LOGISTICS TRANSFORMATION:
NEXT STEPS TO AGILE
SUPPLY CHAIN INTEGRATION

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July 2005

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Executive Summary

Numerous studies have recommended that the Department of Defense apply best commercial practices to logistics operations as a long-term solution to its inventory management weaknesses. However, there is no consensus in the private sector as to what commercial practices are best for supply chain management of very large, multi-company collaborative enterprises. In fact, many of the new supply chain systems that were built, failed due to the usual culprits of speculative requirements, immature technologies, seriously inadequate budgets and project scopes, and the sheer brute force required for most legacy integrations.

Commercial suppliers can perform useful roles in the Department of Defense and Army transformation efforts: as a source of materiel and third-party logistics suppliers for extending the supply chain beyond the organic base, as a current and future knowledge source for at least some best practices and lessons learned, and as a source of off-the-shelf software solutions for supply chain transformation.

The Department of Defense's and, more specifically, the Army's enterprise resource planning implementation may still face unresolved issues in private sector supply chain management. It faces numerous risks: company risk, global market risk, and learning curve risk. To manage company risk, the Supply Chain Operations Reference Model is used for supply chain performance measurement of early-maturity organizations. More mature supply chain management practices include demand-driven supply networks, global sources, vendor-managed inventory, and more integrated contract management. Global market risks include no budget, no return on investment, no trust, no reliability and no security. Learning curve risk involves not applying lessons learned. The Army's transformational initiatives are far more demanding than most commercial supply chain improvement efforts.

The initial draft of this report was written by Christine Brim.

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The Challenge: Even though you have the transformational roadmap, you still need to ask for directions.

Managers in both the military and commercial sectors are trying to understand why it is difficult to transform supply chains into the cross-industry, worldwide, enterprise collaborations. A lack of knowledge of best practices is not the problem; logistics experts in government and commercial enterprises know what ought to be done. Supply chain managers may have, in fact, an excess of imposed vision. Aggressive transformational roadmaps exhort employees to think "outside the box" and to achieve total visibility, seamless integration, the "perfect order," 100 percent performance metrics, demand-driven inventory delivered everywhere, all in a world presented without economic trade-offs or opportunity costs. Enterprise integration has a unique ability to bring out the utopian side of executive personalities in both the public and private sectors.

If anything, beleaguered managers, laboring to transform legacy supply chains, experience an overload of knowledge of best practices: they are inundated with weekly conferences, one-off lessons-learned, lists of the 10 best practices, and futurist agendas. Yet, private sector budgets to implement all that enterprise integration have stayed flat or fallen, creating a spectacular gap between investor and executive expectations on the one hand, and organizational performance on the other.

Worse, many of the new supply chain systems failed, due to the usual culprits of speculative requirements, immature technologies, seriously inadequate budgets and project scopes, and the sheer brute force required for most legacy integrations. Problems occurred in both civilian and military enterprise integrations. In the January 2005 "High Risk Series" report, the Government Accountability Office (GAO) identified Department of Defense (DoD) supply chain management as one of 25 government activities requiring broad-based transformation.[1] The GAO had made similar findings in 2003, in 1990, and in earlier decades. This most recent report found that Operation Iraqi Freedom (OIF) had encountered supply backlogs, losses, delays, shortages of critical spares, cannibalized equipment and accounting discrepancies totaling over $1.2 billion. Both GAO and DoD have identified weaknesses across the entire supply chain, including distribution, inventory visibility, critical spare parts management, inventory in excess of current operating requirements, the lack of integrated information management systems, and "*a failure to apply lessons-learned*."

In the earlier 2003 report, the GAO had recommended that DoD apply best commercial practices to logistics operations as a long-term solution to its inventory management weaknesses. Many analysts hold up private sector best practices as the highest of standards – the Holy Grail of Wal-Mart efficiencies – towards which laggard government logisticians must strive. There is some merit in this; the recommendation that Wal-Mart run its inventory management like the Army's supply lines in OIF has not been heard.

But the assumption that the private sector always does it better can lead to risky policies, and prevent effective private/public partnerships in supply chain transformation over the long run. It overestimates private sector efficiencies and cost savings in supply chain management, and undervalues the realistic transitional progress being made in the public sector, where the change process is both evolutionary and revolutionary in nature.[2]

Public and private supply chain managers have much in common. Private sector supply chain integration project failures are also widespread, especially in large enterprise integrations of multiple organizations. Case studies of troubled supply chain projects involve smart, well-capitalized companies: Nike, Cisco, and nearly half of the 200 companies responding to a 2002 Booz Allen Hamilton survey on supply chain project difficulties.[3] Yet, there are other companies, such as UPS, that have demonstrated success in global supply chain leadership while dealing with similar demands and conditions. Commercial supply chain systems have been stressed by unprecedented global growth rates, competition, rapid development of new architectures and integrative technologies, reduced information technology (IT) budgets, staff cuts and corporate consolidations. Under even greater duress, military logistics systems, stressed by recent wars, have resulted in "a lean supply chain without the benefit of either an improved distribution system or an enhanced information system."[4]

Stresses create learning. Utopianism is on its way out; a realistic, evolutionary, step-by-step progress towards transformation is in. An infrastructure is emerging for turning supply chain lessons into supply chain processes. Just as these competitive pressures have pushed some corporations to try to align processes and architectures, a rough consensus is emerging on the need to integrate disparate military logistics architectures (DoD, Joint, and the Services). Proposals such as the Joint Theater Logistics Command create operational pressures to align processes and architectures within the public sector. [5] Public and private supply chain enterprises are moving towards a Service-Oriented Architecture (SOA) as a way to integrate both legacy and future systems and partners. Both are beginning to focus more on business processes rather than functional divisions, and using a common reference model for supply chain operations. Collaborative system technologies, especially web services, may soon reach the tipping point where total lifecycle costs begin to reduce. A key collaboration to observe for all these trends is the partnership between the Army and SAP for the SAP Netweaver support to the Single Army Logistics Enterprise (SALE).[6]

Yet the gap identified by the GAO still exists: the failure to apply lessons-learned in supply chain integration. Most organizations are at the beginning of this learning curve.

The Solution: A public/private effort to map the route from lessons-learned to implemented business processes.

Given the new realism of supply chain managers in and out of the government, what are the next steps to achieve a better success rate? A joint public/private effort is needed, to identify effective change management methods for supply chains in large enterprises. If both public and private sector supply chain managers are having common problems

building enterprise-wide collaborations, they should look for root causes of those problems.

Any initiative to improve the application of lessons learned should work closely with ongoing supply chain integration efforts already underway in the Army, to help translate between the "lessons learned" community and the SALE systems development team. Key conflicts in values among members of a supply chain may be identified in the process of these discussions, and serve as useful inputs to the system developers. The end products may be inputs for rapid implementation – use cases, contractual terms, business rules, process maps and descriptions, models and metrics – as well as broader understandings of organizational behavior and political disincentives to change.

The effort should address both best practices and lessons-learned, as both are ways to improve supply chain performance. A traditional distinction takes an organizational view: best practices are what other successful organizations do, and lessons-learned are what happen when we fail to apply those best practices – or more interestingly, when we apply them but they do not fit our situation. Another view is more dynamic, seeing today's best practice inevitably being overtaken by events, and becoming tomorrow's sadder but wiser learned-lesson. Both are at high risk for being known, but neglected.

In the Army, many lessons-learned are not reported, those that are reported often do not trigger corrective actions across supply chains, and the corrective actions that do occur are not integrated as business processes within Enterprise Resource Planning (ERP) technologies. Too often, supply chain lessons-learned, after-action reviews and peer-reviewed best practices are stored on the shelf or lost in a document-based database. The traditional approach to distributing knowledge and implementing new ideas is still the doctrinal publication model, which requires a 3-5 year lead-time between learning and publication. As an example, Army Field Manual 4-0 barely mentions logistics transformation.[7] The Center for Army Lessons Learned (CALL) has a highly effective collection methodology to populate their CALLCOMS database, but the paradigm is that of a traditional document library with strong search and retrieval tools. CALL knowledge is still separated from the business process, until someone has a question and begins reading documents to develop a one-off answer. CALL provides a powerful knowledge repository for eventual "knowledge reachback"[8] from the campaign theatre, but they do not provide the necessary structured link between learning and enterprise-wide business processes. It is not in their current mission.

However, process-oriented information technology has moved beyond this paradigm, particularly in object-oriented knowledge-based systems. Knowledge (what ought to be done) can be encapsulated within the related business process (how it should be done), and within business analytics (how it was done, and where it needs to improve). The winning organization is the one that turns supply chain lessons into applicable business processes, faster than its competitors. The goal is to shorten the "knowledge chain," to implement a prioritized set of lessons learned rapidly as business processes.

What are key dimensions of Supply Chain Lessons-Learned and Best Practices?

In order to apply best practices and lessons-learned more effectively, a public/private effort needs to be able to categorize and rank them. Supply chain best practices and lessons can be characterized along many dimensions. Six supply chain best practices are summarized here, starting with a purely military dimension:

- What type of warfare does the supply chain best practice support?
- Where does the best practice/lesson-learned fit in the Supply Chain Operations Reference (SCOR) model, both in process description and in the level of that process?
- What is the supply chain integration maturity level of the best practice/lesson-learned? Is it for early-stage integration efforts, or for more advanced, enterprise-wide collaboration?
- How does the best practice/lesson-learned weight the three clusters of cross-industry performance metrics identified by the MIT Supply Chain 2020 project?
- What are the external risks, in the U.S. and in the world, that could limit the application of this best practice/lesson-learned? What are known methods for mitigating these risks?
- How ready is this best practice/lesson-learned to be translated into a business process?

1. What type of warfare does the supply chain best practice support?

The Quadrennial Defense Review defines four types of warfare – traditional, irregular, catastrophic and disruptive – each of which will have unique supply chain support requirements. For example, a best practice for traditional warfare may have limited utility against an irregular insurgency; materiel, skillsets, tempo, and asset visibility could all be very different. The Army may currently have an overmatch of lessons-learned for traditional warfare, and a real gap in lessons-learned for supplying irregular warfare. Catastrophic and disruptive warfare may involve large numbers of organizations outside of the traditional military. Logistical best practices may need to be proactively sought in irregular, catastrophic and disruptive warfare.

2. Where does the best practice/lesson-learned fit in the SCOR model, both in process description and in the level of that process?

A common, cross-industry reference model of the entire supply chain enterprise is needed to capture, taxonomize and store lessons-learned and best practices as "use cases." The model used in the private sector, and to a lesser extent by the public sector, is the Supply Chain Council's SCOR.

In the late 1990s, the Supply Chain Council developed SCOR as a cross-industry process reference model designed to describe, measure and analyze supply chain configurations. SCOR contains standard supply chain definitions, metrics, best practices, and references to technologies to enable supply chain improvements. The SCOR model acts as a high-

level common reference for supply chain management business process reengineering, enterprise contract management, supply chain architectures, data models, XML or semantic web schema, enterprise business analytics, and supply chain management simulations.[9] The scope of SCOR process types spans five sequential supply chain categories: plan, source, make, deliver and return (reverse logistics). The SCOR contains three additional levels of detail: the second level for supply chain management configuration using seventeen core process categories, the third level for process elements, and a fourth for performance.

Related reference models include the Design-Chain Operations Reference Model for product design, and the Customer-Chain Operations Reference Model for customer relationship management, each adding more business processes at the furthest starting and ending extremes of the supply chain. For example, the Army's ongoing problem with limiting the number of types of batteries is best dealt with at the design-chain stage (design for fewer battery types), rather than at the supply chain stage (figure out how to supply many different battery types).

The first wave of supply chain improvements, in the 1990s, was realized within single companies, and those based on the SCOR had significantly better results. The manufacturing consulting firm Pittiglio Rabin Todd & McGrath conducted the Integrated Supply Chain Benchmarking Study,[10] to examine the impact of the SCOR benchmarking model on supply chain performance in high-technology companies. The study compared performance metrics for companies using fundamental supply chain best practices, as defined by the SCOR model, with performance metrics for industry-wide median performance. Initial results of the study are shown in Table 1.

Table 1: Integrated Supply Chain Benchmarking Study Performance Metrics

	Performance metric	**Companies using SCM best practices**	**Industry median for companies**
1.	Orders filled from inventory	95 percent	86 percent
2.	Annual inventory turns	6.9	2.4
3.	Average cash-to-cash cycle time, in days	28	71
4.	Average number of days holding inventory	29	64
5.	Supply-chain costs as percentage of revenue	4.6 percent	9.5 percent

These metrics are also the measures employed most often by supply chain executives. According to a recent survey conducted by *Optimize*,[11] nearly 70 percent of participants measure reductions in operations costs, 62 percent measure the rate of accurate shipments to and from customers and suppliers, and 60 percent track the rate of timely shipments to and from customers and suppliers. But only 47 percent evaluate improvements in logistics capabilities, only 36 percent evaluate demand forecasting, and a scant 28 percent evaluate supplier performance. Almost one-fourth simply do not measure supply chain

management effectiveness in any way. Such companies present risks to any supply chain in which they are a member.

Most companies are not using today's newer transformational best practices in supply chain management. In the *Optimize* survey, 58 percent had either inconsistent or poor visibility throughout their supply chains, unable to track some or all products. When asked whether or not they collaborated by sharing information with suppliers, 61 percent of the same companies stated that they either never, rarely or only occasionally shared information across the supply chain. A full 85 percent stated that they did not have full supply chain systems integration with suppliers, and almost one third lacked any integration with suppliers.

3. What is the supply chain management maturity level of the best practice/lesson-learned? Is it for early-stage integration efforts, or for more advanced, enterprise-wide collaboration?

Modeled on the Capability Maturity Model (CMM), the Supply Chain Management Maturity Model (SCM3) is an emerging concept not yet standardized within the supply chain management industry. Supply chain management processes have lifecycles within organizations, and as they mature, they can be more explicitly defined, managed, measured and controlled. A SCM3 defines the stages of this process lifecycle. Two approaches to a SCM3 are outlined here.

The first approach is linear, pragmatic and tactical, with a focus on continuous improvement and measurable performance. This SCM3 has five levels shown in Table 2, starting from the least mature (Adhoc Level 1) and progressing to the most mature (Extended Level 5):

Table 2: Supply Chain Management Maturity Model: CMM Type	
Level 1: Adhoc	The supply chain practices are unstructured and ill defined. Jobs and organizational structures are not based upon horizontal supply chain processes. Targets, if defined, are often missed. SCM costs are high.
Level 2: Defined	Basic SCM processes are defined and documented. Jobs and organizational basically remain traditional. Targets are defined but still missed more often than not. Overcoming the functional silos takes considerable effort due to boundary concerns and competing goals. SCM costs remain high.
Level 3: Linked	Broad SCM jobs and structures are put in place outside and on top of traditional functions. Cooperation between intra-company functions, vendors and customers reaches horizontally across the supply chain. Targets are often achieved. Continuous improvement efforts take shape. SCM costs begin decreasing.
Level 4: Integrated	The company, its vendors and suppliers, take cooperation to the process level. Organizational structures and jobs are based on SCM procedures. Advanced SCM practices, such as collaborative forecasting and planning with customers and suppliers, take shape.

	Process performance becomes very predictable and targets are reliably achieved. SCM costs are dramatically reduced.
Level 5: Extended	Competition is based upon multi-firm supply chains. Collaboration between legal entities is routine. Multi-firm SCM teams with common processes, goals and broad authority take shape. A horizontal, customer-focused, collaborative culture is in place. Process performance and reliability of the extended system are measured and joint investments in improving the system are shared, as are the returns.

An alternative SCM3 approach is a variation on the Boston Consulting Group's Growth Share Matrix. Compared to the CMM-type SCM3, this Matrix approach is less focused on continuous improvement and more on strategic goals and investments. Using the SCM3 Matrix, an organization can assess current maturity levels, and end up with a portfolio of best practices efforts representing each of the four quadrants.

Table 3: Supply Chain Management Maturity Model (SCM3): Bearing Point Matrix

BUSINESS CRITICALITY----------→	**2B. Operational Excellence** • Materials management information system application fully integrated within the enterprise resource planning system • Coordinated business processes • Numerous points of control and decision-making	**3. Breakthrough Strategies: Strategic Sourcing Organization** Sustainable systems of: • Supply chain spending controls • Decision support • Maximal technology usage • Adaptive Demand Networks replace Supply Chains[12] • Sense & Respond replaces ERP/ERM[13]
	1. Fundamentals • Limited or fragmented technology • Contracts and procurement manually maintained • Inadequate reporting	**2A. Key Investments in Innovation** • Contract management • Data cleansing • Enhanced budgetary/reporting and decision support
	INNOVATION ----------→	

Using the concepts from all SCM3 approaches, most U.S. companies are not yet out of Level 1/Level 2 status – or are barely moving into quadrants 2A and 2B in the SCM3 Matrix. According to the *Optimize* survey, a majority of companies use only basic technologies – most originally developed in the 1980s and 1990s – for supply chain management. These include traditional order-processing and -fulfillment software (75 percent), inventory-management software (68 percent), electronic data interchange (68 percent), and ERP (62 percent). Technologies associated with supply chain management best practices are used by, at best, about a third of the survey respondents: business intelligence (38 percent), online collaboration (36 percent), business-performance

management (36 percent), logistics planning and scheduling software (28 percent), collaborative product-information management software (21 percent), and Radio Frequency Identification (RFID) (11 percent). The costs and risks of adopting best practices in supply chain management are significant, and most U.S. suppliers are at lower, fundamental levels of any type of SCM3.

4. How should we apply the three clusters of performance metrics identified by the MIT Supply Chain 2020 project?

The MIT Supply Chain 2020 project[14] was started less than a year ago, both to understand successful supply chains, and to raise awareness of risks to supply chain integration that had previously been hidden by excessive optimism over the pace of change. The 2020 project has two industry advisory groups that meet several times a year to develop a case-base of successful business practices and future scenarios. The scenarios identify macro factors such as external forces outside the control of supply chains, and internal forces that can be leveraged for better performance. External forces include global economics, geopolitics, trade regulations, technologies, labor laws, Green laws, demand trends and competitive landscapes. Internal forces include production and distribution technologies, information technologies, human capital, new materials and physical infrastructure.

The 2020 project developed three clusters of performance metrics, based on advisory group practices across multiple industries:

- Customer-focused metrics (effectiveness): quality, on-time delivery, order quality, "perfect order"
- Efficiency metrics: supply chain costs, metrics derived from costs or margins, costs of touches or materials
- Asset utilization metrics: focused on economies of scale, such as plant utilization, inventory turns, cash-to-cash cycles

The importance placed on each of these metric types will vary by the industry of the supply chain. For example, applying a best practice based on an efficiency metric to a matching organization that also values efficiency is more likely to succeed. Applying that same best practice to an organization that instead values effectiveness (customer-focused), will encounter barriers.

5. What are the external risks, in the U.S. and in the world, that could limit the application of this best practice/lesson-learned? What are known methods for mitigating these risks?

The MIT Supply Chain 2020 project has identified over 35 global risk factors, to generate future scenarios for supply chains. Summary discussions of eight types of external risk follow: the first five risks result from U.S. political and economic conditions, and the final three are due to global conditions.

5.1. Lack of collaboration. There are a number of barriers to collaboration among companies in a supply chain. This may well involve individual players having to change their existing policies and procedures. It will also involve a greater degree of openness - possibly involving open-book accounting and greater shared decision-making. Recent surveys indicate that companies in 2004 are not willing to collaborate. Collaboration with willing partners to integrate the supply chain remains inconceivable for many organizations that hold to the traditional adversarial business model.[15] The costs of operating the new collaborative supply chain are also high. Agility-based collaboration increases the number of processes that can go wrong in supplier management in the transforming – not yet transformed – supply network. Risks include supply chain members who lack information, create or suffer long lead times, offer low reliability and lack technical ability for electronic integration.[16]

Some successes in enterprise-wide collaboration have occurred as well, and various models for change management have been suggested over the past five years, to encourage managers to think in terms of organizational and business process change, not just technological "black box" change. For example, Booz Allen Hamilton's "Federated Supply Chain" and "Advantaged Supplier Network" models emphasize the need for companies to negotiate common business goals and agree on shared business processes before beginning any transactional links for actual data sharing – and then to integrate systems as loosely as possible, in order to stay adaptable.

5.2 The Radio Frequency Identification Risk. Capital risks are greatest when Return on Investment (ROI) is potentially negative. The immediate example of a supply chain management investment required by a market leader is Wal-Mart's requirement for passive Electronic Product Code Radio Frequency Identification (EPC RFID) implementation by suppliers. RFID is the clearest case of a low-to-no ROI business application for many supply network members.[17] Wal-Mart has required its top 100 suppliers to apply passive EPC standard RFID tags to cases and pallets by January 2005, although it appears that the deadlines are being extended on a case-by-case basis throughout the year. The RFID business case benefits market-dominator Wal-Mart, but not its suppliers.

Passive RFID is particularly costly for manufacturers and distributors selling to retailers, given its technological shortcomings,[18] current lack of interoperability across vendor products, and delayed or negative ROI. RFID is still an immature technology, and the actual RFID tags and readers are often unreliable, creating a high failure rate. Possible savings include warehouse efficiencies, less inventory, improved visibility and traceability; however, those savings are projected several years at best after RFID implementation. Costs may drop more rapidly with offerings from the increasingly competitive group of RFID integrators, including Sun Microsystems, Hewlett Packard, IBM, Oracle, SAP and Microsoft. By 2007, industries with pricing power and regulatory drivers, like pharmaceuticals, may push RFID down to the unit pack level (below the cases and pallets level). DoD policy now requires all manufacturers and suppliers with have new contracts to provide RFID tags by January 2007 on all individual cases, all cases packaged within palletized unit loads, all pallets, and all unit packs for unique

identification items, as well as commodities shipped to any DoD location. Ironically, Siemens just announced plans to replace silicon RFID tags with polymer tags, which could lower the tag price to below the 5-cent threshold required for suppliers to break even – by 2008, a full year after all suppliers with new contracts will have to provide more expensive tags for DoD.[19]

On the other hand, Wal-Mart[20] is also working to mitigate risks in demand forecasting for suppliers, through business processes such as Vendor-Managed Inventory. VMI is now a primary resource to improve forecasting accuracy in Demand-Driven Supply Networks (DDSNs). Improved analytics giving better probabilistic forecasts underlie most supply chain management measurable improvements. Wal-Mart's 2004 two-tier analytics offering to suppliers shows actual customer demand at the store and Supercenter level of granularity. This is an improvement over most VMI programs that only show replenishment demand at the distribution center level. The Wal-Mart demand stream is the most important global test-bed for new forecasting tools in the private sector.

5.3 Contractual Risks. Visibility into contracts and rate of spending against them yields immediate benefits, especially in dynamic, rapidly changing supply networks. [21] Without that visibility, significant risks of supplier non-compliance are more likely in complex spending categories such as freight, benefits, Maintenance, Repair and Operations (MRO), real estate, direct materials, security, disaster recovery, etc. Actual contract billing data, and performance-against-contract compliance data, is crucial for process management and accounts payable. Contract visibility needs to be a constant process, not an occasional discrete activity, and demand driven.

5.4 Inadequate Security. Over 80 percent of global freight moves by sea, but most U.S. ports are privately owned and operated with only voluntary responsibility for security and contingency plans. [22] Security programs like the Customs-Trade Partnership Against Terrorism (C-TPAT) and the Free and Secure Trade, which require detailed shipping information, may ultimately improve the channel-clearing of goods across borders and improve processes, even if they do little to improve security. In spite of security standardization initiatives like C-TPAT and Operation Safe Commerce, ports still each have different requirements for shippers, increasing costs of security compliance when it occurs at all. Programs like C-TPAT rely on companies voluntarily self-assessing and reporting security procedures, and a one-time inspection, to determine that its cargo is low-risk. Most other voluntary initiatives have included only leading companies with the technological capability to participate, while the majority of companies are not participating to date.

Federal and state homeland security investments have not always prioritized shipping and port security, or supply chain security overall. Individual company best practices in security are meaningless without government-mandated minimum levels of security compliance from each member of the supply chain, including full inspection with wide deployments of X-ray inspection systems for all shipments in U.S. ports. At the moment, that government mandate does not exist, and the probability is high for terrorist attacks on extended global supply networks. If future security requirements do require visibility

and accountability across the supply chain, third-party logistics suppliers like UPS may be positioned to provide worldwide security infrastructure.

5.5 Fragile Space-based Communications. Global supply networks rely on space-based, wireless and landline telecommunications for demand-driven inputs and responses. However, space-based communications assets have been seriously eroded over the last two decades. Both the U.S. military and civil orbital infrastructures are increasingly fragile. Robust capital investments in civilian space-based assets, as well as military space assets, are needed for the success of global supply chain networks. Those U.S. investments are currently lagging. By contrast, foreign investments in space-based assets in Europe and the Pacific Rim will become increasingly important for global supply network communications.

5.6 Fewer global controls over financial and human capital assets. The global decentralization of knowledge capital (know-who, know-what and know-how) is being driven by new capital flows to create a decentralized global strategic industrial base, available to the highest bidder.[23] Managers now compete to be the best integrators of expertise across nationalities, capital structures, enterprises and disciplines, with only ideology and religion as barriers to cooperation. U.S. infrastructure is being sold at fire-sale prices to foreign dollar-rich investors. For example, in the last two years, Chinese interests have bought the Asian undersea telecommunications assets – crucial to global supply chain communications - of Level 3, PSI-Net, Asian Global Crossing and Global Crossing.[24]

5.7 European Green laws influence depot siting and disposal costs. Disposal is increasingly costly due to environmental regulations, so refurbishing is often a better option. Within the year, the European Union's Restriction of Hazardous Substances legislation takes effect for six key materials, with more to come.[25] The costs of disposal may be a key variable in regional siting of depots and MRO facilities after 2005, with developing countries competing for MRO investments with more flexible environmental standards. Demand for MRO facilities may increase. Increasing variability in spare parts due to lack of integration between the design chain and the supply chain may result in requirements for excessive numbers of spares and repair technology.

5.8 Worldwide Market and Financial Rapid Growth Risks. Supply Chain investments compete with other capital needs. Available capital is tied up in inventory and distribution commitments, with little budget or management focus available to engage in risky changes to legacy systems. Capital shortfalls are prevalent in all industries facing unprecedented global demand for capital, goods and services. In 2004, basic supply chain services experienced growth at levels very difficult to manage.[26]

Companies are learning to forecast longer lead times, transportation costs and supply variability. Specific volume commitments are being made to carriers, in exchange for guaranteed capacity and service levels (with steep discounts in case of non-compliance). Globalization has made supply chains potentially more agile, but manufacturing delays are often turning agility to inertia. Transportation costs for U.S. manufacturers have

increased from 5 percent to 15 percent in the last year alone, as companies had to substitute air freight and traditional buffer stocks to compensate for manufacturing and shipping delays.[27] Companies who outsourced component manufacture to China, in particular, are finding production line failures, security delays, and port delays to be major risks. Producers are mitigating these risks by keeping U.S. production and assembly lines staffed as back-up for shipping-delay related gaps, in parallel to their outsourced production sources.

As third-party logistics and distribution providers also become over-taxed by global growth, some companies are investing in private fleets for supply chain members, with cost sharing. Companies are looking to third-party logistic (3PL) suppliers for integrated support across all geographies. Third-party logistics suppliers are currently in such demand that they are profiling the entire supply chains of companies they want to work with as customers; these customers are treated as collaborators in profit-sharing programs, in order to share costs and benefits of supply chain management transformation. [28]

However, 3PL suppliers are under great pressure themselves to drop prices. Costs of supply chain management integration and transformation in the 3PL suppliers are often not passed on to the ultimate customer due to global price competition across diverse industries. Customers are looking for price drops of 2-5 percent per year from 3PL providers, to justify the business case for outsourcing logistics. Since they cannot pass costs on to customers, 3PL suppliers are reducing profits and reinvestments for new product or service development. RFID implementation costs are particularly hitting 3PL profits over the next two to five years, but 3PL suppliers find high costs and low ROI from most IT investments. The impact on the 3PL industry is to force consolidation, creating fewer providers and abandonment of some niche markets.

The current trade-offs in global sourcing, balance regional contract manufacturing (as in China) against higher logistics costs and longer lead times. [29] Extended supply lines are congested due to inadequate capacity in U.S. ports, transportation lanes, rail and trucking routes. As the worst bottlenecks move from one region to another, supply networks must be able to take advantage of rapidly changing cost structures and changing lead times. To manage risk in global sourcing, companies are moving to integrated contract management and performance assessment software.[30] The cost of all this inventory-in-transit may be a more important decision variable in choosing a supplier than the low cost of contract manufacturing, even in a region close to the final consumer.

6. How ready is this best practice/lesson-learned to be translated into a business process?

Five dimensions are listed above for analyzing and categorizing best practices – type of warfare, SCOR element and level, maturity level, weighted performance metrics, and risk assessment. If all five are applied to a typical best practice or lesson-learned, supply chain managers will have a better understanding of whether that best practice is ready to be translated into a business process and implemented. If it can be clearly defined across

the dimensions, managers can then translate the best practice or lesson-learned into a structured, documented, business process and institutionalize it enterprise-wide.

A business process modeling tool is needed to translate all these ongoing lessons-learned and best practices into the language of business processes, so that they can be rapidly integrated into any enterprise integration system – for example, into the SALE. The Army is already using a widely accepted business process modeling technology, the Architecture of Integrated Information Systems (ARIS), as part of the Army's supply chain integration using the SAP Netweaver technology. ARIS is due to become fully embedded within the Netweaver software suite by mid-2005.

An understanding of the SALE integration is necessary to grasp the potential role of ARIS in modeling best practices as business processes. The SALE encompasses the ongoing integration of the Battle Command Sustainment and Support System, Global Combat Support System – Army (GCSS-A), Logistics Modernization Program, and Product Life-cycle Management (PLM+). SAP Netweaver web services is the off-the-shelf software solution for SALE.

The scope of this enterprise integration exceeds previous ERP implementations. Just the GCSS-A rollout alone will allow more than 135,000 users to view complete logistics management information and make timely, data-driven decisions. The initiative will integrate and streamline supply chain operations across a single logistics enterprise. The system will replace 14 standard Army mission information systems, including several thousand different legacy applications worldwide, within the SALE architecture. SALE and Netweaver will link the applications running at GCSS with those running at the Army's Logistics Modernization Program. The two systems will integrate through a hub called PLM+. This is a far-reaching implementation environment for any applied best practice or lesson-learned.

The ARIS architecture and business process repository requires documentation and agreement among process owners before the business process can be configured. When an object in that repository is modified, the effects are reflected throughout the enterprise in all views: business process, function, data, organization and output. ARIS aligns completely with the DoD C4ISR Architecture Framework. Within Netweaver, the event manager function shows how well the supply chain is functioning. The information is stored and managed within the business warehouse. The performance management system stores best practices information such as those developed by the SCOR model, against which the system can monitor how well internal organization or cross-organization processes are performing.

Conclusion

The next stage in Army supply integration is well underway with the SALE program. Joint private sector efforts to share best practices and lessons-learned are also ongoing at the Supply Chain Council with the SCOR model, and within the MIT Supply Chain 2020

project. But the links need to be created between these programs, and the ever-growing inventory of supply chain lessons-learned. These links between knowledge and implementation could evolve as part of the SALE requirements process. They could develop if the CALL mission were broadened to include modeling lessons-learned as business processes, to create use-cases for the SALE development. And they could be "jump-started" in a selective effort by a public/private project, modeled on and complementary to the purely private sector 2020 project. The long-term goal is to dis-intermediate knowledge itself as much as possible, and to enable the supply chain manager to adapt business processes rapidly and effectively.

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