Syllabus

Course Title

Economics of Climate Change: Case Studies and Best Practices in Construction

General Information

General description of the required education/training, outlining the main objectives and explaining the necessity of the education/training at the organizational/country/regional level

The course “Economics of Climate Change: Case Studies and Best Practices in Construction” is aimed at developing professional competencies of master’s students in accordance with their study programmes.

Global climate change has a significant impact on economic and social systems, requiring the development of effective adaptation strategies at the level of states, regions, enterprises, and individual economic sectors. This issue is particularly relevant for the construction industry, as it has a substantial impact on climate change (carbon footprint, energy consumption, use of natural resources, etc.).

The aim is to study and develop a systematic understanding of the natural and anthropogenic causes of contemporary global environmental changes, the main driver of which is climate warming, to clarify their dynamics and impacts on the natural environment, and to examine possible ways of preventing their future consequences through appropriate measures in the construction sector, including the design stage.

Economic modelling in the construction sector is a key tool for:

- developing and evaluating policies aimed at reducing the negative impacts of climate change and ensuring sustainable development in construction;
- forecasting risks and estimating potential economic losses in construction;
- optimising financial mechanisms for implementing adaptation and decarbonisation measures in the construction industry;
- integrating international standards and practices in climate modelling and economic analysis of the construction sector.

Course objectives:

● To familiarize students with the main techniques of climate and economic modelling, including integrated assessment models for studying the relationship between economic activity and climate change in the construction sector.

● To analyse and discuss economic factors influencing adaptation decisions in construction, including cost-benefit considerations, resource availability, market dynamics, and the economic impact of climate risks on various sectors and communities, using insights from best practice case studies.

● To synthesize knowledge in climate change economics to formulate policy recommendations in the construction sector that enhance climate resilience in vulnerable economic areas, focusing on strategies that promote both economic growth and environmental sustainability.

● To promote the development of critical thinking and an interdisciplinary approach to addressing climate challenges in construction.

The course “Economics of Climate Change: Case Studies and Best Practices in Construction” combines online and offline learning elements (blended learning) and lasts one semester. It includes lectures, practical sessions, students’ independent work, and final assessment.

The proposed course is aimed at developing students’ professional competencies necessary for analysing and designing economic solutions in the field of climate change in construction, in accordance with the educational programme.

Audience

The main target audience of the course and any secondary audience, if it may influence decisions regarding the structure or content of the course

Expected level of knowledge and skills of the main audience (current or minimally required), as well as other factors (for example, cultural characteristics, level of technical training, access to the Internet) that should be considered when planning the course, as they may affect the choice of teaching methods, materials, and approaches to interaction with the audience

The primary audience consists of second-cycle (Master's level) students in the specialties G2 "Environmental Protection Technologies" and E2 "Ecology," who are engaged in research in the fields of climate change, environmental policy, and sustainable development. The course is aimed at developing skills in applying mathematical and economic models to assess climate change and its impact on the construction industry.

The secondary audience includes second-cycle (Master's level) students and researchers from other related fields such as economics, energy, natural sciences, engineering, and sustainable development policy. Since climate change has a complex impact on various sectors, the knowledge gained in this course can support the development of interdisciplinary approaches to modelling environmental and socio-economic processes.

- Understanding of the interaction between natural and economic systems, including the impact of climate change on the construction sector economy.
- Knowledge of key economic concepts such as efficiency, sustainability, and market-based mechanisms of environmental regulation in construction.
- Basic skills in working with environmental and economic data, including methods of quantitative analysis and modelling.
- Technical preparation level – the course includes introductory modules for those without sufficient experience in mathematical modelling.
- Access to software – the use of open-source tools is recommended, or access to licensed products may be provided.
- Interdisciplinary context – the course is designed not only for specialists in ecology and environmental protection technologies but also for professionals from other fields, requiring adaptation of materials for a broad audience.

This approach will support the development of skills in applying modelling methods to address climate change challenges in the construction sector and will ensure effective preparation of researchers for interdisciplinary work in ecology, economics, and sustainable development in construction.

Competencies

Training needs at the individual or organization/country/regional level, as well as a description of how these needs were identified and recognized as relevant.

Competencies targeted by the training.

Competencies that master's students should acquire during the course "Economics of Climate Change: Case Studies and Best Practices in Construction":

C2. Understand the dynamic relationship between economic activity and climate change and explain how they influence and interact with each other.

Learning outcomes and performance criteria

Learning outcomes and performance criteria formulated with regard to the knowledge and skills to be acquired during the training process.

LEARNING OUTCOMES

LO4. Be familiar with the main techniques of climate and economic modelling, including integrated assessment models, for studying the relationship between economic activity and climate change. ECC

LO5. Analyse and discuss economic factors influencing adaptation decisions, including cost-benefit considerations, resource availability, market dynamics, and the economic impact of climate risks on various sectors and communities, using insights from best practice case studies. ECC

LO6. Synthesize knowledge in climate change economics to formulate policy recommendations that enhance climate resilience in vulnerable economic sectors, focusing on strategies that promote both economic growth and environmental sustainability. ECC

PERFORMANCE CRITERIA

Interpret model results in terms of policy implications

Identify and critically assess key economic factors (e.g., cost-benefit analysis, availability of financing, economic incentives, and resource allocation) influencing adaptation decisions

Enhance the climate resilience of vulnerable economic sectors by applying knowledge of climate change economics.

Course Content

Provide a content outline that corresponds to the learning objectives and outcomes. This may be a course outline as it will be presented to students, but not necessarily a complete curriculum.

Include a general list of all topics that you consider necessary to cover. If you believe it would help clarify the scope, indicate what will NOT be covered.

The course "Economics of Climate Change: Case Studies and Best Practices in Construction" (3 modules) includes 7 lectures:

1. **Concept of a model in construction economics. General approach to modelling the economics of climate change in construction**
   1) Concept of a model in construction economics and its functions.
   2) Macroeconomic models used in the construction cycle.
   3) Macroeconomic modelling in the policy cycle of adaptation in the construction sector.
   4) The Ramsey model.
   5) The DICE model.
2. **Integrated models, development scenarios in construction**
   1) Results of the DICE model in the construction sector.
   2) Estimates of the global impacts of climate change as a function of global mean temperature.
   3) Development scenarios for the construction sector under climate change conditions.
3. **Economic factors influencing climate change adaptation decisions in the construction sector**
   1) Economic development and climate adaptation.
   2) Efficiency factors in the construction process.
   3) Principles of economic evaluation of architectural solutions.
   4) Direct and feedback relationships in the "construction sector – climate adaptation" system.
   5) Economic opportunities of the construction sector in the context of climate adaptation.
4. **Energy efficiency in construction as one of the main principles of climate adaptation**
   1) Concept of energy-efficient buildings.
   2) Assessment of different types of building lighting and energy consumption.
   3) Assessment of heat losses in buildings of different purposes.
   4) Energy efficiency legislation.
   5) Building energy efficiency certification.
   6) State support for energy efficiency.
5. **Green construction in the context of climate change adaptation**
   1) Green buildings: general overview.
   2) LEED and BREEAM building rating systems.
   3) Vertical greening as a climate change adaptation measure.
   4) Green roofs as a climate change adaptation measure.

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5) Rain gardens as a climate change adaptation measure.

6. **Legislative and institutional frameworks for climate change adaptation in construction at national and sectoral levels**
   1) National and sectoral legislation of Ukraine in the field of climate change adaptation.
   2) Role, functions, and responsibilities of state authorities in climate change adaptation.
   3) Policy and legal instruments for climate change adaptation at national and sectoral levels.
7. **Regional and local policy recommendations for climate change adaptation in the construction sector**
   1) Role, functions, and responsibilities of local executive authorities and local self-government in climate change adaptation.
   2) Policy and legal instruments for climate change adaptation at regional and local levels.
   3) Strategic planning of climate change adaptation measures at the regional level.
   4) Strategic planning of climate change adaptation measures at the city level.

Learning Solutions and Methods of Implementation

List the learning solutions (teaching methods) that will be used and explain why they were chosen. For example: classroom learning, online learning, blended learning, workplace learning, online resources for self-study, coaching or mentoring, etc.

Learning format

For students at the research and educational level of higher education, **blended learning** is provided, combining traditional and digital teaching methods. This approach supports flexible knowledge acquisition and the development of practical skills.

1. **Practical classes**
   - Conducted in classrooms under the guidance of the instructor.
   - They allow students to receive individual consultations, examples of problem-solving, and practical recommendations.
   - They ensure direct interaction between students and the instructor, contributing to effective learning.
2. **Lectures (online format)**
   - Provide students with flexible access to learning materials, regardless of place and time.

- They support the development of independent information search and analysis skills.
- They ensure inclusiveness of the learning process, allowing students with special educational needs to access required knowledge without limitations.

3. **Independent learning**
   - Implemented through the study of lecture materials, completion of assignments, and independent search for additional resources.
   - Includes preparation of **presentations**, analytical reflection on the acquired information, and its application in real cases.
   - Develops **critical thinking** and the ability to work with large volumes of data.

Through a **personalized approach**, students are able to adapt the learning process to their own needs and level of preparation. The instructor acts as a mentor, helping students effectively apply acquired knowledge to practical tasks and research activities..

Learning Strategies

Consider which learning strategies you will use. Provide justification for why you intend to apply them, including reasons why they will help participants achieve the planned learning outcomes.

Combine different learning strategies to create a diverse learning environment that accommodates different learning styles of participants. This will increase the effectiveness of learning and help achieve the planned learning outcomes. This section does not require a detailed description of specific activities.

Learning strategies in the course "Economics of Climate Change: Case Studies and Best Practices in Construction"

During the course, the following approaches will be used:

1. Classroom learning
   - Promotes direct interaction between students, the instructor, and other participants.
   - Allows group discussions, case analyses, and scenario modeling, ensuring a deeper understanding of modeling methods in the context of climate change in the construction sector.
   - Provides hands-on practice with models and algorithms under the guidance of the instructor.

2. Online learning
    - Provides flexible access to lecture materials, scientific articles, databases, and other resources.
    - Enables students to independently explore quantitative analysis tools, software, and methods for developing adaptation solutions.
    - Supports inclusive learning by allowing participation of students with different levels of preparation and access to resources.
3. Blended learning
    - Combines traditional classroom sessions with online formats, providing a comprehensive approach to learning modeling.
    - Facilitates step-by-step acquisition of knowledge – from theoretical review to practical application in real research.
    - Allows students to work at their own pace while receiving individual support from the instructor.

By combining these learning methods, students will effectively develop skills in modeling, data analysis, and the application of economic tools to assess the impact of climate change.

Learning Activities

Describe the main learning activities that will be included, such as lectures, readings, case studies, discussions, exercises, practical assignments, simulations, role-playing games, etc.

Format of learning activities

The learning process will include lectures, which will account for approximately 20% of the total course time. Practical classes will be implemented in the form of various assignments (20% of the time) and preparation of presentations (60% of the time). Discussion of results will take place both during task completion and after their completion.

Lectures

Instructor's role:

- Record short 20-minute video lectures with clear and logical presentation of the material.
- Provide visualization of the material (presentations, graphs, diagrams).
- Explain key concepts in an accessible way and answer students' questions.

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Student's role:

- Review the video lecture before the class.
- Analyze the material and prepare questions.
- Actively participate in discussions during the lecture.

Practical classes (seminars)
Practical work will include research on the following topics:

- Development of basic econometric models for analyzing the impact of climate change on the economy.
- Modeling mitigation scenarios for climate change using system dynamics.
- Risk assessment and adaptation strategies in the construction sector.

Instructor's role:

- Demonstrate examples of solving practical problems.
- Organize discussions and debates on course topics.
- Summarize and present conclusions of discussions.

Student's role:

- Actively participate in discussions.
- Ask questions regarding task completion and preparation of presentations.
- Use acquired knowledge to develop their own analytical materials.

Assessment of Learning

Describe the assessment plan for participants before, during, and/or after the course, including tests, exercises, activities, and projects that will be assessed. Indicate whether self-assessment or peer assessment will be used.

Explain how the assessment is linked to the learning outcomes.

Methods of student assessment

The following assessment methods will be used during the course: Self-assessment tests – used to reinforce theoretical material. They help students better understand key course concepts, and their results are included in the final grade.

1. Seminars and peer assessment – students will have the opportunity to analyse their peers' presentations by evaluating:
    - How fully the topic was covered;
    - Whether all important aspects of climate change mitigation methods were considered;

- Whether the conclusions are well-founded and reflect the main points of the presentation.

2. Instructor assessment – includes the analysis and evaluation of student presentations and reports based on criteria such as content quality, argumentation, and clarity of presentation.
3. Final test – a summative assessment that evaluates the level of mastery of the key topics of the course.

Storyboard of Learning (Learning Storyboard)

Use this to create a visual scenario of your blended learning activity

Learning resources and tools

List the available resources that will be used for different types of learning activities and recommended to students.

Describe the technologies that will be used to implement learning solutions, including educational technologies and operational equipment (hardware, software, collaboration tools).

1. Access to learning materials – video lectures, presentations, and additional informational resources will be available on the Moodle platform, allowing students to familiarize themselves with the material before lectures and practical sessions.

2. Access to online resources – students will have the opportunity to use open and specialized informational resources via the internet, including databases, scientific articles, and analytical reports.

3. Online lectures and communication – lectures and interactive sessions will take place in MS Teams, providing the ability to communicate with the instructor in real time, participate in discussions, and collaborate on projects.

4. Presentation materials – the educational content will be provided in PowerPoint presentation format, helping students to structure the information and use it when preparing their own reports and projects.

5. Additional tools – interactive platforms for testing, data analysis, and modeling may be used during the course to facilitate practical understanding of the material.