SUPPLY CHAIN MANAGEMENT 2010

AND BEYOND:

Mapping the future of

the

Strategic Supply Chain

November 2, 2006
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A Report
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November 2, 2006
Notice

This research study has been supported financially by the Department of Marketing and Supply Chain Management, The Eli Broad Graduate School of Management, Michigan State University, the APICS Educational and Research Foundation, Inc., SAP, and from funds provided by the Hoagland-Metzler Chair in Strategic Sourcing at Michigan State University.

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November, 2006

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ACKNOWLEDGEMENTS

This report could not have been possible without the assistance of numerous people. We would like to use this space to acknowledge the contributions made by these people and groups. Specifically, we would like to recognize:

- The APICS Educational and Research Foundation, Inc., SAP, and the Department of Marketing and Supply Chain Management, the Eli Broad Graduate School of Management at Michigan State University for their financial support.
- Laird Burns, Delvon Parker, and Shawn Jones for acting as recorders during the course of the workshop. Many of the insights and information presented in this report would have never been captured without their work.
- To Hari Krishnan RK, a graduate student assigned who worked with Steven A. Melnyk and whose help in doing the literature review work was invaluable.
- Kathy Stopa, Executive Assistant, Executive Development Programs, for doing all of the legwork demanded by this project and for making sure that project was carried out without problems or hassles.
- David Frayer and Nick Little, Executive Director and Assistant Director (respectively) of Executive Development Programs at the James B. Henry Center for Executive Development, Michigan State University, for encouraging and facilitating this project.
- The participants, for without them, this project could have never taken place.

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November 2006
# TABLE OF CONTENTS

Acknowledgements........................................................................................................................................ iv  
Table of Contents ........................................................................................................................................ v  
Introduction .................................................................................................................................................. 1  
SCM 2010 and Beyond: why this study now? ............................................................................................ 5  
  Overview ................................................................................................................................................. 5  
  Supply Chain Management – A Field in Transition ............................................................................. 7  
  The Structure of the Report ..................................................................................................................... 9  
  Concluding Comments ........................................................................................................................... 9  
Background to the Study: The Research Methodology Outlined ............................................................ 11  
  Overview ............................................................................................................................................... 11  
  Phase I - Background ............................................................................................................................. 11  
  Phase II – The Delphi Study .................................................................................................................. 13  
    The Delphi Study Described ................................................................................................................ 13  
  Phase III – The Workshops .................................................................................................................... 17  
Identifying the Gaps .................................................................................................................................. 21  
  Gaps ....................................................................................................................................................... 23  
  Micro-Gaps ............................................................................................................................................. 25  
    Strategic Visibility and Alignment ....................................................................................................... 26  
    Talent Management and Leadership ................................................................................................. 36  
    Supply Chain Models Including Optimization, Risk and Cost .......................................................... 37  
    Process Orientation Including Measures, Information, and Integration ........................................ 40  
    Relationship and Trust ....................................................................................................................... 42  
    Supply Chain Architecture and Structure ....................................................................................... 43  
Closing the Gaps: The Agendas for Action ................................................................................................. 45  
  The Agenda for Research ....................................................................................................................... 45  
    Strategic Visibility and Alignment ....................................................................................................... 45  
    Supply Chain Models Including Risk Mitigation and Cost Optimization ........................................ 48  
    Process Orientation Including Measures, Information, and Integration .......................................... 52  
    Relationships And Trust .................................................................................................................... 53  
    Supply Chain Architecture and Structure ....................................................................................... 54  
  The Agenda for Knowledge Dissemination ......................................................................................... 55  
  The Agenda for Practitioners ................................................................................................................ 60  
Integrating Agendas ................................................................................................................................. 61  
Mapping the Future of Supply Chain Management: Concluding Comments ........................................ 64  
  Setting out the Next Steps .................................................................................................................... 66  
  Final Comments .................................................................................................................................... 68  
References .................................................................................................................................................. 70  
appendices .................................................................................................................................................... 72  
Appendix 1: delphi letter – round 1 ........................................................................................................... 73  
SCM 2010 and Beyond Identifying the Future Directions of Strategic Supply Chain Management ...................................................................................................................................................................................... 74  
  Overview ............................................................................................................................................... 74  
SCM 2010 and Beyond Identifying the Future Directions of Strategic Supply Chain Management ...................................................................................................................................................................................... 75  
  Part One ............................................................................................................................................... 75
Part Two: Defining Strategic Supply Chain Management .......................................................... 76
Part Three: Assessing the Importance of Supply Chain Trends and Developments .................. 78
Appendix 2: Delphi letter – round 2 .......................................................................................... 81
SCM 2010 and Beyond Identifying the Future Directions of Strategic Supply Chain Management ....................................................................................................................... 82
  Overview ................................................................................................................................. 82
Part Three: Assessing the Importance of Supply Chain Trends and Developments ............... 83
Appendix 3: Workshop protocol ............................................................................................... 87
Workshop Protocol ..................................................................................................................... 88
  Session 1 – Establishing the Baseline ..................................................................................... 88
  Debriefing of Session 1 Findings – Total Group Discussion .................................................. 88
  Session 2 – Identifying Gaps .................................................................................................. 89
  Debriefing of Session 2 Findings – Total Group Discussion .................................................. 89
  Session 3 – Addressing the Gaps to SCM 2010 ................................................................. 90
  Debriefing of Session 3 Findings – Total Group Discussion .................................................. 90
Appendix 4: SCM 2010 on-site workshop agenda ................................................................ 91
Agenda ....................................................................................................................................... 92
  Thursday, September 21 ...................................................................................................... 92
Appendix 5: List of participants ............................................................................................... 94
INTRODUCTION

Supply Chain Management (SCM) is now a fact of life. It is also a dynamic entity that is constantly changing and evolving in response to changes in technology, competitive actions, and customer demands. Supply chain managers recognize that their role has moved from being tactical to being strategic. This “new” supply chain is characterized by three major traits: (1) it is strategic; (2) it is dynamic; and, (3) it is customer-driven. The supply network that serves these customers must be optimized and react to supply uncertainties and demand variability. New paradigms in supply chain management must evolve that guide new management strategies, identify new research agendas, and lead to dissemination of new knowledge to supply chain employees. To understand these new agendas, a two-part initiative was undertaken through a joint project between Michigan State University and the APICS Educational & Research Foundation. This summary provides a brief report of the major findings from the project. A report detailing all the results from the project will be forthcoming in the near future.

The purpose of the project was to understand the key issues facing supply chain managers in the coming years and identify the key initiatives required to close the gap between today’s capabilities and the demands of the new supply chains. To address these challenges two groups of experts were invited to participate in the project. The first were executives from a diverse group of companies representing a variety of industries and supply chain roles. The second group consisted of academics from a number of universities with well-respected supply chain programs. The project consisted of three phases:

Phase 1 – Background work aimed at identifying critical issues pertaining to supply chain management, leading academic researchers and supply chain practitioners, and firms considered to be at the leading edge of supply chain management.

Phase 2 – A Delphi study was administered to all participants to identify and prioritize the issues facing supply chain managers today, and the issues they expect to face out five years and beyond.

Phase 3 – A workshop was held at Michigan State University to bring together these supply chain experts and explore opportunities to meet these future challenges.
The report of the findings on both phases of the project is being distributed to all participants and will be made available to the public at a later date through published outlets.

RESULTS

The Delphi study served as a mechanism to identify the most critical issues facing supply chain managers in 2010 and beyond. The results of the study showed these five issues to be most important in the future:

1. Supply chain disruptions and supply chain risk
2. Leadership within the supply chain
3. Managing the timely delivery of goods and services
4. Managing product innovation by drawing on the capabilities of the supply chain
5. Implementing appropriate technology to allow seamless exchange of information within the supply chain

During the workshop, participants described leadership as the people skills and talents needed to manage future supply chains.

In the second phase of the project, a workshop was held at Michigan State University on September 20-21, 2006, bringing together experts in supply chain management from industry and academia. The group identified sixteen (16) initiatives required to close the gap between current capabilities and future supply chain requirements. These sixteen initiatives were summarized into the following six strategic initiatives:

- Achieve strategic visibility/alignment and information integration
- Acquire exemplary supply chain talent and leaders
- Utilize supply chain optimization models (e.g., risk, cost)
- Manage through a process orientation with appropriate measures
- Focus on relationship building and trust both between and within companies
- Align and realign supply chain architecture/structure

The participants agreed that closing the gap between current capabilities and future requirements is essential for excellent supply chain performance in 2010 and beyond. Those organizations that are best at closing the gap will have a competitive advantage. Those who have not prepared for the future will face unacceptable risk and higher total cost.

NEXT STEPS

After identifying the initiatives required to close the gap between current supply chain performance and future requirements, the workshop participants focused on identifying the management practices and research agendas that must be developed to improve supply chain execution. Also discussed was how the new knowledge might be best disseminated. Participants were asked to select one of six focused areas for further subgroup work. The subgroups included two which will address the supply chain body of knowledge --- operational and strategic. Workshop participants felt that it was important that universities and professional organizations
be involved in providing the appropriate education and training for supply chain leaders of the future. The other four subgroups include: collaboration, metrics, risk, and cost models and will focus on providing direction for research and practice on the six strategic initiatives.

The Delphi study and workshop provided insight into the issues facing supply chain managers in 2010 and beyond, but must be validated using other industry and academic partners. A second group will be convened at a future date and the results combined and distributed to all participants. The workshop attendees agreed to reconvene at a future date for ongoing discussions and updates.

The project leaders would like to thank all the participants for their active engagement in both the Delphi study and the workshop. Your willingness to share information and ideas resulted in agenda to pursue which will drive improved performance in the supply chains of the future.
Overview

Supply Chain Management (SCM) is now a fact of life. Increasingly managers, researchers, and educators recognize the importance of SCM as both a strategic and tactical weapon. However, the practice of supply chain management is ever changing. Initially, the supply chain was viewed as an entity that was primarily concerned with the upstream – suppliers and supplier management. By the mid 1990s, there was a change in orientation. The focus has shifted from the upstream to the entire supply chain. As we move into the middle of the first decade of the 21st century, we are seeing another shift in focus – from supply chain management to strategic supply chain management. As this transition takes, there is a strong need for researchers, managers, and educators to reassess the current and future stages of supply chain management with the goal of identifying, presenting, and implementing a new set of agendas --- agendas targeted at directing, motivating, and facilitating research, knowledge dissemination,¹ and management/practice in this area.

As a result of these and other factors, it was decided that the time was “right” for a study aimed at uncovering, studying and assessing the differences between today’s supply chain and that of the future supply chain – the supply chain that we can expect to see in place within the next five years. To achieve these objectives, it was decided that multiple method research approach would be employed – an approach that combined a thorough literature review with a Delphi study and an on-site workshop. The overall goal of this approach would be to help answer the following questions:

- What is the current supply chain system look like? What are its major traits/features/attributes?

¹ The term “knowledge dissemination” is used rather than teaching for several first reasons. First, in discussions with several knowledgeable practitioners in preparation for the study, the research team was left with the impression that teaching was viewed as something that took place in colleges and universities. Second, knowledge dissemination was viewed as a much broader activity – something that could be done within companies, with professional societies, and within educational institutions. Third, knowledge dissemination seemed to imply also a broader approach to getting the knowledge out. It was seen as something that could be done using the Internet, Webinars, seminars, and discussions. For these and other reasons, the team settled on this term within this report.
To what extent is the future supply chain “superior” in performance to the current supply chain? Why?

What are the gaps/obstacles that are preventing firms and their managers from making the transition from the current to the future supply chain and from realizing the potential benefits offered by the future supply chain?

What “action items” can be identified that can be used by the various stakeholders to facilitate the transition from the current to the future supply chain?

Consistent with these questions, this study had, as its direct outcomes, three items:

- A quantitative description of the current and future supply chains (to be provided by the Delphi study).²
- A summary and discussion of the major gaps/obstacles affecting the ability of firms to make the transition from the current to the future supply chain.
- A set of three agendas containing actionable items targeted towards the three critical stakeholders – supply chain management practitioners, researchers, and educators.

This report presents the final results of this study. In it, you will find these three outcomes. It is hoped and expected that this report will serve to stimulate a discussion of whether you, as a manager, researcher, or educator, are ready to make this transition. In reviewing the findings presented in this report, it is important to recognize that what we are dealing with is a forecast of the future (albeit a forecast generated through the interaction of a selected group of highly knowledgeable people). Consequently, the reader is cautioned to remember this forecast, like any other forecast, comes with three warnings to remember:

- All forecasts are wrong;
- All forecasts change; and,
- You or someone else will be responsible for the ultimate accuracy.

² A detailed discussion of the research methodology is reserved for the next chapter.
Before discussing the research methodological approach underlying this study, it is first necessary to review the concept of the supply chain and the factors currently influencing its growth and evolution.

**Supply Chain Management – A Field in Transition**

Supply Chain Management (SCM) is now recognized as one of the major developments in business thought for the 21st Century. Many business schools, including the likes of the University of Michigan and Harvard, are developing SCM curricula and programs. At the same time, definitions of various SCM perspectives and domain are maturing. Originally, SCM was viewed rather simplistically as a summation of operational activities in functional areas such as purchasing, operations management, and logistics. Today, SCM is increasingly seen to be a strategic, highly integrative management area that exceeds any single functional perspective (see Figure 1-1 found at the end of this chapter).

However, it is generally well known that supply chain management is a discipline that has been developed in the field and expanded by managers and by firms such as Toyota, McDonald’s, Wal-Mart, Kellogg’s, Harley-Davidson, and Dell. Consequently, the study (i.e., the activities involving research and knowledge dissemination) of supply chain management has consistently lagged behind the practice of supply chain management. This is a situation that must be corrected if managers, educators, and researchers are to meaningfully and effectively cooperate in order to make relevant and timely contributions to this discipline.

Currently, there is evidence that the theory and practice of supply chain management is undergoing a major transformation – a transformation from tactical supply chain management (a field primarily of interest to logistics, operations and purchasing managers and researchers) to strategic supply chain management. Strategic supply chain management is characterized by three major traits:

- **Total**: To be effective in teaching supply chain management an instructor’s coverage should address the “total” (complete) supply chain. A “total” coverage addresses both the upstream (supply-side) and downstream (demand-side) aspects of the supply chain, including a discussion of marketing and customer relationships. It also covers both domestic and global issues associated with supply chain management. A “total” coverage views supply chains from a life cycle perspective, one that traces products from
“cradle to grave.” A “total” coverage introduces students not only to the mathematical tools that support supply chain management decision-making, but also to the “soft” side of supply chain management, including the management of people, information, and organizational relationships. Finally, a “total” coverage includes discussions of planning activities and decision processes that cut across traditional functional organizations.

- **Strategic:** The supply chain concept exists as a means to enhance the ability of a firm to develop and maintain strategic advantages in a competitive market place. The benefits of supply chains extend beyond the operational dimensions of lead time, quality, and flexibility to the strategic and financial areas. Supply chains, if properly structured, can effectively combine the core competencies of a given firm with the skills and capabilities of its suppliers. However, to be strategic, supply chains must be driven by marketing strategies, targeting of customers, and the creation of value propositions that are highly attractive to these customers. The needs of the customer (especially the critical customer) must be met and exceeded consistently by the supply capabilities of the supply chain.

- **Dynamic:** Supply chains are seldom static. They are constantly changing and evolving as a result of strategic changes taking place within the firm, competitive actions, changes in technology, and shifts in targeted customers or in customers’ needs.

Strategic supply chain management is a relatively new development. It is a development that offers great promise but one that raises numerous questions and unresolved issues that must be addressed should the promise of strategic supply chain management be realized.

When dealing with these unresolved issues and questions, it is important to recognize that these issues must be framed in terms meaningful to the three key “stakeholders”: practitioners (those who are involved in the development, implementation, and evolution of supply chain management in the field), researchers (those involved in generating new knowledge focused primarily on the various aspects of supply chain management), and, educators (those who are responsible for spreading the principles and practices of supply chain management to business students, graduate students, executives, and members of professional organizations).
The Structure of the Report
This report and its findings are presented in five chapters. The first chapter (the one that you are now reading) provides an introduction; the second presents the structure of the multi-method research methodology as well as summarizing the results of the Delphi study (which identifies and rates in importance of the various traits associated with today’s supply chain and those of the future supply chain). In the third chapter, we explore the various gaps/obstacles that are inhibiting the transition from the current to the future supply chain. The fourth chapter presents the action item agendas, while the fifth chapter explores the issue of the next step. The various appendices found at the end of this report present material used during the execution of the Delphi study and in the workshop. As is noted in the fifth chapter, this study should not be viewed as an end, but rather as a starting point for future research into the strategic supply chain – SCM 2010 and beyond.

Concluding Comments
Supply Chain Management is now a fact of life. It is also a dynamic, living entity that is constantly changing. At times, these changes are small; at other times, the changes are significant and dramatic. The indications are that we are currently encountering a time of dynamic and significant change. It is hoped that the findings presented in this report will better prepare the reader to meet the challenges of the new supply chain.
Figure 1-1
The Current Supply Chain

Relationship Management

Information, Product, Service, Financial and Knowledge Flows

SUPPLIER NETWORK

INTEGRATED ENTERPRISE

DISTRIBUTIVE NETWORK

Sourcing
Logistics
Operations

Capacity, Information, Core Competencies, Capital and Human Resources

Source: Supply Chain Faculty, Michigan State University
BACKGROUND TO THE STUDY:  
THE RESEARCH METHODOLOGY OUTLINED

Overview
This report summarizes the various phases generated at a workshop on “Supply Chain Management 2010 and Beyond” that was held at the James B. Henry Center for Executive Development at Michigan State University, beginning on Wednesday September 20 and ending Thursday September 21, 2006. This workshop and its findings, in turn, were the result of a process that began in late 2005 with the decision to go forward with the workshop. At that time, it was decided that, if the workshop was to be successful, a structured approach had to be presenting place. In a subsequent meeting held on Saturday January 7, 2006, it was decided that a three phase approach would be used:

- **Phase 1** – Background work aimed at identifying critical issues pertaining to supply chain management, leading academic researchers and supply chain practitioners, and firms considered to be at the leading edge of supply chain management.

- **Phase 2** – A Delphi study was administered to all participants to identify and prioritize the issues facing supply chain managers today, and the issues they expect to face out five years and beyond.

- **Phase 3** – A workshop was held at Michigan State University to bring together these supply chain experts and explore opportunities to meet these future challenges.

Phase I - Background
This stage began in February 2006. It involved first undertaking a complete literature review of the supply chain management related body of knowledge. In developing this review, literature from both the academic and practitioner fields were examined. Among the journals selected for this review (but the review was not limited to these journals alone) were the following:

- The *Journal of Operations Management*
- The *International Journal of Production Research*
- *Decision Sciences Journal*
- *Harvard Business Review*
- *Strategic Management Journal*
• The *Academy of Management Journal*
• *Sloan Management Review*
• *California Management Review*
• *The International Journal of Operations and Production Management*
• *The Journal of Business Logistics*
• *The Journal of Supply Chain Management*
• *The International Journal of Production Economics*

In addition, a thorough review of information available on the Internet and through the Center for Advanced Purchasing Studies was also undertaken. The review covered a time period from 1998 to the present date. All information generated from this review was stored in Endnote 8 format to facilitate its rapid storage and retrieval.3

The purpose of the review was four fold:

• To identify the major issues and concerns pertaining to the continued evolution and growth of supply chain management. These issues and concerns were critical since they formed the foundation for the Delphi study (as described in the next phase).

• To identify those researchers who were active in the study of issues pertaining to supply chain management.

• To identify those practitioners, consultants, and practitioner authors who were active in the study and reporting of issues pertaining to supply chain management.

• To identify companies that were considered to be at the leading edge of the theory and practice of strategic supply chain management (i.e., where the supply chain was used to help the firm either develop unique, compelling strategic objectives or where the supply chain played a critical role in helping the firm attain its strategic objectives). In selecting these firms, the interest was not simply in those firms that dealt exclusively on the upstream/supply side of the supply chain. Rather, there was an explicit attempt to include firms that also focused on the downstream/demand side of the supply chain.

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3 Endnote 8 is a software product operating both in the Windows and Apple OS X operating environment that allows researchers to search on-line bibliographic databases, organize references, images and PDFs and to create bibliographies and figure lists. It also enables researchers to also organize such information and to quickly search it.
The information generated was reviewed by the members of the research team. When adequate closure was determined to be present (e.g., when no new issues or concerns could be identified from additional review of the literature), it was decided to move to the second stage: the Delphi Study.

**Phase II – The Delphi Study**

The development of the Delphi study phase began in late April, with the finalized version of the Delphi form (Appendix 1) sent out by on May 22, 2006. That is, the panel of “experts” was notified that the Delphi questionnaire was available to be completed; the Delphi questionnaire was mounted on the Michigan State University business server and available through the Internet. During this period, several critical events took place. First, funding for the workshop was secured. The project was funded in part by SAP, the APICS Educational and Research Foundation, Inc., the Department of Marketing and Supply Chain Management from the Broad College of Business at Michigan State University, and Joseph Sandor, the Hoagland-Metzler Chair of Strategic Sourcing at Michigan State University. Second, the research team (initially consisting of Drs. Steven A. Melnyk (Michigan State University), Rhonda Lummus (Iowa State University), and Robert J. Vokurka (Texas A&M University-Corpus Christi)) welcomed an additional member, Joseph Sandor.

Professor Sandor had arrived at the Department of Marketing and Supply Chain Management as the Hoagland-Metzler Chair. Professor Sandor played a critical role in the successful completion of this project in several ways. As previously noted, Professor Sandor provided funding used to host the opening reception for the workshop (September 20, 2006). Further, Professor Sandor made available his industry contacts. These contacts were extensively used in soliciting and securing highly placed industry participation (i.e., participation at the senior management level).

**The Delphi Study Described**

In planning for the on-site workshop, it was decided that one way of getting the group to focus on the issues and concerns of interest (rather than simply spending their time on-site identifying and discussing these issues) when developing the requested agendas was to administer a Delphi

---

4 The task of reviewing the literature and the Internet and gathering the resulting information was carried out by Hari Krishnan, an MBA student in the Broad School, who was assigned to Dr. Steven A. Melnyk as a research assistant.
questionnaire to the potential workshop members. The Delphi technique is a method used to obtain a reliable consensus of opinion of a group of experts by means of series of questionnaires combined with controlled feedback (McKenna, 1994, p. 1221). As a technique, it is well designed to handle opinions rather than objective facts (Schmidt, 1997). It is also a widely used technique, having been used in over 1,000 published research studies since its introduction during the late 1940s (McKenna, 1994).

The Delphi technique is most appropriate under the following conditions (Linstone & Turoff, 1975):

1. The research problem does not lend itself to precise analytical techniques but can benefit from subjective judgments on a collective basis.
2. The research population may present diverse backgrounds with respect to experience or expertise.
3. More subjects are needed than can effectively interact in a face-to-face exchange.
4. Disagreement among individuals may be so severe or politically changed that anonymity must be insured.
5. Time, cost, and logistics would make frequent meetings of all the subjects unfeasible.

Of these five conditions, it was the first and the fifth that proved to be the primary reasons for the selection of the Delphi technique for this phase of the study.

The Delphi technique embodies the following key characteristics (Chocholik, Bouchard, Tan, & Ostrow, 1999; Loughlin & Moore, 1979; Whitman, 1990):

1. The use of a panel of “experts” for obtaining data.
2. Participants do not meet in face-to-face discussions.
3. The use of sequential questionnaires and/or interviews.
4. The systematic emergence of a concurrence of judgment/opinion.
5. The guarantee of anonymity for subjects’ responses.
6. The use of frequency distributions to identify patterns of agreement.
7. The use of two or more rounds between which a summary of the results of the previous round is communicated to and evaluated by panel members.

Having selected the Delphi technique for this second phase, the next step was to develop the Delphi survey. This survey (see Appendix 1) was developed by drawing on the findings of the literature review carried out during Phase I. The initial questionnaire was subjected to thorough pre-testing. It was submitted to various groups of executives both within the Executive
Development Programs of Michigan State University and to a group of some 40 middle and upper level managers who were involved in supply chain management affairs. Based on feedback received from these groups, the initial Delphi questionnaire was revised. Once revised, it was posted on the Internet.

The first round of the Delphi ran from May 22 to June 9, 2006. These were summarized and included as part of the second round of the Delphi (which ran from July 15 to August 10). The results of the first round can be found in Appendix 2. The results generated from this second round were collected and summarized for presentation during the first session of the workshop (Thursday, September 21, 2006). The results are presented in Table 1.

Table 1
Delphi Results – Second Round

<table>
<thead>
<tr>
<th>Issue</th>
<th>Importance Now</th>
<th>Importance 5 years From Now</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issue</td>
<td>Round 1 Mean</td>
<td>Round 2 Mean</td>
</tr>
<tr>
<td>1 Supply chain disruptions and supply chain risk</td>
<td>4.25</td>
<td>4.29</td>
</tr>
<tr>
<td>2 Leadership within the supply chain</td>
<td>4.00</td>
<td>4.24</td>
</tr>
<tr>
<td>3 Managing the timely delivery of goods and services.</td>
<td>4.25</td>
<td>4.33</td>
</tr>
<tr>
<td>4 Managing product innovation by drawing on the capabilities of the</td>
<td>3.29</td>
<td>3.48</td>
</tr>
<tr>
<td>supply chain</td>
<td>3.67</td>
<td>3.76</td>
</tr>
<tr>
<td>5 Implementing appropriate technology to allow seamless exchange of</td>
<td>3.92</td>
<td>3.89</td>
</tr>
<tr>
<td>information within the supply chain</td>
<td>3.58</td>
<td>3.76</td>
</tr>
<tr>
<td>6 Developing trust between supply chain members</td>
<td>3.75</td>
<td>3.90</td>
</tr>
<tr>
<td>7 Measuring performance across activities and partners within the</td>
<td>3.92</td>
<td>3.81</td>
</tr>
<tr>
<td>supply chain</td>
<td>3.79</td>
<td>3.81</td>
</tr>
<tr>
<td>8 Protecting intellectual property within the supply chain</td>
<td>3.88</td>
<td>3.95</td>
</tr>
<tr>
<td>9 Managing and structuring relationships within the supply chain</td>
<td>3.50</td>
<td>3.33</td>
</tr>
<tr>
<td>10 Power relationships within the supply chain</td>
<td>3.63</td>
<td>3.90</td>
</tr>
<tr>
<td>Issue</td>
<td>Importance Now</td>
<td>Importance From Now</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>14 Managing and improving environmental performance within the supply chain.</td>
<td>3.13 3.20 0.07 4.00</td>
<td>4.05 0.05</td>
</tr>
<tr>
<td>15 Developing and maintaining appropriate communication and connectivity within the supply chain:</td>
<td>3.75 3.75 0.00 4.25</td>
<td>4.05 (0.20)</td>
</tr>
<tr>
<td>16 Using the resources of the supply chain to identify new and unique solutions to existing and new problems.</td>
<td>3.17 3.45 0.28 4.13</td>
<td>4.00 (0.13)</td>
</tr>
<tr>
<td>17 Rapid redesign of supply chains to meet changing customer needs.</td>
<td>3.67 3.38 (0.29) 4.21</td>
<td>3.90 (0.31)</td>
</tr>
<tr>
<td>18 Sharing rewards and financial risk within the supply chain.</td>
<td>3.13 3.19 0.06 4.00</td>
<td>3.86 (0.14)</td>
</tr>
<tr>
<td>19 Managing confidentiality within the supply chain.</td>
<td>3.63 3.62 (0.01) 3.83</td>
<td>3.86 0.03</td>
</tr>
<tr>
<td>20 Developing and implementing Strategic Segmentation/spend analysis on the customer side of the supply chains.</td>
<td>3.46 3.38 (0.08) 3.96</td>
<td>3.76 (0.20)</td>
</tr>
<tr>
<td>21 Developing and implementing Strategic Segmentation/spend analysis on the supply side.</td>
<td>3.46 3.71 0.25 3.92</td>
<td>3.67 (0.25)</td>
</tr>
<tr>
<td>22 Developing, changing and maintaining the appropriate organizational cultures within the critical partners of the supply chain.</td>
<td>3.29 3.00 (0.29) 3.67</td>
<td>3.62 (0.05)</td>
</tr>
<tr>
<td>23 Responding to the “China Price” syndrome (i.e., a competitor who emphasizes and delivers low cost).</td>
<td>3.75 3.81 0.06 3.38</td>
<td>3.52 0.14</td>
</tr>
<tr>
<td>24 Identifying and managing channel conflict.</td>
<td>3.50 3.05 (0.45) 3.67</td>
<td>3.43 (0.24)</td>
</tr>
<tr>
<td>25 Governance within the supply chain (e.g., Sarbanes-Oxley)</td>
<td>3.33 3.38 0.05 3.58</td>
<td>3.38 (0.20)</td>
</tr>
<tr>
<td>26 Co-locating key stakeholders within the supply chain.</td>
<td>3.00 3.14 0.14 3.25</td>
<td>3.24 (0.01)</td>
</tr>
</tbody>
</table>

### ROUND 2 Additional Items

<table>
<thead>
<tr>
<th>Issue</th>
<th>Importance Now</th>
<th>Importance From Now</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply chain talent management including training, skill building, competency development, and career development.</td>
<td>4.20</td>
<td>4.60</td>
</tr>
<tr>
<td>Managing fuel and transportation costs.</td>
<td>3.86</td>
<td>4.29</td>
</tr>
<tr>
<td>Supply chain infrastructures world-wide, e.g., port, airports, highways, railroads.</td>
<td>3.55</td>
<td>4.19</td>
</tr>
<tr>
<td>Managing environmental issues and recycling of materials.</td>
<td>3.24</td>
<td>4.00</td>
</tr>
<tr>
<td>Development of new technologies that impact supply chain efficiency, e.g., RFID.</td>
<td>3.48</td>
<td>4.00</td>
</tr>
<tr>
<td>Collaborative supply chain forecasting.</td>
<td>3.30</td>
<td>3.96</td>
</tr>
<tr>
<td>Process improvements and waste reduction.</td>
<td>3.57</td>
<td>3.90</td>
</tr>
<tr>
<td>Identification and development of alternate materials.</td>
<td>3.40</td>
<td>3.75</td>
</tr>
<tr>
<td>Alternate material identification and development.</td>
<td>3.24</td>
<td>3.62</td>
</tr>
</tbody>
</table>
In interpreting these results, it is important to note that all of the items listed were evaluated using a 5 point Likert scale, where “1” denoted that the item was regarded as irrelevant by the respondent; “3” indicated that the item was somewhat important; and, “5” denoted that the item was regarded as “critical.” Consistent with the theme of SCM 2010 and beyond, the Delphi forced the experts to assess each trait along two time dimensions: importance today and importance five (5) years from today.

The results paint an interesting picture. Critical to managing today’s supply chain are issues such as delivery, supply chain disruptions, leadership, security, and trust (to name some of those issues rated at a 3.75 level or above). Yet, managing tomorrow’s supply chain is viewed as being far more complex and demanding. One way of assessing this change is to look at those traits rated 4.00 or higher. For today, only three (3) traits were rated so highly. Yet, five years from now, there are 16 traits out of 26 that were rated at this level. In the future, the supply chain will be asked to do more than simply deliver goods and services and to manage risk. It will be asked to deal with issues such as coordinated and improved performance measurement across the supply chain. It will be asked to develop and manage supply chains that can reduce environmental costs, be agile in using supply chain capabilities to design and deliver superior solutions to our customers, and it will be asked to do manage and protect not only physical assets but also intellectual property assets (an issue consistent with a supply chain that is moving from simply product development to product design and innovation).

In short, the future is going to be challenging. To meet those future challenges, we have to start putting in place needs programs and actions today. Identifying those programs and actions is the major focus of this study third phase.

**Phase III – The Workshops**

Nearly all of the preceding work can be regarded as being preparation for the main event of this study – the on-site workshop. The goal of this workshop was to bring together the participants for the purposes of:

- Reviewing the findings of the Delphi;
• Identifying the current and future states of supply chain management;

• Uncovering the major issues and gaps affecting the movement of supply chains between the current and future states; and,

• Developing agendas in three critical areas (practice, research, and knowledge dissemination) aimed at closing/resolving the gaps previously identified.

Achieving these objectives required an on-site workshop since the face-to-face discussion and dynamic interchange of ideas and comments was seen as critical to the success of the project and to the resulting quality of the documents/outputs generated from this workshop.

A requirement generally enforced was that for a person to participate in the workshop, they had to have participated in the prior two rounds of the Delphi study. Further, to make participating in the workshop attractive, the organizers had secured external funding (as previously noted). This funding was used to pay for all expenses (hotel, meals) incurred by the participants once they arrived on-site. Each participant was responsible for paying for their travel expenses.

In preparation for the workshop, which was to begin with a reception in the evening of September 20 and which was to continue with the workshop events all day on Thursday, September 21 2006, the organizers developed a general process framework for the workshop. That is, the workshop was envisioned as consisting of the following activities:

• An introductory session to review the objectives, summarize the results of the Delphi and to review the workshop protocol;

• A series of small group breakout groups followed by large group discussions. At each stage in the process, the participants would break into three small groups, where the issues/topics assigned to them would be discussed. Each group’s interactions would be managed by a facilitator. At the end of the small group activities, the participants would re-aggregate for the purposes of reviewing the results and identifying the critical issues; and,

• An ending summary session.

Consistent with the general approach, a workshop protocol was developed (see Appendix 3). This protocol was designed to insure that consistency and structure in the various activities.
Supporting each of the small group breakout sessions was a set of standard reporting forms (to be used for capturing and reporting the results of each small group). Once the protocol was finalized, it was possible to finalize the agenda (see Appendix 4) and to identify the facilitators (see Table 2). Finally, it was decided to have recorders in each of the sessions. The purpose of the recorders was to transcribe the results into the appropriate forms and to upload the forms to the Michigan State University computer system using the Angel course management system as the vehicle for receiving and posting the results (this system was also used for storing and making available the reporting forms). The recorders for this workshop were volunteer doctoral students in the Operations Management program in the Department of Marketing and Supply Chain Management.

### Table 2

**Workshop Facilitators and Recorders**

<table>
<thead>
<tr>
<th>Session</th>
<th>Facilitator</th>
<th>Recorder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Group Breakouts</td>
<td>Rhonda Lummus</td>
<td>Delvon Parker</td>
</tr>
<tr>
<td></td>
<td>Robert J. Vokurka</td>
<td>Shawn Jones</td>
</tr>
<tr>
<td></td>
<td>F. Robert Jacobs</td>
<td>Laird Burns</td>
</tr>
<tr>
<td>Large Group Discussions</td>
<td>Steven A. Melnyk</td>
<td>Laird Burns</td>
</tr>
<tr>
<td></td>
<td>Joseph Sandor</td>
<td></td>
</tr>
</tbody>
</table>

The workshop was held at the James B. Henry Center for Executive Development at Michigan State University. This site was selected because it was relatively convenient to reach (located within 90 miles of Detroit). In addition, the center was joined to the Candlewood Suites, thus providing on-site lodging and hosting.

After several last minute cancellations, the on-site workshop brought together 23 people (Appendix 5). The information generated from the resulting workshop is presented in the next two chapters.
IDENTIFYING THE GAPS

There are two supply chains present (Figure 1). The first is the current supply chain. As experienced by many firms, this supply chain is **effective** (able to meet or satisfy corporate objectives) and **efficient** (able to satisfy these needs at a lower total relative to the alternatives available). Yet, as can be seen from Figure 1, this chain is reaching the upper limits of its performance potential. The reasons for this upper limit can be found in the nature of this supply chain. It is primarily a tactical supply chain – one that is charged with carrying out the directions of upper manager but one whose capabilities are often not completely understood nor appreciated by those who are charged with setting corporate strategy. It is a supply chain that is often narrowly focused. Its charge is often stated in terms of execution and cost. The strategic implications of the supply chain are often overlooked. Consequently, with the existing supply chain, there is a chasm present between those who work with and in the supply chain and those who oversee the resources of the firm and who are charged with identifying ways that the firm can generate higher relative levels of value.
Against this first supply chain, there exists another emerging supply chain – one denoted as SCM 2010. In contrast to the first supply chain, this supply chain is very different. It is strategic in nature; it deals with not only execution but also with product design (within the context of the supply chain); it is strongly global in nature (i.e., it embraces and plans for the global dimension of sourcing and marketing); it is highly adaptive to changes in both supply and in demand; it focuses on cost avoidance (avoid making bad decisions in the first place) not only cost savings (which is correcting the effects of a bad decision previously made); it recognizes the presence of risk (and that risk is more than simply supply chain disruption) and it plans for and manages appropriately risk. It is viewed as a strategic asset and in many cases a core competency. It is a system that encourages and fosters collaboration and trust where appropriate. It evaluates performance along multiple dimensions – lead time, cost, quality, risk exposure, consistency
with strategic objectives, and environmental considerations. While the current supply chain has reached the upper limits of its performance potential, this new supply chain has yet to reach its full potential. More importantly, while the current supply chain is approaching the end of its “life cycle,” this new strategic supply chain is at the start of its life cycle. The question to be addressed – how do we get from one supply chain to the other? To do that, we must understand the gaps that stand in the way of this transition.

**Gaps**

The task facing most managers today is that of transitioning their supply chains from the tactical level to the strategic level. This is not an easy transition to make since it requires identifying and overcoming several critical gaps. Identifying and describing these gaps became the focus of the second session of the workshop.

The participants (both academic and practitioner) noted that most of the major supply chain characteristics had gaps from where organizations are today in supply chain management practices, processes, and relationships. These gaps could be grouped into six major categories:

- Strategic visibility and alignment
- Talent management and leadership
- Supply chain models including optimization, risk, and cost
- Process orientation including measures, information, and integration
- Relationships and trust
- Supply chain architecture and structure

**Strategic visibility and alignment:** There is still a lack of a strategic perspective of the supply chain in many organizations. Senior management does not yet fully understand the value of the field and the benefits need to be better measured and recognized. In some organizations, a more refined alignment of functional areas needs to take place to more fully exploit the value of supply chain management. A true global perspective is more broadly needed.

**Talent management and leadership:** There is a shortage of talent management in the field of supply chain management. An insufficient supply of competent cross-functionally trained supply chain professionals exists. Competency models need to be developed to better identify and
prepare individuals for key supply chain roles. Global business skills need to be developed since much of our commerce today expands across national borders. A better identification of the required body of knowledge at both the operational (undergraduate) and strategic (graduate) educational levels is needed. There are insufficient ties between educational institutions and industry and more student and faculty internships would be valuable. Individuals need to advance through supply chain competencies, gaining cross-functional experience, to become supply chain leaders.

**Supply chain models including optimization, risk, and cost:** There are insufficient validated models for supply chain optimization, risk minimization, and cost. Organizations are putting the pieces together, but more is needed in the way of defined supply chain models for evaluation and optimization of the entire chain. Management often times has a limited perspective of risk and top management needs better understanding of the risk drivers and strategic importance of risk management. This includes both competitive and natural disaster disruptions as well as better awareness of risk’s flip side - opportunity. The opportunity includes not only developing distinctive and sustainable cost advantage but also finding ways to better engage the supply base to drive top-line growth.

**Process orientation including measures, information, and integration:** Supply chain activities are still often functionally-based. More of a process orientation is needed to fully extract the potential value of supply chain alignment. This requires measurements that cross functional boundaries and the information needed to adequately monitor performance and improvements. Many measures used today are short-term and inter-firm measures are needed for supply chain activities. Appropriate information is sometimes difficult to extract and there are incompatible IT systems between organizations.

**Relationships and trust:** An integral part of effective supply chain management is the personal relationships between people across processes and organizations. This requires an appropriate reward structure and top management support internally. Externally, goal congruency, trust, communication, integrated processes are all prerequisites.

**Supply chain architecture and structure:** There is a need for better methodologies of total supply chain network optimization including real time information and visibility. Value streams need to be mapped for value drivers using defined procedures and prioritization mechanisms and
rules. Tools for automatically mapping numerous supply networks would be useful as well as the identification of choke points from the aggregation of supply chains.

**Micro-Gaps**

These six gaps identify major sets of obstacles and issues that managers must be prepared to address if the supply chain is to realize its strategic potential. Yet, these six gaps are in many ways too broad. They lack detail; they embody some very specific issues and gaps that were identified during workshop. Specifically, 16 micro-gaps were identified. These micro-gaps will be examined in this section. To facilitate their discussion, they will be grouped around those six gaps that they were assigned to in the general discussion session. This grouping is summarized in Table 1.
### Table 1
Mapping Micro-Gap Issues Against the Gaps

<table>
<thead>
<tr>
<th>Gaps</th>
<th>Micro-Gaps</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategic visibility and alignment</strong></td>
<td>Strategic supply chain investment and improvements</td>
</tr>
<tr>
<td></td>
<td>Global</td>
</tr>
<tr>
<td></td>
<td>How to develop skills sets to know every market in every country and effective manage this, intercultural training</td>
</tr>
<tr>
<td></td>
<td>Information and supply chain visibility</td>
</tr>
<tr>
<td></td>
<td>“Cradle to Cradle” management</td>
</tr>
<tr>
<td><strong>Talent Management and Leadership</strong></td>
<td>Leadership</td>
</tr>
<tr>
<td></td>
<td>Resolving Supply network paradoxes</td>
</tr>
<tr>
<td></td>
<td>Talent management</td>
</tr>
<tr>
<td><strong>Supply chain models including optimization, risk and cost.</strong></td>
<td>Total supply network optimization – visibility, real time information, multiple supply chains of unequal importance</td>
</tr>
<tr>
<td></td>
<td>Supply chain governance</td>
</tr>
<tr>
<td></td>
<td>Leadership team ‘hasn’t got it’ but a chief SC officer still runs logistics or purchasing as ‘lackey to other guys’ – some have crossed this chasm</td>
</tr>
<tr>
<td></td>
<td>Risk management, planning, strategy</td>
</tr>
<tr>
<td><strong>Process orientation including measures, information, and integration</strong></td>
<td>Supply network measures</td>
</tr>
<tr>
<td></td>
<td>Product innovation using supply chain</td>
</tr>
<tr>
<td></td>
<td>Business process integration</td>
</tr>
<tr>
<td><strong>Relationship and trust</strong></td>
<td>Collaboration and relationships</td>
</tr>
<tr>
<td></td>
<td>How to redefine boundaries of what people focus upon to induce collaboration, rewards for this</td>
</tr>
<tr>
<td><strong>Supply chain architecture and structure</strong></td>
<td>Layered and dynamic supply chains</td>
</tr>
<tr>
<td></td>
<td>Supply chain structure - physical</td>
</tr>
</tbody>
</table>

### Strategic Visibility and Alignment

The first micro-gap identified was that of **Strategic Supply Chain Investment and Improvements**. Specifically, with this first micro-gap, the participants noted that management has to make significant improvements and investments in the supply chain if its potential is to be realized. These investments are not simply in “brick and mortar.” Rather, they are investments in performance measurement systems, linkages between supply chain design and management and the overall business plan, the development of supply chain advocates and champions at the upper levels of corporate management, and in shifting the perspective of management from the short term to the long term.
These investments are needed because, currently, supply chains and their managers are limited by the following factors:

- Short term perspectives (building a strategic supply chain is a long term undertaking and it must be evaluated in terms of the long term);
- Lack of critical capabilities in the supply chain (due to a lack of necessary investments);
- Failure to recognize the supply chain’s critical role in delivering value at the corporate level and to recognize that supply chain management could be viewed as a strategic core competency;
- Insufficient feedback or communication between top management and those managers involved in the supply chain. Consequently, those at the top are often unaware of the capabilities and limitations of their supply chains. In contrast, those involved with the design and management of the supply chain are unaware or unable to restate the corporate objectives into terms meaningful for the supply chain. The result is a significant disconnect between these two groups.
- Reward systems are not commensurate with the required long-term focus. In most firms, supply chain performance is rewarded in terms of short-term cost cutting and cost savings activities. Such a perspective encourages managers to overlook activities such as Early Supplier Involvement (ESI), and new product development and supply chain designs.
- Little or insufficient publicity for the impact and importance of the supply chain. Consequently, there is limited or no recognition either internally or externally for the corporate supply chain.
- Not enough supply chain advocates/champions at the upper management levels. Consequently, there is no one at the upper management levels who is protecting and nurturing the supply chain and who is promoting supply chain capabilities and importance at this level.
- Viewing supply chain management as simply a purchasing function. Such a perspective emphasizes buying and selling; it does not adequately recognize that effective supply chain management involves a number of activities beyond purchasing – activities such as
engineering, logistics, supplier development, product design, accounting measurement, alignment and coordination of information flow and critical business processes.

Addressing these gaps is critical because, if unaddressed, they will effectively hinder the ability of the firm to transition its supply chain to the strategic supply chain. Tackling these gaps requires increased investment and a significant change in top management awareness and attitudes.

The second micro-gap is that of the **Global Gap**. This gap is a reflection of the fact that most supply chains must now operate in a global environment. In this new environment, extensive interdependency is the rule, not the exception. It is an environment where the lowering of trade and political barriers and the rapid growth of digital technology has made it possible to do almost instantaneously business with billions of buyers and suppliers across the world. This is the very notion that underlies the recent best seller, *The World is Flat: A Brief History of the 21st Century* (Friedman, 2005).5

Effectively operating in this new and broader environment requires the development and encouragement of new skills. These skills include more than simply business skills. They include skills involving language and intercultural awareness. The following is a list of the critical skills strategic supply chain managers need to not only survive but also thrive in this new environment:

- Understanding the markets (domestic and global);
- Understanding capacity (both from a volume and capability perspective). Capacity is critical to supply chains since supply chains can be viewed as capacity chains. Yet, for many managers and even researchers capacity remains one of the most complex and difficult concepts to explain. One of the reasons lies in the nature of capacity. Capacity is more than volume (the number of units of output produced per time period). It also involves capabilities. Capabilities, which are the products of processes, assets, infrastructure, system organization, and system extensions (additional investments made in extending/enhancing corporate or supply chain assets), define the strengths and weaknesses of the firm and of the supply chain. Capabilities define what one system is

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“good” at doing and what that same system is “poor” at doing. When dealing with supply chains, the challenge facing managers is to ensure that the capabilities of the supply chain are properly aligned and coordinated so as to better meet the needs of customers. While sufficiently difficult to achieve domestically, this alignment is even more critical when dealing with global supply chains. Because of separations in terms of time, distance and culture, it is possible to structure a supply chain in which the capabilities of the suppliers are mismatched with the needs of the customers. The results of such mismatches can and are often disastrous for the firm and the customers.

- Enhanced and broader planning. Surviving and thriving in the global environment requires more than simply generating production plans and transmitting product orders to our foreign suppliers. Rather, it involves developing a planning system that focuses on issues such as matching the capabilities of the supply base with the needs of the customers; it involves developing a planning system that builds and uses supply chain visibility to identify and mitigate potential problems; it involves building a planning system that promotes collaboration and coordination of activities within the supply chain. Consequently, we should view the traditional Resource Planning system (Figure 2) as the starting point for managing global supply chains. By itself, it is not enough; it has to be enhanced and broadened. While appropriate for managing the internal factory, it is not adequate to the needs of managing and directing the global supply chain.
Understanding the critical costs incurred when going overseas. In many cases, doing business in the People’s Republic of China may mean that the labor costs are lower. However, in exchange for these lower labor costs, the firm may find itself faced by higher fixed/overhead costs since it has to build the infrastructure necessary to build up the expertise and capabilities of these new facilities. The firm’s management may have to teach management and planning skills to the plant management of these new Chinese facilities. It may have to set up the information and planning systems needed for the new
Chinese plant to carry out its activities. All of these activities require investments that the firm may not have planned for and which may be sufficient to offset any labor costs incurred.

- Recognizing the “risk” implications of global supply chains. Global supply chains are, by their very nature, have some interesting traits. First, they are spatially longer – they cover more geographic distance. They are potentially more “fragile.” If something happens anywhere in the supply chain (e.g., a plant fire at the supplier’s site, a ship carrying the products from our suppliers sinks, the products are held up for longer than expected at inspection), the supply chain can take longer to respond. With the more prevalent usage of lean systems and practices (resulting in reduced buffers), these supply chains are also becoming increasingly fragile – less able to quickly and efficiently deal with such risks. For example, the SARS crisis of 2003 adversely affected the delivery performance of many North American firms that depended on supplies coming from the Far East. In many cases, the managers from these North American firms were unable to travel to the Far East and visit their suppliers (in order to assess the extent of the problems and the options available to them) because of travel restrictions imposed by the various governments involved. Without adequate buffer stocks to protect the North American firms, performance was adversely affected as deliveries fell and costs increased. Finally, when dealing with global supply chains, there is the risk of not being able to adequately protect intellectual property. The participants noted several instances of where products embodying significant investments in intellectual property were outsourced overseas. Eventually, the buying organizations learned that the suppliers were sharing/selling the intellectual property to others or they were engaged in “third shift” activities. In these cases, global supply chains could and did compromise intellectual property. All of these are the different types of risk imposed by global supply chains.

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6 The “third shift” describes a situation where a supplier located typically in the Far East will produce the goods with high intellectual property for two shifts for the buying organization (the organization that invested time, money, and effort in developing new products and their associated intellectual property). Production over these two shifts is needed to meet the needs of their customers. However, these same supplier firms, for the last shift, have extra capacity available. Consequently, they make some cosmetic changes to the product and then manufacture and sell it for a lower price. These firms have not had to make the same investments in
• The need to develop a better cultural understanding (e.g., language, value system, country morals and legal system). For example, when dealing with firms in some countries, it is difficult to get the managers there to admit fault for any problem that has occurred that is directly attributable to them. For these managers, saving face is critical. In other cases, foreign subordinates are hesitant to offer suggestions or to criticize the actions of their superiors (something that many Western managers have come to expect). For these subordinates, it is culturally inappropriate for them to challenge the actions of their superiors.

• The need to understand the impact of governmental differences on global supply chain management. When dealing with product and information flows that cross international boundaries, management must deal with differences in governmental regulations. What is appropriate in one country may not be appropriate in another. When building a product that consists of components built in different countries, there is the question of what standards (e.g., quality, environmental) to apply. The participants brought up numerous instances where the regulations of various countries in which they operated were difficult to “harmonize.” Dealing with the task of how to bring harmony out of conflicting regulations was recognized to be a major challenge facing any manager working with the global supply chain.

• Improved continuous environmental scanning, as it relates to the global supply chain:
  o Better assessment of Risk potential
  o SWOT (Strengths/Weakness/Opportunities/Threats) Analysis
  o Capacity analysis across the supply chain.

• Improved communication internally.

The third micro-gap is that of Information and Supply Chain Visibility. The gap involves information not being visible to all participants in the supply chain, from end-to-end. There are multiple causes for this gap including:

• Access issues – not all participants have access to the needed information.

devolving the intellectual property that the buying organizations did. This is a real and significant threat to intellectual property.
• Data integrity – incorrect or missing information. This is a critical issue when dealing with global supply chains. In many cases, suppliers located in the Far East have very crude information systems. In many cases, the management of these foreign firms is unaware of the need for data that is complete, current, and accurate. They are unaware of the importance of good data. For those foreign managers who may be aware of the need for good data integrity, they may find that they are pre-occupied with the needs of meeting current production requirements. In some countries, the suppliers that North American firms are dealing with are very new. One director noted that one of their suppliers had just recently opened a plant in what had been one year before a rice field. The employees in this operation had been farmers the prior year. This meant that the need for good data and high levels of data integrity were “shelved” while the management at this new plant focused on such issues as teaching employees, organizing production, and in meeting production schedule needs. The bottom line – when dealing with global supply chains, data integrity is an issue and a concern, not a given.

• System incompatibility – systems for supply chain partners cannot properly communicate.

• Lack of content clarity. This refers to the basic breakdown of communication between supply chain partners, with the result that what the customer wants (and thinks that they have clearly communicated) is not what the supplier has heard and understood. This is a critical issue when dealing with global supply chains. One participant told the story of working with a Far Eastern supplier. The discussions had been long, protracted, and difficult. At the end, the person in charge of negotiations for the American firm had laid out their requirements in a great deal of detail. The question was then posed – “Do you understand what you must do?” The supplier replied, after a pause, “Yes.” The American firm walked away thinking that everyone agreed to the resulting plans and requirements. Yet, when the relationship was put into action, the supplier did not perform to the level required. The managers at the American firm, in frustration, asked how they, the supplier, could fail since they had indicated that they understood what was needed. In the resulting discussion, what came out was that the supplier had not lied –
they understood what their customers wanted. However, they were not asked to indicate whether they could meet these requirements.

- Missing global perspective. Managers must realize that global supply chain management is more than buying and selling globally. It involves issues of how to bring together assets that are globally dispersed so as to better meet the ever-changing needs of its customers. It also means recognizing that today’s suppliers may not be suppliers in the future. This point was driven home by the comments made by one vice-president of global sourcing who observed that in a recent trip to China, he was told by the management of one firm that while that firm was currently exporting over 90 percent of its output, in five years time, the management at that firm expected that 100 percent of their production would be directed to meeting the growing internal demands of the Chinese market. Furthermore, in 10 years, the management at this Chinese firm expected that the China market would become the largest customer base – far outstripping the ability of Chinese suppliers to meet these needs. This would mean that the surplus in demand would have to be met through imports into China. The potential problem for many American firms, noted this vice-president, would be the lack of manufacturing capacity in the United States – capacity that was eliminated because of decisions previously made to outsource that same production to China. Avoiding this and other problems requires that management embraces a global perspective when doing both short term and long term planning.

- Too reactive – tactical, not strategic, in nature. Potential problems are not identified and addressed in advance. Rather, the problems are identified once they become evident. The system then works on correcting the effects of the problem. Most global supply chains suffer because they emphasize problem correction rather problem prevention. In other words, they are not designed and managed “correctly.” In many cases, these flaws are compounded by the location of suppliers (often far away from us), the inability of suppliers to secure financial resources at the same rates as their often larger customers, and the relative “immaturity” of their internal information, planning, and production processes.
Information and supply chain visibility is critical because in today’s world, potential issues and problems must be identified and addressed before they become real problems. Once they become real problems, the traits of the new supply chain (global, dispersed) can hinder the ability of the firm to quickly deal with these issues. Just as visibility when driving a car is critical, so is visibility when managing the supply chain.

The fourth micro-gap involves firms and their supply chains adopting a “Cradle-to-Cradle” perspective when it comes to materials and inputs. The participants recognized that in the future the demand for inputs and materials would increase at a rate beyond that of the suppliers’ ability to provide. This increase is not simply because of factors such as the limited supply of oil. Rather, it was also due in large part to the emergence of the People’s Republic of China and India as dominating product consumers. For example, consider the following statistic. By 2010, it is expected that China will have over 1.4 billion people of which some 660 million will be between the ages of 20-50 (IIASA, 2006). Not only is this group of reproductive age, it is also in the age group that will generate the greatest level of demand as consumers of goods and services. Consequently, this demand is expected to greatly exceed the capacity of Chinese plants, thus requiring that China became the major importer of world goods and services. This trend, which is not limited to China but also includes India, is expected to increase the demand of raw materials to the point that the competition for scarce materials will significantly inflate prices.

One way of reducing this impact is to become “better” at preserving existing raw materials. That is, firms must become not only more efficient (use less material per every unit of output) but also do a better job of tracking and reducing the amount of raw material lost as scrap or as pollution. In the past, this approach has been referred to as “cradle to grave” – from extraction from the earth and to the return of the material to the earth. Yet, this approach is fundamentally flawed in implementation because it is associated with “recycling.” Recycling involves capturing scrap, salvage, and rework and returning to a state that allows that material to be used as a raw material again. The problem with this approach is that resulting raw material is of a lower grade than the original material. In many cases, this new material cannot be used to satisfy original demand. Additional material must be extracted to meet this original demand. What is needed is an

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alternative approach – one in which raw materials can be returned to the same state as they were in originally so that they can be used to meet the original demand.

McDonough and Braungart (2002)\(^8\) have coined the term “cradle to cradle” to describe this new approach. To implement this new approach (one that is needed to meet the “threat” of China as a major and growing source of demand) requires a coordinated approach within the supply chain. It requires a change in how activities (including purchasing and product design) are carried out. It requires new performance measures that highlight (and reward) efforts aimed at attaining the goals of a “cradle to cradle” approach. Traditional recycling (which McDonough and Braungart refer to as “down-cycling”) must be discouraged since they do not preserve existing levels of supply. In short, the new supply chain must become better at preserving existing levels of supply not simply because it is environmentally and socially correct. Rather, it must do so because such activities are demanded by the realities of the new environment.

**Talent Management and Leadership**

There are three micro-gaps that must be addressed as part of this gap. The first is that of leadership.

*Leadership* focuses on acquiring and developing exemplary supply chain talent and leaders. Currently, there is a lack of a strategic view and supply chain perspective or orientation. There is also a lack of measurements that drive leadership and the strategic integration necessary. Many organizations are faced with the problem of trying to determine how supply chain personnel fit within the organizational structure. All of these lead to a need to better identify and nurture talent in organizations to provide the supply chain leadership necessary for future success.

The second micro-gap is *Resolving Supply Network Paradoxes*. Effective supply chain management requires different approaches and a different perspective. Practices that may have worked well in managing the internal factory can create problems when applied to the supply chain. These “inconsistencies” or paradoxes must be identified and addressed in advance if the potential problems are to be avoided. An example of such a paradox discussed over the course of the workshop focuses on relationship between supply design and cost performance. If the supply chain is designed right the first time, then there should be very little opportunity for

subsequent cost reduction. However, in most organizations, supply chain improvement is measured in terms of cost reduction (which encourages the supply chain to be not initially optimally designed). It was pointed by several participants that most firms have accounting systems in place to capture the impact of cost savings (which according to one participant is nothing more than correcting the effects of bad decisions previously made). Few firms, in contrast, have accounting systems that can accurately capture and report the impact of cost avoidance. Consequently, while management desires cost avoidance, it rewards cost savings.

The third micro-gap is *Talent Management*. There is a need to develop competency models for the types of talent that is needed now and into the future. Previous talent needs were more functional in nature, training in a specific discipline. Supply chain talent is now needed that is more generalist in nature and includes integration of various disciplines. Today, there is a lack of sufficient graduates with demand outstripping supply. There are insufficient ties between industry and educational institutions to foster the development of talent. Finally, there is a dearth of student (at the undergraduate, graduate and doctoral levels) and faculty internships to provide a training ground and experience base. We have far too few students who can do strategic supply chain; we have far too few faculty who can teach strategic supply chain.

It is interesting to note that this concern with leadership and talent is simply unique to supply chain management. In a recent issue of the *Economist* (October 7, 2006), the survey section focused on the hunt for talent.9

**Supply Chain Models Including Optimization, Risk and Cost**

The focus here is on studying and improving system performance through the building and analysis of models. Included under this section are the following micro-gaps.

*Total Supply Network Optimization* focuses on the need to develop and use various optimization models, e.g., risk, developing target costs, cost models, as a basis for identifying various forms of system performance. Experimentation and analysis of Inhibitors to more widely using these tools today are the lack of trust and reticence to share information between supply chain partners, a lack of visibility in not clearly knowing what the customer wants, different objectives among the supply chain partners, and the distribution of power within supply chains. Models are only as

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good as the information factored into the model which is another deficiency in today’s supply chain activities.

The next gap involves that of Supply Chain Governance. Governance involves having processes and systems that are transparent and whose operations can be monitored on a regular basis. The goal of improved governance is to insure that all those involved with the system are following current processes and procedures. Currently, governance is a major issue for many North American firms. For example, within the United States, the level of overall system governance is being elevated in importance and enhanced in performance – developments that can be attributed to the implementation of Sarbanes-Oxley Act of 2002.¹⁰

Increasingly, the need for governance is spreading from accounting and reporting activities to other areas. One area expected to be affected by this spread is that of supply chain management. The view of the participants is that most firms are unprepared for this development. At present, internally, there is a lack of process ownership and accountability for supply chain activities. This lack of governance may eventually raise concerns regarding the manner in which contracts are awarded, relationships managed, and performance evaluated. When it comes to system and procedure governance, many supply chain systems can be regarded as “black boxes.”

To the participants, governance had both an internal and external dimension. Internally, governance involved not only process ownership and accountability (as previously noted) but also governance regarding crisis planning. Overall, there was a lack of adequate governance and ownership involving crisis planning. One indication of this state was the widespread lack of Business Continuity Planning.¹¹ Consequently, few firms are prepared to deal with the emergence of a sudden change in the conditions of supply and/or demand. For most firms, crisis planning and short-term crisis-driven reaction is more the rule rather than the exception. As will be discussed later on, disruptions can have a catastrophic impact on the performance of supply

¹⁰ Pub. L. No. 107-204, 116 Stat. 745, also known as the Public Company Accounting Reform and Investor Protection Act of 2002 and commonly called SOx or SarbOx; July 30, 2002
¹¹ Business Continuity Planning (BCP) is a formal procedure/system used to identify the major forms of risk (and their associated impacts) facing an organization, to formulate plans and strategies aimed at reducing these risks (or offsetting their impact) and to create a plan for how an organization will resume partially or completely interrupted critical function(s) within a predetermined time after disruption.
chains because many supply chains are being “leaned” out in response to demands for better performance (lead time, quality, flexibility) and reduced cost.

In addition to the need for better governance for business continuity planning, there is also a need for better governance for supply chain security. Governments in Europe, Canada and the United States (to name a few areas) face the potential for terrorism. Weapons can be smuggled into the country using supply chains developed by companies for importing components. Furthermore, these same supply chains can be used as a vehicle for spreading the effects of the acts of terrorism. Consequently, governments are increasingly placing the responsible for supply chain security on the private sector.

Within the United States, the federal government has implemented a voluntary program – the Customs-Trade Partnership Against Terrorism (C-TPAT). This program offers participants the opportunity to benefit from expedited customs inspections at the border. To secure this benefit (one among many), the firm must be willing to take over responsibility for the security of its own supply chain and for controlling/monitoring activities within its foreign suppliers. Achieving this objective requires extensive governance in the supply chain.

Externally, there also needs to be a better understanding of the power bases and the role and impacts of the supply chain “captain.” The supply chain “chain” is that person within the supply chain who takes over responsible for monitoring and coordinating activities and for dealing with any problems as they arise. Further, understanding is required of “choke points,” where the process flows and integration across the supply chain might be hindered. A “choke point” can be viewed as a bottleneck within the supply chain. It is an area that limits overall supply chain performance as a result of aggregation. That is, one firm taking the action alone will have no major impact on the performance of the supply chain. However, numerous firms, each acting independently of each other, taking the same action, can be expected to create a constraint.

An example of the choke point concept can be found in the following story. A British aerospace firm, in order to reduce overall costs, decided to standardize on one specific type of Plexiglas. The reason – the supply of this component was relatively high, the demand low. By standardizing on it, it was hoped that costs would fall. However, the problem was that other European aerospace designers had examined the same problem and arrived at the same conclusion. Consequently, the demand had escalated, while the supply had not. The end result –
price went up and availability fell. As can be seen from this example, the actions of the various customers had created a choke point.

Finally, there is the gap of **Risk Management, Planning, and Strategy**. The balance between buffers, postponement, and optimal costs for robust supply needs better understanding and application. As firms reduce buffers in the form of lead time, capacity (i.e., suppliers) and inventory, their supply chains become more susceptible to any potential disruption or change in timings within the supply chain. Shortcomings to this type of activity are the need to understand supply chain risks, management’s perspective of risks including an absence of a strategic view, a lack of established processes and methods, a lack of information, a lack of analytical tools, a lack of knowledge of supplier processes, an inability to understand the notion of “choke points” as they apply to supply chains, and a failure to identify and understand critical supply points, as they affect and are affected by disruptions. Risk drivers have to be understood including the probabilities and the impact of the drivers.

In addition, risk management needs to focus on not only supply-side changes but also changes on the demand side. It must not consider reductions in supply but also unexpected increases in demand (increases that exceed the capacity either of the firm or its supply base). Both types of changes can and do adversely affect the performance of the supply chain.

**Process Orientation Including Measures, Information, and Integration**

As previously noted, the supply chain can be best understood as the system created by the interrelationship of the various processes. Consequently, effective supply chain management requires a strong process orientation. In achieving this process orientation, the participants noted three micro-gaps that had to be addressed.

A major micro-gap affecting the implementation of this process awareness involves the lack of appropriate and meaningful **Supply Network Measures**. Performance measures are critical within the firm since they form the communication and nervous system of the firm. Metrics (which consist of three elements – the numerical measure, the standard, and the reward system) communicate to top management the impact of systems such as the supply chain to the achievement of overall financial and strategic objectives. Metrics are used to translate overall strategic objectives into operational terms (i.e., what do I, as a stockroom clerk, have to do well for the firm to achieve corporate objectives). If implemented correctly between supply chain
partners, metrics facilitate the coordination of actions between partners. If implemented incorrectly, metrics contribute to friction and frustration. Metrics tell the people involved in the system (be it at the corporate or supply chain levels) what is important and, more importantly, what is not important. For example, if something is not measured and/or not rewarded, then implicitly, what management is telling its personnel is that that activity is not important.

Supply chains should be managed through a process orientation with appropriate measures. Further work is needed on supply network measures including:

- Proof points to show how it works and to gain adoption from early adopters;
- An understanding of what are the right measures;
- Information is inaccessible and cannot be extracted;
- Incompatible Information Technology (IT) systems among companies in the supply chain;
- Lack of analysis tools that transform data into information;
- Personnel that don’t have adequate skill sets;
- Need for more longer term measures (instead of shorter term measures); and,
- Need for aligned and coordinated inter-firm measures (most are intra-firm measures).

Although supply chain measures are needed across the supply chain, they also must be linked to single firm financial and operational measures.

The participants expressed frustration with current supply chain metrics. Often, these metrics only evaluated the impact of the supply chain on the cost savings incurred by the firm. This approach emphasized cost savings at the expense of cost avoidance; it emphasizes short-term gains at the expense of potentially higher long-term gains. It also contributes to a situation where it is acceptable for the firm to do better at the expense of its supply chain partners.

There is the micro-gap involving Product Innovation using Supply Chain. Increased collaboration is needed between supply chain partners in participation in design efforts to improve product designs while reducing time to market. Also, supply chain partners need to work more closely together to offer problem solutions and incorporate newer technologies where
appropriate. Increasingly, the focus within many North American firms is shifting from competition through reduced cost to competition through innovation. To succeed with this new strategy, firms must rely not only on their capabilities but also on the skills and capabilities of their supply chain partners (both upstream/supply side and downstream/customer). By drawing on these capabilities and skills, the firm can potentially reduce lead times and costs while also improving quality. It can also deliver products and services that better meet the needs of the critical customers.

The final micro-gap associated with the “Process orientation including measures, information, and integration” gap is that of **Business Process Integration**. Organizations and supply chains need a broader process orientation. Individual functions don’t always map well to the business processes and functional boundaries may need to change to new boundaries – a new paradigm. Needed are touch points and linkages between functions, while maintaining ownership, but with metrics that are shared.

**Relationship and Trust**

Central to this gap was addressing issues pertaining to **Collaboration and Relationships**. There needs to be a greater focus on relationship building and trust between and within organizations. An improvement would be a redefinition of boundaries as what people focus upon to induce collaboration and provide rewards for doing this. There are internal problems that need to be overcome such as power struggles, egos, an inconsistent reward structure, a lack of integrated process thinking, top management support, and processes such as Sales and Operations Planning (S&OP) that foster these types of improved relationships. Externally, there is a need for more trust, both between individuals and organizations. The participants had noted that in many industries, trust was present some years ago. However, as the pressure to improve performance increased, many purchasing managers focused primarily on price. Any collaboration between suppliers and the buyers that had resulted in either overall shared cost savings, reduced lead times, or better product designs were often overlooked and in some cases ignored. Examples were offered whereby product designs generated through collaborations were turned over to other suppliers to build. The rationale frequently given was that these new suppliers were able to build the product at a lower cost. This practice was seen as playing a critical role in the loss of trust now present in many supply chains.
Constraints are methods of communication, lack of integrated processes across firm boundaries, goal incongruity, and planning versus implementation (“talking the walk, but not walking the talk”). Increased globalization brings about additional constraints such as distance, cultural inconsistencies, language barriers, and time zones.

Supply Chain Architecture and Structure
As previously noted, the sixth gap focuses on the design and structure of supply chain structures. Addressing this final gap requires dealing with two separate but related micro-gaps.

The first such micro-gap is that of Layered and Dynamic Supply Chains. Supply chain architecture needs to be aligned and realigned as they are dynamic. Maintaining this alignment is not a simple task because most supply chains are not one-dimensional. At a minimum, most supply chains consist of five layers:

- **The product supply chain.** The supply chain structure responsible for managing the design, manufacture, and delivery of the goods and services demanded by the customers. This chain is constantly changing in response to changes in customer demand, competitive actions, government mandates, technological change, or supply base changes (Gattorna, 2006).

- **The financial supply chain.** The financial supply chain focuses on the financial flows and ownership of the financial resources needed by the supply chain. In many cases, the benefits anticipated by outsourcing to the supply base have been reduced by the inability of these smaller firms to secure access to needed financial resources at the same favorable levels secured by the larger customers (Hartley-Urquhart, 2006).

- **The information supply chain.** This supply chain focuses on the flow, management, and ownership of information through the supply chain.

- **The competency supply chain.** This deals with the nature of core competencies within the supply chain. It identifies the core skills of the various supply chain partners and how these core competencies are interlinked.

- **The responsibility supply chain.** The responsibility supply chain addresses the issue of which supply chain partner is responsible for what activities within the supply chain. Accountability is critical to success.
In addition, this issue also focuses on the amount of visibility to be present in the supply chain and how the structure of the supply chain can be used to support this visibility requirement (modular versus integrated).

Finally, there is the gap of **Physical Supply Chain Structure**. Improvements continue to be necessary for better physical structures of supply chains and material flows. Here, our focus is on issues such as the location of supply chain partners, the physical linkages that exist between partners, and the number/type of supply chain nodes.

These various as critical because how they are addressed and resolved will determine the shape of the future supply chain – supply chain 2010. Based on these gaps, it is now necessary how to address them. That means developing a set of agendas aimed at closing the gaps. Developing those agendas is the focus of the next chapter.
CLOSING THE GAPS: 
THE AGENDAS FOR ACTION

Having identified the gaps, the task next facing the workshop participants was that of closing these gaps. To do that, the participants were charged with the task of developing agendas – lists of actionable items that would ultimately be prioritized and form the basis for initiatives and projects at the university, corporate, or professional society levels. Initially, the goal would be to generate three agendas; practice, research, and knowledge dissemination. However, it soon became evident that the practice agenda was not appropriate. Managers, it was pointed out, would do what is appropriate. After all, they are also the ones who are blazing the trail into strategic supply chain management. Consequently, it was decided to focus on the latter two agendas. This chapter presents these agendas and summarizes the discussion that accompanied their presentation.

The Agenda for Research

Of the six gaps discussed in the preceding chapter, the research agenda focuses on the following five: (1) Strategic Visibility and Alignment; (2) Supply chain models including cost optimization and risk mitigation; (3) Process orientation including measures, information, and integration; (4) Relationships and trust; and, (5) Supply chain architecture and structure.

Strategic Visibility and Alignment

Under this topic, three issues were raised as requiring research because the answers to the questions that these issues contained could not be readily found but they were needed:

- **What is the impact of the supply chain on corporate performance?** In general, the impact of the supply chain is evaluated in most firms in terms of traditional price/cost savings. That is, the question most frequently asked is, “How much did we save by outsourcing an activity, bidding some good or service, negotiating, or fire fighting?” As a consequence of this approach, most managers see the supply chain as something that is used to reduce price and nothing more. For many managers, this reduces the overall attractiveness of and opportunity from, supply chain management. However, effective and efficient supply chain management can and does affect and enhance the ability of the supply chain to better compete in the marketplace. In addition, as firms such as IBM, Toyota, Honda, Harley-Davidson, P&G, Deere and others recognize, supply chain
management is a corporate core competency – a skill set that the firm develops to earn a sustainable competitive advantage.

To move the supply chain from being seen as primarily tactical/price oriented to strategic, it is important that research identify and assess the total impact of the supply chain on corporate performance. By total impact, the participants meant the effect of effective and efficient supply chain management on overall financial performance -- Earnings Per Share, Stock Prices, top-line growth, new product development, assurance of supply, risk mitigation, and the ability to secure funds at preferred rates, product delivery lead time, product design lead, ability to respond quickly and efficiently to changes in demand (either upwards or downwards), ability to quickly reconfigure product design in response to market demand, or to changes in the conditions of supply (as captured in terms of Price/Quantity/Time). In addressing these questions, it is important that the answers not simply be limited to perceptual responses (e.g., having a person respond by strongly agreeing to the statement that “Our supply chain has greatly enabled us to reduce product design lead times”). Rather, what are needed are quantitative, objective responses. These are responses that identify the exact size of the improvements in terms of dollars and days (if appropriate) as well as specific processes that produced such favorable performance.

In answering these questions, the researchers will be giving the supply chain practitioners the ammunition needed to show that supply chain is not simply tactical, but rather strategic. Addressing these questions can help demonstrate (depending on the results generated) to managers (especially those operating at the top level) that strategic supply chain management is not simply a tool for reducing price but also for increasing sales and for generating higher levels of value faster and better relative to the competition.

- **When do firms benefit from Supply Chain Management over time?** This question takes a different approach to the task of assessing the impact of the supply chain on the firm. With this approach, we recognize that building the “right” supply chain means building an asset. Whenever you build an asset, whether it is a building or a name or a supply chain, you have to invest time, effort, and money. When dealing with such investment, the costs are incurred upfront for benefits that are generated later on. This question looks
at identifying the time until breakeven. That is, we are interested in identifying how long it takes to reach that point where the total benefits generated by the supply chain offset the total investments that the firm has made in its supply chain.

This is not an easy question to address since the resulting costs and benefits are contingent upon a number of different factors, including:

- The types of supply chain relationships being built;
- The current stage of supply chain development;
- The rate of change and level of competition within the environment in which the firm competes;
- The position of the firm within the supply chain and its ability (based on such conditions as its power relative to those of the customers and the suppliers) (Porter, 1980) to influence actions within the supply chain.

As can be seen from this brief, a critical task in addressing this question is to identify those factors that can influence the timing and quantity of investments and revenues accruing from the supply chain.

- **How does a firm leverage (use) real time information?** As recognized by Hayes, Pisano, Upton, and Wheelwright (2005), information technology and information-intensive operations are critical traits of the new strategic supply chain environment in which many managers and firms now find themselves competing. In many cases, this means that firms and management can benefit from real-time information. They can identify problems as they occur. They track shipments in real time. They can also identify and correct potential problems before they occur. However, real time information, as a corporate asset and as an operational capability, is a relatively new development. Consequently, there is confusion surrounding its use, the conditions affecting its, and the impact of its use of internal operations, corporate performance, and supply chain performance.

To reduce the level of confusion, more research is needed. Specifically, research is needed to addressed the following questions:
What is the impact of real-time information on corporate and supply chain performance? What are financial impacts? What are the qualitative impacts? What impact does real-time information have on strategy?

What conditions/prerequisites must be satisfied (at either the operational, corporate or supply chain levels) before the firm can realize the potential benefits offered by real-time information systems?

What conditions are most conducive to the use of real-time information within a supply chain? What conditions are least conducive?

When using information, what conditions influence how far down (i.e., the number of tiers away from the firm) that the information flows from the firm should go?

For what type of events/problems is real-time information most appropriate? For what types of events/problems is it least appropriate?

Should real-time information be immediate in time or should there be lags in the information flows?

Supply Chain Models Including Risk Mitigation and Cost Optimization

Of the various gaps discussed in the workshop, the one that evoked the greatest amount of discussion involved risk and risk management within the supply chain. This is the gap that is currently most visible to top management and it is the one that is generating the most publicity in the business press (e.g., Sheffi, 2005). Managers and researchers are becoming increasingly aware of the need to provide more insight into the concept supply chain risk and its management. By risk, what is meant is anything that adversely affects the three major parameters of supply: Price (P), Quantity (Q), or Timing (T).

However, in contrast to much of the current body of knowledge, which is highly descriptive, proscriptive in tone, and often based on case or anecdotal evidence, a different, more quantitative approach is needed. That is, what is needed are analytical and simulation based models. These models would allow researchers and managers to explore alternative situations and problems scenarios without having to worry about exposing the real firm and its supply chain to potentially...
dangerous and catastrophic events. Such quantitative models can be used to address questions such as:

- What are possible strategies and tactics that can be used to manage and mitigate risk? Under what conditions are these various strategies most effective? Least effective?

- What is the impact of “learning” (either at the personal/management or corporate level) on risk management over time?

- What methods can be developed to identify potential risky supply chain subnets and choke points that are not located close to the firm? Can leading indicators of such potential danger points be developed? This set of questions tries to get an issue that disturbed the participants. This involved situations where the location of the risk (e.g., disruption or bottleneck) is not close to the firm (i.e., where the disruption is not at tier one). In these situations, the lack of visibility and control creates a situation where the risks are essentially hidden to the firm. Consequently, management at these firms is unable to anticipate or prevent these potential hidden problems. Developing and testing models, tools, and leading indicators aimed at uncovering such “hidden” dangers is the major intent of this research action item.

- What types of metrics (financial and otherwise) can be developed to indicate the ability of the management to control risk and the firm’s exposure to risk? What types of metrics can be used to monitor or predict problems in key suppliers within the upstream supply chain?

- How do you handle sole sourcing? What is the system cost of sole sourcing? Is sole sourcing more or less risky than multiple supplier sourcing for the same goods and services? To what extent does trust mitigate risk in either sole of multiple sourced supply arrangements? While dual sourcing is preferred when possible, in many cases, it is not feasible. Under these conditions, the major challenge facing the firm and its management is that of what to do to best protect the firm from any possible problems in the supply chain due to sole sourcing.

- What is the impact of risk and risk management in new product design? Given the increasing importance of product design and innovation for many North American firms
(the major feeling was that it was difficult to compete against countries like China and India on the basis of price), managers are now interested in identifying what types of risk (internal and external) they can expect to encounter and what strategies and techniques can be developed and implemented to address these risks.

- Can a broader model of supply chain risk management be considered? Currently, the attention is focused on the disruption component alone. However, there are more issues to risk management than supply disruption. There are issues involving strategy, personal and corporate attitudes to risk, and the ability of the firm to either weather or control its exposure to risk. These factors need to be incorporated into a larger model of risk that looks at both the negative impacts as well as positive opportunities.

- What risk management options are available for dealing with the various types of risk – geographic (e.g., an earthquake shutting down supplier production), supply chain length (being exposed to a supply chain risk emanating from a supplier located at the second or third tier in the supply chain), geo-political (e.g., having a critical supplier located in Israel, where the threat of war is constant and real), competitive (a critical supplier is acquired by one of your major competitors), and financial? Can these various categories of risk be expressed in monetary terms? Can a general or broad risk index be developed? Such a risk index is important because it permits comparisons across firms. It also encourages benchmarking and corporate learning (as firms doing poorly on the index seek out similar firms that are doing better and try to learn from them). Such an index makes risk more meaningful to top management.

- Can operational measures and models of supply chain resilience and robustness be developed? If, as a result of such factors as the greater reliance on the supply chain combined with more emphasis on focusing on core competencies and greater usage of lean principles and practices (resulting in the general reductions in buffers), supply chains are becoming more “fragile,” then it is important to understand how the firm responds to the threat of supply chain fragility. Key to this response are the issues of robustness and resilience. Robustness describes the ability of the firm to the resist the onset of a supply chain disruption (as measured in terms of time, quantity of production lost, and cost). Resilience describes how quickly the firm can recover, once the disruption has
manifested itself. While relatively straightforward to describe, developing indexes or operational definitions of these two constructs is far more difficult and demanding. Yet, both researchers and managers need them.

- What factors influence supply chain resilience and robustness? This is a continuation of the preceding discussion. Here, the focus shifts to strategies and tactics such as the use and placement of buffers, product redesign and postponement strategies (having a product that can be dynamically redesigned in response to changes in the conditions of supply (P, T, Q) within the supply chain), the use of information (to provide a warning of potential difficulties), and the use of alternative, secured suppliers. These need to be assessed using tools such as computer simulation or analytical models to determine factors influencing the use and the effectiveness of these various strategies and tactics.

- How can we deal with “aggregation” effects? Most of the approaches to supply chain risk management look at the firm and its supply chain in isolation. That is, the assumption is that when actions are taken by one firm to manage risk, the competition is essentially neutral (the academic term for this state is “ceteris parabīs”). Yet, there are instances where an action taken by one firm to control risk can be positive if no one else does the same thing. Yet, if everyone else implements the same action, the aggregated effects can be totally unexpected. One of the participants shared the following story with the workshop. The firm was dealing with product proliferation in a certain component. To improve supply conditions and to increase leverage (buying power through concentration of purchases), it was decided to standardize the various components on a certain component that was currently in excess supply. It was anticipated that the standardization combined with the increase in purchasing volume would enhance continuity of supply and would reduce price. However, what the firm’s buyers were not aware of was that many of its competitors, faced by similar situations, had arrived at the same conclusion and implemented the same course of action. The result – demand increased to the point that it exceeded supply. Instead of lower prices and assured supply, the firm was faced by increasing prices and being placed on allocation. The buyers were also put in the unenviable position of having to explain to its upper
management why they were unable to deliver on the promises that they had made. What these buyers had encountered were the effects of aggregation.

• Can better supply predictive performance be linked to improved overall financial performance in the form of increased EPS and stock price?

• Consider the impact of payment terms?

Process Orientation Including Measures, Information, And Integration
While there were many issues discussed when talking about this gap, only one issue and research need was continuously repeated. This involved the development, usage, and impact of internal performance measures for evaluating or assessing supply chain performance and impact. As pointed out previously in this report, there is a tendency in many firms for managers to use internal measures (typically those focusing on price savings). Several concerns were raised about this practice:

• Such measures focus on price/cost savings, rather than cost avoidance. Such measures also tend to overlook or report performance on activities or projects that deliver important (both strategically and to our customers) improvements in lead-time, new product innovation, quality, or flexibility.

• Such measures emphasize benefits to the firm rather than benefits that are shared by the entire supply network.

• Such measures emphasize benefits that can be measured rather than qualitative benefits (e.g., goodwill, improvements in reputation).

• Such measures can and do threaten trust and collaboration between supply chain partners. The participants shared stories where trust and collaboration was apparently “thrown away” in order to achieve measurable (and rewarded) price/cost savings. One participant told a story where their firm had worked with a major customer to design a new system. Once the specifications had been decided upon, the customer decided to implement the

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12 It is interesting to note that the participants had difficulty in identifying any cost-based measures that were able to track and report cost avoidance. The lack of such a measure was seen as a major reason that many firms were unable to successfully pursue projects and supply chain activities that emphasized cost avoidance rather than cost savings.
purchasing decision by turning over issues pertaining to product design to their engineering group. Issues pertaining to the product purchase (such as the price and the terms of delivery) were turned over to the purchasing group. This group, since it was being measured on the size of the price reduction that it generated, decided to take a hard-line when negotiating the purchase contract with their supplier. The buyers wanted the lowest price. When the supplier pointed out that some considerations had to be given to them because of the sizeable investments that were made in designing the product – investments that were encouraged by the buying organization. The buyers took the position that such investments were effectively “sunk” costs and not relevant. When the supplying firm was unable to meet the target cost requirements, the buyers took the design and outsourced it to another supplier. This action effectively destroyed the possibility of any future cooperation between these two organizations.

Given the potential negative impact that internal performance could have on accurately and completely reporting supply chain performance within the firm and on how supply chain relationships are managed, the participants wanted rigorous research addressing the following question:

- What is the impact of using internal measures to evaluate supply chain performance? To what extent can managers use internal measures to evaluate supply performance? If managers cannot use such internal measures, what alternative performance measures are there?

**Relationships And Trust**

During the breakout discussions as well as in the large group discussion, the importance of collaboration, trust, and having the “right” relationships in place was stressed. One participant bemoaned the loss of trust that that person attributed to the introduction of Lean/Just-in-Time and the advent of certain purchasing managers who emphasized price reduction above everything else. Consequently, the participants felt that there was a significant lack of knowledge regarding trust, relationship identification, relationship building, and relationship maintenance. Research was both needed and demanded in these areas. Specifically, the following research questions were identified:
• Where are the best practices in terms of relationship and trust within the supply chain?
  Specifically, there is a need for a set of detailed case studies focusing how firms that have
developed and maintained successful and mutually beneficial supply chain relationships.

• What is the value (measured either quantitatively or qualitatively) of trust?

• What factors influence trust?

• How can trust be built in a relationship where it is needed but lacking?

• How can trust be sustained?

Supply Chain Architecture and Structure
Closely related to the preceding issue is the issue of supply chain architecture and structure. This
issue deals with how the supply chain is to be structured. Addressing this involves dealing with
issues such as the level of integration and coordination between supply chain partners. It also
deals with how much visibility (i.e., how far up and down the supply chain) is needed and
desired. In light of these issues, the following critical questions were identified:

• What are the various organizational structures available to a firm and under what
  conditions are the various structures most appropriate? Under what conditions are these
  various structures most appropriate? Least appropriate? How does an organization
  manage the process of realigning its structure? These questions deal with alternative
  organizational structures. During the discussion, the participants identified several
  potential structures – e.g., customer focus, program focus, joint governance. Yet, it was
  noted that these might not be a comprehensive set of possible structures. These questions
  strive to identify the comprehensive set of organizational structures and then to assess
  and evaluate these structures.

• What are the common supply chain architectures (patterns for organizing the partners and
  the relationships between them) today? Under what conditions are the various structures
  most appropriate? Under what conditions are these various structures least appropriate?

• What are the performance implications of the various supply chain structures and
  architectures?

• What factors influence the performance and sustainability of each structure?
• What guidelines, if any, are available for helping managers transition a supply chain architecture from one form to another?

• What structures are appropriate for emerging supply markets?

• What is the role of technology in supply chain structures (e.g., individual technologies, virtual organizations, work practices, “no roof” home offices…)?

• What are the prerequisite conditions for changing supply chain architectures?

The following are the major items identified as part of the research agenda. It is interesting to note that when these items were presented in the large group meeting, one of the practitioners stated that research answers would be obtained to the first three questions, then that person would be willing to send participants to a seminar where these “answers” would be presented. This statement was interpreted as a vote of confidence for the research agenda.

**The Agenda for Knowledge Dissemination**

The large number of research issues raised in the preceding section emphasizes the fact that supply chain management (especially strategic supply chain management) is a relatively new development. Consequently, relatively little is known about it, but the demand for knowledge is great and growing.

The same lack of knowledge was evident when developing an action agenda for knowledge dissemination. The group consensus was that while there was a great demand for knowledge about supply chain management, the knowledge base for meeting this demand was relatively small, sparse or missing entirely in certain areas, and widely dispersed. To meet this growing demand, something was needed. To address these and other knowledge gaps, the following action items were proposed:

• The development of detailed bodies of knowledge for both tactical and strategic supply chain management. The first step in developing any form of agenda focused on knowledge dissemination was to establish the body of knowledge that had to be mastered or taught. When dealing with supply chain management, it was agreed that this body of knowledge broke into two major but related components: the tactical body of knowledge and the strategic body of knowledge.
When most firms recruited a person for a supply chain management, they tended to recruit for a specific functional position (e.g., a buyer or a production scheduler or a warehouse manager). Most of these needs were satisfied by many of the undergraduate programs found at colleges and universities throughout the United States and Canada. Yet, the issue for these programs is to identify what topics (i.e., the body of knowledge) had to be taught to the students so that they had the skills and knowledge to effectively work in supply chain management at the tactical level. At present, there is no universally agreed upon body of knowledge. Every college or university or professional society has implemented their somewhat unique view of what needs to be taught.

One way of improving the quality of tactical supply chain professionals is to develop and present a tactical body of knowledge. This body of knowledge would identify the topics and skills that should be taught to the tactical supply chain manager.

Complementing this body of knowledge should be a strategic body of knowledge. That is, there should be an effort to identify those skills and content areas that everyone who is charged with managing supply chain at a strategic level should be realistically expected to know. Further, these two bodies of knowledge should be compared to identify those areas where there is an overlap in knowledge and those areas that should be strongly differentiated between the two levels. There should be a clear delineation between what makes a strategic supply chain manager and what makes a tactical supply chain manager. Further, the tactical body of knowledge should identify the minimum level of exposure to strategic issues. Similarly the strategic body of knowledge should identify the minimum level of exposure to tactical issues.

Finally, these bodies of knowledge must establish what a minimally qualified candidate in either strategic or tactical supply chain management can be realistically expected to know. It is hoped and expected that these standards would also explicitly lay out base competency levels and expectations for students at both levels, tactical and strategic.

- Develop and maintain a catalog of cases dealing with supply chain management. One of the major problems facing anyone interested in teaching supply chain management is the simple lack of good cases that deal with the various aspects of supply chain management (e.g., forecasting and inventory management within the supply chain, new product
development within the supply chain, managing supply chain disruptions). What cases that are available, are available from a large number of different sources. Some are well known (e.g., the case libraries from the Harvard Business School, the Darden Business School, and the Ivey School at the University of Western Ontario). Others are available from international sources. Still others come from professional societies and organizations. Consequently, what is needed is a thorough review of the cases offered by these various sources with the goal of identifying those that are appropriate for use when teaching topics pertaining to supply chain management. The cases identified from this review should be next brought together and examined so that its content can be categorized and a brief summary of the case generated. This information should be then used to develop an on-line database of appropriate cases. Such a database should be made available (through a controlled access) to anyone involved in teaching supply chain management. It should also be augmented over time by the following information:

- Teaching notes.
- Experiences with its use.
- A rating review.
- Suggestions for how to best use it.
- Suggested discussion questions.
- Appropriate readings to accompany the case.
- Other cases to accompany the case.

Finally, this database should be reviewed on a regular base to identify potential topic deficiencies (i.e., supply chain topics of interest but for which there are few if any appropriate cases). This information should be then shared with cases writers and institutions involved in case writing to help encourage the development of cases filling these needs.

- Develop an on-line portal site aimed at providing “one stop shopping” for supply chain management information. The on-line information relevant to supply chain management can be described as diverse, large, and spread across a number of different sites.
Consequently, searching the Internet for information and stories pertaining to supply chain management can be described as frustrating and very much of a “hit or miss” task. Instead, a portal for supply chain management is proposed – something akin to the GlobalEDGE™ portal\(^\text{13}\) developed by Michigan State University’s CIBER Center. This portal, which gets over 1,000,000 hits per month, is viewed as the major source of information on global business. Such a portal, ideally hosted by either a university or professional society, would provide an extremely useful resource for knowledge dissemination and for research.

- Promote greater collaboration between industry, professional societies, and universities/colleges. Supply chain management is a field of study that is currently being pioneered by work being done by leading edge practitioners working in forward thinking firms. It is also a field that is experiencing an increasingly level of demand for good, rigorous, useful, practical research. It is also experiencing a lack of well-trained business school graduates – people who can immediately step into supply chain related positions and provide the direction and drive needed. To meet these needs on an on-going basis requires more than interim one-on-one interactions between two or more of the groups. It requires a different approach. To this end, it is proposed that some form of organization or vehicle be developed for encouraging this collaboration on an on-going basis. This could be the form of consortium of firms, professional societies and universities/colleges that are dedicated to supply chain management (specifically strategic supply chain management). Such a consortium might be housed in a university. The goal of this consortium is to promote collaboration through regular meetings, Webinars, research grant programs, and newsletters. This consortium should be structured to deliver real, measurable value to the participants involved.

- Modify the college/university reward systems to encourage greater emphasis on teaching and on writing/developing/supervising supply chain cases. It is well known that in many business schools, research, not teaching is not only encouraged but also rewarded. While the reasons for this emphasis are well known, this approach has adversely impacted teaching. Many educators are not devoting the time and effort necessary to keep their

\(^{13}\) http://globaledge.msu.edu/ibrd/.
teaching material up to date and relevant. Such activities are not rewarded. Many educators are not teaching in either developing or writing cases or supervising others who then write the cases. Again, such activities are not rewarded. The results are gaps affecting supply chain management education – gaps that must be covered in the near future.

- Use industry professionals to supplement college/university learning. It is important that students be exposed to not only the theory but the practice of supply chain management. One way of achieving this objective is to develop and implement a program of having *professors of practice*. That is, industry professionals would be sponsored to spend a minimum of one semester teaching in a university and sharing with the students their experiences in supply management. Such a program would not only insure that students were introduced to the practice of supply chain management, but it would also increase the attractiveness of supply chain management programs, thus drawing the best students to this program.

- Establish and lay out the role of colleges/university. At present, there is a great deal of confusion regarding what should be taught to students in colleges/universities at either the tactical or strategic levels. For example, some of the industry workshop participants felt that universities taught too much theory and gave too little exposure to practical applications. Consequently, when industry hired these students, managers found that they had to invest in further training and education (especially in practical applications) before these candidates can be expected to be productive. By practical applications, the industry participants did not mean specifically applications such as specific forms of Enterprise Resource Planning (ERP) systems or specific programs. Rather, what is meant is that the students have been exposed to forecasting, the application of project management, capacity planning, collaboration, cost modeling, risk mitigation, and performance measurement (to name a few such applications).

- College/university curriculum should be realigned with the six gaps identified in the preceding chapter. The participants noted that the six gaps in supply chain management are critical. Consequently, they encouraged colleges and universities to re-examine their course offerings to determine the extent to which they cover and/or address the gaps.
Failure to address these gaps will critically limit the attractiveness of the students produced by the resulting programs. In subsequent group discussions, this recommendation was also extended to encompass supply chain programs put on by professional organizations such as ISM (Institute for Supply Management), APICS (The Association for Operations Management), PMAC (Purchasing Management Association of Canada), and CSCMP (Council for Supply Chain Management Professionals).

- Attempt to increase the proportion of college/university educators who have practical industry experience. The workshop participants recognized that effective education and knowledge dissemination is greatly enhanced when the educators have a familiarity with the topics that extends beyond what the educators have read. One mechanism for developing such a familiarity, as suggested by the participants, was to introduce industrial sabbaticals. That is, companies would provide opportunities for educators to spend at least one term working with the firms and learning about the practice of supply chain management. To enhance the attractiveness of these sabbaticals, a research project would also be embedded in the sabbaticals.

The workshop participants strongly voiced their opinion that groups involved in knowledge dissemination focused on supply chain management face a potential golden age – a period in which they can educate students and practitioners alike in a field with great and growing demand. However, if the institutions are to benefit from this “golden age,” they must provide knowledge that is relevant, useful, timely, and current. The action items presented in this section are intended to help these institutions provide such knowledge.

**The Agenda for Practitioners**

Initially, when the planning for the Delphi study/workshop took place, it was intended that the practitioners would generate their own agenda of action items. However, as the workshop progressed, it was generally agreed that it did not make sense for there to be a separate agenda for practitioners. Practitioners (especially those who are working in forward looking organizations) have a very good idea of what they can and must do to continue tapping into the benefits offered by supply chain management. Consequently, it was decided to focus on the first two agendas.
**Integrating Agendas**

At the end of the workshop, when the participants reviewed the various agendas, they were struck by one fact. These are not three separate agendas; they are three related agendas. When taken together (Figure 4-1), it is clear that what the various agendas are achieving, irrespective of their focus, was they were contributing to the building of two critical bodies of knowledge – one for tactical supply chain management and one for strategic supply chain management. These two bodies of knowledge form the foundations on which we build not only the strategic supply chain (the newest version of supply chain management) but also its successor.

**Figure 4-1**

Integrating the Three Agendas
Having established the various agendas, the major tasks facing the workshop participants have been completed. Yet, there is a need to summarize what has been uncovered and focus on what needs to be yet done. These objectives are covered in this chapter.

In reviewing the findings with the participants, the following findings and other comments were uncovered:

- The shape of supply chain management is indeed changing. Today’s supply chain is evolving from one that is fundamentally order oriented, cost driven and execution focused to one that is strategically focused, dynamic, designed oriented, and driven by multiple objectives. The trends and factors discussed in this report strongly support this transition.

- When dealing with supply chain management, there is a tendency to confuse direct costs with total costs. When it is said that the tactical supply chain is too pre-occupied with costs, what is meant is that it is too pre-occupied with direct (or small c) costs. This is in contrast with the strategic supply chain, which is more concerned with total costs. Yet, it is in this total costs that one of the major obstacles to the implementation of the strategic supply chain is encountered. One of the major problems facing many managers interested in implementing a strategic supply chain is the inability of many accounting systems to accurately quantify strategic total costs resulting from such activities as Early Supply Involvement (ESI), New Product Development (NPD), risk management, collaboration, joint governance, and integration (to name a few areas).

- Supply chain management is changing from being a system that is primarily jointly managed by three corporate functions (purchasing/sourcing, logistics/transportation, and operations management) to a system that must be draw on the capabilities of all the functions of the modern firm – accounting, financing, engineering, marketing, as well purchasing/sourcing, logistics/transportation, and operations management. This new state is illustrated in Figure 5-1.

- Supply chain management is increasingly forcing managers and researchers to think in terms of managing operations and process ACROSS corporate boundaries.
• The focus of supply chain management is shifting from the upstream/supply side to the downside/demand side. We are now recognizing that it is the customer that drives the supply chain, not the supply base.

• The focus of supply chain management is shifting from management to design/redesign (product design, process design, and supply chain design).

• Supply chain management is now becoming a core competency – a skill set that some firms are developing and turning into a vehicle for generating and maintaining a sustainable competitive advantage in their respective markets.

• The term “supply chain management” should be replaced by a more appropriate and less misleading term. Supply chain management to many of the workshop participants suffers from three major misconceptions. The first is that it seems to imply that the focus of supply chain management is the supply base (i.e., the upstream portion of the supply chain). In light of comments previously made, this is not the case. Second, the term focuses attention on management rather than design. Third, the term “chain” implies linear relationships. Supply chains display a wide range of different structures. Some of the structures are linear and chain-like in structure, while others exhibit parallel and simultaneous structures (where the suppliers interact directly with the firm’s critical customers). Consequently, several replacement terms were recommended: Supply Network Optimization (SNO), Value Network Optimization (VNO), and Value Network Systems (VNS).

• During the final stages of the discussions, a new view of the supply chain was proposed – the Adaptive Supply Chain (ASN). The supply chain must deal with and respond to challenges and changes taking place on both the supply and the demand sides. On the supply chain, these challenges can take the form of changing availability/prices of raw materials. On the demand side, these changes reflect changes in the customer mix and changing customer demands. As these conditions emerge, the supply chain and its design must be able to quickly and efficiently realign itself to compensate and respond to these changes. The analogy to the adaptive supply chain is the dynamic bill of material used by the automotive companies for dealing with catalytic converters. A catalytic converter employs a number of very expensive metals. As the price of the metals changes, the
automotive firms can change the portion of metals used – to include more of the “cheaper” metals and less of the “more expensive” metals. This is an adaptive model.

**Figure 5-1**
*Understanding the Impact of the New Supply Chain from a Corporate Perspective*

### Setting out the Next Steps

The final step in the Delphi study/workshop was to set out the next steps. Three critical steps were identified:

- **Dissemination of the results.** The first and most critical step is that of making sure that the findings generated by this study are distributed to the appropriate groups, so as to encourage action consistent with the findings and to create awareness of the issues raised. Consequently, it is the intention of the research team to spread these results in several ways. First, an executive summary has been written that will be made available to the participants and to other executives interested in supply chain management. Second, this report will be distributed to groups and societies interested in supply chain management (e.g., APICS, ISM). Third, presentations based on this workshop have been developed and are being carried out. One such presentation will take place at the 2006 APICS...
International Conference. Other targeted outlets will include ISM and IPSERA (to name a few). Fourth, a series of research papers based on the Delphi study and workshop and targeted towards specific well regarded academic and practitioner journals will be written and submitted for publication. In focusing on this step, the research team recognizes that the findings presented in this report will not have any significant impact either on practice, knowledge dissemination, or research unless the information is distributed and made available.

**Small Group Activities.** At the end of the workshop, the participants wanted to continue working on exploring issues pertaining the various gaps identified during the workshop. Consequently, a series of small groups were formed. These groups dealt with topics such as identifying the body of knowledge – tactical, the body of knowledge – strategic, models for supply chain risk management, and understanding the adaptive supply chain management. Currently, these groups are working to develop vision statements for their areas and to begin exploring issues and questions pertaining to their areas. It is hoped that group reports will be generated in the future and made available for review.

**Validating the Results and Repeating the Process.** The findings reported in this study involve a certain set of researchers and firms. When carrying out such a focused study, there is always the danger that the findings may not be generalizable (i.e., that they reflect the bias of the groups involved and not the true trends that they are trying to uncover). Furthermore, in identifying the future supply chain management system, we are dealing with what is essentially a forecasting problem involving a dynamic system. What appears to be the future of supply chain management today may not seem the same one or two years from now. In light of these two considerations, two decisions were made. First, this study would be replicated at least one more time in North America. It would also be replicated in Europe and in the Far East. These replications would help identify the trends and factors that appear to be common and the trends and factors that appear to be regionally specific. The would also help the research team assess the extent to which the trends and issues uncovered by this study (and presented in this report) are generalizable. It is expected that these additional sessions will be held within the next year.
Second, given that supply chain management is highly dynamic and ever-changing, it is not enough to have only such study. Such a study should be repeated in another two or three years. The results of such a study should help better establish those trends that are still present and to identify the new trends and developments that are shaping the supply chain of the future.

**Final Comments**

Supply chain management is changing. If researchers, educators and practitioners are to be prepared to cope with these changes, they must be identified and discussed in advance. After all, anticipating and preparing for a change is preferred to reacting to it once the changes have taken place. This report has attempted to do so. In doing so, it has seen that the tactical supply chain, while still important in many settings, is being complemented by and in some cases replaced by a new and more powerful supply chain, the strategic supply chain. This report has identified gaps that should be recognized and addressed, in order for this shift from the tactical to the strategic supply chain to take place. It has attempted to direct and shape future activities in terms of research and knowledge dissemination.

In the end, however, what this study has found is that in spite of how much we know about supply chain management, there is much more that we do not know. This study has found that the future of supply chain management is bright and that the opportunities offered by supply chain management are both numerous and growing. Such a state bodes for the future of supply chain management as a field of practice, as a field for research, and as a subject for knowledge dissemination.
REFERENCES


APPENDICES
APPENDIX 1:
DELPHI LETTER – ROUND 1
Overview

First of all, thank you again for participating in this first round of the Delphi Study on Strategic Supply Chain Management. After you have finished reading this introduction, you will be directed to the Delphi Study itself. Please remember that you are being asked for your assessment – there is no right or wrong answer. Rather, there is only your answer. Please complete all portions. It is also important that you provide any comments or insights that you feel are appropriate in responding to the questions. When you have completed the survey, the results will be reviewed by the project leaders and returned to you in summarized form for the second round of the study.

From the time that this document has been sent out (May 22, 2006), you will have until June 9th to complete it. Should you have any questions, please feel free to contact Steven A. Melnyk (melnyk@msu.edu/517-353-6381). As always, all contributions will be anonymous in the summarized returns.

We look forward to receiving your responses.

Steven A. Melnyk  Rhonda Lummus  Robert J. Vokurka
Michigan State University  Iowa State University  Texas A&M Corpus Christi
Part One

The following section is necessary to establish the demographics of the respondents.

1. Select from the following list the one that best describes your current employment?
   
   a. Self-employed: ___________
   b. Government Employee: ___________
   c. Business Employee: ___________
      Please identify the industry: ___________
   d. University/College Faculty ___________
   e. Other (Please describe): ___________

2. What is your current job title?_______________________________

3. How long have you been in your current position?
   ________________ years.

4. How long have you been involved with supply chain management?
   ________________ years.
Part Two: Defining Strategic Supply Chain Management

For the following section, please review and comment on the following definitions of (1) a supply chain, (2) supply chain management and (3) strategic supply chain management using the following scale:

1      2      3      4           5
Strongly Agree    Agree    Neutral    Disagree    Strongly Disagree

1. Supply Chain:

*A supply chain is defined by the entire network of organizations and activities involved in (1) designing a set of products or services and related processes, (2) acquiring and converting inputs into these products or services, (3) distributing and consuming these products or services, and, (4) disposing of these products or services.*

Do you agree with this definition? 1 2 3 4 5

What changes would you make?

2. Supply Chain Management?

*Supply Chain Management is the management of relationships, materials and flows that connect the parties and activities in a supply chain.*

Do you agree with this definition? 1 2 3 4 5

What changes would you make?
3. Strategic Supply Chain Management:

Strategic supply chain management involves the decisions that shape the long-term capabilities of the company’s supply chain functions and their contribution to overall strategy through the on-going reconciliation of market requirements and supply chain resources …”

Do you agree with this definition? 1 2 3 4 5

What changes would you make?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Part Three: Assessing the Importance of Supply Chain Trends and Developments

For each of the following issues, evaluate their importance in managing supply chains TODAY and FIVE YEARS FROM NOW. Please use the following scale:

<table>
<thead>
<tr>
<th>Issue</th>
<th>Importance NOW</th>
<th>Importance 5 years from now</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Leadership within the supply chain</strong></td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
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<tr>
<td><strong>Power relationships within the supply chain</strong></td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td><strong>Supply chain disruptions and supply chain risk</strong></td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td><strong>Rapid redesign of supply chains to meet changing customer needs.</strong></td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td><strong>Identifying and managing channel conflict</strong></td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td><strong>Governance within the supply chain (e.g., Sorbanes-Oxley)</strong></td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
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<tr>
<td><strong>Managing and structuring relationships within the supply chain.</strong></td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td><strong>Managing and improving environmental performance within the supply chain.</strong></td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td><strong>Developing and implementing Strategic Segmentation/spend analysis on the supply side.</strong></td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td><strong>Developing and implementing Strategic Segmentation/spend analysis on the customer side of the supply chain.</strong></td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td><strong>Measuring performance across activities and partners within the supply chain.</strong></td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
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<tr>
<td><strong>Sharing rewards and financial risk within the supply chain.</strong></td>
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<td>1 2 3 4 5</td>
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<tr>
<td><strong>Changing/re-aligning performance measurement across activities and partners within the supply chain.</strong></td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td><strong>Co-locating key stakeholders within the supply chain.</strong></td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td><strong>Managing product innovation by drawing on the capabilities of the supply chain.</strong></td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>
Responding to the “China Price” syndrome (i.e., a competitor who emphasizes and delivers low cost).

<table>
<thead>
<tr>
<th>Issue</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>Managing confidentiality within the supply chain.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>2</td>
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<td>4</td>
<td>5</td>
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<tr>
<td>Protecting intellectual property within the supply chain.</td>
<td>1</td>
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<td>5</td>
<td>1</td>
<td>2</td>
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<tr>
<td>Maintaining visibility and control within the supply chain.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>5</td>
<td>1</td>
<td>2</td>
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<tr>
<td>Maintaining and protecting security within the supply chain.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Using the resources of the supply chain to identify new and unique solutions to existing and new problems.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Developing, changing and maintaining the appropriate organizational cultures within the critical partners of the supply chain.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Developing and maintaining appropriate communication and connectivity within the supply chain:</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Developing trust between supply chain members</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Implementing appropriate technology to allow seamless exchange of information within the supply chain.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Managing the timely delivery of goods and services.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Identify any other issues that are critical in supply chain management TODAY, but have not been included in the list above.

1.                                                                                     
2.                                                                                     
3.                                                                                     
4.                                                                                     
5.                                                                                     
6.                                                                                     

79
Identify any other issues that will be critical FIVE YEARS FROM NOW in supply chain management but have not been included in the list above.

1. 
2. 
3. 
4. 
5. 
6. 

Please return the completed form to:

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Michigan State University  
East Lansing, MI 48824-1122  
517-353-6381; melnyk@msu.edu
APPENDIX 2:
DELPHI LETTER – ROUND 2
Overview

First of all, thank you again for participating in the first round of the Delphi Study on Strategic Supply Chain Management. We are now moving on to the second round. After you have finished reading this introduction, you will be directed to the Delphi Study itself. Please remember that you are being asked for your assessment – there is no right or wrong answer. Rather, there is only your answer. Please complete all portions. It is also important that you provide any comments or insights that you feel are appropriate in responding to the questions. When you have completed the survey, the results will be reviewed by the project leaders and returned to you in summarized form for the SCM 2010 workshop that will take place in September at the Henry Center at Michigan State University, East Lansing, MI.

From the time that this document has been sent out, you will have until August 11th to complete it. Should you have any questions, please feel free to contact Steven A. Melnyk (melnyk@msu.edu/517-353-6381). As always, all contributions will be anonymous in the summarized returns.

We look forward to receiving your responses.
Part Three: Assessing the Importance of Supply Chain Trends and Developments

During Round 1, you evaluated each of the following issues on the importance in managing supply chains TODAY and FIVE YEARS FROM NOW. You are now asked to reevaluate each of these issues with consideration of the mean ratings from Round 1 participants. Please use the following scale:

<table>
<thead>
<tr>
<th>Issue</th>
<th>Importance NOW</th>
<th>Round 1 Mean</th>
<th>Importance 5 years from now</th>
<th>Round 1 Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership within the supply chain</td>
<td>1 2 3 4 5</td>
<td>4.00</td>
<td>1 2 3 4 5</td>
<td>4.38</td>
</tr>
<tr>
<td>Power relationships within the supply chain</td>
<td>1 2 3 4 5</td>
<td>3.79</td>
<td>1 2 3 4 5</td>
<td>4.08</td>
</tr>
<tr>
<td>Supply chain disruptions and supply chain risk</td>
<td>1 2 3 4 5</td>
<td>4.25</td>
<td>1 2 3 4 5</td>
<td>4.58</td>
</tr>
<tr>
<td>Rapid redesign of supply chains to meet changing customer needs.</td>
<td>1 2 3 4 5</td>
<td>3.67</td>
<td>1 2 3 4 5</td>
<td>4.21</td>
</tr>
<tr>
<td>Identifying and managing channel conflict</td>
<td>1 2 3 4 5</td>
<td>3.50</td>
<td>1 2 3 4 5</td>
<td>3.67</td>
</tr>
<tr>
<td>Governance within the supply chain (e.g., Sarbanes-Oxley)</td>
<td>1 2 3 4 5</td>
<td>3.33</td>
<td>1 2 3 4 5</td>
<td>3.58</td>
</tr>
<tr>
<td>Managing and structuring relationships within the supply chain.</td>
<td>1 2 3 4 5</td>
<td>3.92</td>
<td>1 2 3 4 5</td>
<td>4.20</td>
</tr>
<tr>
<td>Managing and improving environmental performance within the supply chain</td>
<td>1 2 3 4 5</td>
<td>3.13</td>
<td>1 2 3 4 5</td>
<td>4.00</td>
</tr>
<tr>
<td>Developing and implementing Strategic Segmentation/spend analysis on the supply side</td>
<td>1 2 3 4 5</td>
<td>3.46</td>
<td>1 2 3 4 5</td>
<td>3.92</td>
</tr>
<tr>
<td>Developing and implementing Strategic Segmentation/spend analysis on the customer side of the</td>
<td>1 2 3 4 5</td>
<td>3.46</td>
<td>1 2 3 4 5</td>
<td>3.96</td>
</tr>
<tr>
<td>Supply Chain Improvement Area</td>
<td>Rating</td>
<td>Mean</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------------------</td>
<td>--------</td>
<td>-------</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Measuring performance across activities and partners within the supply chain.</td>
<td></td>
<td>3.58</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Sharing rewards and financial risk within the supply chain.</td>
<td></td>
<td>3.13</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Changing/re-aligning performance measurement across activities and partners within the supply chain.</td>
<td></td>
<td>3.50</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Co-locating key stakeholders within the supply chain.</td>
<td></td>
<td>3.00</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Managing product innovation by drawing on the capabilities of the supply chain.</td>
<td></td>
<td>3.29</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Responding to the “China Price” syndrome (i.e., a competitor who emphasizes and delivers low cost).</td>
<td></td>
<td>3.75</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Managing confidentiality within the supply chain.</td>
<td></td>
<td>3.63</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Protecting intellectual property within the supply chain.</td>
<td></td>
<td>3.75</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Maintaining visibility and control within the supply chain.</td>
<td></td>
<td>3.88</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Maintaining and protecting security within the supply chain.</td>
<td></td>
<td>3.63</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Using the resources of the supply chain to identify new and unique solutions to existing and new problems.</td>
<td></td>
<td>3.17</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Developing, changing and maintaining the appropriate organizational cultures</td>
<td></td>
<td>3.29</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.67</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
within the critical partners of the supply chain.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Importance NOW</th>
<th>Importance 5 years from now</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing and maintaining appropriate communication and connectivity within the supply chain:</td>
<td>3.75</td>
<td>4.25</td>
</tr>
<tr>
<td>Developing trust between supply chain members</td>
<td>3.92</td>
<td>4.42</td>
</tr>
<tr>
<td>Implementing appropriate technology to allow seamless exchange of information within the supply chain</td>
<td>3.67</td>
<td>4.46</td>
</tr>
<tr>
<td>Managing the timely delivery of goods and services.</td>
<td>4.25</td>
<td>4.58</td>
</tr>
</tbody>
</table>

In addition, please evaluate the importance of the following issues suggested as important by Round 1 participants:

<table>
<thead>
<tr>
<th>Issue</th>
<th>Importance NOW</th>
<th>Importance 5 years from now</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply chain talent management including training, skill building, competency development, and career development</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Managing supplier diversity</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Managing environmental issues and recycling of materials Alternate material identification and development</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Development of new technologies that impact supply chain efficiency, e.g., RFID</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Collaborative supply chain forecasting</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>
Supply chain infrastructures worldwide, e.g., port, airports, highways, railroads

Managing fuel and transportation costs

Process improvements and waste reduction

Identification and development of alternate materials

Identify any other issues that are critical in supply chain management TODAY, but have not been included in the list above.

1. 
2. 
3. 
4. 
5. 
6. 

Identify any other issues that will be critical FIVE YEARS FROM NOW in supply chain management but have not been included in the list above.

1. 
2. 
3. 
4. 
5. 
6. 

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APPENDIX 3:
WORKSHOP PROTOCOL
WORKSHOP PROTOCOL

The following protocol is intended to be distributed before the September 21 workshop. It is also intended to be followed by the session facilitators for each of the three breakout sessions on September 21.

During the course of the 21st workshop, all members of the organizing committee (everyone who is a member of the SCM 2010 group on ANGEL) will have access to the ANGEL site. This site will be used for the storage and transmittal of all data gathered during the workshop. Everyone is also expected to bring with them a portable computer, which they will use during the course of the workshop.

The participants will be organized into three groups. The session facilitators will be drawn from the organizing committee.

**Session 1 – Establishing the Baseline**

The first session has a very specific desired outcome – to describe the nature of Strategic Supply Chain Management in 2010 and beyond. To do this, the participants will be asked to first describe the characteristics that they associate with supply chain management in today’s environment. The term characteristic is used to denote any element, feature, behavior, structural element, or critical functionality that is associated with SCM. Next, they will be asked to describe the characteristics that they see as being associated with SCM 2010. For each characteristic, the participants should identify the following:

- What is the characteristic?
- Why is it important?
- Examples of this characteristic in practice?
- Implications of the characteristic (so what)?
- How would you measure this characteristic and its activity?

The intention of this session is simply brainstorming. The group is intended to generate as detailed a list of both the current state of SCM and the future state of Strategic SCM. A recorder will record the results on their computer and transfer to the results to the resulting ANGEL site in the following format:

GROUP 1 Baseline

When the session is over, the participants will be dismissed and the recorders will finish inputting their group’s findings into their computers and then upload the files to ANGEL. There will be 30 minute break between sessions during which this activity is to be completed.

**Debriefing of Session 1 Findings – Total Group Discussion**

At this point, the participants will reconvene in the large meeting room for a debriefing. The findings from each group will be printed and distributed to the participants. At this point, each group will discuss the list and their findings briefly (timing is critical). After all of the findings have been presented, the group will review the baseline (SCM today) and SCM 2010 to identify
and flag any obvious duplicates. These will be eliminated. Next, using Nominal Group Technique, the group will vote on the factors pertaining to SCM 2010 to determine the rank order of the attributes. The result will be one list common to all three groups that lists in rank order the important features of SCM 2010. This list will form the starting point for Session 2 – Identifying Gaps.

**Session 2 – Identifying Gaps**

The main group will reconvene in their breakout rooms (using the same groups as established for Session 1). The major objective of this second session is to identify the major gaps that exist between the baseline SCM (SCM 2006) and SCM 2010. These gaps can include any type of gap, in terms of such issues as:

- Knowledge gaps (knowledge/content that is necessary but currently missing).
- Technology gaps (technology that is needed but missing).
- Organizational gaps (changes in organizational structure/culture that is necessary but currently missing).
- Strategic gaps (changes in the strategic planning process).
- Measurement gaps (gaps pertaining to performance measurement).
- Practice gaps (gaps involving examples of strategic supply chain management that would be useful but that are currently not available).
- Skills gaps (gaps involving management practices, tools, and procedures that are necessary for SCM 2010 but currently missing).
- Other gaps (anything else that the group can identify).

For each group, the group during its discussion is to provide the following information:

- What the gap is (a precise description of the gap).
- Why the gap is important?
- What is needed to resolve the gap?
- What happens if the identified gap is not addressed?
- The importance of resolving/addressing the gap (using a simple A/B/C ranking system).

Again, a recorder will be responsible for recording the information. At the end of the session, the participants will be given a 30 minute break during which time the information generated from the second session will be recorded, uploaded to the ANGEL site, and subsequently downloaded and copies generated for the participants.

**Debriefing of Session 2 Findings – Total Group Discussion**

Again, the participants will reconvene in the large meeting room for a debriefing. As with the debriefing session for the first session, the findings from each group will be printed and distributed to the participants. At this point, each group will discuss the list and their findings briefly (timing is critical). After all of the findings have been presented, the total group will review the lists of gaps, identify any duplicates (which will be eliminated), and generate a total list of gaps. Again, using Nominal Group Technique, the group will vote on the gaps in order to
rank order them. The resulting ranked list will form the baseline for the third session – addressing the gaps.

Session 3 – Addressing the Gaps to SCM 2010

The participants will reconvene again into three groups. There is a major difference at this point. Each group will focus on addressing and resolving the gaps from one of three distinctly different perspectives: Practice, Research, and Knowledge Dissemination. It is important to recognize that the final perspective – knowledge dissemination – includes more than simply academic education or teaching. It also includes professional education, teaching materials, and access to information (e.g., web sites, a SCM 2010 portal similar to that provided by MSU’s CIBER Center (which has developed a site for global business that receives some one million hits per month)). One way that the perspectives can be assigned to the groups is through random assignment – each facilitator draws a tag from a hat that identifies the perspective to be taken.

During this session, the participants will discuss how to best address the gaps. Ideally, each group will generate an action list of activities aimed at addressing/resolving the gaps.

The recorders will record the resulting findings and again upload them to the ANGEL site, from where they will be downloaded and printed for distribution to the participants.

Again, there will be a 30 minute gap between sessions.

Debriefing of Session 3 Findings – Total Group Discussion

In this session, the findings of the various groups will be reviewed and discussed in the large group discussion. As with the other two debriefing sessions, each agenda will be voted on by the participants to determine the priority of action items for each of the three lists. The participants will be also invited to comment on the various action items, with the goal of better defining and refining the list. The lists so refined and expanded during this session will form the foundation of the report generated from this workshop.

As this session winds down, we need to get input on the next steps for this initiative. This is an important step as the participants will be expecting some ongoing involvement in the overall activity. We also want to keep this group engaged as we implement some of the findings in various venues.

At the end of the workshop, I would suggest that we have Joe Sandor add some concluding comments and that we give each participant a letter of appreciation from APICS E&R Foundation and MSU. Finally, we should lay out the time line for what the participants can expect to have happen in the near future regarding SCM 2010 and Beyond.
APPENDIX 4:
SCM 2010 ON-SITE WORKSHOP AGENDA
**Wednesday, September 20**

6:00p – 9:00p Reception and Dinner
- Welcome by Bob Duncan, Bob Nason, Rhonda Lummus, Steve Melnyk, and Robert Vokurka
- Roundtable Introductions
- Remarks on Supply Chain Trends by Joe Sandor
  --Shibui Room

**Thursday, September 21**

7:00a – 8:00a Breakfast
  --Atrium

8:00a – 8:30a Meeting Organization, Logistics and Expectations
  Steve Melnyk
  Review of Delphi Results & Agenda Review by Rhonda Lummus
  --B120

8:30a - 9:30a Session I Baseline Breakouts (small groups facilitated)
  --See Attached Group List and Rooms

9:30a – 10:30a Session I Reports & Recap - Consensus on issues (large group)
  --B120

10:30a – 11:30a Session II Gap Identifications Breakouts (small groups facilitated)
  --See Attached Group List and Rooms

11:30a – 12:30p Lunch
  --Atrium

12:30p – 1:30p Session II Reports & Recap - Consensus on Issues (large group)
  --B120

1:30p – 2:30p Session III Gap Closure Breakouts (small groups facilitated)
  --See Attached Group List and Rooms

2:30p – 3:30p Session III Reports & Recap - Consensus on Issues (large group)
  --B120

3:30p – 5:00p Summarize Results
Open Discussion/Feedback
Next Steps
APPENDIX 5:
LIST OF PARTICIPANTS
Strategic Supply Chain Management: 2010 and Beyond  
Michigan State University and APICS E&R Foundation  
East Lansing, MI  

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