Course PM

SEE050 – Systems Interventions for Sustainability Transitions

Course purpose and aim

Many of the technical systems in society that engineers engage with throughout their career are facing large changes in their technological development, markets, legislation and user behaviors. In response to ambitious sustainability demands, it is no longer a question of marginal changes of existing systems but rather of replacing existing systems with new configurations. This need is emphasized in the United Nations Agenda 2030 "Transforming our World" with the 17 Global Goals for Sustainable Development. The purpose of the course "System interventions for sustainability transitions" is to increase its participants' abilities to work with systems innovation. You will integrate different perspectives to map out and create in-depth understandings of complex socio-technical systems (e.g. systems for energy, mobility or food). In addition, you will explore solutions that challenge existing systems, and through dialogue with relevant societal actors and researchers, identify leverage points where interventions can contribute to desired change in the systems.

The course creates an opportunity for you to engage with sustainability challenges on a systems level together with stakeholders in a local/regional context, also in interaction with researchers.

The course aims to result in an output (grounded leverage point) of relevance for a future master's thesis in line with Challenge Lab. This leverage point will be phrased as a research question with sustainability transition potential, aligned with your personal interests and connected with an ongoing local/regional process with associated stakeholders, and (if of interest to further pursue the leverage point during the spring) connected with a potential supervisor and plan for a master's thesis.

The course also aims to foster learning on a level of theories, concepts, methods and tools throughout the process whilst working towards the final output. In that way, the course builds upon a "learning-by-doing" approach where concepts are introduced, practiced in a case and reflected upon and so integrated in your internal process of "becoming a systems practitioner" with support from the course staff.

Learning outcomes (after completion of the course the student should be able to):

1. Apply basic concepts connected to systems innovation
2. Identify, analyse and discuss challenges within current socio-technical systems in relation to future requirements for sustainability with backcasting
3. Reflect upon choices of different systems tools, as well as their possibilities and limitations
4. Create conceptual models of complex systems
5. Identify and define systems boundaries and scales within a system
6. Analyse cause and effect from a systems perspective
7. Identify reinforcing and balancing dynamic feedback mechanisms
8. Make a stakeholder analysis and lead dialogues in multi-stakeholder settings
9. Find strategic and relevant leverage points where initiatives can have large effects on a system
10. Identify and formulate problems/challenges in complex societal systems

Course Design

Content

This course combines historical and conceptual developments of systems thinking with practical application in a multi-stakeholder case for regional socio-technical sustainability transitions. The course starts with a general introduction to systems interventions for sustainability transitions including systems innovation, backcasting, transdisciplinarity and multi-stakeholder co-creation. This introduction is followed by deeper engagement with systems thinking including its historical development and central concepts. These elements are then combined and practiced through a hands-on real-world case in West Sweden, running across the remainder of the course.

The case is done in smaller groups and starts by approaching a regional, thematic socio-technical system (e.g. mobility, energy, food) where there are sustainability challenges. A particular system is selected for deeper analysis and engagement. This system is conceptually mapped through static representations to understand both dominant socio-technical configurations and promising alternative systems configurations (niches). Throughout this process dialogues are held with stakeholders in society to iterate and anchor the systems representations in real-world contexts. Here tools such as actor analysis and participatory methods including facilitation and dialogue techniques are central.

Based on the static systems representation and stakeholder dialogue, the most interesting dynamics in the socio-technical systems are further analysed with its relations to the niches. Rough areas are selected where there might be potential for transformative change (systems innovation), either within the dominant systems configurations or for accelerating niche development. A detailed mapping is made in iterative manners to catch feedback mechanisms and other dynamics, to eventually identify leverage points where a small change can have larger effects. The selected leverage points are also based on stakeholder interests and larger trends in society (landscape level) to ensure the societal relevance and feasibility of the leverage point. The leverage points are then formalized into research questions with a selection of appropriate methods within a backcasting framework that can be brought further for a flying start of a master thesis in line with Challenge Lab.

Organization

The course is organized based on a combination of lectures, a case and reflection:

- **Theory and Tools:** Interactive lectures and literature with introduction of tools.
- **Case Work:** A hands-on case where the tools are applied in real-world sustainability challenges in West Sweden.
- **Reflection:** A reflection paper on systems thinking encompassing the whole course where you will reflect upon the tools and their use in the case.

In comparison to SEE040, this course focuses on deepening and application of systems-related tools that are used in an extensive case that also can lead towards a research question for a future master thesis.

Literature

All literature is posted on Canvas at course start. The literature should be seen as providing perspectives to the interactive lectures and workshops, not as a substitute to them. Hence, concepts might be presented during a lecture or workshop but not in the literature and vice versa.

To support you in engaging with literature there will be reflective sessions throughout the course. Here, we reflect together over the quality of what we have generated so far and share experiences from the processes of doing so.

The literature for each module can be found on Canvas under Modules.

Examination including compulsory elements

The course is examined through a group case and individual reflection assignments. Please scroll to the scheduling section at the end of this document for a list of all deadlines.

<u>Case:</u>
The case stretches the entire course. You work together in groups which may change throughout the course depending on how your interests evolve. You can also find information on this in the Content section above, and we will provide further guidance during the course introduction.

Accompanying the casework are a series of submissions throughout the course. There will be one hand-in for each of the five modules, due on Fridays (noon). Handing in these assignments is mandatory. They are graded on a pass/fail basis and passing all hand-ins leads to passing the case.

<u>Weekly individual reflection assignments</u>
Starting in week two, you will upload a brief reflection assignment every week (up to two pages). These uploads are mandatory but are not graded. We want to ensure that you continuously reflect on three aspects:

- The theories, concepts and tools you are introduced to in the literature and interactive lectures and workshops.
- The quality of the outputs you produce, such as static or dynamic systems maps, leverage points, etc.
- The processes of learning about theories, concepts and tools and of creating these outputs.

You should upload your weekly reflections on Canvas every Thursday (23:59). You will also send your reflection to one of your peers and receive their reflection via email and will have <u>one day</u> to read and comment on these reflections (until Friday 23:59).

We will also provide more information on the reflection assignments in the introductory lecture to the course.

<u>Final individual reflection assignment</u>
At the end of the course, you will write a final assignment where you will reflect upon the whole course. This will give you an opportunity to take a step back and reflect on what you learned and achieved during the course. You will submit the final assignment by January 16th (23:59). This final submission will be graded and determine your grade for the overall course.

We will provide more details on the content and format of this assignment during the course.

Mandatory attendance

All sessions are mandatory, and you are expected to attend the sessions. Please contact the course coordinator if you cannot attend a session for some reason. Sessions will be held on campus. We follow the general Chalmers guidelines for on-campus activities during the covid-19 pandemic. You can find general information on Chalmers guidelines here, and specific information for students here.

If you have any concerns or questions about class activities on campus do not hesitate to contact the course coordinator.

Since we have a waiting list with students who want to participate in the course, it is important to attend the first lecture (Nov 2) to claim your place. If you do not claim your place in the course, it might be given to another student. If you cannot attend the first lecture, inform the course coordinator via email in advance of this lecture.

Submissions, revisions and re-examination

All submissions in the course should be done through Canvas. Submissions by email to the course team will not be accepted. Late case submissions may result in supplementary assignments.

Any revisions to the case or the written assignment should be submitted as soon as possible, but no later than two weeks after having received the feedback.

"Plussning", attempts to increase an already passed grade, is not available for any part of the course.

Last year's course evaluation

This course occurs for the first time this year. We are looking forward to any feedback you may have for us to improve this course in the upcoming years!

Schedule and location

The course will be provided on campus. We follow the general Chalmers guidelines related to Covid-19 for on-campus activities. You can find general information on Chalmers guidelines here, and specific information for students here. If you have any concerns or questions about class activities on campus related to your own health or that of relatives, or if you need to stay home because you have symptoms, do not hesitate to contact the course coordinator.

Please see TimeEdit for an updated course schedule with information about location and specific times. We always start sharp in the morning (e.g. 8.00).

General scheduling:
- Mondays: 8-12
- Wednesdays: 10-17

A full schedule will be published upon course start, below is an overview of all events:

Date	Time	Module
Nov 2nd	8-12	Module A: Course introduction (mandatory to keep your spot)
Nov 4th	10-17	Module A: Course introduction
Nov 9th	8-12	Module B: Approaching systems
Nov 11th	10-17	Module B: Approaching systems
Nov 16th	8-12	Module C: Conceptual models
Nov 18th	10-17	Module C: Conceptual models
Nov 23rd	8-12	Module C: Conceptual models
Nov 25th	10-17	Module C: Conceptual models
Nov 30th	8-12	Module D: Levers for change
Dec 2nd	10-17	Module D: Levers for change
Dec 7th	8-12	Module E: Suggesting interventions
Dec 9th	10-17	Module E: Suggesting interventions
Dec 14th	8-12	Course wrap-up
Dec 16th	10-17	Course wrap-up

Deadlines:

Case (in smaller groups):
- Hand-in Module A: Friday, 6th November (12.00/noon)
- Hand-in Module B: Friday, 13th November (12.00/noon)
- Hand-in Module C: Friday, 27th November (12.00/noon)
- Hand-in Module D: Friday, 4th December (12.00/noon)
- Hand-in Module E: Friday, 11th December (12.00/noon)

Weekly reflection assignments (individual):

- Week 2: Thursday, 12th November (23.59)
- Week 3: Thursday, 19th November (23.59)
- Week 4: Thursday, 26th November (23.59)
- Week 5: Thursday, 3rd December (23.59)
- Week 6: Thursday, 10th December (23.59)

Weekly peer reviews (individual):

- Week 2: Friday, 13th November (23.59)
- Week 3: Friday, 20th November (23.59)
- Week 4: Friday, 27th November (23.59)
- Week 5: Friday, 4th December (23.59)
- Week 6: Friday, 11th December (23.59)

Final reflection assignment (individual):

January 16th (23.59)