Abstract

This paper is the result of a meeting between a group of business people/practitioners who are members of The National Initiative for Supply Chain Integration (NISCI) and a group of academics who are interested/participate in supply chain education at the University level. The meeting took place in July of 2000, with the aim of developing at least a preliminary “model” of the major issues and topics that should be included in supply chain education at the Bachelor’s and Master’s degree levels.

Introduction

NISCI is a loosely organized group of companies joined together for the following purpose:

NISCI statement of Principle

“Maintaining an international viewpoint, we are dedicated to sharing openly our best practices and developing solutions which maximize value-creation within our operations and supply chains of three links or more”.

Member organizations include:

- Amkor
- Cummins Engine
- Daimler Chrysler
- Deere & Company
- Harley-Davidson
- Intel
- Supply America
- The National Association of Purchasing Management (NAPM)
One common issue that members of this group face is difficulty in hiring qualified college graduates with a good background/understanding of supply chain management issues. To address this issue, the NISCI group invited a group of University Professors interested in or involved in supply chain management education to meet with them to discuss concerns and curriculum issues. Representatives attended from the following universities/colleges:

- Arizona State University
- Florida State University
- Indiana University
- Michigan State University
- St. John’s University

There was a total 20 people present.

Methodology

The participants in this process attended voluntarily. This group of people, and their views, are not meant to be representative of the population at large. Participants’ backgrounds were skewed toward manufacturing organizations, with an operations, as opposed to a marketing bent toward supply chain issues.

The meeting of this group proceeded as follows: An emeritus faculty member (and current employee of NAPM) began with an introduction of supply chain management concepts. He facilitated the meeting. Each of the attendees had the opportunity to provide her/his definition of supply chain management. The definitions that were provided included the following elements:
Define Supply Chain:
- The processes that enable the progress of value from raw material to final user and back to redesign and final disposition
- Internet work of collaborative organizations for bringing value to the consumer
- Process for satisfying the consumer's needs, known or unknown
- Extended enterprise from the raw materials to the end consumer (Dirt-to-dirt)
- Network of interdependencies
- Multiple tiers, both within and outside the organization
- The effective utilization of resources, both internal and external
- Network of companies and processes that satisfy consumer needs
- Create value of interlocking, collaborating organizations
- Customer as partner rather than end customer
- Manage the integrated model
- Sustainability
- Competitive imperative model:
  - Add suppliers' supplier
  - Omit consumer
  - Add transaction processes
- The flows go both ways
  - Flow, plus the network, plus its effectiveness

There was widespread agreement that effective supply chain management is about integration. In the next step, the group split into two groups to brainstorm the key concepts and competencies that they believed should be included in supply chain education. The groups then reconvened to share their ideas and approaches. Based on this discussion, the group as a whole reached a consensus that some classification of grouping of the concepts was required to make the process useful.

The nature of the groupings was discussed and debated – what would be the most useful classification? By undergraduate versus MBA requirements? But there would be overlaps. By level of complexity? By some sort of progression from basic to advanced topics? Finally, it was decided to divide the activities by strategic and tactical. The group was re-divided into two teams. Before splitting up, each team reviewed all of the posted flip-chart sheets from the previous session identifying key concepts and competencies, classifying each concept/activity identified as either tactical or strategic.
Some concepts were classified as both strategic and tactical in nature. The teams then took these lists, and met to group the concepts/activities into some meaningful categories. The groupings are shown on Tables 1 - 3.

**TABLE 1**

**Groupings of Brainstorm Ideas into Curricular areas: TACTICAL**

### 1A: Interpersonal Skills
- Negotiation Skills
- Communication (written and oral)
- Persuasion/ influence
- Team/relationship building/trust
- Leadership
- Change Management/ Flexibility
- Diversity
- Customer Service
- Project Management
- Ethics/Coaching

### 1B: Financial Analysis
- Total Cost Modeling
- Total Cost/Total Value
- Cash Flow
- Cost Forecasting
- Risk Analysis
- Cost Structures/Drivers
- Value Analysis
- Mergers & Acquisitions Skills & Understanding

### 1C: Relationship/Web Management
- Supplier Assessment/Analysis
- Trust Building
- Conflict Management
- Coaching/Counseling
- Knowledge Transfer
- Performance Metrics
- Ethics/Standards
- Contract Management
- Information Sharing
- Personnel management
- Internal/external relationships
- Negotiation
- Diversity
- Structures
- Decision making
- Cultural compatibility
- Communications
- Collaboration
- Leadership
- Change management
- Influencing/persuading
- Project management
- Supplier development

### 1D: Technical Toolbox
- Logistics and Transportation
- E-Commerce
- Environmental and Regulatory
- ERP-MRP Information Systems
- Understanding Manufacturing Options
- Quality Systems, ISO, TQM
- Quality Management
- Industry Standards -ASIM, ANSI
- Inventory/forecasting and Simulation
- Inventory Management
- Statistical
- CPFR - Collaborative Planning Forecasting & Replenishment
### Table 2: STRATEGIC

#### 2A: Supply Chain/Network Design (Product Strategy, Process Strategy)
- Early supplier involvement
- Supplier analysis
- Design for Mfg
- Integrated product development
- VA/VE
- Mergers and Acquisitions skills & understanding
- Holistic/Systems thinking
- Concurrent design (3D engineering)
- insource/outsource decision
- Global cultural sensitivity
- Diversity issues
- Industry analysis
- Knowledge & transfer & stewardship
- Reverse Logistics
- Core Competency Analysis Total value models
- Process thinking
- E-Business strategy
- Environmental
- Systems/IT technology

#### 2B: Organization Dynamics
- Relationship management – internal, collaboration skills
- Trust building
- Cross functional
- Holistic/Systems thinking
- Change management/flexibility
- Conflict Management
- Organizational structure
- Knowledge & transfer & stewardship
- Core Competency Analysis
- Intrepreneurial & Entrepreneurial thinking
- Leadership
- Process thinking
- Diversity issues
- Team building
- Systems/IT technology

#### 2C: Risk Management
- Global cultural sensitivity
- Diversity issues
- Ethics
- Industry analysis

#### 2C: Risk Management (continued)
- Reverse Logistics

#### 2D: Sourcing Strategy & Outsourcing
- Mergers and Acquisitions skills & understanding
- Holistic/Systems thinking
- insource/outsource decision
- Industry analysis
- Strategic Negotiation skills
- Total value models
- e-Business strategy
- Benchmarking

#### 2E: New Product/Developmental Sourcing
- Early supplier involvement
- Supplier analysis
- Design for Mfg
- Integrated product development
- VA/VE
- Holistic/Systems thinking
- Concurrent design (3D engineering)
- Industry analysis
- Process thinking

#### 2F: External Relationship Management
- Managing outsiders
- Trust building
- Customer Service
- Mergers and Acquisitions skills & understanding
- Holistic/Systems thinking
- Conflict Management
- Global cultural sensitivity
- Diversity issues
- Strategic Negotiation skills
- Intrepreneurial & Entrepreneurial thinking
- Leadership
- Process thinking
- Managing Outsourced suppliers
- Team building
Some overall themes and concepts emerged: An overarching principle of supply chain management is a holistic, process-oriented approach. This is a challenge for education, just as for business, which has historically been organized along functional lines. The key ideas that need to be communicated in all supply management education are:

1. Supply chain management is a philosophy

2. Excellent supply chain management can create competitive advantage

3. Supply chain management should support an organization’s core competencies.

There are obvious levels of performance in each of these supply chain concepts: awareness, understanding, and mastery. For many concepts, awareness might be sufficient. For others, a higher level of skill is required. The skill level needed depends
on a variety of factors, including the industry in which the individual is employed, and the degree: masters versus bachelors.

The skills and competencies required to be successful in supply chain management can also be viewed as supporting different levels of relationships, as illustrated in Figure 1.

In the very center of the circle is “I”. This represents the individual’s internal thought processes and high level understanding of supply chain concepts. This internal “I” profoundly affects everything that the individual does. These are the types of things that can often not be taught: an individual’s own idiosyncratic view of the world, values, ideas and some aspects of ethics.

The next level, interpersonal, deals with all of the interpersonal skills an individual needs to be effective in dealing with others – some of which are listed under interpersonal skills in Table 1. Many of these skills are invaluable at the next levels –
for example the ability to persuade and influence, the ability to work in teams, communication skills and so on.

As we move out of the circle into progressive levels, different, but complementary skills are needed to be effective. In addition, there is a building on the skills/concepts of the previous level. Thus, each level transcends but includes the lower levels. For example, the skill “knowledge transfer” at the intrafunctional level may not be as complex or challenging due to similar backgrounds and knowledge bases of those involved. As we move out to the interfunctional level, knowledge transfer becomes more complex due to differences in mind sets, goals, and training. This is amplified at the intercompany and interindustry levels. The nature of the knowledge transfer may also vary significantly among levels in figure one. Thus, each one of the concepts and skills is many layered, rather than defined in a simple, finite manner.

It is hoped that the classification of required supply chain management skills into categories will facilitate discussion and curriculum development, and support the efforts of those involved in developing supply chain curriculum.

In terms of designing and developing supply chain curriculum, the nested model in Figure 1 should help provide some insights. Individual skill development, the “I”, is required first, in order to effectively apply the skills and tools needed at the outer layers of the rest. In examining Table 1, the key “I” type of skills are not necessarily those that are specific to supply chain management – things like value – clarification, analytical
thinking, decision making, process and holistic thinking. These should be part of any good liberal arts education.

At the next level – basic interpersonal skills, there are again some very “generic” sorts of skills required here that could fit into a good business communications and/or management class. Many representative skills are listed in Table 1 under Interpersonal skills. Once these skills have been developed and reinforced, the student is ready to learn more specific supply chain management skills.

An excellent place to begin is with the “Technical Toolbox” skills. Here, the student learns the basic concepts and issues that shape everyday tactical decisions – from choice of transportation provider to managing and monitoring inventory and quality levels. At the same time, students should be taking marketing (2G., Customer Strategy) and operations (2H., Manufacturing Strategy) classes that allow them to understand the criticality of customer strategies and manufacturing strategies and how these shape the supply chain strategy of the organization.

A logical next progression is into financial analysis issues that shape supply chain management. In an ideal world, the student would have adequate coverage of the financial analysis topics listed in Table 1 as part of a basic finance course. However, most finance courses focus on external financial markets, stock prices and evaluation of the firm’s value. The financial analysis class suggested here should follow the students’ successful completion of basic financial accounting, managerial accounting and finance. The emphasis would be on understanding the dynamics of supply chain cost and value.

With a solid foundation in tools and concepts, the student should now be ready to progress into specific supply chain related topics and issues. Most of these issues are
classified as strategic. However, many of the relationship/web Management topics listed as 1C. are specific to supply related issues. While “decision making” is listed as a topic, the decision-making processes should focus on learning how to make good decisions using supply related situations and cases. Likewise, while the concept of performance metrics should be taught in a broad sense, specific applications should focus on supplier, logistics, and supply chain performance metrics. Thus, this area focuses on the third, fourth and fifth rings of the circle: intra-functional, inter-functional and inter-company issues.

As we progress into more strategic levels and issues in the supply chain, it is expected that undergraduate students would “survey” these topics, while MBA students would focus on these topics. These topics, such as supply chain design, new product Development and Risk Management touch upon the organizational, inter-company, industry and even global level. These broader topics are critical for those who will be making policy decisions, setting strategy, and interfacing directly with top management and strategic suppliers and customers.