

TEK665 INNOVATION SYSTEMS AND SOCIOTECHNICAL TRANSITIONS

COURSE PM 2021

Introduction

Welcome to the course TEK 665 Innovation systems and sociotechnical transitions (7.5 ECTS), which is managed by the division of Environmental Systems Analysis (ESA) at the Department of Technology Management and Economics (TME).

Purpose and intended learning outcomes

The purpose of the course is for students to develop an understanding of (1) the collective aspects of the innovation process and how they can be analysed, (2) conditions and mechanisms for sociotechnical transitions in important societal sectors, such as energy supply, transport, buildings and food, and (3) the possibility to influence innovation and transition processes at the level of technology, industry or sector through organisational strategies and public policy.

When you have passed the course, you should be able to:

- account for different concepts, theories and frameworks describing innovation and transition processes at the level of technology, industry or sector;
- account for factors and mechanisms that influence the conditions and possibilities for innovation and sociotechnical transition at the level of technology, industry or sector and explain their consequences for the sustainable development of different societal sectors;
- critically discuss to what extent the factors and mechanisms can be influenced by firms and other societal actors and what strategies and policy instruments could be required to stimulate innovation or transition in an industry or sector; and
- apply selected frameworks in an analysis of an industry or sector and based on the analysis formulate recommendations for strategy and public policy.

Changes from last year

Based on feedback received by students last year (which was the first time this course was provided), we have added a number of introductory sessions in the beginning of the course, revised the literature list, removed one assignment, replaced one of the group assignments with an individual assignment, and revised the grading scheme.

Course administration

The ESA course team is located in the Vasa building at Vera Sandbergs allé 8, house 2, staircase A, 3rd floor. Contact us directly in class or via email:

- Anna Bergek (anna.berge@chalmers.se) – examiner, course leader, main lecturer
- Carolina Resende Haddad (resende@chalmers.se) – course assistant, seminar leader
- Maria Altunay (maria.altunay@chalmers.se) – administrative assistant (Canvas, Zoom etc.), seminar assistant

The course leader normally replies to email communication daily, but this is not always possible due to meetings and other obligations.

Please correspond with teachers via email, not via Canvas! All emails should feature the course code TEK665 in the beginning of the subject line in order to be prioritized in the daily pile of emails.

The course is administrated via the course room on the Canvas learning platform. All students who have been admitted to the course should be able to access the course room. Please contact us if you have problems with this!

All information you need is available in Canvas, including the latest version of this course information document, assignment instructions, lecture slides and other material. The course room is also where you sign up for groups and upload your assignments.

The course room will be updated during the course, so please check it regularly. You can receive automatic updates from the system. Announcements related to the course, e.g. schedule changes or specific instructions, will be made there as well. E-mail will *not* be used to send out information.

Course literature

The course literature consists of a collection of scientific articles and book chapters, which for the most part are available via Chalmers library service (otherwise in Canvas). A list with links is provided at the end of this document. We have selected a mix of recently published pieces and highly cited “classics”, which much of the more recent literature builds on. Together, the selection provide a good base for understanding the core issues dealt with in this research field.

There is quite a lot of literature, but you will not be required to memorize anything. The general articles should be seen as reference articles, which explain the main theoretical frameworks, while the articles for the seminars contain empirical cases, which illustrate how these (and other) frameworks can be applied to understand the innovation and transition dynamics of specific sectors. Collaboration is encouraged – feel free to divide the general articles between you and summarise and explain them to each other.

Course contents and main learning activities

Overview of contents

This course covers different perspectives on the collective aspects of innovation, focusing on frameworks to describe, analyse and explain innovation and transition processes at technology, industry or sector level. The content is divided into four main modules, which all contain both lectures and student-led literature seminars:

- *Technological & sectoral perspectives on innovation.* Focuses on literature discussing technology- and sector-specific patterns of innovation, most notably sectoral systems of innovation and production and technological (innovation) systems.
- *Geographical perspectives on innovation.* Focuses on literature discussing spatial and geographical aspects of innovation, e.g. regional innovation systems and “multi-scalar” innovation.
- *Sociotechnical transitions.* Focuses on literature discussing large-scale sectoral reconfigurations, most notably the multi-level perspective and strategic niche management.

- *Innovation/transition policy.* Explores the policy implications of different system perspectives and discusses how other actors in the system could influence innovation and transition processes.

Learning activities and workload

The course is organized as a mix of lectures and student-active learning activities. There are five main types of teaching and learning activities:

- *Own literature studies.* The course is rather heavy on literature, so it is important to start reading immediately. We expect you to spend around 80 hours on literature studies.
- *Lectures.* The lectures provide an overview of the literature and present the theoretical platform of the course. Attendance is recommended, but not mandatory. You can either read the assigned literature before the lecture or use the lecture as a structuring device for your reading.
- *Thematic seminars incl. preparations.* The seminars are student-led opportunities to discuss and reflect on empirical literature focusing on a particular sector (energy or transport). They include written preparations and oral presentations in small groups as well as individual peer reviews of other students' work. Attendance is mandatory.
- *Individual reflection report writing.* At the end of the course, each student will use insights from the seminar assignments to make a cross-theme comparison and reflect on the strength and weaknesses of different theoretical perspectives for describing and explaining innovation and sociotechnical transitions.

Please note that 7.5 ECTS credits correspond to a workload of about 200 hours. We expect this time to be distributed between the different activities approximately as follows.

	Time estimate
Literature studies	80-90 h
Scheduled sessions	40 h
Seminar preparations & peer reviews*	50-60 h
Individual reflection report*	20-30 h
Sum total	ca 200 h

*Excluding literature studies.

Schedule

Module	Date	Time	Session		To do
Course introduction with theoretical & empirical overviews	Tue 19/1	13-17	Lecture & workshop	Course introduction + workshop What is innovation?	<ul style="list-style-type: none">Study course PM and assignment instructions carefullyReading (assigned general articles)Sector mapping (group work) – data collection, analysis and preparation of presentations
	Thu 21/1	13-15	Lecture	Introduction to innovation systems & transitions as a topic	
		15-17	Information session	Introduction to seminar assignments, group formation etc.	
	Fri 22/1	13-15	Self-study time	Time to start working on sector mapping	
	Tue 26/1	13-15	Seminar 1A	Presentation of sector mapping (in seminar groups)	
		15-17	Seminar 1B		
	Thu 28/1	13-15	Seminar 1C		
		15-17	Seminar 1D		
Technology & sector	Fri 29/1	13-15	Lecture	Technological and sectoral innovation systems	<ul style="list-style-type: none">Reading: general articles + individual empirical articlesSeminar preparations (trio)Peer review (individual)
	Thu 4/2	13-17	Consultation /self-study /reserve time		
	Tue 9/2	13-17	Seminar 2A&B	Presentations and discussion of seminar assignment (in seminar groups)	
	Thu 11/2	13-17	Seminar 2C&D		
Geography	Fri 5/2	13-15	Lecture	Geographical perspectives on innovation	<ul style="list-style-type: none">Reading: general articles + individual empirical articlesSeminar preparations (trio)Peer review (individual)
	Tue 16/2	13-17	Seminar 3A & 3B	Presentations and discussion of geography seminar assignment (in seminar groups)	
	Thu 18/2	13-17	Seminar 3C & 3D		
Transitions	Fri 12/2	13-15	Lecture	Sociotechnical transitions	<ul style="list-style-type: none">Reading: general articles + individual empirical articlesSeminar preparations (trio)Peer review (individual)
	Tue 23/2	13-17	Seminar 4A & 4B	Presentation and discussion of transitions seminar assignment (in seminar groups)	
	Thu 25/2	13-17	Seminar 4C & 4D		
	Fri 26/2	13-15	Self-study time		
Policy & strategy	Fri 19/2	13-15	Lecture	Policy (and strategy) for innovation systems and transitions	<ul style="list-style-type: none">Reading: general articles + previous empirical articlesSeminar preparations (larger groups)Peer review (individual)
	Tue 2/3	13-17	Consultation/self-study/reserve time		
	Thu 4/3	13-17	Consultation/self-study/reserve time		
	Fri 5/3	13-15	Guest lecture	Göran Marklund, Deputy Director General, Vinnova	
	Tue 9/3	13-17	Seminar 5 (all groups)	Presentation and discussion of policy seminar assignment	
Sum-up	Thu 11/3	13-17	Course sum-up (workshop style) + consultation time		<ul style="list-style-type: none">Preparation for course sum-up workshop

*All sessions will be held in Zoom (see links on the Home page in Canvas)..

Literature list

The literature is divided into two main types: general (theoretical) literature and sector-specific (empirical) literature for the seminar assignments. Articles in *italics* are supplementary – they provide complementary or deepening theoretical perspectives and can be consulted to understand specific issues or contrasting ideas put forward in the sector-specific literature.

All links have been checked recently. If any link in spite of this does not work – let us know so that we can replace them. You need to use your CID or be connected to Chalmers VPN to access some of the library's electronic resources from home. For more information, see [the library's information on access to electronic resources](#).

General (theoretical) literature

These articles and book chapters are mainly intended to provide insights into the theoretical perspectives of the course and the field as a whole (which will be introduced in the lectures). It also puts the sector-specific articles into a more general perspective. It is usually enough to read the introduction and the theory section (and possibly the conclusions) of each paper. You do not have to go into methodological details or empirical examples unless you think they help you understand the theories better.

Introduction and overview

- Geels, F.W., Sovacool, B.K., Schwanen, T., Sorrell, S., 2017. [Sociotechnical transitions for deep decarbonization](#). *Science* 357, 1242-1244.
- Souzanchi Kashani, E., Roshani, S., 2019. [Evolution of innovation system literature: Intellectual bases and emerging trends](#). *Technological Forecasting and Social Change* 146, 68-80. [Sections 1, 2 and 5.]
- Boschma, R., 2005. [Proximity and Innovation: A Critical Assessment](#). *Regional Studies* 39, 61-74.
- Uyarra, E., 2010. [What is evolutionary about 'regional systems of innovation'? Implications for regional policy](#). *Journal of Evolutionary Economics* 20, 115.

Technology & sector

- Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., Rickne, A., 2008. [Analyzing the functional dynamics of technological innovation systems: A scheme of analysis](#). *Research Policy* 37, 407-429.
- Malerba, F., 2002. [Sectoral systems of innovation and production](#). *Research Policy* 31, 247-264.
- Carlsson, B., Stankiewicz, R., 1991. [On the nature, function and composition of technological systems](#). *Journal of Evolutionary Economics* 1, 93-118 (also available in Canvas).
- Malerba, F., Nelson, R., 2011. [Learning and catching up in different sectoral systems: evidence from six industries](#). *Industrial and Corporate Change* 20, 1645-1675.
- Bergek, A., Hekkert, M., Jacobsson, S., Markard, J., Sandén, B., Truffer, B., 2015. [Technological innovation systems in contexts: Conceptualizing contextual structures and interaction dynamics](#). *Environmental Innovation and Societal Transitions* 16, 51-64.

Geography

- Asheim, B.T., Grillitsch, M., Trippl, M., 2016. Regional innovation systems: past – present – future, in: Shearmu, R., Carrincazeaux, C., Doloreux, D. (Eds.), *Handbook on the Geographies of Innovation*. Edward Elgar Publishing, Cheltenham, pp. 45-62 (in Canvas).
- Tödtling, F., Trippl, M., 2005. [One size fits all?: Towards a differentiated regional innovation policy approach](#). *Research Policy* 34, 1203-1219 (Sections 1-3).

- Asheim, B., Isaksen, A., 2002. [Regional Innovation Systems: The Integration of Local 'Sticky' and Global 'Ubiquitous' Knowledge](#). *The Journal of Technology Transfer* 27, 77-86.
- Iammarino, S., 2005. [An evolutionary integrated view of Regional Systems of Innovation: Concepts, measures and historical perspectives](#). *European Planning Studies* 13, 497-519.

Sociotechnical transitions

- Geels, F.W., 2004. [From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory](#). *Research Policy* 33, 897-920.
- Smith, A., Raven, R., 2012. [What is protective space? Reconsidering niches in transitions to sustainability](#). *Research Policy* 41, 1025-1036.
- Kemp, R., Schot, J., Hoogma, R., 1998. [Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management](#). *Technology Analysis & Strategic Management* 10, 175-198.
- Schot, J., Geels, F.W., 2008. [Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy](#). *Technology Analysis & Strategic Management* 20, 537-554.

Policy and strategy

You are expected to make use of literature from *at least* one of the following themes in your seminar assignment, depending on the focus of your analysis.

Technology & sector

- Hillman, K., Nilsson, M., Rickne, A., Magnusson, T., 2011. [Fostering sustainable technologies: a framework for analysing the governance of innovation systems](#). *Science and Public Policy* 38, 403-415.
- Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., Rickne, A., 2008. [Analyzing the functional dynamics of technological innovation systems: A scheme of analysis](#). *Research Policy* 37, 407-429. [Already included above.]
- Klein Woolthuis, R., Lankhuizen, M., Gilsing, V., 2005. [A system failure framework for innovation policy design](#). *Technovation* 25, 609-619.

Geography

- Grillitsch, M., Asheim, B., 2018. [Place-based innovation policy for industrial diversification in regions](#). *European Planning Studies* 26, 1638-1662.
- Tödtling, F., Trippel, M., 2005. [One size fits all?: Towards a differentiated regional innovation policy approach](#). *Research Policy* 34, 1203-1219 (Sections 1 + 3-5). [Already included above.]
- Klein Woolthuis, R., Lankhuizen, M., Gilsing, V., 2005. [A system failure framework for innovation policy design](#). *Technovation* 25, 609-619. [Also included in technology & sector theme.]

Transitions

- Weber, K.M., Rohracher, H., 2012. [Legitimizing research, technology and innovation policies for transformative change: Combining insights from innovation systems and multi-level perspective in a comprehensive 'failures' framework](#). *Research Policy* 41, 1037-1047.
- Schot, J., Steinmueller, W.E., 2018. [Three frames for innovation policy: R&D, systems of innovation and transformative change](#). *Research Policy* 47, 1554-1567.

Sector-specific (empirical) articles (for seminar assignments)

These articles have been chosen based on the empirical cases they focus on. Each group has its own assigned literature for each theme (see assignment instructions). You should focus your reading on case descriptions and analyses. However, theory sections often provide additional insights into the corresponding theoretical theme and could be used as a complement to the general literature.

Examination and grading

The purpose of the examination is to assess to what extent you have achieved the learning objectives of the course. To pass the course (grade 3), you have to achieve all learning objectives. In order to get a higher grade (4 or 5), you need to demonstrate knowledge and understanding, competences and skills, and judgement and approach beyond the level outlined in the learning objectives. It is very important that you understand what is required of you in relation to different examination tasks. If you do not – ask!

The course is examined through three main examination components, which are described in more detail in a separate assignment instruction document:

- *Seminar assignments (in groups)*: One oral presentation (sector mapping) and four literature-based assignments with written submissions and oral presentations, which together correspond to 70% of the course grade. Seminar attendance is mandatory.
- *Peer reviews (individual)*: Four peer reviews of other groups' submissions and presentations, which together with a couple of bonus points for extra-active seminar engagement correspond to 10% of the course grade.
- *Reflection report (individual)*: Written cross-thematic comparison with own reflection based on the seminar assignments, which corresponds to 20% of the course grade.

The final course grade is determined by the sum of the achieved point scores on all assignments (see summary table below). An individual overall assessment will be done for students who are close to a higher grade.

		U (fail)	Grade 3	Grade 4	Grade 5	Max
Seminar assignments	1	Fail	Pass	Pass	Pass	70 p
	2	<4 p	4-5 p	6-7 p	8-10 p	
	3	<6 p	6-8 p	9-11 p	12-15 p	
	4	<8 p	8-11 p	12-15 p	16-20 p	
	5	<10 p	10-14 p	15-19 p	20-25 p	
Peer reviews		0 p on any peer review	At least 1 p on each review (=4 p in total excl. bonus points for seminar engagement)	At least 1 p on each review + 6 p in total (incl. 0-2 bonus points for seminar engagement)	At least 1 p on each review + 8 p in total (incl. 0-2 bonus points for seminar engagement)	10 p
Reflection report (individual)		<8 p	8-11 p	12-15 p	16-20 p	20 p
Total		<40 p in total <i>or</i> U (fail) on any examination component	min 40 p + at least grade 3 / pass on all examination components	min 60 p + at least grade 3 / pass on all examination components	min 80 p + at least grade 3 / pass on all examination components	100 p

Re-examination and “plussning”

If you get a fail grade on any assignment, you will be allowed to submit a revised version within two weeks of receiving the grade. The maximum grade on a revision is 3 (and you will get the minimum point score of a 3 for that assignment). If you fail the revision as well, you will have to redo the assignment in the next re-examination period. It is not possible to submit a new version

of a passed assignment or do other types of complementary assignments just to get a higher grade (“plussning”). An assignment that is submitted well after the deadline will be treated as a revision, i.e. no higher grade than 3 will be awarded and you will have to redo the assignment in the re-examination period if you fail.

Good examination practices

Since examination is about judging *your* learning outcomes, it is highly important that everything you hand in for examination purposes can be attributed to your own work. You should, therefore, follow a few important principles for putting your name on assignments and submissions, collaboration and plagiarism, as described below.

Different universities and countries have different rules and traditions when it comes to examination practices. It is your responsibility to make sure you know what rules apply at Chalmers (e.g., [Rules of Discipline for students](#) and [Academic integrity and honesty at Chalmers](#)).

Putting your name on an assignment or submission

Do not put your name on a submission unless you have actually done your share of the work. If there is an ethical problem with a submission made under your name, you can be held accountable even if the problem concerns work done by another student in a group work.

Collaboration

Collaboration includes all forms of interaction between students related to an assignment, even one-way sharing of material (i.e. if you share something but do not get anything in return).

In this course, the following rules apply:

- *Group assignments:* Collaboration is expected within each group. You may also discuss your work with other groups, but seminar submissions must be written independently by each group and must be sufficiently different from other groups' submissions.
- *Individual assignments:* You must write all assignments independently, but you may ask other students for feedback before you submit them for assessment and grading. However, mind the plagiarism rules below!

Plagiarism

Plagiarism is about not making clear that your work builds on another person's work. This implies, among other things, that you should use your own words and not “copy-and-paste” from the literature. You should also provide proper references to the sources of information you use in your assignments. You are *not* allowed to use any text from assignments completed by other students in this course or other courses. Re-using your own previous work can also sometimes be considered plagiarism.

Your assignments will be checked for unauthorized collaboration and plagiarism in the Urkund system (www.urkund.se). If the Urkund analysis shows sign of plagiarism, we might be required to report the matter to the President of Chalmers who might refer it to the disciplinary board.