet their subsistence needs • DLA contracts should highlight surge requirements and potential risk scenarios, meaning the “what ifs” • Army needs DLA support for Reserve/National Guard (catering, grocers, restaurants)
Data infrastructure and standardization	• Customers want more regional visibility across inventories in the subsistence supply chain • Up-front investment in cybersecurity and data access security

After documenting the readiness and innovation assessment findings, we summarized key supply chain gaps and compiled a list of innovative technologies and practices that may improve the subsistence supply chain. We recommend that DLA consider the R&D ideas outlined in Table ES-3.

Table ES-3. DLA R&D Pilot Recommendations

Key supply chain gap	Related innovative technologies and best practices	Potential DLA R&D initiatives
Need to improve shipment status and condition visibility	• Automatic identification and data capture technologies including barcoding, radio-frequency identification, and wireless sensor mesh • Dashboards	Conduct in-transit visibility/condition monitoring pilot with TRANSCOM and an OCONUS partner
Lack of standard information sharing with all stakeholders, including lack of standard metrics and targets	• Dashboards • Data analytics • Artificial intelligence (AI)/machine learning (ML) • Data standardization	• Configuration mapping to determine what information is available, what systems contain that data, and to develop a roadmap to access the data • Determine stakeholder information and metrics needs and roles/ access requirements
Lack of Service system integration, and outdated ordering system	• Better user interface and access to system (STORES replacement) • Integration with Service systems (Joint Food Management System [JFMS])	Engage stakeholders in user requirements and testing for STORES replacement and JFMS
Need for more process automation	• Barcodes and scanning • Robotic Process Automation • AI/ML	• Continue rolling out receiving and barcode pilot (OCONUS) • Identify additional opportunities for contracting/business process automation
Current subsistence business model doesn't fully support newer retail approaches being explored by Services and UCCs (e.g., campus-style dining, grab/go, kiosk, food truck, catered meals)	• Innovative contracting strategies (alternative subsistence delivery models) • Data standardization/IT infrastructure to support • Financial transactions (e.g., electronic data interchange)	• Army Reserve/National Guard catering support solution as pilot for other Services • Explore retail solutions and develop roadmap
Need to pay additional attention to risk management and surge contingencies	• What-if (surge) clauses in contracts • Scenario modeling • Mitigation strategies	Conduct Supply Chain Resilience study/pilot
Pricing inconsistencies and long-lead times for new item introduction	• Robotic Process Automation • Data access/standardization	• Implement technology solution for fair and reasonable determinations • Reengineer/automate new item introduction process

Contents

Chapter 1 Introduction.....	1-1
Background	1-1
COVID-19 Response and Study Impacts.....	1-2
Report Organization	1-2
Chapter 2 Objectives and Approach	2-1
Study Objectives	2-1
Readiness and Innovation Assessment Approach.....	2-1
Task 1: Assess the current state of Subsistence supply chain readiness through a survey.....	2-1
Task 2: Interview personnel to collect their in-depth views on readiness, current gaps, and future technology innovation initiatives.	2-2
Task 3: Ascertain the highest-priority supply chain gaps and recommend innovation opportunities and pilot investments.	2-3
Supplemental Research: Assist in the development of alternative sources to Government Purchase Card for Army Reserve and National Guard feeding.....	2-4
Chapter 3 Class I–Subsistence Overview.....	3-1
Overview	3-1
Executive Agent	3-1
DLA’s Subsistence Prime Vendor Partners.....	3-2
Networking	3-2
CONUS Prime Vendors At-A-Glance	3-2
OCONUS Prime Vendors At-A-Glance	3-3
Business Volume.....	3-4
Supply Chain Processes	3-5
Food Safety and Quality Programs	3-6
Establishing New Products.....	3-6
Environment Management Initiative	3-7
Chapter 4 Readiness Assessment Results.....	4-1
Interview and Survey Results.....	4-1
Overall Performance	4-1
Findings and Improvement Opportunities	4-3
Policies and Planning	4-3

Catalog Management	4-4
Vendor Management.....	4-5
Fulfillment	4-6
Information and Metrics	4-7
Chapter 5 Innovation Assessment Results	5-1
Interview and Survey Results	5-1
Overall Performance	5-1
Findings and Improvement Opportunities	5-3
Emerging Technologies.....	5-5
Innovative Subsistence Best Practices.....	5-7
Innovative Contracting Practices	5-8
Data Infrastructure and Standardization.....	5-8
Chapter 6 Conclusions and Next Steps	6-1
Appendix A Class I–Subsistence Supply Chain: Readiness Assessment and Innovation Survey	
Appendix B Subsistence Memorandum	
Appendix C Class I–Subsistence Supply Chain: Readiness and Innovation Assessment Interview	
Appendix D Class I Detailed Survey Results	
Appendix E Commercial Best Practices Study	
Appendix F Reserve and National Guard Support Whitepaper	
Appendix G Policy for DoD Food Programs	
Appendix H Abbreviations	
Figures	
Figure 2-1. Three-phased Approach	2-1
Figure 3-1. SPV CONUS Locations	3-3
Figure 3-2. SPV OCONUS Locations.....	3-4
Figure 3-3. DLA Class I Volume by Service and Business	3-5
Figure 6-1. Notional Future Class I–Subsistence Supply Chain	6-3
Tables	
Table 2-1. Interview Topics	2-3
Table 4-1. Interview and Survey Participation by Organization.....	4-1
Table 4-2. Survey Rating Scale.....	4-2
Table 4-3. 2012/2021 Response Comparison.....	4-2

Table 4-4. Summary of Readiness Assessment Findings.....	4-3
Table 5-1. Survey Rating Scale.....	5-1
Table 5-2. DLA Adequately Supports Innovation in the Class I	5-2
Table 5-3. DLA Supports Cutting-Edge Technology and Innovation.....	5-2
Table 5-4. Innovation Assessment Findings	5-3
Table 5-5. Overview of Emerging Technologies	5-4
Table 6-1. Assessment Categories	6-1
Table 6-2. DLA R&D Initiative Recommendations	6-2

Chapter 1

Introduction

Background

As the Department of Defense (DoD) Executive Agent (EA) for the Class I–Subsistence supply chain, the Defense Logistics Agency (DLA) requires a comprehensive review to capture the current state of the Service and Unified Combatant Commands (UCCs) Class I–Subsistence supply chains. Accordingly, DLA Troop Support tasked LMI with conducting an independent assessment of how well it is fulfilling its roles and responsibilities as the DoD EA for Class I–Subsistence.

DoD EAs are defined as heads of a DoD component to whom the Secretary of Defense or the Deputy Secretary of Defense has assigned specific responsibilities, functions, and authorities to provide defined levels of support for operational mission, administrative, or other designated activities. These activities must involve two or more of the DoD components. DoD EA policy states that each DoD EA program may be assessed “periodically, but not less than every 3 years,” to determine its “continued need, currency, and effectiveness and efficiency in satisfying end user requirements.”¹

DoD Directive (DoDD) 5101.10² designates the DLA Director as the DoD EA for subsistence (Class I): food and food-related supplies, including condiments, utensils, paper products, and bottled water. The policy requires that the DoD components, in coordination with the DoD EA for subsistence, provide the proper resources and operate a coordinated subsistence acquisition and logistics program to provide the same level of efficient and effective worldwide support during peacetime and under military operations.

Since the last readiness assessment was conducted in 2012, DLA determined that a follow-up assessment was required to determine how well it is implementing its responsibilities and, more important, to identify areas where it needs to improve to provide better support to its customers.

DLA and the Services lacked a holistic view of recent operational initiatives and changes. As DLA launches new modernization efforts, new IT initiatives could result in data stovepipes, which, if not synchronized with Service and UCC needs, will create more problems than they will solve. In 2018, LMI explored these issues through a supplemental research and development (R&D) project, *The Future of Subsistence Prime Vendor*. The resulting report outlined technological solutions DLA could invest in to support its future operations.

The present R&D effort builds on the existing body of work by expanding the focus to subsistence operations DoD-wide at Service and UCC locations. Without the knowledge from this review, new IT initiatives that will create new data pipelines could create more

¹ DoD Executive Agent, DoD Directive 5101.1, dated September 3, 2002, para. 5.3.2.

² DoD Executive Agent (DoD EA) for Subsistence, DoD Directive 5101.10E, dated October 26, 2015.

problems if UCC and Service needs are not synchronized with new technology modernization efforts

In this study, LMI assessed current UCC and overseas DLA Troop Support Class I–Subsistence functions. We examined their current operational and technological capabilities and the associated gaps in the Class I supply chain. We further assessed appropriate technology solutions to fill observed gaps using surveys, interviews, and technology assessments. Additionally, research was conducted to support the Reserve Component and National Guard subsistence requirements for drilling units at their home locations. Appendix F outlines the results and recommendations of this additional research that identifies potential sources of supply, vendor profiles, and possible business models that could be applied at the national, regional, or local levels.

COVID-19 Response and Study Impacts

Over the course of this project, extra precautions were necessarily taken to protect the project team and the project stakeholders. Due to the evolving coronavirus situation and the proliferation of the highly contagious variants, the team was only able to conduct in-person interviews with eight Service and UCC representatives; the remainder of the interviews were conducted via telephone or ZoomGov. A significant portion of the project budget was predicated upon travel to Service and UCC sites to conduct in-person interviews.

Report Organization

The remainder of the report is organized as follows:

- Chapter 2 outlines the project objectives and approach.
- Chapter 3 provides an overview of the Class I–Subsistence supply chain.
- Chapter 4 presents the readiness assessment results.
- Chapter 5 documents the results of our innovation assessment.
- Chapter 6 summarizes our overall project findings and outlines our recommendations.
- A series of appendixes provide project artifacts, supporting details, and additional research.

Chapter 2

Objectives and Approach

Study Objectives

This objective of this study is to assess DLA's performance as the EA and to evaluate how innovative practices and technologies could improve the subsistence supply chain. We assessed the Class I–Subsistence functions by examining current operational and technological capabilities, as well as associated gaps. Additionally, our aim was to recommend innovative technology solutions, automation, and commercial practices that improve customer service, increase efficiency, and synchronize data standards and interoperability to enhance the delivery of Class I supplies to the warfighter.

Readiness and Innovation Assessment Approach

To assess the readiness of the global subsistence supply chain and make technology, automation, and process recommendations on the future construct of the Class I supply chain, we executed a three-phased approach for this project (Figure 2-1).

Figure 2-1. Three-phased Approach



In Task 1, we assessed the current state of readiness of the subsistence supply chain through a survey. For Task 2, we interviewed UCC and Service representatives to collect in-depth views on readiness, current gaps, future technology, automation, and process initiatives. In Task 3, we determined the highest-priority supply chain gaps and recommended improvement opportunities, including technology development and CONUS/OCONUS R&D pilot initiatives.

Task 1: Assess the current state of Subsistence supply chain readiness through a survey.

In coordination with DLA Troop Support and the Subsistence EA, LMI developed survey questions (Appendix A) to address the two aspects of the study. Survey topics were organized into two assessments:

- Class I Readiness Assessment—Questions to help DLA evaluate how well the DoD EA for Class I–Subsistence is supporting the military services and UCCs' readiness worldwide during peacetime and combat operations.
- Subsistence Innovation Assessment—Questions to gauge how well DLA is supporting subsistence innovation efforts and to help select future innovative technologies and practices that could benefit the Services and UCCs.

To increase survey participation, LMI drafted a memorandum (Appendix B) stating the goals of the subsistence readiness and innovation assessment. The memo, which was signed by DLA Troop Support Commander Brigadier General Gavin Lawrence, requested the support of the military departments and UCCs. DLA sent the memorandum and the survey to the following organizations:

- Director, Joint Staff, J4 Logistics
- Director Chief of Staff, Army G-4
- Deputy Chief of Naval Operations (Fleet Readiness and Logistics) N4
- Deputy Chief of Staff, Logistics, Installations, and Mission Support (A4/7)
- Deputy Commandant, Installations and Logistics, U.S. Marine Corps
- Commander, U.S. Africa Command (AFRICOM)
- U.S. Central Command (CENTCOM)¹
- U.S. European Command (EUCOM)
- U.S. Northern Command (NORTHCOM)
- U.S. Indo-Pacific Command (INDOPACOM)
- U.S. Southern Command (SOUTHCOM)
- U.S. Special Operations Command (SOCOM)
- U.S. Transportation Command (TRANSCOM).

The UCCs and Services determined the headquarters and subordinate organizations that should respond to the survey. LMI followed-up with UCC- and Service-designated participants and sent each a link to an online survey. UCCs were encouraged to include Service component commands within their respective organizations as appropriate to respond to the survey. When we received multiple surveys from the same organization, we averaged the results to prevent placing undue weight on a single organization's response.

Next, we compiled and analyzed the survey response data and assessed the results. We used these results to identify potential focus areas for further review and to guide the follow-up interviews. We also averaged answers to overall questions for both the readiness and assessment section of the survey. We also compared the results to the previous readiness assessment.

Task 2: Interview personnel to collect their in-depth views on readiness, current gaps, and future technology innovation initiatives.

In coordination with the DLA Troop Support, we leveraged the survey results to draft a topic outline and interview guide. LMI coordinated with DLA Troop Support to identify appropriate interview candidates. During the interviews, we followed-up on survey responses, focusing on topics that organizations commented on or rated DLA performance as exceptionally high or low. When possible, we travelled to stakeholder

¹ The memorandum was forwarded to CENTCOM representatives after its initial release.

locations and conducted the interviews in-person, but we conducted most interviews virtually because of COVID-19 travel restrictions.

Appendix C provides the interview guide and the outline of the topics we addressed during the interviews for Class I. LMI provided an outline of interview topics to our interviewees in advance as shown in Table 2-1.

Table 2-1. Interview Topics

Readiness assessment topics	Innovation assessment topics
• Policies and planning • Supply chain management • War reserve stocks • Joint Food Management System (JFMS) • Operational synchronization • Material availability • Non-traditional support	• Emerging technologies • Innovative subsistence best practices • Innovative contracting processes • Data infrastructure and standardization

Appendix C contains the interview guide and more detail on the topics we addressed during the interviews for Class I. Additionally, LMI interviewers asked follow-up questions to the survey responses from the organizations to identify areas where the UCCs and services had provided comments, as well as where they had provided either exceptionally high or low ratings in response to any of our questions.

As interviews were completed, LMI aggregated and analyzed the interview responses and assessed the results. LMI also captured findings on any existing Service and UCC technology development interest, research focus, or initiative related to the subsistence supply chain. Appendix D provides the detailed survey results.

Task 3: Ascertain the highest-priority supply chain gaps and recommend innovation opportunities and pilot investments.

Building on previous work conducted for the *Future of Subsistence Prime Vendor* project, we researched innovative commercial technologies, automation, and processes (Appendix E) and developed pilot technology concepts that could contribute to closing high-priority gaps. To baseline these for comparison, we referenced previous DLA and LMI research reports, academic research, professional journals, and interviews with subject matter experts and commercial subsistence providers and consolidators.

As part of the gap assessment, we assessed both survey and interview results against DLA's EA responsibilities, emerging commercial technologies, and supply chain best practices. After compiling the results of our analysis, we reported key findings and recommended improvements for both the readiness and innovation aspects of the assessment.

Our team then drafted this final report to describe the current state of readiness and innovation within DLA's Class I–Subsistence supply chain, identify current gaps, and make recommendations for improvement. These recommendations include innovative pilot initiatives for constructing the Class I supply chain and implementing emerging commercial technologies and practices.

Supplemental Research: Help develop alternative sources to Government Purchase Card for Army Reserve and National Guard feeding.

Building on the preliminary findings from the subsistence readiness and innovation effort, we conducted the following additional research to support a DLA request to provide an innovative contracting solution from the Army:

1. Identify potential sources and business models through review of request for information (RFI) results, existing Reserve and National Guard sources, and commercial research.
2. Contact potential national/regional grocery, restaurant, and catering sources to identify points of contact, type of support provided, capabilities, and potential constraints.

We documented our findings and recommendations in Appendix F to this report.

Chapter 3

Class I–Subsistence Overview

Overview

As the DoD EA for subsistence, DLA is responsible for providing support to the military services and various Class I customers world-wide. Additionally, DLA manages the end-to-end Class I supply chain and works with commercial industry through prime vendor (PV) contracts to deliver food items at both CONUS and OCONUS locations. DLA's vast network of PVs ensures best practices and capabilities are applied to the distribution of food items of the highest quality and safety to meet the warfighter's subsistence requirements.

Executive Agent

The DoD vision is that the Subsistence EA serves as the end-to-end supply chain manager:

- administering the Joint Subsistence Policy Board (JSPB) and developing and implementing plans and procedures for subsistence support;
- planning for, procuring, managing, and distributing subsistence products throughout the DoD supply chain;
- delivering subsistence items to locations as mutually agreed to by the DoD Components;
- coordinating with the military departments, planning, developing, funding, implementing, and maintaining the JFMS that interfaces with existing Service systems;
- maintaining authorized war reserve stocks of subsistence; and
- providing subsistence common-user transportation requirements to the U.S. Transportation Command for movement in the Defense Transportation System (DTS), as prescribed in the DoDD 4500.09E.

In 2004, DoDD 5101.10 designated the DLA Director as EA for subsistence. The DLA Director delegated EA execution responsibility to DLA Troop Support. DoD re-issued DoDD 5101.10E on October 26, 2015, to maintain the DLA Director as the EA for subsistence and to outline the respective roles and responsibilities.¹

As the Class I–Subsistence EA, DLA is responsible for directing the development and implementation of plans, procedures, and DLA resource requirements for subsistence support. DLA also oversees war reserve stocks, leads the JSPB, and improves supply chain integration. Additionally, Appendix G contains the DoD Food Programs and

¹ <https://www.dla.mil/Portals/104/Documents/TroopSupport/Subsistence/DoingBusiness/510110p.pdf>.

policies that DLA supports, advocates for, and complies with to ensure the highest nutritional standards are met for the warfighter.

DLA's Subsistence Prime Vendor Partners

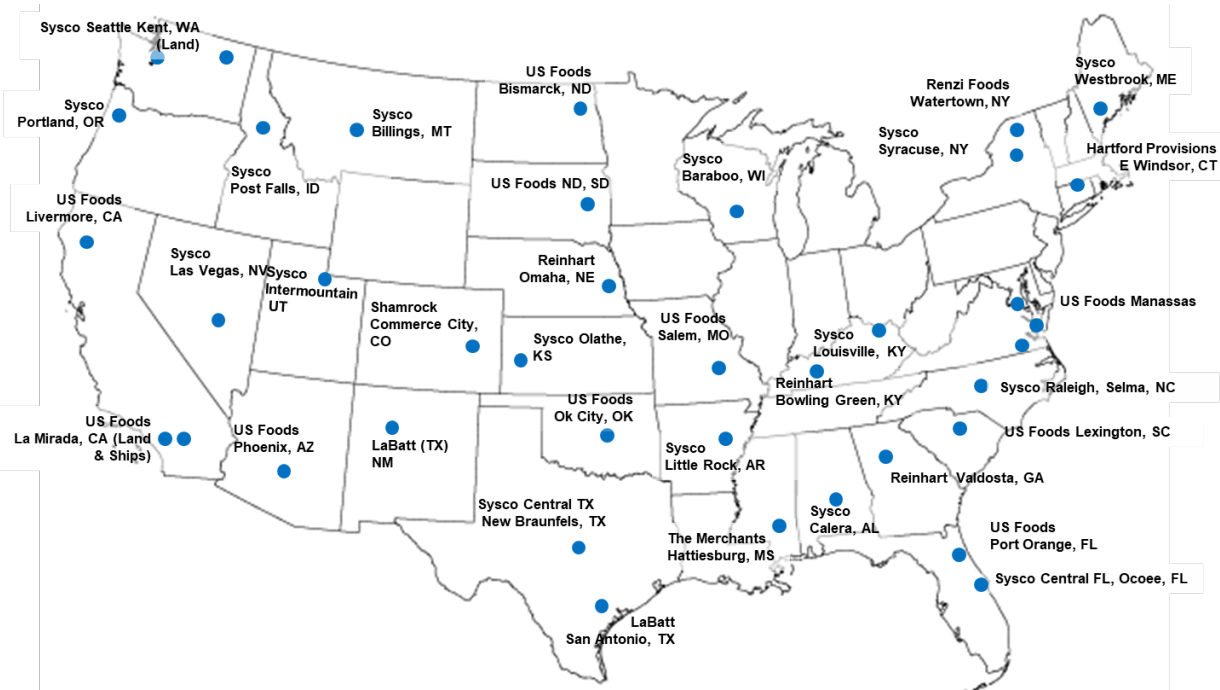
Networking

To better understand requirements and capabilities, DLA actively networks with customers and industry. These networking efforts support both supply and demand planning. Some examples of industry and customer networking activities and events include:

- Subsistence Worldwide Customer Conference & Food Show
- JSPB
- United States National Guard
- Natick Labs/Joint Service Operational Ration Forum
- U.S. Department of Agriculture (USDA)/U.S. Department of Commerce/U.S. Department of State
- Research and Development Associates for Military
- Food and Packaging Systems, Inc.
- Prime Vendor Food Shows
- Army Public Health Center.

CONUS Prime Vendors At-A-Glance

Most of the CONUS PVs are existing commercial full-line food service distributors. DLA has approximately 40 contracts—some being fourth generation contracts—across 9 PVs. The food from these vendors supports DoD service dining facilities (DFACs), ships, the Jobs Corps, Coast Guard, and other non-DoD entities. In FY20 alone, DLA oversaw \$734 million in CONUS PV sales. See Figure 3-1 for more information on subsistence prime vendor (SPV) CONUS locations.

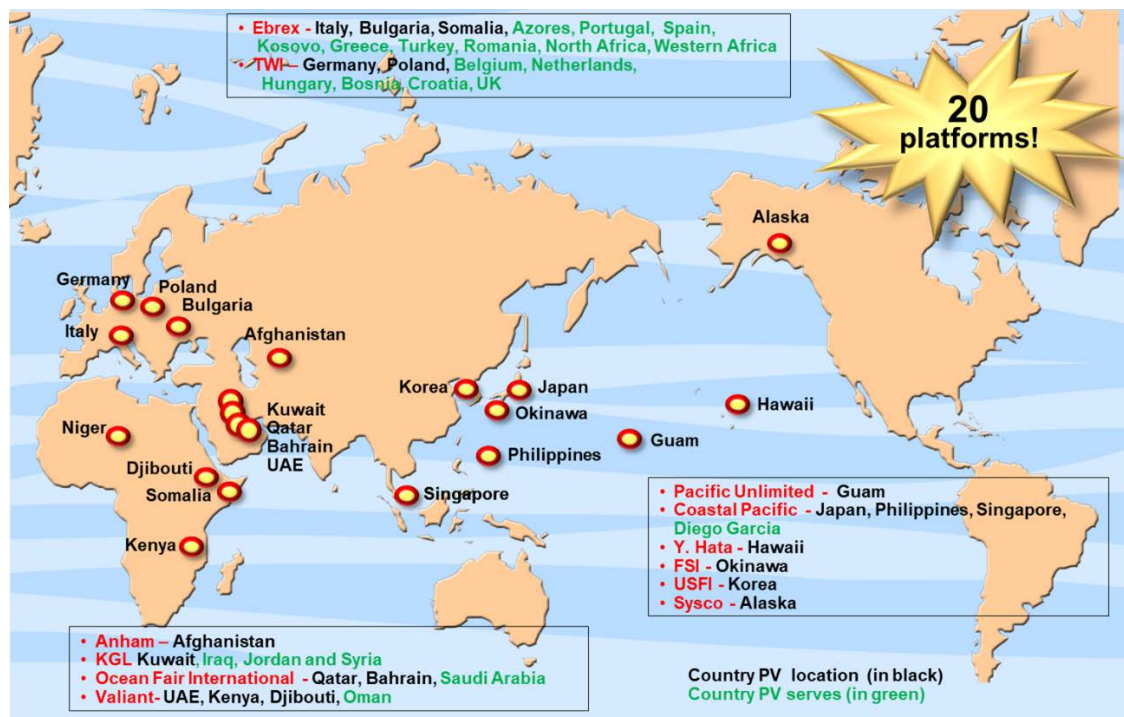
Figure 3-1. SPV CONUS Locations

Source: DLA Troop Support Subsistence Overview Brief September 16, 2021.

OCONUS Prime Vendors At-A-Glance

The OCONUS SPVs tend to be third party-logistics companies with a developed food distribution infrastructure. DLA oversees 13 OCONUS contracts with 13 PVs. The subsistence procured from these PVs supports DFACs, Forward Operating Bases, Mobile Kitchen Trailers, Government Furnished Material storage, and distribution for items such as Meals Ready-to-Eat (MREs). OCONUS subsistence sales in FY20 amounted to \$898 million.

Figure 3-2. SPV OCONUS Locations

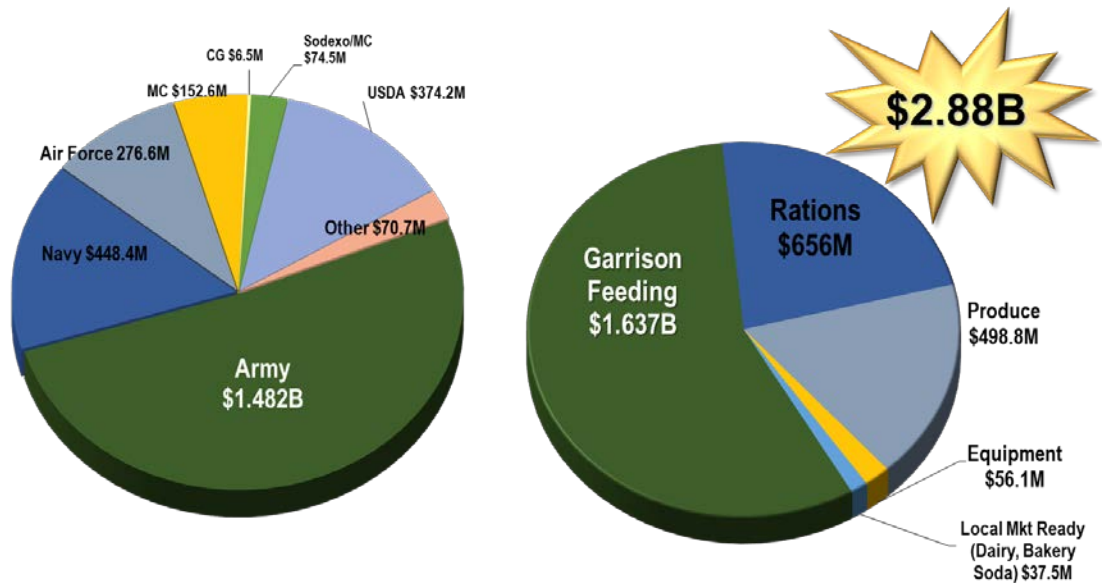


Source: DLA Troop Support Subsistence Overview Brief September 16, 2021.

Business Volume

The subsistence supply chain includes non-perishable food, combat rations, and water, as well as refrigerated and non-refrigerated items. DLA's Class I business volume is substantial, annually comprising 12.1 million orders and \$2.9 billion in sales in FY20 alone. Class I business also includes 57,493 customers, 134,613 items, and 428 suppliers for CONUS and OCONUS combined.

Figure 3-3 shows FY20 business volume segmented by both service and business category. Note that DLA determines each Service's subsistence requirements based on its feeding plans.

Figure 3-3. DLA Class I Volume by Service and Business

Source: DLA Troop Support Subsistence Overview Brief September 16, 2021.

Note: CG = Coast Guard; MC = Marine Corps.

This segmentation shows that the Army represents the majority of DLA sales for Class I.

Supply Chain Processes

The DoD Class I supply chain can be described by the following processes:²

- Requirements determination and stockage
- Acquisition and procurement
- Physical distribution and transportation
- Retrograde and disposal.

Requirements transition from operational rations (OPRATS) to traditional service feeding plans as the theater matures. PVs primarily supply Class I items directly to dining halls and galleys. DLA manages OPRATS—including MREs, and Unitized Group Rations (UGRs)—at its depots and contracted sites. It procures produce as a direct vendor delivery (DVD) item.

DLA acquires most Class I material through PV or DVD contracts for delivery to its ships and DFACs. It procures OPRATS when requirement forecasts exceed on-hand inventories. Surge requirements are included in contracts for OPRATS as well as PV subsistence material. Market-ready items (e.g., baked goods, dairy products) can be locally procured by military services, operational elements, or DLA.

² Joint Publication 4-09, *Joint Doctrine for Global Distribution*, December 14, 2001.

The physical distribution of most Class I material, other than OPRATS, is primarily a commercial function under PV arrangements, except in the following scenarios:

- Navy ships load PV-sourced material and transfer it to afloat forces during underway replenishments.
- The DTS ships PV material from CONUS to OCONUS locations, where the PV resumes transportation responsibility to the end user.
- Due to political or operational considerations in some OCONUS areas, PV-sourced material may be transferred to the military for further distribution to the end user.

To facilitate theater distribution, containers of OPRATS can be configured for consumption in meal or menu sequence for a specifically sized unit.

Because of health concerns related to these processes, DLA does not retrograde and return Class I material. For disposal, it surveys material in accordance with applicable service procedures. The Defense Reutilization and Marketing Service helps DLA dispose packaged OPRATS.

Food Safety and Quality Programs

The Food Safety Office within DLA advises the DLA commander as the EA for food safety and food defense. The Food Safety Office:

- manages DoD hazardous food and non-prescription drug recall system;
- maintains relationships with Food and Drug Administration, USDA, Natick Army Laboratory Research Development and Engineering Center, U.S. Army Public Health Command, and U.S. Army Soldier and Biological Chemical Command to address food safety issues and outbreaks;
- monitors emerging and reemerging diseases for food export/import impact; and
- helps DLA initiate requests for approved source audits.

Within DLA Troop Support, there are approximately 10 quality assurance auditors who travel worldwide to vendor facilities to evaluate product contractual compliance, quality, and wholesomeness. The auditing team, which includes experts from USDA and the U.S. Department of Commerce, conducts quality systems audits for OPRATS, PV, and produce quality audits. The auditors verify the overall sanitation practices, policies, and procedures of contractors to ensure food safety.

Establishing New Products

Items cataloged for customers are based on needs and requirements. New products are added to DLA catalogs based on review of salient characteristics/ingredients, vendors specifications, labels, packaging, research on allergens, unwanted ingredients such as MSG, hemp seeds, trans fats, unsaturated fats, etc. New items must comply with Joint Services Buyers Guide, Berry Amendment/Buy American Act, USDA/National Oceanic and Atmospheric Administration/non-governmental standards, etc.

Environment Management Initiative

Some of DLA's sustainability initiatives that touch or directly involve the subsistence supply chain include:

- Go-4-Green: A joint-service performance-nutrition initiative that improves the food environment and better food and beverage selections to optimize performance, readiness, and health.
- Green Procurement: DoD programs that give preference to products and services that are environmentally preferable because they “have a lesser or reduced effect on human health and the environment when compared to other products and services that serve the same purpose.”
- Healthy Base Initiative: DoD demonstration project designed to combat obesity and tobacco usage.
- Total Force Fitness: a program that focuses on one's entire health throughout a military career; a framework that helps warfighters, their family members, and military units reach and sustain optimal, holistic health and performance.

Chapter 4

Readiness Assessment Results

This chapter presents the interview and survey results, overall performance, and finding and improvement recommendations for the readiness assessment component of the study.

Interview and Survey Results

LMI solicited surveys from each of the military services and UCCs. We also requested follow-up interviews with each of these organizations. Table 4-1 shows the number of surveys that these organizations returned and whether or not we were able to conduct a follow-up interview.

Table 4-1. Interview and Survey Participation by Organization

Category	Organization	Number of surveys returned—2012	Number of surveys returned—2021	Interview conducted—2012	Interview conducted—2021
UCC	AFRICOM	1	2	Yes	No
	CENTCOM	1	2	Yes	Yes
	EUCOM	6	3	Yes	Yes
	INDOPACOM	6	6	Yes	Yes
	NORTHCOM	1	1	No	Yes
	SOCOM	0	1	No	Yes
	SOUTHCOM	3	5	Yes	Yes
	TRANSCOM	1	5	Yes	Yes
Service	Air Force	1	2	Yes	Yes
	Army	5	7	Yes	Yes
	Marine Corp	1	0	Yes	No
	Navy	1	2	Yes	Yes
Total		27	36		

Survey participation for this assessment exceeded participation in the 2012 assessment by 33 percent. We conducted a similar number of follow-up interviews as in the previous assessment.

Overall Performance

We asked survey respondents to rate how strongly they agreed or disagreed with statements based on a 5-point scale as depicted in Table 4-2.

Table 4-2. Survey Rating Scale

Rating	Description
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

Appendix D provides the detailed survey results for each question.

We present DLA's overall performance as the Class I EA based on two survey questions:

- DLA is serving effectively as EA for subsistence.
- Responder is satisfied with the level of DLA Class I support.

The ratings in these overall questions remained nearly the same for the UCCs and the Services while TRANSCOM rated DLA nearly a full point better in 2021 than in 2012. These results are useful as a general comparison because the two assessments used identical overall questions and the same survey method. For both assessments, the results are a weighted average of the responses from UCC and Service-selected participants. We present this data as a high-level aggregate view of the subject matter experts; however, the most useful readiness assessment feedback is the responses to the specific survey questions and the interview feedback summarized below and detailed in Appendix D.

Table 4-3 compares the results of the current readiness assessment results to the responses to the same questions in 2012.

Table 4-3. 2012/2021 Response Comparison

Assessment year	Question	Services	UCCs (excluding TRANSCOM)	TRANSCOM
2012	DLA effectiveness as EA	3.9	4.5	2.0
	Satisfaction with DLA Class I support	4.2	4.5	2.0
2021	DLA effectiveness as EA	4.0	4.2	3.0
	Satisfaction with DLA Class I support	4.0	4.1	3.3

DLA's customers, the military services, and the UCCs generally believe DLA is performing well as the EA. Service and UCC overall ratings were comparable to the positive overall 2012 results. Although the TRANSCOM survey responses were somewhat more negative than the other UCCs and the Services, the ratings did improve a full point or more when compared to the 2012 assessment. Their comments focused on their perception that DLA could be more proactive in working with TRANSCOM to resolve issues with DTS.

One UCC respondent commented, “DLA has always done a great job on assisting deployed units.” A Service customer said, “DLA team does rations well!!!” Another Service customer appreciated their meetings with DLA that allowed for better understanding and cooperation between the two organizations. Another said, “I have coordinated Class I support at many levels. My experience with DLA has always been very satisfying.” Survey respondents also rated DLA as being receptive to feedback (4.0 on a 5-point scale) regarding improvements to the Class I supply chain.

Although the overall assessment by the Services and UCCs was positive, survey respondents and interviewees offered several suggestions on how DLA could improve support. We summarize our findings and improvement opportunities gleaned from the surveys and interviews below.

Findings and Improvement Opportunities

Although survey respondents and interviewees generally rated DLA’s EA performance favorably and expressed their satisfaction with DLA as the DoD EA, respondents noted that DLA could perform better in certain areas. We gleaned supply chain improvement opportunities from the survey responses. We focused our follow-up interview questions on the areas where customers offered suggestions. We organized our findings according to five categories gleaned from survey and interview results as shown in Table 4-4.

Table 4-4. Summary of Readiness Assessment Findings

Category	Findings
Policies and planning	• No policy recommendations • Positive comments on DLA reps • Consider frequency and membership of JSPB meetings
Catalog management	• Lack of speed and transparency of new item introductions • Case minimums don’t adequately support smaller units or retail model • Unwanted substitutions, inconsistent pricing, lack of DoD-wide buyer guide
Vendor management	• Perception remains that DLA supports vendors over customers • Desire for support in austere locations • Opportunity to partner with TRANSCOM to resolve vendor cargo issues
Order fulfillment	• Long lead times for OCONUS; TRANSCOM looking for better collaboration • OCONUS customers want in-transit visibility
Information and metrics	• Need common set of metrics and targets • STORES is not integrated with Service systems

The following sections outline our findings by category and provide examples and our recommendations.

Policies and Planning

In our policies and planning category, we include how well DLA coordinates with the DoD components, administers the JSPB, and develops and implements plans and procedures for subsistence support.

Findings

There were no suggestions on updates or additions to subsistence policy. In fact, one Service cited subsistence policy advocated by DLA as a significant area of strength. Similarly, most interviewees cited good relationships with DLA representatives in the field as a key advantage. Survey respondents rated their organizations' relationship with DLA 4.1 on a 5-point scale. The response was also positive (average of 3.9) on a series of questions regarding the designated DLA representative. A UCC survey respondent said the following with respect to Class I subsistence needs: "[The] DLA Liaison Officer at [our UCC] is highly engaged." Another UCC said of their DLA representatives, "Most if not all keep me updated on any [UCC] Class 1 issues." A Service representative also praised their DLA liaison for the direct support provided where required.

One UCC respondent noted some inconsistencies between the information they get from customer service representatives in the field and the guidance they get from DLA Troop Support headquarters. A Service representative also mentioned inconsistencies in the level of support they received from DLA representatives in certain locations. Finally, one UCC did not know who their DLA representative was.

Several interviewees said that DLA should reevaluate the frequency of JSPB meetings and the participants on the JSPB. One Service interviewee commented specifically that a once-per-year JSPB may be sufficient (and compliant with the JSPB charter requirement to meet at least annually). Others commented that JSPB meetings should be "principals only" to better facilitate effective discussion and decision-making. At a more tactical level, Services and UCCs were interested in interacting more with DLA in the field. They also wanted to ensure that strategic subsistence issues from Joint Subsistence Advisory Board (JSAB), UCC, and Service meetings rolled-up to the JSPB for decision. Understanding COVID restrictions, a Service respondent commented that they would like to see more face-to-face interaction between DLA representatives and Service food officers in the field to better understand and address issues and concerns.

Recommendations

To improve in this assessment category, we recommend that DLA consider the following recommendations:

- Review frequency of JSPB meetings and participants in JSPB to facilitate discussion and decision-making.
- Ensure that strategic subsistence issues discussed in JSAB, Service, and UCC meetings roll up for decision at JSPB meetings.

Catalog Management

The catalog management category included issues related to item standardization, new item introduction, substitutions, variety and nutrition, national brand items, and pricing.

Findings

UCCs and Services think that DLA should improve the speed and transparency of the new item request form process. Multiple UCCs and Services commented that the request process is too complicated. A Service respondent stated that, "(it) takes months, sometimes almost a year, to add required items in CONUS." Another Service

respondent acknowledged that the new item request process (through STORES) had recently improved, but also said that they wanted more granular visibility of the status of new item requests and perhaps an alert or notification regarding the status of a request. Overall, survey respondents scored the new items request process 3.4 on a 5-point scale.

Services and UCCs noted that case minimums and current units of measure (UOMs) don't support smaller units and the emerging campus-style dining model. A Service respondent commented that the larger case minimums are especially difficult for small sites with minimal storage capabilities in remote areas of CONUS. The same respondent continued, "They don't need large pack sizes, rather they need retail pack sizes." There was also concern that vendors were frequently making unwanted substitutions; interviewees noted the SPVs sometimes provide house brands instead of the requested name brand.

Services agree that DLA should focus more on achieving better and more consistent pricing. Service respondents scored DLA 3.3 on a 5-point scale on satisfaction with the selection, price, quality, and nutritional value of subsistence products. One Service respondent commented that they are able to achieve better pricing for common items through Service contracts. There were also comments that the buyer's guides were different for each Service causing a lack of local stock number standardization and a proliferation of items.

Recommendations

To improve catalog management, we recommend DLA do the following:

- Create, monitor, and leverage metrics and standards, including time requirements, for each phase of the new item introduction process (e.g., Service approval, DLA review, vendor response, etc.) to improve performance and reduce lead times.
- Analyze business case and consider contracting options to allow for smaller UOMs to support smaller units and retail delivery model.
- Track substitutions and their impact and then address substitution issues based on those data.
- Consider options to improve prices (e.g., better forecasting, guaranteed usage, etc.) and provide more transparency on the distribution fee.
- Promote a standard DoD buyer's guide.

Vendor Management

This assessment category includes DLA's management of SPV and other subsistence contracts.

Findings

Similar to a finding from the 2012 Class I readiness assessment, Services and UCCs perceive the need for more focus on the customer and more accountability for PVs. One Service said bluntly that DLA, "Supports the contractors more than the Services." A UCC respondent commented that, "Contracts are awarded and not enforced 'til customer

demand reaches imminent state. Lack of contract flexibility leads to increased transportation cost.” A Service respondent stated, “DLA ‘hears’ our needs but due to the complexity of DLA’s organization it is challenging and confusing at times meeting our needs.”

Additionally, TRANSCOM commented that its relationship with DLA is, “not conducive to truly conducting supply chain management of Class I cargo shipped through the DTS.” TRANSCOM’s primary area of concern is DLA’s perceived lack of response in resolving PV cargo issues when disputes arise between TRANSCOM vendors and DLA vendors. For example, a TRANSCOM interviewee stated that DLA, “repeatedly fails to work with (TRANSCOM) to plan or resolve issues associated with the shipment of (prime vendor) cargo through the DTS.”

DLA often lacks contract support in austere locations such as Africa and South America. A UCC respondent commented that, “Africa is still an undeveloped logistical nightmare.” One suggestion from a UCC interviewee was for DLA to provide access to a list of approved local vendors by region to improve lead times.

Recommendations

Based on these findings, LMI recommends DLA take the following steps to improve vendor management:

- Review existing processes to document SPV performance issues with customers (e.g., item rejection process, suitable substitutions) and then formalize processes where needed.
- Review local vendor approval processes for efficiencies to decrease time associated with availability.
- Research delivery options to support austere locations, including new technologies (e.g., drones) or other commercial delivery options.
- Consider standing-up a DLA/TRANSCOM working group to discuss subsistence supply chain issues and identify any needed policy, contract, and process changes.

Fulfillment

The fulfillment assessment category includes issues associated with order management, distribution, and transportation.

Findings

Overall, survey respondents scored DLA’s performance 3.7 on a 5-point scale on a series of questions regarding planning for, procuring, managing, and distributing Class 1–Subsistence products throughout the DoD supply chain. DLA scored particularly well (4.4 on a 5-point scale) on a survey question asking about interaction with DLA on matters related to operational and contingency stocks. One UCC representative commented positively regarding DLA’s response to contingency requirements, saying “I have minimal requirements for subsistence. When I do, they are contingency-based and DLA supports quickly.”

The average response to a survey question regarding delivery times meeting required delivery dates was 3.6 on a 5-point scale. Some stakeholders reported long OCONUS lead-times in general and customs and port delays in particular. A TRANSCOM survey respondent said that, “Globally about 80 percent of Class 1 is delivered within required delivery date (RDD), (however) Africa is a continuing problem area to clear customs. This is a host nation challenge.” Overall, for example, one UCC commented, “Subsistence Prime Vendor cataloging and fill rates need to be improved.” One of the Services noted that meeting RDDs varied by region.

TRANSCOM survey respondents and interviewees are seeking better collaboration with DLA on carrier claims and other transportation issues. One TRANSCOM representative said that the relationship with DLA, although cordial, was “not conducive to truly conducting supply chain management of Class I cargo shipped through the DTS.” The same respondent also commented that DLA often does not respond adequately to resolve issues associated with the shipment of SPV cargo.

Services and UCCs said that they lack easy access to in-transit visibility information. Survey respondents scored adequate visibility of in-transit subsistence assets 3.3 on a 5-point scale. Excluding the UCCs, Services rated this same question 2.9—the lowest Service average score. A Service respondent said that they would like commercially available solutions for scanning and tracking subsistence from point of order to receipt.

Recommendations

Based on these findings, LMI recommends that DLA take the following actions to improve their order fulfillment:

- Review contracts for SPV compliance because any performance issues ultimately impact the end customer.
- Consider adding requirement in OCONUS SPV contracts to provide visibility and reporting of in-transit data (e.g., electronic data interchange [EDI] transactions, radio-frequency identification [RFID]/barcode reads).
- Conduct and share results of in-transit data analysis to improve planning.
- Review afloat resupply operations to understand requirements and potential for improvement to decrease lead times.
- Improve fulfillment metrics reporting to better diagnose problems.

Information and Metrics

The information assessment category includes food management IT systems, asset visibility, and metrics.

Findings

Overall, survey respondents scored DLA performance 4.2 on a 5-point scale on the following survey question:

- DLA works effectively with the services and UCCs to select standards of support and establish effective metrics to measure the readiness and performance of the Class I–Subsistence supply chain.

Although the overall survey response was positive regarding subsistence metrics and readiness and performance standards, many survey commenters and interviewees cited a need for a common set of metrics with standard definitions and targets that are shared with all stakeholders. For example, one UCC commented that there was no metric to link transportation of Class I material to end-use readiness. Likewise, Services were unaware of any enterprise metrics to measure subsistence readiness and performance. Services said that they lack dashboards and metrics to monitor and see problems before they impact mission.

Food service representatives said that they lack enterprise visibility of local inventories. For example, one UCC interviewee would like to be able to make short shelf-life items visible within the region so they could be used by other activities. This visibility could potentially prevent spoilage and unnecessary buys and associated transportation costs.

Although STORES meets customer's basic needs, survey respondents and interview participants commented that it could be improved and be more user friendly. Overall, survey respondents scored STORES' effectiveness as a catalog and order management tool 3.3 on a 5-point scale—one of the lower average scores on the survey. Interviewees frequently cited the lack of integration between Service and DLA systems. As stated by one Service respondent, "We have been trying to get an interface from our system to STORES for over 5 years now."

Recommendations

To improve performance in this category we recommend that DLA:

- Conduct a study to determine what data to collect, the value of the information, the cost to collect the data, and appropriate standards and metrics targets for collection.
- Leverage the JSPB to drive enterprise metrics with links to more tactical metrics.
- Review local inventory visibility issue and consider cost/benefit of alternatives because a change would require new business model, different financial transactions, and better coordination across Services.
- Continue to develop JFMS, considering opportunities for better data exchange between Service and DLA systems.
- Continue plans to develop STORES replacement considering user experience.
- Conduct frequent stakeholder reviews and include users in requirements gathering for both JFMS and STORES replacement.

Chapter 5

Innovation Assessment Results

This chapter presents the interview and survey results, overall performance, research into commercial and government best practices, and findings and improvement recommendations for the innovation assessment component of the study.

Interview and Survey Results

Using the same approach as the Readiness Assessment, LMI solicited surveys and conducted interviews with each of the military services, the geographic combatant commands, and TRANSCOM. Table 4-1 in Chapter 4 shows the number of surveys that these organizations returned and whether or not we were able to conduct a follow-up interview.

Overall Performance

We asked survey respondents to rate how strongly they agreed or disagreed with statements based on a scale of 1 through 5 as depicted in Table 5-1.

Appendix D provides the detailed survey results for each question.

Table 5-1. Survey Rating Scale

Rating	Description
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

We evaluated DLA's overall performance and perception of performance regarding innovations as the Class I EA based on the following survey questions and components:

- DLA adequately supports innovation in the Class I–Subsistence supply chain with regards to:
 - Emerging technologies
 - Innovative subsistence best practices
 - Innovative contracting processes
 - Data infrastructure and standardization.
- Emerging technologies: Cutting edge innovative IT solutions that could benefit the Class I–Subsistence supply chain.
 - The Class I–Subsistence supply chain has a high level of asset visibility.

- We can monitor the condition (e.g., temperature) of assets in the Class I–Subsistence supply chain.
- DLA understands and supports the nutritional needs of the warfighter adequately.
- The current transportation network supports “last mile” distribution of Class I–Subsistence items to deployed forces adequately.
- DLA supplies fresh fruits and vegetables to forward locations effectively.
- DLA handles food recalls quickly and effectively.
- DLA supports special diets effectively (e.g., vegan or plant-based diets).

DLA’s customers, the military services, and the geographic UCCs generally believe DLA is performing well in pursuing innovation as the EA. DLA received the following ratings for their support for Class I innovations as shown in Table 5-2.

Table 5-2. DLA Adequately Supports Innovation in the Class I

Question	Services	UCCs (excluding TRANSCOM)	TRANSCOM
Emerging technologies	3.6	4.0	3.8
Innovative subsistence best practices	4.0	4.3	4.1
Innovative contracting practices	3.7	4.0	3.9
Data infrastructure and standardization	4.0	4.0	3.9

DLA customers, the military services, and the geographic UCCs were also asked to rate their belief/interest in the cutting-edge technology innovation solutions (and DLA’s support for each) as shown in Table 5-3. Overall, there was widespread agreement DLA adequately supports these capabilities and solutions.

Table 5-3. DLA Supports Cutting-Edge Technology and Innovation

Question	Services	UCCs (excluding TRANSCOM)	TRANSCOM
The Class I–Subsistence supply chain has a high level of asset visibility	3.8	4.0	3.9
We can monitor the condition (e.g., temperature) of assets in the Class I–Subsistence supply chain	3.6	3.5	3.5
DLA understands and supports the nutritional needs of the warfighter adequately	3.7	4.2	4.0
The current transportation network supports “last mile” distribution of Class I–Subsistence items to deployed forces adequately	3.6	3.9	3.8
DLA supplies fresh fruits and vegetables to forward locations effectively	4.1	4.2	4.1
DLA handles food recalls quickly and effectively	3.9	4.2	4.0
DLA supports special diets effectively (e.g., vegan or plant-based diets)	3.4	3.9	3.7

As stated in Chapter 4, DLA’s customers, the military services, and the UCCs generally believe DLA is performing well as the EA. Service and UCC overall ratings were positive.

While the overall assessment by the Services and UCCs was positive, survey respondents and interviewees offered several suggestions in which DLA support could further enhance the subsistence supply chain. We summarized our findings and listed improvement recommendations gleaned from surveys, interviews, and research below.

Findings and Improvement Opportunities

Over the past 2 years, DLA has worked to identify new technologies and business practices to improve service to the warfighter and position the Class I–Subsistence supply chain to support future modernization efforts over the next 5–10 years. The responses to this part of the interview will help DLA to synchronize this modernization with ongoing and planned Service and UCC efforts. As with the Class I Readiness Assessment, we'll start each group of questions by reviewing the survey responses from your organization. We collected a number of supply chain improvement opportunities from the survey responses and our follow-up interviews. We focused our follow-up questions on the areas that customers and stakeholders judged more negatively than the others. We organized these improvement opportunities according to these four assessment categories; emerging technologies, innovation subsistence best practices, innovative contracting processes, and data infrastructure and standardization as summarized in Table 5-4.

Table 5-4. Innovation Assessment Findings

Category	Findings
Emerging technology	• Most interest was focused on data analytics and process automation • Survey and interview data indicates significant demand for in-transit visibility capabilities
Innovative subsistence best practices	• Services/UCCs subsistence operations trending towards retail (i.e., campus-style) dining models as well as kiosks, grab-and-go, food trucks, etc. • High demand for dashboard with user-based information feed to provide in-transit visibility and other data insights
Innovative contracting processes	• Overall, the Services and UCCs agreed that DLA contracts meet their subsistence needs • DLA contracts should highlight surge requirements and potential risk scenarios, meaning the “what ifs.” • Army needs DLA support for Reserve/National Guard (catering, grocers, restaurants)
Data infrastructure and standardization	• Customers want more regional visibility across inventories in the subsistence supply chain • Up-front investment in cybersecurity and data access security

The following sections more completely summarize our findings by category and provide examples as well as our recommendations.

Table 5-5. Overview of Emerging Technologies^a

Technology	Definition
 Blockchain	Blockchain, or distributed ledger technology, is an encrypted and immutable history of transactions across all participants or stakeholders in a supply chain, where each of those participants has its own complete history of the transactions in the supply chain. There are many variations of the underlying blockchain technology, which is rapidly innovating and maturing. The most cited benefit of blockchain for the supply chain is increased auditability and traceability of transactions.
 Data Analytics	Data analytics is the analysis of large datasets from various sources and datatypes to understand and predict trends. The understanding garnered from such a program can range from predicting prices of individual commodities to tracking orders by facility more easily.
 Machine Learning (ML) and Artificial Intelligence (AI)	AI is any program that can perform a task under varying circumstances without significant oversight. ML is any program that can improve its performance from repeated action. Usually, AI and ML operate in a specific, defined, and narrow scope and are implemented together as different aspects of the same computer program. The use cases for AI and ML range from supply chain planning to automated visual inspections of goods.
 Automated Receiving	Automated receiving is the incorporation of technology, such as handheld scanners or phone apps, into the warehousing and receiving processes to improve auditability and traceability of an item through the supply chain. For example, using handheld scanners during receiving, combined with adoption of GS-1 standards in barcodes, can improve data granularity and reduce the number of unliquidated obligations in the SPV program.
 Connected Sensors and Automatic Identification	Sensors connected to each other and through a variety of wireless technologies report to analytical systems on DoD networks that share data for increased insight into the tracked items' identity, location, and status. These sensors can include temperature, location, motion, humidity, light, and gas detection. These sensors can improve auditability and food defense by reporting data irregularities in real time.
 Biometric ID	Biometric ID is the use of retina, fingerprint, iris, face, or other biometric markers as a form of identification. These biometric markers can be used in conjunction with other security or identification measures, such as identification cards or signatures, to improve the security of transactions made in the subsistence supply chain.
 Genetic Nutrition	Not everyone reacts to the same food in the same way. Genetic nutrition analyzes an individual's genetic, metabolic, and habit information to gain insight into how that individual reacts to different diets. In addition, genetic nutrition can help discover the diet to which the consumer will react best, thus, improving overall health.

Table 5-5. Overview of Emerging Technologies^a

Technology	Definition
 Wearables	Wearables monitor an individual's habits, such as physical exercise, heart rate, and amount of sleep. Such technologies include smartphones, smart watches, and fitness trackers. Using data collected from this technology, the services can gain insight into the health of service members, potentially changing diets to compensate or improve health and health outcomes for the consumer. Wearables also include technologies to enhance human perception in some way, such as Google Glass, which can be used as a training mechanism and offer users information they would not have otherwise had.
 Hydroponics	Hydroponics is a method of growing vegetables and herbs without using soil. The nutrients required by the plants are supplied solely through nutrient-rich water running over and through the roots of the plants. Hydroponics growing facilities include greenhouses and containers (like a shipping container). Hydroponics can reduce the length of the fruits and vegetables supply chain, decreasing food defense risks and spoilage.
 Alternative and Cultured Meats	The addition of meat substitutes, such as plant-based alternatives or meat grown in a laboratory, meets the consumer trend of cleaner labels and increased voluntary dietary restrictions, such as veganism and vegetarianism.
 Drones	Unmanned aircraft vehicles can deliver subsistence materials to remote or hostile territories, or for emergency relief. Because of a limitation in size and payload, these aerial vehicles deliver small resupply orders. Innovations are investigating one-time use drones to reduce costs as well as drones designed for multiple missions. Like aerial autonomous delivery vehicles, land-based autonomous vehicles can deliver orders, including through platooning, where one lead vehicle is manned, setting the speed and direction for a convoy of vehicles while other vehicles follow the leader. This method enables larger deliveries, a decreased delivery schedule, and decreased risk to the person delivering the order.

^a The Future of Subsistence Prime Vendor: Incorporating Emerging Technologies and Improved In-Transit Visibility, LMI Report 11064.014.00L1_DL705L1, M. Bishof, D. Evans, R. Graupmann, D. Jamieson, K. McCarthy, R. Miller, G. Montgomery, M. Peterson, R. Salley, and R. Yon, August 2018.

Emerging Technologies

In our emerging technologies category, respondents were asked to score how well DLA is supporting Class I–Subsistence innovation efforts and will help to select future innovative technologies and practices that could benefit the Services and UCCs. We begin by evaluating the respondent's familiarity with the technology innovations highlighted in our research and targeted by DLA R&D, then ask respondents to gauge the impact the innovation might have on subsistence.

Findings

The UCCs and Services showed widespread belief in the potential positive impact of emerging technologies on the subsistence supply chain. Few technologies presented during the surveys received a rating below 3.5 on a 5-point scale when rating potential benefit. However, the UCCs and the Services gave lower scores across the board when asked about their current interest level in each technology, with many technologies

receiving a rating below 2 out of 5 on interest level. Interviews indicated that several trials and prototypes had been conducted on these innovative new tools and techniques, and it was unclear to most what the outcomes were. Others doubted the added value of these technologies in a forward position at time of need, due to the operating conditions the warfighters must face in their mission. However, there were two areas where potential impact and interest levels remained relatively high: data analytics and automated receiving/automation in general.

Outside of more data access and data analytics (covered in more detail later in this chapter), few specific use-cases for emerging technologies were suggested during the interviews. There's a huge demand for in-transit visibility capabilities to be acquired and expanded upon, and for more access to transit information to help stakeholders make more informed decisions when planning. Data availability and accessibility are repeated themes throughout almost all of the interviews. DLA's customers are always hoping for more data and insights from DLA's supply chain and DLA's systems.

Unintuitively, when the UCCs and the Services were asked about their interest in partnering with DLA to pilot innovative Class I–Subsistence practices or technologies, both groups responded overwhelmingly positive. On a scale of 1 to 5, the average was a 4 in terms of interest. Similarly, when asked about the potential enhancements and added benefits that could be realized by pairing the listed emerging technologies and innovations, the average score was a 4.1 out of 5 in terms of potential. The contrast between these scores and the preceding, lower scores regarding interest levels were explored in the interviews.

It seems that before a technology is recommended or viewed as high value, it must be proven in the field. Our research findings indicate that field deployment may not be where the most proven value-add can be found. In Appendix E, the commercial best practices for all the above listed technologies are explored. In many cases, these technologies and innovations offer the most value and greatest impact from the rear, supporting forward activities but not deployed there.

Recommendations

Based on our innovation findings we recommend that DLA invest in technologies to improve communication. DLA should consider technology capabilities in early acquisition instead of last leg of delivery through things like hydroponics/vertical farming as season agnostic supply of product or market intelligence to better sustain subsistence class products.

- Invest in in-transit visibility technologies and adapt STORES/other access to enable end customers to see this information.
- Consider technology capabilities in early acquisition instead of in last leg of delivery (e.g., hydroponics/vertical farming as seasonal agnostic supply of product).
- Develop market intelligence capability to give customer's more information at SPV selection (more data).
- Deploy time-temperature indicators/sensors to consistently monitor and track in real time spoilage metrics of subsistence for products in transit and in storage.
- Use ML to determine optimal order quantity and order date based off trends.

Innovative Subsistence Best Practices

Our innovative best practices category asked the UCCs and the Services how well they believe DLA leverages best practices and innovated processes to support Class I–Subsistence. Special attention was paid to efforts to automate and streamline subsistence activities and supply chain processes.

Findings

UCCs and the Services generally agree that DLA supports best practices and works to compliment innovation, but some predict the future of subsistence will also require new and creative contract vehicles and innovative customization for procurement strategies to keep up with markets shifts and support new subsistence concepts. Talk about what these new contracts and strategies might look like was sometimes vague, and acknowledged the challenges involved for DLA to implement such an evolution. There were more specifics when discussing discrete capabilities and process improvements.

We found wide appeal amongst the subsistence base for kiosks and grab-and-go dining styles. Some pricing and nutrition requirements were identified as obstacles to these initiatives, so innovative contracting would be required to ensure widespread adoption and support of these strategies. More information about this subject is documented in Appendix F. Before implementing such changes, standards for the implementation of modern food practices should be developed in conjunction with DLA.

The most common response regarding subsistence best practices involved the wish for more in-transit visibility for UCC and Service customers. Across the board, respondents without access to STORES voiced frustration at the lack of transparency regarding their purchases in transit. It was consistently stated that better in-transit visibility would support better planning and management by giving customers insights into shipping delays and timing.

Recommendations

Foremost of all the recommendations in the Innovation Assessment, we recommend DLA work with stakeholders to develop a unified dashboard to enable customers to view information relevant to their activities within the subsistence supply chain. This recommendation was heard in almost every interview, and in discussion in the innovation and readiness categories.

- Explore the kiosk/modern dining pilots conducted by the services and adopt best practices/lessons learned to enable more widespread adoption.
- Develop a dashboard with user-based information feed to provide in-transit visibility and other data insights (for collaboration, planning, etc.).
- Focus on integrating IT innovations to achieve the greatest impact on improving subsistence processes.
- Develop inventory monitoring technologies to understand quantities present in storage and in transit.
- Expand on current barcoding projects to utilize in transit and inventory management to increase product visibility.

Innovative Contracting Practices

UCCs and Services were asked about the confidence levels in DLA contracting innovation and creativity, as well as any new or alternative contracting methods or strategies being employed in government or commercial supply chains that may improve the Class I–Subsistence supply chain.

Findings

Overall, the Services and UCCs agreed that DLA contracts meet their subsistence needs and will continue to in the future. Comments on the surveys and discussions during the follow-on interviews mentioned only a need for more agility. Specifically, it was mentioned that contracts should address, whenever possible, surge requirements and potential risk scenarios. In other words, there should be contracting clauses accounting for the “what ifs.” These requests are informed by unique challenges that arose during the COVID-19 pandemic and subsequent supply chain disruptions.

Other recommendations were made regarding alternative subsistence and food service practices. Campus style dining models have been tried by various stakeholders to mixed results. Contracts that could support kiosks, grab-and-go, and other infrequent/ad-hoc demand subsistence are worth investigating, based on results from those interviews. More information on one such use-case can be found in Appendix F. This use case highlights the Army requirement to support infrequent demand from Reserve and National Guard units. They are seeking DLA’s support for a contracting solution that does not require using the Government Purchase Card (GPC).

Recommendations

- Consider commercial vendor blanket purchase agreement with a grocer, caterer, or restaurant to support Army requirement for Reserve and National Guard units.
- Explore further partnership with the Defense Commissary Agency.
- Study COVID and other crises to develop risk management and resiliency standards for subsistence contracts/policies.
- Develop new contracting models to address customer challenges and leverage opportunities.
- If an item is deemed incorrect or an insufficient substitution at any point in the supply chain, DLA should be alerted to get in touch with the SPV.

Data Infrastructure and Standardization

UCCs and the Services were asked their opinion about current DLA data sharing and management infrastructure and practice. They were surveyed and interviewed about innovative ways to collect, access, standardize, and share data and information in the Class I–Subsistence supply chain, and how DLA could evolve to help. Overall, this was the innovation category with the lowest average scores in the survey results. However, the interviews painted a picture of a customer base that wants more data and more access, not one that believes DLA’s data standards were lacking any key information.

Findings

There was mild disagreement between the Services and the UCCs regarding DLA's data sharing. While the UCCs rated their access to useful DLA data a 3.8, the Services rated their access a 3.1. The Services similarly rated data standardization and sharing as merely average, giving scores of 2.4 and 2.7 out of 5, respectively. The UCCs had a more positive outlook, giving the same categories scores of 3.7 and 3.7, respectively. During the interviews, many of the access complaints were lodged against the STORES system and the process an individual must go through to gain access.

Beyond these data access concern, members of the UCCs and the Services indicated an interest in an expanded market intelligence capability and access to information about vendor past performance and product trends. Further, respondents stated that inventory management could be simplified by offering visibility across inventories in the subsistence supply chain, enabling more collaboration and additional cost savings for all of DLA's customers.

The most consistent feedback we received was the need for unified digital dashboards to reference and display relevant data to subsistence stakeholders. Developing a single dashboard view that pulls data from a number of different sources into one place would enable subsistence supply chain managers to make better decisions and expedite planning.

Recommendations

- Plan for cybersecurity and integration requirements and invest in IT as the key enabler to improve data insights and increase automation.
- Pursue initiatives to improve interoperability between systems and organizations.
- Develop a cloud-based data repository for STORES that holds all historical shipment metrics and associated data as well as data on previous inventory catalog continuity when SPV changeover occurs.
- Increase transparency with a STORES system that holds data on what products are included in current and future subsistence orders to improve communication and visibility with SPV.
- Automate reoccurring order entry into DLA ordering system (i.e., STORES or STORES replacement).

Chapter 6

Conclusions and Next Steps

Customers generally rated DLA performance as the Class I EA favorably. Most respondents agreed that DLA was serving effectively as the EA and that they are satisfied with DLA's level of Class I support. As would be expected, the Service and UCC stakeholders identified areas in which they would like to see DLA make improvements.

Although overall response was positive, our assessment team sought explanation and examples of any survey outliers during the interview process. These areas of concern present opportunities for DLA to improve its performance as the EA. Common categories where survey respondents and interview participants offered feedback and identified the need for improvement are shown in Table 6-1.

Table 6-1. Assessment Categories

Readiness assessment	Innovation assessment
• Policies and planning • Catalog management • Vendor management • Order fulfillment • Information and metrics	• Emerging technologies • Innovative subsistence best practices • Innovative contracting processes • Data infrastructure and standardization

We outlined our findings in each of these categories and offered recommended improvements to DLA performance as the Class I EA in Chapter 4 and Chapter 5. Although most respondents were satisfied with DLA's current support and efforts for innovation, we uncovered a theme of Services and UCC stakeholders wanting more data, more collaboration, and more transparency.

In many cases, implementing these improvements will require greater collaboration and cooperation among stakeholders and an end-to-end supply chain view. We believe that the executive governance boards Class I and the JSPB are best positioned to determine the priority of these improvements and guide the implementation of our readiness assessment recommendations. We recommend DLA adopt more frequent readiness assessments as part of a regular process for Class I–Subsistence and its other EA supply chains, so it can identify improvement opportunities and performance trends over time. We also recommend implementing technology innovations, including enhanced in-transit visibility capabilities and a unified data dashboard that subsistence stakeholders can access to make use of a variety of relevant data streams for their products and consumers.

Based on the findings identified via the readiness assessment and innovation findings ascertained through the innovation assessment and commercial research, we summarized key supply chain gaps and compiled a list of innovative technologies and

practices that may improve the subsistence supply chain. We recommend that DLA consider the R&D ideas outlined in Table 6-2.

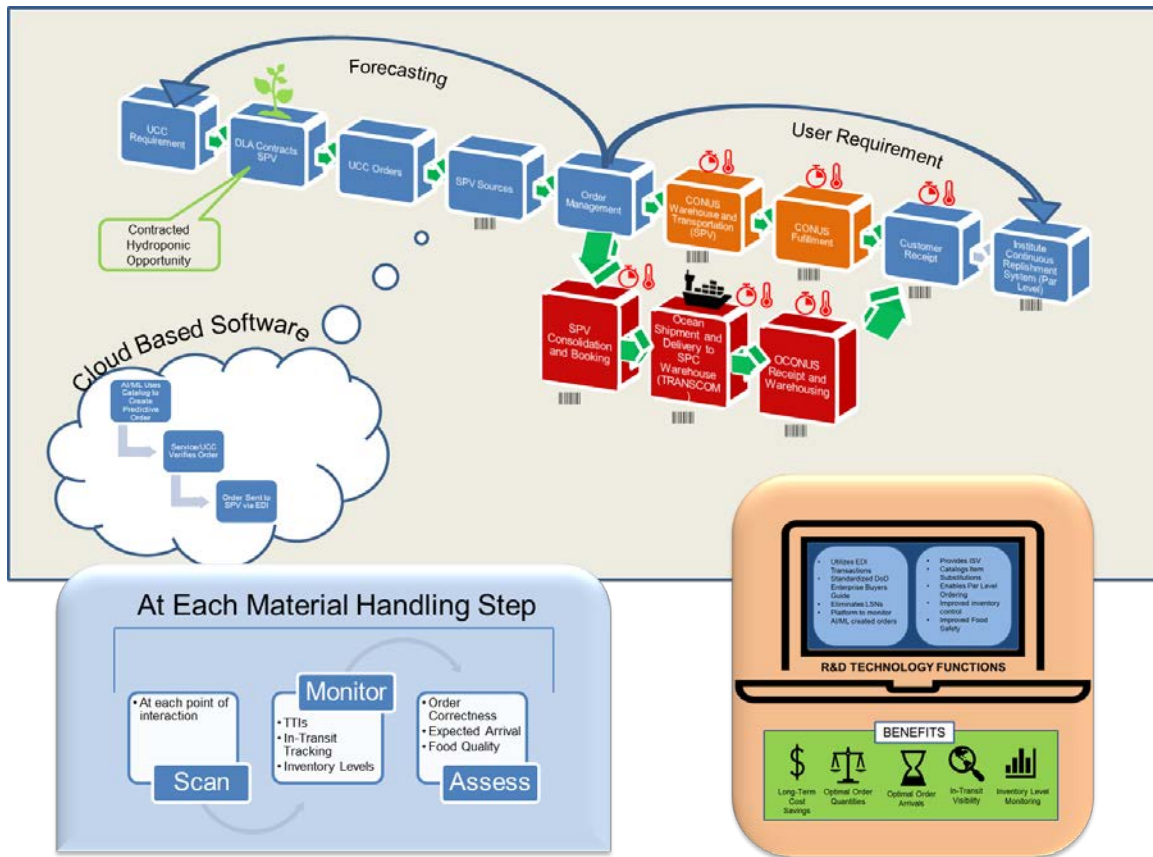
Table 6-2. DLA R&D Initiative Recommendations

Key supply chain gap	Related innovative technologies and best practices	Potential DLA R&D initiatives
Need to improve shipment status and condition visibility	• Automatic identification and data capture technologies including barcoding, RFID, and wireless sensor mesh • Dashboards	Conduct in-transit visibility/condition monitoring pilot with TRANSCOM and an OCONUS partner
Lack of standard information sharing with all stakeholders, including lack of standard metrics and targets	• Dashboards • Data analytics • AI/ML • Data standardization	• Use configuration mapping to determine what information is available, what systems contain that data, and to develop a roadmap to access the data • Determine stakeholder information and metrics needs and roles/ access requirements
Lack of Service system integration, and outdated ordering system	• Better user interface and access to system (STORES replacement) • Integration with Service systems (JFMS)	Engage stakeholders in user requirements and testing for STORES replacement and JFMS
Need for more process automation	• Barcodes and scanning • Robotic Process Automation • AI/ML	• Continue rolling out receiving and barcode pilot (OCONUS) • Identify additional opportunities for contracting/business process automation
Current subsistence business model doesn't fully support newer retail approaches being explored by Services and UCCs (e.g., campus-style dining, grab/go, kiosk, food truck, catered meals)	• Innovative contracting strategies (alternative subsistence delivery models) • Data standardization/IT infrastructure to support • Financial transactions (e.g., EDI)	• Use Army Reserve/National Guard catering support solution as pilot for other Services • Explore retail solutions and develop roadmap
Need to pay additional attention to risk management and surge contingencies	• What-if (surge) clauses in contracts • Scenario modeling • Mitigation strategies	Conduct Supply Chain Resilience study/pilot
Lack of subsistence forecasting and planning tools (OPRATS and SPV); lack inventory visibility	• AI/ML • Resource pooling	• Develop subsistence market intelligence tool • Acquire retail inventory management tool
Pricing inconsistencies and long-lead times for new item introduction	• Robotic Process Automation • Data access/standardization	• Implement technology solution for fair and reasonable determinations • Reengineer/automate new item introduction process

Implementing the recommended DLA R&D initiatives could lead to a notional future Class I–Subsistence supply chain that fully integrates our recommendations (Figure 6-1). This graphic provides a high-level depiction of the increased in-transit and inventory visibility and the streamlined end-to-end processes. The graphic details the

current Class I–Subsistence supply chain process steps with the addition of new innovative workflows, highlighting how the improvement opportunities outlined above can enhance supply chain effectiveness.

Figure 6-1. Notional Future Class I–Subsistence Supply Chain



The recommended R&D initiatives combine to provide supply chain changes in three primary areas: using cloud-based software to improve Class I–Subsistence procurement, implementing a new approach to each material handling step, and upgrading the DLA subsistence IT tools to improve communication, visibility, and stakeholder engagement.

Appendix A

Class I–Subsistence Supply Chain: Readiness Assessment and Innovation Survey

DoDD 5101.10E, *DoD Executive Agent for Subsistence*, October 26, 2015 (please see attached), designates the Director, DLA as the DoD EA for Class I–Subsistence. This survey assesses DLA's performance as the EA and evaluates how innovative practices and technologies could improve the subsistence supply chain. The two parts of the survey are as follows:

- Class I Readiness Assessment—These questions will assist DLA in evaluating how well the DoD EA for Class I–Subsistence is supporting the military services and UCCs' readiness worldwide during peacetime and combat operations.
- Subsistence Innovation Assessment—This part of the survey will gauge how well DLA is supporting subsistence innovation efforts and help to select future innovative technologies and practices that could benefit the services and UCCs.

The responses to this survey will be combined with information gathered during interviews with selected organizations. Following completion of the assessment, we will compile the results in the *Subsistence Readiness Assessment and Innovation Report* and distribute it to each responding organization.

As you answer the survey questions, please be aware that the assessment evaluates DLA support specific to your organization as well as to the overall Class I–Subsistence supply chain in general. Therefore, survey responses in the report may be attributed to specific organizations.

Instructions

Ms. Janine Samoni, janine.samoni@dla.mil, (215) 737-2999, is the DLA point of contact for this survey and LMI is the contractor assisting DLA with this assessment. Upon completion of the survey, please email your responses to cmontemayor@lmi.org.

Name: _____

Email Address: _____

Phone Number: _____

UCC/Service: _____

Organization: _____

Please provide the following information for your organization's point of contact:

Duty Title: _____

Office Code: _____

Denote the grade/rank of your organization's point of contact: _____

Class I Readiness Assessment

These questions will assist DLA in evaluating how well the DoD EA for Class I–Subsistence is supporting the military services and UCCs. Please rate the following statements on a scale of 1–5 (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, NA = Not Applicable, or UK = Unknown).

The statements are organized according to the Class I–Subsistence EA responsibilities as outlined in DoDD 5101.10E. At the end of this part of this survey, we request an overall assessment of DLA's performance as the EA and provide a comments section to elaborate on any of the below questions or for any general comments.

1. DLA coordinates with the DoD components, administers the Joint Subsistence Policy Board (JSPB), and develops and implements plans and procedures for subsistence support.
 - a. _____ DLA works effectively with the services and UCCs to select standards of support and establish effective metrics to measure the readiness and performance of the Class I–Subsistence supply chain.
 - b. _____ Sufficient DLA personnel resources are assigned for your Class I–Subsistence support needs.
 - c. _____ You have had satisfactory opportunities to describe your command's Class I–Subsistence policy and programs to DLA and to coordinate with DLA in developing Class I–Subsistence readiness and sustainment requirements for your organization.
 - d. _____ DLA is integrated into and participates actively in your Class I–Subsistence planning process and exercise program.
 - e. _____ You have a process or program to evaluate Class I–Subsistence supply chain readiness and performance in coordination with DLA.
 - f. _____ You have defined specific days of supply or other policies and standards for Class I–Subsistence readiness and communicated those to DLA.
 - g. _____ You are satisfied that the relationships between your organization and DLA facilitate responsive Class I–Subsistence supply chain support.
 - h. _____ You know who the designated DLA representative is to satisfy Class I–Subsistence needs for your region or command.
 - i. Your designated DLA representative
 - i. _____ Adequately communicates his or her roles, responsibilities, and capabilities for Class I–Subsistence.
 - ii. _____ Meets with units in theaters of operation.
 - iii. _____ Trains units in theater.
 - iv. _____ Has the resources and capabilities to support your theater's needs.
 - v. _____ Is involved in your logistics support planning.

- j. _____ You receive adequate information about Class I–Subsistence readiness with appropriate time to affect decisions for planned and ongoing operations.
- k. _____ You interact with DLA on structuring your specific Class I–Subsistence plans and programs.

Please enter comments with respect to your responses above:

- 2. DLA plans for, procures, manages, and distributes Class I–Subsistence products throughout the DoD supply chain and delivers items to locations as mutually agreed to by the DoD Components.
 - a. _____ Our organization is satisfied with the selection, price, quality, and nutritional value of the Class I–Subsistence products from DLA.
 - b. _____ DLA's new item introduction process works well.
 - c. _____ DLA's STORES is an effective catalog and order management tool.
 - d. _____ Delivery times for Class I–Subsistence assets meet required delivery dates.
 - e. _____ DLA facilitates the invoicing and reconciliation process for Class I–Subsistence orders effectively.
 - f. _____ DLA is receptive to feedback regarding improvements to Class I–Subsistence issues as they arise.
 - g. _____ In partnership with the United States Transportation Command (as the Distribution Process Owner), DLA effectively manages Class I–Subsistence supply chain distribution of surge and sustainment materiel obtained from commercial sources.
 - h. _____ DLA adopts commercial best practices effectively to optimize Class I–Subsistence support.

Please enter comments with respect to your responses above:

- 3. DLA maintains authorized war reserve stocks of subsistence.
 - a. _____ DLA supplies the necessary Class I–Subsistence surge and sustainment support.
 - b. _____ DLA's Warstopper Program interacts effectively with your organization's war reserve materiel programs to support Class I–Subsistence operations.
 - c. _____ Your organization interacts effectively with DLA on matters related to operational and contingency stocks and the resources needed to ensure Class I–Subsistence readiness and sustainment support.

Please enter comments with respect to your responses above:

4. In coordination with the military departments, DLA plans, develops, funds, implements, and maintains a Joint Food Management System that interfaces with existing service systems.
 - a. _____ DLA serves as an effective advocate for addressing Class I–Subsistence long-term challenges, such as achieving an integrated information architecture and a joint requirements process and modeling tool.
 - b. You have adequate visibility of Class I–Subsistence assets:
 - i. _____ In your theater.
 - ii. _____ In-transit.
 - c. _____ There is adequate accountability of Class I–Subsistence assets in your theater.
 - d. _____ You have adequate planning tools for estimating Class I–Subsistence requirements.
 - e. _____ DLA coordinates with and seeks input from the military departments as they plan and develop a Joint Food Management System that interfaces with existing service systems.

Please enter comments with respect to your responses above:

5. DLA oversees the subsistence support activities of the DoD EA for Class I–Subsistence and the JSPB.
 - a. _____ Class I–Subsistence requirements are synchronized with the development of operational plans and force structure changes.
 - b. _____ Logistics plans are developed for Class I–Subsistence support operations in all environments.

Please enter comments with respect to your responses above:

6. DLA coordinates with the DoD EA for Class I–Subsistence through the JSPB regarding requirements determination, logistics planning, and proposed mission transfers to ensure materiel availability during peacetime and wartime and eliminate duplication of effort.
 - a. _____ DLA manages the transition from one provider to another during contract turnovers successfully.
 - b. _____ DLA adequately assists when units deploy to a region covered by a different subsistence contract or vendor.

Please enter comments with respect to your responses above:

7. DLA supports non-traditional organizations, as required.
 - a. _____ DLA supplies effective Class I–Subsistence support to non-DoD organizations (e.g., Federal Emergency Management Agency, United States Department of Agriculture, Department of State, and United States Agency for International Development).

Please enter comments with respect to your responses above:

8. DLA serves as the DoD EA for Class I–Subsistence.
 - a. _____ Overall, DLA effectively serves as the DoD EA for Class I–Subsistence.
 - b. _____ Overall, you are satisfied with the level of Class I–Subsistence support from DLA.

Please enter comments with respect to your responses above:

Additional comments on DLA's performance as the Class I EA:

Subsistence Innovation

This part of the survey will gauge how well DLA is supporting Class I–Subsistence innovation efforts and will help to select future innovative technologies and practices that could benefit the services and UCCs. **The table at the end of the survey** describes the emerging technology areas listed in questions 1–3 with potential innovative capabilities for DLA to improve the Class I–Subsistence supply chain over the next 5–10 years.

1. Please indicate your awareness of the below emerging technologies (1 = Yes; 2 = No).
 - a. ____ Block chain
 - b. ____ Data analytics
 - c. ____ Machine learning and artificial intelligence
 - d. ____ Automated receiving
 - e. ____ Connected sensors and automatic identification
 - f. ____ Biometric ID
 - g. ____ Genetic nutrition
 - h. ____ Wearables
 - i. ____ Hydroponics
 - j. ____ Alternative and cultured meats
 - k. ____ Drones

Please enter comments with respect to your responses above:

2. Without considering cost and technology limitations, please assess the following emerging technologies according to how you view their potential positive influence on the subsistence supply chain for your UCC or Service over the next 5–10 years (1 = No Impact, 2 = Minimal Impact, 3 = Some Impact, 4 = Substantial Impact, 5 = Very High Impact, NA = Not Applicable, or UK = Unknown).
 - a. ____ Block chain
 - b. ____ Data analytics
 - c. ____ Machine learning and artificial intelligence
 - d. ____ Automated receiving
 - e. ____ Connected sensors and automatic identification
 - f. ____ Biometric ID
 - g. ____ Genetic nutrition
 - h. ____ Wearables
 - i. ____ Hydroponics

- j. ____ Alternative and cultured meats
- k. ____ Drones

Please enter comments with respect to your responses above:

3. Please indicate your UCC or Service's level of interest in each emerging technology for the subsistence supply chain (1 = No Interest, 2 = Some Interest, 3 = Conducting Research, 4 = Pilot Considered or Underway, or 5 = Implemented).
- a. ____ Block chain
 - b. ____ Data analytics
 - c. ____ Machine learning and artificial intelligence
 - d. ____ Automated receiving
 - e. ____ Connected sensors and automatic identification
 - f. ____ Biometric ID
 - g. ____ Genetic nutrition
 - h. ____ Wearables
 - i. ____ Hydroponics
 - j. ____ Alternative and cultured meats
 - k. ____ Drones

Please enter comments with respect to your responses above:

Over the past 2 years, DLA has worked to identify new technologies and business practices to improve service to the warfighter and position the Class I–Subsistence supply chain to support future modernization efforts over the next 5–10 years. The responses to this survey will help DLA to synchronize this modernization with ongoing and planned Service and UCC efforts. For the purposes of this survey, we are using the following definitions:

- Emerging technologies—cutting edge innovative IT solutions that could benefit the Class I–Subsistence supply chain (**see table at the end of the survey**).
- Innovative subsistence best practices—process improvements and innovative practices that could improve and automate the Class I–Subsistence supply chain.
- Innovative contracting processes—any new or alternative contracting methods or strategies being employed in government or commercial supply chains that may improve the Class I–Subsistence supply chain.
- Data infrastructure and standardization—innovative ways to collect, access, standardize, and share data and information in the Class I–Subsistence supply chain.

Please rate the following statements on a scale of 1–5 (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, NA = Not Applicable, or UK = Unknown).

4. DLA adequately supports innovation in the Class I–Subsistence supply chain with regards to
- a. ____ Emerging technologies.
 - b. ____ Innovative subsistence best practices.
 - c. ____ Innovative contracting processes.
 - d. ____ Data infrastructure and standardization.

Please enter comments with respect to your responses above:

5. Emerging technologies
- a. ____ The Class I–Subsistence supply chain has a high level of asset visibility.
 - b. ____ We can monitor the condition (e.g., temperature) of assets in the Class I–Subsistence supply chain.
 - c. ____ DLA understands and supports the nutritional needs of the warfighter adequately.
 - d. ____ The current transportation network supports “last mile” distribution of Class I–Subsistence items to deployed forces adequately.
 - e. ____ DLA supplies fresh fruits and vegetables to forward locations effectively.
 - f. ____ DLA handles food recalls quickly and effectively.
 - g. ____ DLA supports special diets effectively (e.g., vegan or plant-based diets).

Please enter comments with respect to your responses above:

6. Innovative subsistence best practices (i.e., process improvements)
- a. ____ DLA leverages industry best practices in support of the Class I–Subsistence supply chain.
 - b. ____ DLA has supported the Services and UCCs effectively in efforts to automate Class I–Subsistence supply chain processes (e.g., ordering, receiving) by leveraging innovative processes.

Please enter comments with respect to your responses above:

7. Innovative contracting processes
- a. ____ DLA contracts meet your organization’s Class I–Subsistence needs now and in the future.

Please enter comments with respect to your responses above:

8. Data infrastructure and standardization

- a. ____ Our organization has ready access to the data needed to make good Class I–Subsistence supply chain decisions.
- b. ____ Class I–Subsistence data and data collection (e.g., barcodes and catalog data) are standardized sufficiently.
- c. ____ Class I–Subsistence data is adequately shared across the Services and UCCs.

Please enter comments with respect to your responses above:

- 9. ____ Our organization is interested in partnering with DLA to pilot innovative Class I–Subsistence practices or technologies.

Please enter comments with respect to your responses above:

- 10. ____ Potential enhancements and added benefits could be realized through the pairing of the listed emerging technologies and innovative solutions being used or soon to be implemented in our Service or UCC.

Please enter comments with respect to your responses above:

Additional comments on innovative practices and technologies:

(Please include any additional Class I–Subsistence innovations that your organization is considering as well as any future requirements that would benefit from a technology solution.)

Overview of Emerging Technologies^a

Technology	Definition
Blockchain 	Blockchain, or distributed ledger technology, is an encrypted and immutable history of transactions across all participants or stakeholders in a supply chain, where each of those participants has its own complete history of the transactions in the supply chain. There are many variations of the underlying blockchain technology, which is rapidly innovating and maturing. The most cited benefit of blockchain for the supply chain is increased auditability and traceability of transactions.
Data Analytics 	Data analytics is the analysis of large datasets from various sources and datatypes to understand and predict trends. The understanding garnered from such a program can range from predicting prices of individual commodities to tracking orders by facility more easily.
ML and AI 	AI is any program that can perform a task under varying circumstances without significant oversight. ML is any program that can improve its performance from repeated action. Usually, AI and ML operate in a specific, defined, and narrow scope and are implemented together as different aspects of the same computer program. The use cases for AI and ML range from supply chain planning to automated visual inspections of goods.
Automated Receiving 	Automated receiving is the incorporation of technology, such as handheld scanners or phone apps, into the warehousing and receiving processes to improve auditability and traceability of an item through the supply chain. For example, using handheld scanners during receiving, combined with adoption of GS-1 standards in barcodes, can improve data granularity and reduce the number of unliquidated obligations in the SPV program.
Connected Sensors and Automatic Identification 	Sensors connected to each other and through a variety of wireless technologies report to analytical systems on DoD networks that share data for increased insight into the tracked items' identity, location, and status. These sensors can include temperature, location, motion, humidity, light, and gas detection. These sensors can improve auditability and food defense by reporting data irregularities in real time.
Biometric ID 	Biometric ID is the use of retina, fingerprint, iris, face, or other biometric markers as a form of identification. These biometric markers can be used in conjunction with other security or identification measures, such as identification cards or signatures, to improve the security of transactions made in the subsistence supply chain.
Genetic Nutrition 	Not everyone reacts to the same food in the same way. Genetic nutrition analyzes an individual's genetic, metabolic, and habit information to gain insight into how that individual reacts to different diets. In addition, genetic nutrition can help discover the diet to which the consumer will react best, thus, improving overall health.

Overview of Emerging Technologies^a

Technology	Definition
Wearables 	Wearables monitor an individual's habits, such as physical exercise, heart rate, and amount of sleep. Such technologies include smartphones, smart watches, and fitness trackers. Using data collected from this technology, the services can gain insight into the health of service members, potentially changing diets to compensate or improve health and health outcomes for the consumer. Wearables also include technologies to enhance human perception in some way, such as Google Glass, which can be used as a training mechanism and offer users information they would not have otherwise had.
Hydroponics 	Hydroponics is a method of growing vegetables and herbs without using soil. The nutrients required by the plants are supplied solely through nutrient-rich water running over and through the roots of the plants. Hydroponics growing facilities include greenhouses and containers (like a shipping container). Hydroponics can reduce the length of the fruits and vegetables supply chain, decreasing food defense risks and spoilage.
Alternative and Cultured Meats 	The addition of meat substitutes, such as plant-based alternatives or meat grown in a laboratory, meets the consumer trend of cleaner labels and increased voluntary dietary restrictions, such as veganism and vegetarianism.
Drones 	Unmanned aircraft vehicles can deliver subsistence materials to remote or hostile territories, or for emergency relief. Because of a limitation in size and payload, these aerial vehicles deliver small resupply orders. Innovations are investigating one-time use drones to reduce costs as well as drones designed for multiple missions. Like aerial autonomous delivery vehicles, land-based autonomous vehicles can deliver orders, including through platooning, where one lead vehicle is manned, setting the speed and direction for a convoy of vehicles while other vehicles follow the leader. This method enables larger deliveries, a decreased delivery schedule, and decreased risk to the person delivering the order.

^a *The Future of Subsistence Prime Vendor: Incorporating Emerging Technologies and Improved In-Transit Visibility*, LMI Report 11064.014.00L1_DL705L1, M. Bishof, D. Evans, R. Graupmann, D. Jamieson, K. McCarthy, R. Miller, G. Montgomery, M. Peterson, R. Salley, and R. Yon, August 2018.

Appendix B

Subsistence Memorandum



DEFENSE LOGISTICS AGENCY
TROOP SUPPORT
700 ROBBINS AVENUE
PHILADELPHIA, PENNSYLVANIA 19111-5092

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Class I Subsistence Supply Chain Readiness and Innovation Assessment

In accordance with Department of Defense (DoD) Directive 5101.10, *DoD Executive Agent for Class I*, we request your support for a Subsistence Supply Chain Readiness and Innovation Assessment. Your assistance with this assessment will help us to evaluate how well the Defense Logistics Agency is fulfilling its DoD Executive Agent responsibilities and, more importantly, uncover areas where we need to improve to better support you, our partners. In addition, we will leverage this review and assessment to discover any capability gaps that can be filled by existing or emerging technologies.

We have contracted with LMI for the assessment and would like them to contact your key personnel to participate in a survey and interview process to assist with gathering the relevant data for this assessment. Their participation will be on a limited basis and we will make every effort to minimize disruption to ongoing operations. Please provide contact information for your key personnel to Ms. Janine Samoni, DLA Troop Support, (215) 737-2999, or email: janine.samoni@dla.mil, and Mr. Nicholas McGinty, DLA Troop Support, (215) 737-4252, or email: nicholas.mcgintry@dla.mil at your earliest convenience.

Once the assessment begins in March 2021, it will be completed in approximately eight (8) months. You will receive a written report with the results from this assessment. If you have any questions, please contact Ms. Samoni or Mr. McGinty.

Thank you for your support of this effort to ensure enhanced delivery of Class I supplies to the Warfighter.

LAWRENCE, GAVIN
ANTONIO.103102054
6

Digitally signed by
LAWRENCE, GAVIN/ANTONIO.103102054
DN: cn=ANTONIO.103102054, o=DLA, ou=DLA, email=ANTONIO.103102054@DLA.MIL, c=US

GAVIN A. LAWRENCE
Brigadier General, USA
Commander

DISTRIBUTION:
DIRECTOR, JOINT STAFF, J4 LOGISTICS
DEPUTY CHIEF OF STAFF, ARMY G-4
DEPUTY CHIEF OF NAVAL OPERATIONS (FLEET READINESS AND LOGISTICS) N4
DEPUTY CHIEF OF STAFF LOGISTICS, INSTALLATIONS & MISSION SUPPORT (A4/7)
DEPUTY COMMANDANT, INSTALLATIONS AND LOGISTICS, U.S. MARINE CORPS
COMMANDER
UNITED STATES AFRICA COMMAND
UNITED STATES EUROPEAN COMMAND
UNITED STATES NORTHERN COMMAND
UNITED STATES INDO-PACIFIC COMMAND
UNITED STATES SOUTHERN COMMAND
UNITED STATES SPECIAL OPERATIONS COMMAND
UNITED STATES TRANSPORTATION COMMAND

Appendix C

Class I–Subsistence Supply Chain: Readiness and Innovation Assessment Interview

DoDD 5101.10E, “DoD Executive Agent for Subsistence,” October 26, 2015, designates the Director, DLA as the DoD EA for Class I–Subsistence. This interview assesses DLAs performance as the EA and evaluates how innovative practices and technologies could improve the subsistence supply chain. The three parts of this interview are as follows:

1. **Background and Introductions:** We will start the discussion by providing an overview of our effort on behalf of DLA and then ask some introductory questions regarding subsistence roles and responsibilities, policies, and scope of Class I–Subsistence support from DLA.
2. **Class I Readiness Assessment:** These questions will assist DLA in determining how well the DoD EA for Class I–Subsistence is supporting the military services’ and UCCs’ readiness worldwide during peacetime and combat operations. We organized the discussion topics according to the Class I–Subsistence EA responsibilities as outlined in DoDD 5101.10E. We’ll start each group of questions by reviewing the survey responses from your organization.
 - Policies and Planning: DLA coordinates with the DoD components, administers the JSPB, and develops and implements plans and procedures for subsistence support.
 - Supply Chain Management: DLA plans for, procures, manages, and distributes Class I–Subsistence products throughout the DoD supply chain and delivers items to locations as mutually agreed to by the DoD components.
 - War Reserve Stocks: DLA maintains authorized war reserve stocks of subsistence.
 - Joint Food Management System: In coordination with the military departments, DLA plans, develops, funds, implements, and maintains a JFMS that interfaces with existing service systems.
 - Operational Synchronization: DLA coordinates with the Office of the Secretary of Defense to provide oversight of the subsistence support activities of the DoD EA for Class I–Subsistence and the JSPB.
 - Materiel Availability: DLA coordinates with the DoD component heads through the JSPB regarding requirements determination, logistics planning, and proposed mission transfers to ensure materiel availability during peacetime and wartime and eliminate duplication of effort.

-
- Non-traditional Support: DLA supports non-traditional organizations (i.e., non-DoD organizations), as required.
 - Overall: Overall assessment of DLA as the DoD EA for Class I–Subsistence and discussion of recent COVID-19 impacts.
3. **Subsistence Innovation Assessment**: Over the past 2 years, DLA has worked to identify new technologies and business practices to improve service to the warfighter and position the Class I–Subsistence supply chain to support future modernization efforts over the next 5–10 years. The responses to this part of the interview will help DLA to synchronize this modernization with ongoing and planned Service and UCC efforts. As with the Class I Readiness Assessment, we'll start each group of questions by reviewing the survey responses from your organization.
- Emerging Technologies: Cutting edge innovative IT solutions that could benefit the Class I–Subsistence supply chain (**please see the table at the end of this read-ahead for examples and definitions**).
 - Innovative Subsistence Best Practices: Process improvements and innovative practices that could improve and automate the Class I–Subsistence supply chain.
 - Innovative Contracting Processes: Any new or alternative contracting methods or strategies being employed in government or commercial supply chains that may improve the Class I–Subsistence supply chain.
 - Data Infrastructure and Standardization: Innovative ways to collect, access, standardize, and share data and information in the Class I–Subsistence supply chain.

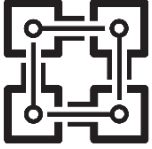
The responses to this interview will be combined with survey results. Following completion of the assessment, we will compile the results in a Subsistence Readiness Assessment and Innovation Report which will be distributed to each responding organization.

As you respond to the interview questions, please be aware that the assessment is intended to evaluate DLA support specifically to your organization as well as to the overall Class I–Subsistence supply chain in general. Therefore, in the report, the interview responses may be attributed to the specific organizations which provided them.

Ms. Janine Samoni, DLA Troop Support, (215) 737-2999, janine.samoni@dla.mil, is the point of contact (POC) for this effort, and LMI is a contractor assisting DLA complete this review and assessment. Carlo Montemayor (cmontemayor@lmi.org) is leading the effort for LMI.

Emerging Technologies

The table below highlights innovative technology featured in a previous DLA R&D study.¹ LMI identified these technologies as having potential utility to the SPV program in the future.

Technology	Definition
Blockchain 	Blockchain, or distributed ledger technology, is an encrypted and immutable history of transactions across all participants or stakeholders in a supply chain, where each of those participants has its own complete history of the transactions in the supply chain. There are many variations of the underlying blockchain technology, which is rapidly innovating and maturing. The most cited benefit of blockchain for the supply chain is increased auditability and traceability of transactions.
Data Analytics 	Data analytics is the analysis of large datasets from various sources and datatypes to understand and predict trends. The understanding garnered from such a program can range from predicting prices of individual commodities to tracking orders by facility more easily.
ML and AI 	AI is any program that can perform a task under varying circumstances without significant oversight. ML is any program that can improve its performance from repeated action. Usually, AI and ML operate in a specific, defined, and narrow scope and are implemented together as different aspects of the same computer program. The use cases for AI and ML range from supply chain planning to automated visual inspections of goods.
Automated Receiving 	Automated receiving is the incorporation of technology, such as handheld scanners or phone apps, into the warehousing and receiving processes to improve auditability and traceability of an item through the supply chain. For example, using handheld scanners during receiving, combined with adoption of GS-1 standards in barcodes, can improve data granularity and reduce the number of unliquidated obligations in the SPV program.
Connected Sensors and Automatic Identification 	Sensors connected to each other and through a variety of wireless technologies report to analytical systems on DoD networks that share data for increased insight into the tracked items' identity, location, and status. These sensors can include temperature, location, motion, humidity, light, and gas detection. These sensors can improve auditability and food defense by reporting data irregularities in real time.
Biometric ID 	Biometric ID is the use of retina, fingerprint, iris, face, or other biometric markers as a form of identification. These biometric markers can be used in conjunction with other security or identification measures, such as identification cards or signatures, to improve the security of transactions made in the subsistence supply chain.

¹ *The Future of Subsistence Prime Vendor: Incorporating Emerging Technologies and Improved In-transit Visibility*, LMI Report 11064.014.00L1_DL705L1, M. Bishof, D. Evans, R. Graupmann, D. Jamieson, K. McCarthy, R. Miller, G. Montgomery, M. Peterson, R. Salley, R. Yon, August 2018.

Technology	Definition
Genetic Nutrition 	Not everyone reacts to the same food in the same way. Genetic nutrition analyzes an individual's genetic, metabolic, and habit information to gain insight into how that individual reacts to different diets. In addition, genetic nutrition can help discover the diet to which the consumer will react best, thus, improving overall health.
Wearables 	Wearables monitor an individual's habits, such as physical exercise, heart rate, and amount of sleep. Such technologies include smartphones, smart watches, and fitness trackers. Using data collected from this technology, the services can gain insight into the health of service members, potentially changing diets to compensate or improve health and health outcomes for the consumer. Wearables also include technologies to enhance human perception in some way, such as Google Glass, which can be used as a training mechanism and offer users information they would not have otherwise had.
Hydroponics 	Hydroponics is a method of growing vegetables and herbs without using soil. The nutrients required by the plants are supplied solely through nutrient-rich water running over and through the roots of the plants. Hydroponics growing facilities include greenhouses and containers (like a shipping container). Hydroponics can reduce the length of the fruits and vegetables supply chain, decreasing food defense risks and spoilage.
Alternative and Cultured Meats 	The addition of meat substitutes, such as plant-based alternatives or meat grown in a laboratory, meets the consumer trend of cleaner labels and increased voluntary dietary restrictions, such as veganism and vegetarianism.
Drones 	Unmanned aircraft vehicles can deliver subsistence materials to remote or hostile territories, or for emergency relief. Because of a limitation in size and payload, these aerial vehicles deliver small resupply orders. Innovations are investigating one-time use drones to reduce costs as well as drones designed for multiple missions. Like aerial autonomous delivery vehicles, land-based autonomous vehicles can deliver orders, including through platooning, where one lead vehicle is manned, setting the speed and direction for a convoy of vehicles while other vehicles follow the leader. This method enables larger deliveries, a decreased delivery schedule, and decreased risk to the person delivering the order.

Additional Innovative Technologies

As part of the current Subsistence Readiness and Innovation Assessment study, we are conducting additional research to update our list of technologies that could help bring innovation to the Class I–Subsistence supply chain. The table below summarizes the preliminary results of that research.

Technology	Definition
Smartphone-Enabled Food Inspection	According to the Centers for Disease Control and Prevention, foodborne diseases kill approximately 3,000 people in the United States annually. ^a DNA testing is currently the primary method for detecting foodborne illness-causing bacteria, such as E. coli or salmonella. This method requires time and highly specialized equipment. Preliminary academic research and prototypes for smartphone-enabled food inspection are underway and could enable faster and simpler bacterial detection beyond traditional laboratory environments. ^b
Digital Twin for Supply Chain Oversight and Management	Digital twins replicate and simulate “physical assets, systems, processes and devices” in a three-dimensional (3D) digital format “using real-world data which allows them to simulate the physical object in real time, offering insights into performance and potential errors.” ^c Analytical techniques, such as AI, ML, and IoT, typically operate in conjunction with digital twin to ensure data is human-interpretable and that systems are connected and communicating effectively. ^{d,e} This emerging technology gives greater visibility and “can detect points where issues or disruptions are possible and where different plans or tools can be implemented. By using digital replicas, businesses can plan for potential disruptions within the supply chain and overall improve the structure, ultimately increasing reliability, performance, and efficiency.” ^f
Augmented Reality	Augmented reality is an emerging technology that “superimposes digital data and images on the physical world” to create “an interactive 3D experience.” ^{g,h} In other words, augmented reality enhances real world settings with digital elements to supplement a specific real-world setting. ⁱ Similarly, mixed reality is an immersive experience that enables users to engage with and control both real and virtual environments. “It provides the ability to have one foot (or hand) in the real world, and the other in an imaginary place, breaking down basic concepts between real and imaginary.” ^j
Smart Packaging	Smart packaging in the food industry often refers to two specific types of packaging: active and responsive. Active packaging is placed in direct contact with the food and is continually interacting to maintain the food quality. Active packaging can be divided into chemo-active and bio-active where chemo-active relies on the ability to change the chemical composition of the food and bio-active involves the package material itself interacting with microscopic organisms within the food. ^k Responsive packaging “elicits a curative or informative response as a result of a specific trigger or change occurring in the food product.” Responsive packaging does all of the same things that active packaging does, except it is able to recognize changes in the environment of the food product and then respond. The range of triggers for responsive packaging are things like moisture, pH, gas, mold, or bacteria. Then, once one of those triggers is registered by the packaging, it can respond accordingly to either alert that there was an issue or implement some corrective action. ^l
RFID Labeling	RFID labels are a type of passive tagging that is comprised of just an antenna and a microchip. To obtain the information stored within the tag, a reader is used to send a signal which activates the tag and sends the information back to the reader. The RFID tags have no internal power source and can be designed to withstand a multitude of differing conditions. These types of tags are overall smaller, cheaper, and more flexible than traditional active RFID tagging while maintaining most of the same functions and an infinite lifespan. ^m

Technology	Definition
Automated Foodservice	The International Society of Automation defines automation as “the creation and application of technology to monitor and control the production and delivery of products and services.” They also make it clear that it considers “everyone involved in the creation and application of technology to monitor and control the production and delivery of products and services.”ⁿ Automation in the food industry could apply automation principles and technologies such as robotics to decrease food production times, alleviate stressors on the foodservice worker, and increase food safety. This automation could be applied to both food preparation and food delivery.

^a <https://www.cdc.gov/foodborneburden/2011-foodborne-estimates.html#:~:text=CDC%20estimates%20that%20each%20year,3%2C000%20die%20of%20foodborne%20diseases.>

^b <https://www.npr.org/sections/thesalt/2018/02/19/584526195/scientists-develop-a-way-to-use-a-smartphone-to-prevent-food-poisoning.>

^c <https://supplychaindigital.com/technology-4/using-data-ensure-authenticity-supply-chain.>

^d <https://www.controleng.com/articles/how-to-use-human-and-artificial-intelligence-with-digital-twins/#:~:text=From%20IoT%20sensors%20to%20artificial%20intelligence&text=While%20very%20simple%20systems%20can,digital%20twin%20of%20complex%20systems.>

^e <https://supplychaindigital.com/technology-4/using-data-ensure-authenticity-supply-chain.>

^f <https://supplychaindigital.com/technology-4/digitalising-supply-chain-digital-twin.>

^g <https://hbr.org/2017/11/why-every-organization-needs-an-augmented-reality-strategy.>

^h <https://www.businessinsider.com/what-is-augmented-reality.>

ⁱ <https://www.intel.com/content/www/us/en/tech-tips-and-tricks/virtual-reality-vs-augmented-reality.html.>

^j <https://www.intel.com/content/www/us/en/tech-tips-and-tricks/virtual-reality-vs-augmented-reality.html.>

^k <https://onlinelibrary.wiley.com/doi/full/10.1111/1541-4337.12174.>

^l <https://onlinelibrary.wiley.com/doi/full/10.1111/1541-4337.12174.>

^m <https://www.atlasrfidstore.com/rfid-insider/active-rfid-vs-passive-rfid.>

ⁿ <https://www.isa.org/about-isa/what-is-automation0.>

Note: 3D = three dimensional; IoT = Internet of Things.

Appendix D

Class I Detailed Survey Results

We asked survey respondents to rate how strongly they agreed or disagreed with each of the statements listed in detail in Appendix A. Specifically, we asked them to assign a numeric rating, on a scale of 1 through 5, as depicted in Table D-1.

Table D-1. Survey Rating Scale

Response	Score
Strongly Disagree	1
Disagree	2
Neutral	3
Agree	4
Strongly Agree	5
No Impact	1
Minimal Impact	2
Some Impact	3
Substantial Impact	4
Very High Impact	5
No Interest	1
Some Interest	2
Conducting Research	3
Pilot Considered or Underway	4
Implemented	5

Table D-2 contains the survey statement number, the question, and the average for all the military services and UCCs respectively along with the overall average.

Table D-2. Detailed Survey Results

Survey statement	Questions	Service	UCC	Total average
1	<i>DLA coordinates with the DoD components, administers the Joint Subsistence Policy Board (JSPB), and develops and implements plans and procedures for subsistence support</i>			
1.a	DLA works effectively with the services and UCCs to select standards of support and establish effective metrics to measure the readiness and performance of the Class I–Subsistence supply chain.	4.2	4.2	4.2
1.b	Sufficient DLA personnel resources are assigned for your Class I–Subsistence support needs.	3.6	4.1	3.8

Table D-2. Detailed Survey Results

Survey statement	Questions	Service	UCC	Total average
1.c	You have had satisfactory opportunities to describe your command's Class I–Subsistence policy and programs to DLA and to coordinate with DLA in developing Class I–Subsistence readiness and sustainment requirements for your organization.	4.2	4.2	4.2
1.d	DLA is integrated into and participates actively in your Class I–Subsistence planning process and exercise program.	4.1	4.1	4.1
1.e	You have a process or program to evaluate Class I–Subsistence supply chain readiness and performance in coordination with DLA.	3.8	3.6	3.7
1.f	You have defined specific days of supply or other policies and standards for Class I–Subsistence readiness and communicated those to DLA.	4.3	3.6	3.9
1.g	You are satisfied that the relationships between your organization and DLA facilitate responsive Class I–Subsistence supply chain support.	3.9	4.3	4.1
1.h	You know who the designated DLA representative is to satisfy Class I–Subsistence needs for your region or command.	4.1	4.2	4.1
1.i	<i>Your designated DLA representative</i>			
1.i.1	Adequately communicates his or her roles, responsibilities, and capabilities for Class I–Subsistence.	3.9	4.1	4.0
1.i.2	Meets with units in theaters of operation.	3.9	4.1	4.0
1.i.3	Trains units in theater.	3.7	3.7	3.7
1.i.4	Has the resources and capabilities to support your theater's needs.	3.8	3.7	3.8
1.i.5	Is involved in your logistics support planning.	4.2	4.0	4.1
1.j	You receive adequate information about Class I–Subsistence readiness with appropriate time to affect decisions for planned and ongoing operations.	3.8	3.8	3.8
1.k	You interact with DLA on structuring your specific Class I–Subsistence plans and programs.	3.9	3.9	3.9
2	<i>DLA plans for, procures, manages, and distributes Class I–Subsistence products throughout the DoD supply chain and delivers items to locations as mutually agreed to by the DoD Components.</i>			
2.a	Our organization is satisfied with the selection, price, quality, and nutritional value of the Class I–Subsistence products from DLA.	3.3	3.8	3.6
2.b	DLA's new item introduction process works well.	3.6	3.3	3.4
2.c	DLA's STORES is an effective catalog and order management tool.	3.3	3.3	3.3
2.d	Delivery times for Class I–Subsistence assets meet required delivery dates.	3.7	3.6	3.6
2.e	DLA facilitates the invoicing and reconciliation process for Class I–Subsistence orders effectively.	3.9	3.7	3.8
2.f	DLA is receptive to feedback regarding improvements to Class I–Subsistence issues as they arise.	4.3	3.9	4.1

Table D-2. Detailed Survey Results

Survey statement	Questions	Service	UCC	Total average
2.g	In partnership with the United States Transportation Command (as the Distribution Process Owner), DLA effectively manages Class I–Subsistence supply chain distribution of surge and sustainment materiel obtained from commercial sources.	4.2	3.7	4.0
2.h	DLA adopts commercial best practices effectively to optimize Class I–Subsistence support.	3.8	3.5	3.7
3	<i>DLA maintains authorized war reserve stocks of subsistence</i>			
3.a	DLA supplies the necessary Class I–Subsistence surge and sustainment support.	4.3	4.0	4.1
3.b	DLA's Warstopper Program interacts effectively with your organization's war reserve materiel programs to support Class I–Subsistence operations.	4.7	3.8	4.2
3.c	Your organization interacts effectively with DLA on matters related to operational and contingency stocks and the resources needed to ensure Class I–Subsistence readiness and sustainment support.	4.7	4.1	4.4
4	<i>In coordination with the military departments, DLA plans, develops, funds, implements, and maintains a Joint Food Management System that interfaces with existing service systems.</i>			
4.a	DLA serves as an effective advocate for addressing Class I–Subsistence long-term challenges, such as achieving an integrated information architecture and a joint requirements process and modeling tool.	3.5	3.7	3.6
4.b.1	You have adequate visibility of Class I–Subsistence assets: In your theater	3.5	3.8	3.7
4.b.2	You have adequate visibility of Class I–Subsistence assets: In-transit	2.9	3.6	3.3
4.c	There is adequate accountability of Class I–Subsistence assets in your theater.	3.4	4.1	3.7
4.d	You have adequate planning tools for estimating Class I–Subsistence requirements.	3.1	3.7	3.4
4.e	DLA coordinates with and seeks input from the military departments as they plan and develop a Joint Food Management System that interfaces with existing service systems.	3.6	3.8	3.7
5	<i>DLA oversees the subsistence support activities of the DoD EA for Class I–Subsistence and the JSPB.</i>			
5.a	Class I–Subsistence requirements are synchronized with the development of operational plans and force structure changes.	4.0	3.8	3.9
5.b	Logistics plans are developed for Class I–Subsistence support operations in all environments.	4.1	3.8	3.9
6	<i>DLA coordinates with the DoD EA for Class I–Subsistence through the JSPB regarding requirements determination, logistics planning, and proposed mission transfers to ensure materiel availability during peacetime and wartime and eliminate duplication of effort.</i>			
6.a	DLA manages the transition from one provider to another during contract turnovers successfully.	3.1	3.5	3.3

Table D-2. Detailed Survey Results

Survey statement	Questions	Service	UCC	Total average
6.b	DLA adequately assists when units deploy to a region covered by a different subsistence contract or vendor.	3.8	4.1	4.0
7	<i>DLA supports non-traditional organizations, as required.</i>			
7.a	DLA supplies effective Class I–Subsistence support to non-DoD organizations (e.g., Federal Emergency Management Agency, United States Department of Agriculture, Department of State, and United States Agency for International Development).	3.9	3.9	3.9
8	<i>DLA serves as the DoD EA for Class I–Subsistence.</i>			
8.a	Overall, DLA effectively serves as the DoD EA for Class I–Subsistence.	4.0	4.0	4.0
8.b	Overall, you are satisfied with the level of Class I–Subsistence support from DLA.	4.0	4.0	4.0
INNOVATION SECTION				
2	<i>Without considering cost and technology limitations, please assess the following emerging technologies according to how you view their potential positive influence on the subsistence supply chain for your UCC or Service over the next 5–10 years</i>			
2.a	Block chain	3.3	3.8	3.5
2.b	Data analytics	4.2	4.3	4.2
2.c	Machine learning and artificial intelligence	3.1	3.8	3.5
2.d	Automated receiving	3.5	4.2	3.8
2.e	Connected sensors and automatic identification	3.8	4.1	3.9
2.f	Biometric ID	3.1	3.5	3.3
2.g	Genetic nutrition	3.6	3.4	3.5
2.h	Wearables	3.2	3.4	3.3
2.i	Hydroponics	3.5	3.9	3.7
2.j	Alternative and cultured meats	4.1	3.4	3.8
2.k	Drones	2.3	3.9	3.1
3	<i>Please indicate your UCC or Service's level of interest in each emerging technology for the subsistence supply chain</i>			
3.a	Block chain	2.0	1.8	1.9
3.b	Data analytics	2.6	2.2	2.4
3.c	Machine learning and artificial intelligence	2.2	1.9	2.0
3.d	Automated receiving	2.8	2.1	2.4
3.e	Connected sensors and automatic identification	2.1	1.9	2.0
3.f	Biometric ID	1.8	1.8	1.8
3.g	Genetic nutrition	2.0	1.6	1.8
3.h	Wearables	1.8	1.6	1.7
3.i	Hydroponics	2.0	1.6	1.8
3.j	Alternative and cultured meats	2.4	1.6	2.0
3.k	Drones	2.3	1.9	2.1

Table D-2. Detailed Survey Results

Survey statement	Questions	Service	UCC	Total average
4	<i>DLA adequately supports innovation in the Class I–Subsistence supply chain with regards to</i>			
4.a	Emerging technologies.	3.6	4.0	3.8
4.b	Innovative subsistence best practices.	4.0	4.3	4.1
4.c	Innovative contracting processes.	3.7	4.0	3.9
4.d	Data infrastructure and standardization.	3.8	4.0	3.9
5	<i>Emerging technologies</i>			
5.a	The Class I–Subsistence supply chain has a high level of asset visibility.	3.8	4.0	3.9
5.b	We can monitor the condition (e.g., temperature) of assets in the Class I–Subsistence supply chain.	3.6	3.5	3.5
5.c	DLA understands and supports the nutritional needs of the warfighter adequately.	3.7	4.2	4.0
5.d	The current transportation network supports “last mile” distribution of Class I–Subsistence items to deployed forces adequately.	3.6	3.9	3.8
5.e	DLA supplies fresh fruits and vegetables to forward locations effectively.	4.1	4.2	4.1
5.f	DLA handles food recalls quickly and effectively.	3.9	4.2	4.0
5.g	DLA supports special diets effectively (e.g., vegan or plant-based diets).	3.4	3.9	3.7
6	<i>Innovative subsistence best practices (i.e., process improvements)</i>			
6.a	DLA leverages industry best practices in support of the Class I–Subsistence supply chain.	3.8	3.6	3.7
6.b	DLA has supported the Services and UCCs effectively in efforts to automate Class I–Subsistence supply chain processes (e.g., ordering, receiving) by leveraging innovative processes.	3.3	3.6	3.5
7	<i>Innovative contracting processes</i>			
7.a	DLA contracts meet your organization’s Class I–Subsistence needs now and in the future.	3.3	3.7	3.5
8	<i>Data infrastructure and standardization</i>			
8.a	Our organization has ready access to the data needed to make good Class I–Subsistence supply chain decisions.	3.1	3.8	3.5
8.b	Class I–Subsistence data and data collection (e.g., barcodes and catalog data) are standardized sufficiently.	2.4	3.7	3.1
8.c	Class I–Subsistence data is adequately shared across the Services and UCCs.	2.7	3.5	3.1
9	<i>Our organization is interested in partnering with DLA to pilot innovative Class I–Subsistence practices or technologies.</i>	4.1	3.9	4.0
10	<i>Potential enhancements and added benefits could be realized through the pairing of the listed emerging technologies and innovative solutions being used or soon to be implemented in our Service or UCC.</i>	4.2	4.0	4.1

Table D-3 contains the average rating across the respondents from all UCCs and the averages for each UCC that responded.

Table D-3. UCC Survey Responses

Survey statement	AFRICOM	CENTCOM	EUUCOM	INDOPACOM	NORTHCOM	SOCOM	SOUTHCOM	TRANSOM	Average by question
1.a	3.5	4.0	3.7	4.8	—	5.0	4.6	3.5	4.2
1.b	4.0	4.0	4.0	4.5	4.0	4.0	4.4	3.7	4.1
1.c	3.5	4.5	4.7	4.7	4.0	5.0	3.5	4.0	4.2
1.d	4.0	4.5	4.7	4.5	3.0	5.0	4.3	3.3	4.1
1.e	3.0	3.5	3.7	4.2	4.0	3.0	2.8	4.5	3.6
1.f	3.5	4.0	4.7	4.2	—	3.0	2.6	3.0	3.6
1.g	4.5	4.0	4.3	4.2	5.0	5.0	4.0	3.0	4.3
1.h	4.5	4.0	5.0	4.5	5.0	3.0	3.8	4.0	4.2
1.i.1	4.0	5.0	4.7	3.8	4.0	4.0	3.5	4.0	4.1
1.i.2	3.5	5.0	4.3	3.5	4.0	4.0	4.0	4.5	4.1
1.i.3	3.5	4.0	4.0	2.5	—	4.0	3.7	4.0	3.7
1.i.4	3.5	4.0	4.7	3.5	4.0	4.0	4.0	2.0	3.7
1.i.5	4.0	4.0	5.0	3.4	4.0	4.0	3.5	4.0	4.0
1.j	4.0	4.0	4.3	3.2	4.0	4.0	4.0	2.7	3.8
1.k	3.5	4.0	4.3	3.7	4.0	4.0	3.8	3.7	3.9
2.a	3.0	4.0	4.0	3.7	4.0	4.0	4.2	—	3.8
2.b	3.0	4.0	3.0	3.0	—	3.0	3.8	—	3.3
2.c	3.0	3.0	3.0	3.3	—	4.0	3.8	—	3.3
2.d	4.0	3.0	3.3	3.2	4.0	4.0	4.0	3.5	3.6
2.e	3.5	4.0	3.7	3.8	4.0	4.0	3.8	3.0	3.7
2.f	4.0	4.0	4.5	4.3	—	4.0	4.0	2.3	3.9
2.g	4.0	4.0	3.0	4.2	—	4.0	3.8	3.3	3.7
2.h	3.5	4.0	3.0	4.2	—	4.0	3.6	2.3	3.5
3.a	4.0	4.0	4.3	3.7	4.0	4.0	4.0	3.7	4.0
3.b	3.0	4.0	4.5	3.5	—	4.0	3.7	—	3.8
3.c	4.0	4.0	4.3	4.2	4.0	4.0	4.3	4.0	4.1
4.a	3.0	4.0	4.0	3.7	—	4.0	4.5	2.7	3.7
4.b.1	3.5	4.0	4.3	3.4	4.0	4.0	3.4	4.0	3.8
4.b.2	3.5	4.0	3.7	3.2	—	4.0	3.6	3.3	3.6
4.c	4.0	4.0	4.3	4.0	4.0	4.0	4.3	4.0	4.1
4.d	3.0	4.0	4.3	4.3	4.0	4.0	4.0	2.0	3.7
4.e	3.0	4.0	4.3	3.3	—	4.0	4.3	—	3.8

Table D-3. UCC Survey Responses

Survey statement	AFRICOM	CENTCOM	EUCOM	INDOPACOM	NORTHCOM	SOCOM	SOUTHCOM	TRANSOM	Average by question
5.a	3.5	4.0	4.5	3.7	—	4.0	4.0	3.0	3.8
5.b	3.5	4.0	4.0	4.0	—	4.0	4.0	3.0	3.8
6.a	3.5	3.0	3.0	4.2	—	4.0	3.0	3.5	3.5
6.b	4.0	4.0	3.7	4.2	—	5.0	4.0	4.0	4.1
7.a	3.5	4.0	4.5	3.7	—	4.0	4.0	—	3.9
8.a	4.0	4.0	4.3	4.3	4.0	4.0	4.4	3.0	4.0
8.b	4.0	4.0	4.0	4.2	4.0	4.0	4.2	3.3	4.0
INNOVATION SECTION									
2.a	3.5	—	4.0	3.5	—	5.0	3.3	3.2	3.8
2.b	4.0	4.0	4.3	4.2	5.0	5.0	3.5	4.2	4.3
2.c	4.5	—	3.3	4.2	5.0	2.0	3.7	4.0	3.8
2.d	5.0	—	4.0	3.8	5.0	4.0	3.3	4.0	4.2
2.e	4.5	—	4.3	4.0	5.0	4.0	3.3	3.5	4.1
2.f	4.0	—	3.0	3.8	—	4.0	3.0	3.0	3.5
2.g	4.0	—	3.5	3.5	—	4.0	3.0	2.3	3.4
2.h	4.0	—	4.0	3.4	—	2.0	3.5	3.3	3.4
2.i	5.0	—	4.0	3.6	—	4.0	4.0	3.0	3.9
2.j	4.5	—	3.5	3.4	—	4.0	2.5	2.5	3.4
2.k	4.5	—	3.5	4.3	3.0	5.0	4.0	3.0	3.9
3.a	2.5	1.0	2.0	2.0	1.0	2.0	1.6	2.0	1.8
3.b	2.5	1.0	2.0	2.7	2.0	2.0	2.4	2.8	2.2
3.c	2.0	1.0	2.0	2.3	1.0	2.0	2.0	2.8	1.9
3.d	2.5	1.0	2.7	2.7	2.0	2.0	2.6	1.4	2.1
3.e	2.0	1.0	2.0	2.3	1.0	2.0	2.4	2.4	1.9
3.f	2.5	1.0	2.0	2.0	1.0	2.0	2.2	1.4	1.8
3.g	2.0	1.0	2.0	1.7	1.0	2.0	1.8	1.2	1.6
3.h	2.5	1.0	2.0	1.7	1.0	1.0	2.8	1.2	1.6
3.i	2.0	1.0	2.0	1.8	1.0	2.0	2.0	1.2	1.6
3.j	2.0	1.0	2.0	2.2	1.0	2.0	1.6	1.2	1.6
3.k	2.5	1.0	2.0	3.0	1.0	2.0	2.6	1.4	1.9
4.a	3.0	—	4.0	4.0	—	5.0	4.0	4.0	4.0
4.b	4.0	—	4.5	4.0	—	5.0	4.0	4.0	4.3
4.c	4.0	—	3.5	3.7	—	5.0	4.0	4.0	4.0
4.d	3.0	—	4.5	3.3	—	5.0	4.0	4.0	4.0

Table D-3. UCC Survey Responses

Survey statement	AFRICOM	CENTCOM	EUROM	INDOPACOM	NORTHCOM	SOCOM	SOUTHCOM	TRANSOM	Average by question
5.a	3.0	4.0	4.5	3.6	—	5.0	4.5	3.5	4.0
5.b	3.0	4.0	3.0	3.2	—	4.0	4.3	3.3	3.5
5.c	4.0	5.0	4.0	4.3	—	4.0	4.0		4.2
5.d	3.0	5.0	5.0	3.0	—	4.0	3.3	4.2	3.9
5.e	4.0	5.0	4.5	3.8	—	4.0	4.0	4.0	4.2
5.f	3.5	5.0	4.0	4.2	—	4.0	4.3	—	4.2
5.g	4.0	4.0	4.5	3.4	—	3.0	4.7	—	3.9
6.a	4.0	4.0	3.5	3.8	—	4.0	4.3	2.0	3.6
6.b	3.0	4.0	3.5	3.6	—	4.0	4.3	3.0	3.6
7.a	4.0	4.0	2.5	3.0	4.0	4.0	4.2	—	3.7
8.a	4.0	4.0	4.5	3.8	4.0	4.0	3.4	3.0	3.8
8.b	3.0	4.0	4.0	3.6	—	4.0	3.8	—	3.7
8.c	3.0	4.0	4.0	3.0	—	4.0	3.0	—	3.5
9	3.0	4.0	5.0	4.5	3.0	4.0	4.0	4.0	3.9
10	4.0	4.0	4.5	4.0	—	4.0	3.8	4.0	4.0

Table D-4 contains average rating across the respondents from all military services and the averages for each Service that responded.

Table D-4. Survey Responses from Military Service Representatives

Survey statement	Army	Navy	Air Force	Average by question
1.a	4.7	4.0	4.0	4.2
1.b	4.7	3.0	3.0	3.6
1.c	4.7	3.5	4.5	4.2
1.d	4.9	3.5	4.0	4.1
1.e	4.4	4.0	3.0	3.8
1.f	4.9	4.0	4.0	4.3
1.g	4.8	3.5	3.5	3.9
1.h	4.7	3.5	4.0	4.1
1.i.1	4.6	4.0	3.0	3.9
1.i.2	4.8	4.0	3.0	3.9
1.i.3	4.0	4.0	3.0	3.7
1.i.4	4.5	4.0	3.0	3.8

Table D-4. Survey Responses from Military Service Representatives

Survey statement	Army	Navy	Air Force	Average by question
1.i.5	4.7	4.0	4.0	4.2
1.j	4.4	3.5	3.5	3.8
1.k	4.7	3.0	4.0	3.9
2.a	4.3	3.0	2.5	3.3
2.b	3.8	3.5	3.5	3.6
2.c	4.0	4.0	2.0	3.3
2.d	4.5	3.0	3.5	3.7
2.e	4.6	3.0	4.0	3.9
2.f	4.9	4.0	4.0	4.3
2.g	4.2	4.0	4.5	4.2
2.h	4.4	4.0	3.0	3.8
3.a	4.8	3.5	4.5	4.3
3.b	5.0	4.0	5.0	4.7
3.c	5.0	4.0	5.0	4.7
4.a	4.0	3.5	3.0	3.5
4.b.1	4.0	3.5	3.0	3.5
4.b.2	3.2	3.5	2.0	2.9
4.c	4.2	3.5	2.5	3.4
4.d	4.8	3.5	1.0	3.1
4.e	4.3	4.0	2.5	3.6
5.a	4.6	3.5	4.0	4.0
5.b	4.8	3.5	4.0	4.1
6.a	3.9	3.0	2.5	3.1
6.b	4.4	3.0	4.0	3.8
7.a	4.7	4.0	3.0	3.9
8.a	4.6	3.5	4.0	4.0
8.b	4.6	3.5	4.0	4.0
INNOVATION SECTION				
2.a	4.0	2.0	4.0	3.3
2.b	4.5	3.5	4.5	4.2
2.c	4.3	2.0	3.0	3.1
2.d	4.4	2.0	4.0	3.5
2.e	4.3	2.0	5.0	3.8
2.f	4.3	2.0	3.0	3.1
2.g	4.3	3.5	3.0	3.6
2.h	3.0	3.5	3.0	3.2

Table D-4. Survey Responses from Military Service Representatives

Survey statement	Army	Navy	Air Force	Average by question
2.i	2.0	3.5	5.0	3.5
2.j	3.8	3.5	5.0	4.1
2.k	4.0	1.0	2.0	2.3
3.a	2.0	2.0	2.0	2.0
3.b	2.8	2.0	3.0	2.6
3.c	2.0	2.5	2.0	2.2
3.d	3.8	2.5	2.0	2.8
3.e	2.2	2.0	2.0	2.1
3.f	1.8	2.0	1.5	1.8
3.g	2.0	2.5	1.5	2.0
3.h	2.0	2.0	1.5	1.8
3.i	1.6	2.0	2.5	2.0
3.j	2.6	2.0	2.5	2.4
3.k	2.4	2.5	2.0	2.3
4.a	3.7	3.0	4.0	3.6
4.b	4.5	3.5	4.0	4.0
4.c	4.2	3.0	4.0	3.7
4.d	4.3	3.0	4.0	3.8
5.a	4.8	3.5	3.0	3.8
5.b	3.7	3.5	3.5	3.6
5.c	4.2	3.0	4.0	3.7
5.d	4.3	3.0	3.5	3.6
5.e	4.8	3.0	4.5	4.1
5.f	4.7	3.0	4.0	3.9
5.g	4.3	3.0	3.0	3.4
6.a	4.5	3.5	3.5	3.8
6.b	4.0	3.5	2.5	3.3
7.a	3.8	3.0	3.0	3.3
8.a	4.4	3.0	2.0	3.1
8.b	2.8	3.0	1.5	2.4
8.c	3.5	3.0	1.5	2.7
9	4.4	3.0	5.0	4.1
10	4.5	3.0	5.0	4.2

We asked survey participants to indicate if they were aware of selected innovations.

Table D-5 contains the count of how many respondents from all UCCs and each UCC were aware of the emerging innovation.

Table D-5. Responses from UCC Representatives

Innovation section #	Innovation	AFRICOM	CENTCOM	EUROM	INDOPACOM	NORTHCOM	SOCOM	SOUTHCOM	TRANSOM	UCC totals
1.a	Block chain	1	0	0	4	0	0	2	4	11
1.b	Data analytics	2	1	2	4	1	1	2	4	17
1.c	Machine learning and artificial intelligence	2	0	2	3	1	0	1	4	13
1.d	Automated receiving	2	0	2	2	0	1	2	1	10
1.e	Connected sensors and automatic identification	2	0	2	2	0	1	2	2	11
1.f	Biometric ID	1	0	2	3	0	1	0	4	11
1.g	Genetic nutrition	1	1	2	2	0	1	2	0	9
1.h	Wearables	1	1	2	2	0	0	1	3	10
1.i	Hydroponics	1	0	1	2	0	1	2	2	9
1.j	Alternative and cultured meats	2	0	2	3	0	1	2	1	11
1.k	Drones	2	0	2	4	0	1	2	3	14

Table D-6 contains the count of how many respondents from all military services and each Service were aware of the emerging innovation.

Table D-6. Responses from Service Representatives

Innovation section #	Innovation	Army	Navy	Air Force	Service totals
1.a	Block chain	2	1	1	4
1.b	Data analytics	6	1	1	8
1.c	Machine learning and artificial intelligence	2	1	1	4
1.d	Automated receiving	5	1	2	8
1.e	Connected sensors and automatic identification	3	0	2	5
1.f	Biometric ID	3	0	1	4
1.g	Genetic nutrition	2	1	1	4
1.h	Wearables	2	1	1	4
1.i	Hydroponics	1	1	1	3
1.j	Alternative and cultured meats	5	1	1	7
1.k	Drones	5	0	1	6

Appendix E

Commercial Best Practices Study

Appendix Overview

This appendix contains research on innovative commercial technologies, automation, and processes that have the potential to close high-priority gaps within the Class I–Subsistence supply chain. Some sections of this appendix build upon the prior report, “The Future of Subsistence Prime Vendor: Incorporating Emerging Technologies and Improved In-Transit Visibility” (2018), particularly in areas in which there has been little technological or process change and where the projected utility to the subsistence prime vendor (SPV) program remains high.

Table of Contents

Appendix Overview	E-1
Data Infrastructure and Standardization.....	E-3
Data Analytics	E-3
The Internet of Things	E-5
Cloud Computing.....	E-6
Emerging Technologies	E-9
Smartphone-Enabled Food Inspection.....	E-10
Digital Twin for Supply Chain Oversight and Management.....	E-11
Blockchain	E-13
Smart Packaging	E-14
RFID Labeling	E-15
Machine Learning and Artificial Intelligence	E-16
Data Warehouses.....	E-18
Automated Receiving	E-19
Biometric ID.....	E-20
Genetic Nutrition.....	E-21
Wearables	E-22
Augmented and/or Mixed Reality	E-23
Hydroponics and Vertical Farming	E-25
Alternative and Cultured Meats	E-26
Drones.....	E-28

Innovative Subsistence Best Practices	E-30
Eliminate Data Silos	E-30
Promote Sustainable Supply Chain Practices.....	E-32
Market Intelligence	E-33
Innovative Contracting Practices	E-35
Supplier Consolidation	E-35

Data Infrastructure and Standardization

Data and analytics are both critical enablers and byproducts of the technologies and business practices outlined in this section. This section offers suggestions on innovative ways to collect, access, standardize, and share data in the Class I–Subsistence supply chain. Robust data infrastructure that improves access to data and enables users to navigate and use data is foundational to most disruptive technologies. The following is a high-level overview of some data infrastructure and standardization methods that could foster future technological integration and supply chain visibility.

Name	Commercial use cases	Potential DoD use cases	Implementation considerations
Data Analytics	Across commercial and federal spaces, new data insights are driving better decision-making and powering new tools and techniques to execute the mission	- Create efficiencies by tailoring options to consumer preferences - Predict future orders for a unit or garrison	Data collection, aggregation, and sharing could prove challenging across Department of Defense (DoD) stakeholders
The Internet of Things (IoT)	- Using IoT wireless sensors to monitor and control temperature for food refrigerators - Deploying wireless sensor mesh in warehouse spaces to better manage inventory	- Further harness IoT solutions to support shipment tracking, predict delivery times, forecast demand, automate paperwork, reduce waste, save energy, control costs and monitor supplier prices - Deploy wireless sensor mesh in warehouse spaces to better manage inventory	IoT requires network connectivity, requiring additional cybersecurity considerations and planning before expanding IoT participation
Cloud Computing	Recent reporting suggests there is a mass migration toward cloud-based computing for large and small businesses	Cloud computing offers a foundation for big data and disruptive technologies, such as artificial intelligence (AI), IoT, and data analytics	Cloud services must meet certain federal and DoD security compliance requirements

Data Analytics

Description

Data analytics is the analysis of large datasets from various sources and datatypes to understand and predict trends. The understanding garnered from such a program can range from predicting prices of individual commodities to more easily tracking orders by facility. Data and analytics is a key enabler as technology like machine learning (ML), AI, and automation become more commonplace.

Businesses are already collecting reams of data through their ordering, marketing, transportation management, and warehouse management systems. Data analytics allows businesses to aggregate that data, analyze it, and transform it into useful

information. Data analytics can increase efficiency in the ordering process, determining fair and reasonable price, and better inform nutritional intake metrics.¹

Commercial Use Cases

Data analytics, including predictive analytics, are enhancing business operations across diverse industries like finance, marketing, and agriculture by allowing businesses to use big data to identify market trends. By studying and analyzing structured and unstructured data from multiple sources, data analytics can help uncover useful trends and information that can aid in decision-making processes.

Commercial leaders, such as Starbucks, Coca-Cola, and Walmart are using data analytics to decide questions such as how to maintain a product year-round when ingredients are not available year-round, manage product development and roll-out, and identify stocking errors. Local grocery owners can use data analytics to determine what items they should stock based on weather patterns.²

Fast food companies such as McDonalds are making substantial investments in data analytics to support their digital menus. Specifically, the company is leveraging information pertaining to “weather, time of day, local traffic, nearby events, and of course historical sales data, both at that specific franchise and around the world” to tailor their digital drive thru menus throughout the day.³ “On a hot afternoon, for example, the board might promote soda rather than coffee. At the conclusion of every transaction, screens now display a list of recommendations, nudging customers to order more.”⁴

Potential DoD Use Case

Data analytics can help predict future demand, improve understanding of trends in consumer behavior (e.g., when the Servicemen and women are more likely to use the facility), monitor trends in consumer tastes (what foods are more popular, when), and track ordering trends by facility, removing items from the menu if they are no longer ordered, adding items to the menu if there is an expected trend toward that item, and using data from war planning to predict demand by location.

Tracking previous orders from a particular customer location or to a specific SPV can give insight into the popularity or unpopularity of items in the subsistence catalog, allowing contracting officers to add or remove items as necessary. In addition to managing the catalog, predictive analytics can identify trends in consumer tastes based on previous customer orders and end customer purchasing habits.

Using ordering data such as time of order and what was ordered can give insight into the future orders originating from that garrison, including the amount that a customer will order, and what they will order. For example, if there are increasing orders coming from a single unit in a forward location, data analytics could help predict the future demand for that unit, enabling the SPV to decrease the time they require and costs they expend to support the growing location.

¹ LMI, Future of Subsistence Prime Vendor Report (2018).

² LMI, Future of Subsistence Prime Vendor Report (2018).

³ <https://digital.hbs.edu/platform-digit/submission/big-mac-to-big-data-why-mcdonalds-is-betting-its-future-on-digital-innovation/>.

⁴ <https://www.nytimes.com/2019/10/22/business/mcdonalds-tech-artificial-intelligence-machine-learning-fast-food.html>.

Implementation Considerations

Data analytics depends on being able to read and gather the data that allows for useful insight. While data is gathered extensively by the Defense Logistics Agency (DLA), SPVs, and the Services, no single database contains or has access to all of the data. Further, some information, like nutritional information or transportation times, may not be gathered at all. Coordination between these parties may be difficult, particularly given the proprietary information each organization holds.

More granular data are more useful, so DLA and the Services should look at what data they are collecting now and how they are collecting it. Data from the receiving process, radio-frequency identification (RFID) temperature tracking, historical prices, prices of similar products, and tracking of nutritional data would all add useful data to the system, and allow for better analysis and deeper insight.

The Internet of Things

Description

IoT is the “network of physical objects—‘things’—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet.”⁵ Some obvious examples of IoT devices include smartphones, laptops, and tablets. Smart lightbulbs, meters, thermostats, microwaves, cars, wearables (i.e. Apple Watch, Fitbit, etc.), and home devices (e.g. Apple HomePod, Amazon Echo, Google Nest, etc.) also play a role in the IoT ecosystem. Gartner projects the IoT platform device market will reach \$7.6 billion by 2024 at a 31 percent Compounded Annual Growth Rate (CAGR).⁶

Commercial Use Cases

Within the food and beverages sector, retailers are leveraging IoT to save energy, reduce waste, and meet food safety standards. The World Economic Forum recently reported that, as a result of IoT temperature monitoring and control solutions, some food retail stores have seen a 40 percent reduction in food waste and a 30 percent net energy savings. “Over the last 5 years alone, IoT solutions have saved \$37 million for food retailers by cutting food waste, while avoiding more than 2 million tons of carbon dioxide.”⁷

Concretely, Walmart is currently using IoT sensors to regulate and track refrigeration unit temperatures and report equipment malfunctions, ensuring they are repaired promptly and with nominal downtime. Wireless sensor mesh technology benefits food storage operators especially because of the strict regulations on handling and storage conditions.⁸ “IoT solutions are used so broadly throughout Walmart’s massive store footprint that its connected devices send a total of 1.5 billion messages per day.”⁹

⁵ <https://www.oracle.com/internet-of-things/what-is-iot/>.

⁶ <https://www.gartner.com/en/documents/3983783/forecast-analysis-enterprise-iot-platforms-worldwide>.

⁷ <https://www.weforum.org/agenda/2021/03/data-driven-action-through-iot-empowers-sustainability-in-food-retail/>.

⁸ <https://adaptive-wireless.co.uk/food-storage-warehouse-monitoring-case-study/>.

⁹ <https://www.retailwire.com/discussion/iot-could-be-the-key-to-ending-food-spoilage-in-grocery-stores/#:~:text=IoT%20solutions%20have%20allowed%20food,in%20the%20hundreds%20of%20millions>.

Potential DoD Use Cases

To a degree, the Class I–Subsistence supply chain already operates in the IoT ecosystem—all business conducted via computers, smartphones, tablets, and other network-connected devices ultimately links DLA, the Services, Unified Combatant Commands (UCCs), and SPVs to the IoT ecosystem. Ways DLA and all other subsistence supply chain stakeholders can maximize IoT solutions to generate and use data to drive decision-making include

- using temperature, light, and humidity sensors for environment monitoring;
- tracking location via GPS-equipped freight vehicles; and
- managing inventory and warehouses using passive or active RFID, Bluetooth, or near-field communication tag technology.¹⁰

Leaning deeper into IoT solutions by finding more ways to generate and use data from IoT technology could better enable DLA to track shipments, predict delivery times, forecast demand, automate paperwork, reduce waste, save energy, control costs, and monitor supplier prices.

Implementation Considerations

IoT is paving the way for big data, data analytics, AI, ML, and other disruptive technologies. As reliance on IoT technology and IoT-generated data increases, it is important to note the following implementation considerations:

- Network Connectivity: Most IoT devices and software are network-enabled, limiting functionality to regions where network connectivity is feasible.
- Cybersecurity: Increased use of IoT solutions can raise the risk of exposure to networks and data. IoT device manufacturers may source components from questionable suppliers or have limited visibility into the supply chain for their hardware. Some software may require patches to mitigate security risks. Finally, the vast amounts of data that IoT devices generate could, in aggregate, result in data that constitutes Controlled Unclassified Information or even classified information.

To combat these risks, IoT planning and data security strategies will be paramount. All subsistence supply chain stakeholders must ensure that networks “are isolated and protected, with data encryption” applied to all “sensors, gateways, and other components.”¹¹

Cloud Computing

Description

Cloud-based computing is a “model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.”¹² In other

¹⁰ <https://www.businessinsider.com/iot-supply-chain-management-logistics>.

¹¹ <https://www.zdnet.com/article/what-is-the-internet-of-things-everything-you-need-to-know-about-the-iot-right-now/>.

¹² <https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf>.

words, cloud computing refers to the operation of Internet-based software and servers.¹³ Some key benefits around cloud-based computing include:

- Cost Savings: Cloud services tend to be less expensive as they do not require on-premises capital investments for physical servers, nor do they require separate in-house maintenance costs.¹⁴ Additionally, cloud resources are designed to scale with usage, with some cloud providers only charging for storage space that is used, as opposed to over-provisioning storage.¹⁵
- Availability: Because cloud capabilities are available through a network, they are generally accessible via heterogeneous thin or thick client platforms, such as desktop computers, tablets, and smartphones.¹⁶
- Enabling Disruptive Technology: Cloud computing has the ability to store large quantities of structured and unstructured data. When coupled with the ability to run specified commands or tools on that data, it offers a foundation for enabling disruptive technologies, such as AI, IoT, edge computing, data analytics, and big data.^{17,18,19}

Commercial Use Cases

Corporate investment and migration from on-premises systems to cloud data storage and cloud-based computing is expected to accelerate substantially in the very near future. Gartner predicts that more than 45 percent of IT infrastructure spending will move away from “traditional solutions” to cloud-based solutions by 2024.²⁰ An International Data Corporation survey conducted in early 2020 predicts that 90 percent of enterprises will actively use hybrid cloud by 2022.²¹ A separate Microsoft-sponsored study published in the Harvard Business Review found that 82 percent of respondents representing large companies and 69 percent of representatives from smaller companies intend to migrate or have already migrated “from traditional, on-premises systems to a public or hybrid cloud data center.”²²

Potential DoD Use Cases

DLA has already taken steps to migrate parts of its data and applications to the cloud. In January 2020, Amazon announced the migration of five DLA applications to the Amazon Web Services (AWS) GovCloud via the Procurement Integrated Enterprise Environment hosting support contract.²³

Class I–Subsistence comprises a global supply chain, meaning DLA produces and uses vast amounts of contracting, logistics, and safety data. Cloud computing offers a

¹³ <https://www.lucidchart.com/blog/cloud-computing-basics>.

¹⁴ <https://www.lucidchart.com/blog/the-cost-of-cloud-computing>.

¹⁵ <https://aws.amazon.com/what-is-cloud-computing/>.

¹⁶ <https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf>.

¹⁷ <https://www.computer.org/publications/tech-news/trends/big-data-and-cloud-computing>.

¹⁸ <https://www.gartner.com/smarterwithgartner/cloud-shift-impacts-all-it-markets/>.

¹⁹ <https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/how-to-build-a-data-architecture-to-drive-innovation-today-and-tomorrow>.

²⁰ <https://www.gartner.com/smarterwithgartner/cloud-shift-impacts-all-it-markets>.

²¹ <https://www.idc.com/getdoc.jsp?containerId=prMETA46165020>.

²² <https://hbr.org/resources/pdfs/comm/microsoft/GettingCloudGovernanceRight.pdf>, page 3.

²³ <https://aws.amazon.com/blogs/publicsector/defense-logistics-agency-migrates-five-applications-ahead-schedule/>.

foundation for applying big data and disruptive technologies, such as AI, IoT, and data analytics, to those data.

Implementation Considerations

Security considerations must remain at the forefront when migrating to cloud-based computing. The Federal Risk and Authorization Management Program (FedRAMP) is a cloud security standardization and assessment body; all Cloud Service Providers (CSPs) must be FedRAMP-compliant to sell cloud services to the federal government.²⁴ CSPs should also obtain provisional authorization or demonstrate compliance with the Defense Information Systems Agency DoD Cloud Computing Security Requirements Guide prior to providing cloud services to DoD customers.²⁵

Furthermore, to structure a secure cloud-based data infrastructure, DLA would also need to decide on one of four cloud deployment methods as defined by the National Institute for Standards and Technology: public cloud, private cloud, hybrid cloud, or community cloud.^{26,27} There are several CSPs that can support public, private, hybrid, or community cloud models that also meet federal and DoD security compliance standards, including Amazon (with AWS GovCloud (US)), Google (with the Google Cloud Platform), and Microsoft (with Microsoft Azure).²⁸

²⁴ <https://aws.amazon.com/compliance/fedramp/>.

²⁵ <https://docs.microsoft.com/en-us/compliance/regulatory/offering-dod-disa-l2-l4-l5>.

²⁶ <https://www.forbes.com/sites/cdw/2017/05/02/why-the-federal-government-warmed-up-to-cloud-computing/?sh=7eb703cf3698>.

²⁷ <https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf>.

²⁸ <https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/how-to-build-a-data-architecture-to-drive-innovation-today-and-tomorrow>.

Emerging Technologies

The following section lists cutting edge, innovative technology solutions that could benefit the Class I–Subsistence supply chain, the commercial and DoD use cases, and considerations for the adoption and implementation of each. Much of this information was carried over from the Subsistence Prime Vendor report, updated to acknowledge new applications and evolutions of the technologies listed. Each of these technologies could serve to enhance the acquisition and management of Class I–Subsistence materials, providing better quality nutrition for the warfighter and improving financial and inventory planning for leadership. Some of these technologies have limited proven application to subsistence use-cases, but research indicates potential application as the technology matures.

Name	Commercial use cases	Potential DoD use cases	Implementation considerations
Smartphone-Enabled Food Inspection	Discussions, research, and prototype development are ongoing in academia	Cost-effective produce inspection for DLA food safety auditors and Service members operating in immature theaters	Technology is nascent and requires further development and testing Smartphone or handheld device could carry contaminants
Digital Twin for Supply Chain Oversight and Management	DHL is leveraging digital twin to run real-time warehouse simulations and manage operations for Tetra Pak food products	Superior inventory management and real-time inventory and product quality insights	- Challenges getting buy-in - Technology is nascent and requires further development for subsistence applications
Blockchain	Walmart-IBM applications for supply chain visibility and traceability	- Faster tracking speed - Mitigate impact and scope of food recalls	- Potential for fraud - Reliance on stakeholder participation
Smart Packaging	- Oxygen, ethylene scavengers - Time-temperature indicators	- Extend food life - Prevent serving spoiled food	- Not many commercial examples - May require supplier buy-in
RFID Labeling	- Sodexo has begun using microwave safe RFIDs - Avery Dennison RFID label innovations	- Visibility throughout entire supply chain - Predictive analysis of subsistence lifecycle	- Need to use passive RFID tagging - May require supplier buy-in
Machine Learning and Artificial Intelligence	- Tracking shelf life of produce - AI powered feasibility assessment for logistics	- Predictive inventory management - Enhance genetic nutrition capabilities	- Requires robust data analytics capabilities - Technology is rapidly evolving; more use-cases are regularly discovered
Automated Receiving	Time and labor savings and operational improvements	Time and labor savings and operational improvements	- Requires expertise and other technology investments - Initially, only viable with vendors trusted by DLA
Biometric ID	- Identity verification and traceability - Replace pass cards and other tools for purchase authorization	- Identity verification and traceability - Replace pass cards and other tools for purchase authorization	Biometric data represents intimate personal identifying information and must be properly secured

Name	Commercial use cases	Potential DoD use cases	Implementation considerations
Genetic Nutrition	Ensure the most beneficial dietary guidance at an individual level	Ensure the most beneficial dietary guidance at an individual level	Genetic and health information is sensitive and must be properly secured
Wearables	- Track exertion and metabolic activity - Develop custom dietary plans	- Track exertion and metabolic activity - Monitor impact of nutrition on warfighter and make proper adjustments	- Reliance on stakeholder participation - Added equipment for warfighter
Augmented and/or Mixed Reality	- Nutritional information display - Virtual tours of facilities/production	- Training - Compliance and quality control - Inventory management	- Nascent technology in the commercial space - Relatively unproven application in subsistence
Hydroponics and Vertical Farming	- Allows subsistence grows in challenging areas (Alaska) - Fresh produce year-round with low maintenance costs	- Forward installations of fresh produce grow - Alternative to seasonal crop production in normal supply chain	Often difficult to standup/justify hydroponics in forward/austere positions
Alternative and Cultured Meats	More ecological and ethical meat production without nutritional sacrifice	More ecological and ethical meat production without nutritional sacrifice	Ongoing regulatory debate surrounding the technology
Drones	- Disaster and humanitarian relief - Remote delivery - Inventory/warehouse management applications	- Remote, forward delivery - Inventory/warehouse management applications	Limited compacity on most commercial drone options

Smartphone-Enabled Food Inspection

Description

According to the Centers for Disease Control and Prevention, foodborne diseases kill approximately 3,000 people in the United States annually.²⁹ At present, DNA testing serves as the primary method for detecting foodborne illness-causing bacteria, such as E. coli or salmonella. This method requires time and highly specialized equipment. Preliminary academic research and prototypes for smartphone-enabled food inspection are underway and could enable faster and simpler bacterial detection beyond traditional laboratory environments.³⁰

Commercial Use Cases

Food scientists at the University of Massachusetts Amherst are developing a system for smartphone-enabled food inspection. To test for contamination, chemically coated chips are dipped in contaminated water for half an hour, allowing enough time for the chip to bind to bacteria. The chip is then clipped to small microscope (commercial unit cost is

²⁹ <https://www.cdc.gov/foodborneburden/2011-foodborne-estimates.html#:~:text=CDC%20estimates%20that%20each%20year,3%2C000%20die%20of%20foodborne%20diseases.>

³⁰ <https://www.npr.org/sections/thesalt/2018/02/19/584526195/scientists-develop-a-way-to-use-a-smartphone-to-prevent-food-poisoning.>

\$30 U.S. dollars), which is attached to the smartphone. This early model is garnering interest from commercial food processing companies.³¹

Similarly, researchers at Purdue University have developed “a bioluminescence-enabled assay coupled with a portable device that works with smartphones and laptops to do onsite testing for harmful E. coli in food samples. The silicon photomultiplier (SiPM) device uses low light from the bioluminescent assay to detect the presence of bacteria that cause foodborne illness in food samples. The Purdue team also created an electrical circuit with an amplifier, comparator, and micro controller to send the data to laptops and smartphones via Bluetooth technology. They used three-dimensional (3D) printing to design a portable cradle for the SiPM.”³²

Potential DoD Use Cases

DLA auditors play a critical role in food safety and inspection, traveling worldwide to vendor facilities to evaluate product and produce quality. Incorporating smartphone-enabled food inspection technology is a potentially cost-effective and portable method for evaluating food quality while in-theater or in circumstances where rapid in-field testing would offer greater benefit and enhanced safety over traditional lab-based testing.

Implementation Considerations

While smartphone-enabled food inspection holds significant promise for point-of-need contamination control, it is important to note that this technology is still in its infancy and commercial market availability for the microscope is pending. Moreover, because bacteria can survive on handheld devices such as smartphones and tablets, DLA will also need to establish additional procedures around smartphone handling and sanitization to adopt smartphone-enabled inspections.³³

Digital Twin for Supply Chain Oversight and Management

Description

Digital twins replicate and simulate “physical assets, systems, processes and devices” in a 3D digital format “using real-world data which allows them to simulate the physical object in real time, offering insights into performance and potential errors.”³⁴ Analytical techniques such as AI, ML, and IoT typically operate in conjunction with digital twin to ensure data is human-interpretable and that systems are connected and communicating effectively.^{35,36} This emerging technology gives greater visibility “can detect points where issues or disruptions are possible and where different plans or tools can be implemented. By using digital replicas, businesses can plan for potential disruptions

³¹ <https://www.npr.org/sections/thesalt/2018/02/19/584526195/scientists-develop-a-way-to-use-a-smartphone-to-prevent-food-poisoning>.

³² <https://www.purdue.edu/newsroom/releases/2020/Q1/portable-device-lights-the-way-to-better-foodborne-illness-detection.html>.

³³ <https://www.fda.gov/food/conversations-experts-food-topics/using-your-smartphone-or-tablet-kitchen-food-safety-hazard>.

³⁴ <https://supplychaindigital.com/technology-4/using-data-ensure-authenticity-supply-chain>.

³⁵ <https://www.controleng.com/articles/how-to-use-human-and-artificial-intelligence-with-digital-twins/#:~:text=From%20IoT%20sensors%20to%20artificial%20intelligence&text=While%20very%20simple%20systems%20can,digital%20twin%20of%20complex%20systems>.

³⁶ <https://supplychaindigital.com/technology-4/using-data-ensure-authenticity-supply-chain>.

within the supply chain and overall improve the structure, ultimately increasing reliability, performance, and efficiency.”³⁷

Commercial Use Cases

There are a growing number of applications for digital twin in commercial logistics and supply chain management. The courier and package delivery company, DHL, established a digital twin warehouse for Tetra Pak food products in 2019. DHL’s smart warehouse leverages data analytics and IoT technology to create a “virtual representation that monitors and simulates both the physical state and behavior of the warehouse assets in real time.”³⁸ The digital twin enables Tetra Pak to coordinate warehouse operations, manage inventory, and resolve safety and productivity issues 24/7.³⁹

Potential DoD Use Cases

The 2018 SPV report highlighted the perceived gaps in Supply Chain Visibility and in-transit visibility (as well as the current level of visibility that is viewed as sufficient) as described by DLA and Service interviewees. Information available in the Supply Chain Fitness Report was perceived as limited and the Services indicated their desire for insight into inventory levels (Days of Supply), climate control, shelf-life, and item availability in prime vendor (PV) warehouses for operational rations to assess inventory adequacy for potential demand surges.

Commercial applications demonstrate the viability of digital twin in smart warehouses, offering real-time information on inventory levels and obtaining additional oversight of warehouse operations. With more employers looking for ways to maximize telework, digital twin technology can supplant processes that normally occurred in-person before the pandemic. Additionally, the pandemic underscores that end-to-end supply chain visibility is required to more effectively respond to supply chain disruptions. Digital twin enables evaluation and analysis “interconnected trade-offs in capacity, service, inventory, and total landed cost.”⁴⁰

Implementation Considerations

The greatest limiting factor in applying digital twin technology to DLA’s subsistence supply chain is obtaining buy-in from PVs and SPVs. Suppliers would ultimately need to carry and support this technology to some degree or DLA would need to provide the capability at a low to no-cost and highly intuitive framework. Technology acquisition costs coupled with a possible perception of undue cost oversight/micromanagement could negatively impact existing vendor relations and deter vendors.

³⁷ <https://supplychaindigital.com/technology-4/digitalising-supply-chain-digital-twin>.

³⁸ <https://www.dhl.com/jp-en/home/press/press-archive/2019/dhl-supply-chain-partners-tetra-pak-to-implement-its-first-digital-twin-warehouse-in-asia-pacific.html>.

³⁹ <https://www.dhl.com/jp-en/home/press/press-archive/2019/dhl-supply-chain-partners-tetra-pak-to-implement-its-first-digital-twin-warehouse-in-asia-pacific.html>.

⁴⁰ <https://supplychaindigital.com/technology-4/evolution-digital-twins-supply-chain>.

Blockchain

Description

Blockchain, or distributed ledger technology, is an encrypted and immutable record of transactions across all participants or stakeholders in a supply chain, where each of those participants has their own complete history of the transactions in the supply chain. There are many variations of the underlying blockchain technology, which is rapidly innovating and maturing. The most commonly cited benefit of blockchain for the supply chain is increased auditability and traceability of transactions.

Commercial Use Cases

Industry is already heavily investing in blockchain technology. As a prime example, retail giant Walmart is leveraging blockchain technology to enhance food traceability and safety. Between 2016 and 2017, Walmart completed two blockchain pilots in partnership with IBM's Food Trust to track pork in China and produce in the Americas by "connect[ing] participants through a permissioned, immutable and shared record of food provenance, transaction data, [and] processing details."⁴¹

Supply chain stakeholders—"growers, processors, wholesalers, distributors, manufacturers, retailers, and others"—create blockchain entries before a unit moves to its subsequent stage, enabling users to also track the time and location at which food was harvested.^{42,43}

In Walmart's pilot with IBM, blockchain reduced mango tracking time from 7 days to 2.2 seconds.⁴⁴ Following these pilots, hundreds of participating farms supplying produce "will be required to input detailed information about their food into a blockchain database developed by IBM for Walmart and several other retailers exploring similar moves."⁴⁵

Potential DoD Use Cases

Blockchain technology would empower DLA to guarantee end-to-end visibility and complete traceability throughout the subsistence supply chain, offer an immutable, self-validating, and auditable record of transactions at every stage of procurement, and allow every player in the supply chain to participate using the same inexpensive and accessible technologies.⁴⁶

Additional use cases for DoD include the ability to contain contamination and minimize waste. Faster and more detailed tracking will enable a faster response in instances of food contamination (e.g. E. coli and salmonella), thereby enabling DoD to mitigate the impact and scope of food recalls and better protect the warfighter from foodborne illness. Finally, because blockchain enables users to track the exact origins of each unit and its progression through the supply chain—including when an item was harvested,

⁴¹ <https://www.ibm.com/products/food-trust>.

⁴² <https://www.ibm.com/products/food-trust>.

⁴³ <https://www.nytimes.com/2018/09/24/business/walmart-blockchain-lettuce.html>.

⁴⁴ https://www.researchgate.net/publication/326188675_Food_Traceability_on_Blockchain_Walmart's_Pork_and_Mango_Pilots_with_IBM.

⁴⁵ <https://www.nytimes.com/2018/09/24/business/walmart-blockchain-lettuce.html>.

⁴⁶ LMI, Future of Subsistence Prime Vendor Report (2018).

produced, or handled—DoD would be able to target only the units believed to be at risk for contamination, thereby reducing both financial and physical waste.⁴⁷

Implementation Considerations

A potential area of risk in leveraging blockchain within the DoD subsistence supply chain is data reliability. “A blockchain can capture the digital record of a box of spinach. But it cannot tell if someone opened the box and changed the spinach inside, replacing it with arugula or illegal drugs.”⁴⁸ To detect and mitigate potential fraud, DLA would need to hire and deploy human inspectors to regularly conduct audits.

Lack of supply chain stakeholder participation could also diminish the utility and impact of blockchain for subsistence acquisition. In order for the system to work, all participants must be willing and able to input data into the ledger.⁴⁹

Smart Packaging

Description

In the food industry, smart packaging often refers to two specific types of packaging: active and responsive. Active packaging is often placed in direct contact with the food and continually interacts to maintain the food quality. Active packaging can be divided into chemoactive and bioactive. Chemoactive relies on the ability to change the chemical composition of the food while bioactive is the package material itself interacting with microscopic organisms within the food.⁵⁰

Responsive packaging “elicits a curative or informative response as a result of a specific trigger or change occurring in the food product.” Responsive packaging does all of the same things that active packaging does, but is able to recognize changes in the environment of the food product and then respond. The range of triggers for responsive packaging are things like moisture, pH, gas, mold, or bacteria. Once one of those triggers is registered by the packaging, it can respond accordingly to either alert that there was an issue or implement some corrective action.⁵¹

Commercial Use Cases

Active packaging is frequently used in the commercial market today with common products being oxygen scavengers and ethylene scavengers. Oxygen scavenging “works through the oxidation of iron compounds placed in sachets within the package that absorb oxygen.”⁵² Mitsubishi Chemical produces an oxygen scavenger that is frequently used called “Ageless,” which the company states “preserves both the taste and freshness of food.”⁵³ Ethylene scavengers are used to slow the ripening process in fruits and vegetables using “potassium permanganate embedded in silica gel sachets.”⁵⁴

⁴⁷ <https://www.nytimes.com/2018/09/24/business/walmart-blockchain-lettuce.html>.

⁴⁸ <https://www.nytimes.com/2018/09/24/business/walmart-blockchain-lettuce.html>.

⁴⁹ <https://www.nytimes.com/2017/03/04/business/dealbook/blockchain-ibm-bitcoin.html>.

⁵⁰ <https://onlinelibrary.wiley.com/doi/full/10.1111/1541-4337.12174>.

⁵¹ <https://onlinelibrary.wiley.com/doi/full/10.1111/1541-4337.12174>.

⁵² <https://www.anfonline.org/docs/default-source/legacy-docs/docs/ce-articles/fpc042019.pdf>.

⁵³ <https://www.mgc.co.jp/eng/products/sc/ageless/>.

⁵⁴ <https://www.anfonline.org/docs/default-source/legacy-docs/docs/ce-articles/fpc042019.pdf>.

Consumer products like the Evert Fresh Green Bag have been used on the International Space Station to prolong the life of fruits and vegetables.⁵⁵

Responsive packaging is less commonly used in the commercial space at this time but there is growing research on the topic. Time-temperature indicators “constantly monitor the temperatures to which the product is exposed” and allow everyone in the supply chain to determine its freshness.⁵⁶ Insignia Technologies was a “Gold Winner” at the 2017 DuPont Packaging Awards for its Freshtag Smart Label that “monitors the total shelf life of products”⁵⁷ using its patented smart color-changing pigments.⁵⁸

Potential DoD Use Case

Implementing smart packaging can greatly reduce lead times in the subsistence supply chain network and prolong the life of perishable food product. A German study found that 47 percent of the time that groceries are discarded is because of food spoilage, which means that adding visibility on subsistence lifecycles could reduce cost.⁵⁹ DoD can implement time-temperature indicators which would not only prevent serving spoiled food but would also allow for food to not be prematurely thrown out. They also can begin making the use of oxygen or ethylene scavengers’ uniform throughout the entire process on appropriate products.

Implementation Considerations

There may be issues implementing some of these changes as they may be out of DLA’s hands and be the responsibility of the supplier. Also, there would need to be buy in for any packaging improvement from both DoD and the supplier to create uniform methods.

Be mindful of emerging research and technology on responsive bio-based packaging alternatives, such as films that have nanoparticles that carry various biological compounds that serve as food quality preservation agents. Biopolymers have also been used to allow for sustainable and biodegradable packaging.⁶⁰

RFID Labeling

Description

RFID labels are a type of passive tagging that are comprised of an antenna and a microchip. To obtain the information stored within the tag, a reader is used to send a signal which activates the tag and sends the information back to the reader. The RFID tags have no internal power source and can be designed to withstand a multitude of conditions. These types of tags are smaller, cheaper, and more flexible than traditional active RFID tagging, but maintain most of the same functions and an infinite lifespan.⁶¹

⁵⁵ <https://www.evertfresh.com/>.

⁵⁶ <https://www.keep-it.no/en/>.

⁵⁷ https://www.insigniatechnologies.com/products_fooddistributionandshippingsolutions.php.

⁵⁸ <https://www.insigniatechnologies.com/technology.php>.

⁵⁹ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6352026/>.

⁶⁰ <https://www.sciencedirect.com/science/article/pii/S2666893920300244#sec0007>.

⁶¹ <https://www.atlasrfidstore.com/rfid-insider/active-rfid-vs-passive-rfid>.

Commercial Use Cases

RFID tags have come a long way since their boxy hardware origins, even being integrated into thin disposable labels. There have also been innovations that eliminated some of the barriers of RFID use in the food industry. Sodexo is currently using microwave-safe RFID labels in their SmartFridge product. This specialized RFID is manufactured by Avery Dennison, who also produce an RFID label that is able to attach to metal surfaces without interference.⁶²

Potential DoD Use Case

RFID tagging could be used to track subsistence products throughout the entire supply chain. This will allow DLA to track subsistence products and be able to do real time inventory checks and lead to predictive supplying. The RFID tagging will also have information on the entire lifecycle of the product which would allow for a better estimate of a products lifespan.

The specialized RFID tags that eliminate metal or microwave interference would be useful for heat and serve subsistence products so the label can remain on the product and continue to be tracked through its entire lifecycle. RFID labels would also be useful in specific situations where there is little to no network connectivity so the inventory available to the warfighter can still be managed and lifespan can still be assessed.

Implementation Considerations

There are three types of RFID tags—passive, active, and intelligent—and selecting the correct one is crucial to implementation in the food industry. Active and intelligent RFID tagging use batteries, which causes contamination issues for the food industry. Passive tags are “low cost tags without batteries so they can be printed on material and adhered to a surface.”⁶³ Using RFID tags will require a hardware investment and uniform use of that RFID reading hardware throughout the entire subsistence supply chain. Also, implementing RFID tagging would require cooperation and collaboration with suppliers.

Machine Learning and Artificial Intelligence

Description

AI are programs that can evaluate data to make determinations and decisions. In December of 2017, companion bills House of Representatives 4625 and Senate 2217 defined AI as “Any artificial system that performs tasks under varying and unpredictable circumstances, without significant human oversight, or that can learn from their experience and improve their performance... They may solve tasks requiring human like perception, cognition, planning, learning, communication, or physical action.”^{64,65}

ML is when a computer can learn and improve its performance based on previous input without explicit coding instruction. This is achieved by building an algorithm to process the input data and by constantly improving that algorithm with new information. ML turns its assessment into something human readable and actionable. Current ML applications

⁶² <https://www.labelsandlabeling.com/features/smart-and-intelligent-labels>.

⁶³ <https://www.fcsi.org/foodservice-consultant/worldwide/rfid-foodservice-hospitality/>.

⁶⁴ Hoadley, Lucas. 2018. Artificial Intelligence and National Security. Congressional Research Service Report, Congressional Research Center.

⁶⁵ LMI, Future of Subsistence Prime Vendor Report (2018).

include visual inspections, traffic predictions, and facial recognition software.⁶⁶ With ML, one could show a computer picture of forks and knives and ask the computer to classify the pictures into two different groups without explicitly telling the computer that one dataset is of forks, and the other one is of knives. The programmer can then give the computer a mixed dataset with pictures of forks and knives and the computer will accurately sort the pictures into the two categories. However, the programmer does not actually instruct the program that one picture contains a fork or what qualities define a fork. The machine determines what characteristics define each category.⁶⁷

Commercial Use Cases

Walmart is using ML, machine vision, and temperature tracking to indicate the shelf life for fresh fruits and vegetables. In this program, called Eden, Walmart used the U.S. Department of Agriculture (USDA) and Walmart-specific standards for food items. Using a photo of the food and tracking temperature in the truck, Eden can determine the estimated shelf life of the produce item. If the temperature inside the truck exceeds acceptable limits and thus, reduces the shelf life of the food, Eden can then reroute the item to a different location where the shelf life will stay within an acceptable range. Eden is still an immature application, but has already saved Walmart \$86 million in food waste in the first year of use.^{68,69,70}

IBM's Watson and Oracle's Adaptive Intelligent Apps are currently offering AI programs to improve supply chain operations, such as improving inventory planning by determining the feasibility of and planning for different menus and menu options.^{71,72} For example, these programs can predict when menus incorporating seasonal fruits or vegetables will be in demand, and suggest orders based on that expected demand. In addition, Just in Time Delivery capabilities can be improved through an added feedback loop to the predictive analytics capability discussed in the separate use case.⁷³

Potential DoD Use Case

Implementation of AI will allow for DLA and subsistence suppliers to be able to predict how much inventory to send and when to send it. The AI could potentially go beyond inventory data and be able to predict whether Meals Ready to Eat (MREs), Unitized Group Rations (UGR) Heat and Serve, or UGR-A ration fresh subsistence options are needed. AI would be able to use data on local seasonal data to determine when more food may be consumed or be able to predict if certain perishable products are more likely to spoil earlier. DoD could implement a system similar to Walmart's to ensure that the warfighter is getting the most out of their supply and that they are not consuming spoiled supply.

⁶⁶ LMI, Future of Subsistence Prime Vendor Report (2018).

⁶⁷ LMI, Future of Subsistence Prime Vendor Report (2018).

⁶⁸ Alaimo, Dan. 2018. Walmart develops produce inspection technology to track freshness. March 2. <https://www.fooddive.com/news/grocery--walmart-develops-produce-inspection-technology-to-track-freshness/518248/>.

⁶⁹ Refrigerated and Frozen Foods. 2018. Walmart introduces Eden, an intelligent food system. March 2. <https://www.refrigeratedfrozenfood.com/articles/94392-walmart-introduces-eden-an-intelligent-food-system>.

⁷⁰ LMI, Future of Subsistence Prime Vendor Report (2018).

⁷¹ IBM. 2018. Watson Supply Chain. <https://www.ibm.com/customer-engagement/supply-chain>.

⁷² Oracle. 2017. Oracle Infuses its Cloud Applications with Artificial Intelligence. October 2. <https://www.oracle.com/corporate/pressrelease/oow17-oracle-embeds-ai-across-applications-100217.html>.

⁷³ LMI, Future of Subsistence Prime Vendor Report (2018).

AI would be able to benefit the nutrition of the warfighter by taking in data about the individuals like their height and weight and pair it with their daily schedules to create for them the meals designed to replenish and improve nutrition. This AI could range anywhere from deciding what meals are served or creating an interface that provides them with options and suggestions that would be most beneficial to them. This service would pair well with wearable devices so more accurate biometric suggestions could be made.

Implementation Considerations

AI and ML could potentially face some pushback and may be difficult to get everyone on board. There is a fear associated with automation of processes that it will eventually negatively affect the human through the reduction of work to do or lack of trust in the work the AI or ML system accomplishes.⁷⁴ Improving AI or ML systems will also require a specialized workforce that knows how to run those systems and interpret the data.^{75,76} Depending on the specialization of workforce throughout the supply chain this could require an investment in additional labor or training.

Data Warehouses

Description

By 2030, tremendous amounts of data will be collected from shipments, the vehicles transporting them, and infrastructure and equipment.⁷⁷ Suppliers, customers, and other supply chain partners will generate increasingly large volumes of data that can be analyzed to improve processes, predict demand, gain additional customer insight, and more. Accordingly, having a scalable and efficient solution for data storage and analysis will be paramount.

Data warehouses are systems that consolidate large quantities of structured and semi-structured data from across disparate sources to perform data analytics, AI, ML, and more.^{78,79} Unlike a data lake, which functions as a repository for all types of data (i.e., structured, semi-structured, and unstructured), data warehouses generally use data that is in a structured or in a “tabular format.”^{80,81}

Commercial Use Cases

While data warehousing has existed for over 30 years, most data warehouses have expanded from on-premise data stores to cloud-based systems with built-in data analytics and data visualization capabilities.⁸² Data warehouses are used across several industries, including finance, education, healthcare, insurance, manufacturing,

⁷⁴ Hammerkopf. Artificial intelligence in the food industry. Available from <http://www.hammerkopf.com>.

⁷⁵ Sebastin, J. Artificial Intelligence: a real opportunity in food industry. Food Quality and Safety. 2018. Available from <https://www.foodqualityandsafety.com>.

⁷⁶ Application of artificial intelligence (AI) in food industry, Chidinma-Mary-Agbai, Department of Food Science and Technology, Federal University of Technology Owerri, Owerri, Nigeria.

⁷⁷ Forger, Gary, Charles Edwards, Bill Ferrell, Steve Hopper, Dana Magliola, and Dave Schneider. 2017. Material Handling & Logistics U.S. Roadmap 2.0. MHI.

⁷⁸ <https://www.ibm.com/cloud/learn/data-warehouse>.

⁷⁹ <https://cloud.google.com/learn/what-is-a-data-warehouse#section-4>.

⁸⁰ <https://blogs.oracle.com/bigdata/post/data-lake-data-warehouse-and-databasewhatx27s-the-difference>.

⁸¹ <https://aws.amazon.com/data-warehouse/>.

⁸² <https://www.ibm.com/cloud/learn/data-warehouse>.

marketing, transportation, and retail.⁸³ Some well-known commercial entities that also use data warehouses are Apple, eBay, Walmart, Whole Foods, Starbucks, Verizon, and AT&T.^{84,85,86} According to Allied Market Research, the cross-industry global data warehousing market is projected to grow to \$34.69 billion by 2025 (up from \$18.61 billion in 2017) at a CAGR of 8.2 percent between 2018 and 2025.⁸⁷

Potential DoD Use Cases

The information that encompasses the Class I–Subsistence supply chain (i.e. catalog, purchase order, invoice, transactional, food safety, inventory, and performance data) comes from disparate sources, including DLA, SPVs, the Services and UCCs. A data warehouse would help break data silos and yield meaningful, big-picture insights. Furthermore, algorithms could be applied on top of the aggregated historical and real-time data to automate forecasting, planning, inventory oversight, and vendor price tracking.

Implementation Considerations

Warehouse creation can take several months and cost millions of dollars in labor. Therefore, according to Gartner, data warehouses are best suited for organizations that use data to answer specific questions or glean certain insights on a recurring basis across multiple users. For sporadic research and exploratory analysis, a cloud-based data lake may be a simpler and more cost-effective solution.⁸⁸

Automated Receiving

Description

Automated receiving takes advantage of barcodes, stock keeping units, RFIDs, etc., to enable a warehouse management system or other inventory management platform to automatically ingest stock, reducing unloading times, automatically allocating work and resources, and saving costs in material handling.⁸⁹ According to Amazon Logistics, automated receiving is one of the foundational elements of the next generation supply chain.⁹⁰

Commercial Use Cases

Commercial industry has begun widespread adoption of the tools and techniques that empower automated receiving, reaping many benefits from time savings to reduction of errors.⁹¹ “According to the 2018 Warehousing Education and Research Council study...a majority of distribution centers use no other technology beyond a warehouse

⁸³ <https://tdan.com/data-warehouse-applications-by-industry/5070>.

⁸⁴ <https://qigaom.com/2013/03/27/why-apple-ebay-and-walmart-have-some-of-the-biggest-data-warehouses-youve-ever-seen/>.

⁸⁵ <https://www.mytotalretail.com/article/inside-look-whole-foods-move-cloud/>.

⁸⁶ <https://www.edureka.co/blog/i-got-data-in-my-jewellery-box/>.

⁸⁷ <https://www.alliedmarketresearch.com/data-warehousing-market#:~:text=Data%20Warehousing%20Market%20Outlook%20%2D%202025&text=The%20adoption%20of%20data%20warehousing,8.2%25%20from%202018%20to%202025>.

⁸⁸ <https://www.forbes.com/sites/forbesbusinesscouncil/2021/03/02/keeping-your-business-informed-a-guide-to-data-lakes-and-warehouses/?sh=7693396743cd>.

⁸⁹ https://www.scdigest.com/experts/Holste_14-05-07.php?cid=8039.

⁹⁰ <https://pages.awscloud.com/rs/112-TZM-766/images/Supply%20Chain%20Optimisation%20Deck.pdf>.

⁹¹ <https://www.falconautoonline.com/goods-receiving-buffering/>.

management system and mobile devices with RF/barcode scanners.”⁹² Automated receiving in warehouse settings has been shown to reduce unload times by 66 percent.⁸⁸

Potential DoD Use Cases

There is no reason to believe that the DoD supply chain would not experience similar benefits should they adopt this innovative paradigm. Automated receiving in warehouses/depots holding Class I–Subsistence products should expect to see time savings, improvements in overall performance, and reduction in errors. Receiving is one of the most labor-intensive processes in the supply chain, and is a non-value add activity. Thus any strategy to reduce time and effort spent receiving should logically produce logistical benefits and cost savings.⁸⁸

Implementation Considerations

Automated receiving requires a thorough and complete understanding of the receiving process before it can be implemented. Automated receiving is often only achievable when other technologies (e.g., barcodes, RFIDs and scanners) have already been adopted. This reliance on adopting other technologies further complicates the already challenging process of automating receiving.

Furthermore, because the automated process will typically bypass a thorough inspection process for received goods, there needs to be another system in place to ensure what was ordered was delivered/received or only vendors trusted by DLA can benefit from this automated process.⁹³

Biometric ID

Description

Biometric ID is the use of retina, fingerprint, iris, face, or other biometric markers as a form of identification. These biometric markers can be used in conjunction with security or identification measures already in place, such as identification cards or signatures, to improve the security of transactions made in the subsistence supply chain.⁹⁴

Commercial Use Cases

Currently Biometric ID is being used in delivery of vaccines to remote areas of the world. A new company called Simprints has a solution that “utilizes contactless biometrics to verify the delivery of vaccines at the frontlines to minimize wastage and improve data quality.” The company is looking to develop a solution that uses “a camera-based, contactless, biometric product that utilizes facial recognition to identify people.”⁹⁵

The Seattle Seahawks have partnered with a company called CLEAR who uses scans of six total fingers (and iris scanning for the airport service), to uniquely identify fans. These scans allow fans to skip or jump to the front of lines to enter the stadium and at

⁹² <https://sps.honeywell.com/us/en/support/blog/productivity/receiving-workflow-provides-opportunities-for-improved-accuracies-and-efficiencies>.

⁹³ <https://sps.honeywell.com/us/en/support/blog/productivity/receiving-workflow-provides-opportunities-for-improved-accuracies-and-efficiencies>.

⁹⁴ LMI, Future of Subsistence Prime Vendor Report (2018).

⁹⁵ <https://www.biometricupdate.com/202010/simprints-biometric-vaccine-management-solution-among-winners-of-mit-healthcare-challenge>.

concessions. When someone purchases alcohol using CLEAR, their biometrics allow them to pay for the beer and verifies to the vendor that they are of legal age.⁹⁶

Potential DoD Use Cases

The Services could use biometric markers as a signature for receipting products at the dock. This method of receipt is more secure than a signature and faster to produce. Through the use of this, they would be able to ledger and record a person who receipted or transferred the item with increased validation of that identity.

Purchases can also be authorized using biometric authentication. Biometric authentication for consumption can also be integrated with nutritional suggestions and can track nutritional intake for the individual, allowing for trend analysis and enforcement of personalized nutrition plans.⁹⁷

Implementation Considerations

For biometric data, spoofing, which is the use of an object to imitate the original biometric marker (e.g., fake fingerprints), is a problem. Less common biometric markers that combine physiological and behavioral markers, such as gait, seem to be less prone to spoofing attacks. However, more research is required.

DLA could use multiple biometric markers, such as fingerprints and iris scans, or fingerprint and handshape to improve the security of biometric forms of authentication. Using multiple biometric data indicators is more secure and less prone to spoofing attacks.

Security concerns over storage of biometric data may be a growing concern. This technology stores unique personal traits which raises privacy issues. In addition, there is concern that since physical characteristics are immutable, if compromised there is limited recourse to take corrective actions (you cannot change a fingerprint like a password).⁹⁸

Genetic Nutrition

Description

The human body produces identifiers that technology can capture to identify individuals and analyze data about the individual. That is, individuals can use biometric markers to learn more about their bodies. For example, genetic testing from 23andMe as well as other such services, has allowed individuals to learn about their genetic heritage. Genetic testing can also test for diseases or likelihood of getting diseases. However, DNA is not the only biometric information that can help an individual understand their ideal nutritional intake. Blood sugar, cholesterol, and metabolism are all biometric markers that can help identify an individual's nutrition requirement.⁹⁹

⁹⁶ <https://www.geekwire.com/2018/scan-fingerprint-get-beer-testing-clears-biometric-technology-seattle-seahawks-game/>.

⁹⁷ LMI, Future of Subsistence Prime Vendor Report (2018).

⁹⁸ LMI, Future of Subsistence Prime Vendor Report (2018).

⁹⁹ LMI, Future of Subsistence Prime Vendor Report (2018).

Commercial Use Cases

Programs like Habit collect biometric data including DNA, blood sugar, cholesterol levels, and behavioral indicators to suggest ideal nutritional allowances for the individual. They put the individual into a category based on if the person requires more protein, vegetables, or grains in their diet compared to the average person. Some programs also test caffeine tolerance and propensity toward diabetes.

Potential DoD Use Cases

Using this type of information, DoD service dining facilities (DFACs) could personalize food plans to the individual warfighter based on the person's biological requirements. This could improve the health of that person, particularly by raising the person's awareness for what he or she may need and how their nutritional needs may differ from someone else's.

Implementation Considerations

Nutritional science is still rather new. We do not fully understand nutrition or the interaction between nutrition and genetic and other biometric markers.¹⁰⁰ However, evidence shows that health outcomes improved once participants learned about their body's reaction to certain diets.¹⁰¹

Privacy concerns over storage of and use of health data for other purposes may be a significant issue.¹⁰²

Wearables

Description

Wearable technology can track physical activity, heart rate, and calories burned. Collecting this type of information with the biometric data regarding ideal nutritional intake could also improve the individual's health by correlating the food intake and exercise output. Behavioral inputs, such as physical activity, may change over time and can also affect the individual's nutritional plan.¹⁰³ Smart watches monitor physical activity through location and heartrate, making people aware of how active or inactive they are and encouraging them to become more physically active. Other wearable devices can track blood sugar levels.¹⁰⁴

These devices will also be potential sources of information for future data analytics, providing health information, location, and other data that can help determine demand patterns and other useful information.

Commercial Use Cases

The National Football League has a partnership with WHOOP, a wearable device that tracks players strain, recovery, and sleep. The device measures data 100 times per

¹⁰⁰ Bearne, Suzanne. 2017. "How DNA-testing kits are becoming big business." BBC News. May 2017.

¹⁰¹ Livingstone, Katherine, Celis-Morales, Carlos, et. al. "Effect of an Internet-based, personalized nutrition randomized trial on dietary changes associated with the Mediterranean diet: the Food4Me Study."

¹⁰² LMI, Future of Subsistence Prime Vendor Report (2018).

¹⁰³ LMI, Future of Subsistence Prime Vendor Report (2018).

¹⁰⁴ Wallack, Roy. 2015. "Wearable technology catapulting health and fitness into future." Los Angeles Times, January 23. <http://www.latimes.com/health/la-he-future-wearables-20150124-column.html>.

second and then sends that data to WHOOP apps, where the user can get analysis and plans of action.¹⁰⁵ Teams and players can then use this data to inform decisions on how they train and take care of their bodies.

Anytime Fitness UK, the leading fitness franchise in the UK, has partnered with a metabolic tracking device company called Lumen. Lumen is a device and phone application that can measure your metabolism through a single breath and then uses that data to provide the user with a personalized nutrition plan best suited for their day.¹⁰⁶

Potential DoD Use Cases

Wearables would allow DoD to monitor the biological metrics of the soldier and their performance levels. Using that data, DFAC would be able to determine how well the given menus help performance and determine what changes could be made to show improvement. The system could also give the warfighter notifications and alerts when they may be deficient in nutritional areas or use their current biological data to help them pick the right meal.

All of this will accumulate a lot of data that can be stored and studied in the hopes of understanding how the warfighters are responding and how better nourishment could be provided overall.¹⁰⁷

Implementation Considerations

Transmission of location information is an increasing concern for DoD, and may limit the functionality of both personal and issued devices in the future. The variety of devices and the fact most wearables are personal devices will make gathering information difficult and prone to privacy concerns. Also, implementing wearables would require a significant data sharing effort between the Services and DLA.¹⁰⁸

Augmented and/or Mixed Reality

Description

Augmented reality (AR) is an emerging technology that “superimposes digital data and images on the physical world” to create “an interactive 3D experience.”^{109,110} In other words, AR enhances real world settings with digital elements to supplement a specific real-world setting.¹¹¹ Similarly, mixed reality (MR) is an immersive experience that enables users to engage with and control both real and virtual environments. “It provides the ability to have one foot (or hand) in the real world, and the other in an imaginary place, breaking down basic concepts between real and imaginary.”¹¹²

¹⁰⁵ <https://nflpa.com/partners/posts/whoop-strikes-landmark-deal-as-the-officially-licensed-recovery-wearable-of-the-nfl-players-association>.

¹⁰⁶ <https://www.businesswire.com/news/home/20210105005146/en/Lumen-Partners-With-Anytime-Fitness-UK-to-Provide-Gym-Members-With-Opportunity-to-Track-Their-Metabolism-and-Nutrition-From-Home>.

¹⁰⁷ LMI, Future of Subsistence Prime Vendor Report (2018).

¹⁰⁸ LMI, Future of Subsistence Prime Vendor Report (2018).

¹⁰⁹ <https://hbr.org/2017/11/why-every-organization-needs-an-augmented-reality-strategy>.

¹¹⁰ <https://www.businessinsider.com/what-is-augmented-reality>.

¹¹¹ <https://www.intel.com/content/www/us/en/tech-tips-and-tricks/virtual-reality-vs-augmented-reality.html>.

¹¹² <https://www.intel.com/content/www/us/en/tech-tips-and-tricks/virtual-reality-vs-augmented-reality.html>.

Commercial Use Cases

Use of AR and MR technology in the commercial food industry is currently nascent and used primarily for marketing and customer user experience purposes. Specifically, commercial food and beverage vendors are leveraging AR to digitally display menu items (Dominos), enable production facility or distillery tours (Macallen), and adding supplemental information and AR games to wine and soda bottles and beverage coasters (19 Crimes, Coca Cola, and Budweiser).¹¹³

Another area where AR and MR technology could be applied is in the food inventory management space. Warehousing companies have begun using AR to determine inventory levels and help in the pick and pack process. DHL claims to have successfully introduced AR to create something they call “vision picking” which has led to a 25 percent increase in picking efficiency.¹¹⁴

Potential DoD Use Cases

AR and MR offer significant promise in both commercial food industry and DoD training, compliance, quality control, and diet intervention applications:

- **Training:** In a 2017 randomized study published in the International Journal of Behavioral Nutrition and Physical Activity, researchers assigned participants to use an AR tool to examine the “impact on estimation error of standard food servings.”¹¹⁵ Participants who used AR to estimate food portion sizes produced more accurate results compared to non-AR (information only) participants.¹¹⁶ Outside of the food industry, companies like BAE are applying MR for guided work instructions for battery assembly.¹¹⁷ DLA could leverage AR and MR to help train individuals conducting receiving activities within the DoD subsistence supply chain.
- **Compliance and Quality Control:** The COVID-19 pandemic has hampered in-person food audits and occasioned more remote or hybrid inspection methods. In conjunction with IoT devices, food safety inspection professionals could leverage AR to inspect elements such as “water antimicrobial levels, product location with time stamping, field irrigation sensors and tracking, locations of pest intrusions and pesticide applications, harvest information, pathogen testing results, and other types of production monitoring.”¹¹⁸ Moreover, such compliance and safety information could eventually be aggregated to support subsequent analysis and decision-making.

¹¹³ [https://medium.com/echoar/how-augmented-reality-ar-is-reshaping-the-food-service-industry-a558039badad#:~:text=Augmented%20reality%20\(AR\)%20technology%20is,to%20enhancing%20the%20customer%20experience.](https://medium.com/echoar/how-augmented-reality-ar-is-reshaping-the-food-service-industry-a558039badad#:~:text=Augmented%20reality%20(AR)%20technology%20is,to%20enhancing%20the%20customer%20experience.)

¹¹⁴ <https://www.dhl.com/global-en/home/about-us/delivered-magazine/articles/2014-2015/dhl-successfully-tests-augmented-reality-application-in-warehouse.html>.

¹¹⁵ <https://ijbnpa.biomedcentral.com/articles/10.1186/s12966-017-0516-9>.

¹¹⁶ <https://ijbnpa.biomedcentral.com/articles/10.1186/s12966-017-0516-9>.

¹¹⁷ <https://www.ptc.com/en/resources/augmented-reality/video/bae-systems-mixed-reality-with-ptc>.

¹¹⁸ <https://www.forbes.com/sites/thomasburke/2020/09/21/the-virtual-inspector-remote-auditing-for-food-safety-verification/?sh=4540343506a9>.

- Inventory Management: Throughout the entire process, AR and MR can be used in location of supplies and for managing the inventory. Using this technology along with RFID or barcodes, the warfighter can record each item that is handled so it can be tracked, and the actual inventory can be known in real time throughout the entire supply chain.

Implementation Considerations

Fully reaping the benefits of AR and MR as IoT-supported technologies requires network/internet connectivity. Using AR and MR could prove challenging in certain locations, such as farms or remote warehouses, where internet connections and IoT device functionality is limited. Implementing AR and MR in low maturity theaters, therefore, may not be a viable option for DLA.

Any type of AR or MR technology will require significant cost up front to buy the hardware and needed software. Along with the cost, setting up the software network may prove to be difficult and time consuming.

Hydroponics and Vertical Farming

Description

Hydroponics is a method of growing vegetables and herbs without using soil. The nutrients required by the plants are provided solely through nutrient-rich water running over and through the roots of the plants. Hydroponics growing facilities include greenhouses and containers (similar to a shipping container). The use of hydroponics can reduce the length of the fruits and vegetables supply chain, decreasing food defense risks and food spoilage.¹¹⁹

Commercial Use Cases

Small-scale commercial hydroponic growing systems are available that can fill this need. VH Hydroponics in Anchorage, AK, has developed a tailored Comparative Genome Sequencing (CGS) that encompasses all materials required to produce a perpetual harvest of green leafy vegetables inside of a 20 to 40-foot container. The growing container is outfitted with lighting, a heating and cooling HVAC system, and a fully automated control panel that controls water delivery and nutrient solutions. The system can operate either off a diesel generator or hard-wired to a building power supply. The system can produce over 450 heads of lettuce per week, along with leafy greens and herbs.

This technology is currently being used in remote areas of the Unalaska island chain in Alaska where it is impossible to garden conventionally because of severe weather. High food cost associated with the transportation to the remote area often keep residents from purchasing the produce. However, since the CGS has been implemented in the town, they now supply every restaurant and local grocery store with fresh food. The method performed in the city can produce over 900 heads of lettuce a week. In an area that

¹¹⁹ LMI, Future of Subsistence Prime Vendor Report (2018).

would have been considered a “food desert” because of the lack of healthy produce, they have developed an oasis for their community.^{120,121}

Potential DoD Use Cases

Vertical tower gardening is an alternative to the CGS that allows for Soldiers to play an active role in their food security and safety. Having the ability to grow plants utilizing the sun for a light source decreases the requirements to operate the system.

Implementation Considerations

To take full advantage of hydroponics and vertical farming technologies, DLA would have to develop new expertise and acquisition practices. In a forward position, a contained grow would need a power source capable of maintaining the required conditions for the produce, as well as a major up-front cost in fresh, uncontaminated water. These two requirements may be untenable in certain military circumstances. Further, there is an expected grow cycle, and this delay may make standard acquisition a more efficient process.¹²²

However, as more industry players begin to develop the technology domestically and abroad, the value of the technology may be in supplementing the subsistence supply chain with year-round local access to fresh produce from vendors, instead of having defense personnel grow the produce themselves.

Alternative and Cultured Meats

Description

The meat alternative market is a rapidly growing segment of the food market worldwide. According to Allied Market Research, worldwide demand for meat substitutes is predicted to grow to \$5.2 billion by 2020, a compound annual growth rate of 8.4 percent for the period 2015 to 2020.¹²³ Examples of meat alternatives include tofu, tempeh, textured vegetable protein, seitan, and Quorn. While most meat alternatives still require freezing or refrigeration, there are some shelf stable options as well. Plant-based meat products seek to improve on the veggie burger of the past by mimicking real meat as closely as possible while using only plant-based ingredients. The Beyond Burger and Impossible Burger are two of the most prominent examples.^{124,125} The main difference between the examples listed above are the inputs and production processes used.

In addition to alternative meats, the market for cultured meats is also expected to grow rapidly in the coming years due to falling production costs.¹²⁶ Cultured meat is produced

¹²⁰ Seward, Carey. 2018. This Amazing Garden In A Shipping Container Would Only Happen In Alaska. February 26. <https://www.onlyinyourstate.com/alaska/arctic-greens-unalaska-ak/>.

¹²¹ LMI, Future of Subsistence Prime Vendor Report (2018).

¹²² LMI, Future of Subsistence Prime Vendor Report (2018).

¹²³ Allied Market Research. 2018. “Meat Substitute Market by Product Type, Source and Category: Glory Opportunity Analysis and Industry Forecast, 2018-2025.” Allied Market Research. <https://www.alliedmarketresearch.com/press-release/global-meatsubstitute-market.html>.

¹²⁴ Celenza, Frankie. 2018. “The Beef Of The Future Is Here, And It’s Not Made of Meat.” The Huffington Post, June 13. https://www.huffingtonpost.com/entry/beef-of-the-future-is-here-and-its-not-made-of-meat_us_5b158064e4b010565aaeb066.

¹²⁵ Lopez-Alt, J Kenjil. 2016. Serious Eats—Let It Bleed (Humanely): We Taste the Vegan “Impossible” and “Beyond” Burgers. <https://www.serious-eats.com/2016/10/beyond-burger-impossible-burger-vegan-taste-test.html>.

¹²⁶ Shoemaker, Natalie. 2017. Big Think—Price of Lab-Grown Burger Falls from \$325K to \$11.36. <https://bigthink.com/ideafest/answering-how-a-sausage-gets-made-will-be-more-complicated-in-2020>.

using laboratory methods. Also called clean meat or in-vitro meat, cultured meat is grown from actual animal cells, and the final product seeks to be identical to the real thing.

Commercial Use Cases

There is currently some debate in industry about which agency, the Food and Drug Administration or the USDA, should be responsible for regulating these products. However that argument is resolved, there are currently commercial offerings on the marketplace and in restaurants for meatless burgers that are not traditional veggie burgers, but protein extracted and engineered to mimic the flavors, nutritional values, and textures/appearance of normal beef. For now, this technology offers little to DLA, but it is a technology on the rise and may quickly become a legitimate consideration as a protein source for American warfighters.¹²⁷

Potential DoD Use Case

Vendors would implement by adding alternative and/or cultured meat to their menus. Warfighters could benefit from decreased risk of foodborne illness and additional choices for those wishing to pursue a low or meat-free diet. The Services could gain additional operational flexibility by transitioning to a mix of animal and alternative meat products because alternative meats are faster to produce.¹²⁸

Implementation Considerations

Implementation of alternative and cultured meats carries some positive considerations:

- Environmental Impact: Lowering the dependence on traditional livestock meat production could reduce greenhouse gas (GHG) emissions (if paired with other sustainability activities), aligning with top federal climate and environmental initiatives.¹²⁹
- Health and Food Safety: Manufacturing and laboratory conditions and safety protocols should lower the risk of foodborne diseases entering the supply chain.¹³⁰
- Supply Chain Costs: Alternative meat products involve much less space, water, and human labor, and their facilities can be located to dramatically shorten or compact the supply chain. Overall, this leads to reduced costs.¹³¹

Potential drawbacks include large research, development, and up-front launching costs. There are also timeframe considerations as this new technology remains relatively untested at massive scale.

¹²⁷ LMI, Future of Subsistence Prime Vendor Report (2018).

¹²⁸ LMI, Future of Subsistence Prime Vendor Report (2018).

¹²⁹ <https://www.eea.europa.eu/publications/artificial-meat-and-the-environment/file>.

¹³⁰ <https://burdockgroup.com/safety-and-regulation-of-cell-cultured-meat-as-a-food-product/>.

¹³¹ <https://www.forbes.com/sites/stevebanker/2021/09/27/sustainability-and-plant-based-meat-supply-chains/>.

Drones

Description

Drones are unmanned aircraft vehicles capable of delivering subsistence materials to remote or hostile territories, or for emergency relief. Because of a limitation in size and payload, these types of aerial vehicles would most likely deliver small resupply orders. Current innovations are investigating drones that are either of one time use, focusing on cost reduction, or drones that are designed for multiple missions.

Similar to the aerial autonomous delivery, land-based autonomous vehicles might deliver orders. This could include platooning, where one lead vehicle is manned, determining speed and direction for a convoy of vehicles, while the other vehicles follow the leader. This allows for larger deliveries, a decreased delivery schedule, and decreased risk to the person delivering the order.

Commercial Use Cases

Drones are already actively used in disaster and humanitarian relief efforts and that work will only continue to grow, but they are still facing serious challenges in airspace management. A key current use of drones is to set up and maintain communications infrastructure, but drones are increasingly being used to deliver relief supplies. Examples like the use of Zipline drones to deliver medical supplies in Rwanda set a solid benchmark.¹³²

The use case above only relates to lightweight deliveries. Drones that carry heavier cargo are still in the works. The U.S. Marine Corps and the Army have a project in the works called Joint Tactical Autonomous Aerial Resupply System.¹³³ The parameters of the project state that the drone must be able to hold 800 pounds of any class supply for a 110 mile radius.¹³⁴ Natilus is a start-up from California that is attempting to make long haul air cargo more efficient, cost-friendly, and pilotless. Natilus is building drones that can withstand payloads of 3.8 tons to 100 tons and hopes to deliver 50 percent more cargo for 50 percent less cost. In 2 years, they do their first commercial use test in 2 years.¹³⁵

Some commercial vendors are selling drone technology that is used to manage inventory instead of deliver inventory. Flytware “combines intelligent software with reliable, off-the-shelf drone hardware for safe and cost-effective automation of inventory counts in warehouses, distribution centers, and even retail stores.”¹³⁶ Drones can theoretically perform autonomous inventory management activities with a small physical profile and increased efficiency in commercial spaces.

Potential DoD Use Cases

The DoD could use drones in last mile delivery cases. In more remote areas where subsistence supplies may be difficult to reach the necessary destination through typical modes of transportation, drone deliveries provide flexible and efficient delivery options.

¹³² www.flyzipline.com.

¹³³ <https://www.flightglobal.com/helicopters/darpa-cancels-ares-cargo-drone-project-with-lockheed-martin-/132645.article>.

¹³⁴ <https://sam.gov/opp/4ea6521e39a04a139ea15c98255d95e2/view>.

¹³⁵ <https://medium.com/vectors-angel/next-generation-aircraft-taking-the-air-cargo-industry-to-new-heights-ace3cabecf70>.

¹³⁶ <https://flytware.com/>.

The method at this stage would be limited to MREs or one-off meal options because of the limited carrying capacity for drone delivery. There are private and DoD projects currently that may eventually lead to pilotless systems capable of delivering large cargo loads that could eventually significantly cut down supply chain lead times.

Implementation Considerations

Current options for drone delivery are very limited. There are not drones with big enough storage capacity to hold large quantities of subsistence or the ability to travel with cargo long distances such as CONUS to OCONUS travel. Using current drones would only allow for very specific use cases where the warfighter is in a remote area and needs subsistence supplies in the short term.

Widespread use of drones in subsistence delivery is an achievable goal and seems to be trending towards eventually becoming a common business practice. However, the technology is not quite there yet with larger size cargo delivery potentially years away. That does not mean this is not a viable opportunity to improve the supply chain. Implementation of this solution could potentially benefit from partnering with current research and testing of drone technology, as well as starting to build the necessary infrastructure necessary once the technology is ready.

Innovative Subsistence Best Practices

Examining business trends and launching new processes can improve business outcomes and enhance customer service. This section includes research on current or emerging trends and best practices in the commercial food industry, as well as analysis on how DLA can apply these trends and practices to its SPV program.

Name	Commercial use cases	Potential DoD use cases	Implementation considerations
Eliminate Data Silos	Google data unification and analysis prototype for Kroger and Feeding America	• Adopt disruptive technologies, • Waste minimization • Potential use for automatic menu planning	• Ensure stakeholder buy-in • Establish and align high-level goals • Prototype and iterate at a small scale • Use common metrics and lexicon to ensure data consistency • Share insights and progress early and often
Promote Sustainable Supply Chain Practices	Companies including FedEx, Cisco, Nestlé, and PepsiCo are implementing sustainability objectives and initiatives into their supply chains	• Digital watermarks for recycling • Recyclable, reusable, and/or compostable packaging • Setting sustainability goals • Localizing distribution • Alternative fuel • Streamlining packing materials	• Clear goal setting and alignment • Clear communication of goals to internal and external stakeholders
Market Intelligence	Companies develop forecasts for the markets based on a wide array of public and private data	• Gain a more complete perspective of subsistence supply chain • Improve insights into and pace of adoption of commercial best practices	• Requires investment in supporting technologies and expertise • Requires training to differential value from market research and historical data

Eliminate Data Silos

Description

Data accessibility and visibility are foundational to fact-driven decision-making and analyses. According to the Harvard Business Review, “the biggest obstacle to using advanced data analysis isn’t skill base or technology; it’s plain old access to the data.”¹³⁷ Data silos—wherein information is generated and/or managed by a single entity in isolation from other datasets or users—can emerge for multiple reasons, including structural, political, and cost drivers.¹³⁸

¹³⁷ <https://hbr.org/2016/12/breaking-down-data-silos>.

¹³⁸ <https://hbr.org/2016/12/breaking-down-data-silos>.

While the impacts of data silos are numerous, some notable consequences of data silos include the following:

- Hampering data analysis and implementation of certain disruptive technologies, such as AI, ML, AR, and MR
- Slowing research processes
- Duplicating workflows
- Increased risk of data leaks.¹³⁹

Commercial Use Cases

In 2020, a team from X Development LLC, a subsidiary of Alphabet Inc., prototyped and tested data analytics technologies to minimize food insecurity and food waste. Specifically, the group worked to “create a smarter food system—one that knows where the food is, what state it’s in, and where best to direct it to ensure it doesn’t end up in a landfill and instead goes to the people who need it most.” Early on, the team encountered data silos and realized those silos were leading to “distribution failures” between suppliers and food banks. Additionally, communication about food availability—quantity and location information—was hampered by a lack of data standardization.

In response, the team developed an “intelligent food distribution system” on Google Cloud in which suppliers’ (i.e., Kroger Supermarkets and the Southwest Produce Cooperative) surplus food information was automatically uploaded and matched with documented needs in the Feeding America network. The prototype also utilized “computer vision and machine learning tools to automatically capture imagery of what is being thrown out.”¹⁴⁰ The resulting system gathers twice the amount of food waste data as the prior method. Future iterations could use emerging technologies to make recommendations that minimize waste. “For example, if the system recognizes there is a lot of rice being thrown out, it could recommend turning it into a fried rice dish or a rice pudding based on other ingredients the system knows are in the kitchen or about to be thrown out.”¹⁴¹

Potential DoD Use Cases

The information that encompasses the Class I–Subsistence supply chain (i.e., catalog, purchase order, invoice, transactional, food safety, inventory, and performance data) comes from disparate sources, including DLA, SPVs, the Services, and UCCs. The commercial use case underscores how data unification could help DoD monitor and minimize food waste. Eliminating data silos and using large quantities of standardized information could also help automate menu development using food inventory and expiry information.

Implementation Considerations

A key consideration for eliminating data silos is ensuring there is sufficient buy-in from the various data contributors and stakeholders. This begins with establishing and aligning high-level goals before rolling out the data unification effort. Practitioners at

¹³⁹ <https://www.qualtrics.com/uk/experience-management/research/data-silos/>.

¹⁴⁰ <https://blog.x.company/a-new-home-for-project-delta-a39f8286b6d7>.

¹⁴¹ <https://blog.x.company/a-new-home-for-project-delta-a39f8286b6d7>.

Google recommend prototyping and iterating at a small scale, rather than jumping into building a full-scale solution; using common metrics and lexicon to ensure data consistency; and sharing insights and progress early and often to maintain stakeholder support as projects scale.¹⁴²

Promote Sustainable Supply Chain Practices

Description

One of the top policy priorities within the current administration and within the Office of the Secretary of Defense is tackling the climate crisis. In a March 4, 2021 memorandum to the Force, Secretary of Defense, Lloyd Austin, announced DoD's move to "elevate climate as a national security priority, integrating climate considerations into the Department's policies, strategies, and partner engagements" and otherwise reducing DoD's carbon footprint.¹⁴³ Additionally, in a 2019 memo written by Brigadier General Gavin Lawrence, DLA Troop Support committed to "continually improv[ing] environmental performance through training, and integrating environmental considerations into the business planning process."¹⁴⁴

Commercial Use Cases

According to a Gartner analysis, "Supply Chain Top 25 for 2021," private companies across multiple sectors are increasing their efforts to integrate more "prescriptive" sustainability targets into their supply chains. Companies are factoring carbon emissions into their strategic metrics, using recyclable and compostable packing materials, and using "creative solutions for increasing shipping density."¹⁴⁵ For instance, FedEx has pledged to make their operations carbon neutral by 2040.¹⁴⁶ Similarly, Cisco Systems announced its plan to reduce its supply chain-related GHG emissions by 30 percent by 2025. Cisco is also pushing 80 percent (by spend) of its "component, manufacturing, and logistics" vendor base to set public GHG reduction goals by 2025.¹⁴⁷

This push for a more sustainable supply chain is prominent within the commercial food industry. As an example, Nestlé is developing and deploying refillable, reusable, recyclable, and compostable packaging concepts. Concretely, in 2020, Nestlé switched to recyclable paper packaging for its Smarties products, which is projected to cut over 400 metric tons of plastic packaging each year.¹⁴⁸ PepsiCo is also piloting its own digital watermark program through the HolyGrail Consortium to streamline and enhance recycling in Europe.^{149,150}

¹⁴² <https://cloud.google.com/blog/products/data-analytics/how-industry-leaders-are-tackling-food-waste-and-food-insecurity>.

¹⁴³ <https://media.defense.gov/2021/Mar/04/2002593656/-1/-1/0/SECRETARY-LLOYD-J-AUSTIN-III-MESSAGE-TO-THE-FORCE.PDF>.

¹⁴⁴ https://www.dla.mil/Portals/104/Documents/TroopSupport/CPPS%20No_%2009%20Environmental%20Policy.pdf?ver=2020-05-12-141830-337.

¹⁴⁵ <https://emtemp.gcom.cloud/ngw/globalassets/en/supply-chain/documents/trends/global-supply-chain-top-25-report-2021.pdf>.

¹⁴⁶ <https://www.fedex.com/en-us/sustainability.html>.

¹⁴⁷ <https://emtemp.gcom.cloud/ngw/globalassets/en/supply-chain/documents/trends/global-supply-chain-top-25-report-2021.pdf>.

¹⁴⁸ <https://emtemp.gcom.cloud/ngw/globalassets/en/supply-chain/documents/trends/global-supply-chain-top-25-report-2021.pdf>.

¹⁴⁹ <https://emtemp.gcom.cloud/ngw/globalassets/en/supply-chain/documents/trends/global-supply-chain-top-25-report-2021.pdf>.

¹⁵⁰ <https://www.aim.be/priorities/digital-watermarks/>.

Potential DoD Use Cases

Some practices or methods that are being used in the commercial space that DLA could explore and integrate into the Class I–Subsistence supply chain include the following:

- Digital watermarks for recycling on packaged food items
- Recyclable or compostable packaging for MREs or UGRs
- Deploying reusable or refillable packaging for MREs or UGRs
- Setting supply chain-wide GHG reduction goals
- Setting supply chain-wide waste reduction targets¹⁵¹
- Minimizing carbon emissions by reducing distance for ground food distribution
- Deploy alternative fuel options for ground freight trucks (e.g., biodiesel or electricity)¹⁵²
- Minimizing use of mixed materials for food packaging.¹⁵³

Implementation Considerations

There are at least two key implementation considerations for promoting sustainable supply chain practices:

1. Establish Goals: Set clear targets and then apply resources to meet those targets.
2. Communicate: Clearly communicate objectives and approach to internal and external stakeholders to facilitate cooperation.¹⁵⁴

Market Intelligence

Description

Market intelligence (or business intelligence) offers decision makers insights that simple market research does not reliably, dynamically reveal. Market intelligence is a technology driven technique that merges internal data sets with external, often publicly available data to enable decision makers to plan strategically (based on historical data) and tactically (based on the most current information and trends).¹⁵⁵

Commercial Use Case

Commercial industry uses market intelligence to improve their decision-making by tracking trends in variables beyond their control. Competitive logistics companies must be able to predict and account for shifts in material and labor costs, volatile fuel costs, and various compliance requirements. For this information to be actionable, it must be tracked in real-time and contextualized.¹⁵⁶

¹⁵¹ <https://emtemp.gcom.cloud/ngw/globalassets/en/supply-chain/documents/trends/global-supply-chain-top-25-report-2021.pdf>.

¹⁵² <https://foodsafetytech.com/column/sustainability-strategies-for-the-food-industry/>.

¹⁵³ <https://www.lumi.com/blog/11-strategies-to-make-your-packaging-more-sustainable>.

¹⁵⁴ <https://online.sbu.edu/news/2016/11/30/how-integrate-sustainability-your-business>.

¹⁵⁵ <https://searchbusinessanalytics.techtarget.com/definition/business-intelligence-BI>.

¹⁵⁶ <https://archintel.com/executive-profiles/business-and-competitive-intelligence-in-the-logistics-industry/>.

At XPO logistics, analysts provide leadership with reports and dashboards powered by advanced analytics, ML, AI, and big data. The insights that can be generated using these advanced technologies and techniques are large-scale and business-critical in a rapidly evolving global supply chain.¹⁵⁷

Potential DoD Use Case

“A better understanding of the supply market, enabled by emerging technologies for data analytics, will minimize investment risks and increase market share for quality support to the warfighter.” DLA and specifically Class I–Subsistence supply chain management would benefit from a more complete perspective of the subsistence market and trends. Leveraging market intelligence, better decision-making, and financial and inventory planning will have cascading benefits across the enterprise and improve subsistence for the warfighter.

Market intelligence can also provide DLA with insights into commercial best practices, as trends in business operations, technology adoption, and workforce strategies can also be monitored and reviewed to help DLA keep pace with industry innovation.¹⁵⁸

Implementation Considerations

Market intelligence depends on adopting new technologies and data integration techniques as well as workforce training and workforce adoption of market intelligence insights. DLA Subsistence would be required to work with DLA J6 to pilot and develop this capability and then develop messaging and training to ensure the capability is adopted throughout the enterprise.¹⁵⁹

¹⁵⁷ <https://archintel.com/executive-profiles/business-and-competitive-intelligence-in-the-logistics-industry/>.

¹⁵⁸ LMI, Acquisition Modernization Program Playbook (2021).

¹⁵⁹ LMI, Acquisition Modernization Program Playbook (2021).

Innovative Contracting Practices

This section contains any new or alternative contracting methods or strategies being employed in government or commercial supply chains that may improve the Class I–Subsistence supply chain.

Name	Commercial use cases	Potential DoD use cases	Implementation considerations
Supplier Consolidation	Observable trend across commercial industry toward supplier consolidation, favoring strategically important vendors	Reducing the number of suppliers would facilitate more strategic relationships with DLA suppliers and encourage supplier investment	Risk of having a single point of failure if supplier group is too concentrated

Supplier Consolidation

Description

Supplier consolidation, the practice of scaling down the number of vendors (especially smaller vendors) within a given market and focusing on more strategically significant vendors, is a well-known contracting strategy.¹⁶⁰ Some noteworthy advantages of supplier consolidation include:

- **Increased Purchasing Power:** Rather than stretching funds across multiple suppliers, supplier consolidation enables buyers to allocate more dollars toward a single or smaller pool of vendors.
- **Fewer Transactional Costs:** A smaller supplier base will result in fewer administrative costs associated with contract management and compliance oversight.
- **Stronger Supplier Relationships:** A smaller supplier base enables buyers to focus more on managing relationships with key vendors to improve “the quality, efficiency, and overall performance of core suppliers.”¹⁶¹ It is important to note there are a few strategies available to help maximize the benefits for vendor consolidation:
- **Supplier Segmentation or Supplier Rationalization:** The practice of “grouping purchases made over a year (or other specific period of time) based on the dollar value of the product or the supplier’s price for commodities.”¹⁶² This approach enables buyers to better assess the value or “relative importance” of every supplier and evaluate the risks associated with “having too many (or not enough) suppliers for each product.”¹⁶³

¹⁶⁰ The Purchasing Chessboard, 3rd Edition, page 94.

¹⁶¹ <https://specialtyresources.com/company/blog/benefits-supplier-consolidation/#:~:text=Supplier%20consolidation%20is%20the%20process,be%20implemented%20by%20any%20industry.>

¹⁶² [https://www.inboundlogistics.com/cms/article/reduce-supply-chain-costs-with-consolidated-procurement-strategies/.](https://www.inboundlogistics.com/cms/article/reduce-supply-chain-costs-with-consolidated-procurement-strategies/)

¹⁶³ [https://www.inboundlogistics.com/cms/article/reduce-supply-chain-costs-with-consolidated-procurement-strategies/.](https://www.inboundlogistics.com/cms/article/reduce-supply-chain-costs-with-consolidated-procurement-strategies/)

-
- Combined Buying Groups: The practice of combining buying groups to “reduce procurement costs and gain a better understanding of spending trends and volumes.”¹⁶⁴

Commercial Use Cases

Supplier consolidation and an emphasis on building strong vendor relationships has emerged as a clear commercial procurement trend in response to the COVID-19 pandemic. In an Economist Intelligence Unit survey taken among 400 senior supply chain and procurement executives between November and December 2020, 30 percent of respondents reported interest in reducing the number of suppliers they use and in working more closely with their suppliers. Approximately one-third of respondents also stated that they had begun to work with fewer suppliers in an effort to simplify their supply chains. “This is especially true for food and agriculture companies that need to ensure a supply of fresh goods.”¹⁶⁵

Some companies like BP and Schneider Electric have made drastic moves to consolidate their supplier base, with BP dividing its 5,000 suppliers into two groups to forge closer partnerships with key suppliers and Schneider cutting its vendor base from 12,000 to 5,000 in the next 2 years. Companies like Airbus contend that fostering trust and loyalty among their supplier base was critical to mitigating supply chain disruptions and sustaining their production during the pandemic.

Potential DoD Use Cases

Streamlining regions, certifying vendor purchasing systems, leveraging national contracts, and relief from the U.S. Transportation Command mandate are all modifications to the existing SPV program. Reducing the number of suppliers (one East Coast and one West Coast vendor for CONUS with a back-up vendor) would provide the opportunity to establish a more strategic relationship with the suppliers and encourage supplier investment. Additional benefits include the potential to achieve greater supply chain optimization, the ability to more fully leverage PV information systems, and the standardization of prices and product lines.

Implementation Considerations

Fundamentally, supplier consolidation poses a single point-of-failure risk to the overall supply chain, particularly following global or regional shocks such as the 2011 tsunami in Japan, the COVID-19 pandemic, or the recent Colonial Pipeline cyberattack.¹⁶⁶ This risk is especially pertinent to DLA, whose CONUS and OCONUS PV supplier base is already relatively contained, with 9 and 13 vendors, respectively.¹⁶⁷ There are, potentially, small business tradeoffs to consider in accepting a sole source scenario, but the single point-of-failure risk persists in this case.

¹⁶⁴ <https://www.inboundlogistics.com/cms/article/reduce-supply-chain-costs-with-consolidated-procurement-strategies/>.

¹⁶⁵ https://eiperspectives.economist.com/sites/default/files/supply-chain_evolution_a_strategic_perspective_-_gep.pdf.

¹⁶⁶ <https://www.forbes.com/sites/forbesbusinesscouncil/2021/12/28/how-to-shift-manufacturing-supply-chain-strategy-during-a-pandemic/?sh=88de7384cf9b>.

¹⁶⁷ DLA Presentation (January 2021), Subsistence Class I Overview, slide 10.

Appendix F

Reserve and National Guard Support Whitepaper

DLA tasked LMI to identify alternative sources to the GPC to support U.S. Army Reserve (USAR) and National Guard (NG) feeding. This appendix documents the results of this additional research.

Background

USAR and NG units have traditionally obtained subsistence for monthly and annual training drills using the GPC through an exception to policy. The current exception to policy is planned to expire April 30, 2022. USAR/NG units are seeking alternatives to GPC purchases for feeding USAR/NG units through an expedited DLA solution that provides catering, grocery, and SPV sources to support mission requirements. At the onset of analysis, DLA provided the USAR/NG Standards for Caterers and Grocers (see Vendor Profiles).

Objectives and Approach

Building on the preliminary findings from the Subsistence Readiness and Supply Chain Innovation Assessment, LMI conducted the following additional research to support the DLA request to identify possible sources of supply and vendor contacts that DLA can leverage to achieve innovative contracting solutions to support the USAR/NG:

- Task 1: Identify potential sources by reviewing DLA RFI results of existing USAR/NG sources and commercial research.
- Task 2: Contact potential national/regional grocery, restaurant, and catering sources to identify POCs, type of support provided, and capabilities and provide potential constraints identified through research.

Identify Potential Sources

The team analyzed research to identify national and regionally aligned vendors for subsistence sources that are traditionally used, such as grocers, caterers, and restaurants chains. Research included identifying contact information for those vendors listed in Enclosure 1 using the following:

- DLA's RFI to industry.
- Information from USAR and NG representatives (state level) for food management team regional managers to identify current subsistence sources leveraged by their organizations. Provided results of NG by state, identifying and documenting DLA support requirements.
- Client U.S. Army (active component) catered meal contract policy for DLA to integrate as a DLA USAR/NG process.

-
- Information obtained by contacting potential national/regional grocery and catering sources:
 - POCs (for potential regional/national government contracts)
 - Vendor capabilities
 - Type of support (restaurant, grocery, or catering)
 - Vendor capabilities by type
 - Identify if vendor provides current USAR/NG support
 - Ability to accept EDI/invoice (order, billing)
 - Online catalog.

Vendor Profiles

LMI compiled a list of POCs (Enclosure 1) from the Vendor Profile Functional Groups, as outlined below, that could provide support through catered services, boxed lunches, subsistence, and other related needs. USAR/NG Standards for Caterers and Grocers were incorporated as part of support considerations. See Tables A-1 through A-5, B-1 through B-5, and C-1 through C-5.

Vendor profile functional groups:

- Group A—Grocers (National/Regional)
- Group B—Restaurants
- Group C—Caterers.

Identified Constraints

During the outreach to commercial vendors and the USAR/NG the following constraints could potentially influence vendors interest in partnering with DLA.

- Vendor willingness to participate: Vendors unwilling to adopt new data exchange platforms (STORES).
- Vendor communications:
 - Some vendors' communications are limited to website-based RFI forms—in most instances we received minimal response.
 - It is difficult to identify individuals who have decision-making authority (conflicts among legal, business development, and operations divisions; regions that are not aligned under corporate headquarters).
- NG austere geographic unit locations:
 - Some unit locations may be remote with limited access to commercial or government sources.
 - Territories (Puerto Rico, Guam, U.S. Virgin Islands) may not be aligned to CONUS type vendors and non-standard subsistence vendors (i.e., Walmart, caterers, restaurant franchisers).

- NG state agencies:
 - Inconsistent participation in responding to Subsistence Questionnaire Form—either incomplete or no response.
 - NG units do not fall under Title 10; the National Guard Bureau does not have command and control over the states.
 - Each state has differing state regulations and policy to govern their units.
- DLA food safety inspections requirements:
 - DLA will need to develop a food safety inspection program for caterers and to complete STORE catalogue requirements for food items.
 - DLA may have limited veterinary and food safety staff to support coverage requirement for all participating caterers, restaurants, and grocer subsistence items.

Findings and Recommendations

In some cases, USAR/NG units are geographically dispersed with limited access to large franchises, grocery chains, or caterers, requiring them to use smaller grocers and independently owned caterers and restaurants.

- **Finding:** Caterers' food safety certification by DLA requires annual inspections.
 - **Recommendation:** Provide USAR/NG units a limited exception to policy and provide training to enable their organizations the ability to validate compliance for food safety requirements. Limited exception to policy would be necessary until DLA is able to complete required inspections and validate food safety.
- **Finding:** DLA will have excessive requirements pertaining to sourcing, validating, and establishing individual catalogs for each grocer to meet established standards for sourcing of subsistence within STORES.
 - **Recommendation:** Provide exception to policy to USAR/NG units to source through local grocer's food products as an interim solution until a buyer's guide can be established based on USAR/NG menu requirements.
 - **Recommendation:** Enable an invoicing process for USAR/NG to mitigate requirements when leveraging the Army Food Management Information System (AFMIS) catalog ordering process. Current process would require each unit to establish an individual AFMIS account with billing capabilities. Additionally, each unit or organization would need to establish or have a subsistence supply management office to perform those duties as required.
- **Finding:** The U.S. Army Debit Card Program may provide an alternative to GPC. Provision would require USAR/NG policy authorizing units to participate in the debit card program.

Enclosure 1 to Appendix F

Group A–Grocers

National

LMI has reached out to six national grocery chains and received four POCs.

Table A-1

Chains	POC name	Contact	Remarks
Kroger	David Matthews	843-610-4963 david.matthews@kroger.com	
Costco	Alicia Versack	425-313-8100	
Giant Martin	Sarah Cornman	sarah.cornman@retailbusinessservices.com	
Walmart	Ken Bartlett	479-273-6483	

Southeast

LMI has reached out to five Southeast grocery chains and received four POCs.

Table A-2

Chains	POC name	Contact	Remarks
Publix	Jim Cossins	863-688-7407 jim.cossin@publix.com	Publix prefers no additional software systems
Piggly Wiggly	Larry Jarrett	860-886-3814	Franchise store operations—will need to approach store owners
Food Lion	Jessica Koepfler	jessica.koepfler@retailbusinessservices.com	
Harris Teeter	Paige Pauroso	ppauroso@harristeeter.com	

Northeast

LMI has reached out to seven Northeast grocery chains and received two POCs.

Table A-3

Chains	POC name	Contact	Remarks
Wegmans	Sean Powers	610-849-6602 sean.powers@wegmans.com	
Giant Eagle	Melinda Gaus	melinda.gaus@gianteagle.com	

Midwest

LMI has reached out to seven Midwest grocery chains and received four POCs.

Table A-4

Chains	POC name	Contact	Remarks
Saveway	Tom Nenninger	314-621-0900	Store owner
Hy-Vee	Amy Devoy	515-267-2800	
Fareway	Derrick Picklat	515-432-2623	
H.E Butt	Christie Braddock	210-938-9388 braddock.christy@heb.com	Responsible for card program

West

LMI has reached out to four West grocery chains and received one POC.

Table A-5

Chains	POC name	Contact	Remarks
Associated Food Stores	Sarah Pennett	801-973-4400	

Group B—Restaurants

LMI has reached out to 13 restaurant chains and received 4 POCs.

Table B-1

Chains	POC name	Contact	Remarks
Jimmy Johns	Pete Thelen	pthelen@spitheplanet.com	Orders go through Dustin Wetzel, president of Spin the Planet: 651-529-0241 dwetzel@spitheplanet.com
Panera Bread	Emily Young	804-687-7745 emily.young@panerabread.com	Can support with direct billing via order/pickup
Mission BBQ	Craig Briggs	cbriggs@mission-bbq.com	Craig can provide national POC
Cracker Barrel	Kim Sanders	800-333-9566	

Group C—Caterers

LMI has reached out to 13 catering chains and received 9 POCs.

Table C-1

Chains	POC name	Contact	Remarks
Box'd Emergency Relief Catering Company	Edwin Merrigan	edwin@boxdmeals.com	Can serve entire U.S.
ECI Management Group	Christopher Gilbert	cgilbert@ecimanagementgroup.com	Can provide boxed lunches, pick-ups, deliveries, self-serve at client site

Chains	POC name	Contact	Remarks
Sodexo	Brett Ladd	brett.ladd@sodexo.com	POC provided is government lead
BCI Blackstone Consulting	Joe Blackstone	310-826-4389, ext. 301	
Aramark	Marc Bruno	215-229-1670	
Chugach	Genevieve Burkett	907-301-5903 genevieve.burkett@chugach.gov.com	
Line Drive Logistics	Daniel Bessman	daniel.bessman@gmail.com	Currently supporting troops in Texas
Washington Deli	Jordan Schakner	jordanschakner@yahoo.com	Mid-Atlantic, serves boxed lunches
Seasonal Food Brand	Joe Breen	joebreen@joebreen.com	Northeast but possible to expand

Region I

Table D-1

Connecticut		
Prime vendors	Prime vendor POCs	Prime vendor POC contact info
Giuseppe Catering	Giuseppe Rizzuto	
Maneely's Catering	Bruce Maneely	860-527-2789
Olde Time's Restaurant	Rodney	860-887-6865
Performance Food Group		800-388-0257
US Foods	Ken Folan	860-886-5141
Hartford Provision Group	Steve Smith	800-883-9800
Massachusetts	CW5 Dawn Broe	dawn.d.broe.mil@army.mil
New Jersey	Gabriel Zettel	gabriel.s.zettel.mil@army.mil
Maine	Steven Eastmen	steven.f.eastmen.mil@army.mil

Note: No POCs or responses were provided by New Hampshire, New York, Road Island, or Vermont.

Region II

Table D-2

Pennsylvania		
Prime vendors	Prime vendor POCs	Prime vendor POC contact info
Valley Food Inc.	Matthew Frey	matthew.d.frey.mil@army.mil
District of Columbia	Sekou Richardson	sekou.o.richardson.mil@army.mil

Note: No POCs were provided by Delaware, Maryland, Virginia, or West Virginia.

Region III

Table D-3

States not wishing to participate		
State	POC	POC contact info
Tennessee	Barbara Bates SFC	barbara.j.bates.mil@army.mil
Alabama	CW2 Christopher Hasty	christopher.l.hasty.mil@army.mil
Kentucky	Lacy Helm SFC	lacey.g.helm.mil@army.mil
South Carolina	CW4 Debra Hayes	debra.j.hayes2.mil@army.mil
North Carolina	CW5 Dawn Broe Semra Leary	dawn.d.broe.mil@army.mil semra.s.lear.mil@army.mil
Virgin Islands	CPT Lateefa Berry	lateefa.k.berry.mil@army.mil

Note: No POCs were provided by Florida, Mississippi, Puerto Rico, or South Carolina.

Region IV

Table D-4

Michigan		
Prime vendors	Prime vendor POCs	Prime vendor POC contact info
Sysco Grand Rapids	Jennifer Albrecht	231-690-4532
Gordon Food Service, Grand Rapids	Kyle Duba	989-350-4944
BJ's Catering	Kayla Gaylord	989-732-4010
Chef Raymone Catering, Clinton Township		586-465-0299
Corporate Express Catering, Oak Park		248-579-4602
Roma's Back Door, Owosso		989)725-5767
Subway corporate phone number		877-360-2283
Jimmy John's local phone number		517-785-3300
Panera Bread, Walker		616-647-3500
Mission BBQ, Northville		734-256-7031
Sysco	Terri Bonovsky	800-225-3883, ext. 3243
Ohio	CW5 Dawn Broe	dawn.d.broe.mil@army.mil

Note: No POCs were provided by Illinois, Indiana, Iowa, or Wisconsin.

Region V

Table D-5

Kansas		
Prime vendors	Prime vendor POCs	Prime vendor POC contact info
Valley Food Systems	Jim Stizza—Director of National Guard	330-719-9622 jstizza@valleyfoodssystems.com
Nebraska		
Russ's Market #7 611 N. Burlington Ave Hastings, NE 68901	Misty, Carrie, Josh	402-463-3574 deli07@brstores.com
Hy-Vee Omaha 17810 Welch Plaza Omaha, NE 68135	Joshua McCoy	402-891-4127 1472cateringngr@hy-vee.com
Hy-Vee Columbus 3010 23rd St Columbus, NE 68601	Brett	402-563-4524
Hy-Vee 115 Wilmar Ave Grand Island, NE 68803	Dave Blum	308-381-3678
Runcie's Catering 313 N Burlington Ave Hastings, NE 68902	Doug	402-984-8459 doug@runciescatering.com
Hy-Vee 108th 10808 Fort St, Omaha, NE 68164		402-493-2089
Tequilas Mexican Grill 205 Norris Avenue McCook, NE 69001	Manager	308-345-2805
Tumbleweed Cafe 850 East S East St Broken Bow, NE 68822	Carmen	308-872-5454
Subway 148 S E St Broken Bow, NE 68822		308-872-3317
Hy-Vee 5020 N 27th ST Lincoln, NE 68521	Miranda	402-477-4764 miranda@hyveecatering.com
Burrito King 2167 33rd Ave Columbus, NE 68601	Judy	402-564-9909
McGator's Catering 8564 Larimore Ave. Omaha, NE 68134	Wally Swetala	402-212-3854 mcgatorcater@yahoo.com
Country Catering, Inc. 78375 WPA Sherman Ave. Litchfield, NE 68852	Diane & Carl Kucera	855-446-2202 diane@countrycatering.net

Nebraska (continued)		
Prime vendors	Prime vendor POCs	Prime vendor POC contact info
Vittles Omaha Catering 5136 Raven Oaks Dr Omaha, NE 68152	Brenda Linden	blnedved @outlook.com
Subway 2501 NW 12th St Lincoln, NE 68521	Subway Manager	402-475-8253
Hake Catering PO BOX 118 Colon, NE 68018	Shane Hake	402-443-6586 hakecatering@gmail.com
Subway 1250 U.S. 20 Chadron, NE 69337	Manager	308-432-2050
The Eatery 2548 S 48th St. Lincoln, NE 68506	Michelle Daize	402-730-7830 md@worlddeats.com
Hy-Vee 840 E 23RD ST Fremont, NE 68025	Brian	402-727-6717
Subway 814 W 27th Street Scottsbluff, NE 69361		308-632-3005
Subway Kearney 5411 N 2nd Ave Kearney, NE 68847	Manager	308-234-2720
Parker's Smokehouse 16880 US-6 Ashland, NE 68003		402-944-2040
Jimmy Johns 206 Wilmar Ave #9 Grand Island, NE 68803	Jimmy	308-389-5555 jared.s.wiehn.mil@mail.mil
Subway 158 HWY 6 Ashland, NE 68003	Justin	402-944-4234
Chip's 1499 N Chestnut ST Wahoo, NE 68066	Jim	402-277-5161
Main Street Market 401 S Beltline Scotts Bluff, NE 69361		308-632-2522
Kerrys Restaurant & Catering 119 N. 1st Ave. McCool Junction, NE 68401	Sandra	402-724-2120 kerrysrestaurant@windstream.net
Colleen's Catering 3200 N 6th St # 3 Beatrice, NE 68310	Colleen S	402-239-3304 colleen@colleenscateringonline.com
Sinnott's Sports Bar 206 E Lincoln St Papillion, NE 68046		402-502-8593 jlhaight@yahoo.com

Nebraska (continued)		
Prime vendors	Prime vendor POCs	Prime vendor POC contact info
Yutan Kitchen/Chinese Restaurant 107 Vine St Yutan, NE 68073		402-625-2055
Grandma Jo's 1144 Illinois St Sidney, NE 69162	Manager	308-254-1006
Taste of Texas BBQ 112 West 11th McCook, NE 69001	Greg	308-345-1611
Grocery Kart 937 S E St Broken Bow, NE 68822		308-872-3124
JW'S Catering 1817 Lincoln Ave. York, NE 68467	JW Wilkinson	402-363-4087 wilkinsonjw@yahoo.com
Jimmy John's 825 23rd St Columbus, NE 68601		402-563-3300
Prime Cut 305 West 27th Street Scottsbluff, NE 69361	Sam	308-632-5353 primecut@gmail.com
Wunderlichs 304 23rd Street Columbus, NE 68601	Cindy	402-563-3700
Citta' Deli 110 West 3rd Street McCook, NE 69001	Bill Lesko	308-345-1515
Mr Goodcents 2712 Cornhusker Hwy, Suite 4 Lincoln, NE 68521		402-465-0077
Southwest Pit BBQ 1601 P St., Lincoln, NE 68508		402-405-1000
Opera House Brewery & Grill 415 N D St. Fairfield, NE 68938		402-726-2447
Another Round 1008 W 18th St North Platte, NE 69101	Rick	308-534-2080 anotherroundnp@gmail.com
1st Choice Catering 1110 South 9th Street Norfolk, NE 68701	Justin	402-316-3412
Baby's Backyard BBQ 220 S Center St. Clay Center, NE 68933	Mike Gould	308-224-5433 babysbackyardbbq@gmail.com
A Catered Affair 3016 N 102nd Omaha, NE 68134	Kathy Silvy	402-614-5200 events@acaomaha.com
Qdoba 1010 Diers Ave Grand Island, NE 68803	Catering Coordinator	308-384-1446 qdobacatering1@qdoba.com

Nebraska (continued)		
Prime vendors	Prime vendor POCs	Prime vendor POC contact info
Hy-Vee 5212 3rd Ave Kearney, NE 68845	Manager	308-236-0020
Phat Jack's BBQ 101 SW 14th Place Lincoln, NE 68528	Matt	402-464-7428 matt@phatjackslincoln.com
Pac-N-Save 1115 West 7th Street Wayne, NE 68787	Jon	402-375-1202
Sunmart 1815 Court Street Beatrice, NE 68310	Gayla	402-223-5207
Valentinos 1519 W Hwy 34 Seward, NE 68434		402-643-4264
OutLaws 1006 W B St. McCook, NE		308-345-4227
Hy-Vee East 120 East Norfolk Ave Norfolk, NE 68701	Vince	402-379-1706
Mom & Dad's BBQ 222 W. 42nd St Kearney, NE 68847	David Cochran	308-234-4696 momanddadsbbq@gmail.com
Apple Market 7 W 25th St Kearney, NE 68847	Manager	308-236-5041
Sonny's Super Foods 2020 10th Ave Sidney, NE 69162	Manager	308-254-4120
Subway 2929 State Fair Park Dr Lincoln, NE 68504		402-464-4300
Parker's Smokehouse 16880 US-6 Ashland, NE 68003	Debbie Pike	402-730-5431 parkerssmokehousecatering@gmail.com
Braxtons Brisket BBQ 102 Norris Ave McCook, NE 69001		308-737-7106
Taco Town 1007 W 27th St Scottsbluff, NE 69361		308-635-3776
Perkins 303 Hwy 26 Scottsbluff, NE 69361	Shane	308-635-2035
Doorstep Diner Catering 5550 S 59th St Ste 10 Lincoln, NE 68516	Chad	866-505-2456 chad@doorstepdiner.com
Chartwells 1111 Main St. Wayne, NE 68787	Kevin Maly	402-375-7091 kemaly@wsc.edu

Nebraska (continued)		
Prime vendors	Prime vendor POCs	Prime vendor POC contact info
Smokin Stan's BBQ 114 W. Madison Ave. Norfolk, NE 68701	Stan	402-316-3459
Back Alley Eatery 124 S 23rd St Beatrice, NE 68310	Kathy	402-223-5011
Noodles and Company 5001 O St Lincoln, NE 68510	Catering Manager	402-261-0034
Ticos Mexican Restaurant 317 S 17th St Lincoln, NE 68508	Catering Manager	402-475-1048
Muchado's 416 S 11th Street Lincoln, NE 68508		402-413-6236
Creative Dining 1000 Main Street Chadron, NE 69337	Connie Frandson	308-432-6380 cfrandson@csc.edu
Guero's Food Truck 2430 N Broadwell Ave Grand Island, NE 68801	Guero	308-850-0875 guerosfoodtruck@gmail.com
Taco Town 1007 W 27th St Scottsbluff, NE 69361		308-635-3776
BIG RED 2101 W Pasewalk Ave Norfolk, NE 68701	Makayla Wieneke	402-371-3068 mwieneke@bigredlottery.com
Garden Cafe 11040 Oak St Omaha, NE 68106	Brent	402-393-1409
Gary's Super Foods North Platte) 1620 E. 4th St North Platte, NE 69101	Manager	308-534-1224
Subway 805 South 13th Street Norfolk, NE 68701		402-379-1027
Heartland BBQ 5402 NW Radial Highway Omaha, NE 68104	Manager	402-397-5765
Arkansas	Timothy Havens	timothy.d.havens.mil@army.mil

Note: No POCs were provided by Louisiana, Missouri, Oklahoma, or Texas.

Region VI

Table D-6

Idaho		
Prime vendors	Prime vendor POCs	Prime vendor POC contact info
GPC US Bank Repository	Thomas Guyer	thomas.r.guyer.civ@army.mil

Note: No POCs were provided by Alaska, Montana, North Dakota, Oregon, South Dakota, Washington, or Wyoming.

Region VII

Table D-7

Arizona		
Prime vendors	Prime vendor POCs	Prime vendor POC contact info
US Foods	Jason Kuhlman	jason.kuhlman@usfoods.com
	Toni Cole	toni.cole@usfoods.com
Sterns Produce	Erick Mauldin	emauldin@sternproduce.com
	Sonia Leon	sonia@sternproduce.com

Note: No POCs were provided by California, Colorado, Guam, Hawaii, Nevada, New Mexico, or Utah.

Appendix G

Policy for DoD Food Programs

Below are the DoD policies pertaining to food program management:

1. DoDD 5105.22, "Defense Logistics Agency (DLA)," June 29, 2017.
2. DoDD 5134.12, "Assistant Secretary of Defense for Logistics and Materiel Readiness (ASD(L&MR))," May 25, 2000, as amended.
3. DoD Instruction 3110.06, "War Reserve Materiel (WRM) Policy," January 7, 2019.
4. DoDD 5101.10E, "DoD Executive Agent (DoD EA) for Subsistence," October 26, 2015, as amended.
5. AR 40-25/BUMEDINST 10110.6/AFI 44-141, "Nutrition Standards and Education," January 3, 2017.
6. DoD Instruction 6130.05, "DoD Nutrition Committee," February 18, 2011, as amended.
7. DoDD 3235.02E, "DoD Combat Feeding Research and Engineering Program," April 6, 2021.
8. DoD Manual 1338.10, "DoD Food Service Program (DFSP) December 2, 2014, implements policy established in DoD Instruction 1338.10 (Reference (f)), assigns responsibilities, and provides guidance for the DFSP.
9. DoD Instruction 1338.10, "Department of Defense Food Service Program (DFSP)," Incorporating Change 4, August 26, 2019.
10. TB MED 530/NAVMED P-5010-1/AFMAN 48-147_IP, Technical Bulletin, Tri-Service Food Code, March 1, 2019.

Appendix H

Abbreviations

3D	three dimensional
AFMIS	Army Food Management Information System
AFRICOM	U.S. Africa Command
AI	artificial intelligence
AR	augmented reality
CAGR	Compounded Annual Growth Rate
CENTCOM	U.S. Central Command
CG	Coast Guard
CGS	Comparative Genome Sequencing
CONUS	continental United States
CSP	Cloud Service Provider
DFAC	DoD service dining facility
DFSP	DoD Food Service Program
DLA	Defense Logistics Agency
DoD	Department of Defense
DoDD	DoD Directive
DTS	Defense Transportation System
DVD	direct vendor delivery
EA	Executive Agent
EDI	electronic data interchange
EUCOM	U.S. European Command
FedRAMP	Federal Risk and Authorization Management Program
GHG	greenhouse gas
GPC	Government Purchase Card
INDOPACOM	U.S. Indo-Pacific Command
IoT	Internet of Things
JFMS	Joint Food Management System
JSAB	Joint Subsistence Advisory Board
JSPB	Joint Subsistence Policy Board

MC	Marine Corps
ML	machine learning
MR	mixed reality
MRE	Meal Ready-to-Eat
NG	National Guard
NORTHCOM	U.S. Northern Command
OCONUS	outside the continental United States
OPRATS	operational rations
POC	point of contact
PV	prime vendor
R&D	research and development
RDD	required delivery date
RFI	request for information
RFID	radio-frequency identification
SiPM	silicon photomultiplier
SOCOM	U.S. Special Operations Command
SOUTHCOM	U.S. Southern Command
SPV	subsistence prime vendor
TB	Technical Bulletin
TRANSCOM	U.S. Transportation Command
UCC	Unified Combatant Command
UGR	Unitized Group Ration
UOM	unit of measure
USAR	U.S. Army Reserve
USDA	U.S. Department of Agriculture