Course Description

“In my eyes, one thing is certain. The future of Europe lies in research, science and innovation.”

Carlos Moeda, European Union Commissioner, November 2014

Europe has a glorious tradition in the realms of educational institutions, cutting edge research, technological innovations, and their application to business and industry. However, there is no doubt that in recent decades the continent has seen a systematic erosion in its former leadership position. The reasons for this decline are many: a prolonged recession, declining budgets for research, brain drain to the U.S., bureaucratic and cultural impediments to the blossoming of startups, lack of an integrated internal market for innovation, poor availability of venture capital, and more.

Beginning in 2010, the European Union decided to embark on an ambitious series of well-funded programs aimed at reverting the downward trend, and moving towards excellence and world leadership in science, technology and innovation (STI). The main vehicle for achieving this goal is the Horizon 2020 program. This course will focus on the current state of STI in the European Union as a whole, and in select countries in particular. An emphasis will be placed on reviewing the outlook for information and communication technologies, nanotechnology, advanced materials, advanced manufacturing and processing, biotechnology, and the space industry.

Course Objectives

Upon successful completion of this course, students will be able to:

1. Become familiar with the historical evolution of scientific research and technological innovations in Europe
2. Understand the factors leading to the relative decline of Europe vis-à-vis the U.S. and more recently, China
3. Appreciate the ambitious nature of the Horizon 2020 program and become familiar with its components
4. Analyze the progress made by various projects in the priority fields of:
• Information and communication technologies (ICT)
• Nanotechnology
• Advanced materials
• Biotechnology
• Advanced manufacturing and processing
• Space technologies

5. Understand the current state of science, technology and innovation in Spain
6. Understand the current state of science, technology and innovation in France
7. Understand the current state of science, technology and innovation in Switzerland
8. Understand the current state of science, technology and innovation in Italy
9. Learn from the success of specific projects
10. Become familiar with the findings of the Innovation Union Scorecard

Recommended Readings
Most of the following are available for free online.

Creating Silicon Valley in Europe: Public Policy Towards New Technology Industries in Comparative Perspective
by Steven Casper
Oxford University Press, 2007

Digital Agenda for Europe: Rebooting Europe’s Economy

Research and Innovation: Pushing boundaries and improving the quality of life
The European Commission, Brussels, 2014

Success Stories in European Research and Innovation
European Commission, Research and Innovation, Information Centre
ec.europa.eu/research/infocentre/success_stories_en.cfm

Silicon Valley Comes under Fire in Europe
by Murad Ahmed
Financial Times, December 26, 2014

Innovation Performance: EU Member States, International Competitors and European Regions compared
European Commission, Brussels, 2014

The New European Commission: Bad news for research and innovation?
Special Report, An analysis of the Juncker Commission
Science/Business Magazine, Brussels, September 2014

Research and innovation as sources of renewed growth
European Commission
Directorate-General for Research and Innovation, Brussels, 2014

HORIZON 2020: The EU Framework Programme for Research and Innovation
European Commission
ec.europa.eu/programmes/horizon2020/en
Switzerland far Outranks EU on Innovation
EurActiv, March 6, 2014

Innovation Union: A pocket guide on a Europe 2020 initiative

Unlocking the ICT Growth Potential in Europe
Written by the Conference Board for the European Commission, 2013

Course Requirements

- Six essays (minimum length: 1,000 words per essay)
  - Essay #1: Main characteristics of science, technology, and innovation in the European Union (due July 2, before the start of the program)
  - Essay #2: Main characteristics of science, technology, and innovation in Spain (due July 13)
  - Essay #3: Main characteristics of science, technology, and innovation in France (due July 19)
  - Essay #4: Main characteristics of science, technology, and innovation in Switzerland (due July 25)
  - Essay #5: Main characteristics of science, technology, and innovation in Italy (due July 31)
  - Essay #6: A comparative analysis of science, technology, and innovation in Europe (due August 4)

On the last two days of classes, each student will make a 15-minute oral presentation, which will summarize the main issues studied in the course

Components of Final Grade

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Grading Scale

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77-79.9 %  C+
73-76.9 %  C
70-72.9%  C-
67-69.9 %  D+
63-66.9 %  D
60-62.9 %  D-
Below 60 %  F

**Suggested Topics:**

**A Historical Overview of Scientific Research and Technological Innovations in Europe**

- The Scientific Revolution
- The Enlightenment
- Physics
- Mathematics
- Astronomy
- Biology
- Chemistry
- Engineering
- Commercialization of innovative technologies
- Mechanical devices
  - Telescopes
  - Calculating devices
  - Industrial machines
- The loss of leadership in science and technology to the U.S.
- The relative decline of Europe
- The emergence of China as a major player

**The Horizon 2020 Program**

- Extend Europe’s capacity for advanced and paradigm-changing innovation
- Foster scientific collaboration across disciplines on radically new, high-risk ideas
- Accelerate development of the most promising emerging areas of science and technology
- Speed up development of the technologies and innovations that will underpin tomorrow's businesses and help innovative European startups to grow into world-leading companies
- Priority fields:
  - Information and communication technologies (ICT)
  - Nanotechnology
  - Advanced materials
  - Biotechnology
  - Advanced manufacturing and processing
  - Space technologies
- Availability of debt and equity finance for R&D and innovation-driven companies and projects at all stages of development
- Focus on support for the following societal challenges:
  - Health, demographic change and wellbeing
  - Food security, sustainable agriculture and forestry, maritime and inland water research, the bio-economy
  - Secure, clean and efficient energy
  - Smart, green and integrated transport
Science, Technology, and Innovation in Spain

- Overview of the Spanish economy
- Overview of the Spanish scientific community
- “The Spanish Strategy for Science, Technology and Innovation”
- “The National/State Plan for Scientific and Technical Research and Innovation”

- Improving the educational system in order to raise STI skills development to international standards
  - Improve job placement for researchers
  - Promote the hiring of Ph.D.’s by new high-tech companies
  - Recruit foreign professors

- Strengthen public R&D capacity and infrastructures
  - Increase the international impact of research centers and universities
  - Support basic research
  - Fund the acquisition of cutting edge equipment

- Encourage innovation in firms and support entrepreneurship
  - Improve supply of venture capital
  - Encourage internationalization of innovative companies
  - Increase R&D spending by large companies
  - Encourage the dissemination of emerging technologies

- Research aimed at addressing societal challenges
  - “Retos Innovacion”
  - Support key technologies: photonics, microelectronics, nanoelectronics, advanced materials, biotechnology, information and communication technologies
  - Health projects
  - The digital society

- Increase international cooperation
  - Spain’s science and innovation systems are not well integrated in international networks
  - Increased participation in Joint Programming Projects of the European Commission (ERA-NET’s, JU’s, and JPI’s)
  - Future and emerging technologies: science-driven large-scale multidisciplinary research
    - Graphene
    - The human brain

Science, Technology, and Innovation in France

- Overview of the French economy
- Overview of the French scientific community

- Innovation-based economic growth
  - The energy transition
  - Information technology
  - Promoting R&D
  - Encouraging startups
  - “The New Face of Industry in France”: 34 targeted industries
  - Commercialization of new technologies
“The New Deal for Innovation”: Public policies to foster entrepreneurship, technology transfer, and innovation

- Research aimed at addressing societal challenges
  - The environment
  - Aging

- Reforming the public research system
  - Better cooperation between universities, engineering schools, and business schools
  - Stronger links between universities, public research institutes, and social and economic stakeholders

- Increasing the impact and rate of return of scientific research
  - Commercialization of public research
  - Reduction of the time to market of business R&D

Science, Technology, and Innovation in Switzerland

- Overview of the Swiss economy
- Overview of the Swiss scientific community
- The Technopark in Zurich
- "Digital Zurich 2025"

Science, Technology, and Innovation in Italy

- Overview of the Italian economy
- Overview of the Italian scientific community

- Improving coordination of STI governance
  - The Ministry for Education, University and Research
  - The Ministry for Economic Development
  - Local entities (e.g. Emilia Romagna, Puglia)
  - Incorporating the priorities of Horizon 2020

- Improving the educational system in order to raise STI skills development to international standards
  - Prevent brain drain
  - Improve links between universities and the labor market
  - Plan "Italia 2020"
  - Improve academic salaries

- Encourage innovation in firms and support entrepreneurship
  - Improve supply of venture capital
  - Encourage internationalization of innovative companies
  - Increase R&D spending by large companies
  - Encourage the dissemination of emerging technologies

Analysis of Select Successful Projects

The Innovation Union Scoreboard (IUS) - a comparative assessment of the research and innovation performance of the EU Member States

- Enablers
- Human resources
- Open and excellent research systems
- Finance and support

- Firm activities
  - Firm investments, linkages and entrepreneurship
  - Intellectual assets

- Outputs
  - Benefits for the economy
  - Innovators

- Analysis of the results for 2014 and 2015
  - Best performers
  - Largest gaps
  - Comparisons with non-EU countries

**Academic Integrity**

Ramon Llull University, the Catholic University of the Sacred Heart and Franklin University Switzerland place a high value on the integrity, appropriate conduct, and academic honesty of all students. Students are expected to maintain high standards of academic integrity at all times. Any instance of academic dishonesty, including plagiarism, will result in a grade of F for the course.