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A Primer on Supply Chain Management

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I. Overview

Over the years, the disciplines of logistics and operations management have evolved, overlapped, and risen in importance within the corporate world. During this process, many new concepts have emerged. Some of these ideas, like fashion fads, disappeared quickly. Other approaches demonstrated their merit and formed the basis of today's leading edge approaches used by such companies as Hewlett Packard [5].

Currently, the principles of supply chain management are sweeping through American industry, causing radical changes in the way companies operate. Many definitions abound for the terms "supply chain" because supply chain management actually encompasses a loose set of guiding principles, as opposed to a rigid discipline. Furthermore, these guiding principles continue to evolve.

Hau Lee and Corey Billington defined the supply chain as "a network of facilities that procure raw materials, transform them into intermediate goods and then final products, and deliver the products to customers through a distribution system."[5] I prefer a broader definition: "The supply chain encompasses all of those activities associated with moving goods from the raw materials stage through to the end user." [7] Under this definition, the supply chain includes "sourcing, procurement, production scheduling, order processing, inventory management, transportation, customer services, and manufacturing." [7]

Once the supply chain concept is clarified, we see that the supply chain management approach seeks to manipulate and optimize the continuous string of processes within the supply chain. Historically, these processes were rigidly controlled with firm boundaries between functions. The new approach takes a *holistic* view of the supply chain, ignoring functional boundaries to pursue advancement of the overall company goals. Ultimately, supply chain managers seek to create a seamless process, **even across the boundaries of the enterprise.** [7] This attempt to coordinate activities outside of the organization constitutes the most important innovation of supply chain management.

The potential payoffs of improved supply chain performance dwarf the efforts expended. A.T. Kearny estimates that inefficiencies exist in most supply chains of up to 25% of total operating costs.[7] When compared to typical profit margins of only three to four percent, it becomes easy to see how small improvements in supply chain efficiency can result in large profit gains.

II. Evolution of Key Concepts

The evolution of current supply chain management principles occurred over three stages. The first stage occurred roughly in the 1960's. This period's managers tended to use a "push" approach towards the marketplace and focused on the physical distribution of finished goods. Operating within highly regulated environments, traffic managers concentrated on tariffs and the regulatory requirements of moving outbound freight. [7] Managers did not view quality control as an integral logistics function. Quality control efforts rarely extended beyond optimum receiving inspection techniques. While defective

goods were routinely rejected or reworked, no systematic effort was expended in order to address the underlying causes of poor quality.[6]

The second significant stage took place in the mid to late 1970's. The beginnings of deregulation forced companies to seek ways of improving their competitive positions. They sought methods of improving integration within the enterprise. Computer technology began to emerge as a practical and affordable business tool. Thus, management information systems (MIS), once utilized only in financial matters, began to find applications in other areas.[7] Important and effective materials management methods such as materials requirements planning (MRP) and electronic data interchange (EDI) were developed. [6]

During this period, logistics concepts broadened to include all internal material flows, not just physical distribution. This view led to an increased use of vertical integration. Thus, the external factors of production were brought into the realm of internal material flow manipulation.[6]

Eventually, wholesale vertical integration led to large, unresponsive conglomerations with large excess capacity.[6] The problems associated with this approach inspired the next step in the evolutionary process of supply chain management.

The current stage of innovation started in the early 1980's. As a backlash to the drawbacks of conglomeration, companies shed activities unrelated to their core businesses. However, managers did not want to sacrifice the lines of communication built through vertical integration. The tool used to maintain effective communication as internal suppliers became external suppliers is information technology. Thus, companies are reaching a point where they can operate lean and concentrate on core disciplines, yet still

integrate efforts with outside entities. The goal they strive for is a seamless symbiotic relationship mutually beneficial to all parties involved. This outcome stands in stark contrast to the adversarial relationships created in stage one.

The integration of quality control efforts constitutes one of the primary goals of this type of relationship. Companies who sought to utilize continuous improvement processes innovated in Japan found that their success depended upon the cooperation of their suppliers. Eventually, companies who coordinated efforts with their suppliers approached a "zero defects" standard. At that point, product quality rises from a competitive advantage to a barrier to entry into the market.[6]

III. Key Concepts

A company which pursues supply chain management seeks to reach a point of total integration without utilizing vertical integration. Managers want to experience a free flow of information in two directions along the chain, including both suppliers and customers.

The most vital tool in making this approach work is information technology. As Francis Quinn states, "Information technology is not a functional adjunct, it is the enabler, facilitator, the linkage that connects the various components and partners of the supply chain into an integrated whole."[7]

What drives activities within the supply chain? During the 1960's "push era," companies attempted to pre-determine consumption levels and force the results down the supply chain. Modern supply chain management is demand driven. The consumers communicate their preferences for quality, price, delivery, etc. to the supply chain. In

turn, the supply chain utilizes information technology in order to coordinate efforts to fulfill the consumers' desires.

In this type of environment, "speed-to-market" techniques become critical. Perhaps the most common of these approaches is just-in-time (JIT). This approach starts with zero defects tolerance and also includes [6]:

- zero stocks
- zero delivery time
- zero breakdowns
- zero paperwork
- zero material waste
- zero on-the-job accidents
- zero capability waste

Achievement of such exacting standards depends upon close supplier integration facilitated by information technology. It also implies decreasing the number of suppliers to an elite corps.[6]

Companies must also utilize benchmarking and continuous improvement techniques in order to achieve JIT standards. A company benchmarks its current position by quantitative measures like defects per thousand units or days to delivery. Next, concurrent engineering methods explore ways to improve upon this benchmarked standard. As old standards are surpassed, they become new benchmarks to improve upon. The improvement process becomes continuous and must involve the entire supply chain in order to realize peak success.[6]

Supply chain management, as a formal approach, continues to progress. Many of the key parameters have only received loose definitions. However, David Anderson, Frank Britt, and Donavon Favre have articulated their version of the key principles involved in successful supply chain management efforts. Their approach has become widely accepted. Most of their Seven Principles of Supply Chain Management are self explanatory, but some require elaboration [1]:

The Seven Principles of Supply Chain Management

1. **Segment customers based upon service needs**.
2. **Customize the logistics network to the service requirements and profitability of customer segments.** Thus, a multi-level logistics system evolves, instead of "one-size-fits-all" logistics.
3. **Listen to market signals and align planning accordingly across the supply chain.**
4. **Differentiate products closer to the customer and speed conversion across the supply chain.** Utilize standardized product platforms in the earliest stages and delay customizing the products until the last stages of the supply chain. Thus, small changes in customer preferences or changes in demand projections for individual products have little impact on operations.
5. **Strategically manage the sources of supply to reduce the total cost owning materials and services.** This principle depends upon the successful utilization of information technology in order to coordinate activities with suppliers.
6. **Develop a supply chain-wide technology strategy that supports multiple levels of decision making and gives a clear view of the flow of products, services, and**

information. Without such a strategy, it becomes unlikely that members of the supply chain can adequately integrate their information technology systems.

7. **Adapt channel-spanning performance measures to gauge collective success in reaching the end user effectively and efficiently.** This principle incorporates the concepts of benchmarking and continuous improvement mentioned earlier.

They go on to further divide the information flow needs into three categories [1]:

1. Routine, day-to-day transactions
2. Mid-term planning and decision making
3. Strategic, long-term analysis

Throughout the adoption of the supply chain management approach, the role of the logistics professional changes dramatically. Once, logisticians were relegated to cost minimization functions within physical distribution. They now must coordinate material and information flows at all levels, both inside and outside the organization. They participate in the continuous improvement process, integrate the activities of multiple entities, and facilitate critical information flows.[7] Logistics management has evolved from a technical skill into an interdisciplinary cross between an art and science.

IV. Payback

As previously stated, supply chain managers seek to create a seamless process, **even outside the boundaries of the enterprise.** [7] Similar in nature to the concept of continuous improvement, the implementation of supply chain management concepts results in an ongoing process of incremental refinements. The organization which

aggressively pursues this approach never reaches a definitive endpoint of "seamless integration." Instead, a steady stream of process improvements and innovations should result from these pursuits. Unfortunately, institutional inertia may present the greatest obstacle managers face in their efforts to improve their organizations.

After a company makes the commitment of time, resources, and willpower in order to implement this approach, what rewards should it expect? The statistics cited earlier showed the vast inefficiencies which currently pervade the supply chain and demonstrated the impact they can have upon profits.[7] Where can managers respect to find these inefficiencies? One area of possible gains emerges from lowered inventories.

Lowered inventory requirements under JIT often meant pushing inventory requirements back upon suppliers. This fact caused great friction among companies.[10] Under a supply chain management approach, a company does not simply transfer inventory responsibility to its suppliers. Instead, it works with suppliers to improve the responsiveness and quality of deliveries. It also works with its customers in order to gauge and plan for demand fluctuations. As a result, the emergency stockpiles required in order to compensate for demand fluctuations or defects should decrease.

As the level of quality from suppliers increases, so should the quality of the finished product increase. Overall, the whole supply chain will gradually become more responsive to demand changes as it perfects a "speed-to-market" approach. These improvements ultimately create value for the customer and result in increased customer satisfaction and loyalty. Over time, the supply chain should go through many iterations of benchmark>improvement>benchmark>improvement. The organization's expertise in

responding to demand becomes so difficult to replicate that it presents a strong barrier to entry for competitors.

The concepts of supply chain management will not remain static and unchanging. Instead, the entire discipline itself is subject to the continuous improvement process which it advocates. In the near future, supply chain managers may even read a synopsis such as this one written in 1997 and chuckle at its naiveté.

Appendix A. Implementation

Many corporate managers may possess a knowledge and understanding of supply chain management principles, yet experience difficulty in utilizing this information. An organization only experiences the benefits of these concepts when it translates them into actions. Although no method of implementation has emerged as the "definitive" methodology, an organization must have a systematic approach in order to achieve success.

This section summarizes an approach proposed by Lisa Dugal, Michelle Healy, and Susan Tarkenton on their monograph entitled Supply Chain Management: A Challenge to Change.[9] Their firm, Coopers & Lybrand Consulting, has successfully used this framework with its clients.

They view the implementation of supply chain management principles as a re-engineering exercise. As shown in appendix B, the success or failure of re-engineering projects often hinges upon an organization's ability to manage cultural change. With that knowledge, their four phased approach incorporates activities which produce a climate conducive to changes.

Phase I: Perform Supply Chain Gap Analysis and Develop the Business Case for Change

This phase seeks to start the process of educating the organization's personnel about the coming changes and establishes the criteria for evaluating the success of the project.

First, the change agents must educate the senior managers on the principles and benefits of supply chain management. Then, the organization must define the key performance indicators which best reflect the success or failure of the changes. Appendix C contains a sample listing of key performance indicators. Of course, these indicators must act in congruence with the company's overall strategic goals. The company can then benchmark these indicators at current levels. Using a model of a high performance supply chain, the change managers can conduct their gap analysis by measuring the differences between the model supply chain and their company's benchmarked key performance indicators. The model supply chain key performance indicators can come from industry leaders, third party studies, or internal generation. The managers can then translate these gaps into quantifiable gains that the company will realize from effective supply chain management. Their data constitutes the business case for change.

Phase II: Supply Chain Design and Action Planning

This phase refines the strategic vision and goals of the project in order to facilitate the creation of a specific implementation plan. The authors recommend a series of interdisciplinary workshops to accomplish this task. The workshops provide a further opportunity to educate the employees and build resilience. Employees adjust to changes more quickly, resist less often, and maintain performance levels more evenly as resilience and participation increase.

Phase III. Proof of Concept Pilot

The company can test its assumptions and methodologies in a limited test run. The results allow managers to make refinements while limiting risk. Lessons learned at this level can help speed the rest of the organization through the learning curve and builds confidence among the employees. At this point, the firm's trading partners and customers should play a role in the process.

Phase IV: Implementation Rollout

The successful completion of this phase should establish supply chain management approaches as the standard operating methodologies within the organization. By this time, employees should have the authority and knowledge necessary to use supply chain management principles. Their success depends upon monitoring and feedback via key performance indicator updates. In fact, employee performance evaluations should incorporate this data.

The authors conclude by pointing out that this approach focuses equally on people and processes.

Appendix B

Factors in the Failure of Change Initiatives[9]

Change Management	31%	
Communication	+21%	= 52%
Other	19%	
Defining Objectives	8%	
Existing Thinking	6%	
Implementation	4%	
Realizing Benefits	2%	
Time Management	2%	
Financing	2%	
Prioritization	2%	
Coordinating Multiple Units	1%	
Technical Implementation	1%	
Methodology	1%	

Appendix C

Sample Key Performance Indicators[9]

Indicator	**Units**
Internal Failure Rate	%
External Failure Rate	%
Lead Times	Weeks/Days
Market Share	%
Volume Growth	%
Shelf Space Allocation	%
Category Profitability	ROI
Brand Recognition	%
Consumer Promotion Effectiveness	Ratio
Customer Deal Effectiveness	Ratio
Order Fill Rate	%
On-Time Delivery Rate	%
Inventory Turns	Ratio
Conversion Process Reliability	%
Total Number of Suppliers	#
Volume from Category I Suppliers	%

References

1. Anderson, D.; Britt, F.; and Favre, D. 1997 "The Seven Principles of Supply Chain Management," *Supply Chain Management Review*, Vol. 1, No. 1, pp. 31-41.
2. Aron, L. 1997, "Prescription for Health Care Cost Control," *Inbound Logistics*, Feb. 1997, pp. 38-41.
3. Bender, Paul, 1997, "How to design an Optimum Worldwide Supply Chain, " *Supply Chain Management Review*, Vol. 1, No. 1, pp. 70-81.
4. Choi, T. and Hartley, J. 1996, "An Exploration of Supplier Selection Practices Across the Supply Chain," *Journal of Operations Management*, Vol. 14, No. 4, pp. 333-343.
5. Lee, H. and Billington, C. 1995, "The Evolution of Supply Chain Management Models and Practice at Hewlett-Packard," *Interfaces*, Vol. 25, No. 5, pp. 42-63.
6. Prida, B. and Gutierrez, G. 1996, "Supply Management: From Purchasing to External Factory Management," *Production and Inventory Management Journal*, Fourth Quarter, 1996, pp. 38-43.
7. Quinn, F. 1997, "What's the Buzz?" *Logistics Management*, Feb. 1997, pp. 43-46.
8. "Supply Chain Rx," *Inbound Logistics*, Feb. 1997, p.11.
9. Tarkenton, S.; Dugal, L.; and Healy, M. 1994 Supply Chain Management: A Challenge to Change, Coopers & Lybrand Publishing, Arlington, VA.
10. Zipkin, P. 1991, "Does Manufacturing Need a JIT Revolution?" *Harvard Business Review*, Jan.-Feb. 1991, pp. 40-50.