

DEVELOPING A MODEL SYLLABUS FOR SUPPLY CHAIN MANAGEMENT COURSE IN THE NEW MILLENNIUM

By

Jayanta K. Bandyopadhyay and Satheesh Srinivasan

College of Business Administration

Central Michigan University

Mt. Pleasant, Michigan, USA

ABSTRACT

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. Unfortunately, very few university has a program in Supply Chain Management, and only a handful of universities has a Production/Operations Management major. Most interestingly, text books are also rare in the are of SCM. Therefore, 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 SCM career path , manufacturing as well as many other industries may be heading towards a crisis.

This paper presents a model for developing a syllabus for a Supply Chain Management (SCM) course to prepare students for meeting the needs and challenges of Supply Chain Management activities 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 university has a program in Supply Chain Management, and only a handful of universities has a Production/Operations Management major with a supply chain management course.. Therefore, 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 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 core curricula (20). Many schools of management and engineering are adopting integrated curricula

that prepare students to design and manage the resulting complex global 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." Today, many top business schools along with some engineering programs in the United States have courses entitled "Supply Chain Management" and more are added each year. In nearly all of the top Management programs, core operations management courses have 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. For example, product design, manufacturing, logistics and distribution are coming head to head with distribution channel design and category management; traditional functional silos of marketing, R&D, manufacturing, and logistics are consolidating into the integrated approach to supply chain management (11).

Although, industrial dynamics researchers dating back to the 1950s (Forester 1958, 1961) have maintained that supply chains should be viewed as an integrated system, and the practitioners 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, it seems natural that businesses would become more supply chain focused. 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. e-business facilitates the virtual supply chain, and as companies manage these virtual networks, competition is increasingly no longer business-to-business but rather supply-chain to supply-chain. Thus, the importance of integration is 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 Samroengraja (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 & TEXTBOOKS

Supply Chain Management (SCM) is an enormous topic which covers multiple disciplines employing many quantitative and qualitative tools. A survey of SCM class 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 SCM 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. For examples, for managerial introductions to Supply Chain Management, the one by Copacino (1997), and Handfield and Nichols (1998) and for logistics texts, the one by Lambert et al. (1997) and Ballou (1998), and for more technical, model-based treatments ,the one by Silver, Pyke, and Peterson (1998) and Simchi-Levi, Kaminsky, and Simchi-Levi (1998).may be referred. Also, there are also several casebooks available in the market that give emphasis on global management issues which include the one by Taylor (1997), Flaherty (1996), and the one by Dormer, Ernst, Fender, and Kouvelis (1998).

From the survey we also found that at most U.S. business schools, Supply Chain Management (SCM) is taught from an operations or logistics perspective. However, in order to enhance the theme of integration, some schools employ the participation of several instructors from different functional areas, most frequently from operations, logistics, marketing, and organizations. .Before launching into a particular selection of topics, most courses begin with an introduction to supply chain, often emphasizing the importance of integration. Whereas, in courses taught by a single faculty member, integration is accomplished by bringing guest lecturers or by the instructor himself or herself, actively presenting different perspectives. After all, by its very nature, supply chain is integrative, so it might seem inappropriate to "disintegrate" it while presenting it to students (22). However, it is impossible to address all the dimensions of supply chain management at one time. 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) inventory and forecasting, (4) marketing and channel of distribution, (5) sourcing and supplier management (6) information and electronic mediated environments (7) product design and new product introduction (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 (14) Just-in-time production and distribution, and (13) total quality management,. 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 areas represents a supply chain issue facing firms in this new millennium. For each of these 14 areas, a brief description of the basic content and references to recent articles that make suitable class reading assignments, and applicable operations research based tools aiding in analysis and decision support are also provided below. In the subsequent section, an extensive list of recent (since 1990) teaching cases, are also presented..

(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. Decisions at this level set the physical structure of the supply chain and therefore establish constraints for more tactical decisions. Optimization models play a role here, as do simple spreadsheet models and qualitative analyses. There are many advanced texts specially dedicated to the modeling aspects of location and most books on logistics also cover the subject. Simchi-Levi, Kaminsky, and Simchi-Levi (1998) present a substantial treatment on designing and managing supply chain, whereas Dormer, Ernst, Fender, and Kouvelis (1998) dedicate a chapter to issues of taxes, duties, exchange rates, and other global location issues (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. Depending on the intent of the instructor, this may include many of the current trends in transportation management, including vehicle routing, dynamic fleet management with global positioning systems, and merge-in-transit. Also topics such as warehousing and distribution, cross-docking and materials handling technologies for sorting, storing, and retrieving products may be included. This category contains much of what was traditionally taught in logistics courses, and there are many excellent texts and useful short articles including those by Kopczak, Lee, and Whang (1995) and Hammond and Morrison (1995) are available on this subject. Because of globalization and the spread of outsourced logistics, this category has received much attention in recent years, a separate category to examine the issues specifically related to outsourcing and logistics alliances are used. Again, optimization models, spreadsheet models and qualitative analysis may also be used. Recent management literature has examined the changes within the logistics functions of many firms as the result of functional integration (Greis and

Kasarda (1997)(18) and the role of logistics in gaining competitive advantage (Fuller, O'Conor, and Rawlinson (1993) (17).

(3). Inventory and forecasting includes traditional inventory and forecasting models. Many business school instructors had been teaching this material for years 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. Inventory costs are some of the easiest to identify and reduce when attacking supply chain problems. Students need to be familiar with simple models that can identify the potential cost savings from, for example, sharing information with supply chain partners. Many schools teach some inventory theory before discussing broader supply chain issues. Of course there are many full texts on the subject such as those by Silver, Pyke, and Peterson (1998) and Graves, Rinnooy Kan, and Zipkin (1993) (27). Useful managerial articles focusing on inventory and forecasting include those by Davis (1993) and Fisher, Hammond, Obermeyer, and Raman (1994) (20).

(4). Marketing and channel of distribution includes fundamental thinking on supply chain structure (Fisher 1997) and covers the interface with marketing that emerges from having to deal with downstream customers (Narus and Anderson 1996). While the inventory category addresses the quantitative side of these relationships, this category covers relationship management, negotiations, and even the legal dimension. Most importantly, it examines the role of channel management (Anderson, Day, and Rangan 1997) and supply chain structure in light of the well-studied phenomena of the bullwhip effect (Lee, Padmandbhan, and Whang 1997). These include, for example, issues related to pricing and trade promotions (Buzzell, Quelch, and Salmon 1990) and channel initiatives, such as vendor managed inventory, coordinated forecasting and replenishment, and continuous replenishment (Fites 1996; Waller, Johnson, and Davis 1999). 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 (Train 1998). The opportunities for interacting with marketing faculty are, of course, the greatest here (21).

(5). Sourcing and supplier management looks upstream to suppliers. Make/buy decisions fall into this category, also does global sourcing. Articles by Venkatesan (1992); Carrol (1993); Christensen (1994); Quinn and Hilmer (1994); Kelley (1995), Robertson and Langlois (1995), (Little 1995; Pyke 1994) are good reading materials. While the location category addresses the location of a firm's own facilities, this category also pertains to the location of the firm's suppliers. Supplier relationship management also falls into this category. Articles by McMillan (1990); Womack, Jones, and Roos (1991) are good reading materials. Some firms are putting part specifications on the web so that dozens of suppliers can bid on jobs. General Electric (GE), for instance, has developed a trading process network that allows many more suppliers to bid than was possible before. Many automotive assemblers are developing a similar capability. Other firms are moving in the opposite direction by reducing the number of suppliers, in some cases to a sole source. Articles by Helper and Sako (1995); and Cusumano and Takeishi (1991) are good reading materials. Determining the number of suppliers and the best way to structure supplier

relationships is becoming an important topic in supply chains. Articles by Cohen and Agrawal (1996), and Dyer (1996); Fine (1998); Magretta (1998) and Pyke (1998) are good reading materials.

(6). The information and electronic mediated environments category addresses long-standing applications of information technology to reduce inventory and the rapidly expanding area of electronic commerce, articles by Woolley (1997), Benjamin and Wigand (1997); and Schonfeld (1998) are good reading materials. Often this subject may take a more systems orientation, examining the role of systems science and information within a supply chain. Such a discussion naturally focuses attention on integrative approach. To stay abreast of this rapidly changing field, many instructors supplement class readings with guest lectures from industry.

(7). Product design and new product introduction deals with design issues for mass customization, delayed differentiation, modularity, and other issues for new product introduction. With the increasing supply chain demands of product variety and customization there is an increasing body of material to cover this area, articles by Gilmore and Pine (1997), Fine (1998) McCutcheon, Raturi, and Meredith (1994), are good reading materials. One of the most exciting applications of "supply chain thinking" is the increased use of postponed product differentiation (Feitzinger and Lee 1997). Here we find an interface with engineering and development area, with clear implications for product cost and inventory savings. Inventory models are often used to identify some of the benefits of these initiatives. Also important are issues related to managing new product introduction and product rollover, articles by Lee, Billington, and Carter (1993) and Billington, Lee, and Tang (1998) are good reading materials.

(8). Service and after sales support category addresses the critical, but often overlooked, problem of providing service and service parts (Cohen and Lee 1990). Some leading firms, such as Saturn and Caterpillar, build their reputations on their ability in this area, and this capability generates significant sales article by Cohen, Zheng, and Agrawal (1997) is a good reading material in this area. 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 articles by Marien (1998) and by Corbett and van Wassenhove (1993); and by Herzlinger (1994), by Padmanabhan and Png (1995), by Clendenin (1997), and by Rudi and Pyke (1998) are good reading materials. There are few teaching cases, and not many models available for this area. Nevertheless, because of legislation and consumer pressure, the growing importance of these issues is evident to most managers. Managers are 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 both measurement within the supply chain and industry benchmarking. Because metrics are fundamental to business management, there are many reading materials outside of the supply chain literature, including accounting texts for instance. Several recent articles concentrate on the link between performance measurement and supply chain improvement, articles by O'Laughlin (1997); and Johnson and Davis (1998) are good readings.

(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. For example, currency exchange rates, duties and taxes, freight forwarding, customs issues, government regulation, and country comparisons are all included. Note that the location category, when applied in a global context, also addresses some of these issues. As we mentioned earlier, there are several texts devoted to global management and a growing number of cases probe specific issues also examine challenges in specific regions of the world e.g., for Asia. Many recent articles such as those by Arntzen, Brown, Harrison, and Trafton (1995). and by Kopczak (1997) and by Sharman (1997) are good reading materials.

(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.

(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 for bringing total customer satisfaction.

COURSE STRUCTURE AND PEDAGOGY

The survey, 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), Dormer, Ernst, Fender, and Kouvelis (1998), and 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 categorized within the 14 key areas. Another common supplement to lectures and cases is guest industry speakers, particularly for rapidly changing, technology-based content.

SUPPLY CHAIN MANAGEMENT SIMULATION AND GAMES

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 MIT (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.

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 1 for a successful supply chain management class using a modular approach. which has been successfully taught at Central Michigan University for the last two years,. This class may also provide a range of treatments for both graduate business programs and engineering programs.

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.

REFERENCES

1. Andersin, E., G. Day and V. Rangan (1997), "Strategic Channel Design," *Sloan Management Review*, Summer, 59-69.

2. Arntzen, 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. Ballou, R. H. (1998), *Business Logistics Management: Planning, Organizing, and Controlling the Supply Chain*, 4th ed., Prentice Hall, New York.
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, 23-30.
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'Connor, 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. Kotler, 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/Mc-Graw-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 20 MBA 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

ABOUT THE AUTHORS

Jayanta K. Bandyopadhyay, PhD. In I.E. and CFPIM, is a tenured Full Professor of Production Operations management at Central Michigan University, and

Satheesh Srinivasan is graduate student at Central Michigan University and a student member of APICS, and ISQPM.

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. DETAIL DESCRIPTION OF EACH MODULE

DETAIL IN MODULE 1:

A. Elements of a Supply chain

1. Supplier

2. Assembler

3. Distributors

4. Retailer

5. Customer

6. Service and support

B. Operating environment

1. Customer expectation

2. process choices

3. Product design choices

4. Production strategic choices

5. Financial strategic choices

C. Just-in-time (JIT) production

1. Key principles of JIT

2. Flow based production

3. Group technology concepts

4. Flexible manufacturing systems

5. Total productive maintenance

6. Concepts of waste and value added activity

D. Total quality management

1. Key principles of TQM

2. Customer focus

3. Process improvement /6 sigma quality

4. Problem solving tools

5. Cost of quality

6. Total quality deployment

7. Continuous improvement

8. Statistical process control

DETAIL IN MODULE 2. FORECASTING AND MANAGING DEMAND

A. The market and the customer

- 1. Customer**
- 2. Competitors**
- 3. Order winning criteria**
- 4. Marketing strategy**
- 5. Customer relationship**

B. Demand management

- 1. Forecasting methods**
 - a. Principles of forecasting**
 - b. Collection and preparation of data**
 - c. Forecasting methods**
 - d. Forecast error measurement and response**

DETAIL IN MODULE 3. TRANSFORMATION PROCESS

- 1. Product design and development**
 - a. Research and product development**
 - b. Product design stages**
 - c. Quality in product design**
- 2. Process choices and manufacturing strategies**
 - a. Basic production processes**
 - b. Basic modes of production**
 - c. Group technology and cellular production**
 - d. Focused manufacturing**
 - e. JIT production systems**

DETAIL IN MODULE 4. MASTER PLANNING & SCHEDULING

- 1. Planning hierarchy**
- 2. Basic production strategies**
- 3. Master production scheduling**
- 4. Materials requirement planning (MRP)**
- 5. Capacity management and capacity requirement planning (CRP)**
- 6. Production activity control (PAC)**

DETAIL IN MODULE 5. SOURCING & SUPPLY MANAGEMENT

- 1. Inventory management**
- 2. Purchasing management**
- 3. Physical distribution systems**
- 4. Location of production facilities and warehouses retail outlets**
- 5. Transportation and logistics**
- 6. Service and after sales support**

DETAIL IN MODULE 6. GLOBAL AND OTHER ISSUES IN SCM

- 1. Measurement and incentives**
- 2. Global issues**
- 3. Outsourcing and strategic alliances**
- 4. Integrative cases and simulation games in SCM**