ME2322 Industrial transformation and technological innovation
3.0 credits, HT26

1. **Introduction**

The aim of the course is for the students to acquire concepts, models, and theories with a focus on industrial transformation and technological innovation and to use them to understand how important societal challenges affect industry and technological development and how important societal challenges can be handled. The course deepens the discussion and analysis of the societal challenges identified in ME2321 Engineering and the Global Challenges.

The examiner and coordinator is Emrah Karakaya (EK); the seminar leader is Beatriz Pérez Horno (BPH).

After completing and passing the course, the student should be able to:

- Describe, explain and use concepts, models and theories to analyze industrial dynamics and technological innovation. Among others applied to industrial development in Sweden.
- Analyze how societal challenges affect industrial dynamics and technological innovation, as well as how industrial dynamics and technological innovation affect the societal response to these challenges.

2. **The structure**

The course consists of one introductory lecture (Intro), four research-based lectures (L), covering *theory*, and four guest lectures, covering *practice* (G). There is also one set of seminars (S). The examination of the course includes TEN1 (an oral exam) as well as INL1 (two assignments, an assignment connected to the seminars and another assignment in the format of a reflection essay in the end of the course). More information about examination is provided in section 4 below.

	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Week 44		Intro			
Week 45		L1	L2	L3	
Week 46		G1	G2		
Week 47	G3		G4	L4	
Week 48		S,S	S,S		
Week 49		Tutorial		Oral Exams	Oral Exams
Week 50	Oral exams	Oral exams	Oral exams		
Week 51					
Week 52					
Week 1					Assignment

The themes of the research-based lectures, covering *theory*, are as follows.

- L1: Industrial dynamics: dominant design and general-purpose technologies (EK)
- L2: Socio-technical transitions: technological innovation systems and multi-level perspective (EK)
- L3: Diffusion of innovations: Adopters and change agents (EK)
- L4: Critical perspectives on transitions towards artificial intelligence and sustainability (EK)

The guest lectures will cover examples from various sectors such as food, energy, gaming and healthcare in Swedish Industry, and will relate to ongoing transitions towards artificial intelligence and sustainability in industry. The guest lectures, covering *practice*, are as follows.

- G1: Food sector
  - One Planet Plate (Anna Wahlberg, Programme Manager Sustainable Food at WWF Sweden)
- G2: Energy sector
  - AI for renewable energy (John Diklev, Founder and CEO at Flower)
- G3: Healthcare
  - AI for clinics (Tim Gisseman, Operations Associate at Tandem)
- G4: Gaming industry
  - The case of large-language models (Patrick Ghirmai Juhl, AI Program Director at King)

3. **Course literature**

The students are expected to read following literature, in connection to themes of the lectures, covering both *theory* and *practice*

Theory-driven literature

- Industrial dynamics
  - Utterback, J.M., 1996. Dominant Design and the Survival of Firms - How companies can seize oppurtunities in the face of technological change, in: Utterback, J.M. (Ed.), Mastering the Dynamics of Innovation. Harvard Business School Press, Boston, Massachusetts, pp. 23–56.
  - Bresnahan, T. (2024). What innovation paths for AI to become a GPT? Journal of Economics & Management Strategy, 33(2), 305-316. https://doi.org/10.1111/jems.12524
- Socio-technical transitions
  - Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S. and Rickne, A., 2008. Analyzing the functional dynamics of technological innovation systems: A scheme of analysis. Research policy, 37(3), pp.407-429. https://doi.org/10.1016/j.respol.2007.12.003
  - Markard, J., Raven, R. and Truffer, B., 2012. Sustainability transitions: An emerging field of research and its prospects. Research policy, 41(6), pp.955-967. https://doi.org/10.1016/j.respol.2012.02.013
  - Karakaya, E., Nuur, C., & Assbring, L. (2018). Potential transitions in the iron and steel industry in Sweden: towards a hydrogen-based future?. *Journal of*

cleaner production, *195*, 651-663. https://doi.org/10.1016/j.jclepro.2018.05.142

- Diffusion of innovations
  - Wejnert, B. (2002). Integrating models of diffusion of innovations: A conceptual framework. Annual review of sociology, 28(1), 297-326. https://doi.org/10.1146/annurev.soc.28.110601.141051
  - Karakaya, E., & Sriwannawit Lundberg, P. (2020). Diffusion, in International Encyclopedia of Human Geography (Second Edition), https://doi.org/10.1016/B978-0-08-102295-5.10638-9
- Critical Perspectives
  - Susur, E., & Karakaya, E. (2021). A reflexive perspective for sustainability assumptions in transition studies. Environmental Innovation and Societal Transitions, 39, 34-54. https://doi.org/10.1016/j.eist.2021.02.001
  - Bennich, A. (2025). Untangling digitalisation: a topic of growing relevance for transition scholars. Environmental Innovation and Societal Transitions, 57, 101021. https://doi.org/10.1016/j.eist.2025.101021
  - Lai, Y. Y., & Karakaya, E. (2024). Rethinking the sustainability of transitions: An illustrative case of burden-shifting and sociotechnical dynamics of aviation fuel in Sweden. Energy Research & Social Science, 113, 103574. https://doi.org/10.1016/j.erss.2024.103574

Case-based literature

- Food
  - Praasterink, F., Beers, P. J., Hassink, J., House, J., & Van Der Horst, H. (2025). Assessing ongoing sustainability transitions: The state of food system transition in the Netherlands. NJAS: Impact in Agricultural and Life Sciences, 97(1), 2534486. https://doi.org/10.1080/27685241.2025.2534486
- Energy
  - Christley, E., Lai, Y. Y., Brauer, H. B., & Ingersoll, A. A. (2025). A beginner's guide to reflexivity in energy research and social science. Energy Research & Social Science, 127, 104267. https://doi.org/10.1016/j.erss.2025.104267
- Health
  - Johansen, F., Loorbach, D., & Stoopendaal, A. (2018). Exploring a transition in Dutch healthcare. *Journal of health organization and management*, *32*(7), 875-890. https://doi.org/10.1108/JHOM-07-2018-0185
- Artificial Intelligence
  - van den Broek, E. (2025). Unpacking AI at work: Data work, knowledge work, and values work. Information and Organization, 35(3), 100584. https://doi.org/10.1016/j.infoandorg.2025.100584

4. **Examination**

The examination of the course includes TEN1 (an oral exam) as well as INL1 (two assignments, an assignment connected to the seminars and another assignment in the format of a reflection essay in the end of the course).

TEN1 (2 ECTS, grading scale: A, B, C, D, E, FX, F)

The oral exam is an individual examination. The students will self-assign themselves for provided time slots on one of the following dates: 3 December, 4 December, 7 December, 8 December or 9 December. An oral exam will be simultaneously taken by three students as follows.

- Intro
- Quiz: Each student answers a mix of multiple-choice and open-ended questions on paper, independent from one another
- Reflection: The examiner collects the papers and ask some follow-up questions for each student to reflect deeper on their answers, one after each other

Some of the quiz questions will cover *theory* while the some other questions will be based on *practical-cases* discussed in lectures and seminars. The more details about the oral exam will provided in the lectures and on Canvas – ahead of the examination.

INL1 (1 ECTS, grading scale: P, F)

Part 1, group work: Each team (of 4-5 students) will choose one of the research questions provided in the course and write a short report (approx. 1000 words) and present their findings in one the seminars. The research questions that students can choose will announced after the research-based lectures and will target both *theory* and *practice* parts of the course.

Part 2, individual reflection: In the end of the course, each students will write a self-reflection report (approx. 500), covering their critical and reflexive learning process in the course.

5. **Other aspects**

In this course, plagiarism is not accepted. All the submissions will be checked for plagiarism. More information on plagiarism (along with a handbook) can be found at: https://www.kth.se/en/student/stod/studier/fusk-1.997287

For students with disabilities who have a statement from KTH's FUNKA unit on recommended support during examination, the following applies in this course:

- All support under code R (i.e. adjustments relating to space, time and physical circumstances) are granted without special decision by the examiner
- Support under code P (educational adaptation) must be actively granted or rejected by the examiner after contact has been made by the student in accordance with KTH's rules. Normally, support actions under code P will also be approved.

The course-specific information on using Generative AI will be provided and discussed in the lectures.