CIVIL-424

Innovation for construction and the environment

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Cursus	Sem.	Type
Civil Engineering	MA1, MA3	Obl.
Civil engineering minor	H	Opt.
Managmt, dur et tech	MA3	Opt.
Sustainable Construction minor	H	Opt.
Systèmes urbains	MA1, MA3	Opt.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	During the semester
Workload	90h
Weeks	14
Hours	**3 weekly**
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

The course delves into how innovation in construction, seen as an engineering process, progresses through steps and stages. It focuses on three main areas: (1) introducing new materials, (2) integrating digital systems, and (3) measuring sustainability and environmental impact. We'll explore how

Content

The course will focus on three main axes of innovation within the construction sector, examining how advancements are made in materials, productivity, and environmental impact. These areas will be explored through various lenses, including historical context, disruptive versus incremental innovation, and the role of different actors in driving change : (i) Materials Innovation: We'll delve into the ideation, creation of intellectual property, and adoption lifecycle of innovative materials. Examples include nature-based innovations and the systematic integration of new processes for efficient resource utilization and material knowledge. (ii) Productivity Optimization: The course will also explore how technology, such as large data, artificial intelligence, and robotics, is revolutionizing construction sites. AI-assisted design, 3D printing, and robotics-enabled construction are prime examples of this transformation, aiming to increase operational productivity while maintaining quality and safety standards. (iii) Environmental Impact Reduction: Another critical focus area is on methods to reduce environmental impact. This includes innovative inspection techniques, augmented reality applications, and smart building solutions. Additionally, we'll examine concepts like life cycle assessment and circular economy principles to ensure sustainability throughout the construction process. Assessment in the course involves collaborative projects where students analyze and propose improvements to production methods, processes, or building systems. Emphasis is placed on quality, economy, and environmental considerations. Creativity sessions, interviews, and prototyping may be utilized to develop and test innovative solutions. The ultimate goal is for students to explore these concepts further in their final projects or theses, fostering initiative and creativity in addressing real-world challenges within the construction industry. Throughout, guest lectures from the Swiss ConstructionTech innovation ecosystem will provide valuable insights and perspectives.

Keywords

Innovation, Materials, Productivity, Environmental impact, Sustainability, Technology

Learning Outcomes

By the end of the course, the student must be able to:

- Design through the course, the students engage in designing innovative solutions for constructions challenges, incorporating elements such as AI-assisted design, 3D printing, and robotics-enabled construction, thus fostering their ability to create efficient and sustainable building systems.
- Synthesize this course encourages students to synthesize knowledge from various sources, including historical perspectives, technological advancements, and sustainability principles, to develop comprehensive and innovative approaches to address complex issues within the construction industry.

- Investigate the course encourages students to investigate emerging trends and technologies in the construction sector via literature works, exploring their potential to improve operational productivity, quality, and safety, thereby enhancing their research and investigative skills.
- Analyze through the course, students analyze innovative solutions in construction, examining factors such as their impact on productivity, materials optimization, and environmental sustainability, thus enhancing their critical thinking skills.

Teaching methods

In the course, teaching methods are carefully designed to foster a deep understanding of literature review techniques, enabling students to critically analyze and synthesize existing research in the field of construction innovation. Through guided exercises and discussions, students learn to discern the impact of articles, identifying key insights and evaluating their significance in advancing industry practices. Additionally, emphasis is placed on developing skills to identify incremental steps that contribute to enhanced productivity across various facets of construction operations. Through practical applications and case studies, students are equipped with the tools to recognize and implement incremental improvements, ultimately contributing to overall productivity gains within the construction sector.

Expected student activities

Throughout the semester, students will engage in a structured progression of activities to prepare for their project, which will be segmented into three core components: literature review, identification of innovation opportunities, and understanding and quantification of environmental impact. Initially, students will delve into guided literature searches, synthesizing findings from academic papers and industry/technical reports. Subsequently, they will participate in collaborative brainstorming sessions to pinpoint potential areas for innovation within the construction sector, conducting feasibility studies to assess the viability and potential impact of innovative solutions. Concurrently, students will deepen their understanding of sustainability principles and environmental assessment methodologies, applying quantitative techniques to evaluate the ecological footprint of construction processes, materials, and technologies. Throughout these activities, students will receive guidance from instructors, engage in peer discussions, and refine their project plans in preparation for the final execution phase.

Assessment methods

Evaluation is continuous through follow-up meetings and follows a weighted structure available on Moodle from week 1.

Supervision

Office hours	Yes
Assistant.e.s	No
Forum	Yes

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

Bibliography becomes available on the course's moodle page

Notes/Handbook

Program of Lectures as well notes become availble on a weekly basis on the course's moodle page

Moodle Link

- https://go.epfl.ch/CIVIL-424