



**Madrid Robotics Digital Innovation Hub**

# **Robótica e Inteligencia Artificial**

## Retos y nuevas oportunidades

E.T.S. Ingenieros Industriales  
**Universidad Politécnica de Madrid**  
*10 de diciembre de 2019*





RoboCity2030.org

Madrid Robotics Digital Innovation Hub

**Robótica e Inteligencia Artificial  
10 de diciembre de 2019, Madrid**

# RoboCity2030

## En la vanguardia de la transformación

*Prof. Carlos Balague*  
Coordinar RoboCity2030  
*Universidad Carlos III de Madrid*  
[www.robocity2030.org](http://www.robocity2030.org)



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# Excelencia en Robótica Inteligente

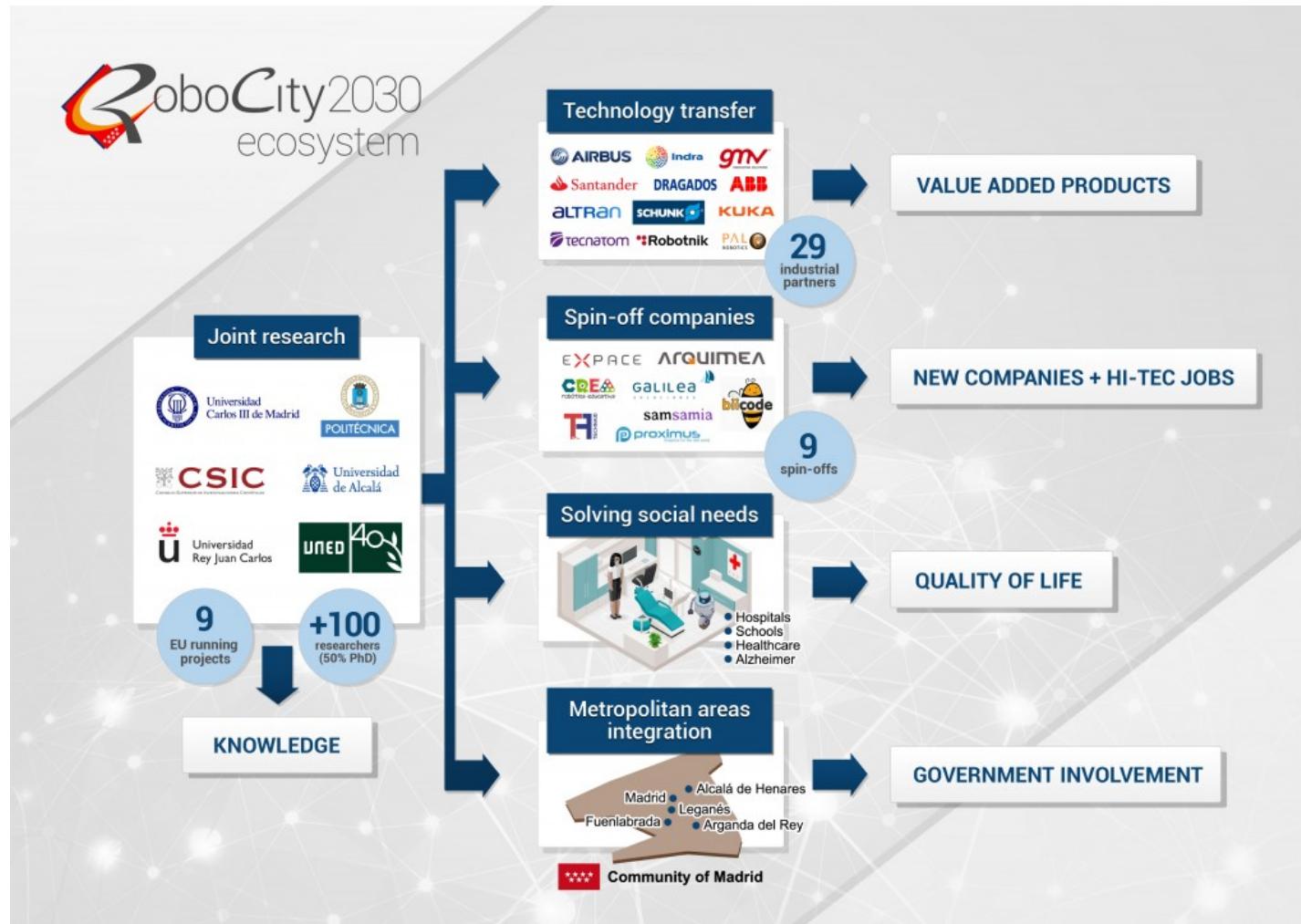
Madrid Robotics Digital Innovation Hub

- **RoboCity2030 I (2006-2010):** Creación de la red de Robótica en Madrid
- **RoboCity2030 II (2010-2014):** Consolidación y cooperación
- **RoboCity2030 III (2014-2018):** Aplicaciones y demostradores de la robóticas
- **RoboCity2030 IV (2018-2022):** Digital Innovation Hub en Madrid

# DIH: Principales áreas de I+D



# DIH: Eco-sistema de I+D e innovación



# RoboCity2030: Cooperación



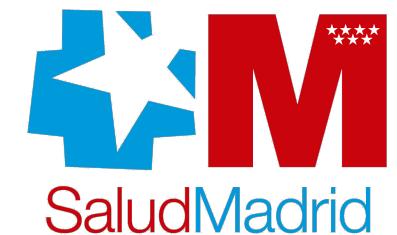
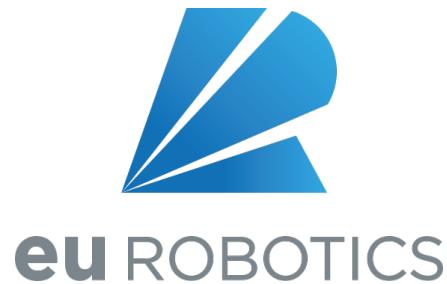
Centro para el  
Desarrollo  
Tecnológico  
Industrial



Plataforma  
Tecnológica  
Española de  
Robótica



Plataforma Tecnológica Española  
de Construcción





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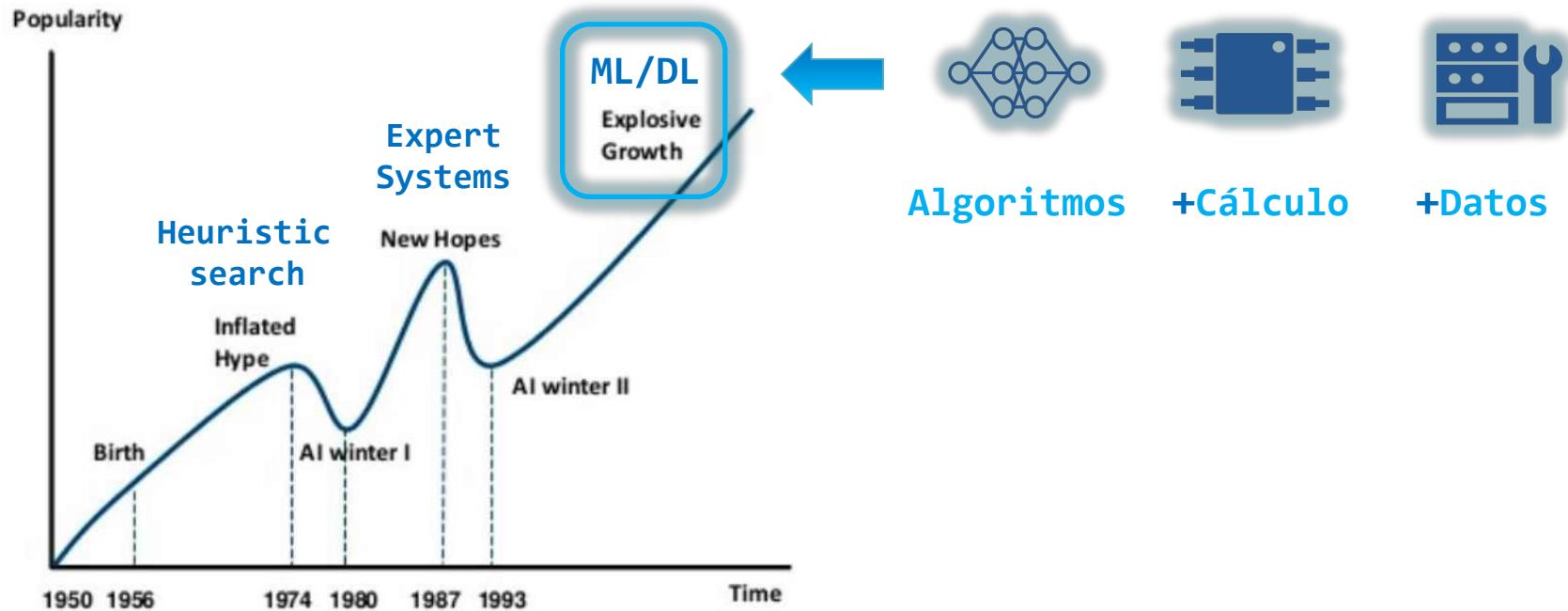


## ARTIFICIAL INTELLIGENCE FOR EUROPE

Enrique Pelayo Campillos  
[enrique.pelayo@cdti.es](mailto:enrique.pelayo@cdti.es)

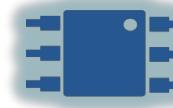
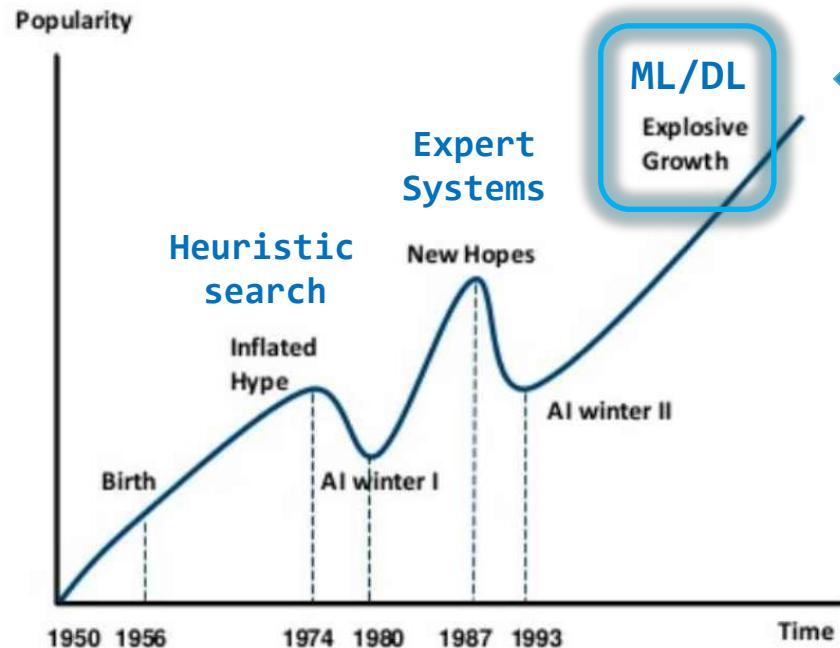
# Inteligencia Artificial

## Crecimiento Exponencial



# Inteligencia Artificial

## Crecimiento Exponencial



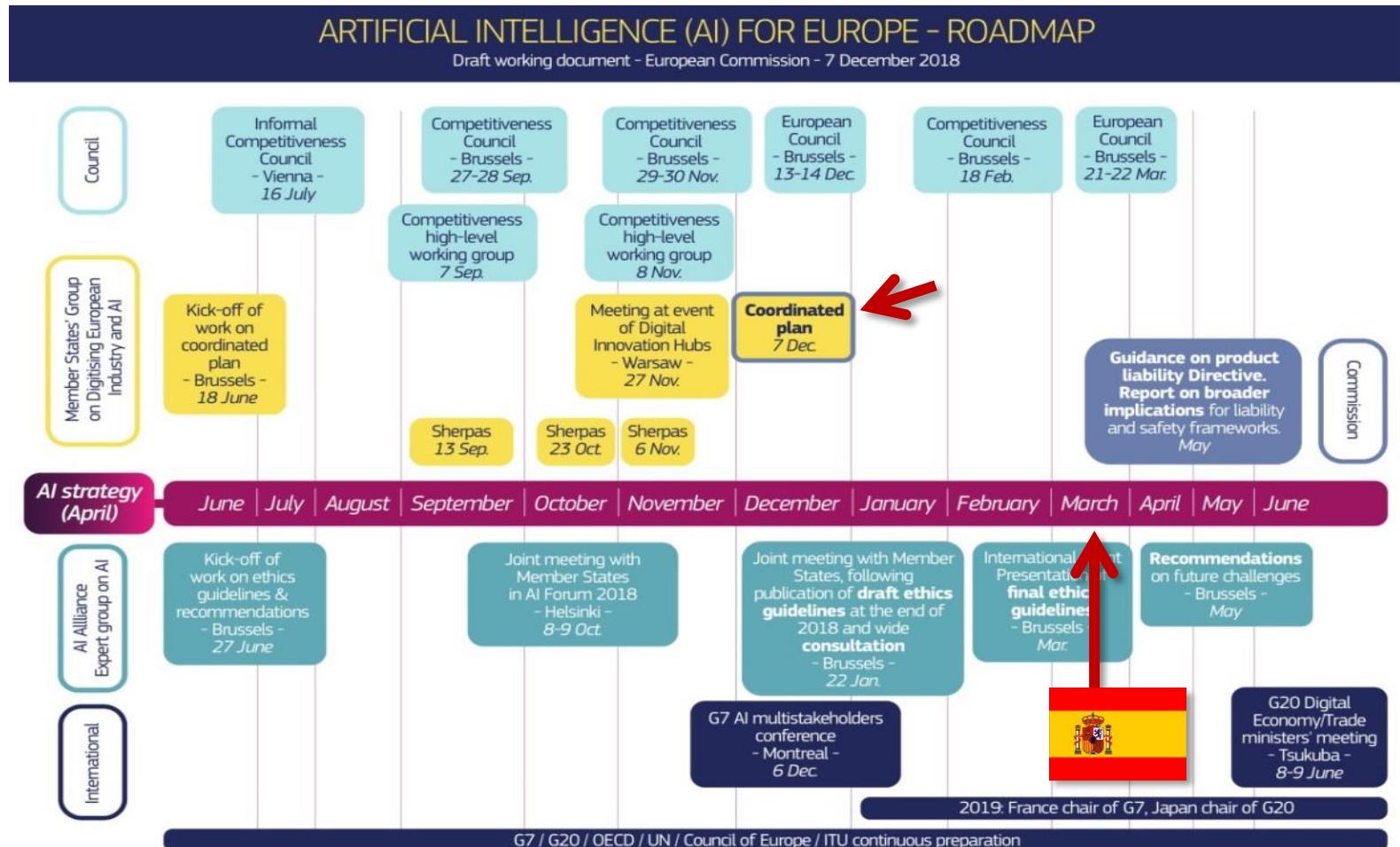
# “Artificial Intelligence for Europe”

## Problemas AI en Europa



# Political actions

## Roadmap



# “Artificial Intelligence for Europe”

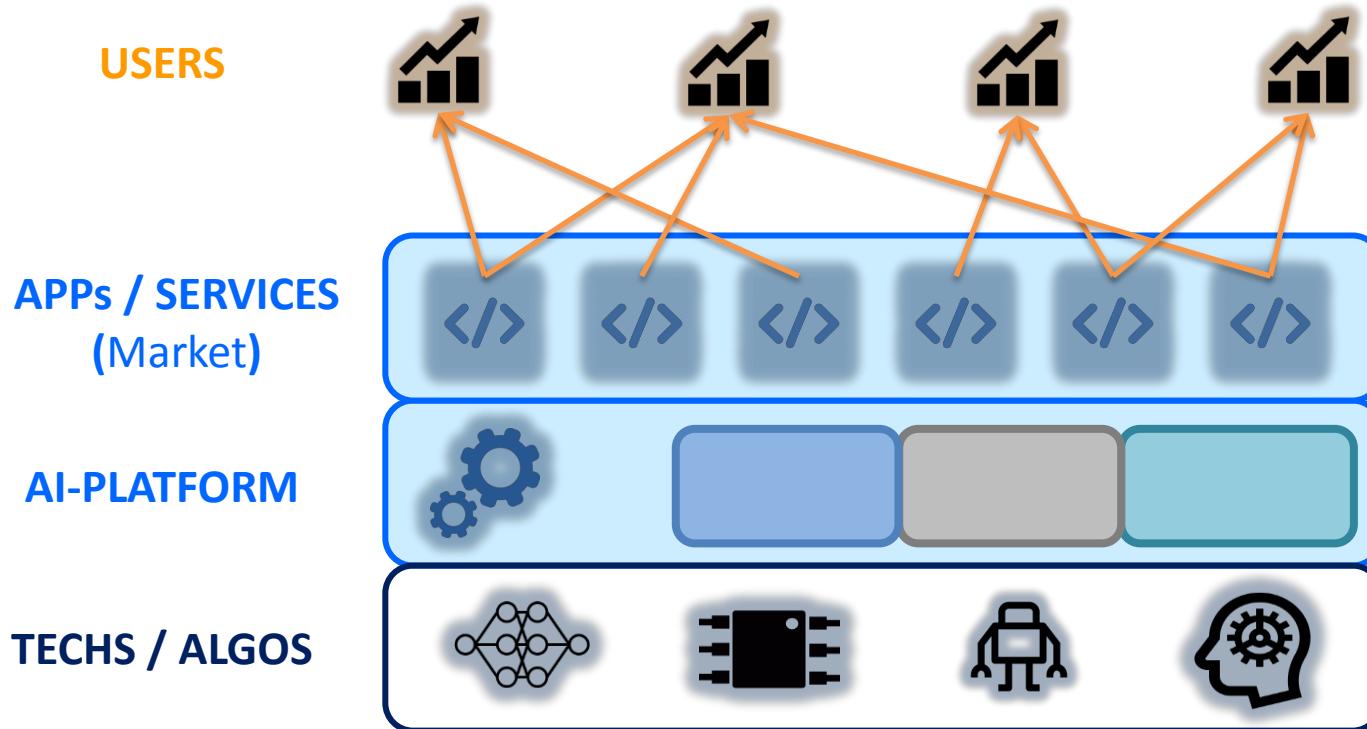
## Características (estrategia)



- **Coordinated Plan AI** (Estrategias nacionales)
- Sinergias publico-privadas (AI PPP)
- Desarrollo tecnologías en **Horizon Europe**
- Despliegue en **DEP**
- **Capacitación**
- Aprendizaje continuo
- **Single Data Space** (Aprovecha datos públicos)
- Tiene en cuenta el **GDPR**
- **AI para el ciudadano**
- Incluye **robots**
- **Ética**

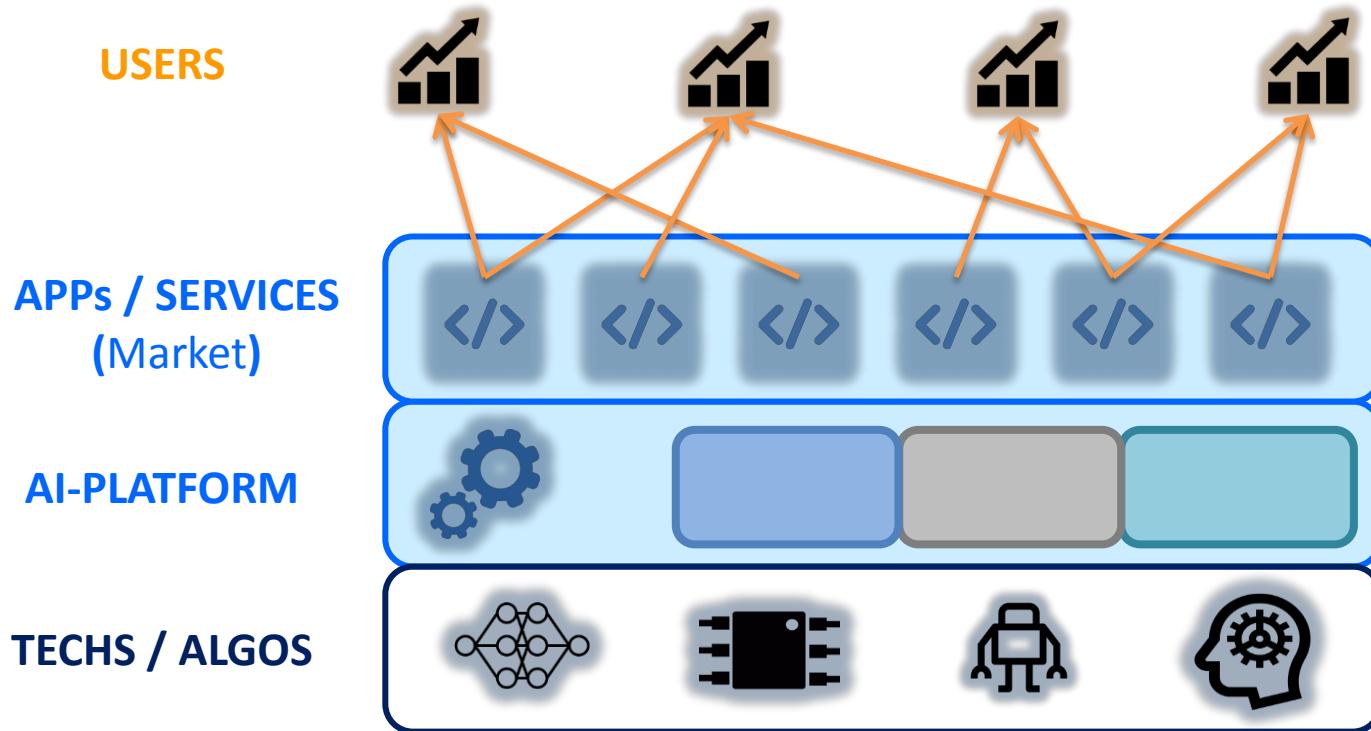
# Inteligencia Artificial en H2020

## Plataforma



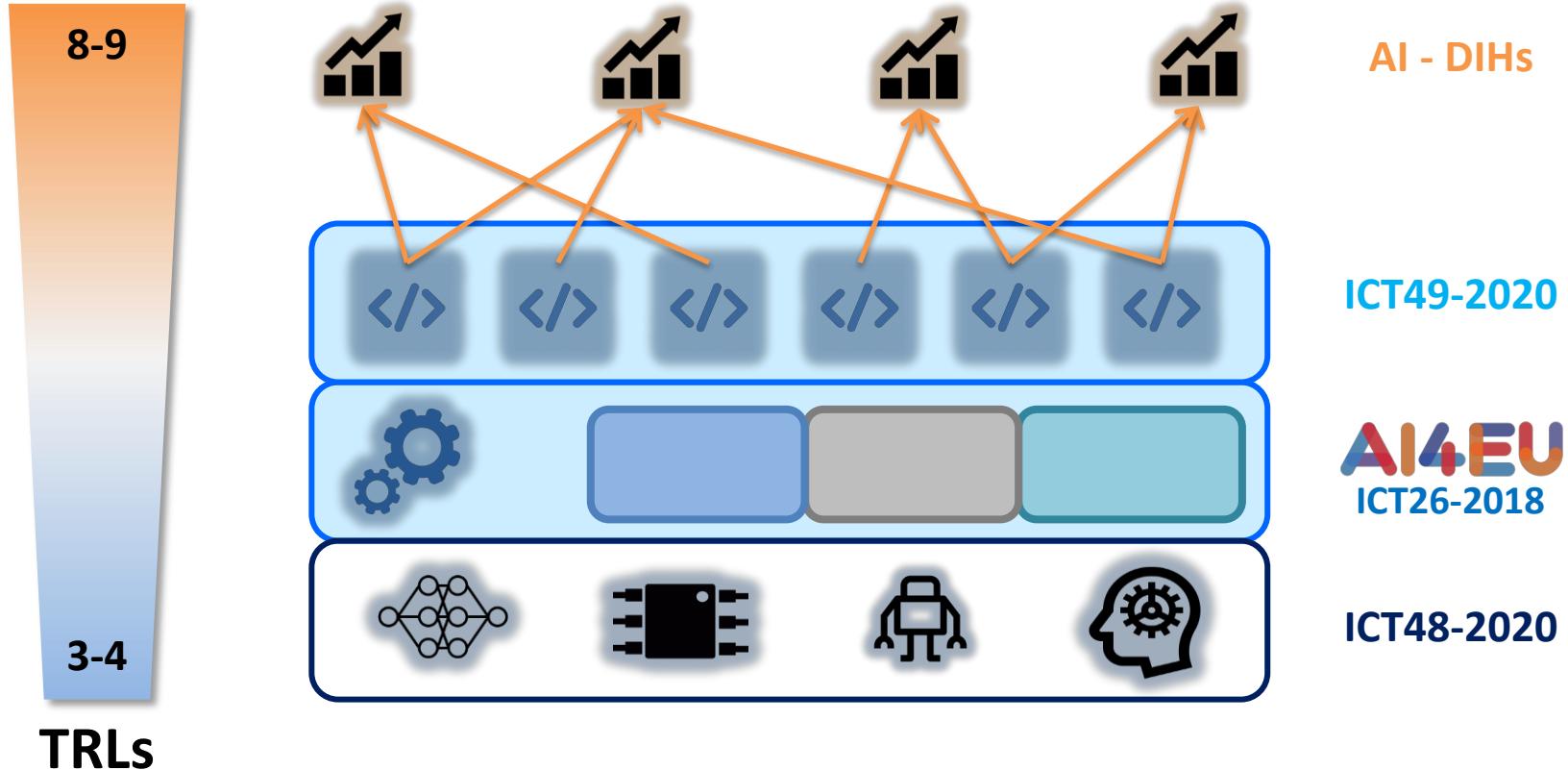
# Inteligencia Artificial en H2020

## Financiación



# Inteligencia Artificial en H2020

Technology Readiness Levels (TRLs)



# El futuro

AI en Horizon Europe (2021-27)



AI + Robotics



## Pilar 1 Excelencia científica

Consejo Europeo de Investigación  
(ERC)

Acciones Marie Skłodowska-Curie  
(MSCA)

Infraestructuras de Investigación



## Pilar 2 Desafíos mundiales y competitividad industrial europea

### Clusters

- Salud
- Cultura, creatividad y sociedad inclusiva
- Seguridad civil para la sociedad
- Mundo digital, industria y espacio
- Clima, energía y movilidad
- Alimentación, bioeconomía, recursos naturales, agricultura y medio ambiente

Centro Común de Investigación (JRC)



## Pilar 3 Europa innovadora

Consejo Europeo de Innovación  
(EIC)

Ecosistemas europeos de  
innovación

Instituto Europeo de Innovación y  
Tecnología (EIT)

## Ampliar la participación y reforzar el Espacio Europeo de Investigación

Ampliar la participación y difundir la excelencia

Reformar y mejorar el sistema europeo de I+I



División de  
Programas de la UE

@EsHorizonte2020

CDTI Centro para el Desarrollo Tecnológico Industrial | E.P.E.



@CDTlofficial



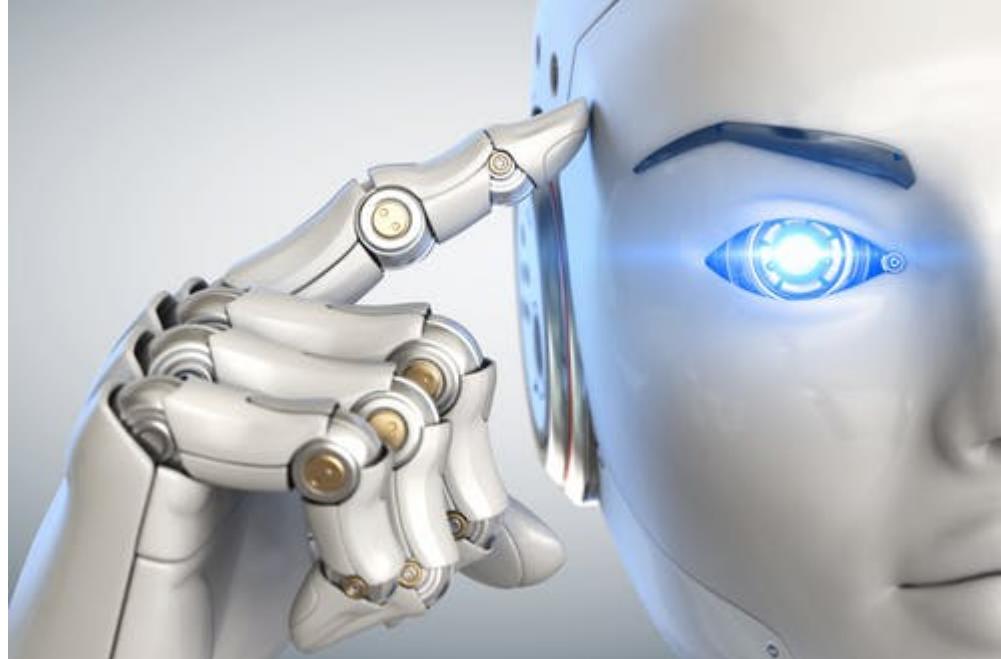
**Enrique Pelayo Campillos**

enrique.pelayo@cdti.es

[www.eshorizonte2020.es](http://www.eshorizonte2020.es) – [www.cdti.es](http://www.cdti.es)



**@EsHorizonte2020 - @CDTlofficial**



# Robótica e Inteligencia Artificial: Visión de CEA



Madrid Robotics Digital Innovation Hub

**Robótica e Inteligencia Artificial  
10 de diciembre de 2019, Madrid**

**Prof. Antonio Barrientos**  
**Vocal Junta Directiva CEA**  
**Universidad Politécnica de Madrid**  
[www.ceautomatica.es](http://www.ceautomatica.es)

# Presentación



## Comité Español de Automática (CEA)

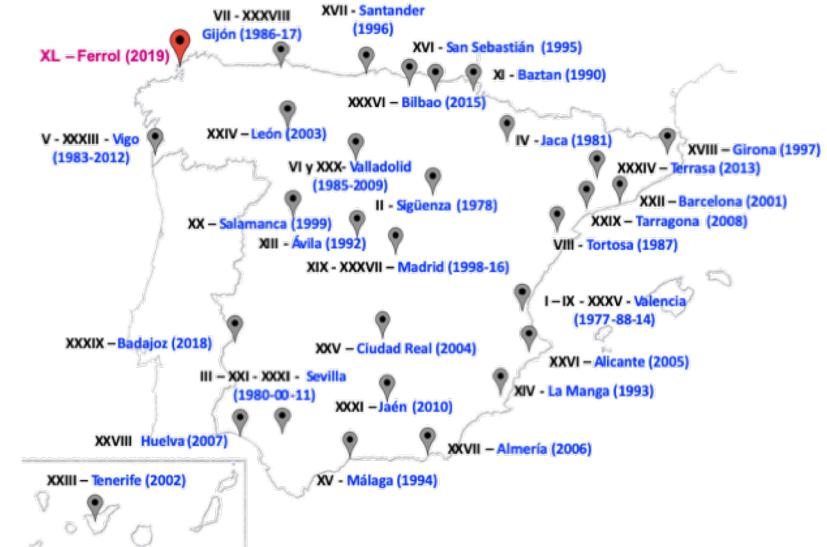
Desde 1968 es una asociación científica española que impulsa el desarrollo de la Automática, comprendiendo entre otros los aspectos relativos a:

- Control inteligente
- Automatización avanzada
- Robótica inteligente
- Visión artificial
- Vehículos autónomos
- Bioingeniería
- Industria 4.0

Revista Iberoamericana  
de Automática e  
Informática industrial

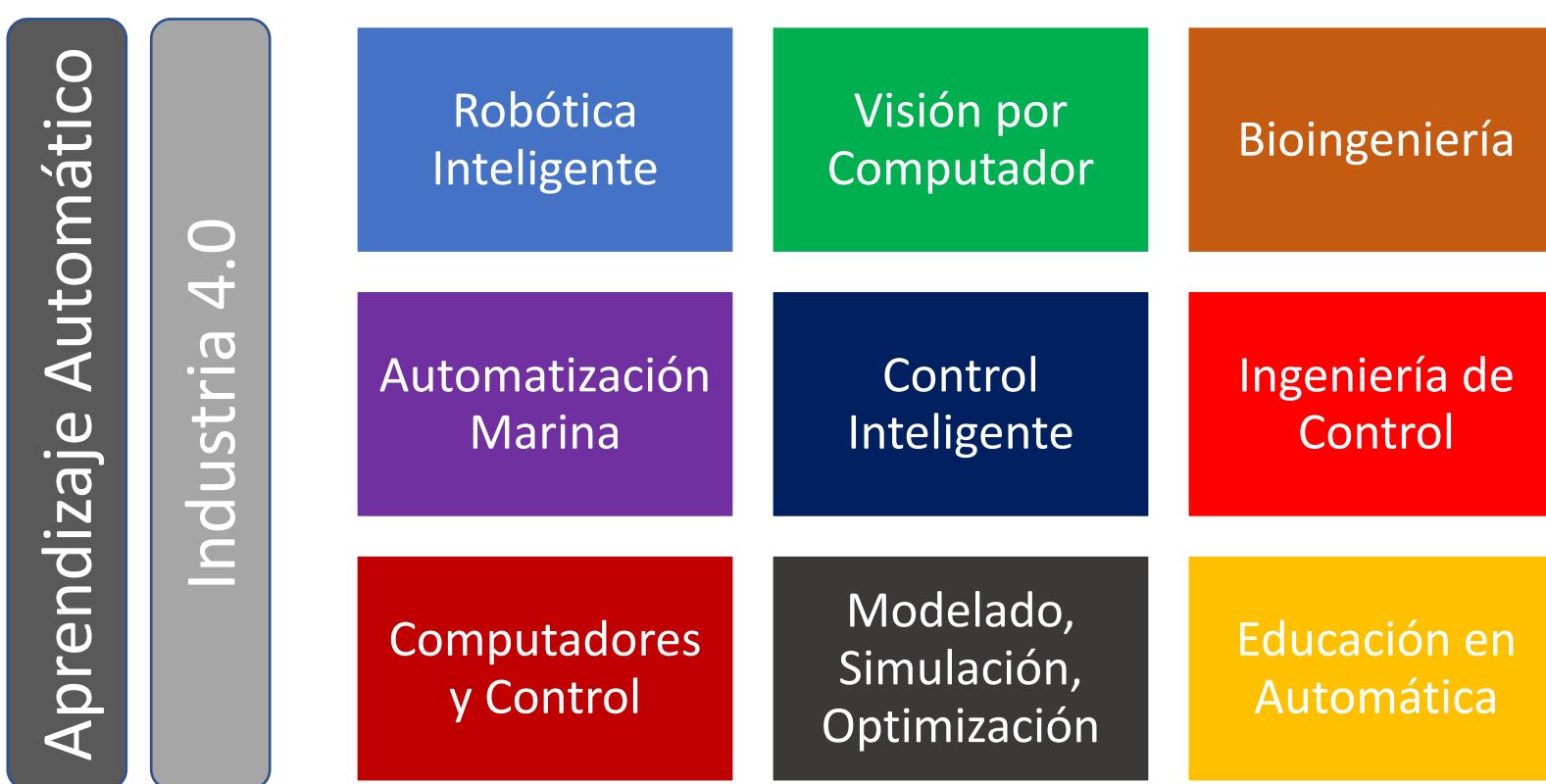


## Jornadas de Automática



**XL Jornadas de Automática Ferrol  
– 250 asistentes**

# Estructura de CEA



**Acciones de dinamización  
“Redes de Investigación”**





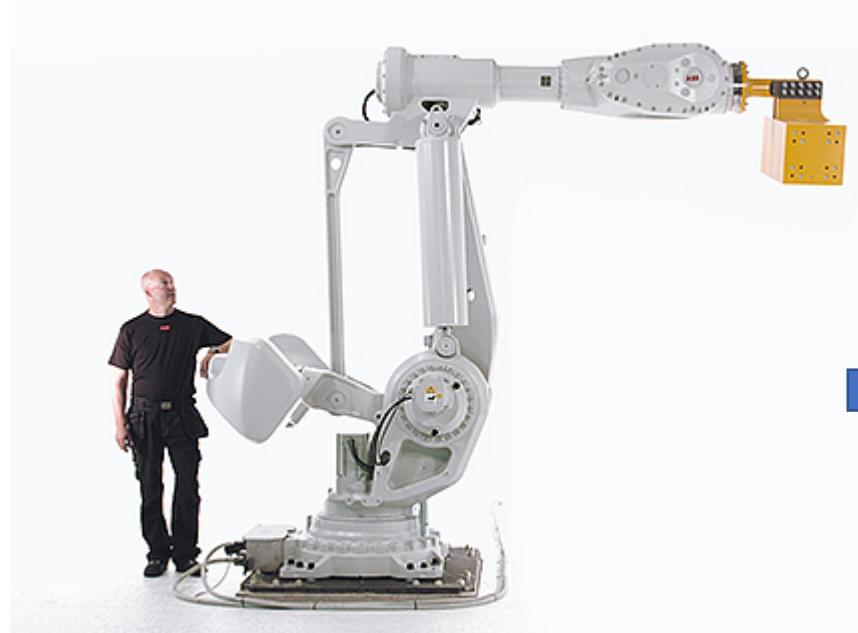
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# CEA y la Robótica

**Prof. Antonio Barrientos**  
*Vocal Junta Directiva CEA*  
*Universidad Politécnica de Madrid*  
[www.ceautomatica.es](http://www.ceautomatica.es)

# Visión de CEA en Robótica (I)



**Robótica Industrial :** robots que trabajan en entornos bien estructurados, especialmente en la manufactura

**Robots de Servicio:** robots que desarrollan tareas que ayudan o complementan a los humanos, excluyendo la manufactura

# Visión de CEA en Robótica (II)

Robótica Industrial



*Robots de  
Manufactura*



*Logística y almacenes  
automatizados*



*Robots  
Colaborativos*

# Visión de CEA en Robótica (III)

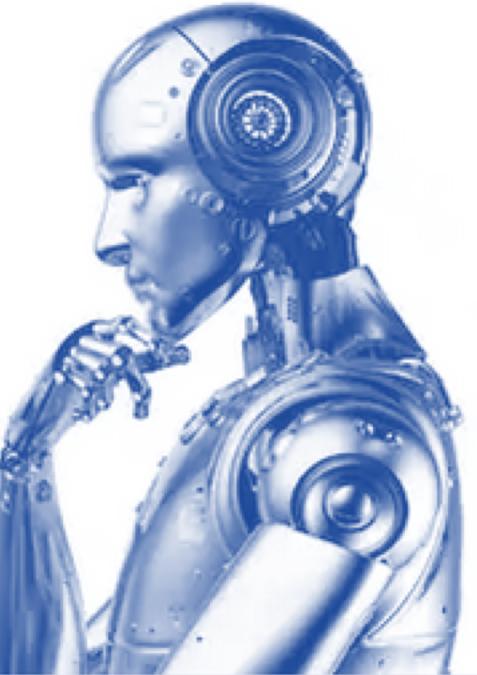
Robótica de Servicios



**Robots de servicios “Personales”**  
o Robótica doméstica: para ayudar a los  
humanos en el ámbito personal (hogar,  
oficina, ocio, etc.)



**Robots de servicios “Profesionales”** : para  
el desarrollo de tareas profesionales en  
entornos no industriales (agricultura,  
medicina, transporte, seguridad, etc.)



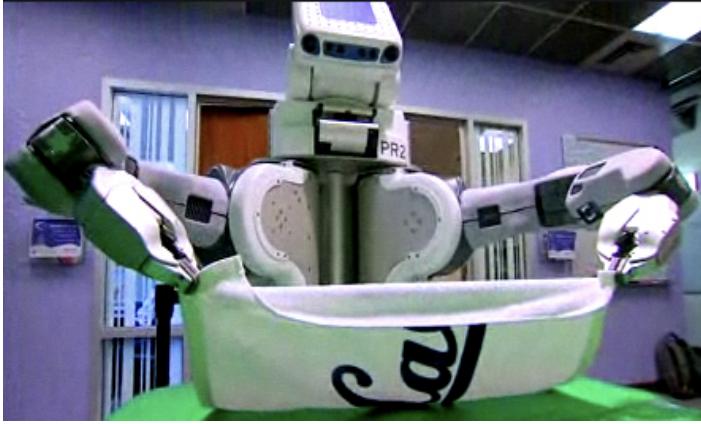
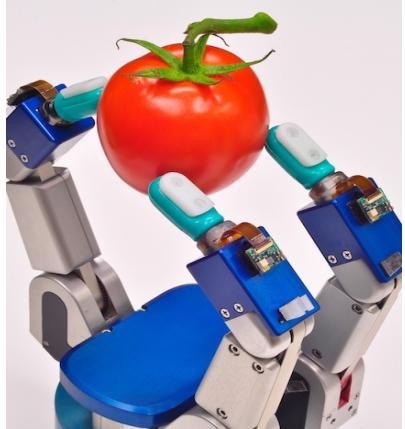
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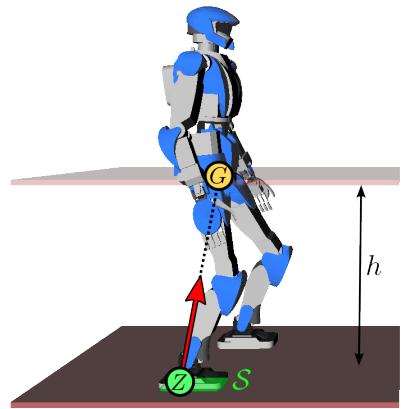
# CEA y la Robótica Inteligente

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# Visión de CEA en Robótica Inteligente (I)

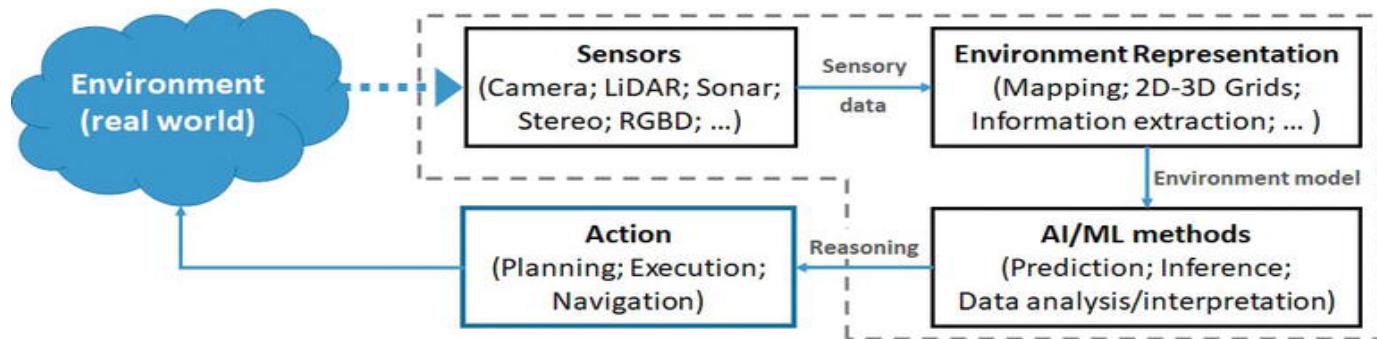
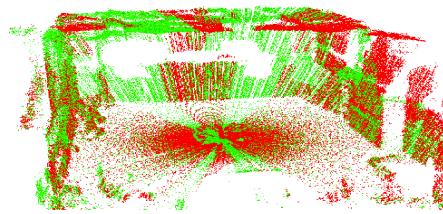


**Manipulación y Agarre :** Los robots manipuladores precisan ser mas hábiles en sus tareas de manipulación, aumentando su capacidad de percibir e interpretar el entorno



**Locomoción:** Los robots deben poder desplizarse por entornos complejos e inestables.

# Visión de CEA en Robótica Inteligente (II)



**Percepción y Comprensión del entorno:** La cantidad de información que nos rodea debe ser percibida para comprenderla situación antes de actuar.



**HMI:** La interacción con los humanos precisa desarrollar altas capacidades de comunicación.

# Colaboración y Coordinación



**COESI**

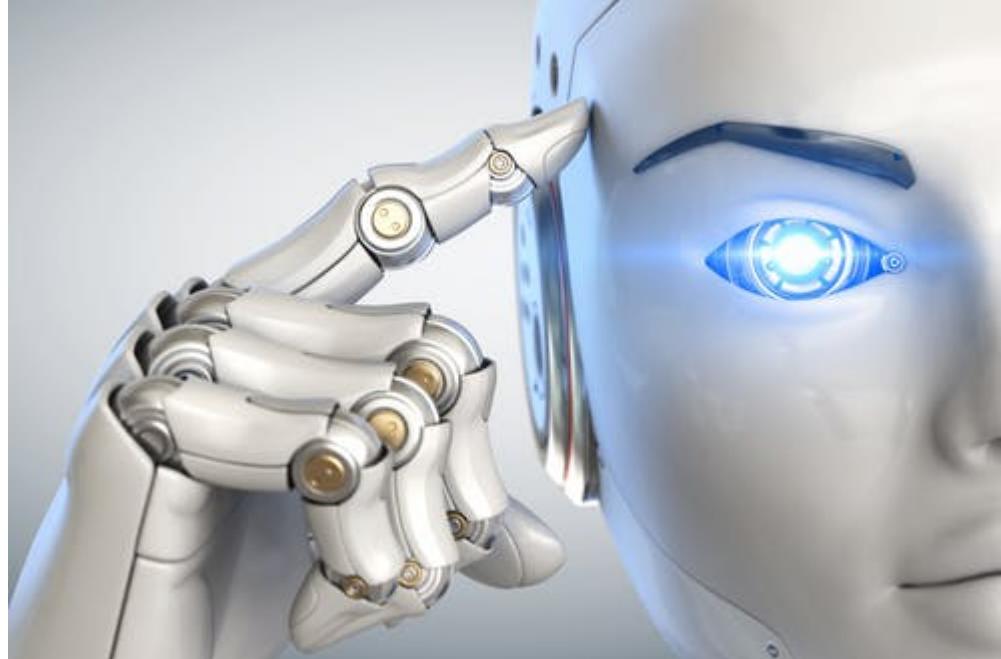
Confederación Española  
de Sociedades de Ingeniería



Asociación Española para la Inteligencia Artificial (**AEPIA**)



**Colaboración y Redes**



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Madrid Robotics Digital Innovation Hub

***Robótica e Inteligencia Artificial  
10 de diciembre de 2019, Madrid***

# Robótica e Inteligencia Artificial: Visión de euRobotics

*Prof. Carlos Balaguer*

*Director euRobotics*

*Universidad Carlos III de Madrid*

[www.eu-robotics.net/eurobotics](http://www.eu-robotics.net/eurobotics)

# euRobotics (I)



**euRobotics** was founded on **17 Sep 2012** by 35 organisations. Now, euRobotics represents more than **300** companies, universities and research institutions, including traditional robotics manufacturers, innovative robotics and software companies, and hospitals, agri-food companies, etc.

# euRobotics (II)

**euRobotics (2012)** formed by the joining of the **EURON (2000)** and **EUROP (2004)**. It promotes the cooperation between industry and academia by applying concepts of **Intelligent Robotics** for European Leadership.

Its **Board of Directors** has 50-50% structure: i) Research (universities and research centers and ii) Industry (big enterprises and SME).

## Board of Directors

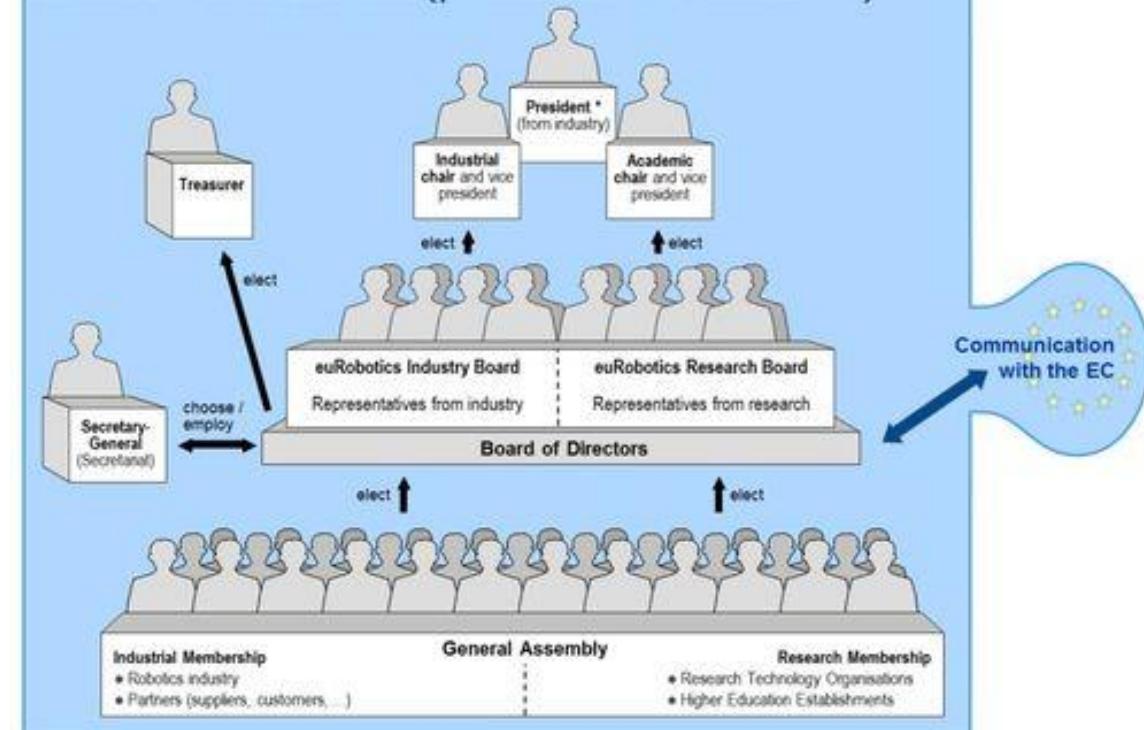
### RESEARCH

1. Agirre Ibarbia, Jon; Tecnia
2. Balaguer, Carlos; University Carlos III of Madrid
3. Brell-Cokcan, Sigrid; Robotics in Architecture
4. Hägele, Martin; Fraunhofer-IPA
5. Leroux, Christophe; CEA
6. Rocco, Paolo; Politecnico di Milano
7. Röning, Juha; Oulu University
8. Saenz, José; Fraunhofer IFF
9. Saffiotti, Alessandro; Orebro University
10. Siciliano, Bruno; University of Naples
11. Stramigioli, Stefano; University of Twente
12. Vincze, Markus; TU Wien

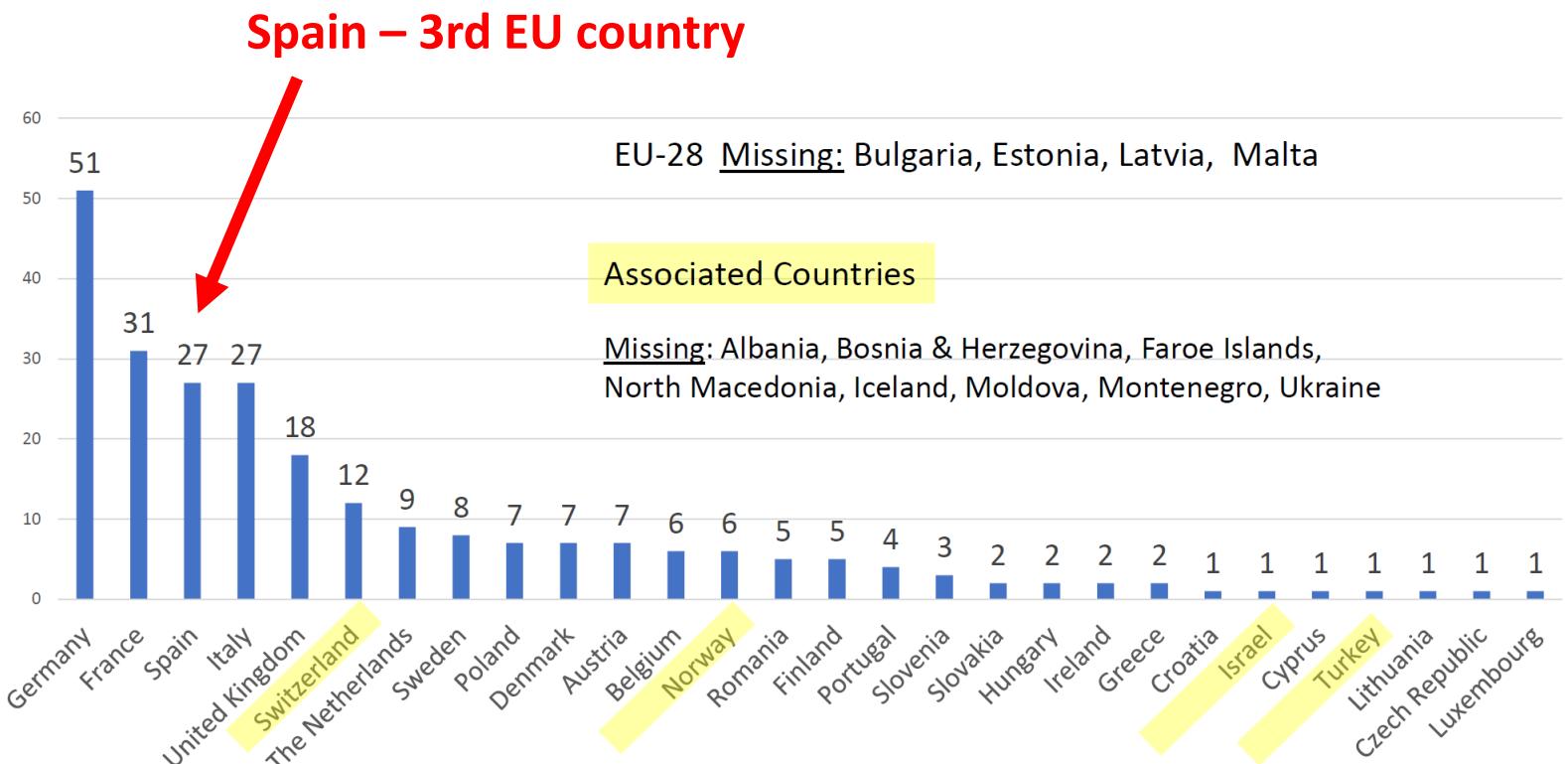
### INDUSTRY

1. Bischoff, Rainer; KUKA
2. Bisset, David; iTechnic
3. Calva, Mauricio; Chevron North Sea
4. Champion, Renaud; PRIMNEXT SARL
5. Ferro, Francesco; PAL Robotics
6. Hofweber, Josef; Continental
7. Koudelkova Delimoges, Petra; Another Brain
8. Pegman, Geoff; R U Robots
9. Stancu, Ana-Maria; Bucharest Promo Robots
10. Tomatis, Nicola; BlueBotics SA
11. Walker, Rich; Shadow Robot Company
12. Waltenberger, Anne; ABB

## Structure of euRobotics aisbl (private side of the Robotics PPP)

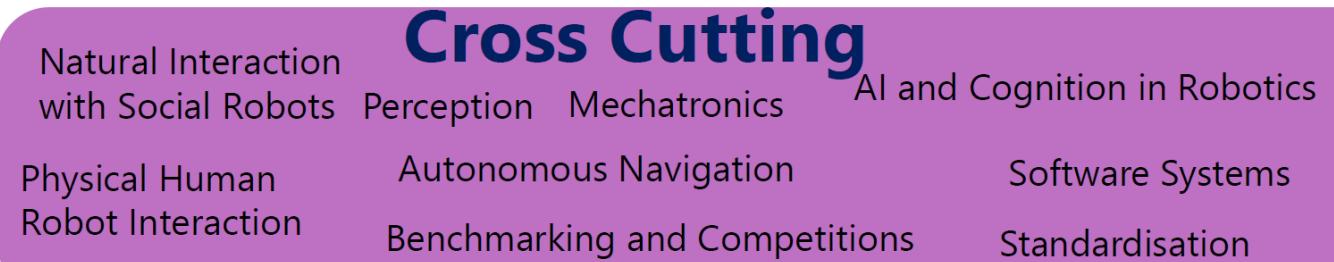


# euRobotics (III)



# euRobotics (IV)

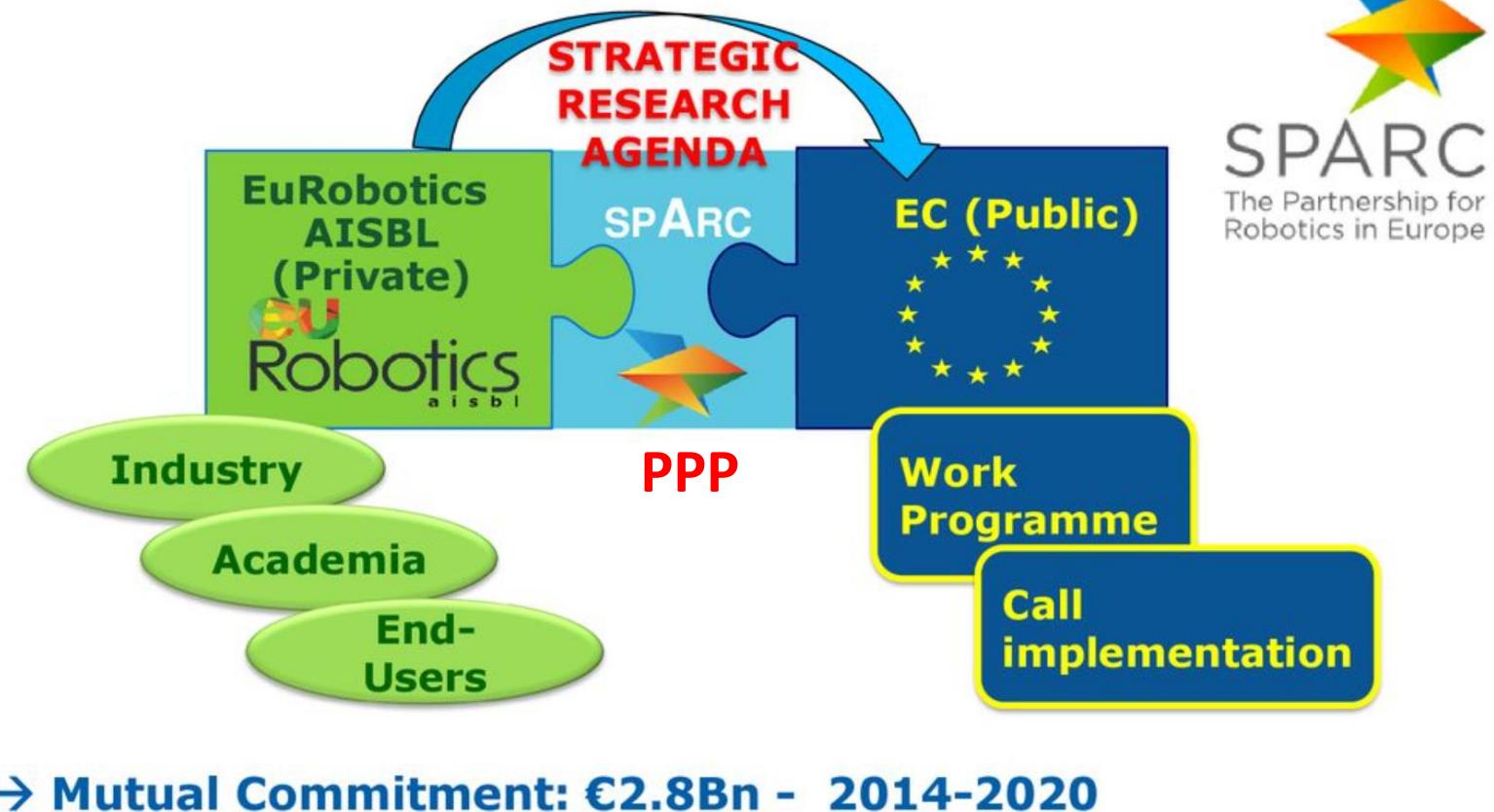
## Topics Group



# euRobotics and SPARC

**SPARC** is the **Public-Private-Partnership** (PPP) for robotics in Europe to maintain and extend Europe's leadership in robotics.

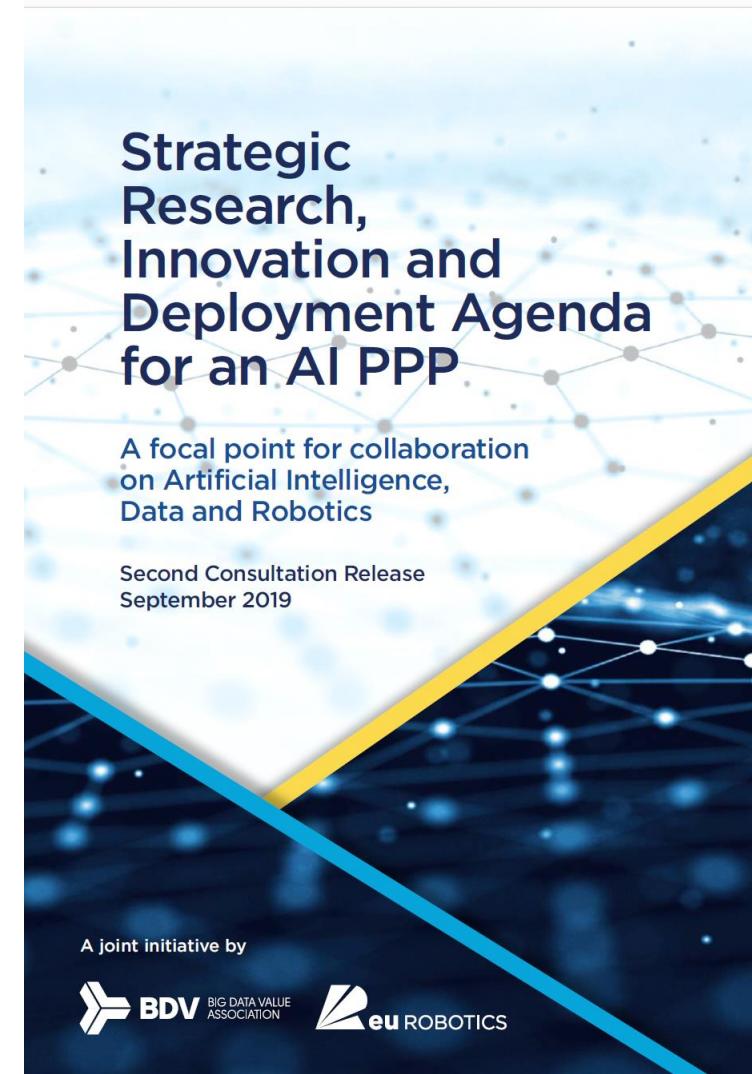
SPARC is the **bridge** among euRobotics and European Commission



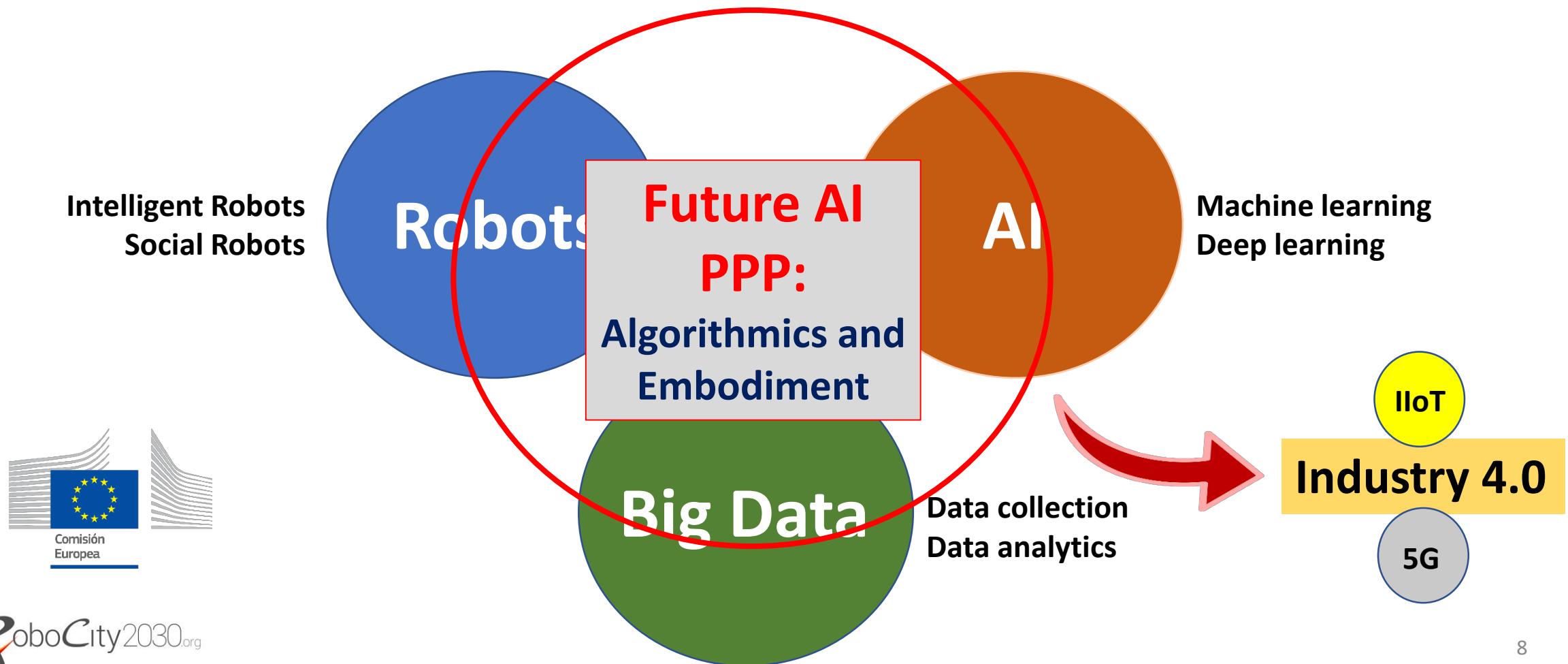
# Robotics and AI (I)

## A Focal Point for Collaboration:

“The European Commission’s Coordinated Plan on Artificial Intelligence highlights the importance of AI for Europe and calls for the development of an **industrially led AI PPP** triggered by the **Big Data Value Association (BDVA)** and the **European Robotics Association (euRobotics)** through the joint action of their respective PPPs.” (September 2019)



# Robotics and AI (II)



# Robotics and AI (III)



***“Robotics and AI are two sides  
of the same coin”***

**Dr. Juha Heikkilä, Head of Robotics and  
Artificial Intelligence Unit of the DG  
CONNECT**

*Digital Excellence Forum @ ICT Proposers'  
Day 2019 (19-20 September 2019)*

# European AI Framework (I)

## European AI Framework

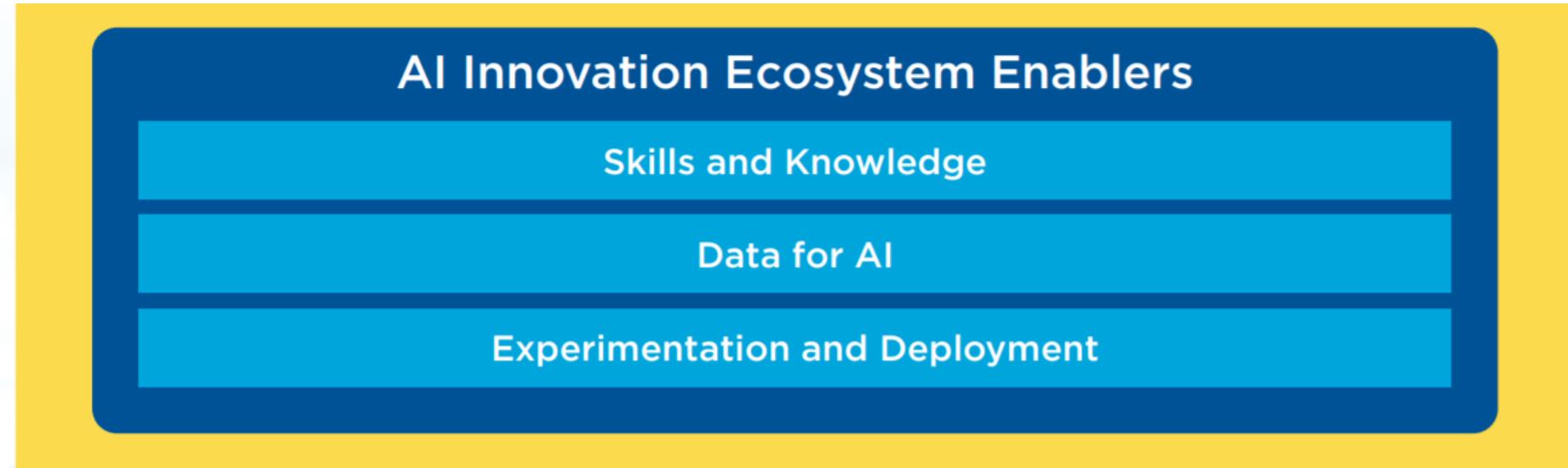
European Fundamental Rights, Principles and Values

Value-Driven AI for Business, Society and People

Policy, Regulation, Certification and Standards

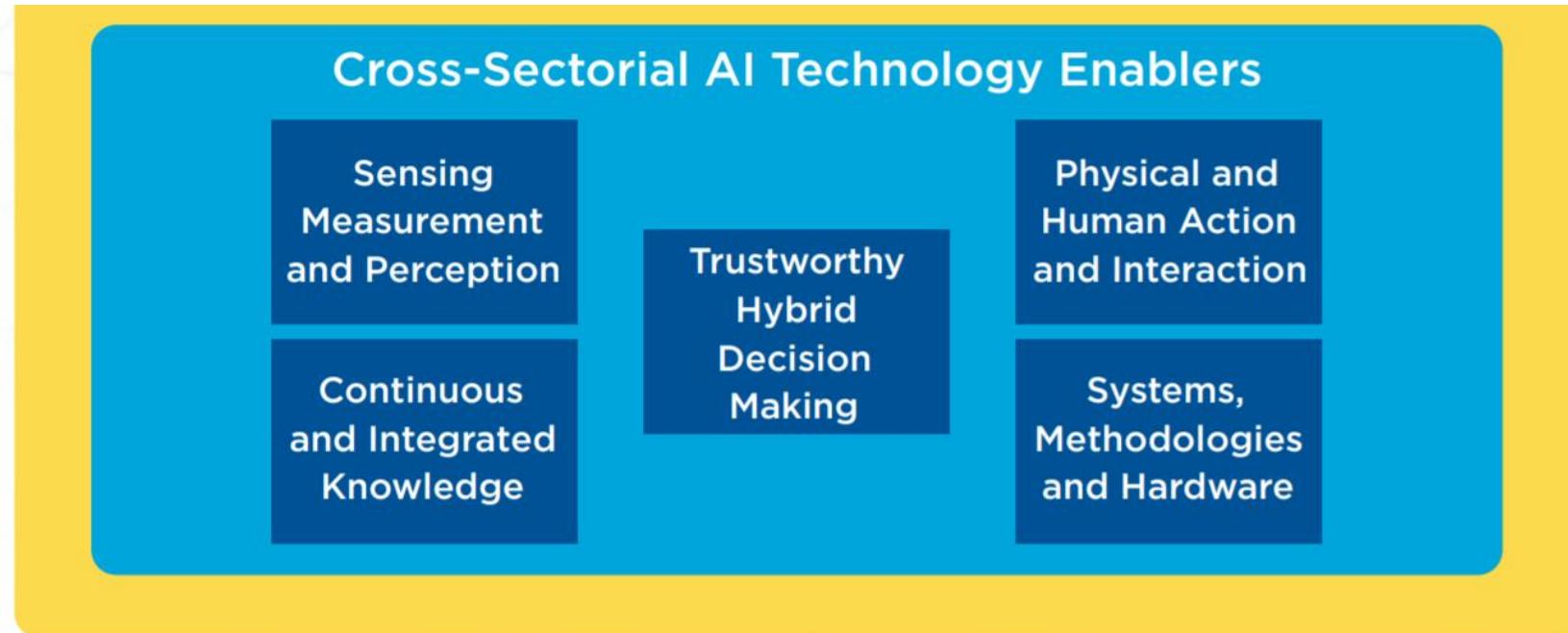
**The European AI Framework** represents the legal and societal fabric that underpins the impact of AI on stakeholders and users of the products and services that businesses will provide

# European AI Framework (II)



The **AI Innovation Ecosystem Enablers** represent essential ingredients for effective innovation and deployment to take place

# European AI Framework (III)



**The Cross Sectorial AI Technology Enablers** represent the core technical competencies that are essential for the development of AI systems



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# **Robótica e Inteligencia Artificial**

**Retos y nuevas oportunidades**

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# Excelencia en Robótica Inteligente



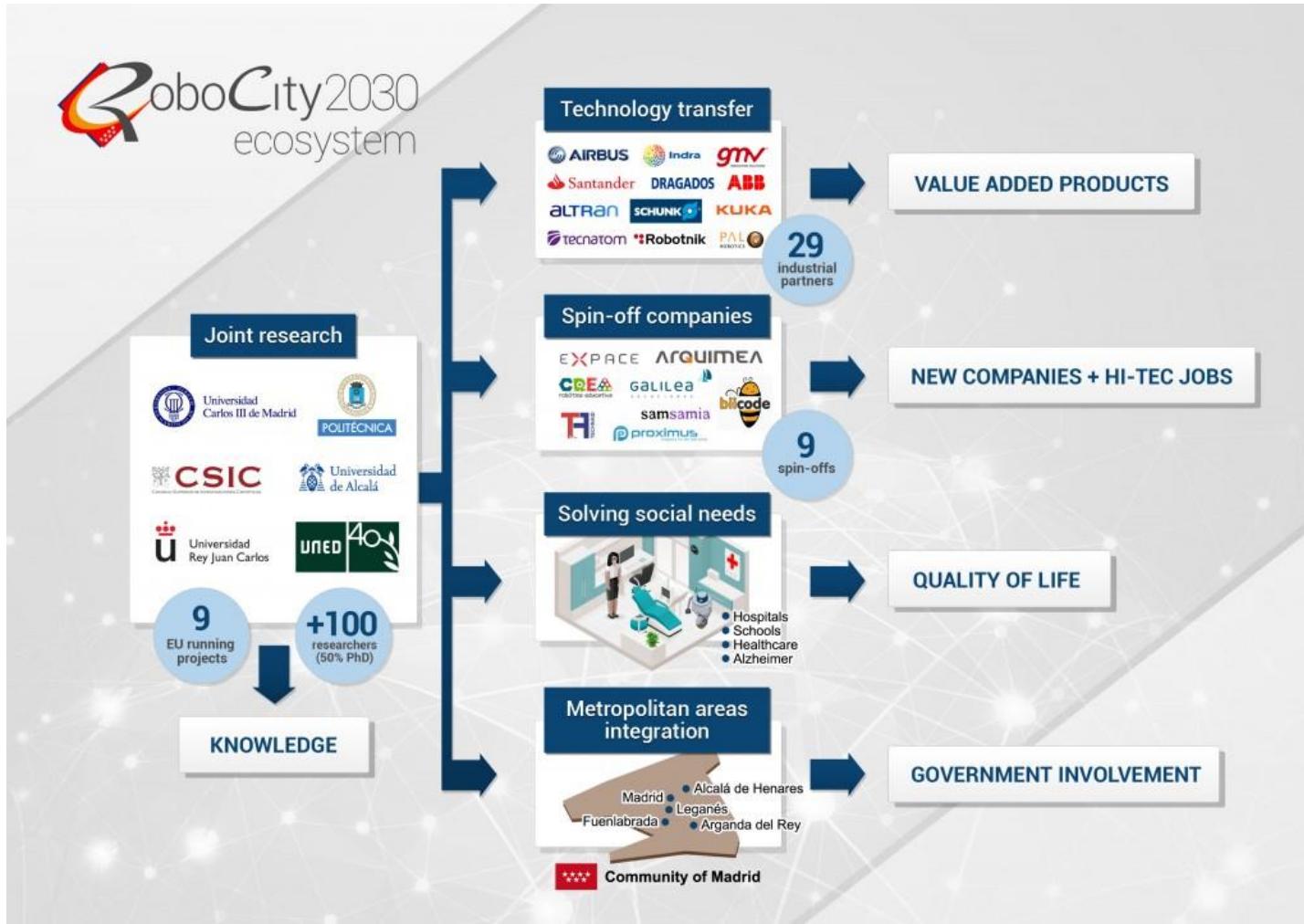
UNIÓN EUROPEA  
Fondos Estructurales  
Invertimos en su futuro



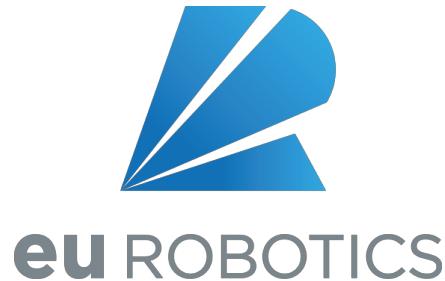
Madrid Robotics Digital Innovation Hub

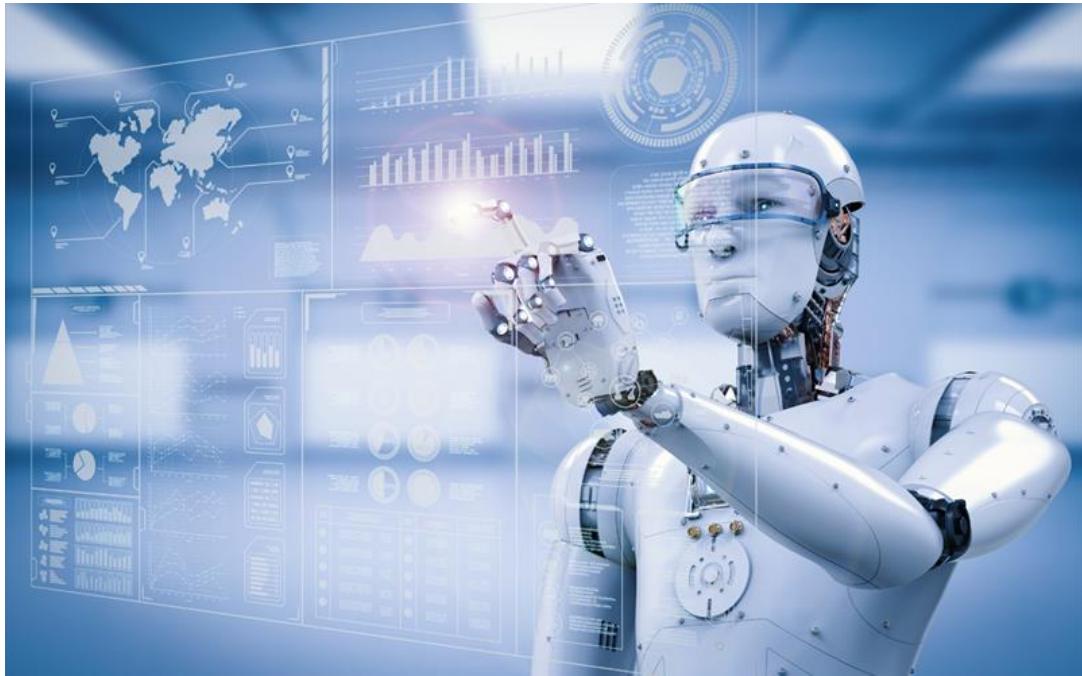
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# DIH: Eco-sistema de I+D e innovación



# RoboCity2030: Cooperación





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**Prof. Luis Miguel Bergasa**  
**University of Alcalá (UAH)**

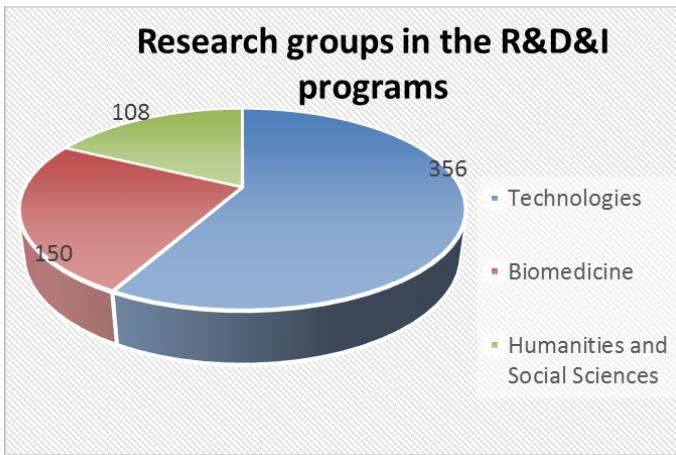


## Madrid: Capital region

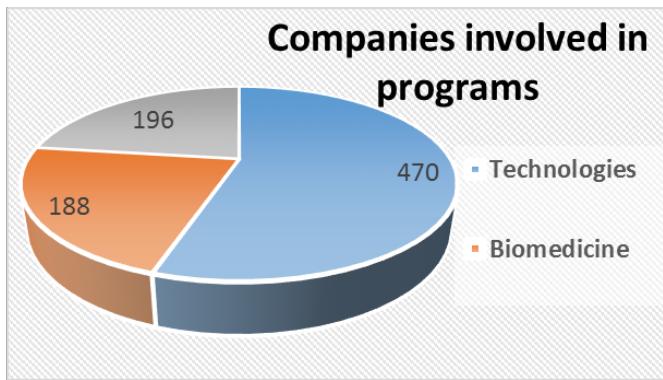
### Community of Madrid

- Population – 6,5 M
- GDP – 204.000 M€ (top 3 in EU)
- GDP per capita – 31.800 €
- Industrial sector – (1<sup>st</sup> in Spain)
  - ICT
  - Aeronautics
  - Automotive
  - Manufacturing
  - Construction
  - Services

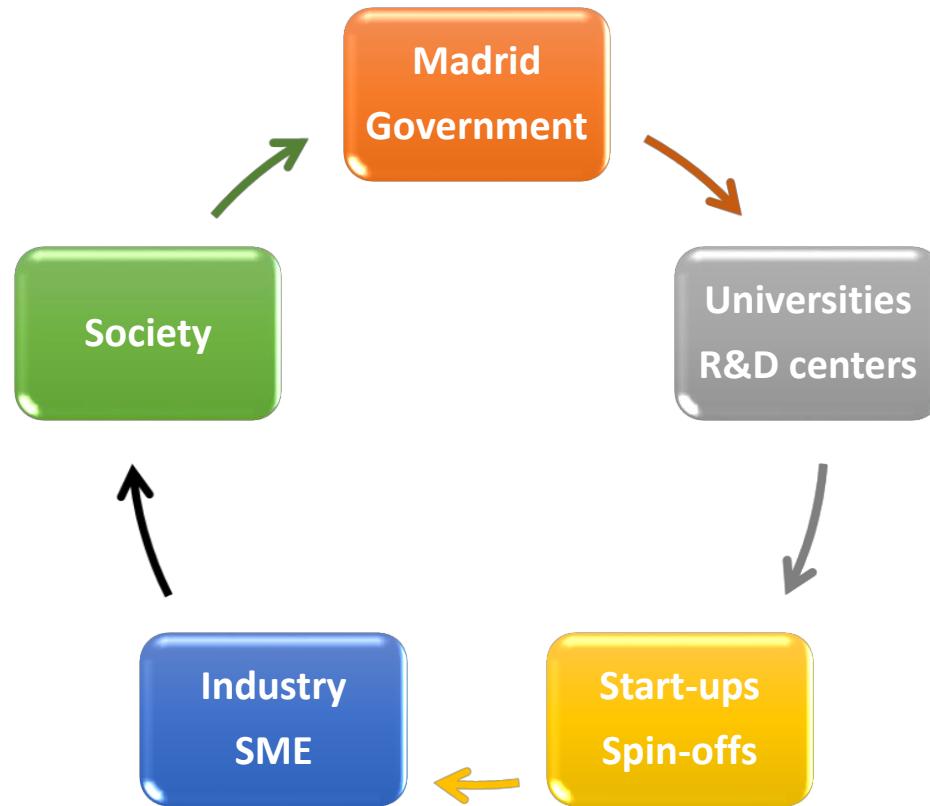
*Source: Eurostat, 2016*



**+600 research teams  
(7.000 researchers)**



**+850 companies  
(80% SME)**



**Every 1 € the investment by the Community of Madrid generates 10 € for companies and R&D**

## Madrid's DIHs:

- **Investment:**
  - **177 M €** regional funds invested (since 2007)
- **Main fields:**
  - Technologies
  - Biomedicine
  - Humanities
  - Social Sciences
- **Employment:**
  - **+750** new high-tech jobs (since 2010)
  - **+60** new start-ups & spin-offs

*Source: CM, 2017*

# 1. Purpose and focus (I)



RoboCity2030-III-CM project (Robótica aplicada a la mejora de la calidad de vida de los ciudadanos. fase III; S2013/MIT-2748) is funded by Programas de Actividades I+D en la Comunidad de Madrid and cofunded by Structural Funds of the EU.

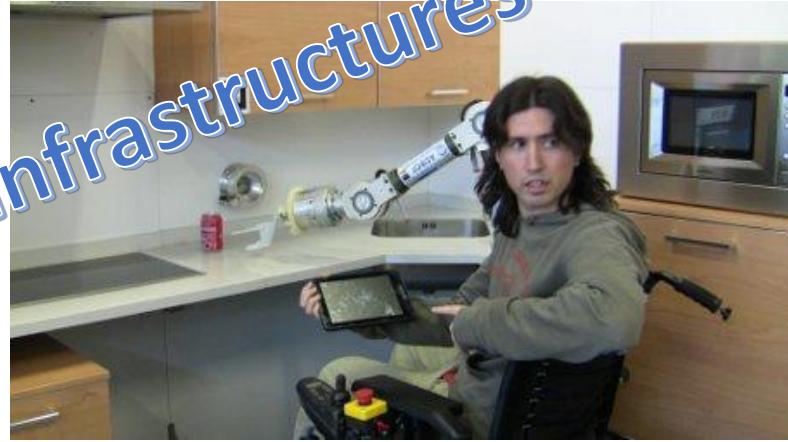
1. Support **research** excellence
2. Perform technology **transfer**
3. Create innovative **start-ups**
4. Active **training** for companies
5. Testing & developing new **products**
6. Dissemination to **society**
7. The **cooperation** with other regions

- **RoboCity2030** is the Community of Madrid Hub in Robotics since 2006:
  - Phase I: 2006-2010 – R&D network
  - Phase II: 2010-2014 – Applications (cities)
  - Phase III: 2014–2018 – Applications (citizens)
- **Phase IV: 2019-2022 - DIH**
- Community of Madrid funding: ~4 M€
- Partners:
  - 5 universities
  - 1 R&D center
  - 29 companies (including SMEs)
  - 9 start-ups (active)
- Municipalities involved:
  - Madrid, Leganés, Arganda, Fuenlabrada, Alcalá de Henares

## 1. Purpose and focus (II)



# Infrastructures



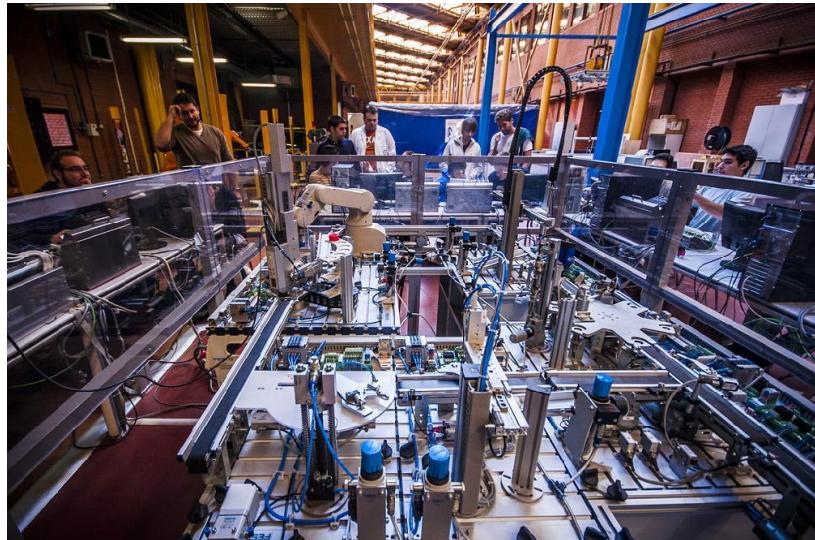
Kitchen test-bed for assistive robots



Highway circuit for autonomous vehicles



Country field for agricultural robots



Industrial test-bed for manufacturing system design



Scientific Park UC3M  
TecnoAlcalá



Channel test-bed for underwater inspection robots

## 2. Facts and figures (II)



**1. Science:** 14 workshops with +1.000 attendants and +250 papers

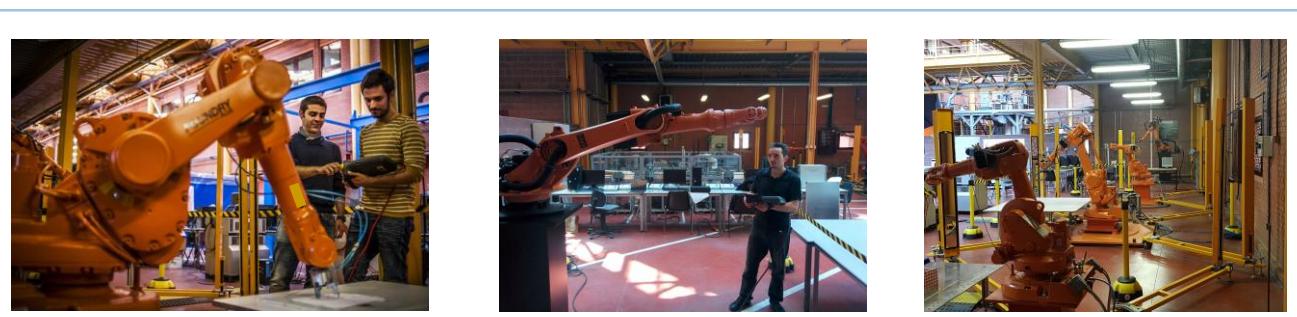


**2. Dissemination:** +5 big events with +3.000 general public and media attendance



**3. Incubator:** 9 new (alive) star-ups created new 120 high-tech and 60 technicians jobs & 16 M€

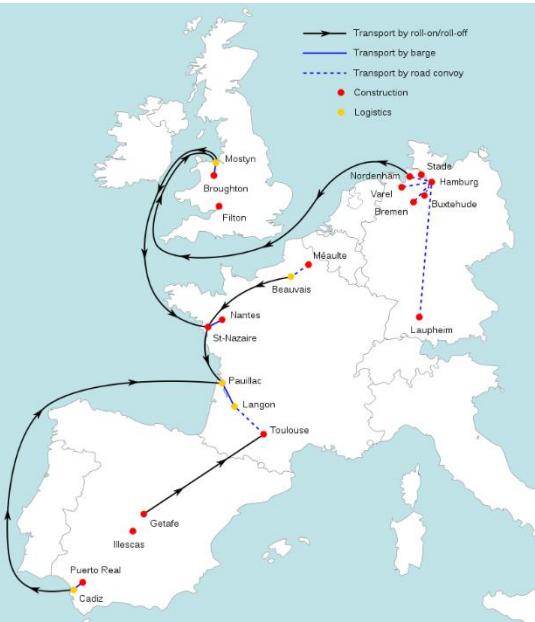
**5. Industry:** +30 companies with contracts for testing and development of new products



**4. Training:** +30 courses for 6 companies in the field of robotics

**3. Impact on the region**





Industry

- Framework collaboration agreement signed in 2012
- AIRBUS factories:
  - Getafe
  - Illescas
- Business areas:
  - Collaborative robots
  - Industry 4.0
  - Logistics
  - Inspection
  - HR (interdisciplinary teams)
- Employees training:
  - 14 courses in robotics
  - 6 courses in automation
- Collaboration with RC:
  - In 2 EU projects
  - In 7 national projects
  - In 2 regional project

## 4.1 AIRBUS: Success story

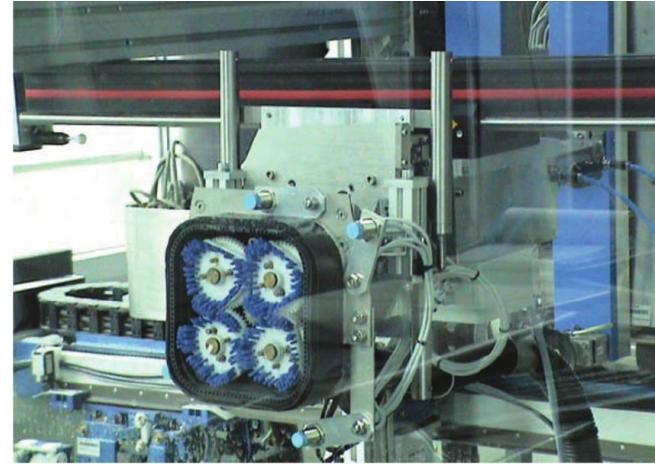


**Highways:** Inspection of roads and highway (UAVs)

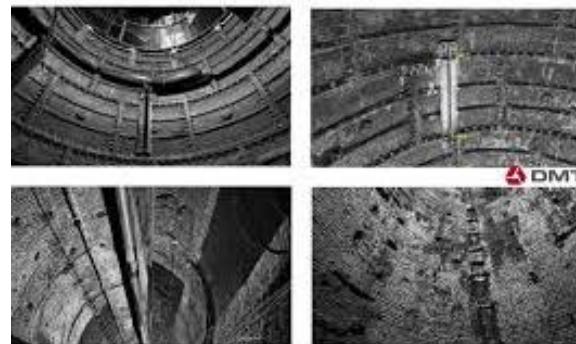


**Tunnels:** Inspection of concrete structures (mobile manipulator)

## Inspection & Maintenance



**Buildings:** Maintenance of building facades (climbing robots)



**Mines:** Inspection of flooded carbon shafts (underwater robot)

- HispaRob – Spanish Robotic Technological Platform (+150 partners)
  - PTEC - Spanish Technological Platform of Construction (+110)
- Business areas:
- Civil infrastructures
  - Buildings
  - Highways and railways
  - Mines
  - Smart cities
- Collaboration with RC:
    - In 5 EU projects
    - In 2 national projects
    - In 2 regional projects



**Rehabilitation:**  
physical & cognitive (3\*)

**Healthcare**



**Patient interaction:**  
children with cancer (7\*)



**Safeguard: infections (2\*)**



**Hospital rooms:**  
automation &  
monitoring (1\*)

- Agreement with public Madrid hospitals network
- Hospitals:
  1. Gregorio Marañón (Madrid)
  2. Carlos III (Madrid)
  3. Alcorcón
  4. Getafe
  5. Leganés
  6. HNPT (Toledo)
  7. Oncologic (Lisbon)
- Issues treated:
  - +20 different problems treated (since 2012)
- Collaboration with RC:
  - In 2 EU project
  - In 4 national projects
  - In 1 regional project

\* number of hospital

## 4.3 SaludMad: Success story





RoboCity2030 has an international network of collaborators with the objectives of:

- Strengthening **trans-regional** collaboration
- Improving **transnational** R&D liaisons
- Finding added value cooperation for **high-tech companies**
- Developing **synergies** and building larger initiatives

Tokyo  
Sidney

## 5. Beyond Madrid region



THANK YOU

<https://www.robocity2030.org/>