MIT Portugal

MIT Portugal Program

An Higher Education network

for

Internationalization and excellence

Massachusetts Institute of Technology

SEMINÁRIO

Rede de Ensino Superior em Portugal: Políticas e Práticas de Associação de Instituições

28 de Novembro de 2011
Auditório do Conselho Nacional de Educação

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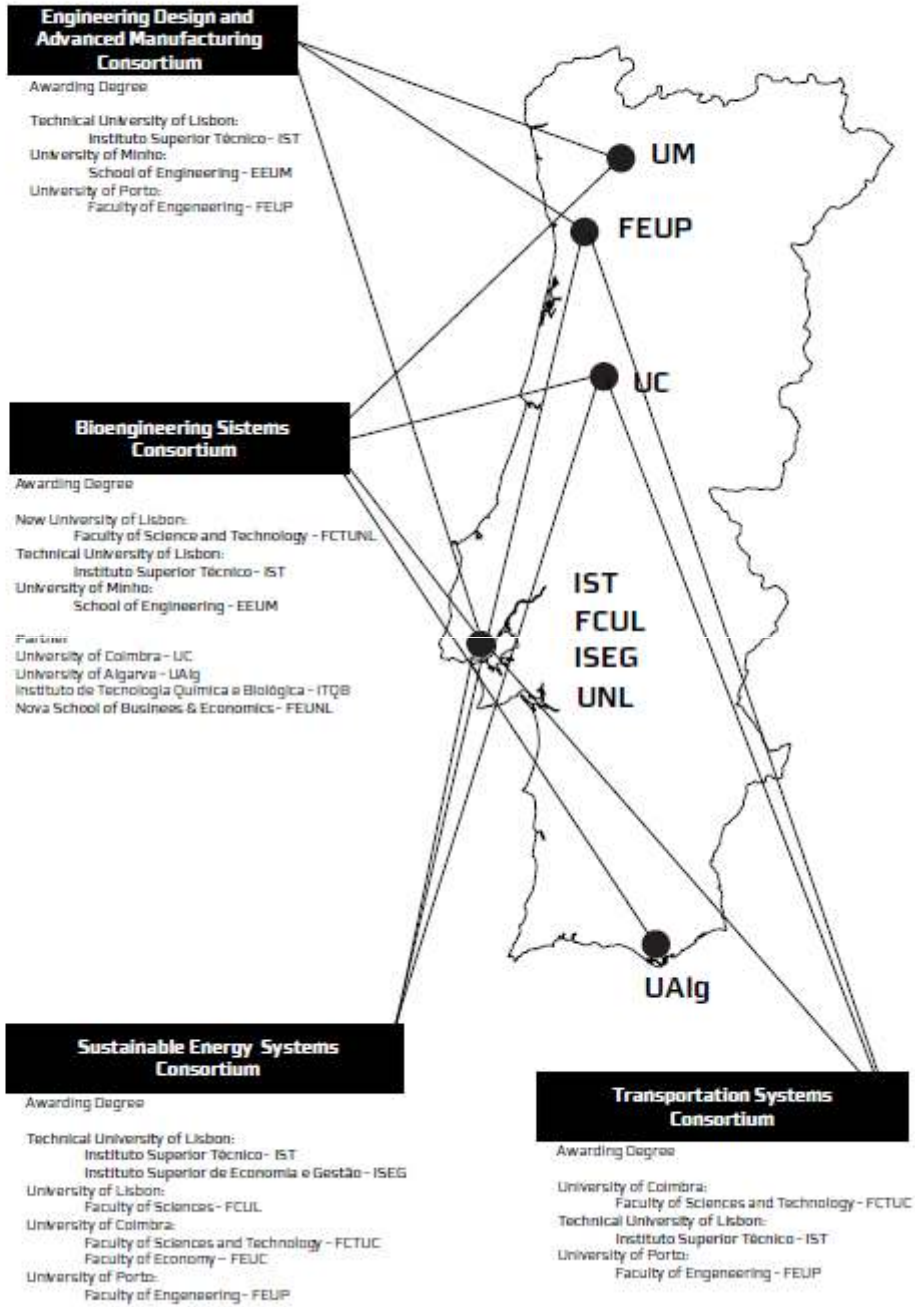

A Network of Portuguese Universities and Research Institutions

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MIT-Portugal Program

Engineering systems focus: gives emphasis to complex systems that not only have critical technological components, but also have significant economical and socio-technical level interactions, going beyond traditionally defined engineering disciplines.

The following specific fields were identified as the initial focus areas, on top of which an integrative anchor program will be developed:

- Engineering Design and Advanced Manufacturing
- Transportation Systems
- Sustainable Energy Systems
- Bio-Engineering Systems

Program Components

Education

New world-class education programs in:

- Bio-Engineering Systems
- Sustainable Energy Systems
- Engineering Design & Advanced Manufacturing
- Transportation Systems

Research

Portuguese universities are collaborating with MIT faculty in program-affiliated research initiatives, in an effort to stimulate R & D within the industrial sector.

Industry

The MIT Portugal Affiliates Program seeks to engage key partners in industry, foundation and private association sectors to reinforce Portugal's scientific and technological capacity in partnership with MIT.

PhD and Masters programs

- PhD:
  - 3-4 years
  - 1 year of classes in either modular-intensive or traditional term-length format: varies by program
  - International program: all materials, lectures and activities in English
  - Teaching by Portuguese and MIT faculty (in person and distance learning)
  - Most students do up to 12 months research at MIT and have MIT co-advisor
- Executive/Master programs:
  - 1 year programs mostly for professionals
  - Comparable to first year of PhD lectures plus additional activities

Key goals of a network of excellence

- To bring together national institutions in order to achieve critical mass to be internationally relevant
- To have a partner of indisputable reputation to leverage our international credibility - MIT
- To promote the Portuguese higher education system as highly attractive to foreigner students
- To attract industry to cooperate more closely with University

KEY INGREDIENTS FOR THE SUCCESS OF NETWORK OF EXCELLENCE

- **Commitment** - Universities and Research Institutions, Government, Faculty and Major Stakeholders
- **Vision** and **Long Term Strategy**
- **Leadership** and capacity to execute and to define **priorities**
- **Transparency** and **competitive mechanisms** based on excellence
- **Trust** !

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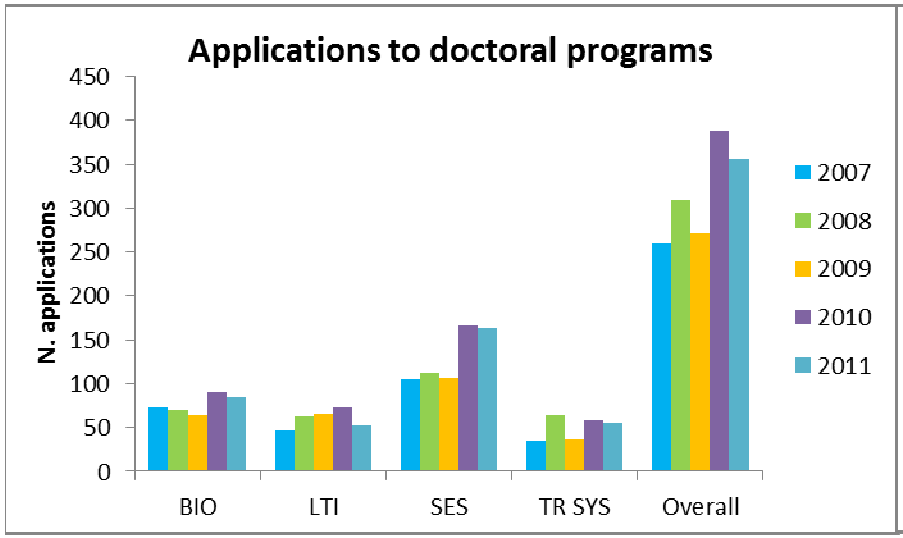
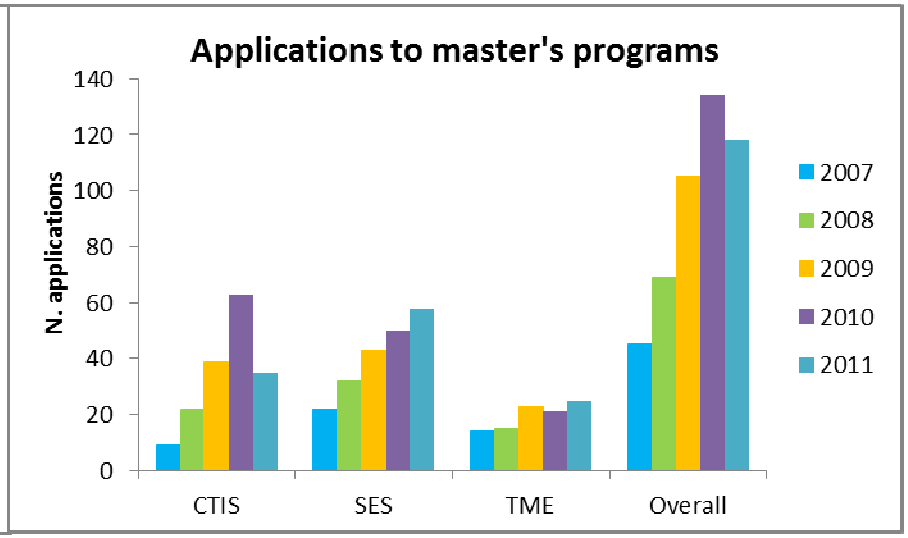
International attractiveness

Recruitment





- The number of applications has been progressively increasing over the years. During its 5 editions the educational programs have received a total of 2054 applications.
- This year (2011/12) the total number of applications was 474:
  - doctoral programs: 356
  - Master's programs: 118

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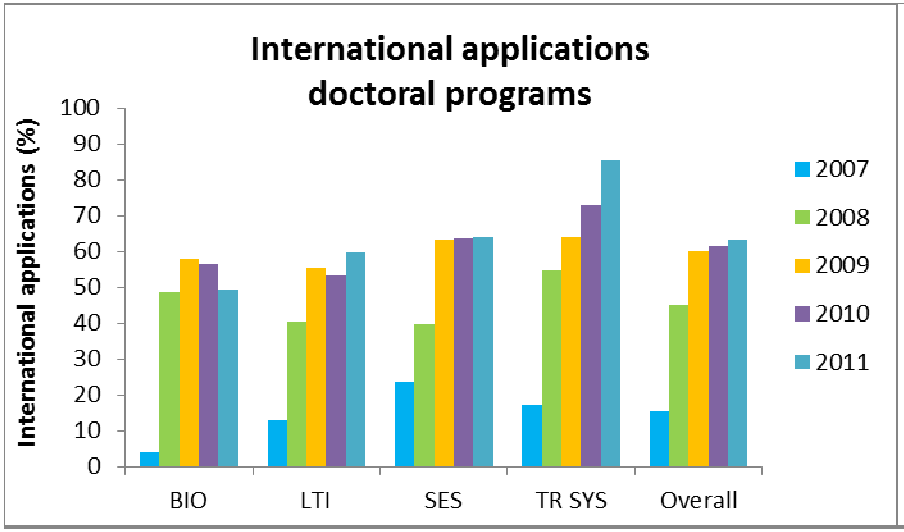
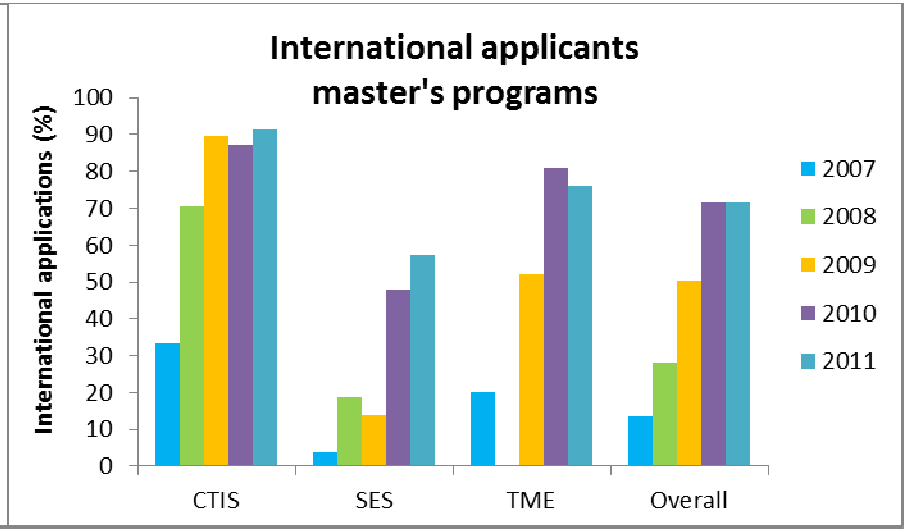
International applications



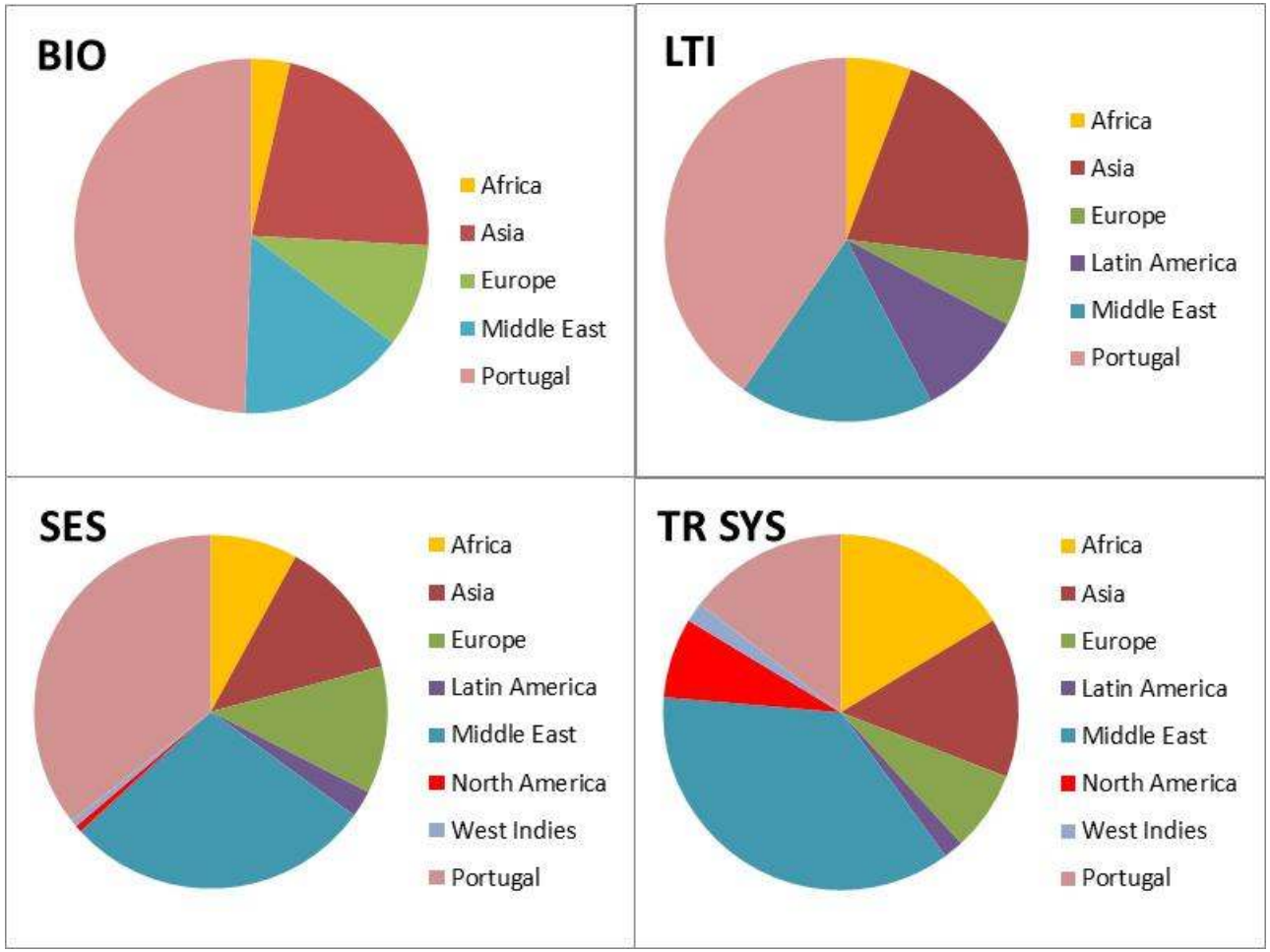


- The number of international applicants has dramatically increased since 2007.

- Doctoral programs: last 3 editions (2009-2011) > 60% of applications are international.
- Master's programs: last 2 editions (2010,2011) > 70% of applications are international.

Candidate's geographical origin

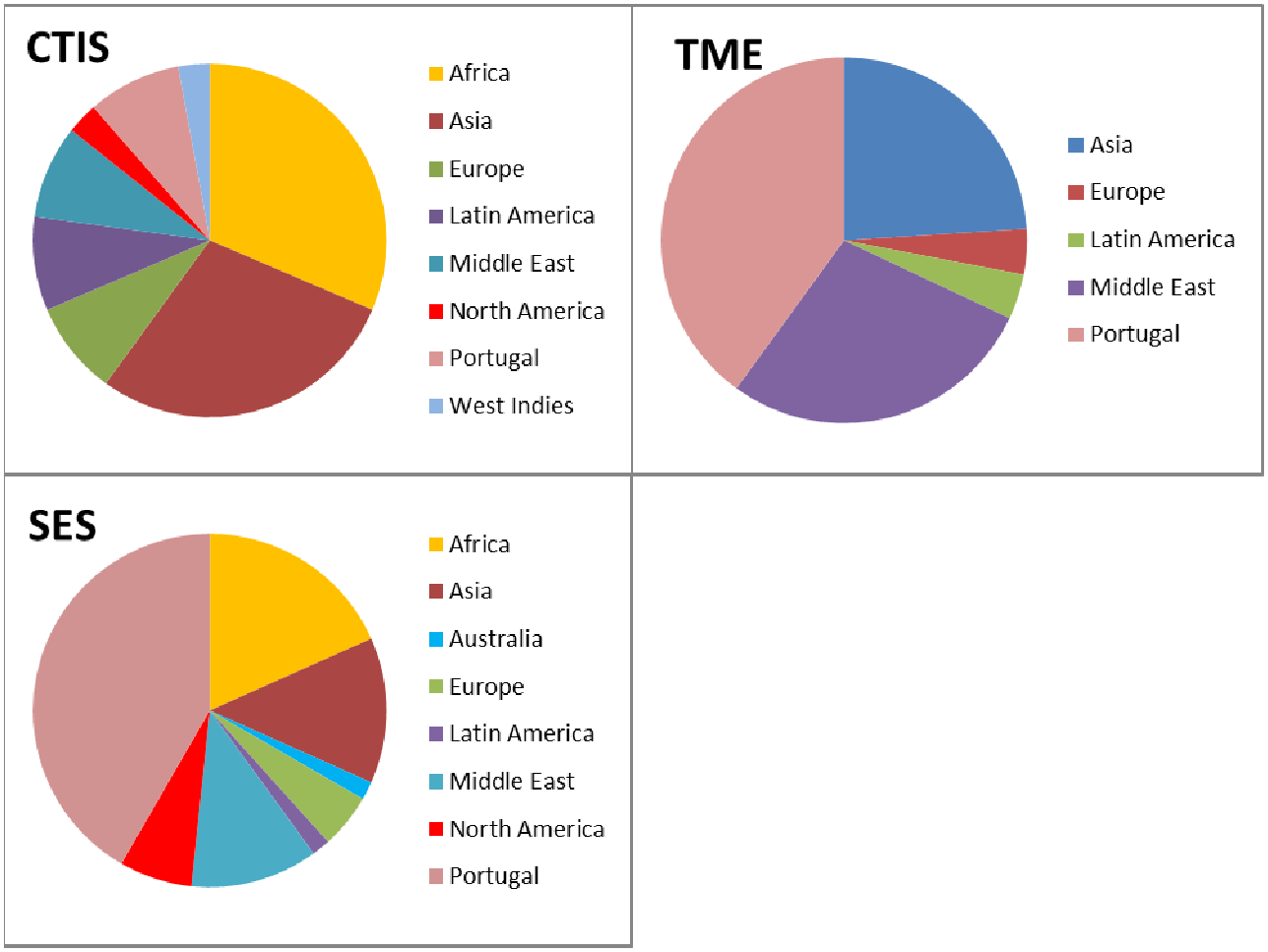
PhD



- As in previous editions, the 2011 PhD candidates are originated from over 50 different countries.

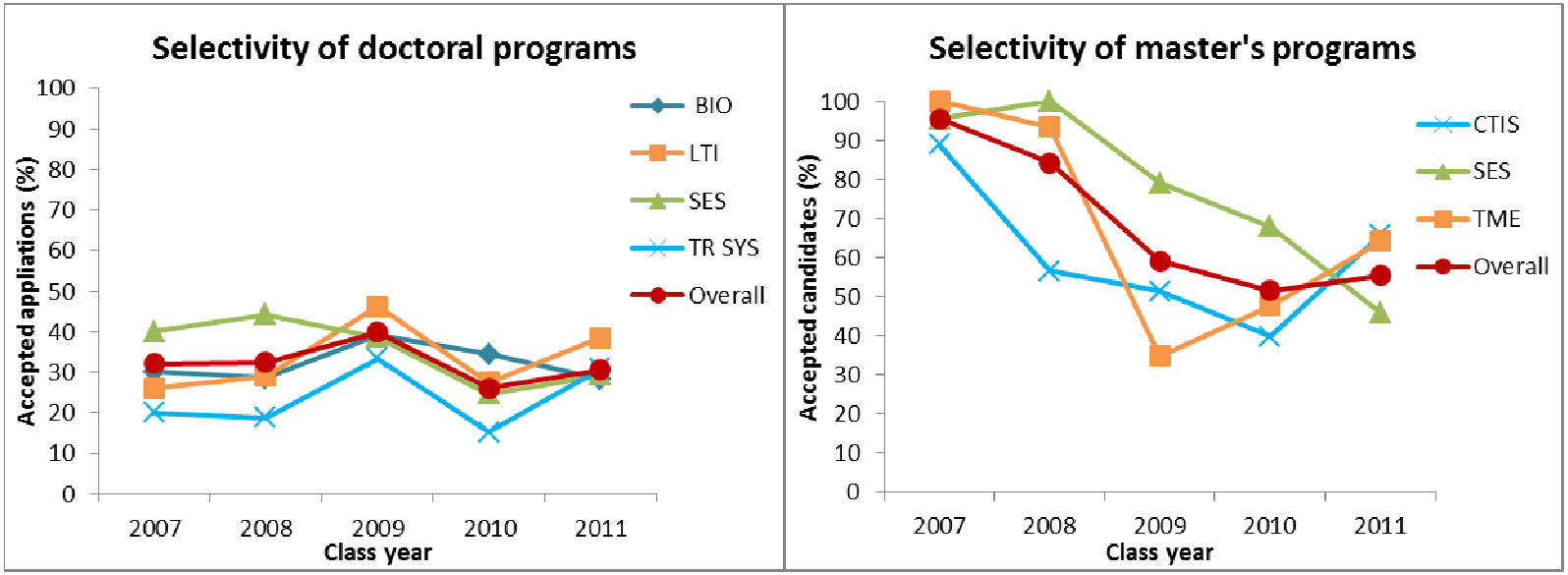
Candidate's geographical origin

Master's



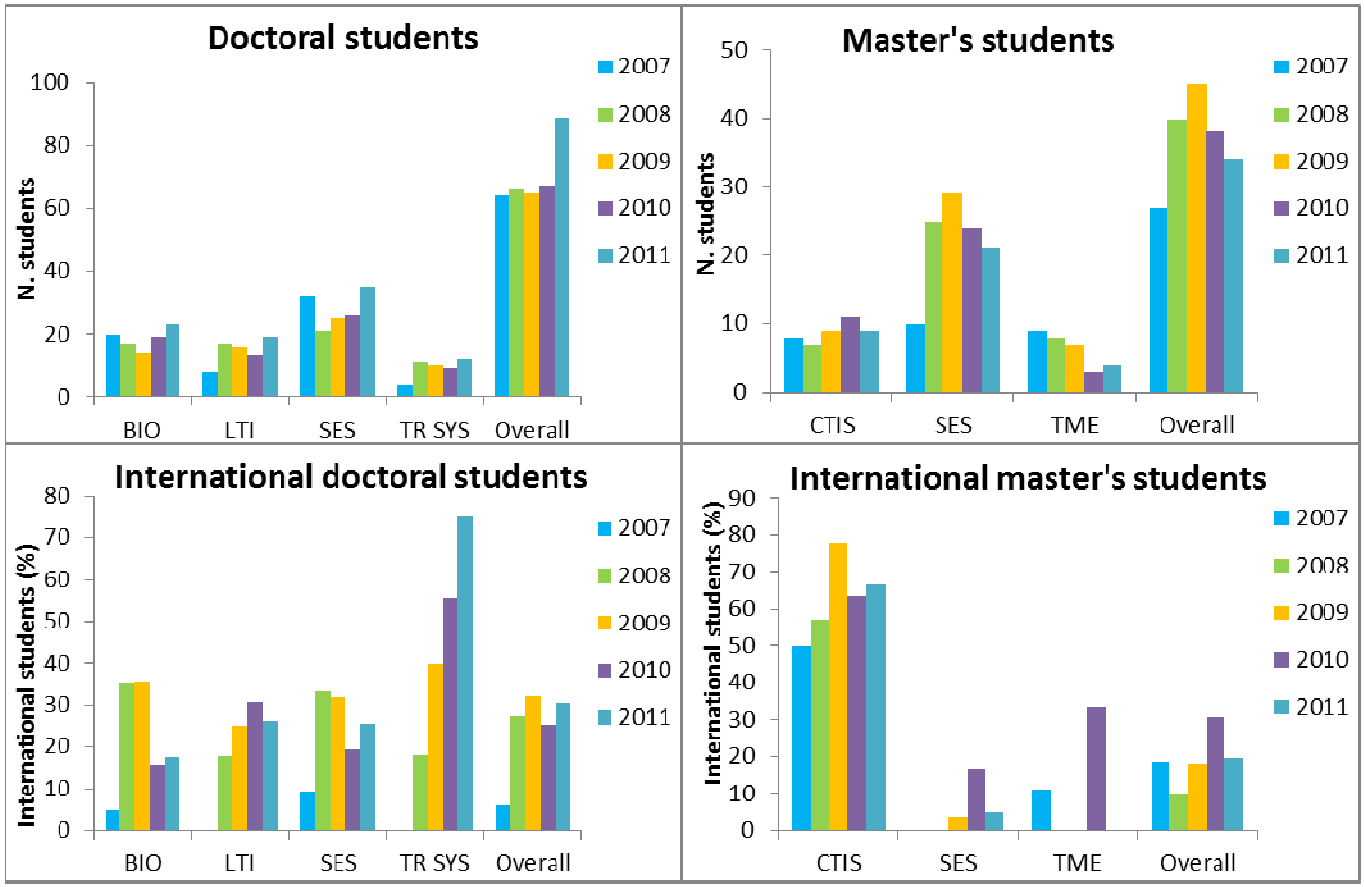
❖ 2011 Master's candidates are originated in 30 different countries, from all continents.

Selectivity



- On average, only 32% of those who apply to PhD programs and 55% of those who apply for a Master's programs get admitted.
- Students are graduates of leading academic institutions such as MIT, University of California Berkeley, Imperial College London and University of Michigan.
- Some do also bring experience in international and national companies such as Volvo Sweden, PricewaterhouseCoopers, Galp Energia, EDP, Petrotec, Colep and Ericsson.

Students



Graduates

- PhD: 4
- Master's: 119

- There are currently 350 PhD students, of which 25% are international; 30% of the PhD students admitted for this year (2011/12) are international.

- There are currently 64 Master's students, of which 32% are international. Since its first edition the CTIS MSc. program has got > 50% of international students (current figure is 67%).

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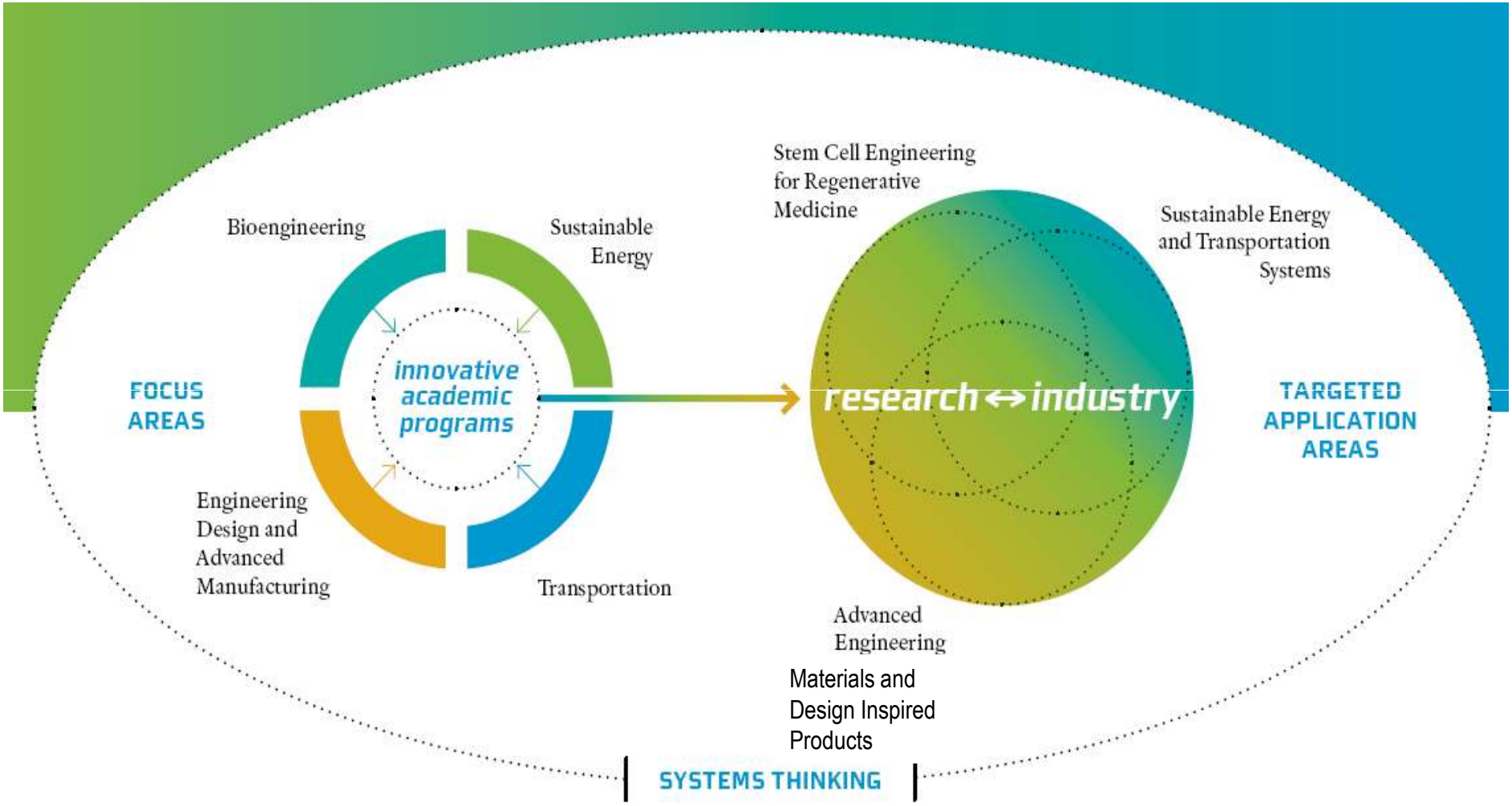
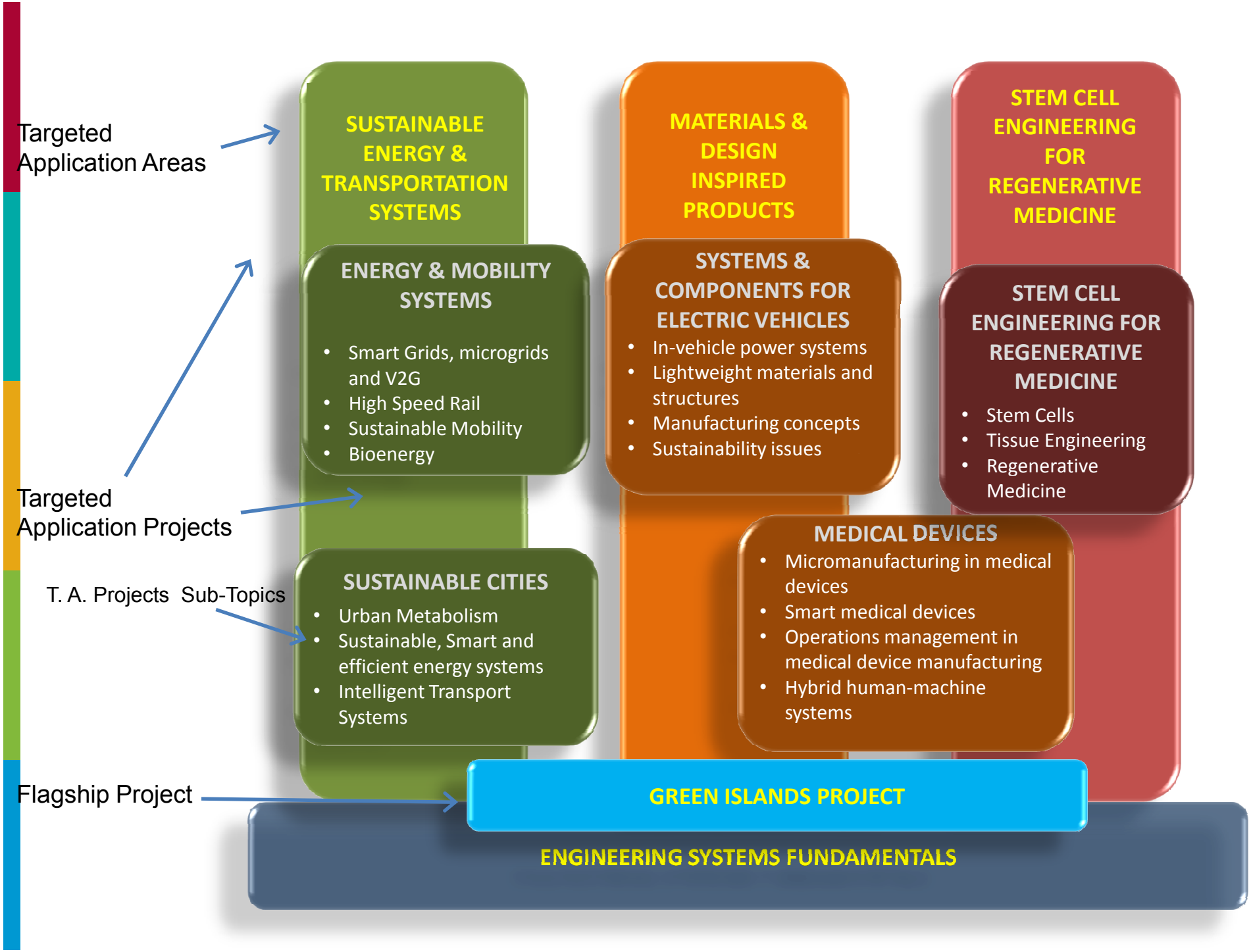
Priorities, difficult to reach excellence in all areas

Research Thematic Alignments

Our knowledge-creation model




Targeted Application Areas
Targeted Application Projects
T. A. Projects Sub-Topics
Flagship Project
SUSTAINABLE ENERGY & TRANSPORTATION SYSTEMS
MATERIALS & DESIGN INSPIRED PRODUCTS
STEM CELL ENGINEERING FOR REGENERATIVE MEDICINE
ENERGY & MOBILITY SYSTEMS
• Smart Grids, microgrids and V2G
• High Speed Rail
• Sustainable Mobility
• Bioenergy
SYSTEMS & COMPONENTS FOR ELECTRIC VEHICLES
• In-vehicle power systems
• Lightweight materials and structures
• Manufacturing concepts
• Sustainability issues
STEM CELL ENGINEERING FOR REGENERATIVE MEDICINE
• Stem Cells
• Tissue Engineering
• Regenerative Medicine
SUSTAINABLE CITIES
• Urban Metabolism
• Sustainable, Smart and efficient energy systems
• Intelligent Transport Systems
MEDICAL DEVICES
• Micromanufacturing in medical devices
• Smart medical devices
• Operations management in medical device manufacturing
• Hybrid human-machine systems
GREEN ISLANDS PROJECT
ENGINEERING SYSTEMS FUNDAMENTALS

MECHANISMS:
Research Projects - Calls
SUSTAINABLE ENERGY & TRANSPORTATION SYSTEMS

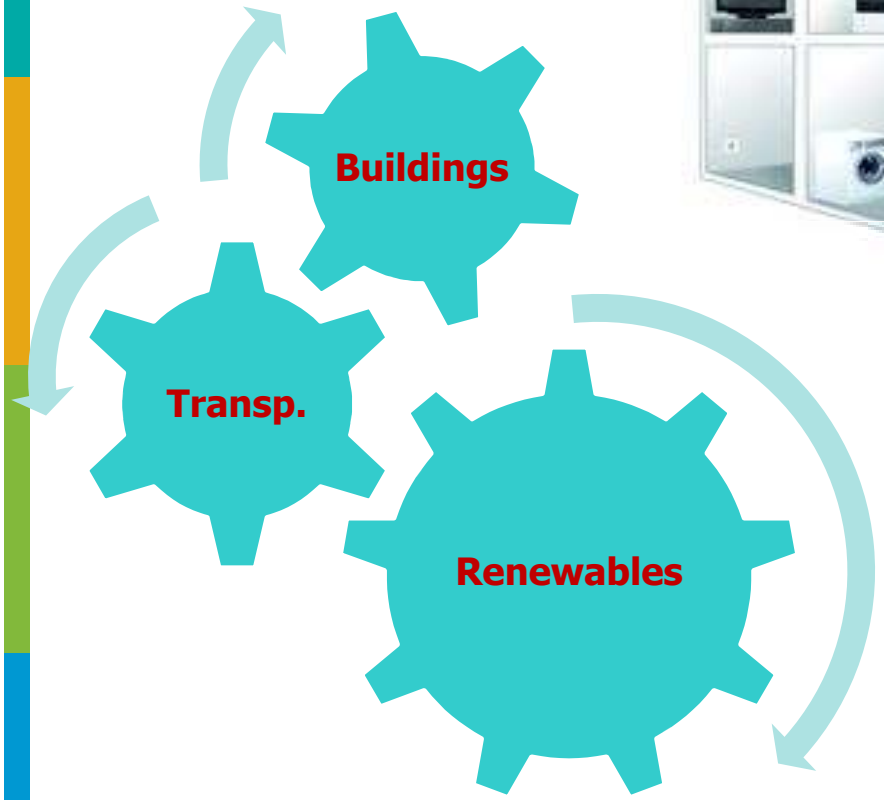
Project Reference	Project Title	Main PT Researchers	Main MIT Researchers	Universities/Schools	Associated Laboratories	Industry Partner
MIT-Pt/SES-GI/0008/2008	Power demand estimation and power system impacts resulting of fleet penetration of electric/plug-in vehicles	**Carla Silva (PI)**, Tiago Farias, Christos Ioakimidis, João Peças Lopes, Manuel Matos	John B. Heywood	**IST/UTL**	IDMEC, ISR, INESC-Porto	GALP, EDP, APVE
MIT-Pt/TS-ITS/0036/2008	SAVED - System for Adapting the Vehicle dynamic parameters to the driving Environment and Driver capabilities	**José Viegas (PI)**, Sílvia Shrubsall, Luis Picado Santos, Jorge Santos, Ana Paiva, João Dias	Nancy Leveson and Qi Hommes	**IST/UTL**, FCT/UC, U. Minho		INiR, Tranquilidade, PRP
MIT-Pt/SES-SUES/0037/ 2008	Net Zero Energy School - Reaching the community	**Carlos Silva (PI)**, Luísa Schmidt, Ana Horta, Augusta Correia, Carlos Pina dos Santos, Margarida Rebelo, Marluci Menezes, Luís Matias	collaboration done through students visits to MIT	**IST/UTL**, ICS/UL	ISR, LNEC	QUERCUS, GALP
MIT-Pt/SES-SUES/0041/ 2008	iTEAM - integrated Transportation and Energy Activity-based Model	**Francisco Pereira (PI)**, Ana Almeida, João Abreu, Samuel Niza, Leonardo Rosado, Teresa Galvão, Ana Camanho, Carlos Bento	Moshe Ben-Akiva, Chris Zegras and John Fernandez, Marta Gonzalez	**FCT/UC**, IST/UTL, FE/UP		ISA, S. A., Quercus, Critical Move, Optimus, Dueto
MIT-Pt/TS-AAS/0046/2008	AIRDEV - Business Models for Airport Development and Management	**Rosário Macário (PI)**, Jorge Pinho de Sousa, Jorge Reis Silva	Amedeo Odoni, Cynthia Barnhardt, Richard de Neufville	**IST/UTL**, FCT/UC, UBI		INAC, Alstom
MIT-Pt/TS-ITS/0059/2008	MISC - Massive Information Scavenging with Intelligent Transportation Systems	**João Barros (PI)**, Jorge Pinho de Sousa, João Paulo Cunha, Michel Ferreira	Muriel Medard, Dina Katabi, Minji Kim	**FE/UP**, FC/UP, UA	IT, IEETA	Biodevices, BAE, MacLaren Electronics, Petratex, STCP
MIT/SET/0014/ 2009	BioTrans - Capturing Uncertainty in Biofuels for Transportation. Resolving Environmental Performance and Enabling Improved Use	**Fausto Freire (PI)**, Carlos Henggeler Antunes	Randolph Kirchain	UC	**ADAI**, INESC-Coimbra	Prio Biocombustíveis, Prio Advanced Fuels
MIT/SET/0018/ 2009	Energy Box - development and implementation of a demand-responsive energy management system	**Carlos Henggeler Antunes (PI)**, Armando Mónica de Oliveira	Richard Larson (the Co-Applicant), Daniel Livengood (PhD candidate)	UC	**INESC-Coimbra**	ISA, S. A.
MIT/SET/0023/ 2009	EXPRESS - EXploration of Portugal's high speed Rail and Economic development Strategy Solutions	**João Abreu (PI)**, Luís Picado Santos, Filipe Moura	Joseph Sussman (the Co-Applicant), Dana Rhodes, Adam Ross, Sevara Melibaeva (student), Travis Dunn (student)	**IST/UTL**, FCT/UC	CESUR	RAVE

An example: Green Islands

The project goal:

- Reduce fossil fuel dependence and create value and jobs building comparative advantages for Portugal through Engineering Design and Systems Thinking.
- Full scale demonstration in São Miguel and Corvo, Azores

The challenge



This is not only a “technical problem”, it requires a **systems view!**

An example:
Systems for Smart Interiors

The objective of this research is the development of integrated systems for smart interiors in automobiles, an entirely new generation of high-performance mechanical systems and interfaces between humans and electronic and mechanical devices inside cars.

Different tasks have been addressed to accomplish its objectives:

- studying textile and composite materials with sensing capabilities;
- embedding optical fiber sensors into flexible carriers;
- inserting interfaces between humans and electronic mechanical devices; and
- developing of a new SMART car seat.

IBER-OLEFF FiberSensing TMG Sunviauto Indústria de Componentes de Automóveis, S. A. MIT Portugal

An example:
Enhancing mobility with hybrid orthoses

8 | EMPRESAS

DACHOR cria ortótese para apoio à locomoção

PROJECTO PIONEIRO, EM PARCERIA COM O MIT, ALIA SISTEMA MECÂNICO À ELÉCTROESTIMULAÇÃO MUSCULAR

NOVIDADE É QUE A AJUDA À LOCOMOÇÃO PASSA A SER ACTIVA E NÃO PASSIVA, COMO ACONTECIA ATÉ AGORA

FICHA

214 PROFESSORES PORTUGUESES

This projects aims to significantly enhance human mobility. The DACHOR (*Dynamics and Control of Hybrid Active Orthoses)* project contributes multibody dynamics and control modelling for the development of an innovative powered Ankle-Foot Orthosis (AFO) with hybrid actuation to aid individuals with reduced mobility and neuromuscular disabilities.

The project includes several innovative aspects:

- analysis of the musculoskeletal dynamics of an integrated biomechanical model of the patient and orthosis;
- the development of a hybrid actuation solution with dynamic scaling of the control authority between a functional mechanical actuation provided by an external power drive and functional electrical stimulation (FES) of selected muscles; and
- the development of an adaptive control law that dynamically regulates the amount of support and rehabilitation provided by the orthotic device.

plux

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An example:

Extending life through faster stem-cell development

This project combines a cross-disciplinary approach of Stem Cell Bioengineering and Experimental Haematology to establish a reproducible, robust and efficient *ex vivo* expansion system for mesenchymal stem cells (MSC) from human bone marrow, adipose tissue and umbilical cord matrix.

The research consortium worked on the isolation and *ex vivo* expansion of MSC under GMP conditions for Cellular Therapies. These MSC were then used in the treatment or prevention of graft-versus-host disease (GVHD) and also to facilitate allogeneic hematopoietic stem cell engraftment and decrease regimen-related toxicity.
Eight patients have already benefited from this pioneer treatment.
The clinical cases include:

- Acute GVHD
- Extensive chronic GVHD
- Hurler's syndrome
- Familial hemophagocytic lymphohistiocytosis
- Aplastic anemia

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células estaminais

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INNOVATION

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Innovation Activities

Courses Bio-eng

- Innovation module
- Bio-teams
  - Modeled after i-Teams as a distributed course
- Curriculum for pre-module:
  - Holistic intro to innovation "pathway"

Courses other

- EDAM Innovation Management Module
- Curriculum for IEI action-based go-to-market analysis
- Spin-off courses based on i-Teams pedagogy

Events

- Idea-Spring
  - After i-teams and IdeaStream
- Bio-teams midterm and finals
- IEI competition events, mixers, networking visits to MIT

Venture Formation

- IEI venture competition
  - Initial design and implementation to attract portuguese and global entrepreneurs
  - Future iterations on design to increase visibility of competition through a badge-based award system
- IEI catalyst and team formation programs
- IEI US-based venture catalyst program

Best Practices and Teach the Teacher model

- Independent activities and events
- Hosting scholars in innovation
- Adapted innovation practices
  - PI and Catalyst guidelines
  - Community outreach and engagement in courses and events
- Interaction with UTEN through EDAM

Startups (I)

- **Startups launched by MPP faculty and students:**

Cell2B establishes itself as a biotechnology company dedicated to the development of a new line of healthcare therapies to prevent and treat organ rejection in patients undergoing organ or tissue transplants.
ImmuneSafe™ is a cell-based therapy. The cells are harvested from the bone marrow of healthy donors and processed to a final off-the-shelf product to be applied after transplantation. It can be universally applied, without compatibility concerns.
Founding Members: David Braga Malta, Daniela Couto, Francisco dos Santos, Pedro Andrade
Daniela Couto won the ANJE's prize 'Mulher Empresária' 2011.

Matera´s operations encompass the development of its technology and products through laboratory-based R&D activities, and the development of business relationships with collaborators, potential licensees, and potential customers. The company technology is based on antimicrobial materials that can be used to coat surfaces and objects with variable chemistry and kill microbes by contact.
Founding Members: Lino Ferreira, Biocant, Biocant Ventures
The company has three employees, 2 of which are qualified to doctoral level, and one is qualified to Masters level.

Startups (II)

- **BioMode S.A, and SilicoLife researchers have recently submitted projects to BioTeams.**

SilicoLife is a company devoted to create computational solutions for the fast growing Industrial Biotechnology market. SilicoLife provides dedicated models, robust algorithms and user-friendly software tools to accelerate microbial strain design and bioprocess optimization, therefore accelerating R&D efforts and shortening the time to market of new biotechnology-based products.
SilicoLife exports more than 90% of its services.
Founding Members: Isabel Rocha, Miguel Rocha, Bruno Ferreira, Simão Soares, Pedro Evangelista, Paulo Maia, Paulo Vilaça, Rafael Carreira, Hugo Costa.
SilicoLife won the "Atreve-te 2010" in December 2010.
This competition distinguishes business ideas from students and graduates and it is sponsored by the Presidency of the Portuguese Republic.
SilicoLife won the first prize, 30.000 euros, from Caixa Geral de Depósitos.

SILICOLIFE
Computational Biology Solutions for the Life Sciences

biomode®
BIOMOLECULAR DETERMINATION

BioMode is a genetic diagnosis tests company with strong product development based on a novel technique and proprietary applications.
The project aims the commercialization of diagnostic kits for the bacterium Helicobacter pylori, present in an estimated half of the human population and that is suspected to cause stomach ulcers in a significant part of it.
Promoters: Maria João Vieira, Nuno Azevedo, Carina Almeida and Laura Cerqueira
Contracted Investment: € 300,000

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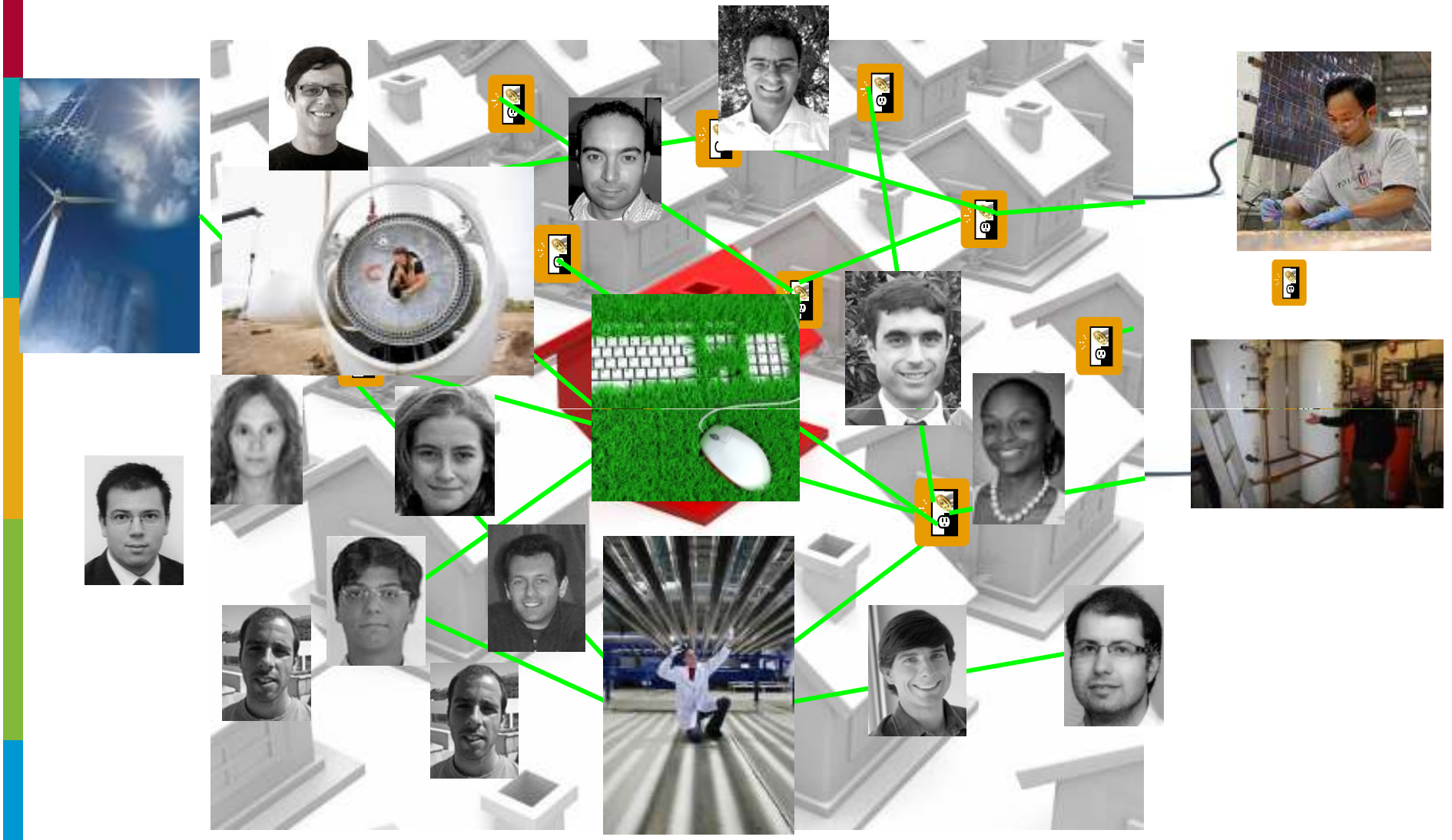
Partnership require a diversified set of actions and tools



But are worthwhile !

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