REVISED DRAFT

Master School EIT ICT-Labs

Design of the I&E modules in the
“Data Science Master Degree”

*EIT ICT-Labs Madrid Affiliated node*

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1. Context

The Technical University of Madrid (UPM) has formally started its participation in the EIT ICT-Labs Master School in the last quarter of 2014 after its acceptance as affiliated partner of the knowledge and innovation community (KIC) EIT ICT-Labs and the formal approval of its inclusion into the Data Science Master degree (DS) in September 2014.

The Master degrees of the EIT ICT-Labs Master School must have 120 ECTS for two academic years; this is also the case of the DS Master Degree. In practical terms it implies that the DS Master will start in the academic year 2015-2016 (from September 2015 to June 2016 in Madrid, Spain) and the students’ recruitment process will finish in May 2015 according to the UPM rules. In parallel, other nodes of the EIT ICT-Labs involved in the same DS Master Degree will organise similar recruitment processes in close coordination within them and with the UPM.

UPM will participate as “entry” and “exit” node for the DS master degree. As a consequence, students will come from Spain but also from other countries (from the EU or abroad) for the first year in the UPM premises. In the second year, students will come to Madrid from other EIT ICT-Labs nodes after finishing their first year in other participating European universities and the same will happen for those students starting the first year in the DS Master Degree in the Madrid node which should continue their master degree in another place.

Then, the content design and activities of I&E minor modules presented in this document has taken into account multi-cultural complexities and possible differences in the entry background of enrolled students.

This document will present the main objectives, curricular elements and evaluation procedures of the Innovation and Entrepreneurship minor (I&E). The minor will have allocated 30 ECTS (equivalent to one full time semester but distributed in the two years period).

This document is also used to discuss with other I&E coordinators in a number of EIT ICT-Labs nodes where I&E modules are being implemented during the last two years. Notice that DS Master Degree is a new degree of the EIT ICT-Labs Master School and all the involved nodes will start simultaneously the first year in the academic year 2015-2016. Nevertheless, the lessons learned from the experiences in other EIT ICT-Labs master degrees running in the 2014-2015 academic year should be very useful in combination with the own vision on the needs from the UPM expressed in this document.

The technical contents of the major of the master (for 90 ECTS) on Data Science will not be addressed here and the intended links with the structure presented in this document will require a specific analysis. This issue is also relevant for identifying possible themes for the I&E thesis and its relationships with the DS master thesis; as it will be presented later, both thesis should be prepared during the second year. Nevertheless, notice that for master students coming to Madrid for the second year their I&E thesis should be hopefully pre-defined during their first academic year 2015-2016.

The I&E design contained in this document starts from three main documents:

- The initial information contained in the proposal submitted by the UPM for the DS master degree (although its contents was not detailed in it).
The common requirements and guidelines set up for EIT ICT-Labs masters for the structure, modules and I&E thesis.

The academic rules approved in Spain (and specifically in the UPM) for obtaining Master Degrees.

The initial list of conditions for the implementation of the Programme should fulfil the rules set up by the Master School of the EIT ICT-Labs for the DS master. Nevertheless, we are well aware that the experience is limited until now and several aspects still require further clarification within EIT ICT-Labs. The analysis of experiences from other nodes or co-locations centres (CLCs) seems to be crucial at this stage.

For additional information on the Master School and specifically on the Master on Data Science see: http://www.masterschool.eitictlabs.eu/programmes/data-science/

2. General conditions

This section will provide a summary of the conditions for implementing the DS Master Degree in the UPM (as a part of the affiliated EIT ICT-Labs Madrid node). These are:

1. Only full time students can be accepted.
   a. Activities will be organised on the basis of the availability of students to follow the courses as full time students.
   b. Some students could receive a scholarship from target universities (from their own scholarships programme or through some agreements with third entities) but it will not be mandatory (this is a difference with respect to the EIT ICT-Labs Doctorate School where all students should have a contract for research training).
   c. If some enrolled students are economically supported while others not, some provisions are needed to set up the requirements and to differentiate the consequences (i.e. to keep the scholarship) with respect to the regular evaluation of courses and to avoid biases in the learning processes.

2. A minimum of 10 students for the 2015-2016 academic year are necessary to keep the UPM as part of the EIT ICT-Labs Master School.
   a. This condition makes the recruitment process (not only in Spain but also in the rest of the participating nodes) a very relevant issue.
   b. Anyway, the objective of the UPM for the academic year 2015-2016 is to reach at 20 students for the first year (in its role as entry node) and to receive 5-10 students (in its role as exit node).

3. Academic activities will be conducted in English.
   a. Both lectures or presentations and also homework for the student (i.e. preparation of reports, evaluations, etc.) should be prepared in English. Then, to ensure the right level of English will be a major requirement in the selection process both for teachers and students.

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1 In Spain, this corresponds to the figure of “Personal investigador en formación (PIF)” in the conditions set up by the Spanish Law for Science, Technology and Innovation.
b. The I&E Master thesis should be also written in English (as well as the DS Master thesis) under two possible approaches:
   i. As a chapter of the DS Master thesis (in case of a full coupling with the DS Master thesis structure and contents) or
   ii. As a separate document (in case of addressing a complementary issue)

4. The **30 ECTS allocated to the I&E minor** will be distributed in the two academic years.
   a. **24 ECTS** for regular courses and activities during the 1st year
   b. **6 ECTS** for preparing the I&E thesis during the second year.
   c. Optional course could be also offered to be selected by students with the permission of the allocated tutor in order to guarantee their usefulness for the thesis objectives.
      i. Only two optional I&E courses will be offered for the first edition of the DS master (academic year 2015-2016)

5. The I&E DS Master Degree will observe an **open access policy** where all relevant information will be loaded on the **standard “Sakai” electronic platform**
   a. Both faculty members, tutors/mentors and students will have protected access to the platform with public and private areas.
   b. It is envisaged to use the platform as communication tool by providing moderated blogs and other social network activities.
   c. The platform will be also used as repository of documents and public reports.
      i. All I&E thesis will be loaded as public documents.

6. Lectures and other activities will be organized mainly in the **Campus of Montegancedo** of the UPM.
   a. I&E activities will be conducted mainly on the CAIT (Centre for Technology Innovation) and in the Madrid APG CLC (Imdea Software building) premises.
   b. Students should have allocated some space for their activities (both individually and in small groups for teaching assignments preparation).
      i. They will be provided with PCs, Internet connections and desks.
      ii. All students will have an e-mail, DS account (i.e. for access to platforms, etc.)
   c. Summer School will be conducted in other premises in Europe to be defined every year.
      i. This is a mandatory activity where specific rules for participating, cost reimbursement, etc. will be provided by EIT ICT-Labs headquarters.
      ii. The UPM faculty members will participate in the Summer School.
   d. Internship will be included during the last quarter of the first year (see later)
      i. One intensive month (with 5 ECTS allocated) by fulfilling rules to be detailed later in this document.
      ii. Exceptionally, this activity could be changed by optional courses if they were needed for the student.
   e. On-line modules (not necessarily full courses) could be prepared to complement face to face activities by using a blended learning approach.
      i. Even if this is not a mandatory condition for the EIT ICT-Labs Master School and Madrid is not participating in the EIT ICT Labs open education activity, the UPM has accepted to prepare a module within
the learning activities of the second semester of the 1st academic year:
Technology intelligence. Anywhere a formal participation of Madrid in
this activity could provide mutual benefits.
ii. This module will be offered to all EIT ICT-Labs students.

7. **Students from other DS nodes** could come to Madrid for completing their second
academic year after agreement signed by the UPM with other universities involved in
the DS Master Degree.
   a. Academic and administrative procedures to implement this issue will require
      specific rules to be able to define the acceptance clauses, the selection
      procedures, and the evaluation conditions to obtain the double degree.
   b. Recruitment process should consider the Madrid attractiveness in terms of ICT
      (visits to companies, opportunities for jobs, etc.) but also on quality of life.
      i. A specific marketing campaign is under development.
      ii. The UPM will provide specific support from the “Students’ office located
          in the Campus of Montegancedo).

8. **Students should obtain a “double Master degree”** with other universities participating
in the EIT ICT-Labs network if complying with the rules of countries and universities
involved.
   a. The approval of double master degrees require specific procedures inside the
      universities involved not linked to EIT ICT-Labs.

3. **General structure**

3.1. **Proposed curricula**

This section will introduce the structure and main subjects chosen for the I&E minor in the
Madrid node.

For each of the proposed subjects, a “learning guide” is being prepared (preliminary versions
are attached to this document). This guide will serve as the main reference point for the EIT ICT-
Labs DS Master School distribution of responsibilities, preparation of educational material and
faculty members’ allocation, but also part of it will be used as a public document, for supporting
the recruitment process of international students and for the presentation to UPM or ministerial
authorities.

Fine tuning with the I&E contents implemented in other DS nodes is also needed to prepare final
documents. Exchange of information with other MS schools locations for other master degrees
is also relevant to obtain first-hand experiences and it will be obtained in the planned meetings
of the EIT ICT-Labs Master School.

Figure 1 (extracted from the EIT ICT-Labs documents) depicts the allocation of I&E ECTS during
the two academic years. The DS Master Degree at the UPM should comply with this general
structure.
Figure 1: General structure for I&E minor (source: ICT Labs documents)

Figure 2 schematically describes the ECTS distribution into the different activities described in figure 1. Notice that some of them are specified in “ECTS ranges” with some flexibility to accommodate specific interests or national regulations in each node.

The “introductory event” (3 days) tries to give registered students to the DS a global view of the activities to be completed, better mutual knowledge of interests and outcomes between students and faculty members, team building, and logistic aspects. It will be organised in the Madrid CLC premises. Faculty members and some collaborating companies will also participate to give their views about the relevance of DS in their entities.

Figure 1 does not consider the “introductory event” (remember that no ECTS are allocated to that activity). We envisage that the equivalent to one day will be devoted to I&E issues with the participation of keynote speakers for the business field and the rest of the time will be devoted to networking and visits to facilities.

An important and global issue for all master students is the “Summer School” (4 ECTS in figure 2) which will be presented later in this document.

Notice that the I&E thesis (6 ECTS) will run during the second year although the topic could be defined and agreed on with the student during the first academic year.

The general structure represented in figure 2 emphasises two elements:

- The need to offer a set of basic knowledge to students to provide them with the necessary skills to think in business terms and to be able to launch their own project.
- The development of a specific business project and business plan as a part of the “Business Development Lab” where intensive mentoring is also complemented with additional seminars or intensive courses which are necessary to complete the training and elevator pitches.
The element described in figure 2 as “Business” (5 ECTS) corresponds to the “internship period” described above.

Although other possibilities could be available, the UPM considers that it is more valued for the enrolled students to offer them an internship period in another place than to include additional courses.

In this way, the student will obtain during the internship:

- Hands-on experience on working procedures and context in individual firms
- Contacts for future development of the professional career
- Inputs for the development of the I&E thesis

Evaluation of the activity to be carried out in that period will be based on the following elements:

- Written report about the activity prepared by his/her mentor
- Summary of activities prepared by the student
Within this framework, the UPM is proposing the following academic structure:

- **1st year (total 24 ECTS)**
  - Basics (7 ECTS)
    - Introduction to Innovation and Entrepreneurship management (6 ECTS)
    - Introduction to technology watch and competitive intelligence (1 ECTS)
  - Business Development labs I&E (8 ECTS)
    - This is a “coaching process” where students need to work for their own business projects but where some intensive seminars are embedded to provide students with additional methods and tools. Two options are also included form where students should select one depending on the students’ interests (a minimum of 5 students is needed for implementing an optional course).
      - Entrepreneurship (3 ECTS)
      - Commercialisation of technology (3 ECTS)
      - Digital-based services creation (2 ECTS) (optional)
      - Launching of ICT product/services (2 ECTS) (optional)
  - Summer School (4 ECTS)
    - The UPM is assuming that the Summer School will be extended during 2 weeks organised by the EIT ICT-Labs.

- **2nd year (total 6 ECTS)**
  - I&E master thesis (6 ECTS)

The proposed distribution of I&E courses during the two academic years (and semesters) has been done according to the allocation of ECTS for the DS major courses and also to be able to launch the preparation of the I&E thesis on time to link better with the major DS thesis.

**Internships** (4 weeks, 5 ECTS allocated), referred in figure 2 as “business”, is planned to be conducted in cooperation with a selected entity cooperating with the DS programme.

Internships for students have been included into the EIT ICT-Labs Master School as an instrument to complement the educational process of the master student with some hands-on experience. We exclusively refer in this document to the specific internship related to I&E and not to other mobility activities which could be also offered in the DS Master (e.g. in relation to the DS thesis).

1. The 5 ECTS allocated to this activity implies that it should be made explicit in the official academic record attached to the diploma with reference to the entity which has received the student.
   a. The way to allocate ECTS could require the satisfaction of specific guidelines within the EIT ICT-Labs consortium to be able to evaluate the students’ work during the internship.
   b. Initially, a short report of activities prepared by the student and an individual evaluation report prepared by the allocated tutor in the entity is needed.
2. Internships for I&E activities could be done in the following types of institutions when they perform I&E activities in relation to DS or at least to ICT:
   a. Private companies in the ICT sector cooperating with the UPM
      i. In TTOs, products or commercialisation departments,
   b. Research centres of the UPM related to ICT
      i. COM, CTB, CESVIMA, CEI, CAR, CEMDITEC
      ii. Large UPM departments in the Schools of Telecommunication and Informatics Engineering.
   c. IMDEA Software
   d. Spin-offs of the UPM
   e. In public TTOs or Business incubators

3. The entities involved in the DS Master Degree internships should commit in advance its willingness to accept students and the general activities to be carried out in their premises.
   a. According to the Spanish Law it implies the signature of individual “educational agreements” with the UPM.
      i. It is not necessary to sign up an agreement with the EIT ICT-Lab although the participating entities will have visibility in brochures, presentations and during the execution of activities.
   b. Initially, the UPM will count for this activity with the cooperation of Telefónica, INDRA and ATOS (involved in the Madrid node) as well as the spin-offs related to ICT field located in Montegancedo, the research centres of the UPM (6 of them in the ICT field) and the IMDEA Software.

4. The UPM will make the effort of allocating students to cooperating entities in the last quarter of the first year (it seems the best period because the student has acquired the necessary basic knowledge to take advantage of the internship.
   a. Notice that this process should match with the development of the technical course of DS and the Summer School.
   b. To facilitate fulfilling other DS activities in parallel, to facilitate the interaction with cooperating entities and also to reduce costs the UPM will provide possibilities for internships in Madrid.

5. In case of finding difficulties in allocating internships to students according to their interests, alternative courses from the UPM academic offer related to the I&E issues could be offered to some students.

Next sections will describe the main objectives and contents of the proposed courses by the UPM. The learning guides annexed to this document² will provide additional information on contents, evaluation, bibliography and other sources of information, and relevant intended learning outcomes.

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² They will follow the general template annexed to this document.
3.2. Subjects for the 1st year

1st semester

Introduction to innovation and entrepreneurship management (6 ECTS)
This first course corresponds to the above mentioned I&E basics course (5-8 ECTS) described in previous figures for all the EIT ICT-Labs Master Degrees. The high-level contents should be similar in all nodes. See learning guide of E1 course in Annex 2 for additional information and details on the contents and learning approaches.

For organisational reasons the UPM proposes to allocate 6 ECTS in the first semester of the first year to be implemented by 4 hours/week of active engagement with students (apart from the individual or group working assignments). This activity will run in parallel with other major technical courses on DS.

Objectives:
This is a general introductory course by assuming that students have not a previous experience or knowledge on topics related to innovation and entrepreneurship. More advanced topics on these issues will be covered in other courses of the DS Master Degree based on the contents of this course.

Specific learning objectives are as follows:

- To provide students with a general overview of the key issues related to innovation management and associated concepts.
- To explain the concepts and procedures behind the protection of technology, its rationale and main types.
- To describe the management of innovation projects along their life-cycle.
- To understand the basis for entrepreneurship and technology-based company creation as an instrument to exploit R&D results.
- To know from specific case studies in the ICT domain and, when appropriate, with data science firms, how innovation has been managed and to compare amongst alternative approaches.

Contents:

- Innovation versus R&D
  - From the idea to the market: a long and risky way
  - Relationship of innovation to research and development: an integrated view
  - Nature of knowledge and value of R&D &
- Innovation processes
  - Basic processes
  - Methodologies and tools for innovation management
    - Strategy definition
    - Ideas creation
    - Products and services development
- Marketing
- Audit and innovation

- Organisational structures to support innovation
  - Organization of R&D&I
  - Organisational models to accommodate innovation processes
  - Large, SMEs and spin-off cases

- Innovation models
  - Types of innovation
  - Technology maturity levels (TRL)
  - Open innovation approaches
  - ICT-Labs open innovation model

- Protection of technology
  - Rationale
  - Protection schemes
  - Patents, utility models, know-how
  - Industrial secret
  - Other schemes (e.g. semiconductor layout)
  - The case of software patents

- Management of innovation projects
  - Life cycles models
  - Identification of milestones
  - Human resources
  - Type of results

- Risk management
  - Reference models and concepts
  - Threats identification
  - Methods for Risk Decisions

- Understanding market environment
  - Industrial sector analysis
  - SWOT for industrial sectors

- Financial support for innovation
  - How much and when money is needed?
  - Sources of funding
  - EU public policies for innovation

- Substantial part of the course will be based on case studies, examples and specificities of the DS master course.

This course will be conducted during the first semester of the master in 4 hours/week intensity. Nevertheless, some intensive days could be organised to cover learning activities outside the UPM premises (visits to technology-based incubators, large IT companies or large IT users).

**Distribution of activities:**

A total of 160 hours distributed as follows:

- 40 hours in interactive lectures,
- 70 hours in personal assignments,
- 30 hours for group discussions and
- 20 hours for visits to facilities.
2nd semester

The 2nd semester (also with the Summer School) will have allocated 18 ECTS for I&E. The student at that time has received some technical subjects (24 ECTS) of Data Science to be able to think in the business and innovation aspects of specific technology-based businesses on DS.

Mentoring is deeply embedded into all the planned activities of this second semester.

The subjects included are:

**Introduction to technology watch and competitive intelligence (1 ECTS)**

This Course/seminar corresponds to the “UPM Winter School” (intensive session) given locally in the UPM and/or CLC premises during the 1st year (second semester).

**Objectives:**

After presenting the basic elements of innovation management, students will receive detailed information on tools and procedures related to the identification, selection and eventually absorption/adaptation of technology which could be useful for the selection of the technologies required to implement their own business projects in the DS Master Degree. More specifically:

- To provide students with some conceptual and practical tools to understand the possible evolution of technologies for specific purposes.
- To know how to develop and interpret a technology roadmap in specific technical areas
- To understand the relationship of technology intelligence to decision making in innovation management.
- To describe the specificities of DS technologies evolution and possible scenarios.

**Contents:**

- **Technology evolution**
  - Technology maturation life-cycle
  - Technology roadmaps
  - Technology forecasting
  - Introduction to quantitative approaches in forecasting: econometrics, exponential-smoothing techniques, s-curves, other. Baseline and sensitivity analysis.
  - Forecasting technology disruptions
- **Technology watch**
  - Processes used
  - Internal and external
  - Scouting networks
  - Tools for technology watch
- **Technology intelligence**
  - Use in decision making
  - Trend-charts
  - Connection to the maintenance of IP portfolio
  - Road mapping of products/services
- **Technology transfer**
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- Technology absorption
- Technology transition
- Work on a case study (group activity)
  - Big data in some sectors (e.g. health)
  - Visual analytics

Distribution of activities:

This course could be organised intensively in a week (intensive format) with 8 hours lecturing, 15 hours for individual work and 7 hours for group discussions.

Entrepreneurship (3 ECTS)

This course corresponds to the first seminar in the Business Development labs I&E (10 ECTS) proposed for the I&E minor and it is offered in the second semester of the 1st year. The objective is to help students in the development of an innovative digital service.

Objectives:

Entrepreneurship has a twofold approach: as a tool for launching own ideas or as a tool for the exploitation of results. Specific objectives are:

- To increase the awareness and attitude of students towards entrepreneurship
- To know how to stimulate the development of business ideas within a given entity (intrapreneurship)
- To know how to write a (successful) business plan
- To understand the financial needs for creation and growth
- To know the steps required to create a company
  - Types of technology based companies
  - Case of the EU and specifically Spain
- To know the steps to create a sustainable technology-based company

Contents:

- Awareness on entrepreneurship
- Types of technology-based companies
  - Spin-offs vs start-ups
- The canvas model – lean startup approach
- Creation of a business plan
  - Contents, use of specific models
  - Overview of financials
  - Legal issues
  - Human resources – The team
  - Role of mentors, advisors and business angels
  - Key metrics and dashboard
- What went wrong? The pre-mortem analysis
- The role of presentations to third parties: how, what and when? Elevator pitch
- Conditions to launch a new company (in Spain)
- Financial support
  - Public administrations
• Risk and venture capital
• Crowdfunding

• Analysis of student business ideas
  o This aspect is highly useful but not mandatory during the course.
• Mentoring for their own company

Distribution of activities:

This course will be organised during one month with 10 hours lecturing, 20 hours for individual work and 5 hours for group discussions. Individual work is mentored.

Commercialization of technology (3 ECTS)

This course corresponds to the second mandatory seminar of the Business Development labs I&E (10 ECTS) proposed for the I&E minor and it is offered in the second semester of the 1st year. The objective is to group in the seminar a set of techniques on services commercialization once the student has selected the business project to be developed.

Objectives:

• To motivate students in the need of having in mind the “idea to the market” concept.
• To present students the basis for exploitation of research results and moving forward product and services to the market.
• To describe some tools used to market analysis and commercialization planning.
• To give students the basis for the exploitation and negotiation of intellectual property.
• To describe some approaches used by IT industries, research centres and universities in the commercialization of IP.
• To provide them the possibility to apply the contents to their own business project.

Contents:

• The exploitation of research results: industrial and academic exploitation
• Technology deal flow identification in an organisation
• Product development
  o From prototypes to industrial proof of concepts
  o The role of experimentation platforms
• Market analysis
  o Market segmentation
  o Sectorial vs geographical approach
  o Competitors and providers
  o Market evolution forecast
  o Valorisation: metrics and indicators
• Alternatives for hitting the market: new business models
  o Spin-off creation
  o Licensing process
  o Technology integration
• Commercialisation plans
  o Commercial approaches (relevance to the type of technology)
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- Presentation of projects
- Negotiation of conditions
- Pricing techniques
- International expansion

- Negotiation of IPRs
  - IP in the data science domain
  - Licensing contracts (models)
  - Legal aspects (confidentiality, non-disclosure agreements, responsibilities, etc.)
  - Compliance with international regulations

- Case studies
  - From University: UPM Innovatech
  - From IMDEA Software
  - From private firms

Distribution of activities:

This course will be organised during one 2 weeks with 30 hours lecturing, 40 hours for individual work and 15 hours for group discussions. Individual work is mentored.

Digital-based services creation (2 ECTS)
This course/seminar corresponds to an optional seminar for the last part of the Business Development labs I&E (10 ECTS) proposed for the I&E minor and it is offered in the second semester of the 1st year.

This course is focused on the ICT sector specificities to reach the market. This is an advanced course focused on the digital-based innovation models, approaches and funding sources with emphasis on services creation. The student at this stage should have enough information on his/her business project. Due to the peculiarities of this master degree, many of them will be related to digital services.

- Introduction to the specificities of digital products and services
  - Digital services evolution (versioning, service life cycle, upgrades, etc.).
  - Technology integration (HW/SW embeddedness, open platforms, interoperability, etc.)
  - Open and user-based innovation (dependence constraints)

- Application of new economic theories on platforms: strategic analysis and multi-sided markets
  - The ecosystem approach: collaboration and competition (coopetition)
  - Disintermediation and re-intermediation of value chains
  - Multi-sided markets
  - Strategic analysis: how to lead a platform
  - Interoperability and “de facto” and “de iure” standards
  - How software platforms are supported (e.g. FI-WARE case)

- Risk management of digital innovation processes

- Personal assignments to students
  - If possible, in connection to their Master thesis in DS

- Application to the business plans of specific spin-offs or start-ups proposed by students
Students should present a business idea to be launched as a company in a digital technology-based domain

**Distribution of activities:**

This course (with 2 ECTS) will be organised during two months with 20 hours lecturing, 20 hours for individual work and 10 hours for group discussions. Individual work is mentored.

**Launching of ICT products or services (2 ECTS)**

This course corresponds to an optional seminar for the last part of the Business Development labs I&E (10 ECTS) proposed for the I&E minor and it will be offered during the second semester of the 1st year.

Advanced course focused on the ICT sector (emphasis on digital services and, if possible, by including data science concepts). This course has been planned once the student has obtained basic knowledge on innovation management (during the 1st semester) and he/she is ready to understand how to launch a new (data science) service at international level.

Main aspects covered are:

- **Understanding the IT sector in the EU: towards digital economy**
  - Global market
  - Global organisations
  - Mergers and acquisitions: dynamic restructuring
- **Structure of the ICT sector in the EU**
  - Main stakeholders
  - Regulation (in the EU) for new products
  - Global markets
- **Digital marketing**
  - Channels
  - Market surveys
  - The new role of users
- **Early-stage internationalization (comparison with other regions). Where should you locate your company? Role of clusters, co-working spaces and centres for innovation support**
- **What happens when the product/service is already in the market?**
  - Lean approach
  - Metrics and dashboard
  - Different routes to success
- **Personal assignments to students**
  - E.g. practical case on launching an application based on data analysis
- **Application to the business plans of specific spin-offs or start-ups proposed by students**
  - Students should present a business idea to be launched as a company in a digital technology-based domain

**Distribution of activities:**

This course (with 2 ECTS) will be organised during two months with 20 hours lecturing, 20 hours for individual work and 10 hours for group discussions. Individual work is mentored.
**Summer School (4 ECTS)**
Within this activity the student could/should be also ready to choose the area (if not with total precision) where he/she likes to prepare the I&E thesis which will be a substantial part of the student’s assignment for the 2nd year. The choice could be complemented during the internship.

The **learning objectives** in the Summer School are as follows:

- In depth understanding how technology and innovation interact with all stakeholders (competitors, alliances, networks, markets, etc.) under an open innovation approach.
- The ability to reflect upon ethical, societal, scientific and sustainability considerations when developing new products/technologies.
- The intellectual abilities in transforming theoretical insights and practical experiences into innovative business ideas.
- The ability to systematically conduct a market and/or financial forecast.
- In depth understanding of global/market trends and recognizing their relative importance for their new venture.
- The cutting edge ability in transforming new innovations into viable business solutions on the commercial market, combined with decision-making and leadership competencies.
- In depth understanding of usability, business life-cycles, operations and maintenance.
- The ability to integrate different ICT-technology specializations.

**Distribution of activities:**

The summer school comprises two weeks of activity according to the following planning:

- In the first week the students develop business and product ideas based on their knowledge and experiences. During this time the students are confronted with all involved stakeholders and with the ethical, societal, scientific and sustainability relevance of their ideas.
- In the second week the students start working on a Product Operational Concept and identify and analyse all issues of relevance; markets, regulatory framework, feasibility, usability, business life-cycles, operations and maintenance.

The Summer School is a common activity for master students enrolled in the different locations where the Master Degree is being implemented. The activities are distributed as:

- One week Introductory: 40 h,
- two weeks thematic at 2 or 3 locations also in cooperation
- last week best teams at one location, 120 h preparation.

Furthermore, the UPM will participate in the Summer School with the following types of activities (activities are organised by EIT ICT-Labs action lines):

1. A set of invited speeches by Spanish actors in the I&E community.
   a. From technology providers (e.g. from Telefónica, Indra, ATOS, etc.)
   b. From large intensive users (e.g. Santander, BBVA, INDITEX, etc.)
2. Organization of open debates on hot topics which affect Data Sciences evolution
   a. IP for Data Sciences
b. Privacy regulation in sensitive sectors (e.g. health, banking)
c. Data access.

**Internship (Business) (5 ECTS)**

The UPM considers that internships are a highly valued activity to complement and enrich the educational purposes. We also assume that students don’t have previous business experience and to understand how businesses address I&E issues is very relevant.

Afterwards, this activity (and also the activities of the Summer School) provide students with enough information to define the topic where they like to prepare their I&E thesis which will be a substantial part of the minor student’s assignment for the 2nd year.

“Internships” are part of educational agreements between universities and private and public entities regulated from the Spanish legislation and University bylaws; implementation is managed by the University. Internship period is not (necessarily) funded to the student although institutional efforts to cover the costs for the students should be done if necessary.

The conditions for selected entities receiving students for this activity are as follows:

- The entity should perform some innovation or entrepreneurial activities in-house.
- The activity should be performed in R&D, TTO or innovation departments.
- A joint entity/university educational programme is elaborated to be covered by the student within the internship period.

The learning objectives of the internship are as follows:

- In-depth understanding of the way that innovation is addressed and managed in the entity where the student is doing the internship period.
- Active participation in working groups created by the company.
- Refinement of the subject for the I&E thesis in discussions within the internship company.
- Getting experience on product/service marketing and/or maintenance activities.
- Getting experience on customer relationship management (CRM).

In case that the student decides to receive the 5 ECTS working for his/her own start-up (probably, as a part of a group of students) specific arrangements will be provided.

Finally, the I&E minor in the DS Master degree will offer the possibility to obtain the allocated 5 ECTS in specific courses included in the regular academic offer of the UPM. Possibilities in this case will be offered to students depending on their interest and curriculum (for instance, when they have previous work experience). The specific alternative education will be based on the offer from the Innovation management area of the UPM in the Telecom Engineering School, Informatics Engineering School or Industrial Engineering School. Possible topics are: financial management, IT sector regulation, operations research, simulation models, etc.

### 3.3. Subjects for the 2nd year
It is assumed that the students should have the knowledge and skills developed during the 1\textsuperscript{st} year. As one possibility is to receive students from other places which like to develop the 2\textsuperscript{nd} year in Madrid, strong interaction with exit universities is needed to ensure that no learning gaps could appear. The Summer School could be used, if needed, to complement specific elements.

This initial list of subjects does not consider optional courses.

\textbf{I&E thesis (6 ECTS)}

If possible, the topic of the I&E thesis should be selected by the student in connection to the master thesis and after agreement with his/her mentor.

The following procedure is proposed:

1. Students will propose the I&E thesis as the end of the 1\textsuperscript{st} year (if possible, during the Summer School).
   a. To facilitate the allocation process, the programme will offer to enrolled students a tentative list of topics; nevertheless, students will be able to propose their own ideas
2. The I&E DS management team discuss the students’ proposals and eventually allocate them to individual students.
   a. Team I&S thesis could be accepted if an internal distribution of responsibilities is clearly defined to support individual evaluation.
3. Tuition from a faculty member of the I&E DS minor will be allocated to any student/team.

\textbf{4. Learning schemes}

The relatively small number of students enrolled in the master per year (possibly from 10 to 20 in the 2015-2016 academic year up to a maximum of 30) can offer an opportunity to use advanced learning schemes during the development of the DS master. The approaches used for the I&E minor are:

- Extensive use of \textit{mentoring processes at the individual level}. All students will have a mentor allocated at the beginning of the 1\textsuperscript{st} year. For the second year, this role could be assumed (if it is a different person) by the director of the DS Master thesis. Activities to be conducted with the mentor will be:
  o Activities off-line (with frequent face to face individual or group meetings, etc.)
  o Activities on-line (through the use of videoconferencing system).

- \textit{Project-based learning} approach when useful for some subjects (not only in the I&E thesis)
  o This is the core learning method used for the Business Development Lab. And the proposed seminars. Students should develop their own (mentored) project.
  o The intention is to allocate a substantial part of the student’s activities to analyse case studies and to develop part of their own innovation processes (or business ideas) in order to practice with some concepts and tools.
  o The objective is also to provide students with skills on searching information on-line to facilitate self-study on some issues and to increase the time devoted to discussions and group-based activities.
• Full use of **Internet tools**
  - Some “learning modules” (part of a course) will be delivered on-line
    - “Modules” information will be loaded into Sakai platform
    - Students will have a virtual disk during the whole Master Degree where documents and home works assignments could be saved.
  - Cooperative working tools are embedded into the platform to facilitate group-based activities.
  - Specialised information searching tools (patents, references, companies, etc.)
    - Selected open software tools will be made available for students.

• Full use of a **blended learning approach** where some in-site modules could be implemented in short periods of time.
  - Intensive days could be also developed in other premises of the UPM or in associated entities when necessary.
  - In other cases, regular weekly distribution of activities was chosen to facilitate comprehension and home-work assignments.

• Interactive **discussions on case studies**
  - Selected case studies will be widely used across the I&E minor. The objective is to facilitate learning processes on documented successes or failures.
  - Invited speakers (if necessary by Skype if they were not physically available) will participate in courses to present and to discuss with students about their own companies and experiences.
    - Speakers could be IT managers, business angels, public officers, etc.
  - Sessions with students from other training centres in EIT ICT-Labs are also envisaged when they work on similar issues.
    - Contacts made during the summer School or organised ad hoc with other nodes involved in DS master degree were envisaged.

• **Visits to facilities.** This type of activity is considered essential to provide students with a pragmatic view of innovation management and trade-offs.
  - To business incubators from selected places.
  - To some IT companies participating on the programme.
  - To pilot plants or large facilities (i.e. large demonstrators or HPC centres).

• **Flexibility to adapt contents** (or the depth) to the interest of specific students
  - On the basis of the examples used in lectures
    - Some of them could change from one edition to another.
  - On the basis of in-depth analysis of case studies as a part of the courses evaluation procedures.
  - On the basis of the type of I&E Master thesis chosen by the student.
  - On the type of company, research centre or OTT for the internship period.

• **Students’ involvement** in learning interaction
  - Active participation in blogs and the ad hoc “DS social network”
  - Preparation of a number of “pitch elevator” sessions.
o Video recording of interviews or positions to master the media context
  ▪ Use of the 3D studio in the Campus of Montegancedo.

o Inter-cultural problem-solving
  ▪ If possible, students’ groups will have Spanish and foreign students during the 1st year.

To support the development of on-line material for the I&E DS courses of the EIT ICT-Labs the UPM will involve the UPM e-Learning unit, **GATE (Gabinete de Teleeducación)**.

5. **Pre-requisites for students**

According to the **UPM rules**, the following requirements will be used to select master students’ during the recruitment process for the 1st year (UPM acting as entry university) that complements the EIT ICT-Labs general ones:

1. Student should have a minimum of B2 level in English.
   a. This condition should be formally accredited, if necessary, by documents.
   b. Anyway, DS management could interview pre-selected students to confirm their language skills.

2. Students should have a diploma (Bachelor equivalent) degree on ICT (telecom, computer science or computer engineering studies or closely related field).
   a. Students with other diploma degrees could be accepted under some of the following conditions:
      i. Old Spanish diploma – level “Diplomado/Ingeniero Técnico” (3 years diploma)
      ii. Obligation to course some extra topics (educational complements) on a personal identification basis.
      iii. Accredited professional experience in ICT research and innovation.

3. For students coming to the UPM to complete their 2nd year of the DS Master degree, the requirements will be to have completed all the teaching requirements of the 1st year in the entry university.

6. **Assessment and grading procedures**

All students will receive an individual evaluation of academic activities with allocated ECTS based on their outcome at the end of each course.

Specific evaluation items will depend on the type of activity and the number of students involved (i.e. individual or team activity). Even if some activities will be worked in small teams (3-4 students) individual evaluation is always needed.

For the courses:

- 20% active participation in lectures/visits + 40% Presentation (group) + 40% examination/lecturing daily (individual).

For the Summer School:
These aspects will be common for all masters in the EIT ICT-Labs Master School.

- Peer evaluation of Product Operational Plan Presentation (25%) and expert evaluation
- Product Operational Plan Presentation (25%)
- Evaluation Product Operational Plan (50%).

For the I&E Thesis

- Presentation: 50%
- Peer evaluation: 50%

For internships in selected companies:

- Summary report of activities: 50%
- Report of the tutor in the company: 50%

By using the general rules of the UPM students will have a second opportunity to pass the exams and to accredit the sufficient knowledge to receive the ECTS of the different courses.

7. Interaction with DS major teaching activities

The whole set of activities described in this document cannot be deployed in an isolated way with respect to other activities carried out in the rest of technical DS major activities.

In order to ensure this relationship, the following aspects will be taken into account:

- The allocation of I&E thesis should be done after knowing the topic and objectives of the DS thesis (or at least both thesis could be assigned in parallel).
  - In this way, relationships could be clearly defined, ensured and monitored.
  - Both thesis will be developed during the second year but the selection should be done at the end of the first year.

- The selected case studies proposed in several courses of the I&E minor should be linked to companies where (big) data become an important asset.
  - Other cases will complement these ones even if they are not related to data sciences when they were appropriate to show other relevant aspects of innovative digital services.
  - Presentation of spin-off and start-ups.

- Individual works’ assignment should be distributed to topics related to the technical subjects even if the I&E perspective is different.

- Invited speakers from major actors in the field will participate in common activities between some major subjects and I&E subjects during the 2nd year.

- Visits to companies, spin-offs etc. related to ICT in order to understand how they have defined a sound technology-based strategy.

Furthermore, common educational activities with other technical courses will be organised to offer students a multidimensional perspective of large problems. These joint activities are
relevant to discuss how technology plays a prominent role but it is not the only necessary approach to fuel success.

More specifically, a set of case studies will be proposed by faculty members to facilitate the students the understanding of the role played by data in their respective businesses\(^3\). Some of these business cases to be analysed (all of them are intensive users of big data capture and analytics) are (some companies are very diversified and an effort will be one to select part of their activities more related to the goals and contents of the DS master degree):

- Amazon (e-book recommenders’ case)
- Google (Internet searching case)
- Facebook (social network case)
- Spotify (on-line music recommenders)
- Booking (hotel recommenders)
- IBM (smart cities big data)
- Telefónica (Imagenio, TV media)
- Canal + (Yomvi, TV media)
- Skype (videoconferencing system)
- Instagram (photo/video)

8. **Key performance indicators**

Quality assurance of organisational and learning processes in the DS Master Degree implementation is a major issue where the UPM is committed with.

To be able to monitor the quality along all activities related to the I&E minor for DS Master Degree, the following key performance indicators (KPIs) have been identified (to be monitored every academic year):

1. The number of eligible applications received for the 1\(^{st}\) academic year
   a. Minimum of 20 with the objective of 30 applications
2. The number of enrolled students for the 1\(^{st}\) academic year
   a. Minimum of 10 with the objective of 20 registered students
3. The number of students from outside the EU finally enrolled for the 1\(^{st}\) academic year
   a. Minimum of 5 with the objective of 50% of the registered students
4. The number of students to the 2\(^{nd}\) year from other ICT-Labs Universities
   a. Minimum of 10 with the objective of 20 registered students
5. The percentage of I&E ECTS passed by student (average)
   a. Minimum of 70%
   b. Minimum of 80% with an extra semester time to finalise the thesis
6. The percentage of students with a scholarship
   a. Minimum of 20%
7. The percentage of students abandoning the master
   a. Maximum of 20%
8. The percentage of master diploma students which found a job related to the DS Master after receiving the Diploma.

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\(^3\) In many cases, business models have been extensively published and they are accessible for students.
a. 50% in three months period
b. 80% in six months period

9. The number of technology-based spin-off or start-ups companies created by students during or in one year after finishing the DS master studies.
   a. A minimum of 2 every year

10. The events organised for international recruitment
    a. 6 events in Spain
    b. 3 events outside Spain (2 Portugal, 1 Latin America)

11. The impacts on media and web sites
    a. +100 impacts

The proposed values for these KPIs presented above will be refined in successive versions of the planning process in close contact with DS ICT-Labs Master School.

The UPM will prepare a Quality Assurance Monitoring Report with the follow-up of the proposed indicators every academic year. If necessary, the report will include a set of measures to fix some pending aspects.

Nevertheless, the analysis of these indicators cannot be done during the first academic year of the DS (i.e. 2015-2016 academic year); however, the collection of information and comparison on similar indicators from other EIT ICT-Labs nodes seems very useful to monitor the progress on the quality assurance systems and the performance of the DS master degree.

9. Faculty members

The UPM has enough faculty members with experience in the courses' contents included in the present I&E proposal in its payroll. Nevertheless, it is also very convenient to invite other experts from other institutions as lecturers for specific modules in order to complement internal views with external perspectives for the benefit of DS master students (see Annex III for short CVs of the professors and senior experts).

Three different categories of faculty members have been envisaged:

Professors of the UPM

1. Prof. Gonzalo León
   a. Coordinator of the I&E activities
   b. Director of the CAIT
2. Prof. Juan José Moreno
   a. Vice President for Graduate Studies
   b. Director for Institutional and Industrial Relations IMDEA Software Institute
3. Prof. Carlos López Barrio
   a. Prof. of Digital Electronics and Innovation
   b. Former CIO of Telefónica
4. Prof. Angel Agudo
   a. Assistant Prof. of Business organisation
   b. School of Telecom Engineering
5. Prof. Claudio Feijoo
   a. Prof. of Telecommunications Engineering
b. Delegate in UPM Shanghai Campus
6. Prof. Ricardo Jimenez
   a. Prof. of Informatics Engineering
   b. Responsible of DS Master Degree
   c. Entrepreneur

Senior experts from the UPM, FGUPM and IMDEA Software
(These experts will have the *venia dicendi* from the UPM)

1. Mr. Aristides Senra
   a. Director of CAIT programmes
2. Mr. Iván Martínez
   a. UPM responsible for Commercialisation (Innovatech programme)
3. Ms. Elisa Navarro
   a. UPM Responsible for Entrepreneurship (*actúaupm*)
4. Mr. Alberto Calero
   a. Senior IT manager
   b. Entrepreneur
5. Mr. Jesús Contreras
   a. ICT-Labs Business Development Accelerator
6. Ms. Ana Goicolea
   a. UPM Responsible for IP protection

External experts (some of them participates in CAIT courses) (informally contacted):

1. Mr. Benjamin Martinez (IP expert, Clarke & Modet)
2. Mr. Arturo Caneda (Sales expert, Caneda Shad Formación)
3. Mr. Antonio Manzanera (VC, Savior Venture Capital)
4. Mr. Jesús de Benito (Business angel)
5. Experts from ICT Labs companies (members of the Madrid node)
   a. José Mª Cavanillas (ATOS),
   b. Francisco Jariego (Telefónica R&D),
   c. Luis Ignacio de Vicente (Telefónica R&D)
   d. Juan José Hierro (Telefónica R&D)
   e. José Luis Angoso (INDRA)
6. Experts from other companies (e.g. from Santander, IBM, Everis, GMV, Clarke&Modet, Accenture) with current agreements with the UPM will be invited for specific issues.

Invited talks / Guest lectures

The programme will also invite to some well recognised people (CEOs or CIOs of some innovative companies, start-up founders, business angels, etc.) to give their views on their own experience or future trends.
ANNEX 1: Syllabus descriptions

<table>
<thead>
<tr>
<th>Name of Module: Introduction to innovation and entrepreneurship management</th>
<th>ECTS: 6</th>
<th>Module-ID: E1</th>
</tr>
</thead>
</table>

Person Responsible for Module (Name, Mail address):
Gonzalo León (gonzalo.leon@upm.es) & Carlos López Barrio (barrio@die.upm.es)

University: UPM

Departments: Support Centre for Technology Innovation (CAIT) and Electronics Department (School of Telecom Engineering)

1. Prerequisites for Participation
According to general prerequisites for ICT KIC master programs this is the first course for enrolled students in the DS Master Degree.

Students should have finished their Degree Project and also participated in the Initial Week.

2. Intended Learning Outcomes
Students after finishing the course will have:

- To know the main concepts, terminology and main issues related to entrepreneurship and innovation management in the IT sector.
- The capacity to identify and link the key issues related to project innovation management and, specifically on the data science field in open and cooperative innovation contexts.
- The ability to propose the right management structure and activities of an innovation project from its conception to the deployment to the outcomes to the market by using a specific management model adapted to the type of project.
- The ability to select the best approach to protect his/her technology depending on the type, maturity level and geographical constraints (through patents, industrial secret, etc.) and to understand their consequences in accessing or commercialising it.
- The capacity to understand the basis for entrepreneurship and the rationales for launching a technology-based company creation from previous R&D activities.
- The capacity to identify different sources for innovation funding and to select the most appropriate one
- The knowledge of main European Union (EU) policies and programmes to support research and innovation. The role played by the EIT.

3. Content
Design of main issues to be covered:

- Innovation processes
  - From the idea to the market: a long and risky way towards innovation
  - Relationship of innovation to research and development:
    - Integrated view within the knowledge triangle paradigm.
  - Nature of knowledge and value of R&D and innovation
    - Agents, Process, Results
    - Strategic Planning of R&D and innovation
    - Evaluation of innovation projects
    - Implicit project management issues

- Organisational structures to support innovation
  - Organization of R&D and innovation
    - Approaches for private and public entities
  - Organisational models to accommodate innovation processes
  - Large, SMEs and spin-off cases

- Innovation models
  - Types of innovation
    - technology innovation
    - organisational innovation
    - commercial innovation
  - Technology maturity levels (TRL)
    - Innovation dependence on maturity level
  - Open innovation approaches
    - Rationale
    - Open innovation platforms, services and products
    - Open software
  - ICT-Labs open innovation model

- Protection of technology
  - Protection schemes
    - Patents vs Industrial secret
    - Other schemes (e.g. semiconductor layout, biotech)
    - The case of software patents (legislation approaches)
  - Filing processes
    - Patent offices (e.g. EPO)

- Management of innovation projects
  - Life cycles models
  - Identification of milestones
  - Human resources
    - Skills and profiles
    - Management of international teams
  - Type of results
    - Prototypes
    - Proof of concept
    - Pilots and demonstrators

- Understanding market environment
  - Industrial sector analysis
  - SWOT
### Financial support for innovation
- How much and when money is needed?
  - Rounds (from seed capital to expansion)
- Sources of funding
  - F&F
  - Risk capital
  - Public funds
- EU public policies for innovation
  - Innovation in H2020
  - Innovation in the regional policy

### Substantial part of the contents will be based on the interest of students based on case studies, examples and geographical/sectorial specificities of this DS master course.
- In the I&E minor of the DS master degree it is necessary to collect a set of case studies (both successful or not) to discuss them with students. Case studies should cover a number of approaches, countries, etc.
  - Discussions with ICT entrepreneurs.
  - Discussions with IT companies with intrapreneurship programmes.
- Visit to technology-based incubators: UPM (actúaupm in the CAIT), Telefónica (Wayra) or the Business Incubator Centre of the ESA (BIC-ESA) in Madrid.

### 4. Teaching and Learning Methods

**Teaching and learning approach:**
- Balance between discussion and individual learning is searched for.
- Types of academic activities include:
  - Formal lectures,
  - Preparation of individual or group presentations
  - Evaluation of knowledge through exams, homework or classroom participation.
- Individual/team working assignments are focused on business cases extracted from the digital services field.
  - Students will work in teams composed by 3 students (exceptionally 2 or 4) in order to develop case studies or a joint business idea.

**ECTS distribution (6 ECTS)**
- Individual/group work: 2
- Applied lectures: 3
- Group training: 1
- Visits: Several facilities in Madrid

### 5. Assessment and Grading Procedures
The evaluation of the students will be based on three main sources:

- Continuous evaluation (50%): activities during lectures (classroom interactivity, short tests, etc.)
- Presentation of individual work (25%) (Analysis of personal business idea)
- Written exam (25%) (basic concepts understanding)

6. Workload calculation (contact hours, homework, exam preparation,..)

- 40 hours lecturing
- 40 hours for individual work
- 20 hours for group discussions
- 20 hours for visits and external activities
- 40 hours for exam preparation (including pitch elevator preparation)

Personal tuition will be offered to students or teams (average 1 hour/week)

7. Frequency and dates

This course will be organised during the first semester of the 1st year.

4 hours activity per week

8. Max. Number of Participants

The course is limited to a maximum of 30 students

Students will be distributed in teams of 2-3 (depending on the number of students in the course) for developing the planned group-based activities.

9. Enrolment Procedure

Enrolment is not independent of the general enrolment process of the DS master.

E1 is a mandatory unit of the I&E minor. All students in the DS master diploma must cover it.

10. Recommended Reading, Course Material
Students will use the following type of educational material

1. Slides used in the lectures
2. Selected recorded interviews with technology-based entrepreneurs
3. Selected recorded interviews with business angels
4. References of some case studies

Furthermore, the following selected bibliography should be available for students:

8. EIT documents

In successive academic years the individual work prepared by E1 students will be also available for other students’ cohorts.

### 11. Other Information (e.g. home page of module)

Course description is included in the E1 web page in the DS web site

Access to documents included in the ICT-Labs Master School web site will be also made available to students
**Name of Module:** Technology watch and competitive intelligence  
**ECTS:** 1  
**Module-ID:** E2

**Person Responsible for Module (Name, Mail address):**  
Gonzalo León (gonzalo.leon@upm.es)  
& Iván Martinez (ivan.martinez@upm.es)  
& Alberto Tejero (alberto.tejero@upm.es)

**University:** UPM  
**Department:** Support Centre for Technology Innovation (CAIT)

**1. Prerequisites for Participation**

According to general prerequisites for ICT KIC master programs.

Students should have finished and obtained the ECTS credits of the I&E basics course. At this stage, students don’t have defined their I&E thesis but they should express their interest on one technical area related to DS contents.

**2. Intended Learning Outcomes**

Students after finishing the course will have:

- The knowledge of the rationale and basic concepts related to technology watch and competitive intelligence.
- The ability to identify the way that information and communications technologies evolve over time.
- The ability to indentify the maturity level of a technology.
- The ability to develop and interpret a technology roadmap.
- The ability to use some techniques applied for technology watch and forecasting.
- The ability to understand the relationship of technology watch and competitive intelligence to support decision making in innovation management.
- The ability to identify and to describe the specificities of DS market and its technology dependencies.
- The capacity to incorporate technology watch units in a given organization.
- The ability to understand common barriers for technology transfer and absorption in the field of digital services.
3. Content

Description of main issues to be covered:

- Technology evolution
  - Technology maturation
  - Technology roadmaps
    - Co-evolving information and communications technologies
  - Technology forecasting
    - Rationale and use
    - Tools: SWOT, Delphi, Ishikawa diagrams
    - Scenario-building and back-casting
  - Introduction to quantitative approaches in forecasting: econometrics, exponential-smoothing techniques, s-curves, other.
    - Baseline and sensitivity analysis.
  - Forecasting technology disruptions

- Technology watch
  - Processes used
  - Internal and external
  - Scouting networks
  - Tools for technology watch
    - Patents and bibliographic searching (tools and data bases)
    - Technology maps

- Technology intelligence
  - Use in decision making
  - Trend-charts
  - Connection to the maintenance of IP portfolio
  - Road mapping of products/services

- Technology transfer
  - Technology absorption
  - Technology transition

- Work on a case study (group activity)
  - Big data in some sectors (e.g. health)
  - Visual analytics
### 4. Teaching and Learning Methods

**Teaching and learning approach:**
- Types of academic activities include
  - Formal lectures for technology watch and competitive intelligence,
  - Preparation of students’ presentations,
  - Discussions
  - And evaluation of knowledge.
- Individual/team working assignments are focused on some technology area (allocated to one group of students).
- Students will work in teams composed by 3 students (exceptionally 2 or 4) in order to develop a business idea.

**ECTS distribution (1 ECTS)**
- Individual group work: 0.5
- Applied lectures: 0.5
- Visits: Intelligence units of Santander and BBVA in Madrid

### 5. Assessment and Grading Procedures

The evaluation of the students will be based on three main sources:
- Continuous evaluation (50%):
  - On activities performed during lectures (classroom interactivity, short tests, etc.)
- Presentation of individual work (25%)
- Written exam (25%)
  - Basic concepts understanding)

### 6. Workload calculation (contact hours, homework, exam preparation,..)

8 hours lecturing,
15 hours for individual work and
7 hours for group discussions

### 7. Frequency and dates

This course will be organised during one week (intensive format) during the second semester of the 1st year.

### 8. Max. Number of Participants

The course is limited to a maximum of 30 students
9. Enrolment Procedure

Enrolment is not independent of the general enrolment process of the DS master.

E2 is a mandatory unit of the I&E minor.

All students in the DS master diploma must cover it.

10. Recommended Reading, Course Material

Students will use the following type of educational material

5. Slides used in the lectures
6. Selected recorded interviews with technology-based entrepreneurs
7. Selected recorded interviews with business angels
8. References of some case studies

Furthermore, the following selected bibliography should be available for students:

   http://www3.interscience.wiley.com/journal/123275929/abstract
2. Ramona-Mihaela MATEI, Ioan RADU Conceptual Relationship between Information and Communication Technologies and Competitive Intelligence Activities
4. HAMDI Hassen - RAMRAJSINGH Athissingh: Veille et intelligence économique au sein des TPE : vers l’appropriation des outils gratuits
   http://www.itu.int/dms_pub/itu-t/oth/23/01/T23010000220001PDFe.pdf

In successive academic years the individual work prepared by E1 students will be also available for other cohorts.

11. Other Information (e.g. home page of module)

Course description is included in the E2 web page in the DS web site
Access to documents included in the ICT-Labs Master School web site will be also made available to students
Name of Module: Entrepreneurship  
ECTS: 3  
Module-ID: E3

Person Responsible for Module (Name, Mail address):
Ángel Agudo (af.agudo@upm.es) & Aristides Senra (aristides.senra@upm.es) & Elisa Navarro (elisa.navarro@upm.es)

University: UPM  
Department: Dep. of Organisation (School of Telecom Engineering, UPM) and Support Centre for Technology Innovation (CAIT)

1. Prerequisites for Participation

According to general prerequisites for ICT KIC master programs.

Students should have finished the E1 (I&E basics) and E2 (Technology watch and Competitive intelligence) courses.

2. Intended Learning Outcomes

Students after finishing the module will have:

- The ability to identify innovative business ideas inside (intrapreneur) or outside a pre-existent firm (entrepreneur).
- The ability to explain his/her technology-based business ideas to external investors
- The ability to write non-technical information about the business idea for investors or users
- The ability to write a complete business plan by using pre-defined models
- The ability to understand the necessary steps to create a sustainable technology-based company
- The ability to get external funds to finance the development.
- The capacity to present media material on Internet about their idea
### 3. Content

**Description of main issues to be covered:**

1. **Awareness on entrepreneurship and intrapreneurship**
   - Relevance for innovation process
   - Relevance for career development

2. **Types of technology-based companies**
   - Spin-offs vs Start-ups
   - Other SMEs created by merging or acquisitions

3. **Presentation of business ideas**
   - Conditions for developing a (successful) business idea
   - Preparation of elevator pitches

4. **Creation of a Business Plan**
   - Business idea summary
   - Contents, use of specific models

5. **Conditions to launch a new company (in Spain)**
   - Legal conditions
     - Types of technology-based companies
     - Internal and external responsibilities
   - Taxation context

6. **Financial support**
   - Public administrations
   - Risk and venture capital
   - Crowdfunding

7. **Analysis of student business ideas**
   - This aspect is highly useful but it is not mandatory during the course to complete a business plan
   - Elevator pitches (groups of students)

8. **Supporting the first steps of the new company**
   - The role of business incubators
   - The role of venture capitalists (business angels, risk capital firms, ...)
   - Access to public funds
4. Teaching and Learning Methods

Teaching and learning approach:
- Types of academic activities include:
  - Formal lectures
  - Preparation of presentations
  - Evaluation of knowledge.
- Individual/team working assignments are focused on consolidating a first business idea
  - Group of students should be motivated to find a business idea in relation to the contents of the DS Master Degree.
  - This effort will continue during the 2nd year during the development of the I&E thesis.
- Students will work in teams composed by 3 students (exceptionally 2 or 4) in order to develop a business idea.

ECTS distribution (2 ECTS)
- Individual group work: 1
- Applied lectures: 0.5
- Pitch training: 0.5
- Visits: WAYRA incubator in Madrid

5. Assessment and Grading Procedures

The evaluation of the students will be based on three main sources:
- Continuous evaluation (50%): activities during lectures (classroom interactivity, short tests, etc.)
- Presentation of individual work (25%) (Analysis of personal business idea)
- Written exam (25%) (basic concepts understanding)

6. Workload calculation (contact hours, homework, exam preparation,...)

20 hours lecturing
30 hours for individual work
10 hours for group discussions
30 hours for exam preparation (including pitch elevator preparation)
Personal tuition will be offered to students or teams (average 1 hour/week)

7. Frequency and dates
This course will be organised during one month in the second semester of the 1st year.
4 hours activity per week

8. Max. Number of Participants

The course is limited to a maximum of 30 students

9. Enrolment Procedure

Enrolment is not independent of the general enrolment process of the DS master.
E1 is a mandatory unit of the I&E minor. All students in the DS master diploma must cover it.

10. Recommended Reading, Course Material
Students will use the following type of educational material

1. Slides used in the lectures
2. Selected recorded interviews with technology-based entrepreneurs
3. Selected recorded interviews with business angels
4. References of some case studies

Furthermore, the following selected bibliography should be available for students:

8. EIT documents
9. UIIN documents
10. Legislation on entrepreneurship in the EU

In successive academic years the individual work prepared by E1 students will be also available for other cohorts.

11. Other Information (e.g. home page of module)

Course description is included in the E3 web page in the DS web site

Access to documents included in the ICT-Labs Master School web site will be also made available to students
### Name of Module: Commercialisation of technology

| ECTS: 3 | Module-ID: **E4** |

### Person Responsible for Module (Name, Mail address):

**Claudio Feijoo** ([claudio.feijoo@upm.es](mailto:claudio.feijoo@upm.es)) &

**Aristides Senra** ([aristides.senra@upm.es](mailto:aristides.senra@upm.es))

### University: **UPM**

### Department: **Support Centre for Technology Innovation (CAIT)**

### 1. Prerequisites for Participation

According to general prerequisites for ICT KIC master programs.

Students should have finished and obtained the ECTS corresponding to the following courses:

- **I&E basics course (E1)**
- **Technology watch and competitive intelligence (E2)**
- **Entrepreneurship (E3)**

Exceptionally, students could participate if E3 assignments are not completed yet.

### 2. Intended Learning Outcomes

Students after finishing the module will have:

- The ability to think in terms of the exploitation of research results (having in mind the “idea to the market” concept)
- The basis for the exploitation of research results and moving forward product and services to the market by using a set to techniques
- The ability to identify and select the most appropriate techniques for the type of results to be marketed.
- The ability to use some tools used to market analysis and commercialization planning.
- The basis for understanding the key issues for the exploitation and negotiation of intellectual property.
- The ability to write a license contract.
- The knowledge of some commercialisation approaches used by IT industries, research centres and universities.
3. Content

Description of main issues to be covered:

- The exploitation of research results: industrial and academic exploitation (differences)
- Technology deal flow identification in an organisation
  - Connection to technology watch
  - Technology transfer Offices (OTT)
- Product development process
  - From prototypes to industrial proof of concepts
  - Lean approach, key metrics and canvas model (link with BPL)
  - The role of experimentation platforms
- Market analysis
  - Market segmentation
  - Sectorial vs geographical approach
  - Competitors and providers
  - Market evolution forecast
- Alternatives for hitting the market: new business models
  - Spin-off creation
  - Licensing process
  - Technology integration
- Commercialisation plans
  - Commercial approaches (relevance to the type of technology)
  - Presentation of projects
  - Negotiation of conditions
  - Pricing techniques
  - International expansion
- Negotiation of IPRs
  - IP in the data science domain
  - Licensing contracts (models)
  - Legal aspects (confidentiality, non-disclosure agreements, responsibilities, etc.)
  - Compliance with international regulations
- Case studies
  - From University: UPM Innovatech
  - From ICT-Labs
  - From private firms (e.g. Telefónica, INDRA, ATOS)
  - From some selected spin-offs
### 4. Teaching and Learning Methods

**Teaching and learning approach:**
- Types of academic activities included formal lectures, teamwork, and preparation of presentations and evaluation of knowledge.
- Individual/team working assignments are focused on consolidating a first business idea (notice that this effort will continue during the 2nd year).
  - Students will work in teams composed by 3 students (exceptionally 2 or 4) in order to develop a business idea.
  - If possible, the course will be based on one of the technologies under development by the group of students. If this approach was not possible, other immature technologies will be used.

**ECTS distribution (3 ECTS)**
- Individual group work: 1
- Applied lectures: 0.5
- Case study: 1.5

### 5. Assessment and Grading Procedures

The evaluation of the students will be based on three main sources:
- Continuous evaluation (50%): activities during lectures (classroom interactivity, short tests, etc.)
- Presentation of individual work (25%) (Analysis of personal business idea)
- Written exam (25%) (basic concepts understanding)

### 6. Workload calculation (contact hours, homework, exam preparation,..)

- 20 hours lecturing
- 40 hours for individual work
- 10 hours for group discussions
- 30 hours for exam preparation (including pitch elevator preparation)

Personal tuition will be offered to students or teams (average 1 hour/week)
### 7. Frequency and dates

This course will be organised during one month during the second semester of the 1st year.

4 hours activity per week

### 8. Max. Number of Participants

The course is limited to a maximum of 30 students

### 9. Enrolment Procedure

Enrolment is not independent of the general enrolment process of the DS master.

E4 is a mandatory unit of the I&E minor. All students in the DS master diploma must cover it.

### 10. Recommended Reading, Course Material

Students will use the following type of educational material

1. Slides used in the lectures
2. Selected recorded interviews with technology-based entrepreneurs
3. Selected recorded interviews with business angels
4. References of some case studies

Furthermore, the following selected bibliography should be available for students:

1. H2020 documents on IPR
2. OEMP and EPO guidelines
3. Patent articles

In successive academic years the individual work prepared by E1 students will be also available for other students’ cohorts.

### 11. Other Information (e.g. home page of module)

Course description is included in the E4 web page in the DS web site

Access to documents included in the ICT-Labs Master School web site will be also made available to students
### Design of I&E Modules in the Data Science Master Degree. EIT ICT Labs

#### Name of Module: Digital-based services creation

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Module-ID</th>
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<tbody>
<tr>
<td>2</td>
<td>E5</td>
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#### Person Responsible for Module (Name, Mail address):

Gonzalo León (gonzalo.leon@upm.es) &
Alberto Calero (acalero@gmail.com)

#### University: UPM

#### Department: Support Centre for Technology Innovation (CAIT) and School of Telecommunications Engineering

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1. **Prerequisites for Participation**

Optional course (with E6)  
According to general prerequisites for ICT KIC master programs.

Students should have finished:
- E1: I&E basics course
- E2: Technology watch
- E3: Entrepreneurship
- E4: Commercialisation of technology

Students will work in parallel in the course E6 depending on the chosen course.

2. **Intended Learning Outcomes**

Students after finishing the module will have:

- The ability to define a digital service and its components to be marketed
- The technical knowledge to select the most relevant components and/or contributors
- The ability to design a market strategy for the service at the international level
- The knowledge of supporting the user to the end-user.
- The ability to pack the service with post-sale services (maintenance, upgrade, etc.)
3. Content

Description of main issues to be covered:

- Introduction to the specificities of marketed digital products and services
  - Digital services evolution (versioning, service life cycle).
  - Technology integration and evolution
    - HW/SW embeddedness, open platforms, etc.
  - Services components
- Application of new economic theories on platforms:
  - Multi-sided markets
    - The ecosystem approach: collaboration and competition
    - Disintermediation and re-intermediation of value chains
    - Multi-sided markets
  - Strategic analysis: how to lead a platform
  - Interoperability and de facto and de iure standards
  - How platforms are supported (e.g. FI-WARE case)
- Risk management of innovation processes
  - Risk identification and quantification
  - Risk mitigation
- Personal assignments to students
  - Work on a digital service proposed by students
  - If possible, in connection to their Master thesis in DS
- Business plans of specific spin-offs or start-ups proposed by students
  - Students should present a business idea to be launched as a company in a digital technology-based domain

4. Teaching and Learning Methods

Teaching and learning approach:

- Types of academic activities included formal lectures, teamwork, and preparation of presentations and evaluation of knowledge.
- Individual/team working assignments are focused on consolidating a first business idea (notice that this effort will continue during the 2nd year).
  - Students will work in teams composed by 3 students (exceptionally 2 or 4) in order to develop a business idea.

ECTS distribution (2 ECTS)

- Individual/group work: 1
- Applied lectures: 0.5
- Pitch training: 0.5
5. Assessment and Grading Procedures

The evaluation of the students will be based on three main sources:

- Continuous evaluation (50%): activities during lectures (classroom interactivity, short tests, etc.)
- Presentation of individual work (25%) (Analysis of personal business idea)
- Written exam (25%) (basic concepts understanding)

6. Workload calculation (contact hours, homework, exam preparation,..)

10 hours lecturing
20 hours for individual work
5 hours for group discussions
20 hours for exam preparation (including pitch elevator preparation)

Personal tuition will be offered to students or teams (average 1 hour/week)

7. Frequency and dates

This course will be organised during one month during the second semester of the 1st year.
It is basically a lab-based course and lectures will be allocated in very small sessions of mentoring.

8. Max. Number of Participants

The course is limited to a maximum of 30 students

9. Enrolment Procedure

Enrolment is not independent of the general enrolment process of the DS master.
E1 is a mandatory unit of the I&E minor.
All students in the DS master diploma must cover it.
## 10. Recommended Reading, Course Material

Students will use the following type of educational material:

1. Slides used in the lectures
2. Selected recorded interviews with technology-based entrepreneurs
3. Selected recorded interviews with business angels
4. References of some case studies

Furthermore, the following selected bibliography should be available for students:

1. Articles and studies
2. Information from digital services available in the market

In successive academic years the individual work prepared by E1 students will be also available for other cohorts.

## 11. Other Information (e.g. home page of module)

Course description is included in the E5 web page in the DS web site

Access to documents included in the ICT-Labs Master School web site will be also made available to students
Name of Module: Launching of IT products and services  
ECTS: 2  
Module-ID: E6

Person Responsible for Module (Name, Mail address):
Claudio Feijoo (claudio.feijoo@upm.es) & Julián Chaparro (julian.chaparro@upm.es)

University: UPM  
Department: UPM Shanghai Campus, and UPM Organisation Department (School of Telecom Engineering)

1. Prerequisites for Participation
Optional course (with E5)
According to general prerequisites for ICT KIC master programs.
Students should have finished
- E1: I&E basics course
- E2: Technology watch and competitive intelligence
- E3: Entrepreneurship
- E4: Commercialisation of technology

Students will be enrolled in parallel with E5 course depending on the chosen course.

2. Intended Learning Outcomes
Students after finishing the module will have:
- The ability to define a marketing plan and its international expansion
- The ability to negotiate with other actors in the ICT field the participation in the value chain
- The ability to create a commercial structure
- The criteria to define a pricing strategy
- The knowledge to obtain information on initial users
3. Content

Description of main issues to be covered:

- **Understanding the sector: towards digital economy**
  - Global market
  - Global organisations
  - Mergers and acquisitions: dynamic restructuring

- **Structure of the ICT sector**
  - Main stakeholders
    - Incumbents and new entrants
    - Actors in value chains
  - Regulation (in the EU) for new products
    - EC competences (EU Treaties)
    - Industrial policies
  - Global markets
    - Indicators from the EU Digital Agenda

- **Digital marketing**
  - Channels
  - Market surveys
  - The new role of users

- **What happens when the product/service is already in the market?**
  - Lean approach
  - Metrics and dashboard
  - Different routes to success

- **Personal assignments to students**
  - E.g. practical case on launching an application based on data analysis

4. Teaching and Learning Methods

Teaching and learning approach:

- Types of academic activities included formal lectures, teamwork, and preparation of presentations and evaluation of knowledge.
- Individual/team working assignments are focused on consolidating a first business idea (notice that this effort will continue during the 2nd year).
- Students will work in teams composed by 3 students (exceptionally 2 or 4) in order to develop a business idea.

**ECTS distribution (2 ECTS)**

- Individual group work: 1
- Applied lectures: 0.5
- Pitch training: 0.5
## 5. Assessment and Grading Procedures

The evaluation of the students will be based on three main sources:

- Continuous evaluation (50%): activities during lectures (classroom interactivity, short tests, etc.)
- Presentation of individual work (25%) (Analysis of personal business idea)
- Written exam (25%) (basic concepts understanding)

## 6. Workload calculation (contact hours, homework, exam preparation, ...)

10 hours lecturing

20 hours for individual work

5 hours for group discussions

20 hours for exam preparation (including pitch elevator preparation)

Personal tuition will be offered to students or teams (average 1 hour/week)

## 7. Frequency and dates

This course will be organised during one month during the second semester of the 1st year.

4 hours activity per week

## 8. Max. Number of Participants

The course is limited to a maximum of 30 students

## 9. Enrolment Procedure

Enrolment is not independent of the general enrolment process of the DS master.

E6 is a mandatory unit of the I&E minor. All students in the DS master diploma must cover it.
10. Recommended Reading, Course Material

Students will use the following type of educational material:

1. Slides used in the lectures
2. Selected recorded interviews with technology-based entrepreneurs
3. Selected recorded interviews with business angels
4. References of some case studies

Furthermore, the following selected bibliography should be available for students:

1. Articles from business cases
2. 
3. 

In successive academic years the individual work prepared by E1 students will be also available for other cohorts.

11. Other Information (e.g. home page of module)

Course description is included in the E6 web page in the DS web site

Access to documents included in the ICT-Labs Master School web site will be also made available to students
**Name of Module:** Summer School  
**ECTS:** 4  
**Module-ID:** E7

**Person Responsible for Module (Name, Mail address):**  
Gonzalo León (gonzalo.leon@upm.es) & Ricardo Jiménez (rjimenez@fi.upm.es)

**University:** UPM  
**Department:** Support Centre for Technology Innovation (CAIT)

### 1. Prerequisites for Participation

According to general prerequisites for ICT KIC master programs. Students should have finished the I&E basics course.

### 2. Intended Learning Outcomes

Students after finishing the module will have:

- The ability to combine technical and non-technical approaches
- To compare approaches used in other countries

### 3. Content

The contents of the Summer School will be defined every year.  
This information will be made available for students in advance to select optional seminars if that option is open.

### 4. Teaching and Learning Methods

Teaching and learning approach:

- Types of academic activities included formal lectures, teamwork, and preparation of presentations and evaluation of knowledge.
- Students will work in teams composed by 3 students (exceptionally 2 or 4) in order to develop a business idea.

**ECTS distribution (2 ECTS)**

- Individual group work: 1
- Applied lectures: 0.5
- Pitch training: 0.5
5. Assessment and Grading Procedures

The evaluation of the students will be based on three main sources:

- Continuous evaluation (50%): activities during lectures (classroom interactivity, short tests, etc.)
- Presentation of individual work (25%) (Analysis of personal business idea)
- Written exam (25%) (basic concepts understanding)

6. Workload calculation (contact hours, homework, exam preparation,...)

Distribution of time and effort in the Summer School will be defined at the beginning of the academic year.

7. Frequency and dates

This course will be organised during 3 intensive weeks in one place in Europe.

Places and dates could change every year during the month of July.

8. Max. Number of Participants

The course is limited to a maximum of 30 students

9. Enrolment Procedure

Enrolment is not independent of the general enrolment process of the DS master.

E7 is a mandatory unit of the I&E minor. All students in the DS master diploma must cover it.

10. Recommended Reading, Course Material

Students will use the following type of educational material

1. Slides used in the lectures
2. Selected recorded interviews with technology-based entrepreneurs
3. Selected recorded interviews with business angels
4. References of some case studies

Selected bibliography will be defined and made available for students according to the topics covered every year.

In successive academic years the documents generated in the Summer School and the individual work prepared by E7 students will be also available for other cohorts.

11. Other Information (e.g. home page of module)
Course description is included in the E7 web page in the DS web site.

Access to documents included in the ICT-Labs Master School web site will be also made available to students.
ANNEX 2: Faculty members

**Gonzalo León** is the CAIT-innovatech Director and Rector’s Deputy for Strategic Programs. He is professor of Telematics Engineering and has worked for internationalization strategy and technology transfer of several multinational companies. Former General Secretary of Science Policy, Deputy Director General for International Relations Vice director at the Office of Science and Technology of the Prime Minister’s Office and Vice President for Research at the UPM. He has been President of the Space Research Advisory Group in the European Commission, President of the expert group of the Lisbon Strategy in R & D, President of the Expert Group on Research Infrastructures and rapporteur of the G8 Research Infrastructures Senior Officials Group. Today he is the Spanish representative in the Strategic Forum for International Cooperation of the European Union and adviser of the Secretary of State of Science, Technology and Innovation. He has worked for the governments of South Africa, Mexico and Morocco in the evaluation and design of science and innovation policies. Gonzalo León has been member of the Board of Trustees of several companies and foundations and in Advisory Boards of others.

**Francisco J. Jariego** is Director of Industrial IoT (Internet of Things) and Member of the Executive Committee of Telefonica I+D (Research & Development). Francisco holds a Ph. D in Physics from Autónoma University of Madrid and has developed his professional career in the ICT industry, where he has participated and leaded many different research and innovation projects with focus in mathematical modeling and optimization, operations research, software development, information economics and R&D management and strategy.

He served as Director of Technology Strategy for Telefonica I+D from 2009 to 2012, being an active contributor to the definition of the current Telefonica R&D and innovation strategy that led to the creation of Telefonica Digital in 2011. Before his current position in Telefonica, Francisco was the Enablers & Technology Director at Telefonica Digital.
Carlos A. López Barrio is Professor of Digital Electronics and Innovation at the Telecommunication Engineering School (UPM), where he heads the Electronic Engineering Department and the “Technological Innovation” Group. He has held professional posts at Telefónica (Telecom Operator): Director of Innovation (R&D Subsidiary, Spain), from 1988 to 1997, where he was responsible for the development of new telecom services and infrastructures, HW and SW technologies as well as the definition of a medium to long term vision on technology and telecom services for Telefónica, and Vice General Director of Technology and Networks (Corporate and Spanish Subsidiary), from 1997-2004. Former entrepreneur in two startups (IforTV and SpeedUP Solutions).

Carlos López Barrio has been member of the Board of Directors of two companies and two Foundations and in the Advisory Boards of others. From June 1995 to May 1998 he has been one of the Spanish delegates in the IT Committee of the European Commission, Spanish delegate in the European Debate on the Green Book on Innovation, promoted by the European Commission (1996), and, from 2001 to 2002, member of the ISTAG (Information Society Technologies Advisory Group) of the European Commission.

Ángel F. Agudo Peregrina is M.Sc. and Ph.D. in Telecommunication Engineering at the Universidad Politécnica de Madrid, Master in Domotics and Digital Home by the UPM and Master in Economics and Innovation Management by the UPM, UCM and UAM. Ángel is Assistant Professor at UPM School of Telecommunication Engineering.

He is member of the “Innovation, Industrial Property Rights and Technology Policy” Research Group at the UPM and Member of the “Information Technologies for Business Management” Group for Innovations in Education at the UPM. Ángel focuses his research on customer segmentation and adoption of digital technologies, and on innovation and entrepreneurship. He has worked in several National, EU and International funded projects in collaboration with Public Administrations and International Companies and is author of several books, papers and articles.
**Iván Martínez** is Telecommunication Engineer and Master in Business Administration by the Technical University of Madrid (Spain).

He has previous experience of more than five years in project management and information technology consulting in several IT companies like Indra and Thales, being involved in projects for telco, banking or public clients (Telefónica, Bankia, or AENA, among others).

Nowadays he is a management specialist and advises new commercialization ventures in the area of Technology Transfer at the Technical University of Madrid. He has also led the launching of the UPM Innovatech Program, that provides supporting services for the commercialization of technologies generated in the UPM with potential application in the market, ranging from the detection of innovative technologies, developing commercial dossiers based on them, the specialized training in marketing and sales of technology, to advising in the final negotiation of commercial contracts.

Besides, he has advised more than 70 high technology based and/or innovative new commercialization projects. Collaborating with the UPM Technology Intelligence unit, he has managed or got involved in the development of more than 10 technology consulting reports.

**Claudio Feijóo** holds an MSc and PhD in Telecommunication Engineering and an MSc in Quantitative Economics. He is professor at the Technical University of Madrid (UPM) where he researches on the future socio-economic impact of emerging information society technologies, in particular, from an ultra-broadband, mobile and content perspective. Currently he serves as Co-Director of the Sino-Spanish Campus at Tongji University in Shanghai. He is also the co-founder and coordinator of the ICT area in the international master programme on city sciences. He spent two years at the Institute for Prospective Technological Studies of the European Commission researching on the future prospects of mobile content and applications. He also directed the Chair in Telecommunications Regulation and Information Society Public Policies at UPM. He participated in the information society development plans and broadband deployment strategies while being adviser for the Spanish State Secretary on Telecommunications and Information Society. For three years he was also dedicated to launch a university spin-off devoted to the transfer of know-how in technology, media and telecommunications.

He has been involved in numerous research, development and consulting projects, both public and private, in Europe, Latin America, North of Africa and Asia. He lectures regularly in international seminars and postgraduate courses and has authored more than 200 publications in books, journals and conferences. He is guest lecturer at IE Business School on digital business and disruptive ICT, and member of the board of the International Telecommunications Society.
Jesus Contreras, PhD Computer Science (2004) at the Technical University of Madrid, Spain and MBA degree in 2008. He works as Business Developer Accelerator for the EIT ICT Labs (www.eitictlabs.eu) at IMDEA Software Institute (software.imdea.org). He has experience of more than 15 years as Director of Operations, R&D and Business Development in several hedge technology companies: playence, Denodo Technologies, Intelligent Software Components and Software A.G.. In 1996 he started as an assistant researcher in the Intelligence Systems Research Group (www.isys.dia.fi.upm.es) where he participate in projects oriented towards the development of Knowledge Based Systems and Advanced Artificial Intelligence Applications. During his career he published articles and books about semantic web, natural language processing and human-computer interaction.

Luis Ignacio Vicente del Olmo Industrial Engineer, PhD in Physics Sciences (Electronic specialist). Graduated in Economy of Telecommunications, Master in Analysis and Management of Science & Technology. Degree in Innovation Management. Specialist in Innovation Economy. Graduated in European Communities by the Diplomatic School of the Spanish Ministry of Foreign Affairs.

As laboral experience, 25 years working on topics related with R&D & Innovation Management mainly at Telefonica, one of the most important telco operators. Currently, he is Return on Innovation Manager at Telefonica I+D. These responsibilities include the Telefonica Patent Office, the strategy definition about R&D Public Policies. Member of relevant Spanish, European & International Boards related with R&D Management. President of Spanish Technology Platform es.internet where participate more than 400 companies that develop new products on Internet.
Aristides Senra, holds a MSc in Industrial Engineering (2002) and a MBA (2006) both from Technical University of Madrid (UPM). In 2004 he got a grant to develop a project of Entrepreneurial Marketing and Sales for Technology Companies in the Massachusetts Institute of Technology. He has worked in companies such as Indra and ABS and currently is the Director of Innovation and Entrepreneurship Programs in the UPM.

In 2004 he co-founded the Business Plan Competition actúaupm. In ten editions, the actúaupm Competition has supported the creation of 164 new companies that have attracted more than 37 million from investors. Additionally, he teaches Master subjects as strategy, marketing and business opportunity and has participated in the launching of three start-ups.

Prof. Dr. Juan José Moreno-Navarro is Vice-president for Academic Planning and Doctorate at UPM and the Director for Industrial and Institutional Relations of the IMDEA Software Institute. Since 1996 is Full Professor at the Computer Science Department of the UPM. Juan José Moreno-Navarro is chair of the Spanish Software Engineering Society. He has been Director General for University Policy (Ministry of Education, 2009-2012), Director General for Technology Transfer and Enterprise Development (Ministry of Science and Innovation, Secretary General for Innovation, 2009) and Director General of Planning and Coordination (Ministry of Science and Innovation, Secretary of State of Research, 2008-2009). In that period, he was chair of the National Committee for Research Activity Evaluation, has led the implementation of numerous research and technology infrastructures, and has organized and coordinated several Spanish research programmes and calls both for the academic and the industrial communities.

From 2001 to 2006, he cooperated with the Ministry of Education and Science, where he was responsible for the ICT research program for 3 years and responsible for international relations in the ICT area, committee member of the IST 6th Framework Programme of the EU, Spanish National Contact Point for FP7, and member of the ICT committee of COST.

His main area of scientific activity focuses on all aspects of declarative technology and software development. On these issues, he has obtained numerous publications in high international level conferences, books and journals. He has also participated and led several national and international research projects. He has organized, served as member in editorial boards and
program, and given lectures and invited talks at numerous conferences and journals in the field of IT.

ALBERTO CALERO NARBÓ. Since 2011, Alberto is president and founder of A&J Engineering and Partner of several international technology companies like Maven7, Reputation.com. Skyhigh, Bouju, Nextibs, Quantis, Next Limit, Popinnow among others. A&J is focused on business disruptive solutions in Cloud Computing, Big data, Health, Energy and Telecommunications and Network Science. He is member of the board of e-economic/ HG Capital

He was a member of France Telecom Spain/ Orange/Amena Management Committee, Director of the CEO Office and General Director of the Mobile data, contents and services Division. He worked for other companies such as Grupo Prisa, (El Pais, Canal+, Cadena Ser...), as Innovation and Technology General Director reporting to the CEO and being member of the Management Committee; Kodak, as Marketing Director (Spain and Portugal); Hewlett-Packard, as Innovation Network Worldwide Director, European Director of New Internet Services, Marketing Director for South Europe, and IT director. During his professional career has been awarded with several industry prices and honours. (IEEE research, IDC best Marketing Mgr...).

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He has co-authored a book titled "Database Replication" and over 100 papers in international conferences and journals. He has been recipient of several awards: EIT ICT Labs Idea Challenge 2014 3rd award to the best startup idea in the future computing topic for LeanXcale and best Madrid European project for the LeanBigData project. He has been invited speaker at Oracle, Microsoft, Cloudera, HortonWorks, EMC-GreenPlum, HP, Ericsson, Telefonica, etc.