

International Joint Research Project 2011
Studies Series 11-02

A Study of US Forces SCM Analysis and its Application to the ROK Forces



Jae-Yeong Lee
Russell A. Vacante
Sung-Am Moon



KOREA NATIONAL DEFENSE UNIVERSITY



Korea National Defense University
The Research Institute for National
Security Affairs

International Joint Research Project 2011
Studies Series 11-02

A Study of US Forces SCM Analysis and its Application to the ROK Forces

www.kndu.ac.kr/rinsa



International Joint Research Project 11-02

A Study of US Forces SCM Analysis and its Application to the ROK Forces

Printed: November 2011

Published: November 2011

Place of Publication: The Research Institute for National Security Affairs

Address: Korea National Defense University 205 Susaek-dong, Eunpyung-gu, Seoul

Tel: 02-300-4213 / Fax: 02-309-9878

© The Research Institute for National Security Affairs 2011

A Study of US Forces SCM Analysis and its Application to the ROK Forces

Jae-Yeong Lee, Russell A. Vacante, Sung-Am Moon,

A Study of US Forces SCM Analysis and its Application to the ROK Forces

Jae-Yeong Lee* Russell A. Vacante** Sung-Am Moon***

Contents

I . Introduction	5
II . Use of Global SCM in Commerce & by U.S. Forces	7
III . Application of SCM to ROK Forces	28
IV . Conclusion	39

* Professor, Korea National Defense University

** Former Professor of DAU and Present CEO of US RMS Partnership

*** Associate Professor, Korea National Defense University

I. Introduction

1. Background

In these days, most companies logistic activity from raw material acquisition to customers has been changed to the use of SCM(Supply Chain Management). The SCM is now developed to consolidate all processes of materials and products among all related companies. Furthermore, this kind of trend was accelerated via internet, mobile network, electrical commerce, and IT(Information Technology). Based on the civil logistic revolution, military logistic society was also challenged by new types of war environments which are network centric warfare, knowledge & information warfare, and effect based operation, etc... In other words, new war environment requires new way of combat logistic support to be faster, closer, and more accurate.

However, ROK forces logistic system is not yet ready to fully build SCM based logistic support. Hence we proposed several ways of how to apply US SCM based logistic systems to Korea.

2. Study purpose and scope

The purpose of this study is to propose the way of how to apply SCM to ROK forces based on reviewing of global SCM development and its usage status in the US forces. We first analyzed the trend of global logistic environment in both commercial and military fields. At the same time, we also try to find all problems in current ROK forces logistic system and show how can the study results about global SCM world be used to ROK

forces.

The scope of the study and its contents are the following. In chapter 2, it has been reviewed the use of global SCM in commerce & by U.S. forces. In chapter 3, we proposed an application of SCM to ROK forces and we summarized the study results in chapter 4.

II. Use of Global SCM in Commerce & by U.S. Forces

1. Introduction

There are many common Supply Chain Management (SCM) practices shared by commerce and the U.S. military, as well as, differences that can be attributable to their respective objectives. The public or commercial sector objective - acquire profit based on customer service - is often characterized as a “pull, customer based” system. Major Joshua M. Lenzini writes, “The overall business process (is) to enable the profitable transformation of raw materials or products into finished goods and their timely distribution to meet customer demands.” Stated succinctly, the commercial sector’s focus is on quarterly earnings, driven by satisfying customer expectations.

The primary SCM objective of the U.S. military is quite different, employing, until recently, a “push” supply chain approach. This supply chain approach was designed to provide the Combatant Commander mountains of supplies in anticipation of need. Daniel Engels writes, “The primary purpose of optimizing the military supply chain is to enhance readiness for war. Knowing the location and status of all materials needed to support operations is an essential component of readiness.”

To achieve this end more efficiently in the 21st century the military SCM process is increasingly adopting a pull, or customer demand, SCM process similar to commercial industry. However, military logisticians well understand that the adoption of the pull process should not be at the exclusion of the push SCM process. The military supply chain must remain agile and flexible in order to successfully meet current and future

battlefield conditions suggesting that a push-pull SCM system may be required for some time into the future. The commercial and military SCM systems may be similar in structure and implementation however differences will always exist.

Both commercial and military SCM systems have the common goal of - “manufacturing and distributing physical goods as efficiently as possible.” However, the implementation of commercial and military SCM practices differ and are found throughout the enterprise; a comparison of the organizational structure, infrastructure requirements, communications, transportation and related financial matters can quickly surface these differences. These differences can be both subtle and drastic when contrasting the commercial and military SCM systems.

2. Global SCM Status in the Commercial World

A. Organization

The organizational model is important for a successful supply chain management process. The need for organizations to fit the corporate culture is applicable to centralized and decentralized SCM organizations. The success of an organizations supply chain is closely tied to the level of decision making autonomy and influence within its corporate culture.

Differences in SCM organizations depend on the degree of cultural autonomy that exists among the seven SCM components - supply, procurement, manufacturing, order management, transportation, warehousing, and customer practices as depicted in the Figure 1 below.

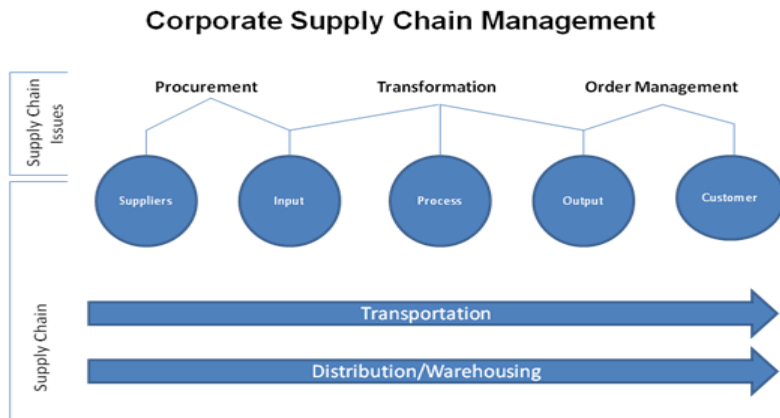


Fig. #1

That is, the success of an organization’s SCM practices depends upon the degree of cultural autonomy and the decision-making authority given to the personnel within the seven SCM components as referenced in Figure 1.

While the degree of cultural autonomy, i.e. decision-making authority, does differ among and between centralized and de-centralized organizations, the common thread linking all seven components together is “the transmission of information flow and the feedback of material and supplies.”

That transmission of information flow, cross-component communications, is an essential lubricant for all SCM systems; e.g., joint planning, one of many SCM benefits is derived from cross-component communications. Improved communication systems, to be discussed in more detail later, has made it possible for commercial SCM organizations to improve product cycle time and accuracy from the raw material to the customer while reducing operating costs.

B. Infrastructure

To have a successful supply chain management system, its infrastructure has to be transparent, flexible, agile and secure. Transparency is within an organization and across all nodes within the SCM system. Information technology (IT) and enterpriser source planning (ERP) software are the primary tools that help commercial SCM system's transparency from the point of procurement to the point of sales. These tools, in turn, have made companies more competitive and profitable. Wal-Mart's status as "the best supply chain operator of all times," as well as UPS' ability to "connect buyers and sellers in more than 200 countries and territories" is indicative of the necessity and evident in the success of highly transparent SCM systems.

Flexibility of the SCM infrastructure in response to changing socio-economic circumstances is a central feature of commercial SCM systems. For example, a company's ability to close a non-profitable retail center and to open its replacement at an alternative location in order to optimize profit is likely due, in large part, to (1) an efficient and streamlined financial system, and (2) active and passive RFID advanced technologies. A company's ability to freely reinvestment profits for the purpose of business development, whether it is for relocating or purchasing of resources or investing in cutting edge technology, is the result of essential infrastructure elements that help keep the supply chain flexible.

Radio Frequency Identification (RFID) technology increases the transparency of the flow of product within the supply chain by means of near or real time tracking. According to one authoritative source, "Radio frequency identification (RFID) is a major enabling technology of real-time location systems (RTLS) that provide location tracking of assets in real

time, usually in a closed-loop network based on WiFi and/or other wireless protocols.” Knowing where the product(s) is/are within the supply chain at any time makes its distribution and re-distribution relatively easy. This type of infrastructure flexibility increases a company’s responsiveness to changing customer’s expectations. RFID technology enables the creation of a wireless SCM infrastructure by enhancing asset “visibility at the edge of the supply chain.”

Agility of the SCM system refers to the ability of the SCM system to respond quickly and appropriately to changing SCM distribution requirements and policies and laws. “Natural disasters, wars, and political upheavals occur regularly around the globe, playing havoc with the flow of parts and goods.” Having alternative supply stocks, sourcing and transportation arrangements, product lines, and inventory locations are among the ways to incorporate flexibility into a company’s SCM system.

Having the ability to reposition inbound and outbound points of entry and exits will make the SCM system more flexible and thus improve the cost and performance of the supply chain.

Also, emerging environmental laws and regulations have begun to impact SCM systems. This means that a company’s SCM system also needs to adjust various aspects of the supply chain quickly to accommodate fast and frequent changes in national and international environmental laws and regulations. These laws and regulations have the potential to impact nearly every aspect of a company’s SCM system to include purchasing and delivery practices, freight consolidation, productions facilities, modes of transportation and warehousing and packaging design.

An agile SCM system is one that can quickly and efficiently acquire ISO 14001 certification. For companies engaged in international commerce this

often means having a SCM system that can adjust to the environmental laws of different countries. For instance, “The US EPA (has) developed Guidance for Environmentally Preferable Purchasing, while Japan enacted the Green Purchasing Law in May 2000 to promote green purchasing as national policy.” The “World Economic Forum has, in addition, identified the top thirteen items in supply chain managements” that are identified as de-carbonization opportunities.” A SCM system that cannot provide an agile response to changing national and international laws and regulations will lose its market share to competitors that can.

SCM security, in many ways, is a paradox. On the one hand the supply chain needs to be transparent to most users in order to keep it running smoothly while on the other hand it is the very nature of security work to counter such transparency in response to potential internal and external threats. Ray LaHood, United States Secretary of Transportation, stated that in the recent past we were concerned with the need to secure transitions with SCM systems against theft. Now our priority has shifted to making SCM infrastructure increasingly resilient against terrorist attacks. Given that more than 50 million tons of freight is moved daily throughout the U.S. and beyond, the issue of maintaining a transparent SCM system becomes increasingly complex. Contributing to this complexity is the possibility that a company’s partner one day can become a competitor the next day, and a country’s ally can suddenly become an adversary seemingly overnight. When the cost of doing business is factored into the SCM process the paradox between maintaining supply chain transparency and security may seem insurmountable.

The cost of securing the supply chain for many small and medium size companies is a dollar value proposition. It often involves trade-off

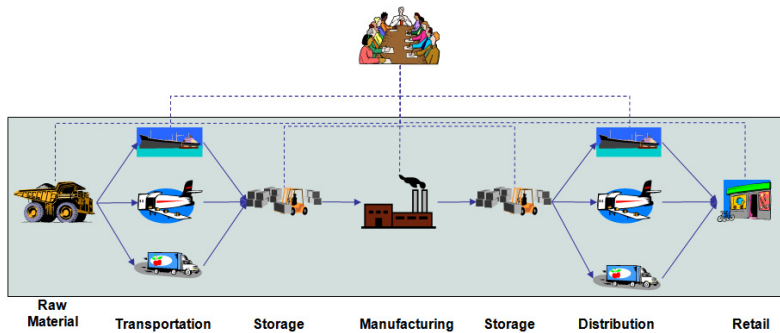
decisions between having a transparent supply chain that helps keep them in business or investing in a costly security technology that has the potential of absorbing their profit and driving them out of business. For instance, it is reported that “the average annual profit margin in the (U.S.) trucking industry is 2.5%.” Given low profit margins, the probability of trucking companies deciding to remain transparent and less secure is very high. Thus, for many small businesses the paradox between having supply chain transparency or supply chain security becomes a non-issue due to cost. Consequently, large companies that have small business partners may be in a position of having end-to-end supply chain transparency but not full supply chain security. Therefore the paradox persists between transparency and security for large and small companies alike.

C. Communications

Communication technology is the lubricant of the supply chain in the commercial environment. This technology comes in many forms, including telephone and fax communications, telegrams, machine to machine communication (known as electronic data exchange EDI), and the Internet. The evolution from communication systems that involved a relatively high degree of human interface to those that require little or no human interface makes SCM more efficient, less costly, and helps to mitigate risk. One author writes: “Efficient communication ensures increased responsiveness and enhanced customer satisfaction.” He also mentions that “The Internet and other enterprise applications integration can disseminate information through the chain in near real time.” As the figure below indicates, SCM requires the integration and coordination of all processes beginning with raw materials to the customer. Delays and disruption in communications

will increase the risk of not meeting customer expectations, increase cost, and potential loss of a competitive edge in the market place.

Supply Chain Management (SCM)



- *Focus on process, not function*
- *Focus on integration and coordination of all organizations*

The arrival and maturing of cloud computing has the potential of benefiting SCM since it can result in more efficient communication between manufacturers, distributors and the final customer. “Companies with a cloud-based center have seen an 18-percent decrease in customer complaints, and a 2-percent reduction in total support costs.” However, advancing Information Technology (IT) does not necessarily mean that it is being readily used as part of the SCM process.

Evidence that business has under utilized IT in the SCM process is cited by one author who reports that while manual data entry remains widespread, human intervention is needed to ensure that the flow of information persists, “The use of translators to convert data from one format to another is almost universal,” there is widespread use of “informed” estimates rather than actual data for many events and many businesses continue to operate

without data to optimize their SCM system.

By not taking full advantage of IT within the SCM process across all aspects of the supply chain change is highly improbable. “The most viable and cost-effective path to achieving on-demand visibility across---the global supply chain involves improving communications.” As reported by the Food and Drug Administration (FDA), poor visibility within the global supply chain contributed to the recall of 1,742 drugs in 2009 as opposed to 426 drugs being recalled in 2008.

The “Bullwhip Effect” within the supply chain is another costly consequence of not using IT to improve the visibility throughout the supply chain. This is a “Tsunami type” product ordering effect within the supply chain that starts out relatively small at the beginning of the supply chain, multiplies throughout and exponentially ends at the end of the supply chain resulting in costly delays and distributions for the retailer, wholesalers and distributors. Second guess sourcing decisions are made and actions are taken based on perception, e.g., poor communications pertaining to customer demand. From the source of supply to the point of sales there is a disruption of the supply. The result: more product(s) becomes available than needed by the customer, or conversely, insufficient product(s) is available to satisfy customer requirements. In either case, the adverse economic consequences throughout the supply chain can be severe.

Achieving and maintaining effective communication within the supply chain is critical for it to remain efficient, reliable, and cost effective. As the supply chain becomes increasingly complex due to globalization, competitiveness, natural disasters and acts of physical and cyber terrorism, strategic steps need to be taken to ensure that the communication can continue to serve as the lubricant of the SCM process. To mitigate risk

under these circumstances organizations need “back-up plans when a supply chain is interrupted.” Just as not having state-of-the art IT systems for facilitating communication throughout the supply chain can result in costly inefficiencies, not having a back-up plan that mitigates disruptions in the flow of communication during a crisis can be equally economically devastating to a business.

D. Transportation

There are many issues that can be discussed pertaining to the role transportation plays within the SCM process. However, there are two interrelated issues that much of the current literature tends to focus on. If the United States, or any other country, hopes to maintain a competitive edge in the global marketplace the intermodal transportation network must be well established and maintained and have a financial strategic plan and resources. SCM tools such as just-in-time deliveries, containerization, and total asset visibility are presently serving commercial industry well. The contribution that these tools make can be mostly negated when a nation’s highway, rail, ship and air infrastructure is not adequately developed or falls into disrepair due to a lack of funding. The private and public funding priority that the U.S. has historically given to having and maintaining a robust infrastructure has made it a leader in the SCM community. Any time a nation loses its focus on making infrastructure funding issues a national economic priority it jeopardizes its competitive edge in the global economy which in turn has the potential of wrecking havoc upon a nations’ economic and national security.

Much of the intermodal transportation infrastructure in the U.S. upon which the SCM system is dependent upon is in a state of disrepair. The

“20 million commercial trucks and buses, 190 million private automobiles, 1.5 million railroad and freight passenger cars, 7,600 certified air carriers aircraft” and thousands of ships that make the U.S. the world’s largest transportation system all require safe and reliable infrastructure. An article published by Brian Everett in the “Supply Demand Chain Executive” states that the “decaying transportation system costs our (U.S.) economy more than \$78 billion annually in lost time and fuel.” He continues by mentioning that “One-third of our major roads are in poor or mediocre condition, and a quarter of our bridges are structurally deficient or functionally obsolete.”

The dreadful attacks on the World Trade Center and Pentagon in 2001 provided insight into how infrastructure disruption can interfere with the optimal use of the SCM system. This catastrophic damage to the U.S. infrastructure resulted in transportation delays that, in turn, resulted in costly inventory delays and widespread supply shortages. A crumbling or out-of-use bridge, highway, rail and port system or pipeline can also result in SCM traffic congestion and have adverse national economic consequences. In addition, a crumbling infrastructure can also invite terrorist attacks. Their weakened state increases the probability that they can be made dysfunctional with less effort and materiel. A congested infrastructure also suggests that there are additional opportunities to place the SCM system at risk. Reportedly freight vehicles in motion experience less theft than “freight at rest” It is also reasonable to say that moving vehicles pose a more difficult target for terrorists than those at rest. The economic consequence to the SCM system resulting from a degraded transportation infrastructure is multiplied many times over given the scope and breadth of international trade and commerce.

Countries, such as the U.S., need to have a strategic plan in funding their nation's transportation infrastructure. Senator Patty Murray, Washington, states that the U.S. needs to fund infrastructure in a sensible way to "get goods from one mode to another." At present U.S infrastructure funding is in a state of disarray and due, in large part, to the tension that exists between commercial versus government funding priorities and resources. Of the 11 critical national infrastructure resources identified by the Bush administration in 2003, private companies "own and operate 85 percent of the nation's critical infrastructure resources." This means that when it comes to the operations, maintenance and security of the railroad infrastructure, private industry is reportedly in charge. In 2010 however, the government awarded nearly \$600 million dollars for infrastructure improvement under the Transportation Investment Generating Recovery (TIGER) Act of which 20 percent was designated for rail projects. Thus, as cited by this example, the U.S. infrastructure funding within the U.S. is left to the decision makers in corporations or to the political priorities of the President and Congress. A unified funding policy, similar to that of the European Union, does not exist. The economic consequences for business dependent upon SCM and for the country can be predictably severe in the foreseeable future.

3. SCM Application Status in the US Forces

A. Organization

The annual cost of the DoD supply chain is estimated to be \$150 billion, excluding cyber technology support cost. The scope, size and mission of the military supply chain has no counterpart in the commercial world. Warfighters are often in a hostile environment that frequently places them

in harm's way, as well as, having to deal "with a wider range of products" than many retailers. With this said the DoD supply chain has adopted some commercial distribution processes. These commercial practices include containerization, hub and spoke distribution centers, as well as, "Wal-Mart" type truck routes for its bases. Since however, the Services are often responsible for their products from time of delivery to time of recycle or disposal the military supply chain cannot be a mirror image of the commercial supply chain.

The SCM model below, although labeled Army, is generically representative of a simple SCM model for each U.S. branch of service. The military mission requires a supply chain organizational model that differs from the commercial sector. The military organizations are required to have self-contained maintenance whereas commercial SCM organizations need not. Many commercial SCM activities usually have more opportunity to outsource their non-core competencies than the military.

As noted in the Figure 2, transportation, distribution and warehousing functions are dual directional, as opposed to being unidirectional as also noted in the commercial SCM graphic above. The global nature of the military mission means that the supply chain is frequently in a state of flux. Transportation, distribution and repair assets during an active campaign do not have fixed locations. For example, the military supply chain during Operation Iraqi Freedom U.S. in March 2003 supported thousands of troops that traveled hundreds of miles per day under severe, harsh environmental and dangerous conditions. Seldom, if ever, does the commercial SCM system encounter such harsh and dangerous circumstance. Wal-Mart stores have fixed commercial assets, its supply chain vehicles travel mostly over well-paved, safe and well-marked roads,

distribution points are relatively close to the end user (customer), maintenance and repair facilities are well-equipped, conveniently located and generally protected from harsh environmental conditions or subjected to armed enemy attack.

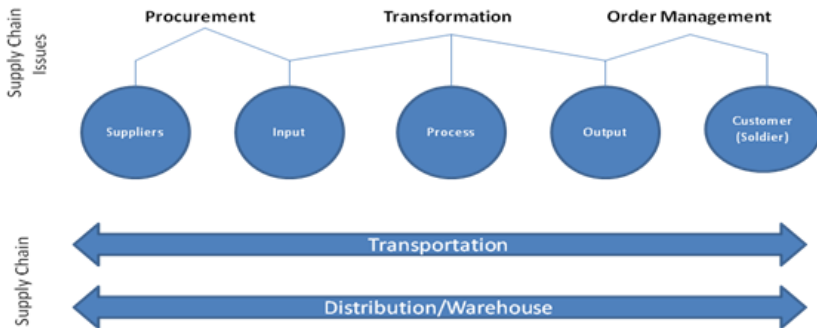


Fig. #2

The DoD has adopted some commercial supply chain practices to improve asset visibility across all components of the supply chain. The World-Wide Web and advances in tracking technologies, e.g. RFID technology, has made this possible. The advent of the Sense and Response (S&R) SCM initiative in 2003 is to the warfighter as just-in-time delivery is to General Motors or Wal-Mart. “The sense aspect of S&R is a real-time information system for gathering demand signals from the field. Response is a capability for flexibility and speed action within end-to-end supply chains.” S&R suggests that it is a conceptual tool designed to ensure the interoperability of the military supply chain.

However, a poor flow of information between various military

organizations persists. A TRANSCOM-DLA Task Group report to the Secretary of Defense in 2003, found that in order to improve the flow of communication between these two organizations their activities need to be better integrated. Firewalls between DoD organizations tend to reduce the optimization of the military SCM system. As further evidence of this General (ret.) Claude “Chris” Christianson recently wrote that the “defense department’s global supplier, DLA, has its own revolving fund to resource its supplier role. That financial system is not connected to the global distributor (USTRANSCOM), who has its own revolving fund to resource the distribution role it plays for the supply chain.” The organizational and mission complexity, size and global task of the DoD plus Congressional imposed budget restrictions are also contributing factors that significantly reduce DoD’s opportunity to mimic the speed and efficiency of commercial supply chain practices.

B. Infrastructure

For the U.S. military, as for industry, transparency throughout the supply chain is important and necessary in order to maintain a time definite delivery capability. To help achieve this objective the military supply chain management model is designed to integrate selected business practices used in the commercial sector. The commercial information systems and networks must provide the military commanders with the strategic capability to have “a common operating picture” of all intermodal delivery systems and the ability to rapidly respond to DoD time sensitive surge requirements.

Since however, 85% of cyber assets are commercially owned, the military SCM system is just as vulnerable to distributive attacks from

inside and outside propagators as industry. There is no Title 10 mission requirement to protect the cyber civilian infrastructure. This in turn means that the military has little or no control over protecting the flow of supplies and equipment, and possibly personnel, to the battlefield. Conversely, Army Regulation 525-26 entitled “Military Operations Infrastructure Risk Management (Army)” addresses both the necessity and importance of cyberspace or Internet networks while underscoring the need for their protection:

“Military operations today are heavily dependent on globally (U.S. and foreign, government and civilian) shared infrastructures (physical and cyber). Technological advances have interconnected these infrastructures, better enabling mission accomplishment anywhere in the world. Although this connectivity enhances mission accomplishment, it also increases the vulnerability to various physical and cyber occurrences. For this reason, it is necessary to identify, protect, and assure these infrastructures.”

The military’s impotency with respect to ownership and security of the electronic highway is further undermined by The Department of Transportation, under Directive HSPD-7 for Critical Infrastructure Identification, Prioritization, and Protection regulation. This regulation delegates responsibility for protecting the “computer-controlled delivery systems, optimization of distribution through, and traffic and operations centers that are consolidated into key locations, and regulation of the transport of hazardous materials” to the Department of Transportation. The growing number of cyber attacks that commercial owners and their respective counterparts in government are encountering suggests that they collectively need to do a much better job in securing the Internet for their financial military security well-being. It is time to have military

representation at the table as future decisions are made with respect to cyberspace security.

C. Communications

The DoD is increasing reliant upon the commercial sector for communications through the Internet. William Pagonis, U.S Army Lt. General (ret.) has recently stated that “At one time, the DoD was the leader in IT Technology, but that is no longer the case. IT technology has jumped so dramatically in the past 20 years and particularly in the past five years that DoD is finding it better to go out and get technology from the civilian sector.” Professor Morris Cohen at the Wharton School of Business reinforced this observation by stating that DoD “is lagging behind in terms of the basic capabilities that the corporate world now demands such as compatible Web-based systems.” To address this issue the DoD has embarked on an IT improvement transformation with the assistance of existing and emerging private companies. It is anticipated that this effort will help standardize web-base communication throughout the DoD which in turn will improve one of the world’s largest and most complex SCM systems.

As referenced in the beginning of Section 2, the DoD community is adopting sense and respond as a new supply chain strategy. It is a concept that utilizes commercial electronic technologies and their applications to reduce or eliminate the need for huge military stockpiles. “Sense and respond logistics is a network-centric concept that enables logistics planners to provide precise logistics support to the warfighter. Soldiers use sense and respond to predict, anticipate, and coordinate a full range of logistics processes, giving the combatant commander numerous options to

plan mission support.”

As warfighting increasingly becomes a joint endeavor, a network-centric communications system will be required to support a cross-service and cross-enterprise SCM system. Network communication that is non-linear, non-hierarchical, “will be the glue” needed to support a broad range of missions. Machine to machine communications will increasingly provide supply chain information and the decision-making authority often will be delegated further down the chain of command. Also, the speed, agility and flexibility of network-centric communications, when fully implemented, should help to negate the “Bull Whip Effect” within the military SCM system as a result of having improved total asset visibility and tracking response speed. The reliance on commercial electronic technologies however, may make the sense and response system subject to disruptive attacks. Thus, the need for a back-up communication plan remains essential.

D. Transportation & Financing

The health of the U.S. physical infrastructure, that includes roads, bridges, railroads, airfields and ship ports, impacts the military SCM system. At a recent government forum it was stated that “a holistic view of what is needed to develop an American supply chain management infrastructure equal to the needs of the 21st Century” is required

The current DoD power projection platform policy indicates that any holistic approach to improving and protecting the physical SCM infrastructure within the U.S. needs to have military representation at planning and during implementation. The 2011 National Military Strategy calls for the nation’s Joint Force to have : “access, freedom of maneuver,

and the ability to project power globally through all domains” which included land, maritime, air, space and cyberspace.

Recently it was reported that the U.S infrastructure is in a state of disrepair. A report from the Industrial College of the Armed Forces documents that “59 percent of US road ways are in poor, mediocre or merely fair condition, 31 percent of the nation’s 582,862 bridges are either deficient or functionally obsolete, 44 percent of in land water way locks and dams are over fifty years old, and 21 percent of US railroad track requires significant improvement.”

Based on this finding the DoD should question whether or not the physical SCM system within the U.S. could currently support the 3.5 million tons of material that traveled over the U.S. high way system in support of Operation Desert Storming 1990.

The real or potential transparency, flexibility, agility, and security available to the supply chain by the Internet and advanced RFID technologies and alike can be rendered relatively useless due to a crumbling U.S. infrastructure that prevents the delivery of material, supplies and systems from the factory or warehouse to a port of debarkation. The military consequences for a power projection force that cannot rely on having an adequately healthy and protected infrastructure are predictably dire. Similarly, since the commercial SCM system uses the same domestic infrastructure, the resulting adverse economic consequences more than double the risk to U.S. national security whether in time of peace or war.

The United States has the largest transportation system in the world and as such it is a critical element of national power. During time of conflict or peace, the DoD supply chain contracts with commercial transportation

providers for strategic lift. For example, during times of conflict, 90% of DoD supplies are transported by ship. Civilian commercial partners are an integral part of the DoD supply chain: “Private companies make up the majority of sealift capacity.”(55) According to the Commanding General of the United States Transportation Command “1,001 aircraft and 360 vessels in the Civil Reserve Air Fleet (CRAF) and Voluntary Intermodal Sealift Agreement (VISA)” have proven to be a real supply chain game changer. (56) The intermodal transportation partnership between DoD and commercial industry greatly improves the response time to the commander’s request for supply chain support worldwide.

E. Conclusion:

The relationship that commercial SCM has to military SCM can be described as highly compatible and supportive. This is not to say that they are equal in most respects. The goals, objectives and environment in which these two SCM systems operate are different and, in many cases, very unique. The military frequently provides the commercial SCM industry with advanced technologies such as the Internet and RFID, as well as, innovative total asset visibility and sense and respond concepts. Industry often then improves these technologies and concepts in a way that makes them more accurate, efficient and flexible. These commercial modifications often subsequently are adopted and incorporated into the DoD SCM system to better ensure the improved timely, accurate delivery of goods and services to the DoDs end user—the warfighter.

As compatible and supportive both SCM currently are to each other, indications are that they have to become even more closely aligned. Issues such as Internet security, physical infrastructure maintenance and cost, lines

of communication, and growing global economic and military competitiveness appear to be too socially challenging and technologically complex for either DoD or industry to address them separately as opposed to collectively. The cost to both the commercial and military SCM system is overwhelming. The decaying transportation infrastructure alone is costing the U.S. “\$78 billion annually in lost time and fuel” and “by 2020, every major U.S. container port is projected to double the volume of cargo.” The Urban Land Institute reports that the U.S. needs to invest \$2 trillion to rebuild its mass, multi-facet transportation infrastructure. The time is now for the strategic planning and implementation of a single SCM system that is designed and built to accommodate both commercial and military SCM requirements.

III. Application of SCM to ROK Forces

1. Comparison of commercial and military SCM

There are several differences when we compare both logistic systems between commercial and military areas. It is obvious to distinct those differences before we apply commercial stuffs into military environment. In order to do that, we compare the process of logistic system used in each field. The Figure 1 in Chapter 2 shows a typical commercial SCM process which can easily be seen in many companies. In commercial world, SCM proceeds with conjunction of all process component such as production, transportation, inventory, positioning, and information.

The Figure 2 in Chapter 2 shows the US military SCM procedure which is almost same but customer. In this case, soldiers are end users so that it becomes very important to forecast right demand, right place and time to be delivered. because any kind of mis-satisfaction of these may cause serious operational damage during combat situation. Therefore, it is highly required very tight cooperation and partnership among all unit component to reduce uncertainty, variation, and risk. This is the main reason why Pull-type logistic system is preferred in military logistic system compared to Push-type logistic system.

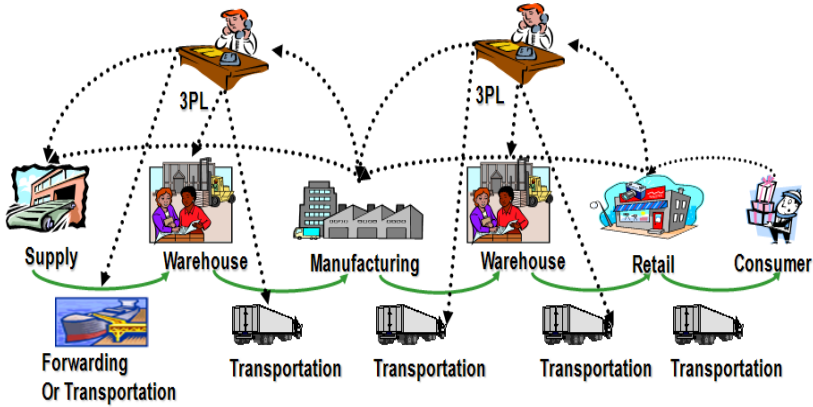


Fig. #3 Process of TPL in SCM business world

One of the recent trend in both commercial and military SCM is that many Third Party Logistics(TPL) extend their roles in global logistic structure. The Figure 3 depicts how TPL works in SCM business world from supply to customer.

2. Military logistics and SCM

One of the key demand needed in military logistics is improving total asset visibility. Focused Logistics, Agile & Flexible Logistic, Sense and Response Logistics are developed to reach the key demand for last two decades. In these days, those efforts are continued and most of logistic goals can be obtained by using SCM with combined with CROSS DOCKING concept and RFID technology.

To apply SCM to military logistics, every steps of SCM procedure have to be linked with military logistic one to optimize the system and produce the best effect.

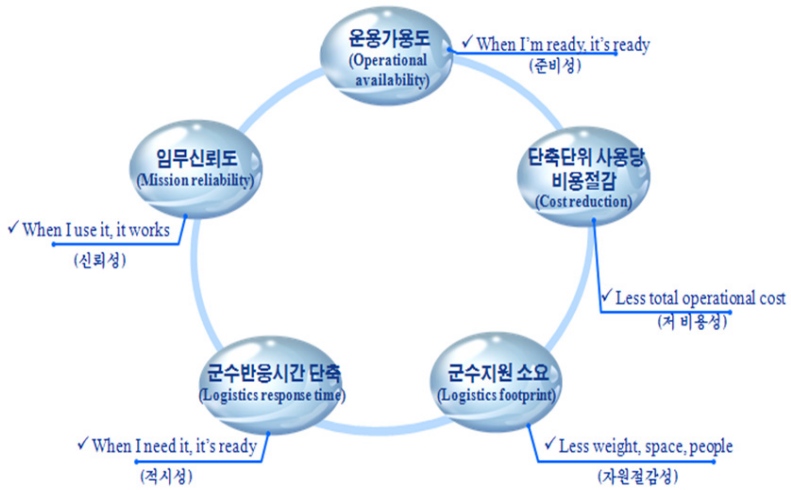


Fig. #4 Five system component factors to measure the effectiveness

Hence it is also required to setup a clear MOE(Measure Of Effectiveness) and use it to measure the effectiveness of each system component factor such as Operational availability, Mission reliability, Logistics response time, Logistics footprint, and Cost reduction as shown in Figure 4.

Eventually, when these component factors are well processed, we can not only improve system reliability but also reduce the unit cost of each weapon system via SCM. As an additional tip for TLCSM and PBL relationship is shown in Figure 5.

TLCSM & PBL Metrics

Operational Availability(A_o)

- **Mission Capability Rate**
- **Mission Completion Rate (sorties, launches, etc.)**
- **% time-free of mission degradation**

Footprint

- **Inventory forward**
- **Personnel in theater (military , civilian, contractor)**
- **Personnel (military , civilian, contractor) non-deployed**

Cost / Time Unit of Operation

- **Flying hour cost**
- **Steaming hour cost**
- **Engine hour cost**
- **Surveillance hour cost**

Logistics Effectiveness

- **Total inventory**
- **Cycle time (CWT/LRT, RTAT)**
- **Perfect order fulfillment**
- **Maintenance man-hours / time unit of operation**

Fig. #5 TLCSM and PBL relationship

3. Application of SCM to the ROK forces

There are many approaches to apply SCM structure to military logistics society. In this sections, we proposed several ways which can possibly easy to apply in current situation in the ROK forces. Some of them are tried to make a planning but not finished yet. Note that many of them mentioned here are highly related each other.

A. Outsourcing

As a defense reform project, outsourcing policy is now planning to execute under the name of commercializing military supply depot and maintenance depot, and MRO(Maintenance, Repair, Operation) business. All of these projects are very challengeable and highly related to SCM. Especially, commercializing military supply depot is nothing but procurement and transportation matters of SCM and commercializing maintenance depot is a core project in weapon system maintenance and also it is highly corelated with MRO business.

B. PBL (Performance Based Logistics)

Korea MND(Ministry of National Defense) pursues the TLCSM(Total Life Cycle Systems Management) as one of main logistics reform projects. As for the overall concept and process for the TLCSM, see the Figure 6. They expect to sustain proper operational cost and optimal maintenance when PBL is adapted. In case of domestic R&D, MND considers both minimization of operational cost and selling PBL packages comes with weapon systems exported.

For example, in case of T-50 aircraft, it provides cumulative advanced technologies to develop FA-50 in the future. They will also consider to sell PBL packages when T-50 is exported to Indonesia. As for the maintenance, there are two alternatives, one is done by air force maintenance depot and the other is done by manufacturer. An analysis like COEA(Cost and Operational Effectiveness Analysis) have to be done before selecting one of them. Anyhow, PBL will be a main issue as exporting defense business volume grows.

In order to keep smart policy for system maintenance, it is highly recommended to prepare study results about how to measure the PBL effectiveness for each weapon system. In case of F-15K R&D project, it is still lack of study investment for COEA research for PBL. When studying PBL it is important to give a solution to find proper amount of supplier and inventory. In other words, it is required that PBL study results have to provide an optimal solution for overall planning of SCM.

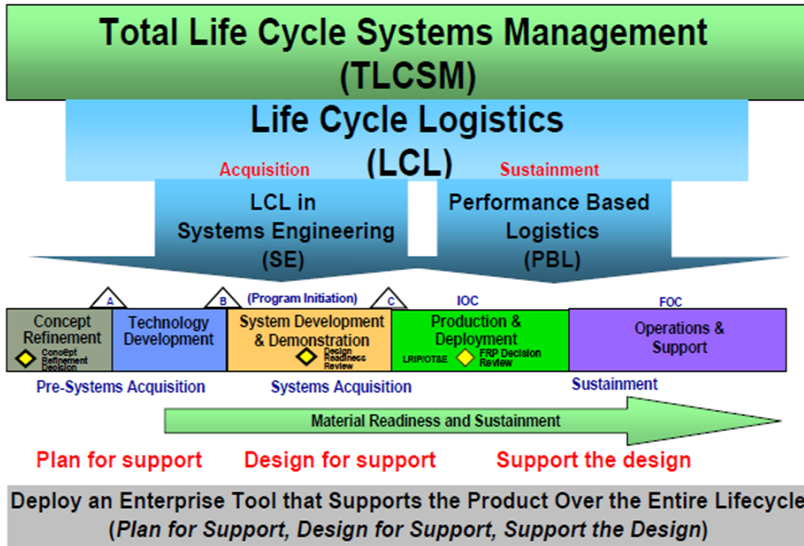


Fig. #6 Overall concept and process for the TLCSM

C. R-TOC (Reduction–Total Ownership Cost)

Another advantage we can get from application of SCM is an overall cost reduction. It is important because direct cost reduction for defense materials is a core job to do in defense budget planning stage. Based on theoretical study results, average cost reduction rate is 10~20% when we applied SCM properly in the early process analyses of procurement, supplier recognition, labor cost, inventory cost, and so on. On top of that, we can also reduce total ownership cost in the application process of reverse SCM for weapon system management and repair field. Needless to say, cost reduction is one of best way to satisfy demand side customer. The Figure 7 shows an overall prospective process how to reduce the TOC.

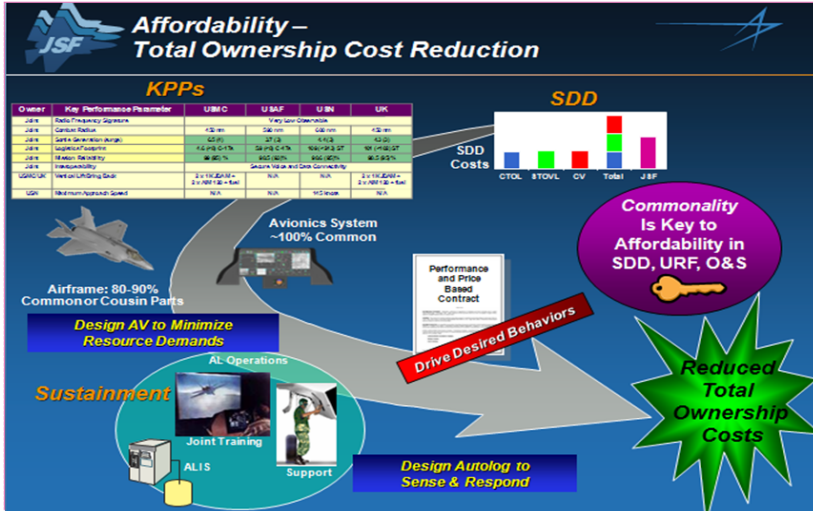


Fig. #7 Overall prospective process how to reduce the TOC.

D. Building a SCM Hub

Another military logistics plan proposed is to build a SCM hub which can be a role of domestic depot for overall defense supply materials. Actually, MND is seriously considering the plan in the near future. One possible example is to establish military aircraft maintenance depot which can provide all supplies to all services, army, navy (include marine corps), and air forces. A plan for building a SCM hub may be one of the key task to fulfill the defense SCM policy and improve the level of national competitive power.

Additional task for SCM hub is to collect a common logistics data in one place as shown in Figure 8. If this system is established, one stop service and control from main suppliers to warfighter are available.

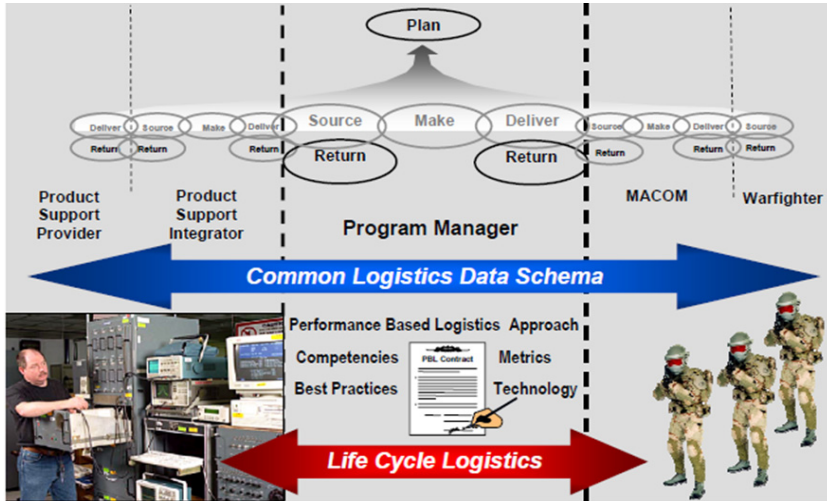


Fig. #8 Common logistics data schema

E. Research & Development for an Optimization Technique

There are many mathematical and optimization techniques for improving effectiveness of SCM. For example, SCOR (Supply Chain Operation Reference) is necessary to build a basic SCM plan. Lean 6 sigma as well as M&S (Modeling & Simulation) are also required to get better study results. Hence research and development for SCM related techniques have to be continued. Actually, MND is very interested in applying the TLCSM so that SCM can be a more important role than studied itself alone when it is connected to other related research topic such as PBL, Lean 6-sigma, and so on. Note that a research fund for the study to this issue will definitely grow a lot in the future.

F. Application of Commercial SCM

In Korea, there are many large scale logistics companies such as Hyundai

globis, LG logistics, POSCO, CJ gls and most of them also have a global export networks. Therefore, it will provide a lot of advantages if MND can use these commercial global logistics networks for military usage. In other words, as for defense side, targets for bench marking from commercial side are enough and easy to increase military logistics efficiency and its capability for combat support.

However, when we try to do bench marking from US SCM, risk analysis is also pursued and reduce any kind of possibility of uncertainty due to the difference in national economic scale, land size, complexity of transportation, ordering speed, inventory management environment, etc...

G. Building a Performance Element of SCM

Suppose we are ready to apply US SCM systems to ROK military side. Then, next thing has to be taken into account is to build a performance element for measurement of SCM system. The performance of SCM has to be measured in strategic, operational, tactical levels shown in Table 1. Even though the Table 1 depicts 13 performance metrics which are used in US air force, ROK forces can modify those metrics either add or delete some elements depending upon situations in Korea.

Performance elements are also selected differently to fit each circumstance from MND, DAPA, each service (Army, Navy, Air force) depend on size, role, expert level, location from each organization.

Table. #1 Performance metrics used in US air force

AIR FORCE SCM PERFORMANCE MEASURES			
Performance Metrics	Level 1 (Strategic)	Level 2 (Operational)	Level 3 (Tactical)
Net Operating Results	X		
Deficiency Report	X		
MICAP Hours	X		
Customer Wait Time	X		X
MC Rates		X	X
TNMCS		X	X
TNMCM		X	X
System Availability	X	X	X
O&S Costs	X	X	X
Issue Effectiveness			X
Demand Forecast			X
Back Order Age			X
Cost of Goods Sold		X	X

Source: Ogden Air Logistics Center, 84th Combat Sustainment Wing, 11 July 2006

Table. #2 Performance outcomes and considerations in US Forces

NAVAIRINST 4081.2A Performance Metrics	
Performance Outcomes	Metrics/Considerations
Operational Availability (Ao)	A(o) - (Under Full CLS Only) Readiness Mission Capable Rates Sortie Generation Rate Turn- Around-Times Surge Requirements Reduced Down Time
Operational Reliability	Sortie/Mission Completions Time On Wing Mean Time Between Failures (MTBF) MTBF Improvement No Fault Found/Reduction Elimination
Cost Per Unit Usage	Cost Per Flight Hour Annual FFP Cost (prorated by units) Obsolescence Management Attrition Replacement Sustaining Engineering/ECP Costs Total Ownership Cost (TOC)
Logistics Footprint	Maintenance Planning Reliability improvement Reduced Cannibalizations Support Equipment Training Publications Inventory Needs Staffing Levels
Logistics Response Time	Parts Availability First Pass Effectiveness Maintainability P.H,S&T Mean Logistics Down Time Supply Chain Management

Source: NAVAIR, 2004b

Eventually, to apply SCM system to ROK military side, it is very important to define the right problem to solve and develop a right process depending upon each organization's appropriate scale. Hence, good SCM plans can cover the range from strategic to operational level, from supply to demand. One typical performance outcomes and their metrics & considerations are shown in Table 2.

IV. Conclusion

In this study, we reviewed SCM's current global issues and its application status in military field via US forces. Based on the study results, we proposed several approaches how SCM can be applied to ROK forces. In this section, we summarize study results and suggest for further study in the future.

- 1) Recently, desire for logistics reform in MND is very strong compared to previous decade. Hence the probability of success in the logistics reform project seems to be very high and SCM can be a major role to support the project.
- 2) Outsourcing is a core project for successful application of SCM to the ROK military side. Detail plans such as establishing supply and maintenance depots are highly co-related with procurement and transportation systems as well as PBL & MRO business.
- 3) PBL has to be pursued during the process of TLCSM in order to make better solutions and get more effective results.
- 4) Cost reduction from SCM application can get from TOC's perspective which is also highly connected with the success of TLCSM.
- 5) As a basement and fundamental tools, establishing a common logistics data hub is very important to support and keep sustainability of SCM system.
- 6) Research and development to optimize the systems has to be continued. More investments for doing research is necessary to keep the system in the best mode.
- 7) Finally, to measure and check the system performance measurement

is necessary and it will do key role to keep the system in the most effective condition. Performance elements have to be selected differently to fit each circumstance from MND, DAPA, each service (Army, Navy, Air force) depend on size, role, expert level, location from each organization.

For further research about SCM, there are two issues as follows. At first, military SCM have to be connected and developed as a total system in national level. Secondly, to keep the system's efficiency simulation model have to be developed and used for real time checking of the system performance.

References

Major Joshua M. Lenzini, Anticipatory Logistics: The Army's Answer to Supply Chain Management, September/October 2002

Daniel W. Engles, Ph.D., Robin Koh; Elaine M. Lai, and Edmund W. Schuster, Improving Visibility in the DoD Supply Chain, May-June 2004.

John Dischinger, David J. Closs, Eileen McCulloch, Cheri Speier, William Grenoble, and Donna Marshall. Get to Know About Logistics and the Industry, June 13, 2007

Author Unknown, Enporion, Supply Chain Organization Models That Drive Success, March 18, 2009.

Chic-Jen Shieh, Supply Chain Management, Organizational Innovation and Corporate Culture: The Impact of Relatedness, African Journal of Business Management, Vol.4(9), pp. 1736-1744, August, 2010.

Priyank Azad, The Role of Technology in Supply Chain, June 30, 2011

Patrick Burnson, World Trade Magazine, May 1, 2002

Ann R. Thryft, senior editor, Supply Chain Management Challenges RFID Technology, January 2007

Michael Johnson, Supply Chain Disruptions: Minimize the Effects," SCRC Article Library, January 19, 2005

Kim, Tae-Hyun & Moon, Sung-Am (translated), 「Logistics and SCM」, David and et al, McGraw-Hill Korea, 2008,

DoD 4140.1-R, 「DoD Supply Chain Materiel Management Regulation」,
2003.

미군의 공급망관리시스템 분석 및 한국군 적용방안

이재영, Russell A. Vacante, 문성암

제1장 연구개요	45
제2장 세계적인 SCM추세 및 미군의 활용실태 분석	46
제3장 SCM의 한국군 적용방안	53
제4장 결론	58

미군의 공급망관리시스템 분석 및 한국군 적용방안

이재영, Russell A. Vacante, 문성암

제1장 연구 개요

1. 연구배경

- 최근 기업의 물류활동은 원자재의 조달에서 최종소비자에게 이르는 전체 물류프로세스를 통합하는 공급사슬관리(SCM)로 발전하고 있다..
- 인터넷, 모바일 네트워크 등을 통한 전자상거래의 확산되고 있다.
- 글로벌 경쟁심화에 따라 기업의 핵심역량에 집중해야 할 필요성이 커지고 제조·유통기업은 물류부문을 전문업체에 위탁하는 추세이다.
- 국방부문의 여건도 변화하는 추세이며 이에 따라 비전투분야에 대한 민간자원 활용, 국방 자원과 시설의 경제적 운영 중요성이 증대하고 있다.
- 전장환경과 전투근무지원 요구능력 변화는 다음과 같이 분석된다.
 - 네트워크 중심전, 수많은 정보들이 데이터화되어 운용된다.
 - 전투부대의 작전수행 보장을 위해 통합전투근무지원 개념의 적용이 요구된다
 - 장차 보급지원의 핵심은 현장위주의 보급, 속도 중심의 지원, 적시·적소·적량의 정밀지원이 요구된다.
 - 미래 군구조 개편 후 군단 중심의 작전환경 구성에 대비하여 지역단위 통합물류센터 운영으로 현장·근접지원 기반이 구축될 것이다.

2. 연구목적 및 범위

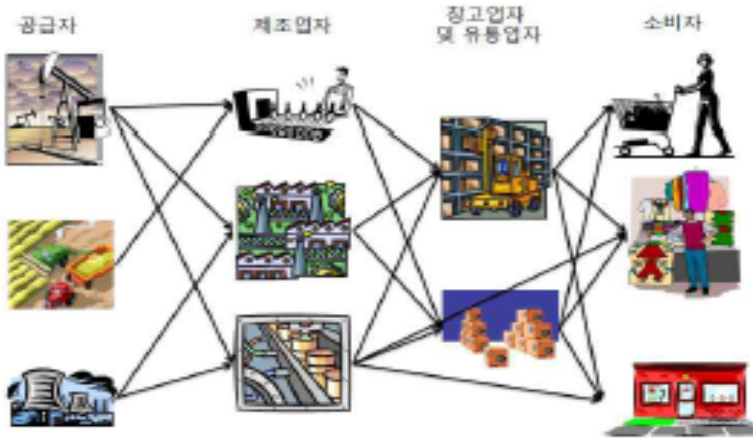
- 연구의 목적
 - 현재 글로벌 물류환경의 변화 추세를 파악하고 미군의 SCM 적용현황을 분석하여 한국의 국가물류체계의 틀 속에서 군 물류체계의 구축현황을 구체화한 뒤, 군 물류체계의 문제점과 발전방향을 제시하는데 있다.
 - 특히 한국군의 SCM 적용을 통한 군수품 보급체계 발전방향을 제시하였다.
- 연구의 범위
 - 본 연구는 글로벌 SCM 및 선진국 중에서 미군의 SCM 체계를 벤치마킹 대상으로 한다.
 - 미군의 SCM 활용현황 분석결과를 기초로 한국군에 적용할 수 있는 방안을 분야별로 제시하였다.

제2장 세계적인 SCM추세 및 미군의 활용실태 분석

1. 글로벌 SCM 현황 소개

- 민간부문에서 공급체인(Supply Chain)이란 아래 그림과 같이 원재료의 채취에서 가공을 통하여 제품의 생산·배송되는 과정에 있는 구성원 모두의 연결을 의미하며, Logistics Network라고도 한다.
- 공급체인관리(SCM: Supply Chain Management)란 고객서비스 수준을 만족시키면서 전반적인 시스템 비용을 최소화할 수 있도록 적절한 수량으로, 적절한 장소와 적절한 시간에 제품이 생산 및 유통될 수 있도록 하기

위하여, 공급자, 제조업자, 창고·보관업자, 소매상들과 같은 공급체인을 효율적으로 통합하여 관리하는 일련의 접근법이라고 할 수 있다.¹⁾



- SCM에 대한 정의는 분야별 전문가마다 다양하게 정의하고 있는데, 몇몇 연구자들의 SCM에 대한 정의를 살펴보면 다음과 같다.
 - Ellram(1994)은 SCM을 원재료 공급자로부터 제조업체, 유통업체, 최종 소비자에 이르는 과정에서 제품의 생산을 위한 원재료의 흐름을 통제하고, 제품 생산을 위한 생산계획을 수립하고, 제품의 판매에 이르는 과정에 대한 통합화된 경영접근법으로 정의하고 있다.
 - Cooper(1995)는 고객만족을 위한 기업활동으로 생산활동, 기업상황, 지리적 한계와 무관하게 원재료의 공급에서부터 최종 소비자에 이르는 물류활동에 대한 핵심을 둔 기업채널관리 기법이다.
 - Ross(1998)는 SCM을 시장에서의 상품과 서비스의 흐름, 창조되는 정보, 개인화된 고객의 가치를 조화롭게 해주고, 혁신적인 해결책을 제시해 주는데 초점을 둔 고객강화 공급시스템으로 공급체인의 비즈니스 파트너와 기업 내부에서 발견되는 경영자원과 생산역량을 단일한 방향으

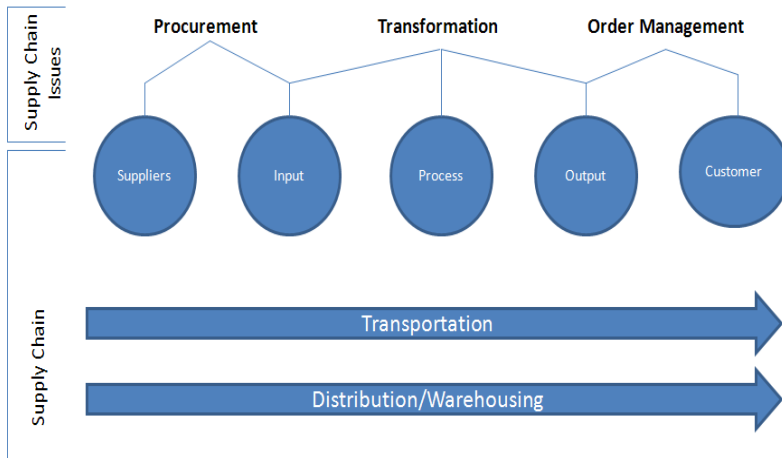
1) 김태현·문성암 옮김, 「물류 및 공급체인 관리」, David 외 2명, McGraw-Hill Korea, 2008, p.1.

로 이끌어주어 성과를 창출해주는 경영철학이다.

- 미국생산재고관리협회(APICS, 1996)는 SCM을 (1) 공급체인에서 원재료의 확보에 이르기까지 완제품 생산 최종소비에 이르는 전체 프로세스를 관리하기 위한 기반으로 정의하고, (2) 가치체인을 통하여 고객에게 제품과 서비스를 제공해 회사내부와 외부의 관련된 기능을 통합하는 과정으로 정의하고 있으며, JIT(Just In Time)의 구매이론을 확장한 로지스틱스 자산관리 방법으로 정의하고 있다.
- 미국 물류학회 학자들은 SCM을 정보와 재고의 외부흐름을 유용하게 해주는데 우선적으로 포커스를 둔 경영방법론으로 기업경영에 있어서 경쟁가치를 창조해주고 모든 채널의 상호작용을 가능하게 해주어 파트너 상호간의 통합구조를 형성하고 있다.

• 민간 SCM과 군용 SCM의 차이점

- 일반 기업 SCM은 아래 그림과 같이 생산, 수송, 주문, 재고, 위치, 정보의 연계에 초점을 맞추고 있다. 즉 물류의 원활할 흐름에 초점을 맞추고 있다고 볼 수 있다.



- 반면에 군용 SCM에서는 계획을 수립시 수요를 예측하고, 실행할 때에는 Pull 시스템을 적용하여 황소채찍효과를 해결하기위한 불확실성감소, 변동의 감소, 리드타임감소, 전략적 파트너십이 요구된다. 즉 상용분야에서의 SCM에 비해서 전장상황에서의 정확한 소요 예측 및 공급을 위해서 보다 전략적이고 명확한 협력관계가 요구된다고 할 수 있다.

2. 미군의 SCM 적용사례

• 공급망 관리(SCM) 절차

- 미 군수조직은 전투원들의 요구사항을 만족시키기 위해 물자관리 활동을 발전, 향상, 처리하는 물자관리 활동의 프레임워크를 제공해주는 "Plan-Source-Maintain / Make-Deliver-Return"의 공급사슬 프로세스를 조직적으로 도입하였으며²⁾, 각 프로세스별 세부기능은 아래 표와 같다.

프로세스	기 능
Plan (계획 · 수요)	자원조달, 생산, 배송의 요구에 부합하는 방책을 발전시키기 위한 수요와 공급의 균형을 맞추는 프로세스
Source (구매 · 조달)	계획 및 실제 수요에 부합하는 재화와 용역의 조달 프로세스
Maintain/Make (생산 · 제조)	계획 및 실제 수요에 부합하도록 제품을 완성된 상태로 변환하는 프로세스
Deliver (배송 · 판매)	계획 및 실제 수요에 부합하는 완성된 재화나 용역을 제공하는 프로세스로서 수요관리, 수송관리, 분배관리를 포함
Return (반품)	어떤 이유로 반품하거나 반품된 제품을 수령하는 프로세스, 배송 후의 고객지원까지 범위 확대

2) DoD 4140.1-R, 「DoD Supply Chain Materiel Management Regulation」, 2003. pp.19~23

- Plan은 수요 및 공급을 포함한 전반적인 계획수립 프로세스를 말하며, Source는 원자재 공급자 선정 및 공급자 성과관리를 포함한 구매(조달) 프로세스이고, Maintain / Make는 생산방식, 재고관리, 설비관리, 테스트 등을 포함한 생산 프로세스이다. Deliver는 주문, 창고관리, 운송업체 선정, 수·배송 대금 정산 등의 판매(배달) 프로세스이고, 마지막으로 Return은 원자재 및 완제품 반품, 환불 등의 반품 프로세스이다.
 - “Plan-Source-Maintain/Make-Deliver-Return” 프로세스로 정비되어 재구성된 조직 구조 하에서 미군은 이라크 전쟁에서의 부대 전개, 주요 전투작전의 승리를 위한 부대의 재배치, 추가로 파병되는 부대의 배치에 대해 공급사슬 전략과 지속적인 지원에 대한 계획과 실행을 수행하였다. 이는 부대의 전략적 사전 전개 계획을 신속하게 재구성하고, 부대를 이라크에 재전개시키기 위한 준비로 구매 및 조달전략을 신속하게 계획 및 발전시키도록 하였다.
 - 미 국방성은 이렇게 공급사슬 프로세스 개량을 추진하여 계획, 조달, 제조, 배송 그리고 반품 활동의 통합능력 향상으로 인해 공급사슬 간의 의사소통과 상호작용을 향상시켰다. 사상처음으로 글로벌 자산관리, 글로벌 수리부속 관리 및 분배를 할 수 있는 기업수준의 공급사슬 통합 및 관리 능력을 갖게 되었고, 이 능력은 무기체계의 유지성을 향상시켰으며 전투원들에 대해 높은 반응성 지원을 제공하였다.
- 공급망 관리(SCM) 적용결과
 - 미 군수조직은 이러한 노력을 통해 현재 군수기반구조와 프로세스를 높은 신뢰성 및 반응성의 공급사슬 네트워크로 변화시키고 있어 미군의 전투작전을 계획하고 유지하는 능력에 직접적으로 영향을 미치고 있다.
 - 미 육군은 세계 어느 분쟁지역이든 96시간 내에 1개 여단을, 120시간 내에 1개 사단을, 30일 내에 5개 사단을 전개시키기 위해 노력하고 있으며, 군수지원도 전투지역에 인원, 장비, 물자를 신속히 전개할 수 있는

능력을 구비하고 구체적인 실현을 위해 컨테이너와 팔레트를 이용한 신속한 적재와 이를 이동할 수 있는 전략 및 전술이동수단을 강구하였다. 그리고 부대 전투력 수준을 유지하기 위해 육군의 범세계 전투지원 체계를 구축하고 군수조직을 재설계하였다. 이라크전에서의 군수지원 특징을 살펴보면 다음과 같다.

- (1) 자산 가시화를 위해 RFID를 포장화물에 부착하여 활용하였고 육군 물자사령부-전구지원사령부-군단지원사령부-사단지원사령부 간에 모든 자산을 가시화하고 신속히 보급함으로써 전쟁의 지속능력을 향상시켰다. 특히, 군수물자 보급시 참고 보관과정을 생략하는 “Just-In-Time System”을 도입하였고 중간제대를 과감히 생략하여 한번에 보급함으로써 신속한 보급이 가능하였다.
- (2) 사용자 및 전투부대 위주의 군수지원을 위하여 지원부대는 전투부대에 근접하여 보급하였고 “집중 군수”의 원칙하에 적시·적소·적량의 군수품을 지원하였다. 또한, 추진보급기자를 전투부대에 근접해서 운용하고 추진보급을 실시함으로써 전투부대는 전투에만 전념할 수 있도록 하였다.
- (3) 보급품의 적재, 하역을 위한 플랫폼의 개발과 적재용 기구 등이 개발되어 적·하화시간을 단축하였고, 정밀공중 수송체계와 무선식별기, 이동추적체계, 자동화 창고, 포장기술, 통합적재기술 등, 속도 물류 실현을 위한 첨단기술이 활용되어 물류의 시간을 단축시켰다.
- (4) 보급·정비·수송이 통합된 군수정보 및 통신체계를 운용하여 무선 자동식별 장치에 의한 효율적인 보급·수송과 위성 및 인터넷을 활용하여 전군자산 가시화와 지원수단을 통합하였다.
- (5) “Pull형 지원체계(전투부대위주 군수지원)”에 의한 군수지원으로 자산정보가 자동적으로 중앙 시스템으로 전송되어, 중앙에서 군수 부대별 재고 보충계획을 수립하여 전투부대별 관리를 통한 재고를 보충하였다.

- 미군은 민간분야 경영혁신 기법인 SCM의 도입으로 자산가시화를 달성하여 신속한 보급체계 구축이 가능해졌으며, 조달기간 단축, 재고감소 등으로 비용을 절감하고 있다. 또한 전투원 및 전투부대 위주의 군수지원으로 전투에 전념할 수 있도록 하고 있다. 미군은 신속 정확한 군수지원을 위해 주공급자제도를 도입하여 실사용자가 공급업체에 직접 청구하여 민간 유통업체로부터 즉각 보급 받음으로써 군수지원의 속도 향상과 더불어 재고의 감축까지 이루어 내고 있고, 사용자 대기시간을 국방군수 성과지표로 설정하여 적용함으로써 실사용자인 전투원을 중심으로 하여 군수지원 소요시간을 단축해 나가고 있다. 미군은 속도 중심 군수지원의 실현을 위해 중간단계를 최대 생략하여 보급원에서 전투원까지 신속하게 보급하는 One-Stop 개념을 적용하여 개혁을 추진하고 있다.
- 미군 공급망 제도의 시사점
 - 이러한 미군의 공급망 관리(SCM) 제도의 도입이 우리에게 주는 시사점을 군수관리 측면과 군수지원체제 측면에서 살펴보면 다음과 같다.
 - 먼저 군수관리 측면에서 보면, 첫째 수요자(customer)에 대한 군수지원 소요시간(response time)을 획기적으로 단축하기 위해 전군 자산가시화(Total Asset Visibility)체제를 구축하였고, 둘째 군수관리 체제를 효율화하여 군수지원의 즉응성(responsiveness)과 성과(effectiveness)를 제고시켰으며, 적극적인 아웃소싱(Outsourcing)으로 군수지원인력, 시설, 장비, 재고자산 등 전·평시 군수지원에 필요한 기반투자를 최소화하여 군수지원 비용(structural overhead costs)을 줄이고 불필요한 노력 및 시간을 제거토록 하였다.
 - 군수지원체제 면에서도 속도중심의 군수지원(Focused Logistics 또는 Distribution-based Logistics) 개념을 만족시키기 위해 강력한 업무 표준화 및 BPR을 추진하고, 자동화된 의사결정 지원시스템을 개발하여 종래의 물량중심에서 속도중심의 통합 군수지원 체제로의 전환을 추진하고 있다.

제3장 SCM의 한국군 적용방안

1. 군수물류와 SCM 관계

자산의 가시화와 더불어 군수의 발전은 Focused Logistics, Agile & Flexible Logistic, Sense and Response Logistics 등의 발전은 SCM의 발전으로 연계할 수 있다. 이에 따른 SCM 기술들이 CROSS DOCKING과 RFID이다.

여기서 군수물류와 SCM의 상관관계를 살펴보면 우선 국방 SCM은 전쟁의 SCM의 최적 효과를 위하여 군수와 직접 연계되고 효과측정요소를 계획하고 측정하며 개선되어야한다는 측면이 있다.

그 대표적 요소가 운용가용도, 임무신뢰도, 군수반응시간단축, 군수지원요소, 단위사용당 비용절감이다. 결국 국방무기체계의 신뢰도는 향상되고 군수 Footprint의 절감으로 비용의 절감이 가능한데 이것은 SCM이 TLCSM (Total Life Cycle Systems Management)과 PBL(Performance Based Logistics) 효과적도의 적정의 구현으로 가능하다. 또한 최근 SCM의 추세를 살펴보면, 보다 전문성 있는 물류업무 추진을 위해 3PL(Third Party Logistics) 및 4PL을 개입시키는 경우가 증대하고 있다.

참고로 물류의 소요계획에서부터 MRO(Maintenance Repair Overhaul)까지의 총체적 Service Engineering이 SCM에서, 관리를 TLCSM 및 PBL과 연계하여 구성요소를 4가지로 구분하여 정리해 보면 아래 그림과 같이 설명될 수 있다.

TLCSM & PBL Metrics

Operational Availability(A_o)

- Mission Capability Rate
- Mission Completion Rate (sorties, launches, etc.)
- % time-free of mission degradation

Footprint

- Inventory forward
- Personnel in theater (military, civilian, contractor)
- Personnel (military, civilian, contractor) non-deployed

Cost / Time Unit of Operation

- Flying hour cost
- Steaming hour cost
- Engine hour cost
- Surveillance hour cost

Logistics Effectiveness

- Total inventory
- Cycle time (CWT/LRT, RTAT)
- Perfect order fulfillment
- Maintenance man-hours / time unit of operation

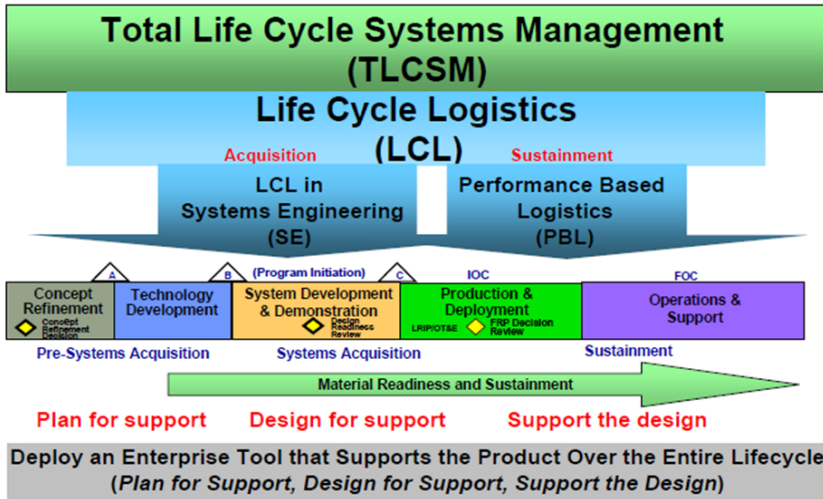
2. 한국군 SCM 적용 방안

- OUTSOURCING

국방부는 국방개혁의 하나로 “Outsourcing”이란 이름하에 보급창 민영화, 정비창민영화, MRO의 구현을 추진 중에 있다. 이것은 군수의 개혁이며 SCM이 절대적으로 연계되는 과제이다. 특히 보급창의 민영화는 SCM의 Procurement 및 Transportation의 과제이며 정비창의 민영화는 MRO에 연계되는 군수정비의 핵심이다.

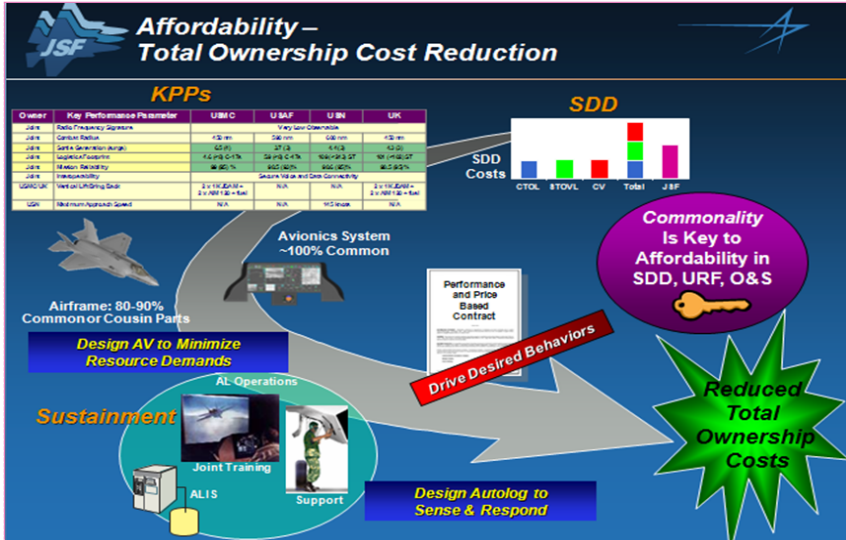
- PBL

국방부는 TLCSM(Total Life Cycle Systems Management)의 총수명주기 체계관리를 추구하고 있다. 특히 무기체계의 개발과 국외도입 무기체계의 적정 운영유지를 위하여 최적운영과 비용절감을 목표로 하고 있다. 국내 개발에 있어서는 개발에서부터 운영유지를 고려한 무기체계를 개발함과 동시에 국내 및 수출에 따른 PBL(Performance Based Logistic)를 고려하고 있다. 대표적인 사례로 T-50의 사례이다. T-50의 발전은 FA-50에 연계되고 정비를 공군이 하는 방안과 민간업체가 하는 방안의 비용대 효과를 고려하는 상황에 있다. 또한 인도네시아 및 여러 나라에 수출시 PBL이 대두 될 것이다. 국외 직구매 무기체계로서는 잠수함과 더불어 F-15K의 PBL에 대한 비용대 효과 분석이 절실하다. 이런 과제의 해결은 SCM의 적정소요에 따른 수리부속의 Procurement로서 적정 Supplier와 Inventory관리 등의 문제를 해결할 수 있어야한다. 즉 SCM의 계획 및 구현에 대한 최적해를 제공 할 수 있는 능력이 요구된다. 아래 그림은 TLCSM, ILS, SE, PBL의 연계도를 보여 준다.



- 비용절감 및 R-TOC (Reduction-Total Ownership Cost)

국방물자의 적정획득이 비용 절감의 핵심이다. 적정 소요에 따른 적정 Procurement, Supplier 인지, 재고, 재고관리, 등은 무기체계 개발의 구매 재료비를 10-20% 절감 할 수 있는 최적 대안이다. 이것은 SCM의 초반 부인 Procurement에서 해결되는 것이다. 또한 무기체계의 Sustainment 인 정비 및 수리에 있어서 Reverse SCM은 고객에게 최고의 만족을 제시 하고 총수명주기비용의 절감에 있어서 최적 대안이기도하다. 아래 그림은 TOC 수행에 대한 전체적인 절차를 보여주고 있다.



- SCM Hub 구축

국방부는 적정 획득을 고심하고 있다. 한 가지 방안은 국방 물류창고를 대한민국에 건설하는 것이다. 예로서 항공에 관련한 물자 HUB를 구축하는 것이다. 이것이 국방 SCM의 구현이며 국가 경쟁력을 높이는 방안이다.

- 최적화 기법 구축

SCM이 계획수립에 있어 SCOR(Supply Chain Operation Reference) 모델의 도입이 필요하고 SCM과 연계하여 Lean 6 sigma와 M&S 모델링을 결합한 최적화 기법이 지속 연구되고 구현되어야한다.

- 민간 물류의 국방적용

대한민국에는 현대글로벌비스, LG, 포스코 등의 대규모 물류회사가 있고 자동차, 선박, 반도체의 수출은 세계적 글로벌 능력을 갖추고 있다. 국방분야도 이들 민간 SCM 역량을 적용하여 항공 및 국방분야의 SCM 수준을 증가하여야한다. 미국의 SCM 기술을 적용하되 국가규모, 영토크기, 수송의

복잡성, 주문의 속도, 재고관리를 고려한 한국적 SCM이 요구된다.

- SCM 성과요소 구축

국방부, 각군, 방사청 등 주요 기관은 SCM의 성과를 Strategic, Operational, Tactical 수준에 의거 제기하여야한다. 대표적 미 공군의 SCM 성과관리는 아래표와 같다.

AIR FORCE SCM PERFORMANCE MEASURES

Performance Metrics	Level 1 (Strategic)	Level 2 (Operational)	Level 3 (Tactical)
Net Operating Results	X		
Deficiency Report	X		
MICAP Hours	X		
Customer Wait Time	X		X
MC Rates		X	X
TNMCS		X	X
TNMCM		X	X
System Availability	X	X	X
O&S Costs	X	X	X
Issue Effectiveness			X
Demand Forecast			X
Back Order Age			X
Cost of Goods Sold		X	X

Source: Ogden Air Logistics Center, 84th Combat Sustainment Wing, 11 July 2006

물론 이를 한국군에 적용하기 위해서는 각 기관의 임무에 부합하도록 성과관리 요소를 적절히 더하거나 제외시켜서 활용하여야 할 것이 요구된다. 결국 각 기관에 맞는 SCM의 적정 계획 설정이 중요할 뿐 아니라 전략에서 운영까지 공급에서 수요까지의 설정하는 것 역시 매우 중요하며 이를 측정하는 효과척도의 사례는 아래와 같다.

NAVAIRINST 4081.2A Performance Metrics	
Performance Outcomes	Metrics/Considerations
Operational Availability (Ao)	A(o) - (Under Full CLS Only) Readiness Mission Capable Rates Sortie Generation Rate Turn- Around-Times Surge Requirements Reduced Down Time
Operational Reliability	Sortie/Mission Completions Time On Wing Mean Time Between Failures (MTBF) MTBF Improvement No Fault Found/Reduction Elimination
Cost Per Unit Usage	Cost Per Flight Hour Annual FFP Cost (prorated by units) Obsolescence Management Attrition Replacement Sustaining Engineering/ECP Costs Total Ownership Cost (TOC)
Logistics Footprint	Maintenance Planning Reliability improvement Reduced Cannibalizations Support Equipment Training Publications Inventory Needs Staffing Levels
Logistics Response Time	Parts Availability First Pass Effectiveness Maintainability P,H,S&T Mean Logistics Down Time Supply Chain Management
Source: NAVAIR, 2004b	

제4장 결론

본 연구에서는 SCM에 대한 글로벌 현황 및 미군의 적용 사례를 중심으로 한국군에 대한 SCM 체계의 적용을 위한 여러 가지 방안을 제안하였으며 이들을 요약하면 다음과 같다.

- 1) 최근 한국 국방부의 군수개혁에 대한 의지가 매우 높은 상황이며 이러한 개혁정책을 뒷받침할 수 있는 수단의 하나로써 SCM이 제 역할을 수행할 수 있을 것이다.
- 2) 아웃소싱은 한국군의 군수개혁 정책에 핵심적인 과제이며 이를 추진함에

있어서 보급창 및 정비창 아웃소싱 문제는 보급절차 및 수송문제와 깊은 관련이 있다. 따라서 PBL 및 MRO 관련과제와 연계하여 추진함이 바람직할 것으로 판단된다.

- 3) PBL은 보다 효과적인 결과를 동반하기 위해서는 총 수명주기관리체계인 TLCSM과 연계하여 추진되어야 한다.
- 4) SCM을 통한 비용절감을 위해서는 TLCSM 과 연관성이 깊은 TOC 관점에서 연구 분석되어야 한다.
- 5) SCM을 추진함에 있어서 지속적인 지원보장을 위한 기초가 되는 공동군수 데이터 통합시스템을 포함한 SCM hub의 구축이 요구된다.
- 6) SCM 운용 최적화를 위한 기법의 연구노력은 계속되어야 한다. 그리고 연구결과의 최고수준 유지를 위하여 보다 많은 투자가 필요하다.
- 7) 마지막으로 구축된 SCM을 체계적으로 관리하고 통제하기 위해서는 성과를 계량적으로 명확하게 측정할 수 있는 측정수단이 필요하다. 이때 성과 관리 측정을 위한 단위는 계층별, 기관별로 특성을 고려하여 선정되어야 한다.

추가적으로 향후 군수물류체계 발전 및 SCM 관련 연구방향을 두 가지로 요약 제시한다.

첫째, 군수물류체계는 향후 반드시 국가차원의 물류체계와 연계하여 발전되어야 하며 이에 대한 추가적인 연구가 필요하다.

둘째, 향후 SCM의 실시간 통제 및 효과적인 관리를 위해서는 시뮬레이션 기법의 적용이 필요할 것이며, 이를 위한 시뮬레이션 모델구축에 대한 투자가 요구된다. 특히 상용물류 체계와는 달리 전사에는 군사작전의 군수품 요구량 및 위치가 수시로 변화할 수 있기 때문에 이러한 변화에 대해 신속하게 최적의 물류방안을 제시하기 위해서는 모의에 의한 시나리오 분석이 더욱 필요할 것으로 판단된다.

유의사항

1. 본 연구보고서 내용은 연구진의 개인적인 견해이며 소속 기관의 공식적인 견해가 아닙니다.
2. 본 연구보고서는 정책입안시 참고자료로만 활용하고 타 기관에 불필요한 자료유출을 삼가하여 주시기 바랍니다.

국제공동연구프로젝트

인쇄일	2011년 11월
발행일	2011년 11월
발간등록번호	11-290412-000077-10
편집 및 발행	국방대학교 국가안전보장문제연구소 TEL (02) 300-4213
인쇄	경성문화사 TEL (02) 786-2999

〈무단복사금지·한정배부〉

