ERANet LAC

PK

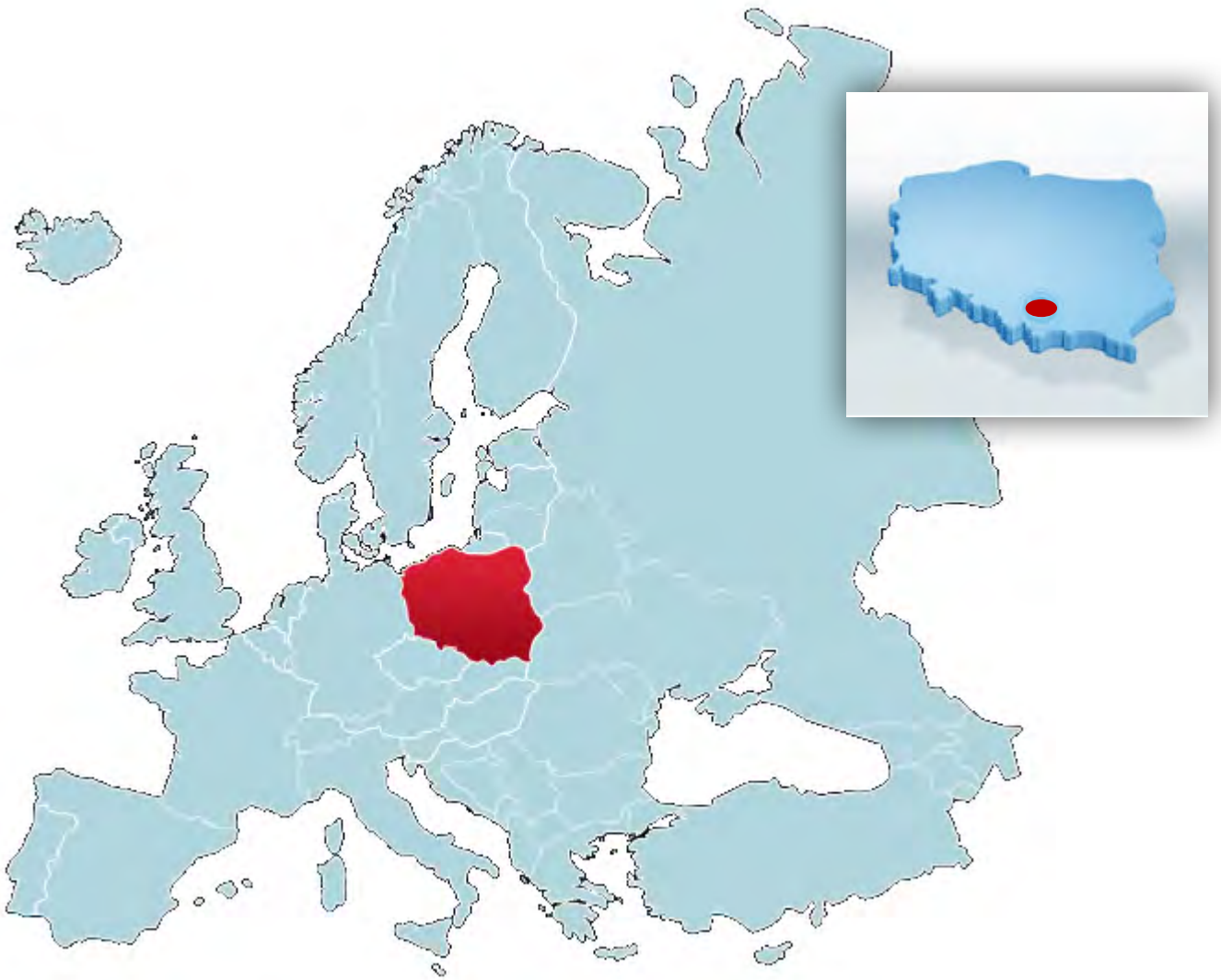
SEVENTH FRAMEWORK PROGRAMME

An ERA-NET financed by FP7

Development of eco-friendly composite materials based on geopolymer matrix and reinforced with waste fibers

Kinga Korniejenko

Cracow University of Technology - localization



Cracow University of Technology: fact and figures

Founded:

in 1954

Staff members:

more than 2 120

Number of students:

- Total 17 941
- Full-time students 13 929
- Extramural students 4 012
- Postgraduate students 836
- Doctoral candidates 282

Units:

- Faculties 7
- Inter-faculty units 11

Courses of study:

25

Cracow University of Technology – structure

7 Faculties :

Other units i. a.:

- Centre for Education and Organization of Quality Maintenance Systems
- International Centre of Education
- Pedagogy and Psychology Centre
- Sports and Recreation Centre
- Library of the CUT

Faculty of Mechanical Engineering structure

1. Institute of Applied Mechanics
2. Institute of Materials Engineering
3. Institute of Machine Design
4. Institute of Automobiles and Internal Combustion Engines
5. Institute of Thermal and Process Engineering
6. Institute of Production Engineering
7. Institute of Computing Science
8. Institute of Rail Vehicles
9. Institute of Industrial Apparatus and Power Engineering
10. Laboratory for Coordinate Metrology

Ongoing Projects

DOCMEN

Co-funded by the Erasmus + Programme of the European Union

Development of two cycle innovative curricula in microelectronic engineering / DOCMEN (2016-2018)

Tempus

MMATENG

Modernization of two cycles (MA, BA) of competence-based curricula in Material Engineering according to the best experience of Bologna Process / MMATENG (2014-2017)

ERANet LAC

An ERA-NET financed by FP7

Development of eco-friendly composite materials based on geopolymer matrix and reinforced with waste fibers (2017-2019)

Research Fund for Coal & Steel

The innovative system for coke oven wastewater treatment and water recovery with use of clean technologies (2016-2020)

Basic information

- ERANet-LAC: Latin America, Caribbean and European Union funded by the European Commission, within the 7th Framework Programme for Research and Technology Development (FP7)
- Topic #02: Waste management, recycling and urban mining
- Title: Development of ecofriendly composite materials based on geopolymer matrix and reinforced with waste fibers
- Acronim: FIBER
- Project no: ELAC2015/T020721
- Coordinator: Cracow University of Technology ,

  Prof. Janusz Mikuła

Basic information - objectives

- Keywords: Environment and resource saving, Environmental protection in production, cleaner production, Materials and reactions

- The project is an answer for a specific challenge connected with **waste management**, recycling and urban mining.

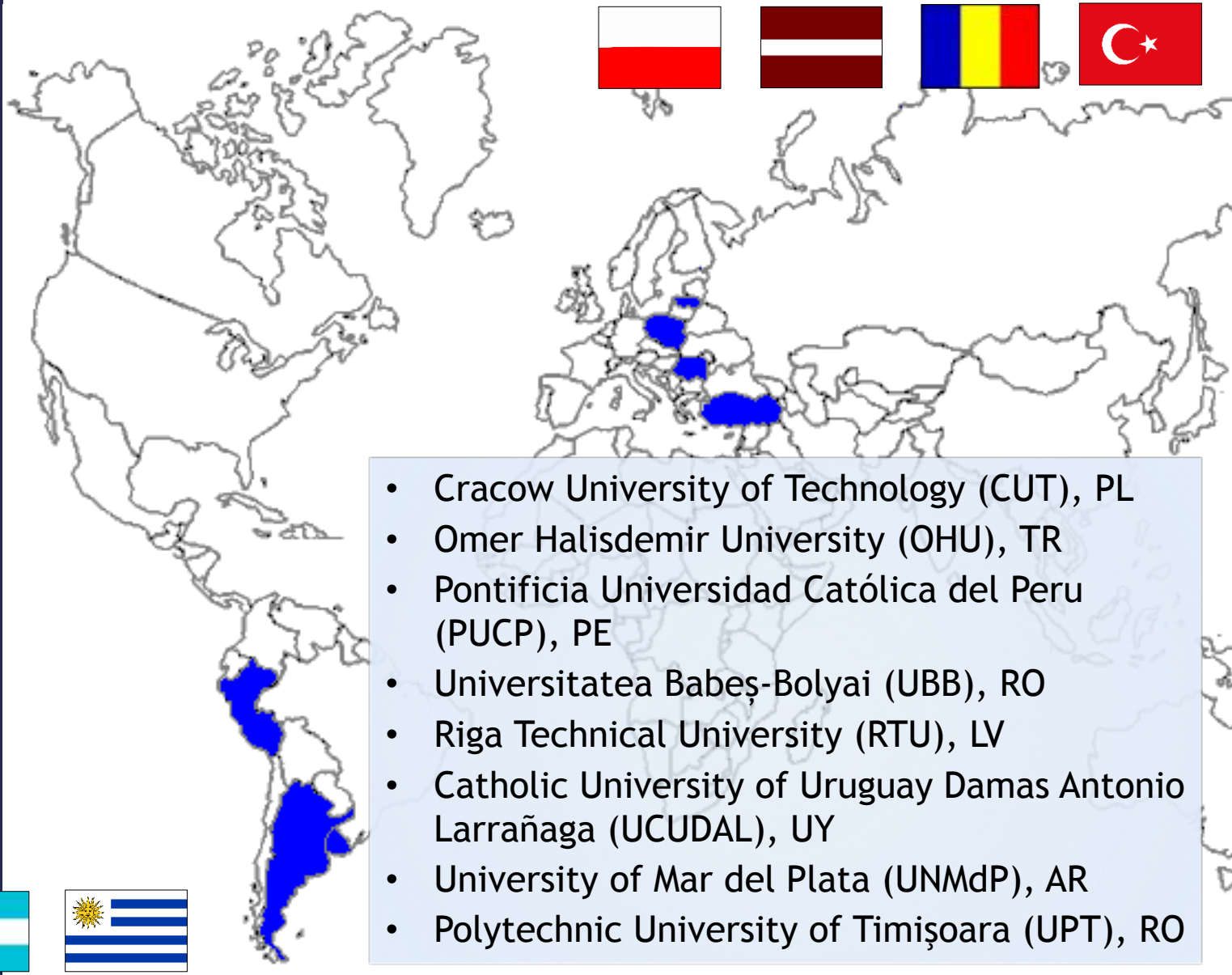
- The main objective of the project is **to prepare a broad spectra of advanced and progressive new fibre-based materials for construction industry** with high potential of commercial utilization, especially **development of composite materials from waste natural fibres** such as: animals and vegetables, for replacing the traditional construction materials.

Basic information - objectives

The specific objectives are:

- Preparation of the theoretical concept for the new composites, analysis and optimization of the structure and mechanical properties and performance of designed composite materials and assessment of their materials for selected applications.
- The selection of most suitable waste fibres added to the hydrothermally alkalized fly ash in order to improve its properties.
- Analysis and optimization using computer methods of the structure and mechanical properties of composites and the assessment of their ability to be used the construction materials.
- Comparison between the new composites and the traditional materials in regard of their properties in laboratory.
- Preparation of solutions and testing prototype components in lab as well as in relevant environment and comparison between the new composites and the traditional materials in regard of their properties in varying environmental conditions.

Consortium structure



- Cracow University of Technology (CUT), PL
- Omer Halisdemir University (OHU), TR
- Pontificia Universidad Católica del Peru (PUCP), PE
- Universitatea Babeș-Bolyai (UBB), RO
- Riga Technical University (RTU), LV
- Catholic University of Uruguay Damas Antonio Larrañaga (UCUDAL), UY
- University of Mar del Plata (UNMdP), AR
- Polytechnic University of Timişoara (UPT), RO

Work Plan - WORK PACKAGE 1

Title: The selection of materials, including waste materials (fly ash) to be hydrothermally alkalized and therefore turned into new material based on geopolymer matrix for construction application

Aim: Preparation of the theoretical concept for the new composites, analysis and optimization of the structure and mechanical properties and performance of designed composite materials and assessment of their materials for selected applications

Participants: **OHU**, UBB, CUT, PUCP, UNMdP

Deliverables: The report being a result of research work carried out defining gaps in the available solutions in the marketplace and preparation of publications / presentations at scientific conferences presenting the results of the comparative analysis on existing solutions and future market trends

Milestones: Choosing min. 5 matrix for future tests.

Work Plan - WORK PACKAGE 2

Title: The selection of waste materials (natural fibres) as a fillers and therefore turned into new composites for construction application

Aim: The selection of most suitable waste fibres added to the hydrothermally alkalized fly ash in order to improve its properties

Participants: UBB, CUT, PUCP, RTU, UCUDAL

Deliverables: The report determination of the effect of additives on the properties of the matrix; materials for publication/ onferences.

Milestones: Choosing 5 promising compositions (matrix & fibre).

Work Plan – WORK PACKAGE 3

Title: Optimization using computer methods properties of new materials and structural elements made of them

Aim: Analysis and optimization using computer methods of the structure and mechanical properties of composites and the assessment of their ability to be used the construction materials.

Participants: **RTU**, UPT, UNMdP

Deliverables: The report contains the prepared material models and practical applications for their use; preparation of publications / presentations at scientific conferences presenting the results of the modeling

Milestones: Results of computer optimization for 5 elements schemes to their production

Work Plan - WORK PACKAGE 4

Title: The research into the application of new materials – comparison functional properties materials

Aim: Comparison between the new composites and the traditional materials in regard of their properties in laboratory

Participants: **PUCP**, CUT, UPT, RTU, UCUDAL, UNMdP

Deliverables: The report contains the results of the tests and preparing materials for scientific publication concerning the practical application of the new materials; materials for publication/ conferences.

Milestones: Development of compositions based on waste materials optimized for the required basic properties of composites (selection on the basic of laboratory tests) and design the prototype solution for tests.

Work Plan - WORK PACKAGE 5

Title: Analysis of practical applications of new materials for construction application and testing prototype components in laboratory as well as validated it in relevant environment

Aim: Preparation of solutions and testing prototype components in lab as well as in relevant environment and comparison between the new composites and the traditional materials in regard of their properties in varying environmental conditions.

Participants: **CUT**, BBU, UPT, OHU, RTU, UCUDAL

Deliverables: Prototype and results of its tests in relevant environment; report and preparation of publications / presentations at scientific conferences presenting the results of the work; monograph.

Milestones: Tested prototype in relevant environment.

Outcomes

- development of competence of the research teams for each partners: research excellence;
- development of competence of network;
- growth experience of each of the project participants in the field of implementation research and / or management them;
- effective use of university research infrastructure;
- gaining interesting material for international publications: **common publication**, especially comparative research between countries (e.g. different needs for economy, comparison for successful implementation of technical solutions)
- gaining interesting material for future research projects (national and international): research project will lead to the development of original technical solutions that will be based on the results of the research, which will make the unit will have innovative solutions that can provide a basis for future grants of an implementation carried out in collaboration with industry.

Outcomes (long - term)

- creating enviroment for possibilities of future cooperation in different research tasks; knowledge about common area of research activity will be base for future training cooperation; establishing cooperation between research centers from different countries the project will involve people from different research units: cooperation agreement, possibilities of new projects, students internships etc.;
- new possibilities research project will lead to the development of original technical solutions that will be based on the results of the research, which will make the unit will have innovative solutions that can provide a basis for future grants of an implementation carried out in collaboration with industry;
- development of researcher mobility international exchange of researchers from R&D entities and industrial partners is encouraged. During the project is planned cooperation between universities, research institutes and enterprises exchange of researchers and experience.

Thank you for attention

Contact

Kinga Korniejenko
Researcher
CUT | Faculty of Mechanical Engineering
Jana Pawła II 37 street
mob. + 48 (0) 609 97 49 88
Email: kinga@mech.pk.edu.pl
kkorniej@gmail.com