

Course PM
Sustainable development, ICT and innovation
AG1815 (7.5 credits)

2021

Course responsible

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COURSE GOALS AND STRUCTURE

Intended learning outcomes

The purpose of the course is to give basic knowledge on sustainable development, mainly in relation to environmental problems and social aspects. ICT (information and communication) solutions may be used to make resource use more efficient and may make possible changes in processes and practices for sustainable development, but may also cause increased environmental problems and negative social impacts. Within the course we will reflect on different opportunities and problems related to ICT-solutions and these will be illustrated with concrete examples from the sector. There will be discussions on how sustainable development could be facilitated by ICT-solutions, and the aim is that you will later be able to use your knowledge in order to support sustainable development in your daily profession.

The course goals are that the student after taking this course will be able to:

1. present and problematize the concept of sustainable development, mainly in relation to environmental problems and social aspects,
2. present and problematize political goals for sustainable development that are set in society,
3. describe and discuss different environmental and social problems in society where ICT-solutions could be useful,
4. on a generic level analyze environmental consequences of ICT-solutions/applications with a systems perspective,
5. understand that environmental and sustainability problems are often complex and may be inadequately defined, and sometimes give rise to goal conflicts, and
6. use knowledge on sustainable development in situations where ICT-solutions are planned, developed or used, suggest ways to integrate this perspective and reflect on the potential in innovation.

Course content

The course includes lectures, seminars incl. minor writing assignments that are linked to the lecture content, a group project assignment performed in collaboration with industry or research groups, and an individual literature assignment.

Lectures cover:

- The concept of sustainable development, national and international sustainability goals, and sustainability problems and challenges
- ICT and sustainable development - how ICT may be a positive driver for sustainable development, but also mean risks and negative impacts
- Sustainable innovations and business opportunities
- Sustainability assessment with systems perspective

EXAMINATION AND GRADING CRITERIA

The final grade is calculated as the average of the Literature assignment (INLA) and the Project assignment (PRO1) (equal weight).

PRO1: Project (4 credits, A-F)

The project is carried out in groups of five, on a topic provided by a company or organisation. It combines knowledge about sustainable development taught in this course with ICT knowledge and skills from previous parts of your educational programme.

- Detailed instructions for project work are found in a separate document: “Project instructions”
- Please check the different deadlines for project drafts etc in Canvas.
- Report content and quality, as well as work process, count for the final grade.
- Attendance at project seminars and supervision meetings is compulsory. If you cannot attend, contact the course responsible for a supplementary assignment.
- Project is graded A-Fx. Fx means that at least one aspect of the project is incomplete and must be supplemented. After supplementing only grade E will be given that specific aspect.

INL2: Response papers and thematic seminars (0.5 credits, P/F)

Response papers are prepared in advance of and discussed during two thematic seminars. Feedback on response papers is provided through discussions at the thematic seminar.

- Please check the deadline for response papers in Canvas.
- Attendance at thematic seminars is compulsory.
- If you cannot attend, contact the course responsible for a supplementary assignment.
- Response papers are graded as Pass/Fail.

INLA: Literature assignment (2.5 credits, A-F)

The literature assignment covers material from lectures, thematic seminars, the course literature, and your own literature search.

- Please check the deadline for the literature assignment in Canvas.
- Literature assignment is graded A-Fx. Fx means that the assignment is incomplete and needs to be supplemented within six weeks. After supplementing from Fx, only grade E will be given.
- If you do not complete the literature assignment, you need to re-register for the course next year to submit.

NÄR1: Attendance at lectures (0.5 credits, P/F)

Active participation at lectures is important, since it will help you to perform well on the response papers, project, and literature assignment.

- Attendance in lectures is compulsory.
- Absence from maximum two lectures is allowed. If you are absent from more than two lectures, contact the course responsible for supplementary assignments.
- Attendance is graded as pass/fail (P/F).

LECTURES & SEMINARS

- The table below presents the order of lectures and seminars.
- Dates are found in the online KTH schedule.
- Zoom links are presented in Canvas.
- In addition to lectures and seminars, the course include (check schedule and canvas):
 - Weekly open project drop-in with project KTH-supervisors in zoom
 - Three individual project group supervision meetings

LECTURE 1 course introduction	Practical information about the course and information about projects and how to select projects. If you miss this lecture, it is important that you get in touch with the course coordinator asap. <i>Lecturer</i> Anna Björklund, Mattias Höjer
LECTURE 2 Sustainable development	The concept of sustainable development is introduced and problematized. What does it mean and what are its implications? What are current challenges within the areas of environment and sustainability? <i>Lecturer:</i> Elina Eriksson, Media Technology and Interaction Design, KTH <i>Reference material:</i> Johan Rockström (2019) Vinter i P1, 28 december 2019 <ul style="list-style-type: none"> - Swedish: Johan Rockström 1 januari 2020 kl 13.00 - Sommar & Vinter i P1 Sveriges Radio - English: Johan Rockström ENGLISH VERSION 1 januari 2020 kl 07.00 - Sommar & Vinter i P1 Sveriges Radio
LECTURE 3 (online): Doughnuts and Planetary boundaries	This lecture consists of online material only, please watch whenever convenient during the week. It goes into depth on the topic of environmental and social planetary boundaries. <i>Videos:</i> <ul style="list-style-type: none"> - Johan Rockstrom: Let the environment guide our development: https://www.youtube.com/watch?v=RgqtrlixYR4&t=129s - Johan Rockstrom: 10 years to transform: https://www.ted.com/talks/johan-rockstrom-10-years-to-transform-the-future-of-humanity-or-destabilize-the-planet - Kate Raworth: Why it's time for 'Doughnut Economics': https://www.youtube.com/watch?v=1BHOflzxPjI <i>Reference material:</i> <ul style="list-style-type: none"> - The nine (environmental) planetary boundaries: http://www.stockholmresilience.org/research/planetary-boundaries/planetary-boundaries/about-the-research/the-nine-planetary-boundaries.html - The Doughnut of social and planetary boundaries: https://www.kateraworth.com/doughnut/

LECTURE 4: ICT and sustainable development	<p>ICT solutions may reduce environmental impact and improve social conditions. How does it work today and how may we reach a sustainable society supported by ICT? What could be your role as an ICT engineer to support sustainable development?</p> <p>Lecturer:</p> <p>Lorenz Hilty, Professor of Informatics and Sustainability at Department of Informatics, University of Zurich</p> <p>Reference material:</p> <ul style="list-style-type: none"> - Hilty, L.M., Aebischer, B.: <i>ICT for Sustainability: An Emerging Research Field</i>. In: Hilty, L.M., Aebischer, B. (eds.) <i>ICT Innovations for Sustainability. Advances in Intelligent Systems and Computing</i> 310, Springer International Publishing (2015) - Kern, E., Hilty, L. M., Guldner, A., Maksimov, Y. V., Filler, A., Gröger, J. & Naumann, S. 2018. Sustainable software products—Towards assessment criteria for resource and energy efficiency. <i>Future Generation Computer Systems</i>, 86, 199-210. - Maria J. Pouri & Lorenz M. Hilty, 2018. Conceptualizing the Digital Sharing Economy in the Context of Sustainability. <i>Sustainability</i>, 10(12), pages 1-19
PROJECT: Starting up of group projects	<p>Information about your project and project groups. All groups will start planning for their project work.</p> <p>It is very important that you attend this meeting! If you miss this meeting, it is important that you get in touch with the course coordinator asap.</p>
LECTURE 5 (online video): Electronic waste	<p>This lecture consists of online material only. It covers informal recycling of electronic waste in developing countries, which has serious environmental and social consequences. The literature also includes information of current Swedish formal recycling of electronic waste.</p> <p>Video:</p> <ul style="list-style-type: none"> - Exporting Harm: The High-Tech Trashing of Asia” (Basel Action Network) https://www.youtube.com/watch?v=yDSWGV3jGek <p>Reference material:</p> <ul style="list-style-type: none"> - Agbogbloshie: the world's largest e-waste dump – in pictures (The Guardian) https://www.theguardian.com/environment/gallery/2014/feb/27/agbogbloshie-worlds-largest-e-waste-dump-in-pictures - Naturvårdsverket (2011) Recycling and disposal of electronic waste. Report 6471.
LECTURE 6: Sustainability-driven innovation and business development	<p>Environmental and resource problems are the biggest challenges of our time, and they call for new business models. The lecture covers innovation theory, examples of sustainability driven business. KTH Innovation gives examples of how they provide support to bring ideas to market.</p> <p>Lecturers:</p> <ul style="list-style-type: none"> - Emrah Karakaya, Assistant professor, Department of Industrial economics and management, KTH - Tom Magnergård, Business Coach - Sustainability, KTH Innovation <p>Reference material:</p> <ul style="list-style-type: none"> - Nidumolu, R., Prahalad, C.K. and Rangaswami, M.R. (2009) Why Sustainability Is Now the Key Driver of Innovation. <i>Harvard Business Review</i>, September 2009. - Karakaya, E., Lundberg, P.S. (2020) Diffusion. In: Kobayashi, A. (Ed.), <i>International Encyclopedia of Human Geography</i>, 2nd edition. vol. 3, Elsevier, pp. 311–315 - Geels, F.W., Sovacool, B.K., Schwanen, T. and Sorrell, S., 2017. Sociotechnical transitions for deep decarbonization. <i>Science</i>, 357(6357), pp.1242-1244.

<p>LECTURE 7 (online video): Life cycle thinking and circular economy</p>	<p>This lecture consists of online material. It covers Life Cycle Thinking (LCT) and Circular Economy (CE), both of which are key concepts relating to rethinking the way industry and society designs, uses and disposes of products.</p> <p>Videos:</p> <ul style="list-style-type: none"> - Paper beats plastic? How to rethink environmental folklore (Leyla Aca-roglu) https://www.ted.com/talks/leyla_acaroglu_paper_beats_plastic_how_to_rethink_environmental_folklore?language=sv - Re-thinking Progress: The Circular Economy (Ellen MacArthur Foundation) https://www.youtube.com/watch?v=zCRKvDyyHml <p>Reference material:</p> <ul style="list-style-type: none"> - UNEP (2004) <i>Why take a life cycle approach?</i> UNEP, Paris. - Arushanyan, Y, Ekener-Petersen, E., and Finnveden, G. (2014) <i>Lessons learned – Review of LCAs for ICT products and services</i>. Computers in Industry, 65 (2), 211-234. - EEB (2019) <i>Coolproducts don't cost the earth - full report</i>. https://eeb.org/library/coolproducts-report/
<p>LECTURE 8 Society's goals and policies for sustainable Development</p>	<p>The lecture presents national and international sustainability goals and policies to reach them.</p> <p>Lecturer:</p> <p>Göran Finnveden, Department of Sustainable development, environmental science and engineering, KTH</p> <p>Reference material:</p> <ul style="list-style-type: none"> - About the Sustainable Development Goals: https://sustainabledevelopment.un.org/ - About AI and sustainable development: Vinuesa et al (2020): The role of Artificial Intelligence in Achieving the Sustainable Development Goals. Nature Communications, 11, 233. https://www.nature.com/articles/s41467-019-14108-y - About the Swedish Environmental Quality Objectives: http://www.sve-dishepa.se/Environmental-objectives-and-cooperation/Swedens-environmental-objectives/ - About climate change: IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. https://www.ipcc.ch/sr15/chapter/spm/ - About policy instruments: Sterner et al (2019) Policy design for the Anthropocene. Nature Sustainability, 2, 14-21. https://www-nature-com.fo-cus.lib.kth.se/articles/s41893-018-0194-x
<p>LECTURE 9 Social sustainability</p>	<p>The social dimension of sustainability is introduced and discussed.</p> <p>Lecturer:</p> <p>Elisabeth Ekener Department of Sustainable development, environmental science and engineering, KTH</p> <p>Reference material:</p> <ul style="list-style-type: none"> - Bhutan's 'Gross National Happiness Index': https://www.youtube.com/watch?v=X8MYtCzBiDA - Richard Wilkinson, about equality https://www.ted.com/talks/richard_wilkinson?language=en

THEMATIC SEMINAR 1	<p>This thematic seminar concerns the material covered in lectures L1– L9.</p> <p>Preparation: Read the instructions in Canvas and submit your response paper in Canvas/Assignments.</p> <p>NOTE: Deadline indicated in Canvas/Assignments.</p>
LECTURE 10 Transport sector – Environmental challenges and ICT solutions	<p>The lecture describes the transport sector, its sustainability challenges and examples of ICT solutions to address these challenges.</p> <p>Lecturers:</p> <ul style="list-style-type: none"> - Jonas Åkerman, Department of Sustainable development, environmental science and engineering, KTH - Anna Kramers, Department of Sustainable development, environmental science and engineering, KTH <p>Reference material:</p> <ul style="list-style-type: none"> - Åkerman (2011) <i>Transport systems meeting climate targets – A backcasting approach including international aviation</i>. Doctoral thesis, KTH Royal Institute of Technology (Chapter 1.1 Background & Chapter 6 Future transport systems meeting climate targets.) - Kramers (2014) <i>Designing next generation multimodal traveller information systems to support sustainability oriented decisions</i>, Environmental Modelling and Software.
LECTURE 11 Building sector – Environmental challenges and ICT solutions	<p>The lecture describes the building sector, its sustainability challenges and the development of ICT solutions to address these challenges.</p> <p>Lecturer:</p> <ul style="list-style-type: none"> - Tove Malmqvist, Department of Sustainable development, environmental science and engineering, KTH - Cecilia Katzeff, Department of Sustainable development, environmental science and engineering, KTH <p>Reference material:</p> <ul style="list-style-type: none"> - Kramers, A. och Svane, Ö. (2011) <i>ICT applications for energy efficiency in buildings</i>. Centre for Sustainable Communications. Stockholm, Sweden. - Pages 397-400 in: Toller, S., Wadeskog, A., Finnveden, G., Malmqvist, T., and Carlsson, A. (2011) <i>Energy Use and Environmental Impacts of the Swedish Building and Real Estate Management Sector</i>. Journal of Industrial Ecology, 15(3), 394-404. - Sections 2.2 + 2.2.1 in: Brown, N. (2017) <i>Managing high environmental performance? Applying life cycle approaches and environmental certification tools in the building and real estate sectors</i>. Doctoral thesis in Planning and Decision Analysis with specialisation in Environmental Strategic Analysis, KTH. - Broms, L., Katzeff, C., Bång, M., Nyblom, Å., Ilstedt-Hjelm, S. and Ernberger, K. (2010): “Coffee maker patterns and the design of energy feedback artefacts”. Proceedings of <i>DIS ’10 The 8th Conference on Designing Interactive Systems (DIS)</i>, Århus, Denmark August 2010, ACM. - Tirado Herrero, Sergio, Larissa Nicholls, and Yolande Strengers. 2018. “Smart Home Technologies in Everyday Life: Do They Address Key Energy Challenges in Households?” <i>Current Opinion in Environmental Sustainability</i> 31: 65–70. - Sovacool, B. K., & Furszyfer Del Rio, D. D. (2020). Smart home technologies in Europe: A critical review of concepts, benefits, risks and policies. <i>Renewable and Sustainable Energy Reviews</i>, 120(December 2019), 109663. https://doi.org/10.1016/j.rser.2019.109663

PROJECT SEMINAR 1: Project outline presentations	In this seminar, project groups present and get feedback on their project outline. Preparation: Read and follow instructions for Project seminar 1 (see separate document “Project instructions”).
LECTURE 12 (online video): Sustainability management	This lecture consists of online material. Responsible leadership of a company or an organisation requires management of social responsibility and environmental issues. Support for this can be provided through various types of management systems and guidelines. This lecture (consisting of online material) introduced ISO 14001, a standard for environmental management. Video ISO 14001 EMS certification requirements presentation https://www.youtube.com/watch?v=spjwQX-acnA Reference material: USEPA. <i>Learn About Environmental Management Systems</i> . https://www.epa.gov/ems/learn-about-environmental-management-systems#what-is-an-EMS
LECTURE 13 Food sector – Environmental challenges and ICT solutions	The lecture describes the food sector, its sustainability challenges and the development of ICT solutions to address these challenges. Lecturer: <ul style="list-style-type: none">- Rebecka Milestad, Department of Sustainable development, environmental science and engineering, KTH- Björn Hedin, Department of Media Technology and Interaction Design (MID), KTH Reference material: <ul style="list-style-type: none">- Gordon et al 2017. Rewiring food systems to enhance human health and biosphere stewardship <i>Environ. Res. Lett.</i> 12 100201- Zapico, J., Katzeff, C., Bohné, U. and Milestad, R. (2016): Eco-feedback visualization for closing the gap of organic food consumption. In <i>Proceedings of the 9th Nordic Conference on Human-Computer Interaction</i>.- Hedin, B. et al., 2019. A Systematic Review of Digital Behaviour Change Interventions for More Sustainable Food Consumption. <i>Sustainability</i> 2019, Vol. 11, Page 2638, 11(9), p.2638.
LECTURE 14 The energy sector – Environmental challenges and ICT solutions	The lecture describes the energy sector, its sustainability challenges and the development of ICT solutions to address these challenges. Lecturer: Oleksii Pasichnyi, Department of Sustainable development, environmental science and engineering, KTH Reference material: Claesson and Poutré (2014) <i>Towards a European Smart Energy System. ICT innovations goals and considerations</i> . EIT ICT Labs.
THEMATIC SEMINAR 2	This thematic seminar concerns material covered in lectures L10 – L14. Preparation: Read the instructions in Canvas and submit your response paper in Canvas/Assignments. NOTE: Deadline indicated in Canvas/Assignments.

<p>LECTURE 15 Scenarios and cities – ICT and sustainable development in the city</p>	<p>This final lecture covers examples of challenges for sustainable development in cities. What kind of opportunities and difficulties may be entailed by ICT solutions?</p> <p>Lecturers:</p> <ul style="list-style-type: none"> - Andrew Karvonen, Division of Urban and Regional Studies, KTH - Mattias Höjer, Department of Sustainable development, environmental science and engineering, KTH <p>Reference material:</p> <p>Höjer, M. och Wangel, J. (2014) <i>Smart sustainable cities – definition and challenges</i>. In: Hilty, L.M., Aebischer, B. (eds.) <i>ICT Innovations for Sustainability. Advances in Intelligent Systems and Computing</i> 310. Springer International Publishing.</p> <p>Glasmeier, Amy, & Christopherson, Susan. (2015). Thinking about smart cities. <i>Cambridge Journal of Regions, Economy and Society</i>, 8(1), 3-12.</p> <p>Martin, Chris J, Evans, James, & Karvonen, Andrew. (2018). Smart and sustainable? Five tensions in the visions and practices of the smart-sustainable city in Europe and North America. <i>Technological Forecasting & Social Change</i>, 133, 269-278.</p>
<p>PROJECT SEMINAR 2 Peer assessment of draft report</p>	<p>In this seminar, each group is assigned the draft report of another group to assess, using the grading template. The assessment by another group does not constitute a formal basis for a grade, but it will be helpful in improving your reports.</p>
<p>PROJECT SEMINAR 3: Final presentations</p>	<p>In this seminar, project groups present their final reports and give feedback on the report of another group.</p> <p>Preparation: Read and follow instruction for Project seminar 3 (see separate document “Project instructions”).</p>
<p>COMPENSATION SEMINAR</p>	<p>Students who were not able to attend one of the thematic seminars will be called to compensate at this seminar.</p>

COURSE LITERATURE/REFERENCE MATERIAL

The course literature for each lecture is listed in the overview of lectures above. All course literature is available in Canvas (Modules) or can be downloaded from the internet.

The indicated literature and other sources of information for each lecture serves as complement to the lecture. Use it as reference material for writing assignments and preparing for seminars in the course. We do not expect you to study and learn all the content.

PRACTICAL INFORMATION

Need for special aid (FUNKA)

<https://www.kth.se/en/student/studentliv/funktionsnedsattning>

If you have a disability, you may receive support from Funka.

You must inform the teacher regarding any need for extra support that you have. Funka does not automatically inform the teacher.

Academic dishonesty and plagiarism

<https://www.kth.se/en/student/studentliv/studentratt/dina-rattigheter-och/fusk-och-plagiering-1.997287>

Response papers, literature assignments and project reports, which are not independently and self-authored, will be considered as cheating and may be reported to the board of discipline.

“Independently and self-authored response papers”, should be understood as freely written papers, without plagiarizing structure or contents from already existing work. If the author’s writing is supported by existing work, source references and notes **MUST** be provided. All quotations must be correctly formatted according to common rules for writing.

Please note that plagiarism control always is carried out for all project reports and literature assignments.

Upping and appealing a grade

Rules for upping and appealing grades apply according to student rights at:

<http://www.kth.se/en/student/studentliv/studentratt/overklagan-overklagande-av-myndighetsbeslut-1.323892>