USING CIVILIAN SUPPLY CHAIN MANAGEMENT BEST PRACTICES TO IMPROVE ARMY SUPPLY CHAIN MANAGEMENT PROCEDURES

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE
General Studies

by

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2017

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

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1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From - To)*
09-06-2017	Master's Thesis	AUG 2016 – JUN 2017

4. TITLE AND SUBTITLE

Using Civilian Supply Chain Management Best Practices to Improve Army Supply Chain Management Procedures

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Chief Warrant Officer Three (CW3) David Marriott

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Command and General Staff College
ATTN: ATZL-SWD-GD
Fort Leavenworth, KS 66027-2301

8. PERFORMING ORG REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for Public Release; Distribution is Unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The purpose of this study is to examine the Army's supply chain management system for capability gaps in the management of Class IX repair parts and determine if the best practices for civilian supply chain management can be applied to the Army system improving its overall performance. Furthermore, this thesis discusses some of the different practices used by civilian corporations that have been tested and proven to achieve enhanced capabilities and improve supply chain procedures. Finally, this paper examines future strategies adopted by the Army and provided recommendations and additional advice on how to ensure successful implementation and proper evaluation criteria after full solution is completed. These techniques and procedures will provide insight on solutions that will address the bullwhip effect across all stages of the Army supply chain management system and how implementing lessons learned from civilian corporations, the Center for Army Lessons Learned, and Combat Training Centers can vastly improve Army logistics. The overall reason of this study is to identify how the Army can improve fleet readiness by providing Class IX repair parts quickly to the end user and support soldiers with modernized multi-functional logistics in all locations.

15. SUBJECT TERMS
Supply Chain Pipeline, Supply Chain Management, Condition Based Maintenance, Readiness Based Spares, GCSS-Army, Best Practices

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			**19b. PHONE NUMBER** *(include area code)*
(U)	(U)	(U)	(U)	79	

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

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

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ABSTRACT

USING CIVILIAN SUPPLY CHAIN MANAGEMENT BEST PRACTICES TO IMPROVE ARMY SUPPLY CHAIN MANAGEMENT PROCEDURES, by Chief Warrant Officer David Marriott, 79 pages

The purpose of this study is to examine the Army's supply chain management system for capability gaps in the management of Class IX repair parts and determine if the best practices for civilian supply chain management can be applied to the Army system improving its overall performance. Furthermore, this thesis discusses some of the different practices used by civilian corporations that have been tested and proven to achieve enhanced capabilities and improve supply chain procedures. Finally, this paper examines future strategies adopted by the Army and provided recommendations and additional advice on how to ensure successful implementation and proper evaluation criteria after full solution is completed. These techniques and procedures will provide insight on solutions that will address the bullwhip effect across all stages of the Army supply chain management system and how implementing lessons learned from civilian corporations, the Center for Army Lessons Learned, and Combat Training Centers can vastly improve Army logistics. The overall reason of this study is to identify how the Army can improve fleet readiness by providing Class IX repair parts quickly to the end user and support soldiers with modernized multi-functional logistics in all locations.

TABLE OF CONTENTS

Page

ACRONYMS

AMC	Army Materiel Command
DoD	Department of Defense
GCSS-Army	Global Combat Support System-Army
IT	Information Technology
LMP	Logistics Modernization Program
PLL	Prescribed Load List
SCM	Supply Chain Management
SSA	Supply Support Activity

ILLUSTRATIONS

Page

CHAPTER 1

INTRODUCTION

Introduction

The purpose of this study was to examine the Army's supply chain management system for capability gaps in the management of Class IX repair parts and determine if the best practices for civilian supply chain management can be applied to the Army system improving its overall performance. Furthermore, this thesis will discuss some of the different practices used by civilian corporations that have been tested and proven to achieve enhanced capabilities and overall improved procedures. Finally, this paper will examine future strategies adopted by the Army and provide recommendations and additional advice on how to ensure successful implementation and proper evaluation criteria for supply chain management innovation.

Another goal of this study was to analyze future innovation of the Civilian corporation and compare the efforts against the Army's future implementation of the Global Combat Support System-Army (GCSS-Army) enterprise resource planning program. This study will examine the improvements it will provide logistics managers compared to previous information technology (IT) management systems and how it will benefit supply chain management innovations. This enterprise resource planning program is the future management program that is expected to increase logistic proficiency across all stages of the supply chain management system. This paper will help readers understand how it will improve proficiency as well as specific considerations that may disrupt its potential modernization. "GCSS-Army is an integrated solution. Integration

promotes accuracy, timeliness, and enables significant economies of scale in system support, training, and management."[1]

Problem Statement

The Army Supply Chain Management (SCM) System for Class IX contains potential capability gaps that reduces fleet operational readiness, stresses the different levels of the supply chain, and adds unnecessary cost in its management of Class IX repair parts.

Primary Research Question

Can civilian supply chain management best practices be used to reduce or remove capability gaps within the Army supply chain management system for Class IX repair parts?

Secondary Research Questions

1. How are military and civilian supply chain management procedures similar?
2. What systems and metrics are used by civilian corporations to manage their supply chain and which methods are considered best practices?
3. What civilian procedures can be implemented to improve the Army supply chain management system?

[1] Defense Logistics Agency, *GCSS-Army Smart-Book* (Washington, DC: Government Printing Office, May 2014), accessed 21 January 2017, http://www.gcss.army.mil.

4. What improvements does GCSS-Army predict after full solution and how does this Systems, Applications, and Products program compare to civilian corporations?
5. What are the future innovations for supply chain management in both the civilian corporations and the U.S. Army?

Assumptions

1. Comparing Army supply chain management doctrine and civilian supply chain management practices will give a baseline of how well the Army is managing the supply chain pipeline and identify gaps that may exist within its procedures.
2. Case studies from the corporations Boeing and Caterpillar will be examined in this paper. These corporations will be researched for supply chain management best practices that will provide military leaders with useful solutions to capability gaps within its own supply chain management system. These corporations will provide adequate information for this study because they have similar supply requirements, billion dollar budgets, and operate globally like the U.S. Army. Additionally, these corporations value readiness and share similar challenges related to fleet and supply chain management.
3. Studying the supply chain for Class IX repair parts will prove beneficial because of its level of complexity. In 2015, the class IX supply chain system used over one hundred thousand suppliers and utilized over two thousand

systems to manage its inventory, valued at nearly ninety-five billion dollars.[2] Suitable practices that can improve the Class IX supply chain found in this paper are expected to be usable across all classes of supply in the Army system.

4. This paper will study two specific Class IX repair parts, the M1 Tank Engine and the AH64 Attack Helicopter engine. These supply chains will provide perspective on specific supply parts managed in the U.S. Army and offer insight on the information flow throughout the different stages of the supply chain pipeline. These platforms will provide detailed analysis on supply chains similar to the corporations in the case studies used for this thesis. The M1 tank engine is managed similar to many items in the Caterpillar supply chain management system. The AH64 Engine is an Army aircraft engine and managed meticulously by the Army aviation branch much like Boeing and its management of aircraft. Additionally, these parts are used on specific Army equipment considered to be high priority platforms. These platforms are known as pacing items because readiness downtime is tracked meticulously and by the hour like Boeing and Caterpillar. This should provide significant material to aid in this study.

5. Information from the Combat Training Centers, the Center for the Army Lessons Learned, and Army white papers will provide the most up to date information needed to compare current practices against current army supply

[2] Colonel Scott S. Haraburda, "Transforming Military Processes from Logistics to Supply Chain Management," *Army Logistician* (February 2016): 4.

chain doctrine. This information will also help demonstrate how well the Army is conducting supply chain management in comparison to civilian corporations.

6. GCSS-Army is an essential program that establishes the necessary IT for supply chain innovation and will allow military management systems to be equivalent to civilian IT. This area must be examined to develop assumptions and future areas of study that may bridge the gaps between Army supply chain management and corporations of similar supply chains.

Limitations

1. Civilian corporations were not willing to disclose specific supply chain management practices that keep them competitive against other organizations. Case studies providing specific concepts in procedures and IT systems were extremely difficult to collect.
2. Statistics outlining improvements in the supply chain management systems caused by the implementation of GCSS-Army do not currently exist because it is currently in the fielding stage. This paper will not attempt to discuss how well the GCSS-Army implementation is working and what improvements it has made.

Delimitations

1. The acquisition stage will not be discussed in this thesis to allow for a greater focus on the stages of ordering, processing, transporting, and storing of Class IX repair parts. The wholesale stage will only be examined to identify gaps within forecasting and the effectiveness in its management of repairable parts.

This thesis will focus on the retail and unit stages and their effects on the supply chain system for Class IX. This will ensure that any insight found during this study can be implemented by Army leaders and will not require the changes to occur outside of the Army organization.

2. This study will focus specifically on class IX repair parts and two Army platforms, the M1A2SEPv2 Tank and the AH64 Apache Helicopter.

Significance

This thesis serves as an analysis of the current Army supply chain management system and how civilian best practices can improve multifunctional logistics and improve overall readiness. This study will recommend techniques and procedures that should be implemented and adopted into Army sustainment doctrine. These techniques and procedures will provide insight on solutions that will address inefficiencies across all stages of the Army supply chain management system and how implementing lessons learned from civilian corporations, Center for Army Lessons Learned, and Combat Training Centers can vastly improve Army logistics. The overall purpose of this study is to identify how the Army can improve fleet readiness by providing Class IX parts quickly and supporting soldiers with streamlined multifunctional logistics.

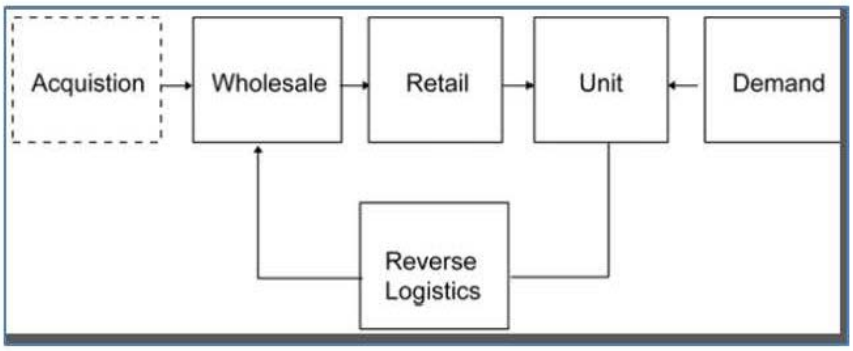

Figure 1. Army Supply Chain Management Stages

Source: Greg H. Parlier, *Transforming U.S. Army Supply Chains: Strategies for Management Innovation* (New York: Business Expert Press, 2011), 172.

Definitions

Bullwhip Effect: A distribution channel phenomenon in which forecasts yield supply chain inefficiencies. It refers to increasing swings in inventory in response to shifts in customer demand as you move further up the supply chain.

Class IX Repair Parts: Parts and components to include kits, assemblies, and subassemblies required for maintenance support of military equipment.

Class IX Requisition: Request from the user for a Class IX repair part needed to conduct routine or unscheduled maintenance.

Condition Based Maintenance: Maintenance that is performed after one or more indicators show that equipment is going to fail or that equipment performance is deteriorating.

Customer Wait Time: Measures the time required to satisfy a supply request from the end user level, or total customer response time.

Global Combat Support System—Army: A web-based, logistics and finance system based upon commercial best business practices and off-the-shelf Systems, Applications, and Products software. Serves as an automated combat enabler for soldiers that integrates readiness and financial systems providing highly accurate cost management and financial visibility for tactical materiel and sustainment.

In-transit Visibility: The ability to track the identity, status, and location of Department of Defense (DoD) units, and non-unit cargo (excluding bulk petroleum, oils, and lubricants) and passengers; patients; and personal property from origin to consignee or destination across the range of military operations.

Lean Six Sigma: A methodology that relies on a collaborative team effort to improve performance by systematically removing waste; combining lean manufacturing/lean enterprise and Six Sigma to eliminate the eight kinds of waste: Time, Inventory, Motion, Waiting, Over production, Over processing, Defects, and Skills.

Logistics: Military operation that controls the design and development, acquisition, storage, movement, distribution, maintenance, evacuation, and disposition of materiel; movement, evacuation, and hospitalization of personnel; acquisition or construction, maintenance, and disposition of facilities; and furnishing of services.

Mission Based Forecasting: Forecasting concept that uses spare and repair part consumption patterns associated with different tactical missions or operational environments.

Pacing Item: Major weapons or equipment systems of such importance that they are subject to continuous monitoring and management at all levels of command. Pacing items are identified in Army Regulation 220–1, *Unit Status Reporting*.

Readiness Based Sparing: The practice of using advanced analytics to set spares levels and locations to maximize system readiness. Readiness-Based Sparing determines the inventory requirements for achievement of readiness goals.

Requisition Wait Time: Measures the time required to satisfy a supply request from the supply support activity (SSA) from retail or wholesale.

Retrograde: A process for the movement of equipment and materiel from a deployed theater to a Reset (replace, recapitalize, or repair) program or to another theater of operations to replenish unit stocks or satisfy stock requirements.

Supply Chain Management: The management of all internal and external logistics processes, information, and functions necessary to satisfy a customer's requirement. The management of the interdependent logistic processes of customer response, inventory planning and management, warehouse management, transportation, supply, maintenance, and reverse logistics.

CHAPTER 2

LITERATURE REVIEW

Introduction

This chapter describes the information analyzed to help answer how the Army can implement civilian supply chain management best practices to correct issues within its supply chain. The information considered will be used to answer six categories: Current supply chain theory and practices for civilian corporations, common civilian supply chain management best practices, a summary of Army supply chain management doctrine and theory, Army supply chain current practices for M1 and AH-64 engines, civilian case studies that address practices and solutions to complex supply chain issues, and scholarly references about supply chain management procedures and anticipated future trends for civilian and military supply chains. Scholarly literature includes sources from DoD, Sister Service, Army, and professional logistics publications, to include their associated official websites.

Civilian Supply Chain Theory and Current Practices

Civilian supply chains operate much like the Army supply chain system and face many of the same challenges. Figure 2 shows the seven components of standard industry supply chain; Suppliers, Procurement, Manufacturing, Order Management, Transportation, Warehousing, and Customers. According to Nada Sanders, "A supply chain is the network of all entities involved in producing and delivering a finished

product to the final customer."[3] Sanders book, "Supply Chain Management, A Global Perspective," provides an in-depth study into corporations that operate globally and the importance of supply chain management. Additionally, her book provided information on supply chain strategy, forecast and demand planning, inventory management, and how to incorporate a sustainable supply chain.

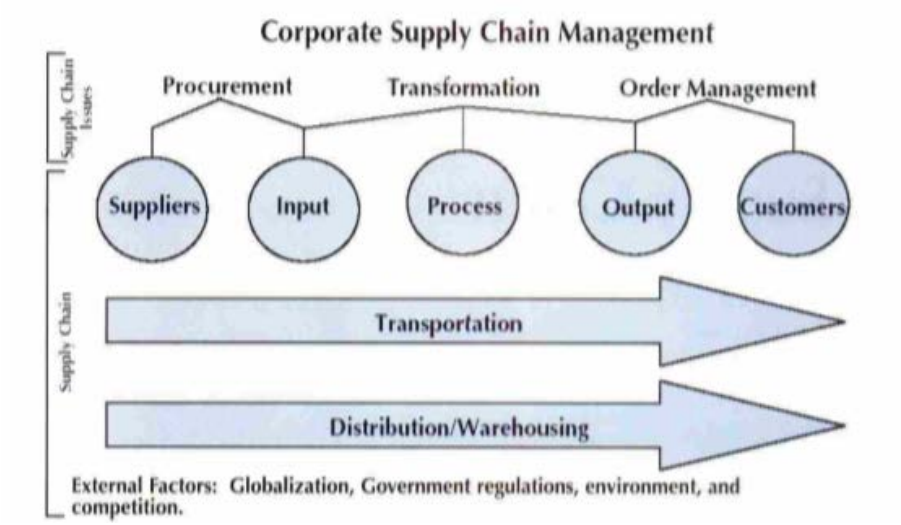

Figure 2. Corporate Supply Chain Management Model

Source: Joshua M. Lenzini, "Anticipatory Logistics: The Army's Answer to Supply Chain Management," *Army Logistician* (September-October 2002): 7.

A key aspect to civilian supply chains is that they must understand their competition and continuously work toward better meeting customer needs through fast and efficient movement of quality goods. Civilian corporations must meet customer

[3] Nada R. Sanders, *Supply Chain Management: A Global Perspective* (Hoboken, NJ: John Wiley and Sons, 2012), 22.

needs with better, faster, competitively priced, and less costly products while ensuring the growth and profitability of the organization. Customer demand drives these requirements and are in constant modification. Customers want the cheapest product and they want it now.

Several factors contribute to the success of a civilian corporation. These factors encompass their understanding of customer demand, their information and communication technology, understanding the competition, and finding sufficient ways to effectively operate within government and environmental regulations. It is through these factors that a civilian corporation can begin to create a supply chain strategy that fits the needs of the organization and its customers.

Profit is the overall motivating factor for any civilian corporation. This is accomplished primarily by focusing on the overall SCM process to deliver the right products or services, in the right quantity, to the right place, at the right time, and with the maximum benefits.[4] The SCM theory that is commonly used by corporations begins by gaining a deeper understanding of current and future customer needs. This is a constant process as customer needs change depending on several factors. These factors can include geographical location, ethnic group, age, seasonal changes, or the popularity of a product. Without this understanding, corporations cannot select the proper suppliers.

The next step in SCM Theory is to understand the supplier's core competencies. What do they hold as important to their organization and how well do they fit into the core competencies of the corporation? How important is meeting customer needs to the

[4] Mamun Habib, *Supply Chain Management: Theory and Evolution* (In Tech, 2011), 29.

supplier? How efficient do they accomplish that task? These questions must be considered before selecting suppliers for your organization.

Next, supply chains must be examined for inefficiencies in and between the stages of the supply chain outlined in figure 2. Communication between each stage of the supply chain model must be quick and efficient. There should be identified inputs and outputs from each stage that provided important information to the other stages increasing overall proficiency of the entire supply chain. Redundancies should be removed and any process that is complex should be reduced to its simplest form. Many corporations use the process of Lean Six Sigma.

Finally, supply chain leaders should develop relationships and alliances with suppliers who have key competencies that strengthen, supplement, and enhance internal core competencies.[5]

Civilian Supply Chain Management Best Practices

Best practices are those methods that are deemed to be better that others. These are normally identified through some form of benchmark or pre-established metric. In many occasions, best practices are company specific but can offer some insight to other corporations. Quickly adopting best practices can streamline processes within any organization while allowing for adaptive innovation. Because civilian corporations compete against one another, many of these best practices are kept confidential to maintain an edge over competitors. However, several writings and articles offer broad

[5] Habib, 45.

concepts that should be considered today's best practices for any supply chain management system.

Brent Johnson, author of "Streamline the Supply Chain with Best Practices" provides readers with a list of universal methods to improving any supply chain. He claims that regardless of what your supply chain model is, best practices should be an integral part of it.[6] His writings offer five practices that have proven to produce positive results in a supply chain; strategy, organization, culture, logistics management, and performance management. These practices have been endorsed by numerous corporations and credit him with the overall improvement in their supply chain.

1. Strategy: Johnson explains that every supply chain should have a defined vision and strategy, both written and communicated verbally, be supported by senior leadership at all levels, and resourced accordingly.[7] Without a clear vision or strategy, workers will create their own goals which may not be in the best interest of the organization. Workers will create strategies to streamline processes at their specific level but normally do not consider how they affect the other stages in the supply chain.

2. Organization: The supply chain organization must be viewed as an important piece to any management team. Upper management must always take into the considerations of the supply chain management team and should be included when making decision that will affect the supply chain. This will instill a sense of ownership in the supply chain leadership and establish a sense of urgency to conduct business

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[6] Brent Johnson, "Streamline the Supply Chain with Eight Best Practices," *Health Care Magazine* (April 2015): 20-21.

[7] Ibid., 22.

efficiently and to the best of its capability. Workers at every level will take pride in the organization and continuously improve methods and procedures to meet the overall requirements.

3. Culture: Customer satisfaction normally drives an organization and the importance of the actual supply chain role is often ignored. Hospitals focus on patient care, goods or service providers focus on customer satisfaction and profit, and military organizations focus on the readiness of combat units. A successful supply chain system evolves around an organization that has a culture for efficiency in its programs. They do not allow the end requirement to shadow the practices that contribute to its success.

4. Logistics Management: Every supply chain is managed by a system. Systems are used to manage inventory, distribution, product development, customer demand, and lead-time. Brent Johnson suggests that every supply chain maximizes on the use of an enterprise resource planning program system to manage the overall functionality of a supply chain.[8] Corporations link organizational strategies to these systems so that information needed to meet requirements is readily available. Having the proper IT can mean the difference between a good supply chain and a great one.

5. Performance Management: Every supply chain should have indicators that illustrate the proficiency of a supply chain. The organizational strategy should provide every supply chain leader with an output that is measurable. These performance indicators must be continuously monitored to ensure they are meeting expectations. Performance management requires tools that provide necessary information to

[8] Johnson, 22-23.

stakeholders who can initiate action to correct degraded performance. Additionally, this information can be used to reward productivity in a supply chain which will support the overall culture of the organization.

These broad concepts are shared among supply chain leaders and are key elements to any successful supply chain. These views are proven to increase proficiency in the supply chains of Boeing, Caterpillar, IBM, and Walmart. Without these concepts, supply chains will normally yield undue cost with an increased logistical footprint to meet a reactionary supply demand.

Army Supply Chain Doctrine and Theory

The Army supply chain shares similarities to many civilian supply chains. Army supply chains deal with suppliers, procurement, manufacturing, order management, transportation, warehousing, and customers (soldiers). Figure 3 shows a simple example of the Army supply chain network and the different stages that operate in it. The article, "Anticipatory Logistics: The Army's Answer to Supply Chain Management" was written by Major Joshua Lenzini, an operations research analyst at the Army Training and Doctrine Command, and has provided several links to how civilian corporations can assist in improving the management of the Army supply chain. He states, "The future of logistics in the Army is evolving toward a holistic approach, much like business' supply chain management efforts, to improve its logistics capability."[9]

[9] Major Joshua Lenzini, "Anticipatory Logistics: The Army's Answer to Supply Chain Management," *Army Logistician* (September-October 2002): 11-14.

The comparisons of figure 2 and figure 3 demonstrate many similarities, however, there are some significant differences between both supply chain models. The arrows for transportation and distribution are dual directional in the Army supply chain. These arrows are showing the retrograde process that is found within the military. This is a process for the movement of equipment and materiel to a Reset (replace, recapitalize, or repair) program or to another theater of operations to replenish unit stocks or satisfy stock requirements. Additionally, the external considerations are relatively different for the military supply chain.

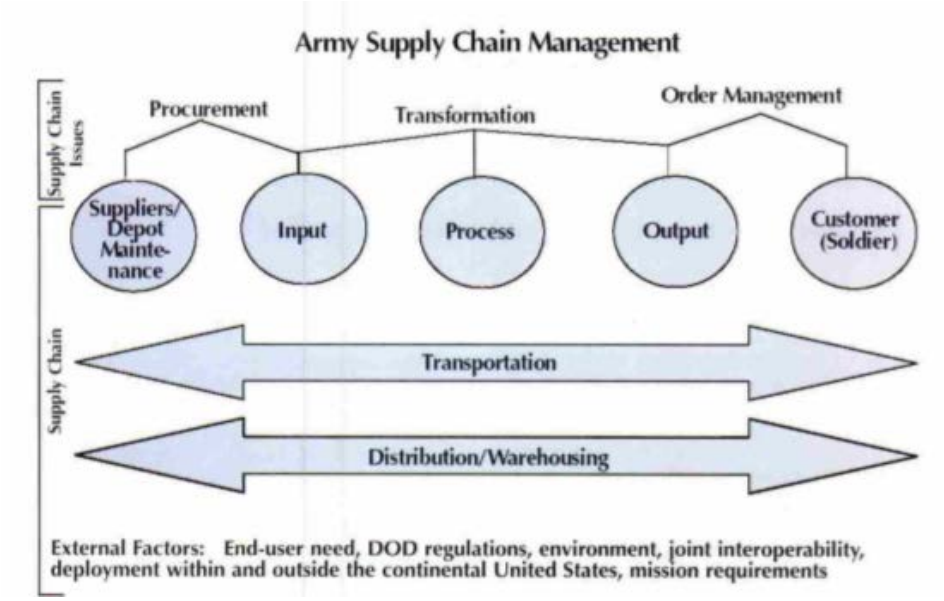

Figure 3. Army Supply Chain Management Model

Source: Major Joshua Lenzini, "Anticipatory Logistics: The Army's Answer to Supply Chain Management," *Army Logistician* (September-October 2002): 13.

The factors that contribute to the success of the Army supply chain have some differences from the civilian corporation. Joint inoperability plays a key role in the

functionality of the Army supply chain. This capability can either increase or decrease a supply chains efficiency depending on its management. Having the ability to procure and stock parts that are usable across military services provides a huge capability to the supply chain manager. Additionally, this will allow a single flow of goods in and out of a theater decreasing congestion along lines of communication.

The understanding of a specific mission and its overall requirements is of the utmost importance to a supply chain leader. Without a grasp on requirements, supply chain leaders will be reactionary to meet soldier demands. This factor must be studied and understood to ensure a sufficient logistical footprint is established. Requirements are determined by Logistics teams from strategic to tactical levels. Tools provided by the Combined Arms Support Command are normally used to conduct the "Science" of determining these requirements. Combined Arms Support Command tools available on their homepage include Operational Logistics Planner, Logistics Estimate Worksheet, and the Quick Logistics Estimation Tool.

Understanding mission requirements and implementing Joint interoperability will increase the success of the Army supply chain system. These factors require astonishing integration between services and planners. Through Army Design Methodology and Military Decision Making Process, staff planners gain understanding of the battlefield, identify strengths and weaknesses of the enemy, and create courses of action. These processes must take into consideration the supply chain in order to ensure mission accomplishment and success.

Army Regulation 711-7, *Supply Chain Management* explains the procedures, policies, responsibilities, and principles for the supply chain management program. It

provides direction for commanders, logistics managers, and personnel in how to properly monitor and manage the supply chain with the objective being its optimal functioning in support of the end user, the Soldier. Army Regulation 711-7 demands that supply chain users adopt (adapt) best commercial business practices when such practices will contribute to increased supply chain performance.[10] Identification of best practices is the purpose of this study and fits into the guideline given in this regulation.

Army Regulation 711-7 discusses the methodology used to improve the Army supply chain. It begins with access to information that allows for rapid and effective decision-making. This begins by establishing a data collection plan with an established baseline, input collection, output data elements, and developing work-arounds for specific metrics. The data collection plan will reveal large amounts of data and must be examined appropriately by data management teams. These teams follow a three-step program to analyze the data; Define, Measure Performance, and Improve the Existing Process.

1. Define: This portion of the methodology focuses on understanding the requirements. This is done by identifying customers, inputs, activity outputs, and process. This is accomplished through Logistical supply teams that physically walk through areas to visually watch policies conducted. The conduct of these walk-throughs is outlined in AR 711-7.

2. Measure Performance: This is completed by defining data requirements, establishing metrics, determining baseline performance, and obtaining performance data

[10] Department of the Army, Army Regulation (AR) 711-7, *Supply Chain Management* (Washington, DC: Government Printing Office, 2004), 7.

to use in the measurement process. Logistics leaders must understand the overall operation and processes used to determine this data and how specific information technologies produce the information.

3. Improve the Existing Process: This is accomplished by setting local objectives, designing "new" process flows, developing plans to achieve improvements, and implementing the changes needed to accomplish those goals.[11]

The above regulation will provide the greatest information for this study; however, the below Army regulations will be examined for usable input for establishing recommendations for action in chapter 5.

Army Regulation 700-138, *Army Logistics Readiness and Sustainability* outlines established policies, responsibilities, and procedures for reporting the physical condition of Army equipment and the ability—inability to perform its intended mission. It also prescribes policies and procedures for total logistics readiness sustainability analysis, the annual logistics assessment of the Army's capability to deploy and sustain combat forces.

Army Regulation 740-1, *Storage and Supply Activity Operations* consolidates, establishes, and defines policy, principles, responsibilities, and objectives to be used and followed in the formation and management of an effective program of materiel storage and supply support operations.

Army Regulation 710-1, *Centralized Inventory Management of the Army Supply System* is used as a consolidation of several regulations that set policy and procedural guidance for management of secondary and major items, stock categories, retention

[11] Department of the Army, AR 711-7, 10.

levels, financial management, operational and repair cycle float, Army war reserve, and the Automatic Return Item Program. Additionally, it ensures compliance with policy as prescribed by the DoD Implementation Plan for Logistics Automatic Identification Technology.

These Army regulations will be used to identify supply chain management norms and establish a baseline for which this study will begin its comparison with civilian corporation supply chain management practices. These regulations will be supplemented with additional military pamphlets and scholarly writings to expound upon the procedures found within them.

Army Current Practices for M1 Tank and AH-64 Engine

The M1 Abrams Tank and the AH-64 Apache are combat platforms that are tracked meticulously by military commanders. These vehicles are extremely important to the military mission and operational readiness is of the utmost importance. When an M1 or AH-64 is deemed non-mission capable, this time is tracked by the hour. Downtime is tracked in two categories, Non-Mission Capable Maintenance or Non-Mission Capable Supply.

Non-Mission Capable Maintenance includes those processes conducted by maintenance personnel. Time is allocated to maintenance managers to identify faults, troubleshoot faults, conduct repairs, and to verify repair completion. If a fault with the M1 or AH-64 engine is identified by the onboard computer, maintenance personnel must diagnose further using the appropriate technical manuals. This process helps to identify if the engine needs to be fully replaced or if repair of a component on the engine will

suffice. If a total replacement is deemed necessary, maintenance personnel will begin the Non-Mission Capable Supply process.

The Non-Mission Capable Supply process begins when the Automated Logistical Specialists requisitions the engine through the Army supply chain. Figure 4 demonstrates the flow of a requisition from a customer. This chart outlines the many processes that are conducted to allow a requisition to be filled by national stocks or any level in between.

The M1 Tank Engine and AH-64 Engine are considered Class IX repair parts and are managed by the Army Materiel Command (AMC). AMC is one of eleven logistics centers that operates within DoD. The dollar value of the repair part inventories that the eleven centers manage is over eighty billion dollars. The inventories are constantly in motion, flowing from manufacturers to storage locations, to military units, to repair facilities, and then finally to disposal activities. This large and expensive network of personnel, facilities, and repair parts is DoD's logistics supply chain, and it is critical to the operational success of the U.S. Military.[12]

[12] John T. LaFalce, "AMC Repair Parts Supply Chain," *Army Logistician* (May-June 2009): 7.

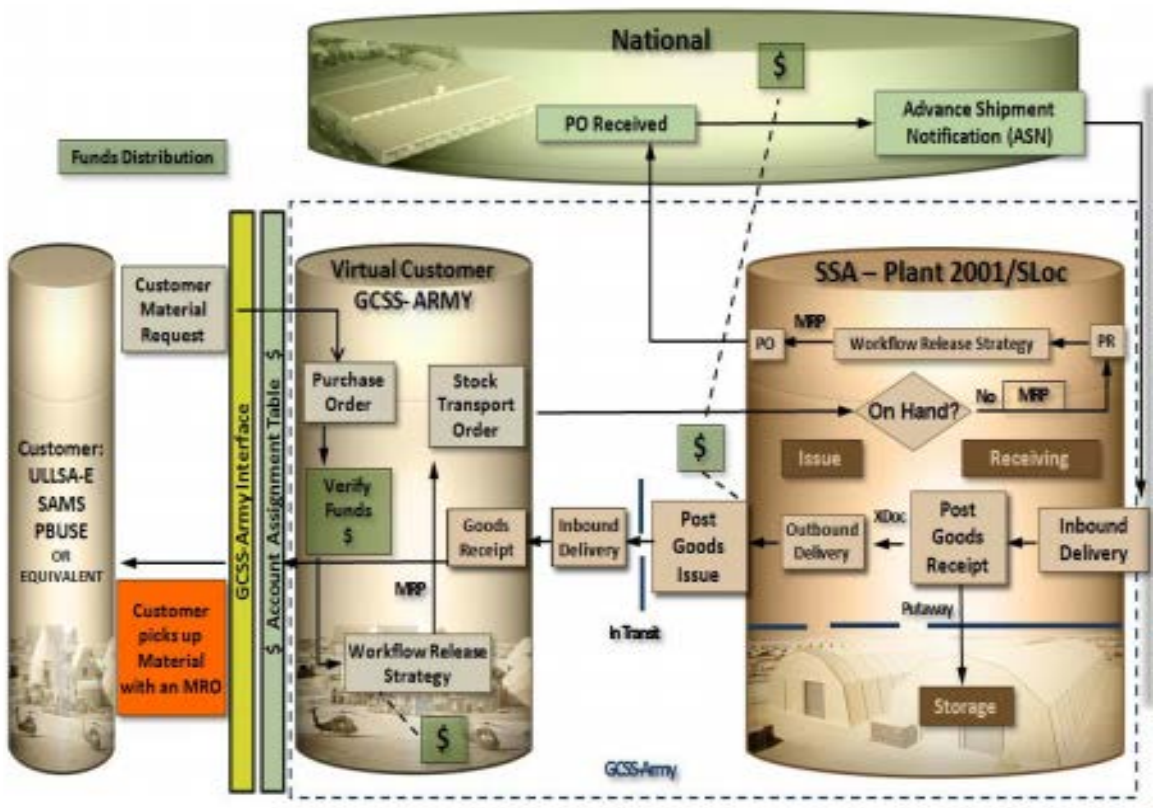

Figure 4. U.S. Army Requisition Flow Chart

Source: Defense Logistics Agency, *GCSS-Army Smart-book* (Washington, DC: Government Printing Office, May 2014), 7, accessed 21 January 2017, https://www.gcss.army.mil.

The headquarters for AMC is located in Redstone, Alabama and is responsible for managing several life cycle management commands and five primary maintenance depots. These maintenance depots sustain the life cycle readiness of the military equipment. In addition to managing Class VII end items, these depots receive, repair, and return Class IX repairable items to the supply chain.

Army Materiel Command manages mostly Class IX repair parts and is responsible for about twenty billion dollars in stock with over one hundred thousand parts

in circulation. These parts are separated into two categories, repairable and consumable. Repairable parts are those parts that can be repaired by maintenance facilities and returned to the supply chain for further use. Consumables parts are not repairable and disposed of at the appropriate level. Both the M1 and AH-64 engines are managed and tracked by AMC. Supply chain leaders track every requisitioned or retrograded engine to ensure Non-Mission Capable Supply timelines are met.

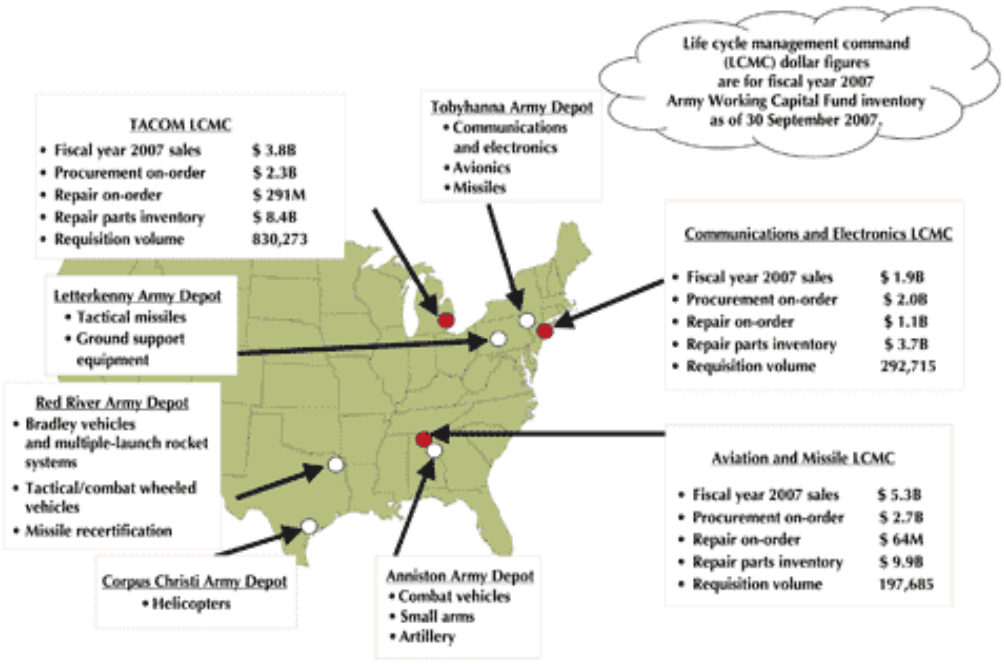

Figure 5. Army Materiel Command Repair Parts Supply Chain

Source: John T. Lafalce, "AMC Repair Parts Supply Chain," *Army Logistician* (May-June 2009): 2.

Figure 5 provides the locations of the Life Cycle Management Commands and Army Maintenance Depots. These commands have many responsibilities and are an integral part of the supply chain. Since AMC manages over one hundred and eighty

thousand repair parts, item managers are assigned to supervise specific Class IX repair parts. Item managers can oversee several thousand different repair parts and are responsible for providing input to the National Inventory Control Point branch. The National Inventory Control Point branch performs supply and maintenance analysis to define the optimal life cycle support concepts to include determining supply stock levels. Supply levels are determined by analyzing historical data to produce estimates for subsequent years.

The M1 and AH-64 engines can be located at three different tiers of supply centers. The national distribution supply level, SSAs, and unit Prescribed Load Lists (PLLs). New parts that are procured from industry using the Army Working Capital Fund enter the DoD supply system and arrive at one of the Defense Logistics Agency's strategic distribution depots. The bulk of AMC's national-level repair parts inventory is stored at this echelon of supply.

The next echelon in the supply pipeline comprises a global network of hundreds of SSA warehouses that are located within the Army Theater, brigade, battalion, and regimental units that they support.[13] This echelon is close to the customer and is managed primarily by military personnel. Each SSA Authorized Stock List is created using historical demand criteria and command preference.

The final echelon in the supply pipeline is located at the user level within the PLL. The PLL is intended to be small and deployable containing only essential items needed for near-term tactical and training operations. This provides the unit a small

[13] LaFalce, "AMC Repair Parts Supply Chain," 7.

package of Class IX repair parts to maintain operational readiness. Parts that are used are processed through the supply channels for repair or disposal. PLL is managed by military personnel and tailored to meet individual unit requirements based on demand.

Wait time is the primary metric used to measure effectiveness of the supply chain at each level. Customer wait time is used to calculate the amount of time it takes a unit order to be supplied by the SSA. Requisition wait time is used to calculate the amount of time it takes the SSA to receive stock from strategic distribution depots. Figure 6 demonstrates the difference between the two performance measurements and the perspective from each unit manager. Metrics used to determine wait time between strategic depots and suppliers is omitted from this study, however, wait time between repair facilities and strategic depots is measured as Non-Mission Capable Maintenance. These wait times can vary based on several factors. Managers at every level have responsibilities that contribute to the overall supply chain.

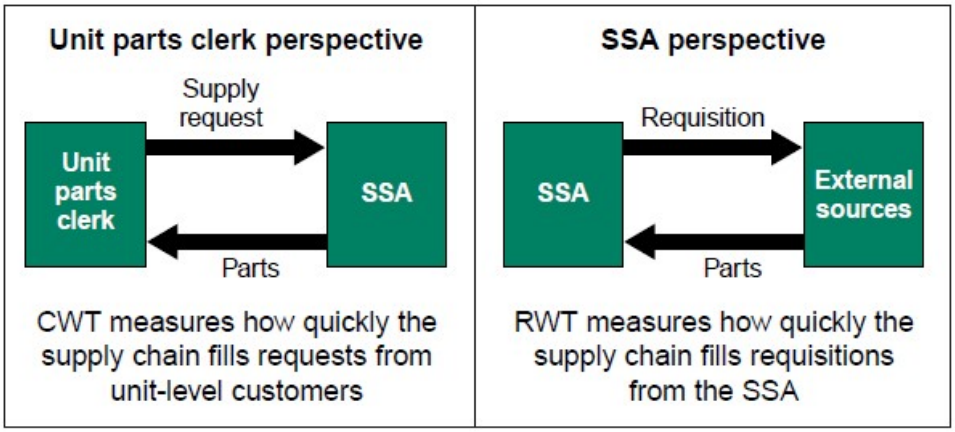

Figure 6. Customer Wait Time (CWT) and Requisition Wait Time (RWT)

Source: RAND, *CWT and RWT Metrics Measure the Performance of the Army's Logistics Chain for Repair Parts* (Santa Monica, CA: RAND, 2003), 2, accessed 16 January 2017, http://www.rand. org/pubs/research_briefs/RB3035.html.

The M1 and AH-64 are managed in the manner described above. Field service representatives, contractors from Honeywell and Boeing are positioned forward with Army Field Service Battalion to assist in the diagnosis and repair of the M1 and AH-64 Engine. These Field service representatives are considered subject matter experts on these repair parts.

Civilian Corporation Case Studies

Robert Frankel's book, *The Definitive Guide to Supply Chain Best Practices*, is a scholarly writing that brings together state-of-the-art supply chain management case studies that identify challenges, evaluate solutions, plan implementation, and prepare for future innovations in supply chain systems. This book offers advice on supply chain collaboration, advanced forecasting, management of inventory cycles, transportation optimization, and IT advances proven to revolutionize civilian organizational supply chain management procedures.

This book analyzes the case study on Dockomo Heavy Machinery Equipment, LTD. Dockomo was having issues with meeting customer demands due to improper management of its forecasting branch. These issues were resulting in several customer cancelations that were detrimental to its supply chain. This caused the bullwhip effect and created inadequate forecasts to be made at each level of supply. Retail stores were requesting additional items to meet customer demands which increased the stock level at local warehouses. Warehouses requested higher numbers of stock to meet the increased demand of retail stores increasing distribution centers. This increase forced suppliers to increase its manufacturing to meet the demands. The bullwhip effect is illustrated in figure 7. The miscalculation at the retail level caused vast problems at the supplier level.

Dockomo spent several million ramping up operations at the supplier level while unaware of the cancelled orders at the retail level. By the time this miscalculation was realized, Dockomo had several million dollars in stock that was unusable.

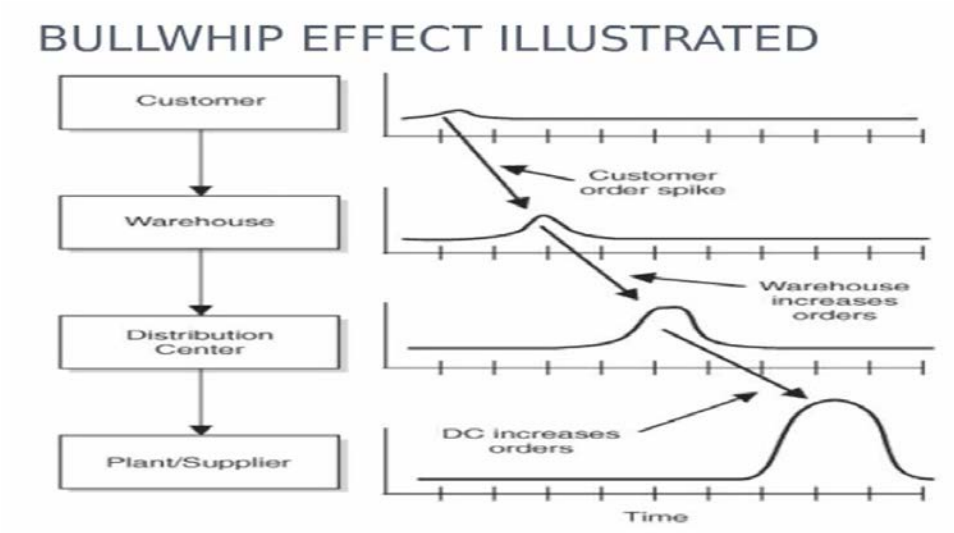

Figure 7. Bullwhip Effect

Source: Robert M. Frankel, *The Definitive Guide to Supply Chain Best Practices: Comprehensive Lessons and Cases in Effective SCM* (Upper Saddle River, NJ: Pearson FT Press, 2013), 5.

Dockomo hired a supply consulting firm to examine their processes and found that supply chain managers at every level made assumptions when attempting to make accurate forecasts for future orders. Dockomo lacked the managerial knowledge to identify the bullwhip effect and did not have the correct information sharing technology to alert supply leaders of changes at every level of the supply chain. Dockomo made updates in their Information Technology and created channels for each level to communicate across. Additionally, Dockomo trained supply chain managers on the processes taken at each level and how each level effected the higher and lower supply

chains. This created unity of effort in the supply chain and forecasting saw an accuracy increase of 20 percent in less than two years.

The case study, “Managing New Product Development and Supply Chain Risks: The Boeing 787 Case” researches the possibilities of outsourcing and the challenges it faced during its manufacturing of a new aircraft. It discusses issues that created severe delays in aircraft delivery causing unfulfilled requests and unsatisfied customers. This case study describes procedures taken by Boeing to quickly rectify these deficiencies and establish clear communication across a global supply chain network.

Many airliners desired Boeings’ new 787 Aircraft as it promised an increase in storage capability and better economic efficiency than later models. Airlines began creating orders for the new aircraft and were expected to receive delivery in four years. Boeing, to cut cost, attempted to use a new supply chain method that involved outsourcing supply and assembly of the aircraft. The structure of the 787 were to be built in over fifty different warehouses and fully assembled by Boeing workers. This was expected to create faster results by spreading responsibility across several suppliers. This turned out to be a disaster for Boeing and actual delivery times were stretched to seven years. Many airliners canceled orders and Boeing lost several million dollars by letting other corporations manage their supply.

Boeing realized that unreliable suppliers caused delays in every other stage of the assembly process. Boeing quickly replaced its supply chain management team with a well-trained and experienced staff to rectify the issue quickly. This team eliminated redundancies and narrowed the supply chain to just a few manufacturers. They designed working groups that created fusion between the different suppliers and communication

began to contribute to a more effective assembly chain. This case study demonstrates the need for collaboration between supply chains and the importance of understanding the processes taken at each level.[14]

Additionally, Boeing provided its supply chain leaders with internship programs to provide them with best practices from partner corporations. The case study, "Unified Communication at Boeing," discusses the importance of collaboration between corporations that manage a similar supply chain. Boeing sends its leaders to training facilities throughout the world in programs that train on supply chain analysis, supply chain logistics, and global trade controls. These interns earn valuable credentials and are place in appropriate managerial positions to share what they have learned. This has contributed greatly to the success of Boeing by creating well trained motivated workers who possess the capability of improving supply chain procedures.

"Visibility Through CAT's Eyes" is a case study that examines the importance of in-transit visibility and how it can drastically improve a supply chain system. This case study observes the practices Caterpillar implemented to develop state of the art in-transit visibility of its equipment and repair parts to enhance its ability to satisfy customer needs globally while decreasing excess stock levels and establishing optimized supply chain management methods.

Caterpillar saw an increase in wait time for parts delivered to countries outside of the United States. Caterpillar conducted an in-depth study to identify insufficient transportation methods or the processes taken to track movement of goods. On any given

[14] Joshua D. Zimmerman, "Development and Supply Chain Risk: The Boeing 787 Case," *Supply Chain Forum* (January 2012): 79.

day, Caterpillar has more than five hundred million dollars of product and parts globally in transit.[15] This study found that goods were spending days at ports or on vessels waiting to be offloaded. Supply Chain levels lost visibility on goods and were unable to properly forecast receipt times and prepare for onward movement through the transportation nodes.

Caterpillar adopted a new in-transit software and quickly trained supply chain leaders on how to use it, increasing movement processes. This software allowed supply chain leaders to arrange for proper equipment to be ready for receipt with the correct follow-on transportation on standby to quickly deliver goods to the customer quickly. This case study not only shows the importance of in-transit visibility but also shows how every supply chain leader has a responsibility to track goods from the point of departure, point of receipt, and on to the next location.

In a similar case study, "Caterpillar's All-Seeing Sensors," the importance of visibility is further promoted. Caterpillar has installed sensors on every item within its supply chain. This amount of visibility is linked with the establishment of what Caterpillar calls, "Assurance of Supply Center." Technical advisors within these teams conduct analysis on the movement of goods and eliminate friction points along routes. Additionally, these sensors trigger supply chain processes to occur when on-board diagnostics determine a component malfunction. This allows the supply chain to react very quickly to equipment failure. Semchi-Levi, a supply chain consultant for Caterpillar stated, "Just common sense, experience, and intuition is not enough, you have to

[15] Chris Gillis, "Visibility Through CAT's Eyes," *The American Shipper* (November 2011): 12.

complement them with data."[16] Supply chain leaders should be supplied with ample and adequate data to help them make decisions. Creating input and output data for supply chain leaders and training them on how to use data to make decisions has amplified profits for Caterpillar and increased its supply chain.

Future Trends for Civilian and Military Supply Chains

Civilian corporations are constantly looking for innovative technology and practices that will increase proficiency in its supply chain. Supply leaders agree that the top trends for the future will be focused around managing clockspeeds, social media, and artificial intelligence.

Clockspeed is the measurement between the average life span of a product and the amount of time it takes to move of a new product through the supply chain to replace it. This difference in time is currently compensated with stockpiles of products. However, this is difficult in today's market because of the vast variety of products offered by corporations. The days of steady supply catalogs are declining and customers are demanding products of different specifications. Each product produces its own clock speed and suppliers must tailor supply chains to meet the demand of the products life cycle. The winners of the future will have the same number of distinct supply chains as there are product clockspeeds.[17]

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[16] Sonja Elmquist, "Caterpillar's All-Seeing Sensors," *Supply Chain Forum* (July 2016): 33.

[17] Sumantra Sengupta, "10 Supply Chain Trends for the Next 10 Years," *SupplyChain247* (July 2013): 7.

Social Media is used by almost everyone and product reviews are a common use for it. Corporations have been trying to find methods that can use the data entered across several thousand websites and blogs to produce an actionable decision process. Future companies will develop practices that are able to receive, process, and act on the data that is being provided to them by their customers via social media.[18]

Artificial intelligence (AI) is improving every day and it is expected that AI will be introduced into supply chain activities. Humans involved in supply chain processes learn a specific skill that is perfected over time. These workers will perform some of the same procedures several times throughout any given day. The issue with humans is their likelihood of making mistakes. These mistakes can cause several issues in any supply chain and can be corrected by using AI to conduct redundant processes. Corporations are toying with the idea of implementing AI into mainstream supply chain processes but are lacking the algorithms needed to create a usable decision matrix for the programs.

Military supply chain future is much different from civilian corporations. The Army is currently in the fielding stage of the GCSS-Army and is expected to be at full solution by the end of fiscal year eighteen. This fielding is a major modernization effort that is expected to improve every supply warehouse, unit supply room, maintenance motor pool, and property book operation in the Army.[19]

The GCSS-Army is expected to eliminate the conventional stove piped areas of maintenance, supply, property accountability, and finance by integrating them under one

[18] Ibid., 11.

[19] Defense Logistics Agency, *GCSS-Army Smart-Book.*

system that unifies the data into a standardized database. This enables warfighters to order, move, track, account for, and maintain equipment from the beginning to the end of the supply chain while easily anticipating, allocating, and synchronizing the flow of resources. Asset visibility, equipment status information, and life cycle maintenance records for each piece of equipment greatly enable planning. Detailed analysis of supply metrics is also available, further improving the planning processes.[20]

Other future trends outlined by the Army are discussed in a study performed by the National Research Council in 2015. The most important update, except for GCSS-Army, is the update in Logistics Decision Support procedures. The Army is expected to put large efforts in revitalizing its logistics analysis capability by acquiring the necessary tools and qualified military and civilian supply chain analyst.[21] Once GCSS-Army is fully integrated, designing a decision support matrix managed by qualified personnel will be the next step in improving the Army supply chain management system.

Joint, interagency, intergovernmental, multinational, nongovernmental, and commercial interoperability is the future of Army supply chain processes. Creating technology that is universal across every domain will create supply chain fusion further increasing the effectiveness of its capability. GCSS-Army is a small step in the right direction toward joint interoperability but does not address the absence of IT capable of communicating with other agencies.

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[20] Ibid.

[21] John T. LaFalce, "Force Multiplying Technologies for Logistics Support to Military Operations," *Army Logistician* (December 2014): 23.

These future trends for civilian and military corporations offer insight into the paths each supply chain is headed toward. Further analysis of these trends will be discussed in chapter 4 of this study.

Summary

This chapter provided a synopsis on the current military and civilian supply chain theories, practices and associated best practices. Army regulation and doctrine provided a basic understanding of how military supply chain management is conducted and the guidelines supply chain leaders follow to establish proficient supply chain systems. Civilian corporation case studies were used to examine possible solutions to problems found in their specific supply chain systems and the solutions conducted to correct those problems. This chapter discussed some of the future innovations that can be expected to emerge in the civilian corporations and how they will revolutionize future supply chains. Lastly, scholarly research conducted by military agencies and committees provided an in-depth glimpse into the future trends for the Army supply chain. This information will be the baseline of analysis for this study and will be used to provide possible solutions to current Army supply chain discrepancies.

CHAPTER 3

RESEARCH METHODOLOGY

Introduction

This chapter explains the research design used to analyze the data gathered in chapter 2 addressing the problem statement and answering the primary and secondary research questions of this study. This design will assist in the development of integrated conclusions and recommendations pertaining to improving the current Army supply chain management system. Additionally, this chapter describes the approach, methodology, evaluation criteria for conclusions and recommendations, and an assessment of research strengths and weaknesses.

Purpose of Study

The purpose of this study is to educate supply chain leaders on the capability gaps that exist in the Army supply chain system. Additionally, this study aims to identify civilian solutions that can rectify these gaps. Finally, this study will produce recommendations aimed at persuading stakeholders at the Defense Logistics Agency, Army Materiel Command, and the Combined Arms Support Command to implement these solutions improving Army supply chain procedures.

The thesis problem statement derived from a need to understand how supply chain management in the Army is conducted compared to successful civilian supply chains. The understanding of Army supply chain processes and how civilian best practices can improve its procedures can greatly contribute to the body of knowledge for future innovations. Fiscal constraints and unknown mission requirements can create undue

stress on the Army supply chain making it difficult to meet operational demands. This study will determine if civilian supply chain best practices can improve the Army system and revolutionize how it conducts sustainment.

Current constructs of the Army supply chain system tend to compartmentalize the different stages by separating them into individual categories; tactical, operational, and strategic. Maintenance managers and Unit Commanders are concerned with generating combat power and sustaining their formations. These managers are alarmed by the decrease in budgets to maintain military fleets and concerned with the increasing customer wait time for Class IX repair parts.

The SSA managers are constantly occupied with the responsibility to meet the needs of its customers while national inventory control point National Inventory Control Point managers in Army Materiel Command are consistently scrutinizing operations that determine national stock levels. SSA technicians are challenged with the task of generating acceptable customer wait time while attempting to improve requisition wait time.

At the strategic level, AMC conducts non-stop operations to continuously improve demand forecasting and establish proper repairable levels at echelons above the tactical and operational levels. Depot level repair facilities work to maintain stock levels for line replaceable units and to quickly return repairable items back into the Army supply chain. Life cycle managers are evaluating procedures at all levels to increase the lifespan of military platforms without reducing its capability.

Improving each level of the Army supply chain management system is the main drive of this thesis. Army Regulation demands that supply chain leaders consistently

develop ways to improve processes to include using practices from well-known civilian corporations. This study will attempt to provide leaders with recommendations to modernize current Army supply chain procedures with proven civilian best practices.

Methodology

The approach to investigating this thesis was to identify the best way to answer the primary research question; what capability gaps in the Army supply chain management system can be corrected by implementing civilian supply chain best practices? The Applied Professional Case Study Research methodology will be used to answer the questions specified in this study.

Case studies are a useful method for conducting qualitative research for problem areas that are human-centric, dynamic, volatile, and contain a mix of stakeholders, interests, variables and information concepts that demand a deep understanding of context in order to produce informed policy choices.[22] The case study method focused on defining supply chain problems, identifying common issues, explaining possible solutions, and providing beneficial recommendations. The selected case studies from Caterpillar, Dockomo, and Boeing were used to gather quantitative perspective which will generate ideas about best practices for supply chain management. This analysis will be used to establish qualitative conclusions and offer solutions to capability gaps within the Army supply chain management system.

[22] Dr. Kenneth Long, "Research Methods Seminar: Case Studies in the MMAS Program," (Instructor lecture, US Army Command and General Staff College, 2015), 2.

Approach Used

This study began with a thorough Review of Department of Defense, Joint, and Army doctrine on supply chain management to gain knowledge on current policies and regulations that govern how logistics managers were to perform daily operations. Once a baseline was established, each policy was examined for deficiencies and areas of weakness that needed to be addressed. These shortcomings in the Army supply chain management system would be used in the second step of analysis.

Next, a comparison between civilian and military supply chains was accomplished by conducting research on current civilian supply chain practices. Scholarly writings on common supply chain procedures for civilian corporations were studied to establish a basic concept for conducting supply chain management in the civilian sector. Recommendations from supply chain consulting firms and subject matter experts were compiled to advocate common best practices used in today's civilian supply chains.

Documents from the Center for Army Lessons Learned and from Combat Training Centers were used to diagnose actual battlefield practices and how well the Army supply chain system operates. Additional resources were used to understand the processes taken from managing requisitions on the M1 Tank and AH-64 Apache engines providing a thorough examination into the processes taken to move these Class IX repair parts.

Case studies from well-known and established civilian corporations were examined for similarities in Army supply chain management gaps. Special emphasis was placed on the corporations Boeing and Caterpillar because of their equivalent supply

chains and fleet management techniques. Additionally, these corporations manage multimillion dollar supply chain systems and operate globally much like the U.S. Military. Each case study was selected to analyze how each shortcoming identified in the Army supply chain was solved by civilian organizations and the process civilian corporations took to decrease deficiencies in their own supply chain management system.

The model used to examine each case study focused on three general areas: improving current Army Doctrine, developing innovative training support packages, and suggesting materiel changes used in managing Army supply chain processes. Any ideas for policy updates or courses of action generated from the analysis of these case studies was further evaluated using the criteria of suitable, feasible, and acceptable.

Suitability of an idea was determined by how well a solution accomplished the Army mission and whether it would successfully improve Army supply chain operations. Second, the solution must have the capability of being implemented within the confines of current Army budget constraints. This determined to what degree the solution was feasible to stakeholders. Finally, it was determined if the suggested recommendations would be widely acknowledged by stakeholders and acceptable for implementation. Only those recommendations or solutions that were deemed suitable, feasible, and acceptable as improvements to the Army supply chain were considered for further study.

Solutions deemed appropriate for use by Army personnel were compared to emerging Army doctrine and policies to eliminate any redundant recommendations. Solutions found in emerging doctrine were examined further to determine if the solution had been tested or if it is still in the development or fielding stages. Civilian best

practices currently not found in Army emerging doctrine were presented as solutions recommended for action to stakeholders.

Potential outcomes of these proposals are described in the final chapter of this study and provide an illustration on how these civilian solutions can improve military supply chain management, decrease costly supply demands, develop collaborative supply chain stages, and increase the overall readiness of Army military fleets. These solutions will validate any hypothesis generated from studied literature and answer the primary and secondary research questions for this thesis.

Research Strengths

Several strengths emerged that assisted in the overall inquiry about the Army supply chain management system. First, Army doctrine was open source and available. Supply chain management doctrine provided the necessary understanding of how supply chain managers were to operate. Additionally, several military websites provided supplementary literature that further explained processes conducted by military supply chain leaders and delivered a comprehensive understanding of how these procedures were to be conducted.

Second, several efforts have been established over the past few years that focus on improving Army supply chain management procedures. Military boards and committee members have completed extensive research on this subject and maintained very detailed records of their findings. These agencies provided vast amounts of input to the overall analysis of this paper and solidified the need for supply chain innovation in the Army. This study was able to build upon the work that was already performed by these

committees and created an environment conducive to harvest notable solutions to complex problems.

Third, my military experience in fleet readiness has afforded me many opportunities to work with supply chain leaders. Eighteen years of military service with over 10 working in SCM have prepared me for this study and provided me with a network of professionals who can assist in finding adequate information about this subject.

Research Weaknesses

The first major challenge of this research was trying to understand how civilian corporations conduct supply chain management. A surplus of information was available but much of it was outdated and unproductive to the overall analysis. This hindrance decreased momentum and reduced time allotted for analysis on the given subject. The Combined Arms Research Library resource center was essential in overcoming this obstacle. This resource center was able to eliminate unproductive literature and provide beneficial documentation for this research paper.

Second, the lack of information on civilian corporation supply chain management best practices proved to be a considerable obstacle. Civilian organizations rely on superior supply chain management systems to gain an advantage over its competitors. In many cases, the U.S. Military is considered a competitor to civilian corporations and causes information sharing on supply chain management best practices to be undesirable. Case studies from civilian corporations only contained broad concepts and simple systematic approaches to solving the most obvious supply chain management issues. However, because the Army supply chain management system is years behind most

civilian corporations, many case studies provided research value for improving Army supply chain procedures.

Summary

This chapter provided an explanation of the methodology used to answer the primary and secondary research questions of this study. Army regulation and doctrine were used to establish a basic understanding of military supply chain management and assisted in the identification of capability gaps within supply chain methods. These gaps were compared to civilian corporation case studies that successfully solved these issues and provided credible solutions to military supply chain management practices and demonstrated possible outcomes if implemented by military supply chain managers.

CHAPTER 4

ANALYSIS

Introduction

This chapter is organized into five sections: an introduction, comparison of civilian and military SCM theory, comparison of civilian and military SCM practices, comparison of civilian and military SMC future trends, and integrated conclusions. Army Doctrine, Center for Army Lessons Learned, and Army papers on supply chain management were analyzed to define current and future Army supply chain theory and practices. Scholarly writings were used to get a better understanding of civilian supply chain management theory and current practices. Case studies were used to give detail on how Caterpillar and Boeing conducted supply chain management innovations and lessons learned from those updates in procedures. Finally, the findings from these areas of study were compiled and compared to offer a broader understanding of supply chain procedures considered to be best practices and were used to provide conclusions to the primary research question.

Comparison of Civilian and Military SCM Theory

Military supply chain management contains several similarities to civilian organizations. The theory behind Army supply chain management is to provide effective and efficient end-to-end customer service to meet operational requirements.[23] Like any civilian corporation, customer satisfaction is the overall goal. Army Regulation 711-7

[23] Department of the Army, AR 711-7, 3.

provides objectives that supply chain managers must implement to ensure they meet this system of ideas. These objectives included the following:

> Structuring materiel management to provide responsive, consistent, and reliable support to the warfighter during war and peacetime.
>
> Size secondary item inventories to minimize the Army's investment while providing the inventory needed to support war and peacetime operations.
>
> Consider all costs associated with materiel management, including acquisition, transportation, storage, and maintenance, in making best-value logistics materiel central to total life cycle systems management.
>
> Maintain materiel control and visibility of secondary inventory down to and including retail inventories.
>
> Continuously identify, isolate, and implement solutions for sub-optimized logistics processes through the development of supply chain strategies, performance metrics, and programs.

The objectives identified show significant similarities to civilian supply chain management theory and resemble parallel ideas critical to improving the overall performance of any supply chain management system. Although civilian corporations are normally aimed at producing a profit, the objectives described can assist in meeting the central goal of customer satisfaction.

Civilian supply chain management theory desires to improve customer demand responsiveness, improve customer service and satisfaction, increase flexibility for changing market conditions, improve customer retention, and create a more effective marketing program.[24]

[24] Habib, 32.

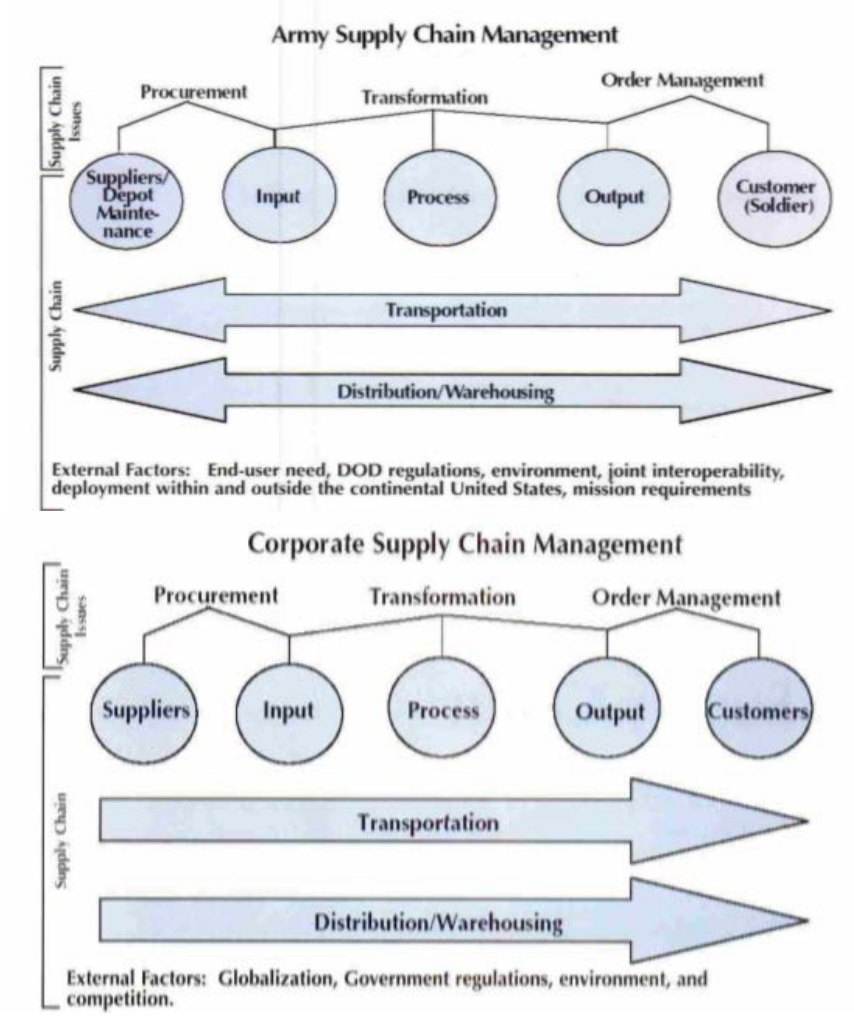

Figure 8. Supply Chain Management Model Comparison

Source: Joshua M. Lenzini, "Anticipatory Logistics: The Army's Answer to Supply Chain Management," *Army Logistician* (September-October 2002): 7, 13.

Figure 8 provides a side-by-side view of the supply chain management models. Supply chain management is similar for both civilian and military organizations but contain significant differences. The corporate model does not have maintenance allocated as a supplier. Procurement in military supply chains are not only fulfilled by suppliers but also by the maintenance depots managed by AMC. These maintenance depots receive

repairable items from lower levels in the supply chain. This is demonstrated in the dual directional arrow in the military model.

Retrograde operations are a crucial component to the Army supply chain. Retrograde is the movement of equipment and materiel from a deployed theater to a Reset program (replace, recapitalize, or repair) or another theater of operations in order to replenish units or stock requirements. Equipment is redistributed in accordance with theater priorities to fill mission requirements within the Area of Responsibility and DoD requirements. AMC is the Army's Executive Agent for retrograde.[25]

External factors that affect the supply chain are different in both models. Civilian corporations must familiarize themselves with government and environmental regulations. These regulations influence the processes found in supply chain methods and can cause tremendous delays if not followed. These can range from operations at ports to using "greener" methods when producing and transporting goods.

The external factors that affect a military supply chain are quite different. Although government and environmental regulations still exist, additional factors must be considered. End-user need is the number one factor for a military supply chain. Warfighters depend on sustainment to accomplish their mission. Without the proper product delivered at the proper time, lives could be at risk.

Understanding mission requirements is an all important factor that can quickly modify a military supply chain. Calculating what is needed for mission accomplishment is only one aspect to understanding mission requirement. Supply chain leaders must also

[25] Chief of Staff, *Army Posture Statement*, 2009, accessed 14 February 2017, https://www.army.mil/aps/09/information_papers/retrograde.htm.

develop methods to deliver the goods to the end user. This requires supply chain leaders to be experts on supply chain capabilities and understand global procedures and responsibilities.

Joint interoperability is another factor that most civilian corporations are not concerned with. Military supply chains should always look to streamline the flow of logistics into a theater of operation across all military services. This eliminates cluttered ports and congested lines of communication for transportation assets. Military supply chains leverage common user logistics to create an integrated network. Common user logistics is materiel or service support shared with or provided by two or more services.[26]

What drives military and civilian supply chains are very different. Civilian corporations are concerned with profit. The amount of money saved on efficient supply chain processes equals profit for a corporation. Civilian organizations have spent an enormous amount of resources on creating the most efficient supply chain. Civilian supply chains organize their overall business practices to enable a profitable transformation of raw materials or products into finished goods and creating effective distribution methods to meet customer demands.[27]

Military supply chains are concerned with readiness. Ready units are considered capable of accomplishing a range of military operations with assigned personnel and equipment. Equipment readiness is measured through Non-Mission Capable Supply or Non-Mission Capable Maintenance days. The number of days it takes for maintenance

[26] Joint Chiefs of Staff, Joint Publication (JP) 4-0, *Joint Logistics* (Washington, DC: Government Printing Office, 2008), 12.

[27] Lenzini, 11.

personnel to repair equipment plus the number of days it takes for supplies to arrive to maintenance facilities are measured to determine supply chain efficiency. This calculation assists in the determination of national stock levels and drives current supply chain practices.

Even though civilian and military supply chains are driven by different factors, civilian practices can produce beneficial suggestions to innovating military supply chain practices.

Comparison of Civilian and Military SCM Practices

Military supply chain practices are simple compared to the many different methods used by civilian corporations. AMC manages many Class IX repair parts. For every platform in the military, there is a life cycle program that outlines how each piece of equipment will be maintained. These programs manage the procurement, maintenance, and warehousing for Class IX repair parts belonging to a specific platform. Item managers are assigned to manage a set of repair parts and track the location and quantity of each part.

These parts are stored in warehouses globally and managed by supply chain leaders. Distribution depots are maintained at the strategic level and contain most of the stock. Supply Support Activities hold the next level of inventory and are usually co-located with the units they support. These warehouses stock specific repair parts based on mission requirement and equipment supported at that location. This stock is called the Authorized Stockage List. The final level of inventory is managed at the unit known as

PLL. This inventory is meant to remain very mobile and in support of a specific unit type. They are normally small in quantity and contain only a few hundred different parts.

Each inventory is established using historical demand criteria. The number of times a part is requisitioned will assist in the developing stock amounts at each level. Although stock authorization is different at each level, this is the only metric used to establish inventory levels.

Civilian corporations use several techniques to gain an edge against competitors. A common practice used by large corporations is Just-In-Time production. The theory behind Just-In-Time begins with delivery goods right when they are needed. Goods are only received into the supply chain when they are needed rather than holding stockpiles of goods anticipated to be ordered. This requires a team of dedicated experts who can analyze IT data points to provide corporations optimal forecasting results. Additionally, Just-In-Time requires a very proficient supply chain that has very few redundancies and little to no waste. The process of using Lean Six Sigma has assisted several corporations in identifying processes that can be removed to increase and simplify supply chain distribution.

The Army customer is very different from civilian corporation customers because the demand for a part can mean the difference between life and death. If a warfighter does not receive needed supplies, his unit could be in serious misfortune because of a deteriorated combat effectiveness. Stock levels are normally kept at a larger quantity in the Army as compared to a civilian counterpart because military leaders cannot assume risk on not meeting a demand timeline especially when deployed in an austere environment.

Comparison of Civilian and Military SCM Future Trends

Army future transformations are based around the Logistics Modernization Program (LMP). What began as a plan to modernize Army supply chain management has evolved into one of the largest, fully integrated supply chain and maintenance, repair, and overhaul solutions in the world.[28] LMP is the main program that will implement flexible and responsive business systems and process. This involves the implementation of GCSS-Army systems.

The GCSS-Army is the IT platform that future Army supply chain leaders will use to conduct common supply chain business practices. This platform will provide the Army with the technology to integrate the Army's compartmentalized supply chain. Additionally, it consolidates maintenance, supply, property accountability, and finance under one management system.

Condition Based Maintenance Plus (CBM+) is a system that is being tested to increase supply chain response time. CBM+ uses onboard diagnostics on specific combat platforms to detect functionality of a component. If the onboard computer identifies a deficiency it triggers the supply chain managers to begin the movement process of that repair part. Essentially, the part is requisitioned prior to component failure and provides the supply chain ample time to position the part for quicker delivery.

Mission Based Forecasting is the process of determining push packages for units designated to deploy to a specific geographical location. Currently, historical demand

[28] Kevin Carroll and Colonel David W. Coker, "Logistics Modernization Program: A Cornerstone of Army Transformation," *Army Logistician* (January-February 2007): 11.

criteria is the main factor used to determine inventory stock levels. The question remains, how do you determine stock levels for a theater that does not have historical data? Mission Based Forecasting uses several reference data points and determines stock levels through programed algorithms designed to assist in this process.

Readiness Based Sparing is a centralized, risk-pooling inventory optimization method used in large-scale, multistage supply distribution systems.[29] This method is the process of networking all supply points within a geographical location to streamline the movement of parts. This network of supply points will lower transportation costs and optimize placement and distribution of repair parts.

Civilian supply chains are conducting most, if not all the above practices. Caterpillar is currently using onboard diagnostics to track the status of every piece of equipment within its inventory. These diagnostics work similar to CBM+ currently being field tested by the Army. Civilian supply chains such as Walmart and Amazon have used multi-echelon supply distribution networks for years and can offer plenty of advice to the Army in its Readiness Based Sparing methods.

Before the Army can begin to look at integrating civilian supply chain future innovations, it must first gain the same abilities of current civilian supply chain management systems. The implementation of LMP and GCSS-Army are the beginning of closing a large gap between civilian and supply chains practices.

[29] LaFalce, "Force Multiplying Technologies for Logistics Support to Military Operations," 23.

Integrated Conclusions

The study of civilian supply chain management networks has provided several ideas that the Army can implement to improve its supply chain. Many civilian supply chains are advanced beyond the capabilities of the U.S. Army and have struggled with many of the same problems the Army is currently trying to solve. It is important that future Army supply chain leaders collaborate with civilian corporations to gather information on future or currently trending supply chain methods.

One of the main ideas that is rooted in almost every civilian supply chain management system is the idea of a strategy. Civilian supply chains develop, integrate, and continuously analyze their supply strategy. The military has developed a strategy and created a path to enhance its supply chain but has done little to communicate it to all leaders within the supply chain system. Each level of the supply chain is conducting business practices in a compartmentalized stage of the chain and do not understand how their areas of responsibility affect the other layers.

A system manages every supply chain. Systems are used to manage inventory, distribution, product development, customer demand, and lead-time. Brent Johnson suggests that every supply chain maximizes on the use of an enterprise resource planning program system to manage the overall functionality of a supply chain.[30] Army strategies should be linked to emerging systems so that information needed to meet requirements is readily available. Training on these systems should be provided to every supply chain leader at every level.

[30] Johnson, 20-21.

Once a clear strategy is developed and linked to a supply chain system, a metric system should be developed. Every supply chain should have indicators that illustrate the proficiency of a supply chain. The organizational strategy should provide every supply chain leader with an output that is measurable. These performance indicators must be continuously monitored to ensure they are meeting expectations. Performance management requires tools that provide necessary information to stakeholders who can initiate action to correct degraded performance. These indicators should be educated to Army supply chain leaders and they should understand how to respond to data outputs.

Combat Training Centers have noticed many deficiencies with supply chain information sharing. Inaccurate reporting of quantities at the unit level is causing inaccurate forecasting in the supply chain. Proactive logistics becomes reactive and supply personnel struggle to get the right goods to the right units at the right time. This causes vast readiness problems with combat platforms and demonstrates the need for deeper collaboration between all levels of the supply chain.

Combat Training Centers have identified methods used by maintenance personnel to make-up for slower supply chains during training. Practices like controlled substitution and battle damage assessment repair are used as quick fixes to maintain combat power but does not engage the supply chain to begin moving goods. These work arounds normally do not maintain equipment for very long and disrupt the flow of goods expected from a functional supply chain.

Units are also found to have huge stock piles of PLL but fail to return repairable items in a timely manner severely disturbing the supply chain. Maintenance depots are unable to properly forecast returning items and cannot predict when those items will be

returned to the supply system. Although most civilian supply chains do not contain a retrograde process in their supply chain, they do emphasize the importance of avoiding work arounds at lower levels. Work arounds prevent the supply chains from operating correctly and efficient communication is deteriorated. Trust in all supply chain levels is of the utmost importance.

The concepts of Lean and Six Sigma are used in various supply chains. Many civilian corporations hire personnel trained in these concepts to assist in the improvement of their supply chain management system. These concepts have proven beneficial in several civilian supply chains and show great promise to improving Army procedures.

The concept of Lean deals with eliminating waste. Eliminating excess inventory no longer needed for operations and removing under-utilized transportation, facilities, time, packaging, administration, and knowledge from a supply chain can greatly increase efficiency. The goal of Lean is to ultimately increase supply chain velocity and flow.[31]

Six Sigma methodology attempts to eliminate variation in supply chain processes. Logistics is about managing inventory, and managing inventory is about managing variance. “Buffer” stocks are commonly used to protect against variation in supply demand. These stocks become costly in regard to management and storage. Six Sigma helps supply leaders to understand and reduce variation.[32]

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[31] Thomas J. Goldsby and Robert O. Martichenko, *Lean Six Sigma Logistics* (Plantation, FL: J Ross Publishing, 2005), 15-16.

[32] Ibid., 22.

Summary

This chapter provided an analysis of the literature reviewed to make conclusions about the thesis topic. Military and civilian supply chains were compared to determine if any practices conducted by civilian corporations might benefit the Army supply chain. Civilian and military supply chain theory, practices, and future trends were further analyzed to produce qualitative information to answer the primary and secondary thesis questions. These questions will determine if civilian supply chain management best practices can improve Army supply chain procedures. Practices that were found feasible to use in the Army supply chain will assist in providing recommendations for action in the next chapter.

CHAPTER 5

RECOMMENDATIONS FOR ACTION

Introduction

This chapter introduces recommendations discovered in this study to improve overall supply chain management practices and improve Army sustainment procedures. This chapter is organized into three categories; recommendations for updating supply chain doctrine, recommendations for supply chain training, and recommendations in supply chain materiel. These recommendations are further categorized by short-term (1 to 2 years) and long-term (3 to 5 years) objectives.

List of Recommendations

Doctrine Update: Modify Army sustainment doctrine to reflect current supply chain business practices, supply chain leadership structure, and overall supply chain management procedures. (Timeline 1 to 2 Years)

Training Update: Modify the Army's supply chain training to include civilian supply chain business practices, GCSS-Army integrated network processes, Lean Six Sigma Logistics, and supply chain performance management. (Timeline 1 to 2 Years)

Doctrine and Training Update: Examine retrograde operations and improve current practices. (Timeline 1 to 2 Years)

Materiel Sourced: Implement CBM+ technology and include it in the GCSS-Army supply chain network infrastructure. (Timeline 3 to 5 Years)

Materiel Created: Establish a Joint interoperable IT system capable of synchronizing supply chain efforts for services in one database. (Timeline 3 to 5 Years)

Further Research: Conduct a follow-on thesis to explore the improvements made with the implementation of GCSS-Army.

Explanation of Recommendations

Doctrine Update: Updating doctrine to reflect current supply chain practices should be completed in the next one to two years to provide supply chain leaders guidelines on the LMP. A feasible supply chain strategy encompassing LMP should be outlined in Doctrine that establishes clear guidance on how supply chain leaders should conduct daily operations.

A supply chain leadership structure should be created to generate an understanding on individual and team supply chain responsibilities within an established supply chain hierarchy. Doctrine should outline how to effectively identify supply chain procedures that can improve organizations and the actions taken to implement them into daily practices. Establishing a supply chain of command encourages communication and provides additional oversight to lower level supply chain management.

Finally, doctrine should be updated to describe procedures to be taken in an austere environment. GCSS-Army and software used by the LMP are web based operations requiring an information network. This makes the Army supply chain information network prone to cyber-attacks and difficult to use in harsh environments. Doctrine should establish clear guidelines supply chain leaders should take and how to maintain supply chain records until communications are re-established.

Training Update: Supply chain leaders should begin receiving advanced training on supply chain management systems in the next one to two years. The study of civilian

supply chain practices should be introduced and internships with civilian corporations should be offered to select individuals.

Lean Six Sigma Logistics have proven to increase proficiency in many civilian corporations. Training should be created that is tailored to military operations using Lean Six Sigma and provided to supply chain leadership.

Special emphasis should be placed on understanding performance measures and the evaluation criteria used to manage the Army supply chain. Training personnel on every stage of the supply chain is crucial in creating supply chain fusion. Every stage in the supply chain affects other processes and these practices should be understood.

Train supply chain leaders on how to effectively analyze data and share information. Managers in the maintenance field should have an in-depth understanding of how they affect the supply chain and the importance of information sharing.

Doctrine and Training Update: Retrograde operations are seldom found in a civilian supply chain. However, civilian corporations are exceptional at moving products from forward positioned warehouses back to strategic sites for use in a different location. Some civilian corporations have established procedures to move products from one forward warehouse to another eliminating the middle management process. This is completed using visibility software that communicates to every stage of the supply chain establishing impressive accountability of resources.

Army retrograde processes are currently slow and do not have the same oversight as other supply chain programs. However, retrograde operations greatly affect the Class IX stock levels and lead to long requisition or customer wait times. Additionally, the

Army should establish procedures to move serviceable Class IX parts from the unit PLL to an alternate location. This creates a supply chain network that is flexible and reactive.

Current procedures and practices should be reviewed and updated to create enhanced capabilities. Updates to retrograde operations should be taught to maintenance managers, unit supply personnel, and supply chain leaders. This action should be completed in the next one to two years.

Materiel Sourced: Civilian corporations use IT knowledge networks that integrate every stage within a supply chain. The Army is currently in the process of implementing the same type of software with GCSS-Army opening many doors to additional supply chain software and technologies. Civilian corporations use advanced visibility software that tracks movement and locations of products in near real-time. Caterpillar uses sensors that communicate with onboard diagnostics to trigger supply chains to move products if a malfunction is detected. These sensors provide maintenance managers data that reveal how well a piece of equipment is operating. These processes are made possible by a supply chain management information network.

The GCSS-Army has the same capability and can adopt many of the same technologies to improve supply chain speed. CBM+ is currently being tested by military personnel and has proven to be an asset to maintenance personnel and supply managers. CBM+ works like the sensors found on Caterpillar equipment and can detect malfunctions in equipment components. This data can be used to trigger supply movement prior to complete component failure. This will preposition repair parts at or near the point of requisition reducing customer wait time dramatically.

These same diagnostics can be used to measure life cycles of components and equipment. This information can be used to assist item managers in creating stock levels for specific Class IX repair parts. CBM+ technology can provide current demand data for forecasting requirements and quickly identify surges in component failures.

Additionally, these same sensors are equipped with tracking capabilities that can be used to follow components through a supply chain. This will assist not only in forward movement, but also in the retrograde process for repairable items. Depot maintenance managers will be notified of a repairable item being returned for maintenance and the supply chain will be triggered to send the required repair parts to the maintenance facility. This will increase overall efficiency in the supply and maintenance functions of the supply chain.

Condition Based Maintenance Plus should be fully funded and implemented in the next three to five years on all major combat platforms. Software linking sensors to GCSS-Army should be requested or manufactured and a training support package should be produced. Equipment being tested for future procurement should have this capability pre-installed.

Materiel Created: Joint interoperability is a key factor in supply chain management for the military. Joint Publication 4-0 outlines procedures sustainment managers should conduct when performing operations in a joint environment. Combat Training Centers and the Center for Army Lessons Learned have identified the difficulty in this task. Outside of predetermined service agreements and normal Title X service functions, no real procedures exist.

Services struggle to de-conflict funding and transportation requirements. Services have trouble working with one another because of differences in regulation or procedures. Additionally, services do not possess an IT system that works together. GCSS-Army, even after full solution, will be unable to communicate with sister services. The need for creating this type of software is crucial in establishing Joint supply chains. This will synchronize procedures and revolutionize Joint logistics.

This project should be established and tested immediately to allow for a solution to be introduced in the next three to five years. Additional software implementing interagency departments would also prove beneficial. This Joint capability would develop the largest supply chain network in the world and transform the way logistics is conducted in an operational theater.

Further Research: This study identified the capability gap in information software and the Army's supply chain management system. GCSS-Army is the fix for this problem and it is assumed that it will become a huge asset to supply chain management. GCSS-Army is currently in its final stage of fielding and is expected to be full solution by fiscal year 18. The recommendations above are dependent upon the validity of this fielding.

The author recommends additional research be conducted after sufficient data is collected from the employment of GCSS-Army. This research should identify supply chain trends prior to full solution and determine if GCSS-Army has improved operations. LMP should be studied to determine if it is still on path or if adjustments are needed for the overall supply chain management strategy.

Evaluation of Recommendations

The recommendations outlined in this chapter were assessed and evaluated to ensure they fit within the guidelines of suitable, feasible, and acceptable to military operations. Each recommendation above was deemed adequate and provided resolutions to current supply chain issues within the proposed guidelines.

Suitable: Each recommendation helps to accomplish Army supply chain management objectives. The recommendations above strive to update doctrine to reflect successful supply chain best practices. These recommendations adhere to Army regulation and fit within the standards outlined in current Army supply chain strategy.

The recommended training updates explore avenues that the Army can use to better equip leaders to operate in the supply chain management system. Each recommendation will help accomplish the mission of educating supply chain leaders on procedures and practices proven to be successful in civilian and military operations. Additionally, the suggested recommendations provide leaders with the tools needed to identify capability gaps in the supply chain and quickly develop sound solutions to complex problems.

The materiel recommendations are suitable because they introduce technology that increases the capability of the supply chain. Introducing CBM+ and a Joint IT system will enhance total force supply chain management systems and accelerate processes used to sustain the warfighter. These recommendations address the speed of the supply chain and how updates to materiel can drastically improve supply chain intervals.

Finally, additional research on this subject will help stakeholders verify improvements to the supply chain through GCSS-Army and LMP. This additional

research will identify how well these systems are improving Army logistics and provide necessary adjustments needed to maintain momentum toward supply chain modernization.

Feasible: In order for a recommendation to be feasible, it must be achievable within reasonable resource constraints. The Army is under strict budget constraints and must identify areas that can be modified allowing funds to be reallocated toward other programs. The recommendations above address and identify deficient processes that can be corrected through policy updates and technological improvements.

Updating supply chain doctrine can and should be updated regularly to remain relevant with current field practices. This is an inexpensive process that uses minimal manpower and limited resources. The above doctrine and training recommendations are exceedingly feasible and pledge to improve supply chain leadership producing optimal sustainment processes.

The materiel recommendations will require a large amount of resources and manpower to implement. CBM+ should first be incorporated on platforms in the developmental stage. Critical combat platforms should be identified and updated as resources permit. CBM+ has been tested and proven to increase supply chain processes in Caterpillar and Boeing thus decreasing wasted funds. Resources should be allocated to the CBM+ implementation plan.

The development of a Joint interoperable supply chain IT system is the future of the total force. This system will solve the issue of managing supplies in a joint operation. Synchronizing logistics between the Army, Airforce, Navy and Marines will increase the

flow of logistics along lines of communication. This materiel development will require DoD funds and not solely Army resources.

The additional research on the implementation of GCSS-Army and the LMP can be conducted with minimal resources and funds. This research should be assigned to the Combined Arms Support Command and conducted after adequate historical data is collected from the GCSS-Army full solution.

Acceptable: The recommendations presented in this thesis are expected to be openly received by supply chain leaders and stakeholders. These proposals provide solutions to capability gaps in the supply chain management system. Army supply chain managers understand the importance of synchronizing the different stages of the supply chain and are ready to update policy to reflect supply chain best practices. Military leaders understand the importance of sustainment during combat operations and are open to ideas that will streamline logistics and provided expedient support to the warfighter.

Personal Lessons Learned

This study has enlightened several areas in my knowledge of the Army supply chain management processes and provided me with many tools to assist in future assignments. This process has taught me how to focus research and ways to determine best courses of action for complex problems.

As a maintenance technician, I was unaware of the impact my maintenance operation could cause on the overall supply chain. Stockpiling parts in containers or conducting vehicle repair work-arounds to alleviate waiting on a part did not allow the supply chain to function as designed. Additionally, I found that the retrograde process for repairable items did not take priority in most maintenance formations. The standard of 10

days to return a repairable item was normally ignored. I did not consider my leadership position to be involved in the supply chain and rarely reviewed supply chain procedures as a way to improve maintenance procedures.

After conducting this study, I have realized the implications of my actions and the responsibility I must fulfill to the Army supply chain. The training that is delivered to Army maintenance technicians does not include supply chain management procedures. The focus is on maintenance operations with very little focus on supply responsibilities. Vehicle readiness drove my maintenance operations and often to the detriment of the Army supply chain. This paper has edified the importance of learning and maintaining good supply chain procedures across all stages of the Army supply chain.

The procedures used in conducting a research project of this magnitude has provided me with the tools necessary to understand complex problems while developing realistic solutions to these challenges. These tools will be able to assist me in future staff work and will be a baseline for conducting analysis. I am better prepared for future assignments that require extensive planning and detailed analysis of an intricate situation.

Proper identification of the problem, gathering the research tools, applying a methodology to analyzing research, and compiling the results are the basis of this study. I will use these same tools when conducting Joint Planning or while utilizing Army Design Methodology. Additionally, these tools will greatly assist in the Military Decision Making Process during mission analysis and course of action development.

This study has mentally and professionally groomed me for future military operations by drastically improving my writing and editing skills, developing a template

for conducting research, and broadening my understanding of the Army supply chain. This thesis has helped develop me as a warfighter and a military leader.

Conclusion

This study demonstrates the importance of supply chain management and how leveraging civilian best practices can improve Army operations. Benefit was found in analyzing civilian supply chains and the tools they use to compete in a challenging market. Civilian corporations are constantly updating procedures and finding new ways of streamlining logistics. Continued learning in this area can only prove to benefit future supply chain management processes.

This study has attempted to add to the body of military knowledge and provided several recommendations to accelerate the improvement of the Army supply chain. Each recommendation was found to be relevant and tested by civilian corporations further validating its use. These recommendations were ascertained through extensive research on supply chain management from credible sources and evaluated using the methodology described in chapter 3.

Military leaders have discussed the future of military operations and realize they are nothing like anyone has seen in the past. Sustainment will be difficult and warfighters will be required to do more with much less. It is vital that the supply chain is as flawless as it can get and that every stage within the supply chain is operating at its maximum capability. Failure to deliver one bolt can mean the difference between mission success and catastrophic failure.

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