

MSUS 402 Systems Thinking and Sustainability

GENERAL INFORMATION

Schedule: Monday/Wednesday 4:00 – 5:30 PM in Bronfman 002

Instructor: Prof. Jeroen Struben,
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Office hours: Wednesday 2:00-3:00 pm, Bronfman 487 (or by appointment)

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Information on readings, assignments, etc. Most course readings are provided in a course pack. Additional readings (required and recommended) are available in MyCourses. The course site MyCourses will contain, besides the syllabus and readings, additional information about assignments, simulations, helpful hints, and other useful information. The instructor and TAs will use MyCourses to send emails, schedule changes, etc. You can also use the site to find partners for group assignments, or to pose questions to the class as a whole.

Objectives and Scope

Despite “sustainability” being touted as a key driver to innovation, why is “sustainability” so hard to achieve? Why do so many organizations, bottom-up initiatives, or policy interventions fail to produce impactful and lasting results? Why is it so hard to build organizational capabilities for sustainability that are themselves self-sustaining? How do actors identify and design high-leverage policies, policies that are not thwarted by unanticipated side effects?

Mounting pressure on the environment and accelerating economic, social, and technological change challenge managers and policy makers to learn how to design and manage high leverage and robust strategies and policies. And we must increasingly learn how to design and manage complex systems with multiple feedback

effects, long time delays, and nonlinear responses to our decisions. Yet learning in turbulent situations is difficult because we never confront many of the consequences of our most important decisions. Effective learning for sustainability then requires methods to develop systems thinking skills, to represent and assess such dynamic complexity, and tools that managers can use to accelerate learning throughout an organization.

This course introduces you to systems thinking for organizational policy and strategy with a focus on sustainability issues. You will learn to visualize an organization and its broader environment in terms of the structures and policies that create dynamics and regulate performance. In addition, you will perform dynamic analysis, by using ‘microworlds’, or management flight simulators where space and time can be compressed, slowed, and stopped, to examine the long-term side effects of decisions, systematically explore new strategies, and develop our understanding of complex systems.

For the purpose of the class we scope sustainability broadly as involving environmental, health, and social issues. In-class applications include: a finite world; organizational growth and innovations for sustainability; self-sustaining organizational growth; collective action; organizational change, implementation of change strategies; transformation of markets involving clean technology, mobility, and nutritious food; public health and climate change. Cases involve both success and failures.

Learning Objectives

By the end of this course you will have an understanding of major systems perspectives on sustainability, of importance and complementarity. Through this you will develop a deeper understanding of the multifarious character of sustainability, as well in what it means to successfully implement policies for sustainability. Building on principles of systems thinking and using system dynamics modeling you will improve your understanding of the ways in which outcomes of organizational action are related to the internal structure and operating policies as well as those of the broader environment - customers, competitors, and suppliers, NGOs, policy makers etc. By the end of this course you will be able to apply principles of policy design for successful management of complex integrative strategies. You will learn to recognize and deal with situations where policy interventions as well as their impact are likely to be delayed, diluted, or defeated by unanticipated reactions and side effects, in particular in the context of sustainability. You will be able to apply a variety of systems thinking tools including causal loop diagram and stock-and-flow mapping, and to explore feedback behavior of systems through simulation analysis. You will learn how these tools complement other effective tools and practices for managing sustainability.

Format

Besides lectures and case studies that integrate the use of systems thinking tools, in this course you gain hands on experience in “systems thinking lab” sessions. These sessions allow you to experience challenges and opportunities in transforming for sustainability through role playing games, using state of the art software for computer simulations, gaming, and management flight simulators. Assignments provide hands-on experience in developing and testing systems thinking tools – from mapping to simulation modeling - in diverse settings.

NO COMPUTER MODELING EXPERIENCE IS NEEDED.

Grading Emphasis:

Assignments: 85% (5 assignments distributed over the term; 3 x 15% and 2 x 20%)
 Class participation: 15%

Each assignment is graded on a 10-point scale. Some assignments will be individual- others group-based. Two points will be forfeited for assignments handed in late. Assignments handed in more than 1 class late will receive no credit. *This policy will be strictly enforced.*

Software

For some sections we will be using easy to use modeling software. Several excellent packages for system dynamics simulation are available commercially, including iThink, from High Performance Systems, Powersim, from Powersim Corporation, and Vensim, from Ventana Systems. All are highly recommended. You may wish to learn more about these packages, as all are used organizations and in the policy world, and expertise in them is increasingly sought by potential employers. We will be using **Vensim**.

Suggested further reading

For those who want to read more beyond the core material I suggest the book *Business Dynamics: Systems Thinking and Modeling for a Complex World* Irwin/McGraw Hill. ISBN 0-07-238915X. (Part of the class material will be drawing upon this book.)

COURSE SCHEDULE

NOTE: The reading list comprises required readings to be read ahead of the associated class; class orderings as well as required readings may be subject to change (for example because of guest-lectures). Any such changes will be announced at least a week ahead of the relevant class. Some readings are not printed in the course pack but will be available via active links from the course syllabus in *myCourses* (indicated below as “**myCourses**”). Additional readings may be assigned in class, including for, but not necessarily limited to, sessions with readings indicated below as “**tba myCourses**”. Assignment in/out dates may change. Any changes will be indicated in class and posted on *myCourses*.

Session			Readings	Asgn
Introduction				
1	MON 05/01	Introduction: Policy Resistance	-	
The State of the World; Systems Thinking and Sustainability				
2	WED 07/01	State of the World 1: the science, trends & implications	Foley (2010) Boundaries for a healthy planet <i>Scientific American</i> 302(4) Running (2012) A measurable Planetary Boundary for the Biosphere. <i>Science</i> . 337(1458) Koonin (2014) Climate Science is not settled. <i>Wall Street Journal</i> Emanuel and Solomon (2014) A Response to Stephen Koonin’s Call to Inaction. <i>The Equation</i>	
3	MON 12/01	Fishbanks – A Renewable Resource Management Simulation	myCourses: Fishbanks Simulation Video Tutorial: https://mitsloan.mit.edu/LearningEdge/simulations/fishbanks/Pages/Video.aspx Optional: FAO (2014) State of the Fisheries 2014	
4	WED 14/01	Fishbanks – Debrief	tba myCourses <i>Note: this session assumes you have read the classic: Hardin, G. (1968). The tragedy of the commons. Science, 162(3859), 1243-1248!</i>	
5	MON 19/01	State of the World 2: Systems Thinking & How to Move towards Sustainability?	Sterman (2012) "Sustaining sustainability: creating a systems science in a fragmented academy and polarized world." <i>Sustainability science</i> . Springer New York, 2012. 21-58. Popkin (2014). On the Edge. <i>Science</i> . Vol. 345(6204) pp. 1552-1554 (skim) The Guardian (2014) The art of systems thinking in driving sustainable transformation http://www.theguardian.com/sustainable-business/systems-thinking-sustainable-transformation Dymphna van der lans (2014) how systems thinking can impact climate change https://www.clintonfoundation.org/blog/2014/09/19/how-systems-thinking-can-impact-climate-change Senge (2014) Systems Thinking https://www.solonline.org/?page=SystemsThinking Meadows (2014) Systems Thinking resources http://www.donellameadows.org/systems-thinking-resources/	1 out

System Thinking: System Dynamics Principles and Tools				
6	WED 21/01	The purpose of modeling, Problem definition and model purpose; intro to causal mapping	tba myCourses	
7	MON 26/01	Dynamics of feedback loops; building theory with causal loop diagrams	Sterman (2000) Business Dynamics (BD), Ch. 5 (<i>not: sections 5.4, 5.6, 5.7</i>)	1 in
8	WED 28/01	Dynamics of stocks and flows; Mapping the stock and flow structure of systems	BD, Ch. 6 (<i>not: sections 6.2.7, 6.2.8, 6.2.9, 6.3.4</i>) BD, Ch. 7.1 & 7.2	
9	MON 02/02	Dynamics of simple structures; overshoot and collapse	BD, Ch. 8;	2 out
Managing Growth for Sustainable Practices and Markets				
10	WED 04/02	Diffusion of innovations, new Practices, and Ideas	BD, Ch. 9.2 until & incl. 9.2.4; 9.3 (<i>not: 9.3.1-end</i>)	
11	MON 09/02	Applying Tools 1-3: Network externalities, complementarities, and path dependence	BD, Ch. 10 (<i>not: 10.2</i>) Henderson, Conkling, and Roberts (2010) Focused on the future of solar power https://mitsloan.mit.edu/LearningEdge/CaseDocs/07-042-SunPower-Henderson.pdf	2 in 3 out
12	WED 11/02	Human Decision Making: Bounded Rationality or Rational Expectations?	Tversky, A., & Kahneman, D. (1974). Judgment under Uncertainty: Heuristics and Biases. <i>Science</i> , 185(4157), 1124–1131. BD, CH 15.1-15.4	
13	MON 16/02	Innovating for Sustainability: In-Class Presentations	-	3 in
14	WED 18/02	Innovating for Sustainability: In-Class Presentations	-	
Getting Unstuck: Sustainable Organizational Strategy & Change				
15	MON 23/02	Getting Unstuck	Sterman (2013) Stumbling towards Sustainability: Why organizational learning and radical innovation are necessary to build a more sustainable world—but not sufficient. Forthcoming, R. Henderson, M. Tushman and R. Gulati (eds.) Organizational & Strategic Change and the Challenge of Sustainability. Oxford University Press.	
16	WED 25/02	Building Capabilities for Sustainability 1:	Repenning N. and J.D. Sterman (2001) “Nobody ever gets credit for fixing problems that never happened” California Management Review, 43(4). Kotter (1995) Leading Change: Why Transformation Efforts. Harvard business Review (95204)	
READING WEEK				
17	MON 09/03	Growth of Solar 1	In-class handouts	

18	WED 11/03	Growth of Solar 2	In-class handouts	
19	MON 16/03	Building Capabilities for Sustainability 2: Implementing Change	BD, Ch. 2.4, 2.5 tba myCourses	4 out
From Global to Local and Back				
20	WED 18/03	The world Limits to growth and what can we do	Meadows, D. (1999). Leverage points: Places to intervene in a system. The Sustainability Institute. Meadows, D (1991) "The Limits to Growth revisited." <i>The global citizen</i> (1991): 29-33.	
21	MON 23/03	Dynamics of and Challenges to Collective Action	O'Rourke et. al. (2011) "Forum: The Citizen Consumer," <i>Boston Review</i> Glaeser (2013) <i>The Supply of Environmentalism</i> Lewis, K., Gray, K., & Meierhenrich, J. (2014). The structure of online activism. <i>Sociological Science</i> , 1, 1-9.	4 in
22	WED 25/03	Achieving successful collective action in the context of climate change	Ostrom, E. (2010). Polycentric systems for coping with collective action and global environmental change. <i>Global Environmental Change</i> , 20(4), 550-557. Adger, W. N. (2010). Social capital, collective action, and adaptation to climate change. In <i>Der klimawandel</i> (pp. 327-345). VS Verlag für Sozialwissenschaften.	
Transformations & Tools				
23	MON 30/03	Sustainable Transportation	Better Place: Shifting Paradigms in the Automotive Industry (Etzion, and Struben (2014) in: Pirson, M., (Ed) <i>Case Studies in Social Entrepreneurship</i> , The Oikos Collection V4 (Forthcoming, October 2014).	5 out
24	WED 01/04	Systems Thinking Lab: Energy Policy with EN-ROADs	Hargadon and Kenney (2012) <i>Misguided Policy? Following Venture Capital into Clean Technology</i> , <i>California Management Review</i> myCourses: En-Roads tutorial	
Synthesis				
<i>MON 6/4 no class</i>				
25	WED 08/04	Professional and Personal Strategies for moving towards a more sustainable world	tba myCourses	
26	MON 13/04	Review; How to keep learning. Follow-up resources. Career opportunities.	tba myCourses	5 in

Administrative Notes

Academic Standards and Integrity

We expect the highest standards of academic honesty and behavior from all participants in class. McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see www.mcgill.ca/students/srr/honest/ for more information).

L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, veuillez consulter le site www.mcgill.ca/students/srr/honest/)

The standards hold true for citing the work of others (proper referencing to avoid plagiarism), for individual and group work. If you have any questions about standards and expectations regarding individual and team assignments, please ask me after you have read the standards and before doing the assignments.

Instructor generated course materials (e.g., handouts, notes, summaries, exam questions, etc.) are protected by law and may not be copied or distributed in any form or in any medium without explicit permission of the instructor. Note that infringements of copyright can be subject to follow up by the University under the Code of Student Conduct and Disciplinary Procedures.

Right to submit in English or French written work that is to be graded

In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded. This right applies to all written work that is to be graded, from one-word answers to dissertations.

Disability

"If you have a disability please contact the instructor to arrange a time to discuss your situation. It would be helpful if you contact the [Office for Students with Disabilities](#) at 514-398-6009 before you do this."

Academic Issues

"Additional policies governing academic issues which affect students can be found in the McGill Charter of Students' Rights" (The Handbook on Student Rights and Responsibilities is available [here](#)).

Sustainability

"McGill has policies on sustainability, paper use and other initiatives to promote a culture of sustainability at McGill." (See the [Office of Sustainability](#).)