

Developing a Model for a Supply Chain Management Major in a United States University in the New Millennium

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With significant growth in supply chain activities in manufacturing and other industries in the United States, there has been a tremendous opportunity for preparing our university students into a Supply Chain Management (SCM) career path in this new millennium. This paper presents a model for developing a syllabus for a Supply Chain Management (SCM) course, and for developing a major program in Supply Chain Management (SCM) to prepare students for meeting the needs and challenges of Supply Chain Management career path of manufacturing and service industries in the United States in this new millennium

Introduction

With significant growth in supply chain activities in manufacturing and other industries in the United States, there has been a tremendous need for preparing our university students into a Supply Chain Management (SCM) career path in this new millennium. Unfortunately, very few universities have a program in Supply Chain Management, and only a handful of universities has a Production/Operations Management major with a supply chain management course. Consequently, manufacturing and other industries in the United States have been facing a critical shortage of personnel in SCM areas, and unless efforts are made for launching some viable programs in SCM areas in American universities for preparing our university students in a SCM career path, our manufacturing and other industries may be heading towards a crisis.

Managers in nearly every industry have begun to realize that competition in this new millennium is no longer be a company against another company, but one supply chain against another supply chain.(13) This has been generating increasing needs for supply chain management practitioners, and giving birth to an entire industry of supply chain consulting companies. Demand for supply chain expertise has been growing exponentially in this decade. On the contrary, as late as 1995, a few business or engineering schools in the U.S. had courses dedicated to supply chain management. Currently, however, nearly every top business and engineering school has at least one dedicated course, and many more have integrated supply chain topics into a core POM course (20). Many schools of management and engineering are also adopting integrated curricula that prepare students to design and manage the resulting complex web of materials and information flows in global supply chains (21).

Evolution of Supply Chain Management Course

In April, 1995 a panel of academics gathered at the Spring INFORMS meeting to discuss the emerging interest in supply chain management (20). At that time, only a handful of

universities taught a course with the title "Supply Chain Management." Of course, some were teaching some of the supply chain concepts in courses under the label "logistics" or "operations management." Currently, however, many top business schools and some engineering programs in the United States have a course entitled "Supply Chain Management" and more are added each year. In nearly all of the top management programs, the core operations management course has been augmented with significant content on supply chains management concepts (28).

Many skeptics would argue that this rush to change curriculum was little more than a repackaging of topics long covered in operations management such as logistics, inventory control, and facility location (27). Similar to "quality control" in the 1970s and "lean manufacturing" in the 1980s, "supply chain management" had been the popular management topic of the late 1990s. But a closer look at both business practices and MBA programs reveals stronger forces at work creating an environment ready for supply chain management concepts and integration may be the key unifying force behind the supply chain curriculum and practice (11). Although, industrial dynamics researchers like Jay Forester (1958) have maintained that supply chains should be viewed as an integrated system, and the practitioners of SCM might have long been interested in integration, due to lack of availability of information technology, it was impossible to implement "systems-oriented" approach until the recent explosion of information technology (21). However, while technology is clearly an enabler of integration, it alone cannot explain the radical organizational changes in both individual firms and whole industries. Changes both in technology and in management theory can set the stage for integrated supply chain management (18).

While integration and information technology may have been key catalysts in the surge of interest surrounding supply chains, evolution of e-business is further fueling even stronger excitement. Since e-business facilitates the virtual supply chain, as companies manage these virtual networks, competition is no longer business-to-business but rather supply-chain to supply-chain. Thus, the importance of integration becomes further magnified (4).

Experiential Learning in Supply Chain Management

The use of experiential learning in supply chain education had been a common practice in many industries in the United States in the last decade. Fangruo Chen and Rungson Samroengraia (1997) analyze the popular beer distribution simulation game and shows how this game can be extended to examine many facets of information flows, incentives, and the bullwhip effect in a supply chain (7). Joyce Mehring (1998) describes a more detailed supply chain simulation used extensively within BCG Company for exposing managers to supply chain concepts (23). Ann Campbell, Jarrod Goentzel and Martin Savelsberg (1998) examine the use of industrial supply chain software in a classroom environment. They provide many useful hints and ideas for integrating this popular software into the classroom. Thomas Vollmann, Carlos Cordon and Jussi Heikkila (1998) present approaches for teaching supply chain concepts to executives (29).

Supply Chain Management Course Syllabus Survey

Supply Chain Management (SCM) is an enormous topic which covers multiple disciplines employing many quantitative and qualitative tools. A survey of SCM course syllabi of thirty AACSB accredited Business Schools reveals that a wide range of topics and a great diversity of approaches with which SCM topics were treated. Most of the graduate level classes in SIQM did not use a textbook but rather relied on case studies and on articles from managerial journals. However, within the last three years, several textbooks for supply chain have arrived in the market providing both managerial overviews and detailed technical treatments. Also, there are several casebooks available in the market that give emphasis on global management issues (20).

This survey also reveals that at most U.S. business schools, (SCM) is taught from an operations or logistics perspective. In order to enhance the theme of integration, some schools employ the participation of several instructors from different functional areas, and most frequently from operations, logistics, marketing, and organizations. In courses taught by a single faculty member, integration is often accomplished by bringing guest lecturers or by the instructor himself or herself actively presenting different perspectives. However, it is impossible to address all the dimensions of supply chain management at one time (22). Therefore, most instructors discuss its certain dimensions in depth before moving on to others.

Key Elements of Supply Chain Management Course

From analysis of syllabi of as many as thirty supply chain courses of thirty AACSB accredited universities, fourteen (14) key areas have been distinctly identified. They are:

(1) location, (2) transportation and logistics, (3) forecasting, and planning for inventory, (4) marketing and channel of distribution, (5) sourcing and supplier management, (6) information and electronic mediated environments, (7) product design and development, (8) service and after sales support, (9) reverse logistics and green issues, (10) outsourcing and strategic alliances, (11) metrics and incentives, (12) global issues, and (13) just-in-time production and distribution, and (14) total quality. A parallel study done by Johnson and Pyke in 2002 also identified the first twelve out of the above fourteen as key areas (21). Each of the above mentioned 14 areas of SCM represents a supply chain issue facing firms in this new millennium.

(1) Location: pertains to both qualitative and quantitative aspects of facility location decisions. This includes models of facility location, geographic information systems, country differences, taxes and duties, transportation costs associated with certain locations, and government incentives. Exchange rate issues fall in this category as well as do economies and diseconomies of scale and scope. Optimization models play a role here, as do simple spreadsheet models and qualitative analyses. (14, 25)

(2) Transportation and logistics category encompasses all issues related to the flow of goods through the supply chain, including transportation, warehousing, and material

handling. This element may also include many of the current trends in transportation management including vehicle routing, dynamic fleet management with global positioning systems, and merge-in-transit warehousing and distribution, cross-docking and materials handling technologies for sorting, storing, and retrieving inventory. This category contains much of what was traditionally taught in logistics courses (17).

(3) Forecasting and planning for inventory includes forecasting, demand planning, master planning, MRP, and inventory management. Many business school instructors had been teaching this material for years using traditional quantitative models until about 10 years ago, it seemed to fall out of favor as qualitative approaches came to dominate operations courses. However, because of the advent of supply chain management, these models have reemerged in the classroom. (20).

(4) Marketing and channel of distribution includes fundamental thinking on supply chain structure and covers the interface with marketing that emerges from having to deal with downstream customers. Most importantly, it examines the role of supply channel management and supply chain structure in light of the well-studied phenomena of the bullwhip effect including issues related to pricing and trade promotions and channel initiatives, such as vendor managed inventory, coordinated forecasting and replenishment, and continuous replenishment. Because many of these initiatives involve channel partnerships and distribution agreements, this category also contains important information on pricing, along with anti-trust and other legal issues (21).

(5) Sourcing and supplier management looks upstream to suppliers. Make/buy decisions fall into this category, also does global sourcing. This category also pertains to the location of the firms suppliers, suppliers quality assurance and supplier relationship management

(6) The information and electronic mediated environments category addresses long-standing applications of information technology to reduce inventory accumulation in the supply chain and the rapidly expanding area of electronic commerce.

(7) Product design and development deals with design issues for mass customization, delayed differentiation, modularity, and other issues for new product development and design for meeting increasing demand of product variety and customization (5).

(8) Service and after sales support category addresses the critical, but often overlooked, problem of providing service and service parts (9). Some instructors also teach inventory models for slow-moving items in this category.

(9) Reverse logistics and green issues are emerging dimensions of supply chain management. This area examines both environmental issues, and the reverse logistics issues of product returns. The growing importance of these issues is evident to most managers as they are more and more being compelled to consider the most efficient and environmentally friendly way to deal with product recovery.

(10) Outsourcing and strategic alliances examines the supply chain impact of outsourcing logistics services. With the rapid growth in third party logistics providers,

there is a large and expanding group of technologies and services to be examined. These include fascinating initiatives, such as supplier hubs managed by third parties. The rush to create strategic relationships with logistics providers and the many well-published failures have raised questions about the future of such relationships. In any case, outsourcing continues to raise many interesting issues (11)

(11) Metrics and incentives examines measurement and other organizational and economic issues. This category includes measurement within the supply chain, industry benchmarking performance measurement and supply chain improvement (13).

(12) Global issues examines how all of the above categories are affected when companies operate in multiple countries. This category goes beyond country specific issues, to encompass issues related to cross-border distribution and sourcing such as, currency exchange rates, duties and taxes, freight forwarding, customs issues, government regulation, and country comparisons are all included (14).

(13) Just-in-time production and distribution examines the synchronous production and distribution of inventory along the supply chain from suppliers of raw materials to the ultimate customers of the finished goods inventory (13).

(14) Total Quality Management examines the concepts and practices of total quality management along the supply chain from the suppliers of raw materials to the ultimate distributors and retailers of finished goods for bringing total customer satisfaction (3).

Course Structure and Pedagogy

The survey also revealed that instructors are rapidly innovating in the class room by using many different teaching tools and approaches. In most business school classes, the overall approach is still case dominated, with more than half of the sessions dedicated to case discussions within the framework of 14 key areas. Although large number of cases are available in areas such as location, and logistics and global issues areas, very few cases are written specifically in areas of service and after-sales support, reverse logistics and green issues, outsourcing and strategic alliances, just-in-time production, total quality management and metrics and incentives. Besides, there are several texts available that contain cases including those written by Flaherty (1996), by Dormer, Ernst, Fender, and Kouvelis (1998), and by Cavinato and Young (1996). Additionally, the Council of Logistics Management (CML) publishes cases related to logistics area. To supplement case discussions, some instructors also use recent business press stories to update issues in the case or to highlight emerging business trends. Another common supplement to lectures and cases is guest industry speakers (21).

Chain Management Simulation Games Course

The survey also revealed that beyond the lecture and case format, many instructors use at least one game/simulation or interactive exercises. By far the most popular simulation/game has been found to be "the Beer Game" (by Sterman 1989, 1992). This game has a rich history, growing out of the industrial dynamics work of Forrester and others at

NUT (Forrester 1961; Jarmain 1963). This game has been widely used. There are many variants of the game including computer-based versions by Simchi-Levi, Kaminsky (1997) and Simchi-Levi (1998) Chen and Samroengraja (1997) and Web-based versions by Jacobs (2000).

The “Siemens Briefcase game” is another supply chain management game designed to be played by small groups (12-18 people) over an extended period of 1 to 3 days. The game illustrates many details of an order-based system with significant customization, such as the ones by Siemens (1996); and Mehring, Kotler, and Kiesel (1997). The “Llenroc Plastics game” by Jackson (1995) is another more detailed simulation game that can be played over several class periods. On the other hand, the “Poster game” is a simple game to illustrate the difficulties of forecasting and inventory planning for perishable goods by Johnson (1998). Finally, class projects are considered as important part of many courses.

A Model Syllabus Supply for Supply Chain Management

Based upon the information revealed by the survey and also examining the content of the “Basics of Supply Chain” module of CPIM exam of APICS, a model syllabus has been developed and presented in Table I for a successful supply chain management class using a modular approach. This class may also provide a range of treatments for both graduate business programs and engineering programs.

A Model for Supplychain Management (SCM) Major

After a thorough study of the content of the American Production & Inventory Control Society’s (APICS) CPIM and CIRM programs, and after gathering expert opinions from a Delphi survey of experts from practitioners and academicians in SCM field, a model of Supply Chain Management major program has been developed and presented in Table 2, which has been successfully implemented in an American university for teaching students into SCM career path. Student graduates from this major has been successfully placed in jobs in SCM in the United States.

Conclusion

Currently, there is a wide and growing body of materials available from various sources for teaching supply chain management. Similar to many areas in management education, very current cases on hot topics in SCM are always in short supply. Since supply chain concepts are so closely integrated with other functional areas, there is a vast set of topics to cover, and specific classes often concentrate on specific areas such as logistics, manufacturing, or marketing. Likewise, supply chain concepts are often taught by instructors in several functional areas including marketing, operations, and logistics. In the future, we expect supply chain issues to become increasingly important as e-Business and globalization drive the need for closer functional integration. This will only serve to fuel the demand for supply chain education in this new millennium.

Table 1. A Model Syllabus for Supply Chain Management Course

MODULE 1. INTRODUCTION

- A. Elements of Supply Chain
- B. Operating environment of Supply chain
- C. Just-in-time production systems
- D. Total quality management

MODULE 2. FORECASTING AND MANAGING DEMAND

- A. The market and the customer
- B. Forecasting methods
- C. Demand management

MODULE 3. TRANSFORMATION PROCESS

- A. Product design and development
- B. Process choices
- C. Manufacturing strategies
- D. Manufacturing process design
- E. Layout of production facilities

MODULE 4. MASTER PLANNING & SCHEDULING

- A. Planning hierarchy
- B. Basic production strategies
- C. Master production scheduling
- D. Materials requirement planning (MRP)
- E. Capacity management and capacity requirement planning (CRP)
- F. Production activity control (PAC)

MODULE 5. SOURCING & SUPPLY MANAGEMENT

- A. Inventory management
- B. Purchasing management
- C. Physical channel of distribution systems
- D. Location of production facilities and warehouses and retail outlets
- E. Transportation and logistics
- F. Service and after sales support

MODULE 6. GLOBAL AND OTHER ISSUES IN SCM

- A. Measurement and incentives
- B. Global issues
- C. Outsourcing and strategic alliances

Table 2. A Model for a Major Program in Supply Chain Management
(Under a Bachelor of Business management program)

General education requirements:	72cr hrs
Core business courses:	
Fundamentals of Accounting and financial management	3cr hrs
Fundamentals of marketing management	3cr hrs
Fundamentals of supply chain management	3cr hrs
Fundamentals of information management	3cr hrs
Fundamentals of business statistics	3cr hrs
Required courses	
Forecasting and demand management for Supply Chains	3cr hrs
Master planning and scheduling for Supply Chains	3cr hrs
Materials management for Supply Chains	3cr hrs
Purchasing and supplier management	3cr hrs
Quality management & control for Supply Chains	3cr hrs
Global and other strategic issues in Supply Chains	3cr hrs
Electives	15cr hrs
Total Credit hours	120cr hrs

References

1. Andersin, E., G. Day and V. Rangan (1997), "Strategic Channel Design " *Sloan Management Review*, Summer, 59-69.
2. Amtzen, B.C.G.G. Brown, T.P. Harrison, and L.L. Trafton (1995), "Global Supply Chain Management at Digital Equipment Corporation,' *Interfaces*, 25, 1, 69-93.
3. Bandyopadhyay, J.K . and D.A. Sprague, (2002) " Total quality management in an automotive supply chain7, *International Journal of Management*, London, UX
4. Ben, R. and R. Wigand (1997), "Electronic Markets and Virtual Value Chain on the Info Super Highway," *Sloan Management Review*, Winter, 62-72.
5. Bryington. C.H.L. Lee, and C.S. Tang (1998), "Successful Strategies for Product Rollovers, " *Sloan Management Review*, Spring, 23 -3 0.
6. Cavinato, J.L. and R.R. Young (1996), *Logistics Casebook*, Smeal College of Business Administration, Penn State University, State College.
7. Chen, F. and R. Samroengraja (1997), *Supply Chain Simulations*, Columbia Business School, New York.
8. Clendenin J.A. (1997), 'Closing the Supply Chain Loop: Reengineering the Returns Channel Process," *International Journal of Logistics Management*, 8, 1, 75 -85.

9. Cohen, M.A. and N. Agrawal, (1996), "An Empirical Investigation of Supplier Management Practices," The Wharton School Operations and Information Management Department, University of Pennsylvania, Philadelphia.
10. Cohen, M.A., Y. Zheng, and V. Agrawal (1997), "Service Parts Logistics: A Benchmark Analysis," *IIE Transactions*, 29, 8, 627-639.
11. Cooper, M.C., D.M. Lambert, and J.D. Pagh (1997), "Supply Chain Management: More Than a New Name for Logistics," *International Journal of Logistics Management*, 8, 1, 1-14.
12. L.M. Eliram, J.T. Gardner, and A.M. Hanks (1997b), "Meshing Multiple Alliances," *Journal of Business of Logistics*, 18,1, 67-89.
13. Copacino, W.C. (1997), *Supply Chain Management. The Basics and Beyond*, St. Lucie Press Series on Resource Management, Falls Creek, VA.
14. Dormer, P.P., R. Ernst, M. Fender, and P. Kouvelis (1998), *Global Operations and Logistics: Text and Cases*, John Wiley & Sons, New York.
15. Fine, C.H. (1998), *Clock Speed.. Winning Industry Control in the Age of Temporary Advantage*, Perseus Books, Reading, Mass.
16. Fisher, M. (1997), "What is the Right Supply Chain for your Product?" *Harvard Business Review*, March-April 105-116.
17. Fuller, J.B., J. O'Conor, and R. Rawlinson (1993) "Tailored Logistics: The Next Advantage" *Harvard Business Review*, May/June, 87-93.
18. Gilmore J.H. and B.J. Pine (1997), "The Four Faces of Mass Customization," *Harvard Business Review*, Jan-Feb, 1997, 91-101.
19. Greis, N.P. and J.D. Kasarda (1997), "Enterprise Logistics in the Information Era," *California Management Review*, 39,4, 55-78.
20. Handfield, R. B. and E. Z. Nichols (1998), *Introduction to Supply Chain Management*, Prentice Hall Press, New York.
21. Johnson, M Eric; Pyke, David F (2002) "Introduction to the special issue on teaching Supply Chain Management", *Production & Operations Management*, No. 1, Spring 2002
22. Johnson, M Eric; Pyke, David F(2002) "A Framework for Teaching Supply Chain Management", *Production & Operations Management* No. 1, Spring 2002
23. Lee H.L and L. Kopczak (1997), "Responding to the Asia-Pacific Challenge," *Supply Chain Management Review*, Spring, 8-9.
24. Mehring, J.S., M.Kouler, and J.Keisel (1997), 'Improving Supply Chain Performance at BCG Company: Learning with Lego Blocks', University of Massachusetts, Lowell
25. Sharman, G.J. (1997), "Supply Chain Lesson From Europe." *Supply Chain Management Review*, Fall, 11-13.

26. Simchi L, D.P. Sky, and Simchi-Levi (1998) *Designing and Managing the Supply Chain*. Irwin/McGraw-Hill, New York
27. Silver, E.A., D.F. Pyke, and R. Peterson (1998). *Inventory Management and Production Planning and Scheduling*, 3rd ed., John Wiley & Sons, New York.
28. Taylor, D. (1997), *Global Cases in Logistics and Supply Chain Management*, International Thomson Business Press, New York.
29. Van Wassenhove and Corbeyz (1998), "Production & Operations Management Core Course Teaching at the Top 20MBA Programmes in the USA", *INSEAD Working paper*, Fontainebleau Cedex, France.
30. Vollmann Thomas, Carlos Cordon and Jussi Heikkila(1998) "Teaching Supply Chain Concepts to Executives", *Supply Chain Management Review*, Fall 15-17