Course Title (in English) | Ideas to Impact: Foundations for Commercializing Technological Advances
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Course Title (in Russian) | Основы коммерциализации технологических достижений
Lead Instructor(s) | Tekic, Zeljko

Is this syllabus complete, or do you plan to edit it again before sending it to the Education Office?
The syllabus is a final draft waiting for approval (once approved the syllabus will be published on the public web-site and other systems)

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1. Annotation

Course Description

Technological innovation is critical to the survival and competitiveness of emerging and existing organizations. This course lays the foundation to undertake a robust analysis and design of opportunities for technology-based commercialization. We introduce tools and frameworks that help isolate and control the factors shaping the identification, evaluation and development of commercial opportunities. Throughout the course we use technology examples originating from problem sets found in engineering and scientific education to develop the skills necessary to connect technology and impact.

At the same time, through creativity lab students will be introduced to a variety of creative problem solving techniques and learn how to apply these techniques in the context of the development, evaluation and application of ideas and concepts with commercial potential; consider the evaluation of business ideas that translate existing business models into new national contexts.

The course is designed to help students develop the ability to find, evaluate, and develop technological ideas into commercially viable product and process concepts, and build those concepts into viable business propositions. The material covered is research and theory-based but the course is practice-oriented with much of the term spent on shaping technology-based opportunities. A central objective of this subject is to equip students with an understanding of the main issues involved in the commercialization of technological advances at both strategic and operational levels.
Course Prerequisites / Recommendations

Innovation Workshop; or in special cases with special instructor’s permission

2. Structure and Content

<table>
<thead>
<tr>
<th>Course Academic Level</th>
<th>Master-level</th>
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</thead>
<tbody>
<tr>
<td>Number of ECTS credits</td>
<td>6</td>
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<table>
<thead>
<tr>
<th>Topic</th>
<th>Summary of Topic</th>
<th>Lectures (# of hours)</th>
<th>Seminars (# of hours)</th>
<th>Labs (# of hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Introduction to technology commercialization</strong></td>
<td>4</td>
<td>2</td>
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<tr>
<td></td>
<td>What is technology commercialization; invention vs. innovation; the importance of technology and entrepreneurship in economic development; “reference model” that guides the design of the Skoltech education program; important role students and university alumni play in fostering regional and national high-tech entrepreneurship; distinction among the many activities associated with the process of innovation; assessment and evaluation of different models of the innovation process;</td>
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<td></td>
<td><strong>Opportunity Emergence and Evaluation</strong></td>
<td>6</td>
<td>9</td>
<td>0</td>
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<td></td>
<td>Window of opportunity; difference between an opportunity and an idea; different kinds of change that have been found to generate opportunities; how to analyze opportunities by source and form; how have existing companies seized these opportunities; design thinking; Project work: undertake a rigorous analysis to discover and design an opportunity for commercialization in which the knowledge associated with the problem set may be used; how to translate a technical problem set into considerations of design, use and application; relate technical parameters with their impact as attributes of a product; research methods used to identify customers and their needs; primary and secondary sources of information and how to extract value from them; the methodology for researching the customer and the market, as well as some techniques for forecasting customer demands; industry analyzes – Porter’s framework;</td>
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<tr>
<td></td>
<td><strong>Creativity and creative problem solving</strong></td>
<td>4</td>
<td>8</td>
<td>0</td>
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<td>Thinking and learning styles; convergent and divergent thinking; creative problem solving process and framework; roles of prior knowledge, alertness, creativity, and synthesis in the discovery of an opportunity; creativity toolkit: mind mapping, force filed analyses, brainstorming, force fitting, idea evaluation; project work: problem finding / solving; idea presentation; elevator pitch.</td>
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### Intellectual property and technology standards

Intellectual property (IP) – definition, importance and role; major forms of intellectual property protection: patents, trademarks, copyrights, and trade secrets; role of IP in competitive advantage; when and why to file for a patent; the logic behind a patent and how to use it; complementary assets and appropriability regimes; technology standards - definition, importance and examples; role of technology standards in competitive advantage;

<table>
<thead>
<tr>
<th>Assignment Type</th>
<th>Assignment Summary</th>
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<tr>
<td>Team Project</td>
<td>Mid-term presentation and Final presentation</td>
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<tr>
<td>Team Project</td>
<td>Report</td>
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<td>Homework</td>
<td>Learning Log</td>
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<td>Homework</td>
<td>Elevator Pitch</td>
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<tr>
<td>Homework</td>
<td>Classroom intellectual engagement</td>
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</table>

### Competitive Analysis and Business Model Development

Advantages of existing companies and opportunities that favor new entrants; elements of a business model and the different kinds of business models; how to design a business model; business model canvas; how to connect the design of a business model with the resources required to ramp up the project; tools required to compare across and choose among different opportunities; activities involved in new product design and development; methodologies used to develop working prototypes of a new product; limitations of traditional product development; rapid prototyping and the lean startup approach to product development; the role of customer input in designing new products and services;

Formulate and explain the downstream activities (project management, scale up, manufacturing, supply chain, etc.); judge how they evolve the nature of the opportunity originally discovered and how they affect the strategic considerations about the venture (e.g., need for partnership, viability within existing corporation, viability as independent venture, etc.)

Sources of financing innovation: venture capital, friends and family, cash flow; exit strategies; entrepreneurship vs. entrepreneurship; project sponsors;

### Downstream activities (product design, project management, scale up, manufacturing)

### Financing innovation and choosing organizational form

### 3. Assignments

### 4. Grading

Type of Assessment | Graded
Grade Structure

<table>
<thead>
<tr>
<th>Activity Type</th>
<th>Activity weight, %</th>
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<tbody>
<tr>
<td>Attendance</td>
<td>10</td>
</tr>
<tr>
<td>Projects</td>
<td>65</td>
</tr>
<tr>
<td>Homework Assignments</td>
<td>29</td>
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Grading Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>80</td>
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<tr>
<td>B</td>
<td>70</td>
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<tr>
<td>C</td>
<td>60</td>
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<tr>
<td>D</td>
<td>50</td>
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<tr>
<td>E</td>
<td>40</td>
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<td>F</td>
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Attendance Requirements: Optional with Exceptions

5. Basic Information

Course Stream: Entrepreneurship and Innovation (E&l)

Course Term (in context of Academic Year): Term 2

Students of Which Programs do You Recommend to Consider this Course as an Elective?

<table>
<thead>
<tr>
<th>Masters Programs</th>
<th>PhD Programs</th>
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<tbody>
<tr>
<td>Data Science</td>
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<tr>
<td>Energy Systems</td>
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<tr>
<td>Materials Science</td>
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<tr>
<td>Mathematical and Theoretical Physics</td>
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<tr>
<td>Petroleum Engineering</td>
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<tr>
<td>Photonics and Quantum Materials</td>
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Course Tags: E&l

6. Textbooks and Internet Resources
### 7. Facilities

### 8. Learning Outcomes

#### Knowledge

Understand and apply innovation theories and concepts to the rigorous identification and development of new opportunities for societal and commercial impact.

Explain the concepts of customer development and business model development.

Formulate and explain the downstream activities (e.g., project management, scale up, manufacturing, supply chain, etc.) needed to evolve the opportunity originally discovered and understand how they affect the strategic considerations about the venture.

Critically assess and evaluate the resource assembly junctures in the development of new ventures (whether they be within established corporations or start-ups).

#### Skill

Ability to make oral and written presentations.

Ability to work in groups.

Reconcile tools and methods learned in the context of an engineering education with the need to assess and design an opportunity that will bring them to use.

Ability to apply creative problem solving techniques, reflect upon appropriate methods for different stages of problem solving and explore the relationship between creative problem solving and technology-based ideas.
### Experience

<table>
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<tr>
<th>Experience</th>
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<tbody>
<tr>
<td>Ability to forge technology-based ideas into workable business concepts and learn how to test them in the marketplace.</td>
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<tr>
<td>Ability to differentiate and distinguish the different process activities associated with new product/process/service development, inside or outside an established firm.</td>
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<tr>
<td>Understanding of the main issues involved in the commercialization of technological advances at both strategic and operational levels.</td>
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### 9. Assessment Criteria

**Input or Upload Example(s) of Assignment 1:**

<table>
<thead>
<tr>
<th>Select Assignment 1 Type</th>
<th>Team Project</th>
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<tbody>
<tr>
<td><strong>Mid-term presentation.</strong></td>
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The goal this time is to discuss identified problems and provide feedback. Given the sound understanding you have developed about the problems during first two weeks, we ask you and your team to prepare a presentation. Your task (as a team) is to provide a brief overview of 3-4 identified problems. You should describe your best understanding of identified problems (not just one) highlighting why it exists and a group of people that face that problem. Each team will be given 5-6 minutes (two slides per problem, not more than 10 slides all together) to present and explain the problems. Instructors will provide feedback during the class presentations.

Commercialization Plan. Based on your preferences and provided feedback, choose (as a team) one of problems identified and presented on mid-term presentation, and begin working on developing solutions and crafting strategies and business models to commercialize that solution. Your task will be to talk to potential user and customers, to collect their feedback and use range of different tools to develop your solution and best proposition how to commercialize it (Commercialization Plan). This proposition should be outlined and presented in form of a final presentation and a report. Presentations will be given in front of a panel composed of experts. Panel will provide feedback during the presentations. Working on this, students will regularly receive feedback from instructor, guests from industry and TAs.

**Assessment Criteria for Assignment 1**
Evaluation criteria for Assignment 1

Evaluation criteria for mid term presentation:
1. Variety of problems identified (10%)
2. Problem articulation (clearly articulates and describes significant problems or needs; preliminary responses to questions: who, what, why, when, where related to problems identified) (30%)
3. Evidence and analysis provided for identified problems (20%)
4. Originality, quality and comprehensiveness of content of presentation (20%)
5. Technical and procedural excellence of presentation (20%).

Evaluation criteria for the final presentation are:
1. Originality, quality and comprehensiveness of content of presentation (20%)
2. Identification and characterization of key issues in proposed plan to commercialize solution (e.g. market identification, size and attractiveness, target customer identification; value proposition, differentiation, competitors) (30%)
3. Evidence and analysis provided for proposed plan how to commercialize solution (30%) and
4. Technical and procedural excellence of presentation (20%).

Input or Upload Example(s) of Assignment 2:

Select Assignment 2 Type
Team Project

Input Example(s) of Assignment 2 (preferable)
Commercialization Plan. Based on your preferences and provided feedback, choose (as a team) one of problems identified and presented on mid-term presentation, and begin working on developing solutions and crafting strategies and business models to commercialize that solution. Your task will be to talk to potential user and customers, to collect their feedback and use range of different tools to develop your solution and best proposition how to commercialize it (Commercialization Plan). This proposition should be outlined and presented in form of a final presentation and a report.

In addition to the Final team presentation, your task will be to submit a full written commercialization plan for the opportunity you have discovered or developed for your project. This is team report.
Evaluation criteria for the commercialization plan:
1. Articulation of opportunity elements (idea, the opportunity, why the opportunity exists, job-to-be-done, changes, trends, timing) (10%)
2. Identification and characterization of key issues in the opportunity evaluation (technology, user, problem, market, industry) (10%)
3. Identification and characterization of key elements in the opportunity exploitation (value creation strategy, value appropriation strategy, business model, IP) (10%)
4. Identification and characterization of key risks associated with the opportunity exploitation (10%)
5. Identification and characterization of key downstream activities (e.g., usage scenarios, service design, application design, scale up, supply chain, etc.) in the opportunity exploitation and how they affect the strategic considerations about the commercialization (10%)
6. Evidence and analysis provided for the opportunity evaluation (10%)
7. Evidence and analysis provided for the opportunity exploitation (10%)
8. Rigor and quality of quantification of main elements of the commercialization plan (10%)
9. Conceptual structure of report; depth of arguments; rigor & elegance of logic (10%)
10. Overall quality of writing, construction and presentation of document (10%)

A Learning Log is a journal which evidences your own learning and skills development. It is not just a diary or record of “What you have done” but a record of what you have learnt, tried and critically reflected upon.

For example if in your Learning Log you include details of what you did or how you did something then consider asking yourself questions such as:
Did it go well? Why? What did you learn?
Did it go badly? Why? What did you learn?
How can you improve for next time?

A Learning Log contains your record of your experiences, thoughts, feelings and reflections. One of the most important things it contains is your conclusions about how what you have learnt is relevant to you and how you will use the new information/knowledge/skill/technique in the future. Detailed guidelines how to “write” learning log will be provided in the Canvas. This is individual activity.

Assessment criteria for learning log
1. Depth and quality of thinking and reflections (30%)
2. Presentation of evidence about learning during the course (30%)
3. Conceptual structure of report; depth of arguments; rigor & elegance of logic (20%)
4. Overall quality of writing, construction and presentation of document (20%)
Students will have to develop submit on specified day (mostly by Sunday midnight) recorded oneminute pitch presentation on topic selected by course instructor for that week. The topic will be announced at least 5 days in advance, mostly on Monday afternoons. There will be five topics (and you need to submit five pitches) starting from Week 3. This is individual activity.

If less than 5 pitches are submitted, final points for intellectual engagement will be weighted by \((\text{No of submitted pitches})/5\).

**Assessment Criteria for Assignment 4**

Evaluation criteria for Assignment 2

Pitches will be evaluated on four, equally-weighted categories:

1. Problem (clearly articulates and describes a significant problem or need)
2. Opportunity (market identification, size and attractiveness, target customer identification)
3. Solution (value proposition, differentiation, competitors, call for action)
4. Presentation (Hook statement, voice, body language /charisma, clarity, articulation, passion)

**Select Assignment 5 Type**

Homework

**Input Example(s) of Assignment 5**

Classroom intellectual engagement

In-class exercises, discussion and response to presentations, including interaction with guest speakers, (evidence of reading suggested literature, smart comments, brave questions, timely, relevant, and linked to the previous lectures, comments / discussion to the point) – individual, during the term, around 15 points = 2p x 7 weeks – continuously assessed by TAs and me; we need your name in front of you!

Take-home assignments (team and individual, during term, around 8 points)

Class participation (individual, during term, around 5 points)

**Assessment Criteria for Assignment 5**

Variety of criteria

**10. Additional Notes**