

Sustainable Manufacturing - OMS 613
Winter A 2008
Ross School of Business
Prof. Talbot

Course Overview

This course is designed to partially fill some of the gaps in the curriculum for master's students from the Ross School of Business, the School of Natural Resources and Environment, and the College of Engineering who are interested in operations and sustainability. It will examine important operations management issues through the lens of the triple bottom line: economic, environmental and social sustainability with an emphasis on the former two because other Ross and SNRE electives cover social issues in depth.

From the dawn of the industrial revolution, the production, use and disposal of products has been primarily a linear process starting with the extraction of raw materials and ending with the disposition of used and unwanted products and by-products by burial or burning. This linearity has facilitated the development of efficient technical and organizational mechanisms to design, make, market, and distribute products around the world. Equally important has been an almost singular preoccupation on profitability, driven from an operations perspective by considerations of cost, quality and timeliness of product delivery. This focus has motivated incredible increases in manufacturing productivity over the past two hundred fifty years with associated increases in global affluence, access to products, and generally, improvement in the quality of life for millions of people. Manufacturers have become very good at producing and distributing affordable products desired by society. In operations management courses today, we teach students how to design, configure, manage and improve these profit-oriented linear production/distribution systems.

Unfortunately, this model of production and consumption isn't all rosy or sustainable. The dark side of industrialization has been noted almost from the outset of the industrial revolution. Economists, philosophers, writers and social reformers critical of various aspects of industrialization include such diverse luminaries as Adam Smith, Charles Dickens, Karl Marx, Emile Zola, Elizabeth Gaskell, Upton Sinclair, Charlie Chaplin and Rachael Carson. Along with many others, they have been concerned with issues such as worker and product safety, the dehumanization of work, the effects of market concentration on competition, mass social change, pollution and the exhaustion of natural resources. In the past few years, heightened attention has been focused on this model because it has been causally linked to potentially catastrophic global problems such as atmospheric ozone depletion, global warming and the mass extinction of species. Governments have responded with environmental and human rights legislation to define the boundaries of acceptable practices, technologies and products. Companies have responded in various ways from fighting such legislation to proactively trying to develop and adopt innovative best practices. Until recently, operations management courses have largely ignored these issues. The proposed course is designed to partially fill this gap.

This course will examine some of the most important environmental laws and the political, economic and technical realities that directly affect manufacturing, and the managerial challenges and opportunities they are bringing to the world of manufacturing. The basic question we will try to answer is: “How can we profitably produce and distribute products in an environmentally and humanly sustainable manner?” We will use a mixture of pedagogical formats: lecture, discussion, student presentations and cases.

A successful student will leave the course: a) with a much deeper understanding of the major forces shaping manufacturing today; b) better able to analyze and make decisions involving complex tradeoffs across economic, technological, ethical, human rights and environmental dimensions; and, c) more creative in identifying, proving and implementing profitable business opportunities that address these difficult tradeoffs.

Course Instructor

Prof. Brian Talbot
Office: W5720
Phone: 764-6842
Email: btalbot@umich.edu
Office Hours by Appointment

Required Materials

A Course Pack

Distribution of Course Materials

Materials distributed in class not subject to copyright protection will be made available on CTools which is accessible from: <https://ctools.umich.edu/portal>. Students are encouraged to check CTools several times each week for assignments, readings and other course-related announcements. I have consciously leveraged materials available on the web to keep your course pack expenses at a minimum.

Optional Supplementary Reading

I am unaware of any true textbook for this new field. However, there are books that are closely related and worth reading. Several of the most relevant are listed below. If you are planning to work in this field, I strongly encourage you to read all of these.

1. “Environmentally Improved Production Processes and Products: An Introduction,” by Lucas Reijnders, Kluwer Academic Publishers, 1996. I like this book. Unfortunately, the legal content is dated, it’s out of print, and it’s not easy to obtain in volume sufficient for a class. I have placed two copies on reserve in Kresge Library for you.
2. “Natural Capitalism” by P. Hawken, A. Lovins and L. Lovins, Little, Brown and Company, 1999, especially chapters 4 and 12. Philosophical, but with lots of examples. The HBR article in the course pack is a good overview.

3. “Biomimicry” by J. Benyus, Perennial, 1997, especially chapters 1 and 4. This is a call to use nature as a model for product and process design.
4. “Cradle to Cradle,” W. McDonough & M. Braungart, North Point Press, 2002. Chapter 6 is a good summary of their ideas. The focus is on architectural and product design, but they have a broader perspective that is important for manufacturing.
5. “Industrial Ecology,” 2nd Edition, T. Graedel and B. Allenby, Prentice Hall, 2003. I considered using this as a text for this course. It’s well written and covers a lot of topics. However, it has more of a focus on life cycle assessment than I thought ideal for OMS 613.
6. “Environmentally Conscious Manufacturing,” Myer Kutz, Ed., 2007. (A volume in the Wiley series on Environmentally Conscious Engineering.) Contains 11 essays (chapters) on various aspects of environmentally benign manufacturing from a manufacturing engineering perspective.

Term Project

An important component of the course is a team project on a sustainable manufacturing topic of special interest to you. There will be two deliverables: 1) a 15 minute presentation in class on Friday February 22 (this is the scheduled final exam day for the course); and, 2) a written paper (max 25 pages double spaced + max 10 pages of appendices). Because of time constraints on the last day, we can have a maximum of 10 teams. (Fewer are OK.) Teams are self selecting and should have between 2-3 members. A 1-3 paragraph proposal is due no later than Monday January 14. Feedback/authorization to proceed will be given within 48 hours of receipt of proposal. Topics are first-come-first-served. Slides and term papers are due on February 22 and will be placed on CTools for everyone to read, so no proprietary information should be included. More details and suggestions will be posted on CTools.

Preparation and Teamwork

This is a new field of inquiry. In order to maximize our learning and enjoyment, everyone is expected to prepare the readings and cases and participate actively in class. If unforeseen circumstances prevent you from being prepared, you should attend class anyway, but inform me beforehand so that you are not called upon to lead the discussion.

Teamwork in preparing cases and assignments is encouraged. Composition of teams is at your discretion.

Grades

The course grade will be determined as follows:

Class participation	30%
Final Presentation	20%
Group Term Paper	50%

Session 1 Monday January 7

The Big Picture of Natural Capitalism; Green Product and Process Design Linkages

Please read and prepare for discussion:

1. “A Road Map for Natural Capitalism” by A. Lovins, L. Lovins and P. Hawken, Harvard Business Review, Reprint 99309, May-June 1999.
2. Materials on CTools regarding manufacturing and the environment.

Session 2 Monday January 14

Traditional and New Approaches to Pollution Prevention and Energy Efficiency

Please read and prepare for discussion:

1. Documents on CTools regarding various approaches to pollution prevention, cleanup and energy efficiency. Companies we will focus on are Dow, Dupont and 3M.
2. The case “Dow Chemical Company (A): The WRAP Program” by K. Baker, World Resources Institute, 1994
3. “Little Green Molecules,” by Collins and Walter, Scientific American, March 2006.

Don't forget to submit your team membership and project proposals!

(Note: No class on Martin Luther King's Day January 21.)

Session 3 Monday January 28

Manufacturing and U.S. Environmental Law

1. Please read and prepare for discussion the documents on CTools describing the following legislation:
 - a. Clean Air Act (CAA)
 - b. Clean Water Act (CWA)
 - c. Resource Conservation and Recovery Act (RCRA)
 - d. Comprehensive Environmental Response, Compensation and Liability Act (CERLA)
 - e. Toxic Substances Control Act (TSCA)
 - f. Emergency Planning and Community Right-to-Know-Act (EPCRA)
 - g. Oil Spill Prevention Act (OSPA)
2. Prepare the case “Allied-Signal: Managing the Hazardous Waste Liability Risk,” Harvard Business School Case 9-793-044, 1992
3. Please read and prepare for discussion the documents on CTools regarding the pulp and paper industry. I hope to have an expert from the industry speak to us this evening.

Session 4 Monday February 4

Manufacturing & European Environmental Law

1. Please read and prepare for discussion the documents on CTools describing the following legislation and international agreement:
 - a. EU Directive on Waste Electrical and Electronic Equipment (WEEE)

- b. EU Directive on the Restriction of the use of certain Hazardous Substances in Electrical and Electronic equipment (RoHS).
 - c. EU Directive on Registration, Evaluation and Authorization of Chemicals (REACH)
 - d. EU Directive on End-of-Life Vehicle (ELV)
 - e. Kyoto Accord
2. Prepare for discussion the article “Is Extended Producer Responsibility Effective?” Environmental Science & Technology, April 1, 2000
 3. Prepare the case “Bayerische Motoren Werke AG (A)” by C. Cummings and F. den Hond, World Resources Institute, 1993

Session 5 Monday February 11

Recycling, Remanufacturing and Reverse Supply Chains

Read and prepare for discussion:

1. “From Garbage to Goods: Successful Remanufacturing Systems and Skills,” by G. Ferrer and D. Whybark, Business Horizons, Nov – Dec 2000.
2. “Remanufacturing: The Next Great Opportunity for Boosting US Productivity,” by R. Giuntini and K. Gaudette, Business Horizons, Nov – Dec 2003.
3. “Europe Cracks Down on E-Waste” by Alec Appelbaum, IEEE Spectrum, May 2002.
4. “Product Recovery with Some Byte: An Overview of Management Challenges and Environmental Consequences in Reverse Manufacturing for the Computer Industry,” White et al, Journal of Cleaner Production, 2002.
5. “Third-Party Demanufacturing as a Solution for Extended Producer Responsibility,,” Journal of Cleaner Production, 2004.

I hope to have an expert from the electronics industry involved in recovery and remanufacturing speak to us tonight.

Session 6 Monday February 18

Green Factories: From Green Architecture to Green & Lean Processes

Read and prepare for discussion:

1. Lean Manufacturing and the Environment, EPA100-R-03-005, October 2003. This is long, but it moves quickly.
2. CTools materials on green factories, ISO 9000 & 14000
3. The case “Honda of America Manufacturing, Inc.: Lean Manufacturing and Environmental Management at Honda,” World Resources Institute, 1998

Session 7 Friday February 22

Project Presentations