

REVISING A SUPPLY CHAIN CURRICULUM WITH AN EMPHASIS ON THE TRIPLE BOTTOM LINE

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ABSTRACT

This paper discusses a benchmarking study that we conducted over the summer of 2008 as part of the ongoing re-design of our Supply Chain & Operations Management (SC&OM) curriculum. The motivation for this study was our desire to emphasize sustainability (or the triple bottom line of economics, environmental, and social equity performance) more strongly in all of our Supply Chain & Operations Management courses. We performed an analysis of our Supply Chain & Operations Management program compared to nineteen other undergraduate programs in Supply Chain and/or Operations Management in the United States. We found only one other program that requires a course in sustainability and no other programs that require elements of sustainability within their required courses. In addition, we found that we needed to cover purchasing and transportation topics in greater depth. Both of these topics are fertile areas for discussion of sustainability topics. Finally, through our benchmarking study and the research we conducted, we determined that we needed to add more experiential sustainability exercises in our Supply Chain & Operations Management courses.

JEL: I23, M11

KEYWORDS: Sustainability, Supply Chain Management, Curriculum, Triple Bottom Line

INTRODUCTION

This paper discusses a benchmarking study conducted over the summer of 2008 as part of the ongoing re-design of our Supply Chain & Operations Management (SC&OM) curriculum to reflect an underlying theme of sustainability (or the triple bottom line of economics, environmental, and social equity performance) in our Supply Chain & Operations Management major courses. We compared our Supply Chain & Operations Management program to nineteen other undergraduate programs in Supply Chain and/or Operations Management in the United States.

The remainder of this paper is sub-divided as follows. First, we review the literature that relates sustainability to supply chain management, discuss how universities have integrated sustainability in their curricula, describe how various Colleges of Business have integrated sustainability in their curricula, and provide an overview of the integration of sustainability in supply chain management curricula. Second, we present an overview of our Supply Chain & Operations Management program. Third, we discuss the data and the methodology that we used. Fourth, we describe the findings of our benchmarking study. Fifth, we conclude with proposed changes to our program.

LITERATURE REVIEW

Relating Sustainability to Supply Chain Management

The first widespread definition of sustainable development was presented in *Our Common Future* (World Commission on Environment and Development, 1987, p. 8) in which sustainable development was described as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” Later, other authors, e.g., Elkington (1994, 1998), expanded the

definition of sustainability to include the triple bottom line of economic, environmental, and social equity performance. Economic performance measures profits. Environmental performance measures items such as ecological impact or carbon footprint. Social equity performance measures effects on people. Norman and MacDonald (2004) listed various indicators of social equity performance (e.g., diversity measures such as percentage of senior executives who are female, percentage of workers represented by unions, health and safety measures, number of children working in a facility, and community involvement measures such as pre-tax dollars donated to the local community). Factors driving proactive corporate environmental management include cost factors (pollution control, pollution prevention, costs savings from waste reduction); regulatory demands (more stringent regulations, increasing liabilities, stricter enforcement); stakeholder forces (public demand for environmental protection, customer demand for clean processes and products, shareholder aversion to risk); and competitive requirements (new business opportunities, international trade agreements, spread of quality management principles, voluntary standards) (Berry & Rondinelli, 1998).

Wu and Dunn (1995) were some of the first authors to introduce the concept of greening the supply chain. They proposed a model that showed how daily operational decision-making impacts overall firm environmental performance up and down the supply chain. Markley and Davis (2007) argued that one of the few remaining ways that companies can hope to find competitive advantage is through a sustainable supply chain. Preuss (2005) suggested that sustainable supply chain management should focus on the following five areas: (1) products to be purchased (buying greener); (2) manufacturing processes used by suppliers (the buying company could require that suppliers be accredited to an environmental management standard); (3) supplier assessment (the buying company could include environmental performance in its assessment of suppliers); (4) manufacturing processes within the manufacturing company itself (internal initiatives); and (5) downstream logistics activities (product recovery, recycling, and improved coordination of incoming and outbound shipments).

Integrating Sustainability into University Curricula

UNESCO trumpeted the importance of education for sustainable development when it declared 2005-2014 the United Nations Decade of Education for Sustainable Development (UNESCO.ORG, n.d.). The Association of University Leaders for a Sustainable Future (n.d.) promotes sustainability education as a critical focus of teaching, research, and operations at universities worldwide (its members include more than 350 university presidents and chancellors from more than 40 countries who have signed the 1990 Talloires Declaration). Moore (2005) made seven recommendations for sustainability at the university level: (1) Infuse sustainability into all university decisions, e.g., update the sustainability development policy, use sustainability as the overall goal of the university, and use the campus as a living/learning laboratory; (2) Promote and practice collaboration, e.g., create incentives for collaboration, implement broader based admissions standards, and promote group work; (3) Promote and practice transdisciplinarity, e.g., increase program flexibility for undergraduate students, redesign programs, and promote reflection of worldviews; (4) Focus on personal and social sustainability, e.g., increase job security for lecturers, reduce workloads, and promote personal wellness; (5) Integrate planning, decision making and evaluation, e.g., by creating appropriate criteria for evaluating and rewarding faculty; (6) Integrate research, service, and teaching, e.g., promote the scholarship of teaching and community service learning; (7) Create space for pedagogical transformation, e.g., create space and time for reflection, dialogue, and action. Sherman (2008) argued that sustainability should become a big idea that transforms pedagogy in a university's curriculum. Kagawa (2007) cautioned that students strongly associate sustainability with environmental aspects; therefore, curriculum changes must demonstrate the connections between the other two aspects of sustainability, economic and social. Integration of sustainability in non-business curricula appears to be strong in the engineering disciplines in particular (e.g., El-Zein, Airey, Bowden & Clarkeburn, 2008; Lourdel, Gondran, Laforest & Brodhag, 2005;

Mulder, 2004). This is not surprising given engineering's influence in product design, process design, project management, etc.

Integrating Sustainability into Business School Curricula

As sustainability topics have become more prevalent in universities as a whole, those topics have filtered into business school curricula. For example, the Aspen Institute Center for Business Education (n.d.), in its most recent study of full-time 112 MBA programs accredited by AACSB, found that 35 of those MBA programs offer a special concentration or major that allows students to focus on social or environmental issues; however, the proportion of schools requiring content in core courses regarding social and environmental issues remains low. Murray (2006) also lamented that sustainability topics often are taught as optional units instead of being integrated into mainstream business courses. In another study, Biello (2005) cited sixty courses in sustainability offered in accredited graduate programs and in two non-accredited business schools (Bainbridge Graduate Institute and Presidio School of Management) that offer MBAs in sustainable business. Much of the literature concerning sustainability in business schools appears to focus on what skills students should develop and how to integrate sustainability into the curriculum. These topics are discussed next.

Some authors emphasize the development of students' skills when integrating sustainability into the business curriculum. For example, Kearins and Springett (2003) advocated that instructors develop the following skills in students: reflexivity, critique, and social action/engagement. Reflexivity would require students to reflect on the personal and societal values that impact on personal and management decisions. Critique requires students to consider issues of power and ideology that shape a given reality, e.g., the way in which a company is organized, to challenge those issues, and to investigate organizational forms that are more democratic. Social action/engagement motivates students to think about ways in which they could act in a more sustainable manner and how they could facilitate making their broader environment more sustainable. Bradbury (2003) discussed experiential exercises in sustainability geared toward management, organizational behavior, and strategy courses. The intent of these experiential exercises is to prod students into questioning what sustains their own lives, the lives of others close to them, and the organizations in which they work. Those experiential exercises could be designed around case studies of companies that have implemented sustainability concepts, personal vision quests (walking around campus and pondering issues important to themselves), exercises that require students to reflect on their personal use of natural resources, and participating in projects to make an environmental improvement.

As for research on integrating sustainability into undergraduate business curricula, Bridges and Wilhelm (2008) proposed a framework for integrating sustainability into a marketing curriculum. They discussed a 4Ps (product, price, place/distribution, and promotion) approach to curricula in sustainable marketing by which sustainability issues could be included in courses as the 4Ps are presented. Then, they described an MBA elective that they developed. The elective incorporates current readings and cases that focus on sustainability. Their future plans include adding an experiential learning activity to the course, creating a database of marketing internships with sustainable firms, requiring students to develop a marketing plan for making the university more sustainable, and starting a speaker series on sustainable marketing strategies.

Integrating Sustainability into Supply Chain Management Curricula

Inclusion of sustainability topics in supply chain management courses appears to be very limited. Roome (2005) reported on Sustainability and Supply-Chain Management residency (module) offered by OneMBA, a consortium of five MBA programs located in Hong Kong, Brazil, Mexico, Europe, and the U.S. This module used three different types of pedagogy: (1) lectures, (2) experiential learning (cases, exercises, projects, and role-playing), and (3) visits to companies. Based on our research, examples of

integrating sustainability principles into supply chain management undergraduate programs appear to be almost non-existent except for our program (described next). We believe that our Supply Chain & Operations Management program is unique with its emphasis on sustainability. An overview of our Supply Chain & Operations Management program follows.

UW OSHKOSH SC&OM PROGRAM

As of May 2008, our program required 18 hours of required courses: BUS 342: Analytical Methods, BUS 343: Manufacturing Planning & Control, BUS 344: Supply Chain Management, BUS 445: Supply Chain Strategy, BUS 450: Environmental Management, and BUS 460: Advanced Quality Management. We also required 3 hours of electives in a Junior or Senior course offered in the College of Business (we have been advising students to take an elective in Sourcing that we have offered over the last 3 semesters). Table 1 highlights the topics taught and pedagogy used in each course. As of May 2008, sustainability-related topics and pedagogy were included in BUS 343 (Manufacturing Planning & Control), BUS 344 (Supply Chain Management), BUS 445 (Supply Chain Strategy), and BUS 450 (Environmental Management). BUS 343 includes discussion of remanufacturing along with readings of three sustainability articles. BUS 344 includes discussion of reverse logistics. BUS 445 requires students to maintain a reflection journal in which they ponder their thought processes and how their thought process is affected by outside influences (e.g., peers and the media). BUS 450 includes a broad array of topics and pedagogy, including a sustainability project carried out by student teams at local businesses.

Table 1: Topics Taught & Pedagogy Used in UW Oshkosh SC&OM Required Courses (May 2008)

Course Number: Name	Topics Taught; Pedagogy
BUS 342: Analytical Methods	Topics: Linear programming, project scheduling, waiting line models, simulation, decision analysis, multicriteria analysis. Pedagogy: Lecture & cases requiring the use of Excel Solver.
BUS 343: Manufacturing Planning & Control	Topics: Types of manufacturing processes, remanufacturing, forecasting, sales & operations planning, master scheduling, material requirements planning, capacity planning, production activity control, JIT/lean, theory of constraints, inventory management. Pedagogy: Lecture; cases requiring the use of Excel Solver; reading and discussing three sustainability articles related to topics such as sustainability and its impact on operations management (Inman, 1999), Green MRP (Melnik, Sroufe, Montabon, Calantone, Tummula & Hinds, 1999), and accounting for waste when planning capacity (Guide, Srivastava & Spencer, 1996).
BUS 344: Supply Chain Management	Topics: Supply chain flows; drivers of supply chain performance; supply chain metrics; designing distribution networks; warehousing, packaging, and materials handling; project management; planning supply and demand in the supply chain; quantity discounts; safety inventory; transportation modes and costs; reverse logistics; sourcing decisions; information technology; coordinating the supply chain. Pedagogy: Lecture & cases requiring the use of Excel Solver.
BUS 445: Supply Chain Strategy	Topics: Strategy, integration, technology, facilities, lean/quality, organizational design. Pedagogy: Lecture, cases, major research project, journal, on-line discussion.
BUS 450: Environmental Management	Topics: Environmental issues, government regulation, facility design, product design, process design. Pedagogy: Lecture, sustainability cases, guest speakers, videos, sustainability project, on-line discussion.
BUS 460 Advanced Quality Management	Topics: Quality gurus, total quality management, statistical process control, quality award, ISO 9000, seven management and planning tools, six sigma principles, measurement systems analysis, design of experiments, failure mode and effects analysis. Pedagogy: Lecture & cases.

This table shows the required courses in our Supply Chain & Operations Management program. For each required course, we have indicated the topics covered and the pedagogy used.

DATA AND METHODOLOGY

We studied twenty programs in Supply Chain Management and/or Operations Management. Note: We intentionally excluded programs with a primary focus on Engineering, Management Science, or Transportation because those types of programs either are so vastly different from our current program or would require expertise from a major (e.g., Engineering) not currently offered by UW Oshkosh.

First, we identified universities with APICS Student Chapters. APICS is an organization that emphasizes both Supply Chain Management and the traditional Operations Management fields (APICS, n.d.). We also used personal knowledge of universities with comparable programs to develop our list of programs. Table 2 contains the list of the twenty Supply Chain and/or Operations Management programs (including ours) that we studied.

Table 2: List of Supply Chain and/or Operations Management Programs Studied

University	Web Address of Supply Chain and/or Operations Management Program
Auburn University	http://business.auburn.edu/
Arizona State University	http://www.eller.arizona.edu/
Ball State University	http://cms.bsu.edu/Academics/CollegesandDepartments/MillerCollegeofBusiness.aspx
Boise State University	http://cobe.boisestate.edu/
Bowling Green State University	http://www.business.bgsu.edu/cba/index.html
California State University – Chico	http://www.csuchico.edu/cob/
Colorado State University	http://www.biz.colostate.edu/
Miami University	http://www.fsb.muohio.edu/
Michigan State University	http://www.bus.msu.edu/
Northern Illinois University	http://www.cob.niu.edu/
Penn State University	http://www.smeal.psu.edu/
Syracuse University	http://whitman.syr.edu/
University of Arizona	http://www.eller.arizona.edu/
University of Delaware	http://www.lerner.udel.edu/
University of Wisconsin Eau Claire	http://www.uwec.edu/cob/
University of Wisconsin Milwaukee	http://www4.uwm.edu/business/
University of Wisconsin Oshkosh	http://www.business.uwosh.edu/currentstudents/undergraduate/majors/supplychain.php
University of Wisconsin Stout	http://www.uwstout.edu/programs/bsba/
University of Wisconsin Whitewater	http://www.uww.edu/cobe/
Western Michigan University	http://ism.hcob.wmich.edu/

This table lists the 20 Supply Chain & Operations programs and their web addresses.

Next, we analyzed the College of Business web site of each program to identify the supply chain courses required by each program. In particular, we studied syllabi and course requirements posted on the web sites to determine which courses were similar in content even though the course names were different. For example, we viewed the syllabi and other course documents on the web sites to determine similarities in introductory courses named “Supply Chain Management” and “Logistics.”

Finally, we used the knowledge gleaned from our literature review and benchmarking study to identify similarities between our program and the others, to confirm the uniqueness of our program’s approach to sustainability, and to ascertain the limitations of our current course topics and sustainability-related pedagogy. In particular, we wanted to identify important topics that were missing from our courses and pedagogical approaches that would expand the breadth of our sustainability-related pedagogy beyond the use of readings (articles).

FINDINGS

Similarities between UW Oshkosh SC&OM Program and Other Programs

Table 3 is a summary of the Supply Chain and Operations Management courses required by the twenty programs. The UW Oshkosh Supply Chain & Operations Management program includes the top four

courses required by all programs studied: Supply Chain Management/Logistics, Operations Planning & Control, Quality Management, and a Strategy/Applied Projects/Cases/Capstone course. Regarding our other required courses, the BUS 342 course (Analytical Methods) is required by three other programs.

Table 3: Supply Chain & Operations Management Required Courses

Course	Number of Programs Requiring Course
Supply Chain Management/Logistics	16
Operations Planning & Control	13
Quality Management	10
Strategy/Applied Projects/Cases/Capstone Course	10
Purchasing	8
Transportation/Distribution	7
Management Science/Analytical	4
Methods/Quantitative Business Analysis	
Enterprise Systems	4
Project Management	3
Modeling/Spreadsheets	3
Sustainability/Environmental Management	2
Productivity Improvement	2
Negotiations	1
Safety	1

This table lists the Supply Chain and Operations Management courses required by the twenty programs. For each course, we have listed the variations on the name of the course. For example, whether the courses are called, "Supply Chain Management" or "Logistics," the courses are similar in content.

Uncommonness of UW Oshkosh SC&OM Program

The required course in Sustainability is uncommon—only one other supply chain program (Colorado State University) has a required course in Sustainability. That course, like ours, looks at supply chain management practices through the triple bottom line perspective. None of the other programs that we studied integrates sustainability topics throughout its curricula as we currently do. As Sherman (2008) recommended, we are treating sustainability as the big idea, or guiding principle, as we revise our curriculum.

Limitations of our Current Required Course Topics and Sustainability-Related Pedagogy

Regarding course topics, it is evident that we are not emphasizing purchasing and transportation sufficiently in our program. Eight other programs require a purchasing course, and seven other programs require a transportation course. We cover these two topics currently over a two-week module in our Supply Chain Management course. Given that entire courses could be devoted to both topics, it is evident that we need to expand coverage of these topics.

Our current sustainability-related pedagogy consists currently of readings (somewhat dated) in one course (Manufacturing Planning & Control); sustainability cases, videos, speakers, and projects in another course (Environmental Management); and discussion topics, e.g., reverse logistics in Supply Chain management and remanufacturing in Manufacturing Planning & Control. Our primary experiential exercise consists of sustainability projects in the Environmental Management course that have involved student groups measuring waste and energy usage at local service and manufacturing firms. Although our Supply Chain Strategy course includes a requirement that students maintain a journal of self-reflection, that journaling exercise lacks consideration of sustainability topics, e.g., a student's personal use of natural resources as recommended by Bradbury (2003). Likewise, all of our courses lack personal vision quests (i.e., walking around campus and pondering issues important to themselves) as recommended by Bradbury (2003). Finally, our program tends to emphasize the environmental aspect of the triple bottom line and does not follow the advice of Kagawa (2007) who advocated demonstrating the connections between

environmental performance and the other two parts of the triple bottom line (social equity and economic performance).

UW Oshkosh SC&OM Program Improvements

We are focusing improvements in our required courses in two areas: (1) deeper coverage of purchasing and transportation topics, and (2) additional sustainability pedagogy. Table 4 highlights some of the proposed changes to our program.

Table 4: New Topics & Pedagogy in SC&OM Required Courses

Course Number: Name	New Topics Taught; New Pedagogy
BUS 342: Analytical Methods	New Topics: Linear programming & sustainability. New Pedagogy: In-class exercise: Linear programming using environmental constraints.
BUS 343: Manufacturing Planning & Control	New Topics: Sustainability and operations management. New Pedagogy: Readings: Discussing current article relating sustainability to operations management (Kleindorfer, Singhal & Van Wassenhove, 2005). Cases: Chlorine and the Paper Industry, Dow Chemical Company Version A, Honda of America Manufacturing Inc.: Lean Manufacturing and Environmental Management at Honda, Specialty Glass Inc.: Cost Accounting and Hazardous Wastes (World Resources Initiative (n.d.)).
BUS 344: Supply Chain Management	New Topics: Increased emphasis on reverse logistics. New Pedagogy: Readings: Discussing current articles on reverse logistics (Srivastava & Srivastava, 2006; Visich, Li & Khumawala, 2007). Cases: Bayerische Motoren Werke AG (BMW) Version B & Epson (China) Co. Ltd.: Adoption of Environmental Management Practices (World Resources Initiative (n.d.)).
BUS 445: Supply Chain Strategy	New Topics: Purchasing, transportation, negotiation, & social equity. New Pedagogy: Readings: Discussing current article on social equity in supply chain management (Ansett, 2007). Cases: Rainforest Negotiation Exercise (World Resources Initiative (n.d.)).
BUS 450: Environmental Management	New Topics: More emphasis on emerging energy issues & political regulations.
BUS 460 Advanced Quality Management	New Topics: Sustainability as an extension of TQM; Introduction to the ISO 14000 Standard. New Pedagogy: Readings: Discussing articles relating sustainability to TQM (Corbett & Klassen, 2006; Isaksson, 2006). Cases: AT&T Environment and Safety & Eastman Kodak (World Resources Initiative (n.d.)).

This table lists new topics and pedagogy to be added to our required SC&OM courses.

Coverage of Purchasing and Transportation

Initially, we were going to introduce a new course in Purchasing & Transportation. Introducing a new course became infeasible during the Spring Semester, 2009, when budget cuts were announced within our College of Business. Instead, we plan to expand coverage of purchasing, transportation, and a related topic, negotiation, within our Supply Chain Strategy course as noted in Table 4. This change will require that we reduce the number of manufacturing cases required in this course.

New Topics & Pedagogy

As indicated in Table 4, we will add a sustainability exercise to the Analytical Methods course. This linear programming exercise will integrate environmental and economic performance, with an objective function based on profit maximization and constraints that ensure that desired levels of environmental performance are met.

In the Manufacturing Planning & Control and Supply Chain Management courses, we have added more current readings relating sustainability to supply chain management and sustainability cases from the Bell Teaching Case Studies listed on the web site of the World Resources Institute. Those cases integrate environmental and economic performance.

In the Supply Chain Strategy course, we will include discussion of an article related to social equity (labor) issues. In addition, we are considering revising the journaling exercise to include students' reflections on their current environmental practices, such as purchasing practices (e.g., buying eco-friendly vs. low-cost products), tracking their waste generation (e.g., packaging, and paper waste), etc. We also are considering adding a case from the Bell Teaching Case Studies listed on the web site of the World Resources Institute. This case is a negotiation exercise requiring discussion of environmental and economic performance. Finally, we are considering adding a vision quest during one class period in which students could walk along the river that borders our campus. During this vision quest, students would consider personal career and sustainability goals. In the Advanced Quality Management course, we are considering adding sustainability cases from the Bell Teaching Case Studies listed on the web site of the World Resources Institute. Those cases integrate environmental and economic performance.

CONCLUDING COMMENTS

Integrating sustainability into a Supply Chain Management curriculum is an on-going project that will require changes as we learn more about the long-term effects of pollution, as natural resources continue to decrease, and as accounting practices change to reflect a product's true cost. Given that this integration is in its infancy stage, any program must be careful to assess which types of pedagogy most effectively lead to increased student environmental awareness. After sustainability is integrated into all of our SC&OM courses, we will have to debate whether to continue to require the Environmental Management course. Finally, we will have to be vigilant to avoid student burnout on sustainability topics by not duplicating sustainability definitions and content in our required courses.

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