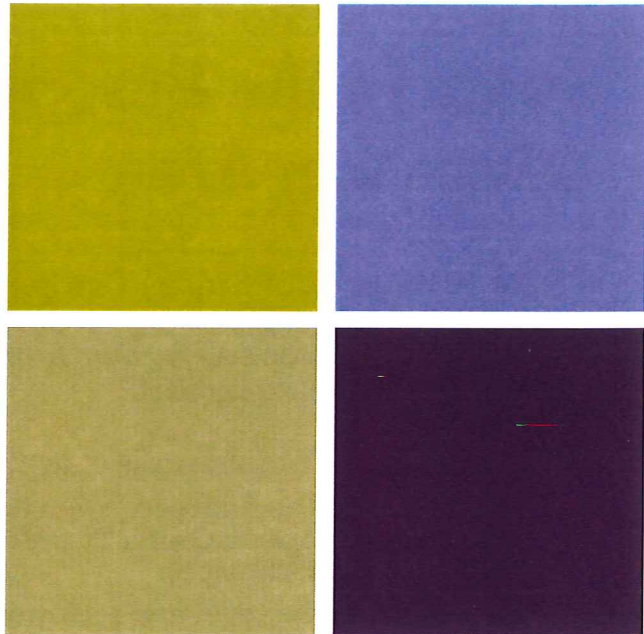


+ Developments in the Engineering Doctorate in Spain



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+ Spain in the European Higher Education Area

- Like 30 other countries in Europe, since 1999 Spain has been immersed in transforming its university education system to adapt to the *European Higher Education Area* (EHEA), a process that will culminate in 2010.
- The objectives of this project are:
 - To harmonise the degree system through a three level structure, by taking the European Credit Transfer System (ECTS), as a measure of academic performance.
 - To guarantee the level and recognition of the qualifications with the purpose of facilitating university student mobility and integrating postgraduates into the single European labour market.
- A fundamental part of this degree structure are the doctoral studies.
 - The ultimate purpose is to provide advanced training in research techniques

+ The Spanish university system

- There are over 70 universities in Spain
 - Around 50 public and over 20 private.
 - Distributed throughout Spain, but concentrated in Madrid, Barcelona and Valencia areas.
- The new structure for university studies has three cycles:
 - Bachelor, Master and Doctorate.
- The degrees are linked to different the branches of learning:
 - Arts and Humanities
 - Sciences
 - Health Sciences
 - Social and Juridical Sciences
 - Engineering and Architecture

+ Undergraduate studies

- The Bachelor Degree studies which lead the qualification of undergraduate
 - Replace the previous 3-year and 5-year Degrees
 - and the Technical Engineering Degree (3 years also).
 - 240 ECTS credits → 4 academic years
- The Bachelor Degree is structured as follows:
 - Basic education subjects (minimum 60 credits)
 - Compulsory subjects
 - Elective subjects
 - Internships (maximum 60 credits)
 - Final project or thesis (minimum 6 credits and a maximum of 30)
 - Recognised cultural and social activities (maximum 6 credits)

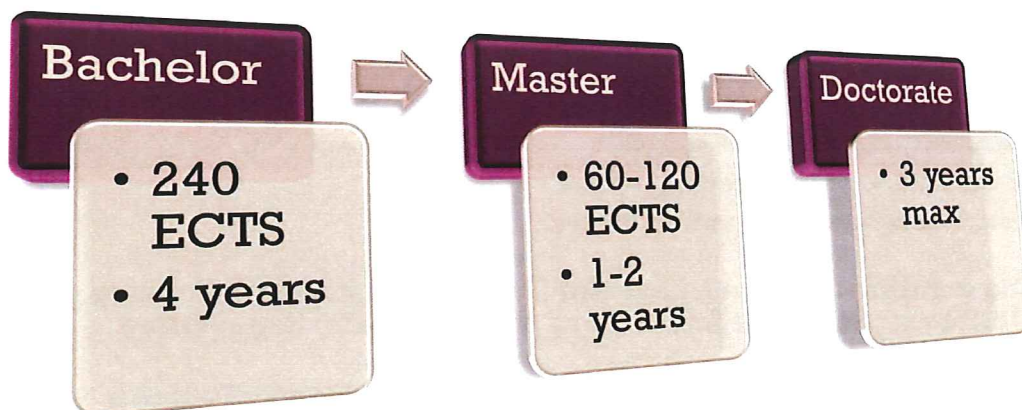
+ Postgraduate studies

- University Master's Degree → 2nd University Study Cycle.
- The ultimate purpose of the Master's courses is:
 - To acquire advanced training,
 - either specialised or multidisciplinary,
 - that is oriented towards an academic or professional specialisation or towards encouraging students to undertake research.
- These studies require 60 to 120 credits
 - acquired during one or two academic years
 - + Ms Thesis, worth between 6 and 30 credits.
- In Spain, the combination of the Bachelor Degree plus its corresponding Master's Degree replaces the former long cycle (5 years) Engineering or Architecture studies.
 - This is not the case for other branches of learning where a Bachelor Degree is sufficient to take up a career.

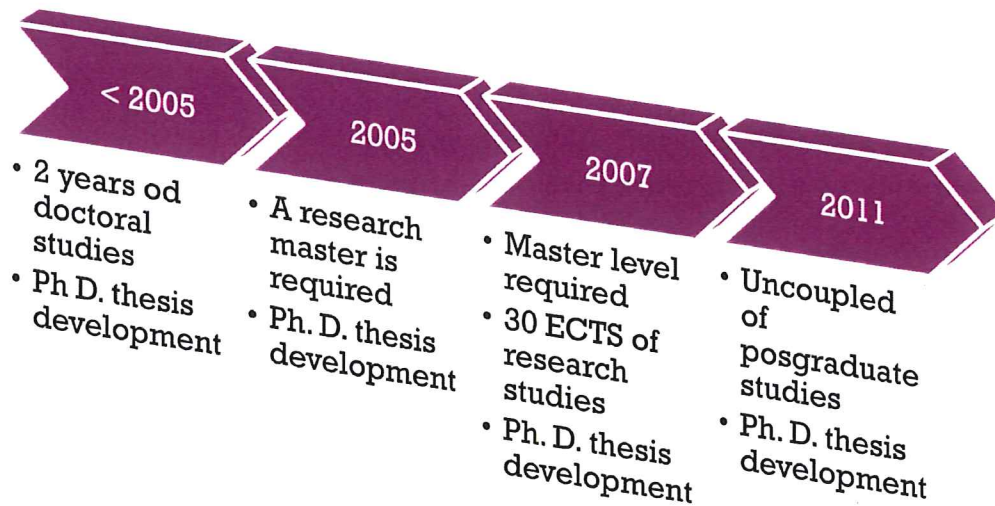
+ Doctoral studies

- Doctoral studies leading to the title of Doctor comprise the 3rd University Study Cycle.
- The ultimate purpose of Doctoral studies is to provide students with advanced training in research techniques.
- They have been traditionally divided into two cycles:
 - A cycle of at least 60 credits that can be part of the Master's cycle,
 - and another research cycle that is completed by the student defending an original research work (doctoral thesis).

+ The Spanish university system



+ Official Doctoral Studies in Spain. Background



+ Regulation of Doctoral studies before the EHEA

- Doctoral studies were two-stage;
 - A two-year training stage worth 32 credits
 - (Spanish credits, 1 Spanish credit = 10 contact hours),
 - At the end of which a Diploma in Advanced Studies was awarded.
 - This qualified the student to begin a doctoral thesis.
- Having obtained the Diploma in Advanced Studies, the student began their doctoral thesis without any time limit being imposed for its completion.

+ 2005 regulation

- This legislation marked a turning-point in the Spanish university system as it was the first piece of legislation passed to begin adaptation to the EHEA
- Doctorate is included as Postgraduate programmes
 - Universities set out the lines of research for each programme, a list of researchers, the maximum number of students, admission and selection criteria ...
- When a student has obtained a minimum of **60 credits from a official Postgraduate programme (research oriented)**, they may apply to be admitted on a doctoral thesis development
 - It is necessary a minimum of 300 credits overall in their university Undergraduate and Postgraduate studies.
- One innovation is the creation of the mention of «Doctor Europeus»

+ 2007 regulation

- It was at this time that most of the undergraduate bachelor programs were designed in Spain in line with this decree and began to be implemented in the 2009-10 academic year.
- A number of master's were also designed.
- For doctoral studies, a period of training and organised research must have been successfully completed.
 - At least 30 ECTS, included or not in a master, but with the level of master studies and research oriented.
 - All the training and research activities required to obtain the degree make up what is called the Doctoral Programme

+ Strategy University 2015

- In 2008, the Spanish Government launched the Strategy University 2015
 - a Government initiative intended to develop a modern Spanish University System
- EU2015 core strategy is grouped into four areas (missions, people, capabilities and environment), within which strategic lines were designed.
- In the missions, which include Teaching and Training and Research, Doctoral teaching plays a fundamental role.
- New ideas:
 - The absolutely necessary inter-relation between training and research
 - To provide advanced training in research techniques to PhD students.
 - A doctorate is the first step in a research career.
 - It also reinforces the European and international dimension of the Doctorate
 - and also relates it to the actions developed in the Erasmus Mundus programme.

+ The current regulation of Doctoral Studies (2011)

- Objectives of this new regulation:
 - The doctorate must play a fundamental role as a crossroads between the EHEA and the ERA, both of which are cornerstones of the knowledge-based society.
 - Research must become clearly important as an integral part of university higher education and mobility must be valued during the Doctoral and Postdoctoral stages as a vital part of young researchers' training
 - Doctors need to play an essential role in all the institutions involved in innovation and research so they can spearhead the transfer of knowledge for the well-being of society.
 - The doctorate must be at the centre of universities' institutional strategies in matters of R&D and Innovation
 - And must strive for the highest levels of quality, internationalisation, innovation, recognition and mobility

+ New characteristics

- Creation of Doctoral Schools.
- Academic boards for the doctoral programmes as well as the figure of programme coordinator.
- The doctoral student's activity document
 - which introduces the idea of the student being supervised and monitored and for the first time sets a maximum term for doctoral studies (three years) and allows them to be done on a part-time or full-time basis.
- The committees evaluating the doctoral theses must have a majority of doctors that do not belong to the University and the collaborating institutions.
- It also includes issues regarding personal data protection and guarantees for any possible patents for the research work.
- It also establishes the possibility of «International Doctor » being included on the degree certificate.

+ Doctoral Schools

- A Doctoral School is defined as a unit created by one or more universities
 - whose main purpose is to either organise the doctorate into one or more branches of knowledge or to make it interdisciplinary.
- The Doctoral Schools must ensure that they develop an individual strategy that is linked to the university or universities' research strategy,
 - They must also provide evidence of a management capability that is adequate for their purposes that is accredited by the sponsoring Universities and institutions.
- The Doctoral Schools must have a Steering Committee to perform the duties required to organise and manage the Schools.
 - The Committee must be made up of at least, the Director of the School, the doctoral programme coordinators and representatives from the collaborating organisations.

+ Doctoral Programmes (I)

- Doctoral studies are organised through programmes.
- A Doctoral Programme is a set of activities that will lead to the acquisition of the competencies and skills required to obtain the title of Doctor.
- The object of this programme will be to develop the different training requirements of the doctoral student and set the procedures and lines of research needed to develop doctoral theses.
- Doctoral studies will have a maximum duration of three years (full-time)
- Doctoral programmes can include organised researcher training aspects that will not require any restructuring concerning ECTS credits

+ Doctoral Programmes (II)

- The doctoral studies will at least ensure that the doctoral student acquires the following basic skills as well as others that fall within the Spanish Qualifications Framework for Higher Education:
 - A systematic understanding of a study area and a full command of the research skills and methods related to that area.
 - The ability to conceive, design or create, put into practice and adopt a substantial process of research or creation.
 - The ability to make a contribution to broaden the frontiers of knowledge through original research.
 - The ability to subject new, complex ideas to critical analysis and evaluate and synthesise them.
 - The ability to communicate with the academic and scientific community and with society in general concerning their areas of knowledge in the ways and languages that are usual in their international scientific community.
 - The ability to promote scientific, technological, social, artistic or cultural progress in the academic and professional fields of a knowledge-based society.

+ Doctoral Programmes (III)

- In addition, being awarded the title of Doctor must endow the holder with a high professional ability in diverse fields, particularly in those requiring creativity and innovation.
- As a minimum, Doctors shall have acquired the following personal abilities and skills to:
 - Function in contexts where there is little specific information
 - Find the key questions that must be addressed to solve a complex question.
 - Design, create, develop and undertake original, innovative projects inside their area of knowledge.
 - Be able to work in a team as well as on their own in an international or multidisciplinary context.
 - Integrate knowledge, confront complexity and formulate judgments with limited information.
 - Intellectually criticise and defend solutions.

+ Supervising and monitoring the doctoral student

- The Research Plan was created to replace the former Thesis Project, including the methodology, objectives, means and timescale for its achievement.
- The supervision duties for doctoral students are set out in a documentary commitment signed by the university, the doctoral student, their tutor and their director.
 - This document shall include a conflict-solving procedure and shall consider the issues regarding intellectual or industrial property rights that may arise within the context of doctoral programmes.
- An Activities document is also established to record individually the activities of interest during the development of the doctorate.
 - It must be regularly reviewed by the tutor and the thesis director and evaluated by the academic committee and form part of the documentation to be evaluated by the Thesis Board.

+ Doctoral thesis

- As always, the doctoral thesis consists of an original research work undertaken by the candidate in any area of knowledge.
- All members forming the Board must possess the title of Doctor and have proven research experience.
- The Board shall comprise a majority of members who do not belong to the University and the institutions collaborating in the School or on the programme.
- A new feature is that it states that in exceptional circumstances determined by the programme's academic committee, such as companies taking part in the programme or School, the existence of confidential agreements with companies or the possibility of taking out patents regarding the content of the thesis, then the universities shall take measures to ensure that these aspects receive no publicity.
- The special mention of «European Doctor» is replaced by «International Doctor», the requirements remaining the same as in the previous legislation.

+ Current state of doctoral studies

- The new legislation lays down a series of deadlines for adapting to it, divided into several phases.
 - The first and most immediate phase is to establish the supervisory and monitoring procedure for the doctoral student and adjust the procedure for defending the doctoral thesis.
 - This phase has been completed in most Universities.
 - The second phase is to change the current Doctoral Programmes to the new scheme and subject the new Doctoral Programmes to a new verification process by the Evaluation and Quality Agencies.
 - The Universities are currently carrying out this process. The deadline set is the start of the 2013/14 academic year.
 - In parallel, the Universities are regulating and setting up their Doctoral Schools.

+ Where the future is leading us. The Quality of Doctoral Studies

- Quality of doctoral studies.
 - To this end, the Ministry has been taking different steps to highlight the quality of those doctoral studies with outstanding achievements.
- Government invite calls to award a doctoral seal of excellence to the Doctoral Programmes or Doctoral Schools that are outstanding in their results, prestige and high level of internationalisation.
- As the highest academic award in university education, one of the future challenges for the doctorate is to reduce the drop-out rate and the average age at which it is completed, as well as for it to become more involved in the requirements of enterprise.
- It is hoped that the seals of excellence will act as a recognition of the scientific-technical and educational competence of Spanish university doctoral programmes and as a recognition of the research groups or departments responsible for training doctors.

+ Criteria for evaluating the Doctoral Programme

- The research background of researchers who have led the doctoral theses read in the doctoral programme in the last six calendar years, as well as the background of the programme director or coordinator.
 - The personal and academic data of each teacher, including the number of six-year terms of research activity.
 - A full reference on a research project or contract of which they are or have been part, indicating if they are the main researcher as well as the length of time and funding body.
 - A full reference of the four major scientific contributions (publications or books or chapters of books, patents, artistic works, contributions to congresses,...) objectively pointing out the repercussion of the results (journal's level of impact, journal's subject matter, relative position of the journal within its subject, etc.).
- The number of students who have defended their doctoral thesis in the programme in the last six years.
- Scientific contributions (publications or books or chapters of books, patents, artistic works, contributions to congresses, prizes received, etc.) directly related to the doctoral theses defended in doctoral programme in the last six years.
- A list of the doctoral students who have registered their doctoral thesis in the last six years.
- A list of the doctoral students who have participated on the mobility programme while preparing their doctoral thesis in the last six years. A list of the doctoral students who have been awarded their degree by a university other than that offering the doctorate.
- The relationships and alliances by means of agreements with other national and foreign and public and private institutions in a context of scientific and innovative collaboration for the development of a programme.

+ Some data on the Doctorate in Spain

- (Data related to doctoral studies in Spain for the most recent year that official statistics are available from the Ministry of Education)
- In 2009, 8.187 doctoral theses were read.
- The total number of students enrolled on doctoral programmes in the 2008-09 academic year was 77.249 and for the 2009-10 academic year it was 70.422.
- 48% are read by women, an important statistic if it is borne in mind that in the first levels of university education the number of women was 54,2% and 50,9% for doctoral students.

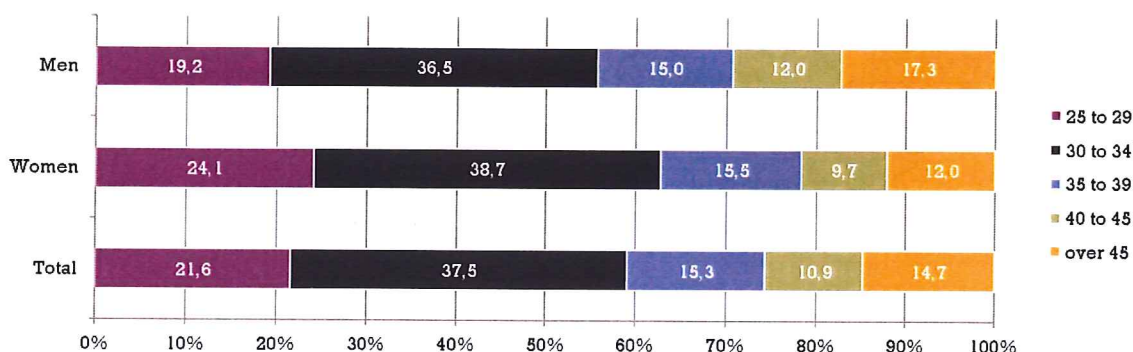
+ Global data

Trends for doctoral students

Trends for theses read

| | Enrolled | | | Theses read | |
|---------|----------|---------|------|-------------|---------|
| | Total | % women | | Total | % women |
| 2007-08 | 77.682 | 51,8% | 2007 | 6.944 | 49,7% |
| 2008-09 | 77.249 | 52,0% | 2008 | 7.830 | 48,5% |
| 2009-10 | 70.422 | 50,9% | 2009 | 8.187 | 48,0% |

Distribution of Theses read by sex and by age group. Year 2009





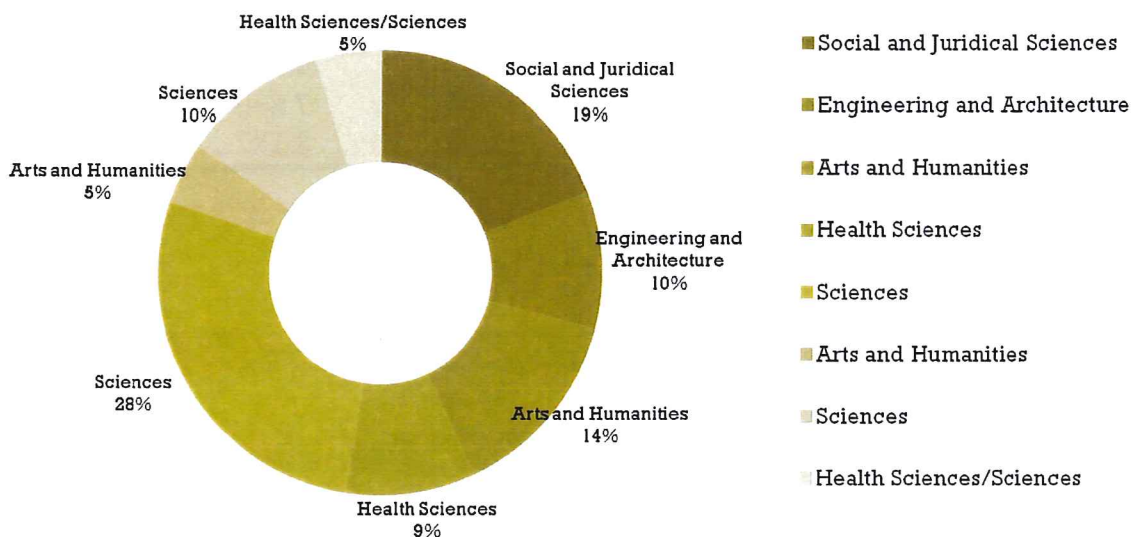
- Two conclusions can be drawn from these data.
 - A higher percentage of women abandon their doctoral studies without completing their doctoral thesis.
 - Women who complete their doctoral thesis do so at a younger age than men.
 - It can be seen how the time factor has different effects for men and women, which was also the case with the mobility programmes.
 - In the area of Science, theses are mainly read by young people under 30 while in Social and Juridical Sciences and in Arts and Humanities most candidates are over 45.



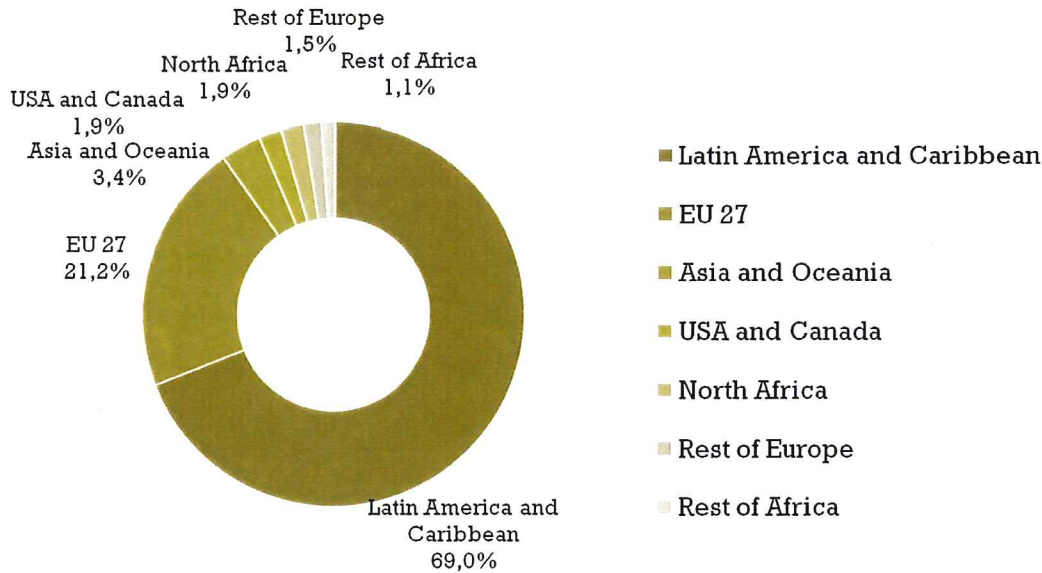
Distribution of Theses read by branch of learning. Year 2009



Distribution of Theses read by branch of learning. Year 2009



+ Distribution of Theses read by foreigners according to place of origin. Year 2009



+ Conclusions

- In this work we have described the state of doctoral studies in Spain.
 - It began with an analysis of the state of the Spanish university system and its process of adaptation to the European Higher Education Area (EHEA).
- Several changes in Spanish legislation over time regarding doctoral studies.
 - This has been a major issue over the last few years because it has resulted in a lack of stability that has caused numerous organisational problems for the Universities.
 - However, in spite of this instability, the results of the doctoral programme have not suffered.
- Strategic plan developed by the FORMER Government for the University,
 - placing a special emphasis on doctoral studies as a fundamental part in the development of R&D.
- As a result of this strategic plan, a new set of legislation has been developed within the framework of this strategy.
 - Actions being implemented to enhance the quality of doctoral teaching have been shown.
- Finally some data were shown regarding doctoral teaching in Spain.

