Co-funded by the
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POLITEHNICA University of Bucharest and IMST Faculty presentation

Curriculum Development

of Master's Degree Program in

Industrial Engineering for Thailand Sustainable Smart Industry

SOME DATa ABOUT ROMANIA

www.siebenbuerger.de

Population: 19.631.292 habitants
Surface: 238391 km^2 (4,8% Europe)
Capital: Bucharest (1.920.610 hab.)
Main important cities:
Iaşi, Cluj-Napoca, Timişoara, Constanţa
Neighbours:
SW – Serbia, NW – Hungary, N – Ukraine,   E – Republic of Moldova
and Ukraine,   S – Bulgaria , SE – Black Sea
Religion: 85,9% Orthodox, 4,6% Romano-Catholic, 3,2% Reformed,
1,9% Pentecostal, 0,3% Muslims (Turkish 0,2% in Constanţa)
Life expectancy at birth - 70.62 years
National day: 01 December (Union Day)
Romanian currency: LEU (RON)
 (1 € = 4.65 RON) (1 USD = 3.9 RON)
Presidential elections: once every 5 years

BUCHAREST (BUCUREŞTI)

UNIVERSITY SQUARE

ROMANIAN ATHAENEUM

PARLIAMENT PALACE

TRIUMPH ARCH

OLD CENTER

NATIONAL ARENA STADIUM

Facts and figures

Romania is the **6th country in the world regarding the number of certified IT specialists per capita**, thanks to its educational system that favors multilingual and technical skills. Higher education in the IT area is provided by 5 top polytechnic universities, 59 domain specific universities, and 174 private colleges, which together produce over 5.000 computer science and engineering graduates per year.

Romania is situated in the **top 5 worldwide regarding skills in computer technical support**, technical help desk, network technical support, computer electronics, telecommunications ..

Romanian academic system

56 state universities

28 private universities

Bucharest
- **POLITEHNICA University**
- Civil Engineering University
- Architecture University
- Agronomy and Vet Medicine University
- The Bucharest University
- Medicine and Pharmacy University
- Economic Studies Academy
- National Music University
- National Arts University
- Theater and Movie National University
- National Sport Academy
- National School for Political Studies

UPB on the World Map
Cooperation Agreements

North America — 11%

Central and South America — 4%

Asia — 12%
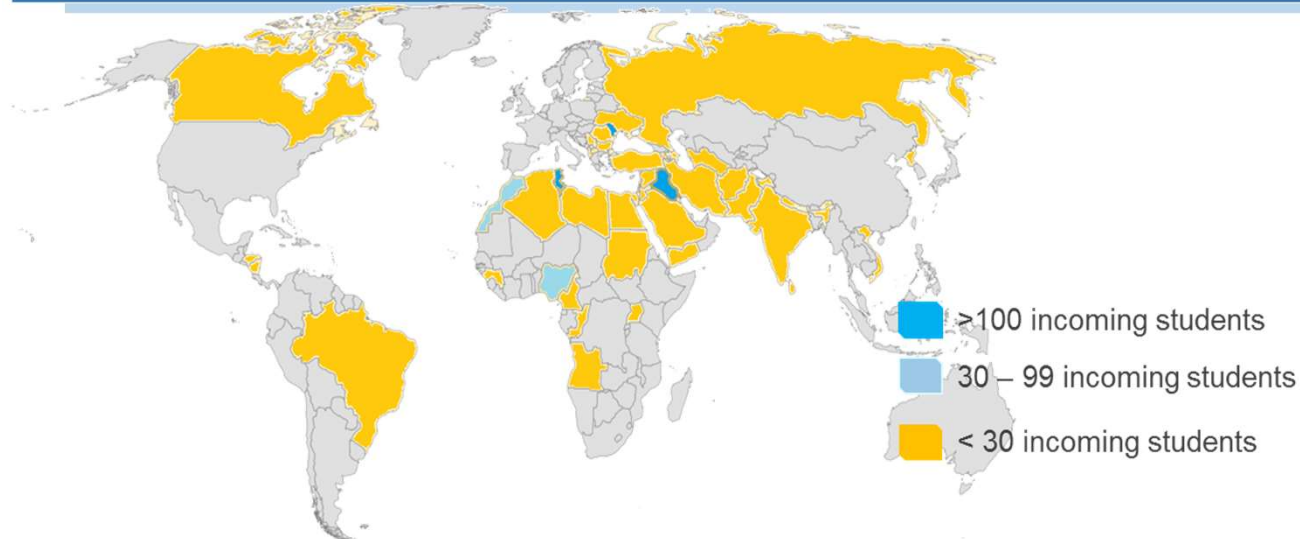
Europe — 70%

Africa — 3%
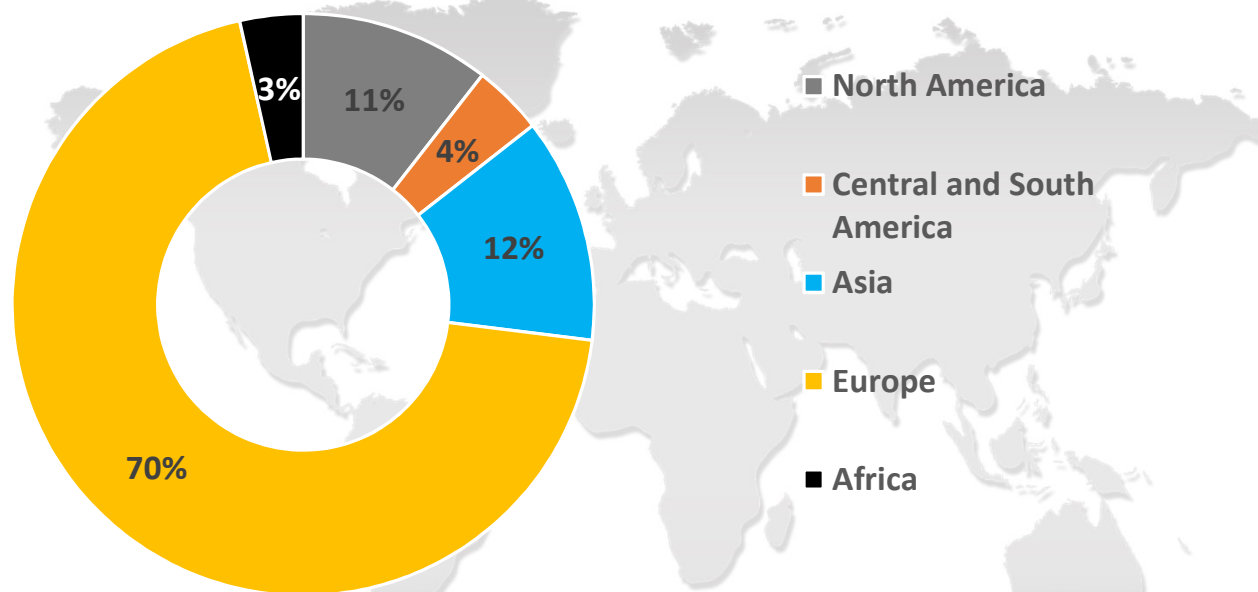
UPB has settled over 265 signed inter-university mobility agreements and well over 150 Memorandums of Understanding with universities across the world.

UPB on the World's Map
International Students

>100 incoming students
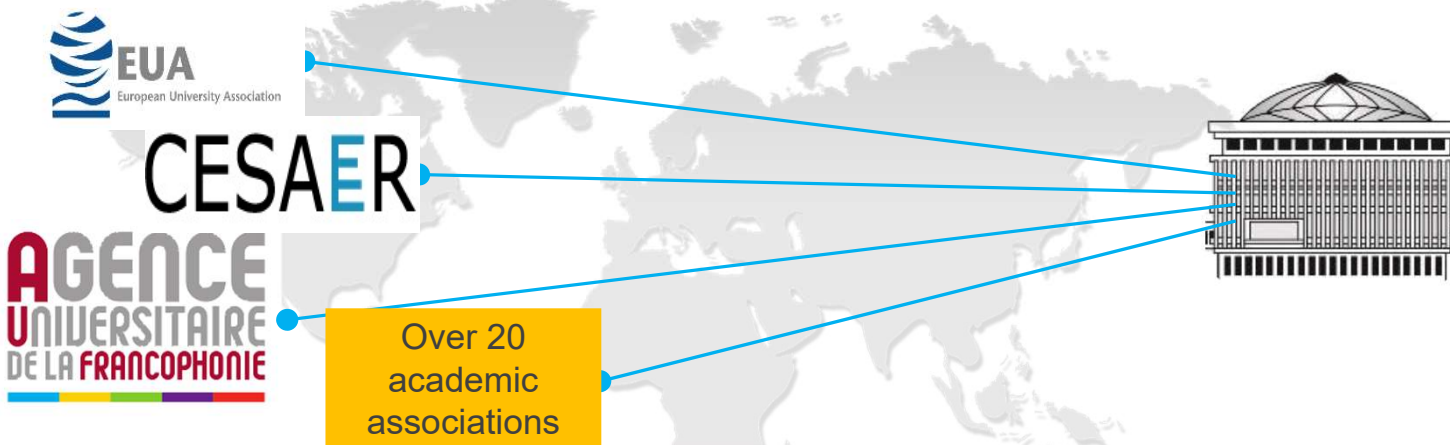30 – 99 incoming students
< 30 incoming students

Aside from own students – which we promote in the international environment – UPB receives over 800 foreign students every year from 55 countries.

UPB on the World Map
International Associations Membership

Over 20
academic
associations

UPB is part of over 20 larger academic associations: European University Association (EUA), The Conference of European Schools for Advanced Engineering Education and Research (CESAER), L' Agence Universitaire de la Francophonie (AUF), European Distance and E-Learning Network Ltd. (EDEN) etc.
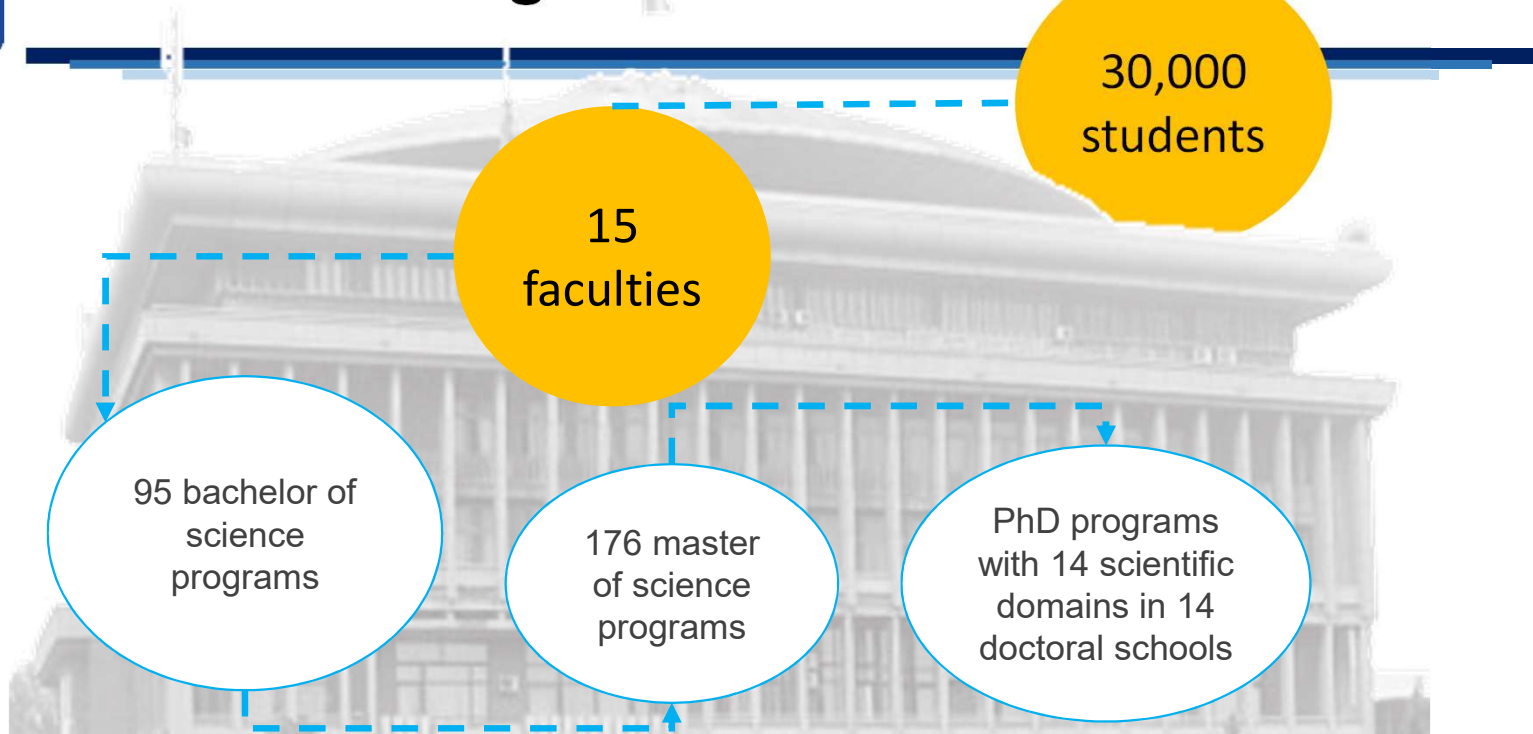
Programs and students

30,000 students

15 faculties

95 bachelor of science programs

176 master of science programs

PhD programs with 14 scientific domains in 14 doctoral schools

UPB is an international technical university with around 30,000 students from more than 55 countries.

Undergraduate Studies in English(BSc)

The Faculty of Engineering and Management of Technological Systems
- Industrial Engineering (bachelor & master)

The Faculty of Electronics
- Microelectronics, optoelectronics and nanotechnology
- Networking and telecommunications software
- Technology and telecommunications systems

The Faculty of Engineering in Foreign Languages:
- Electronics and Telecommunications Engineering (English, French)
- Computers and Information Technology (English, French)
- Applied Electronics (English, French, German)
- Mechanical Engineering (English, French, German)
- Chemical Engineering (English, French)
- Materials Engineering - Materials Science (English, French)

Faculties of UPB

- Electrical Engineering
- Power Engineering
- Automatic Control and Computer Science
- Electronics, Telecommunications and Information
- Mechanical Engineering and Mechatronics
- **Engineering and Management of Technological Systems**
- Biotechnical Systems Engineering
- Transports

Faculties of UPB

- Aerospace Engineering

- Materials Science and Engineering

- Applied Chemistry and Materials

- Engineering in Foreign Languages

- Applied Sciences

- Medical Engineering

- Entrepreneurship, Business Engineering and Management

Academic studies

Undergraduate studies (4 years)

Master's studies (2 years)

Postgraduate studies (1/2 years)

Doctoral studies (3 years)
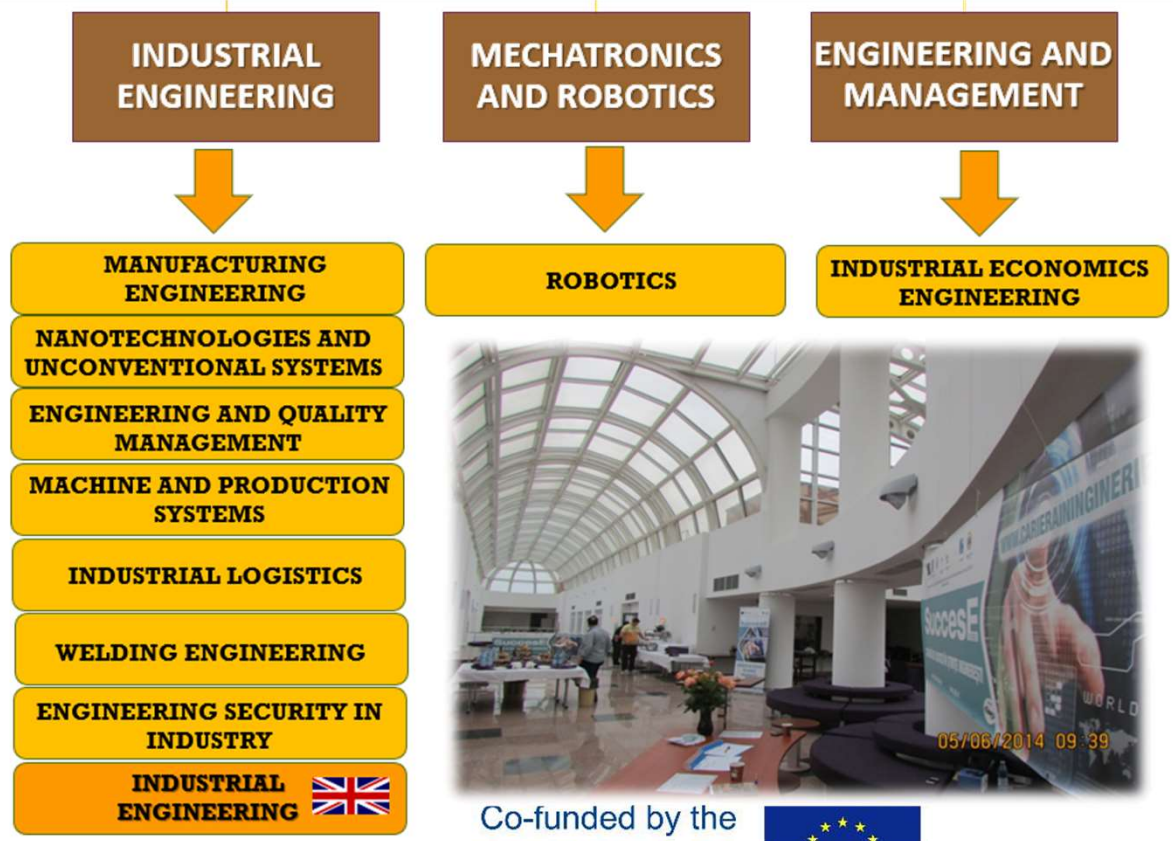
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IMST Faculty structure

INDUSTRIAL ENGINEERING

MECHATRONICS AND ROBOTICS

ENGINEERING AND MANAGEMENT

MANUFACTURING ENGINEERING

NANOTECHNOLOGIES AND UNCONVENTIONAL SYSTEMS

ENGINEERING AND QUALITY MANAGEMENT

MACHINE AND PRODUCTION SYSTEMS

INDUSTRIAL LOGISTICS

WELDING ENGINEERING

ENGINEERING SECURITY IN INDUSTRY

INDUSTRIAL ENGINEERING

ROBOTICS

INDUSTRIAL ECONOMICS ENGINEERING

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IMST Faculty Board

DEAN

Prof. Dr. Eng. Ec.
Cristian DOICIN

DIRECTOR OF DOCTORAL SCHOOL

Prof. Dr. Eng.
Marian GHEORGHE

VICE-DEAN

International affairs, educational programmes from EU funds and study programmes in foreign languages

VICE-DEAN

Scientific research and patrimony

VICE-DEAN

Bachelor study programmes, quality assurance and continuous training

VICE-DEAN

Social activities, tutoring and the faculty visual identity

VICE-DEAN

Master study programmes and internships

VICE-DEAN

Connection with industrial environment, computerization

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

IMST Departments

MANUFACTURING ENGINEERING DEPARTMENT

Prof. Dr. Eng.
Tom SAVU

MACHINE AND PRODUCTION SYSTEMS DEPARTMENT

Prof. Dr. Eng.
Tiberiu DOBRESCU

MATERIALS TECHNOLOGY & WELDING DEPT.

Prof. Dr. Eng.
Gabriel IACOBESCU

STRENGTH OF MATERIALS DEPARTMENT

Prof. Dr. Eng.
Ioan PĂRĂUȘANU

MECHANISMS THEORY & ROBOTICS DEPARTMENT

Prof. Dr. Eng.
Costică OCNĂRESCU

IMST students

Undergraduate 2320

Master 1275

PhD 308

Study Programme

Products – **Q**uality – **P**rofit

Speciali-zation	Production	Materials	Economics	Quality	CAE	Management
Sem.			D i s c i p l i n e			
1			Product Development 1			
2			Quality Management			
3			Business Management			
4	Design & Ergonomy	New Materials	Concurrent Market Analysis	Product Quality	Geometric Modelling (1)	Industrial Logistics
5	Detailed Design	Surface Engineering	Financial Management	Environm. & Life Quality	Sructures Analysis	Informatic Systems
Total						

Study Programme

MSc / Master Level (Example)

Speciali-zation	Production	Materials	Economics	Quality	CAE	Management
Sem.			Disciplines			
1			Product Development 2			
2			Project Management			
3	3D Modelling	Comp. Aided Mould Design	Comp. Aided. Prod. Planning	Quality System	Geometric Modelling (2)	Modelling & Simulation of Ind. Systems
4	Process Optimisation	Structures Analysis	Marketing	Quality Control & Improvement	Product Modelling	Ecology, Environm. & Industry
5	Individual & Group Project (TEAMS . . . .)					
Total						

(II)

Bachelor Programmes in Mnfg.Eng.Dept.

- Manufacturing Eng.
- Nano & Non-conventional Technologies
- Industrial Economics Eng.
- Applied Informatics in Ind. Eng.

Master Programmes in Mnfg.Eng.Dept.

- Industrial Design
- Product Design & Mnfg. Eng.
- Advanced CAE
- Nanostructures & Non-conventional Technologies
- Economics Eng. & Business Management
- Quality in Eng. & Business Management
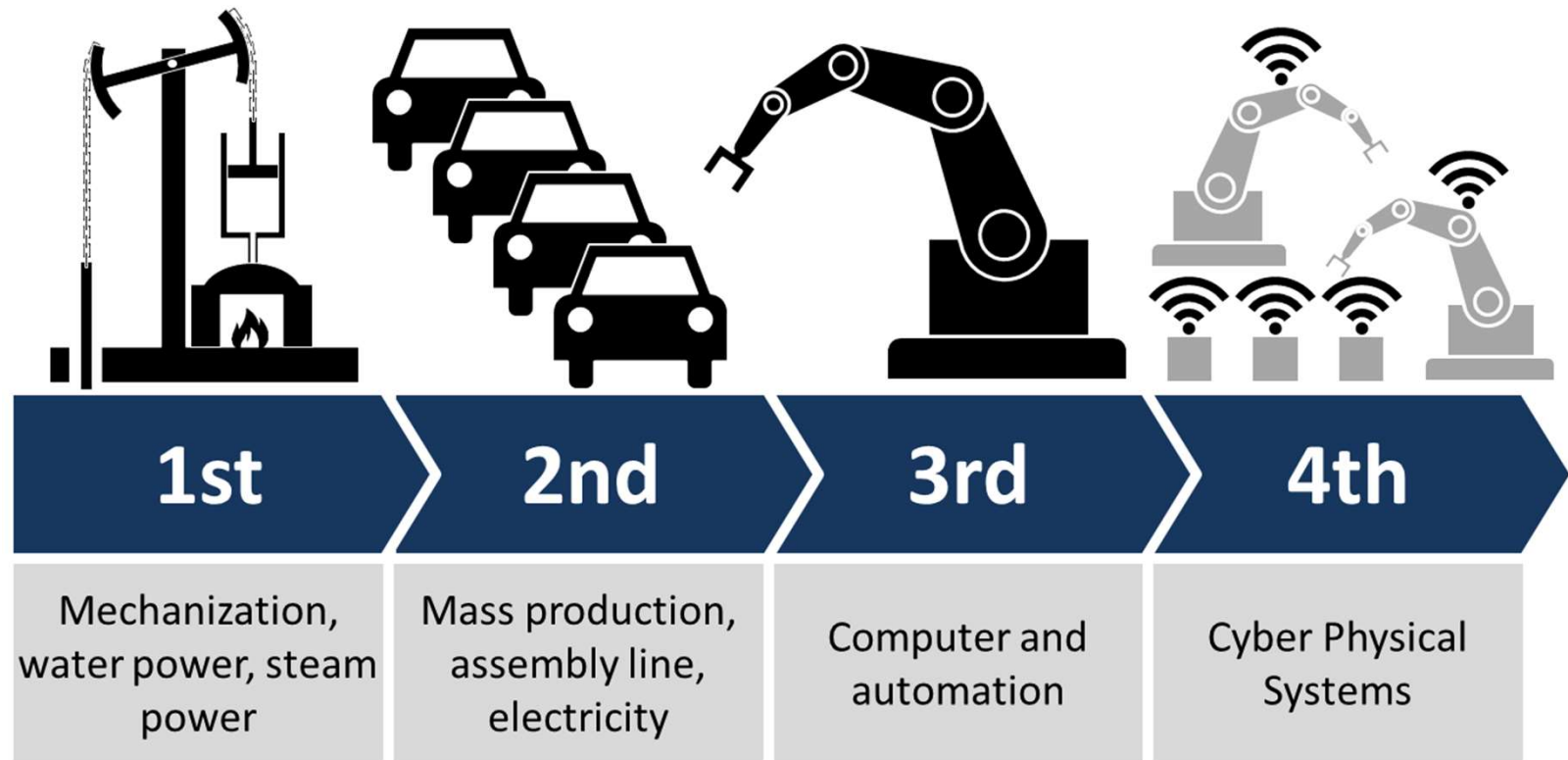- Complex Projects Eng. & Management

Industry 4.0's Challenges for the Industrial Engineering Curricula in the POLITEHNICA University of Bucharest

Curriculum Development

of Master's Degree Program in

Industrial Engineering for Thailand Sustainable Smart Industry

Industry 4.0 = The 4th Industrial Revolution

1st	2nd	3rd	4th
Mechanization, water power, steam power	Mass production, assembly line, electricity	Computer and automation	Cyber Physical Systems

Industry 4.0

In the intelligent Industry 4.0 factories, the **Cyber-Physical Systems** monitor physical processes, create a virtual copy of the physical world and take decentralized decisions.

CPSs communicate by using the **Internet of Things**, cooperating in real-time, both together and with the human resources.

Information storage and processing are performed using the **Cloud Computing**.

Cyber-Physical Systems

Internet of Things

Cloud Computing

Cyber-Physical Systems

CPSs are mechanisms, monitored or controlled by algorithms (software), which are integrated with the users through the Internet.

Physical and software components are interlaced on various spatial and temporal scales, possessing multiple and distinct behaviors and interacting in ways which are changing the context of the whole system.

CPSs examples: intelligent vehicles, medical monitoring systems, process control systems, robotic systems, automated pilots, intelligent houses, smart cities etc.

Involving multidisciplinary approaches, CPSs have the same basic architecture like IoT, but have a greater degree of combining and coordinating the physical components with the computational ones.

Internet of Things

IoT (informational society's infrastructure) describes the interconnectivity of intelligent elements (i.e. devices, vehicles, buildings) containing electronics, software, sensors, actuators and components connecting them to a data collecting and exchange network.

Intelligent elements may be thus remotely monitored and controlled, allowing the integration between the physical world and the computerized systems.

An estimated 50 billions intelligent elements will exist in 2020.

Sensors and actuators are transforming the IoT into a CPSs' instance.

Industrial IoT is using machines able to learn and the Big Data technology for acquiring, processing and using the data from the industrial sensors and automation systems

Cloud Computing

Partitioned, by request usage, by computers or by other devices, of Internet located data sets and computing resources.

University's challenges

Challenges are present during the all three stages in which the university acts in what concerns the knowledge:
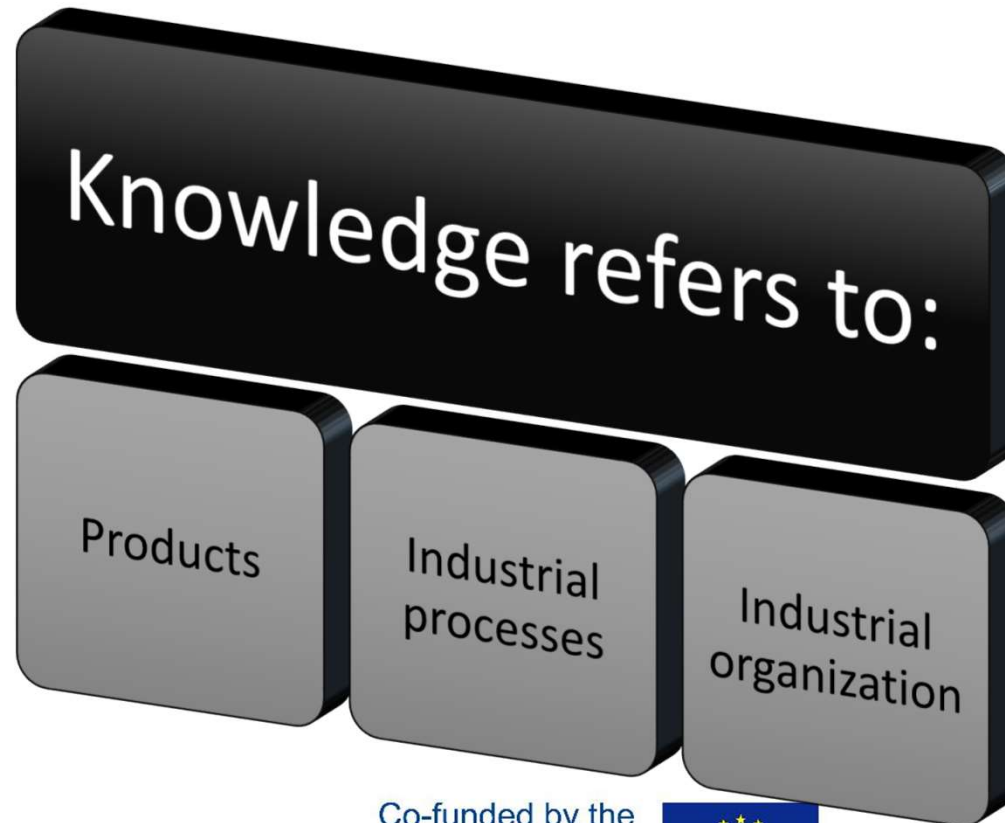
Production

Transfer

Valorization

University's challenges

Knowledge refers to:

Products | Industrial processes | Industrial organization

Producing knowledge

About products:
- having CPS characteristics;
- monitored, controlled and communicating through the IoT;
- adding knowledge in C C and using this in the product design stage.

About processes:
- using machines, tools and equipment from the CPS category;
- monitored and controlled through IIoT, using organizational rules stored in C C and upgrading these rules.

About organization:
- using data and procedures stored in C C and upgrading these rules;
- using an CPS type infrastructure.

Transferring knowledge

- Using CPSs (didactic and experimental setups able to send data about their interaction with the user);

- Using IoT (remote and distributed labs);

- Using Cloud Computing (virtual labs, organization simulators).

Valorizing knowledge

- by developing Industry 4.0 applications;

- by offering IoT resources (setups and equipment);

- by offering Cloud Computing knowledge resources.