Module Title	Digitalization and Sustainability
Code	MCCf243
Degree Programme	Master of Science – Circular Innovation and Sustainability
ECTS Credits	3
Workload	90 hours • 12 hours contact teaching • 4 hours ConverStations • 30 hours ConverStation preparation (in groups) • 40 hours report writing (in groups and individual) • 4 hours excursion
Module Coordinator	Name: Prof. Dr. Jan Bieser Phone: +41 (0) 31 848 64 91 Email: jan.bieser@bfh.ch Address: BFH Business School – Institute for Public Sector Transformation Brückenstrasse 73, 3005 Bern
Lecturers	• Prof. Dr. Matthias Stürmer; W • Further guest lecturers from industry sector
Entry Requirements	None
Competencies upon Completion	**Competencies** After completing the module, students will be able to: • explain the positive and negative impacts of digitalization and ICT on sustainable development and the SDGs and know current research and initiatives from the industry; • explain the environmental and social effects of manufacture, use, and disposal of digital hardware and know solutions to these challenges; • comprehend the theoretical background and know practical examples of how innovative digital applications pose opportunities and threats for environmentally-friendly and socially-just societies; • explain the problems of privatization of the digital space and know how to provide access to digital knowledge in the form of open-source software, open data, and open content. **Outcomes** After completing the module, students will be able to: • critically assess the positive and negative environmental and social impacts of hardware and software; • derive and prioritize recommendations to align the development, production and use of digital products and services with sustainable development; • effectively communicate and discuss their knowledge, findings, and beliefs with colleagues, superiors, and partners.

Content	The COVID-19 pandemic has accelerated the use of digital products and services even faster than expected, in both work and personal life. For example, more than ever, people use videoconferencing systems and cloud services to work from home, order products online, and access an endless selection of videos and music tracks via streaming platforms. The use of digital products and services offers unique opportunities to create greener and more just societies. For example, streaming platforms replace the production and transport of physical media and working from home reduces CO_2-intensive commuting. The Global e-Sustainability Initiative estimated that digital technology could avoid up to 20% of global GHG gas emissions by 2030. However, on a societal perspective, environmental impacts continue to increase despite advancing digitalization. Reasons for this include: • The production, use, and disposal of digital hardware and software cause high resource and energy consumption as well as emissions. For example, the French Think Tank the Shift Project estimated that video streaming alone generates over 300 megatons of CO_2 globally per year, more emissions than the entire country of Spain. • The use of digital products and services stimulates economic growth and consumption that cause environmental burdens. One explanation for this is that, compared to their analogue predecessors, digital products and services are faster, more convenient, easier to access, always available, and often free or very cheap. Thus, digital technologies are no silver bullet for achieving the UN's Sustainable Development Goals. Their potential to contribute to greener and more just societies must be systematically exploited. Students of this course will acquire the competencies required to critically assess the impact of innovative digital technologies on the environment and society and derive measures to align digitization with sustainable development. As digital services have penetrated all areas of life and economic sectors, these competencies are required in all industries. Throughout the course, students work in teams of 2-3 students on an applied problem in the field of digitalization and sustainability. Students may select the topic for their group work from a given list or develop their own in consultation with the lecturers. Exemplary topics are: • How much electricity is required to develop and train ChatGPT or other Generative AI models? • How much electricity is used by data centres, and how can it be reduced? • What are the positive/negative social impacts of smartphone production? • Is online shopping more or less sustainable than conventional shopping? • How can videoconferencing be used to avoid CO_2 emissions caused by business travel? • Will self-driving vehicles reduce or increase car travel and CO_2 emissions? • How can artificial intelligence help tackle climate change? • How can ICT contribute to empowering small local producers? • How can ICT provide opportunities for education in the Global South? On two lecture dates, the students present their intermediate results to each other in the form of so-called ConverStations. During ConverStations, students learn about the work of other groups and receive feedback on their work. A guided tour of a data centre in Bern is also part of the lecture.

Teaching and Learning Methods	• Contact-teaching • Case studies • Interactive group work among students • ConverStation (interactive and rotating group presentations) • Guest lectures • Excursion
Competency Assessment	Final report (100%) Weighting: Group work - coherence of the whole report: 30% Individual work - specific report sections: 70% Additional bonus points can be earned through the ConverStations. Students who receive an insufficient overall grade of 3.5, are given the opportunity to carry out a *subsequent improvement* of written assignments defined by the *Module Coordinator*. The maximum overall grade that can then be obtained is 4. This still counts as the first attempt.
Mode of Repetition	Should a student fail the module, they have one more attempt. They may either: • Submit a new assignment (100%), defined by the *Module Coordinator*, for the next resit examination session. • Repeat the entire module next time it is offered.
Format	2 lessons per week over 7 weeks and 1 excursion • Calendar Weeks 38 to 42: Contact-teaching • Calendar Weeks 43 to 44: ConverStations
Attendance	Not mandatory but strongly recommended, including for the excursion.
Module Type	Compulsory-Elective
Timing of the Module	Autumn Semester, Calendar Weeks 38 to 44
Venue	Onsite | Brückenstrasse 73, 3005 Bern
Literature	**Introduction into the research field and conceptual work** • Hilty, L.M., Aebischer, B., 2015. ICT for Sustainability: An Emerging Research Field, Advances in Intelligent Systems and Computing. Springer International Publishing. https://doi.org/10.5167/uzh-110001 **The footprint of digital technologies and impacts of digital applications** • Freitag, C., Berners-Lee, M., Widdicks, K., Knowles, B., Blair, G. S., & Friday, A., 2021. The real climate and transformative impact of ICT: A critique of estimates, trends, and regulations. Patterns, 2(9), 100340. https://doi.org/10.1016/j.patter.2021.100340 • Bieser, J. C., Hintemann, R., Hilty, L. M., & Beucker, S., 2023. A review of assessments of the greenhouse gas footprint and abatement potential of information and communication technology. Environmental Impact Assessment Review, 99, 107033. https://doi.org/10.1016/j.eiar.2022.107033 • Lange, S., Pohl, J., Santarius, T., 2020. Digitalization and energy consumption. Does ICT reduce energy demand? Ecological Economics 176, 106760. https://doi.org/10.1016/j.ecolecon.2020.106760

	• Hilty, L., & Bieser, J., 2017. Opportunities and risks of digitalization for climate protection in Switzerland. University of Zurich, Swisscom, WWF. https://doi.org/10.5167/uzh-141128 • Rolnick, D., Donti, P. L., Kaack, L. H., Kochanski, K., Lacoste, A., Sankaran, K., et al., 2022. Tackling climate change with machine learning. ACM Computing Surveys (CSUR), 55(2), 1-96. https://doi.org/10.1145/3485128 • Zhang, K., Schnoor, J. L., & Zeng, E. Y. (2012). E-waste recycling: where does it go from here?. Environmental Science & Technology, 46(20), 10861-10867. https://doi.org/10.1021/es303166s **Open source and open data** • Digitale Nachhaltigkeit - Nachhaltige Digitalisierung https://www.digitale-gesellschaft.ch/nachhaltigkeit/ • Stürmer, M., Abu-Tayeh, G., Myrach, T., 2017. Digital sustainability: basic conditions for sustainable digital artifacts and their ecosystems. Sustainability Science 12, 247–262. https://doi.org/10.1007/s11625-016-0412-2
Language	English
Links to Other Modules	• MCCf163 Circular Cities • MCCf313 Society and Technology • MCCf323 Society and Environment • MCCf443 Impact Assessment
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