

System Dynamics

Fall 2025

Nov 21-22-23 \ Dec 12-13-14 \ January 2026 09-10-11 (3 weekends, 9 days of lectures)

(Last updated April 10, 2025)

COURSE INFORMATION

Course Number: Tech 517

Course Title: System Dynamics

Term and Year: Fall 2025

COURSE WEBSITE: See <http://www.karanfillab.com/>

Class Location & Meeting Time:, 3 weekends and 9 half-day lectures

Nov 21-22-23: Friday, Saturday, Sunday 15:30-19:30pm Istanbul Time (Zoom)

Dec 12-13-14: Friday, Saturday, Sunday 15:30-19:30pm Istanbul Time (Zoom)

January 2026 09-10-11: Friday, Saturday, Sunday 15:30-19:30pm Istanbul Time (Zoom)

CONTACT INFORMATION

Faculty

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Lab website: <http://www.karanfillab.com/>

Teaching Assistant: TBD

Office hours: *TBD and By Appointment*

Credits: 6 ECTS credits, 3 KU credits

COURSE MATERIALS

Required Textbook(s): *None*

Recommended Textbook(s):

- [John Sterman](#). Business Dynamics. Systems Thinking and Modeling for a Complex World. McGraw-Hill, U.S.A., 2000.
- [Donella Meadows](#). Thinking in Systems, A Primer. *Edited by Diana Wright. Sustainability Institute*. Chelsea Green Publishing. 2008
- [Jørgen Randers](#). 2052: A Global Forecast for the Next Forty Years, Vermont USA, Chelsea Green Publishing, 2012.
- Tracing Connections: Voices of systems thinkers. *Editors: Joy Richmond, Lees Stuntz, Kathy Richmond, Joanne Egner*. ISEE Systems Inc. 2010
- [Peter M Senge](#). The Fifth Discipline: *The Art & Practice of The Learning Organization*. Revised & Updated edition. New York: Doubleday; 2006. 445 p.
- [Richardson, G. P.](#) 1991. *Feedback Thought in Social Science and Systems Theory*. Waltham, MA: Pegasus Communications.

Course Objectives and Scope:

As human beings in an interconnected world, we face a number of complex and seemingly intractable problems including climate change, food security, global poverty and pandemic diseases. Understanding how to address such problems is the first step to solving them. This course offers an introduction to systems thinking and system dynamics modeling as an approach to diagnosing and solving complex business problems. Students will learn about key concepts and modeling tools in systems thinking for better decision making and analysis, and a range of tools and mainly two types of mapping tools for system dynamics (stock-flow diagrams and causal-loop diagrams), to address central concerns and current topics, including but not limited to:

- Topics in sustainable growth, dynamics of competitive strategy, adoption and diffusion, health policy and management, crisis/pandemic management, case studies, systems strategy, innovations, climate change and climate action simulations.

Systems thinking offers a lens on organizations, environments and human behavior that foregrounds ongoing evolution and conceptualizes them as a non-linear dynamic system. System dynamics modeling is a toolset through which the systems thinking perspective is used to analyze complex systems behavior. In this class you will learn to visualize a system in terms of the structures and policies that create dynamics and regulate performance. System dynamics allows us to create models (or “micro-worlds”) where space and time can be compressed, slowed, and stopped so we can experience the long-term side effects of decisions, systematically explore new strategies, and develop our understanding of complex systems. We use simulation models, case studies, and management flight simulators to develop principles of policy design for successful management of complex strategies. We consider the use of systems thinking to promote effective organizational learning.

The purpose of modeling is to improve our understanding of the ways in which an organization's performance is related to its internal structure and operating policies as well as those of customers, competitors, suppliers and other stakeholders, then use that knowledge to design and implement policies that lead to sustained improvement. During the course you will use several simulation models and management simulators to explore such strategic issues as fluctuating sales, production and earnings; market growth and stagnation; the diffusion of new technologies; process improvement; the rationality of

managerial decision making; project management dynamics, health policy, environmental sustainability, climate change, and other topics.

Audience

This course is targeted to MBAs, EMBA's and other graduate level (MSc or PhD) students, Global Network students, exchange students, and to an international audience from various backgrounds, including management sciences, engineering, social sciences, health or basic sciences. Students may join the course from different time-zones (depending on mode of instruction). Prospective students usually have an interest in systems thinking and modeling, dynamic modeling for policy analysis and management, sustainability, climate, healthcare, strategy and business, role-playing simulators and interactive flight simulators. Students should have, or be willing to invest their time to acquire, familiarity with conceptual and (to some level) technical/simulation tools, and mainly the VensimPLE software.

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 in the business world, and expertise in them is increasingly sought by potential employers. For further information, see the following resources:

iThink: See the isee Systems web site at <www.iseesystems.com>

Powersim: See the Powersim web site at <www.powersim.com>.

Vensim: See the Ventana Systems web site at <www.vensim.com>.

The required modeling software is VensimPLE. In this course, we will be using the Vensim Personal Learning Edition (VensimPLE) by Ventana Systems. VensimPLE is free for academic use, and available for PCs and Macs. Download VensimPLE from <http://vensim.com/vensim-personal-learning-edition> Be sure to download the current version from the Vensim website above, before the first class. Detailed instructions will be distributed for Mac and PC users.

Course Readings

Various relevant past and contemporary readings from system thinking & modeling literature will be provided and additional material will be posted regularly on class website.

Course Structure

Hands-on workshops will be organized with active learning where students, instructor, and teaching assistant will jointly apply the class concepts using the Vensim software on their laptops.

Class sessions will be organized in two major ways:

Synchronous lectures: Students are required to participate and be prepared, do readings before class.

Asynchronous lectures: Supporting class material such as readings/ short lecture videos/ handouts may be posted inbetween and before sessions to enhance students understanding of the concepts.

Class participation :

Active learning through class participation and discussion during class-time and during/ after guest lectures are important components of the course. Students are expected to attend/ and or participate in lectures.

Readings:

Readings include some “required” and additional “elective readings,” which are specified on the Reading List and will be downloadable from the course website. Students are supposed to complete the required reading prior to class, and are encouraged to consult the “elective readings”.

Team project outline:

Students will be asked to work on a case study that will be assigned to them in a group of three (may vary from 2-3), where they will need to apply the materials learned during the course. The assignment includes

a report and (tentatively) an in-class presentation by the teams. Details about the report will be given in the team assignment. One class session (tentatively) will be dedicated to discussing elaboration and completion of the case study and the team projects, based on schedule and availability. The final team assignment will be due to end of the semester.

Grading, Progress and Assessment

The grade for the course will be based on the following, active participation is a bonus.

- Homework/ individual and team assignments (65%)
- Class attendance/ participation (attendance and/or participation in class discussions) (15%)
- Submission of online surveys (20%)

Academic Standards and Honesty:

Copying from others or providing answers or information, written or oral, to others is cheating. Copying from another student's paper or from another text without written acknowledgment is plagiarism.

Unauthorized help from another person or having someone else write one's assignment is collusion.

Cheating, plagiarism and collusion are serious offences resulting in an F grade and disciplinary action.

Student Code of Conduct and Academic Grievance Procedure:

- [Student Code of Conduct](#)
- [Statement on Academic Honesty with Emphasis on Plagiarism](#)
- [Academic Grievance Procedure](#)

Course Surveys: Constructive feedback from students is a valuable resource for improving teaching. The feedback is preferred to be specific, focused and respectful. It should also address aspects of the course and teaching that are positive as well as those which need improvement. Completion of the online surveys is a requirement and counts towards your grade as a 100/100 upon completion (Pass/Fail).

Course Learning Outcomes (CLOs)

1. **Seeing the world using a different lens:** Understand and apply key concepts and modeling tools in systems thinking for better decision making and policy analysis for complex problems, seeing the world in a slightly different way (instincts).
2. **Structured group process with mapping tools:** Be able to conceptualize and map complex dynamic "systems" by using major diagramming tools for system dynamics; such as Causal Loop and Stock-Flow diagrams; and then observe and analyze these maps with a critical mind to diagnose and solve the root of complex problems produced by these systems. Learning from available evidence, being able to translate evidence into concepts and models (insights).
3. **Models that give answers:** Recognize and analyze some common "system archetypes" that can trigger persistent, long-term problems, despite our well-intentioned efforts. Understand the ways in which any systems or organization's performance is related to its very internal feedback structure and operating policies as well as the various roles played its major stakeholders- such as customers, competitors, suppliers, policy-makers, end-users and others, and then use that knowledge to design and implement policies that lead to sustained improvement (answers).

4. **Real-life applications:** Becoming familiar about practical examples about industry and business, working examples and applications, by role-playing with interactive management flight simulators in teams, and having the opportunity to listen to experiences of leading experts in the field (action).

**Koç University Graduate School of Business
System Dynamics --Sept 26-27 and Nov 14-15, 2020**

Saturday, Sept 26	Sunday, Sept 27	Saturday, Nov 14	Sunday, Nov 15
Introductions and Course Outline	Tools for Systems Thinking	Late, Expensive and Wrong:	Systems Thinking in Action
Introduction to Systems Thinking and Business Dynamics Dynamic Behavior Patterns 15:10 - 16:00	Stock-Flow Diagrams Mapping of Stock Flow Networks Case Study 15:00 - 16:00	The Dynamics of Large Projects Process Improvement Examples 15:00-16:00	People Express Case Study Flight Simulator People Express Corporation
Break 16:00 - 16:10 pm	Intermittent Breaks	Intermittent Breaks	Intermittent Breaks
Simulation Workshop: Exploring Simple Structures Vensim Epidemic Tutorial Part A Epidemic and Crisis Management 16:10 - 17:10	Tools for Systems Thinking Stock-Flow Structures and Behavior Linking Structure to Behavior Common Archetypes Exercise 16:10 - 17:10	Project Management Dynamics Project Management Simulator Play Individually or as a Group 16:10 - 17:10	People Express Case Study Flight Simulator People Express Corporation Play as a Group
Break 17:10 - 17:20	Break 17:10 - 17:20	Break 12:00 - 1:00 pm	Break 12:00 - 1:00 pm
Simulation Workshop: Exploring Simple Structures Vensim Epidemic Tutorial Part B Epidemic and Crisis Management 17:20 - 18:20	Dynamics of Competitive Strategy Product Adoption and Diffusion Market Growth/ Strategy 17:20 - 18:20	Project Management Dynamics Project Management Simulator DEBRIEF Capability Traps 17:20 - 18:20	People Express Case Study Conceptual Design and Policy Design DEBRIEF Limits
Intermittent Breaks	Intermittent Breaks	Intermittent Breaks	Intermittent Breaks
Modeling Dynamic Systems Causal Loop Diagrams Exercise 17:20 - 18:20	Climate Interactive Simulation or Fishbanks Guest Talk: TBD Systems Thinking for Health Policy 18:30 - 19:50	Why don't we understand Accumulation? Accumulation and Integration Exercises 18:30 - 19:50	Guest Talk: TBD EnRoads Climate Action Student Success Stories
Daily Wrap Up	Daily Wrap Up and Feedback	Daily Wrap Up and Feedback	Daily Wrap Up and Feedback

NOTE THAT THIS IS AN EXAMPLE SYLLABUS FROM FALL 2020 WITH DIFFERENT MEETING TIMES—SHOWN HERE ONLY TO ILLUSTRATE HOW THE CLASS WORK