Workshop “"Industry 4.0 - Implications for an EU industrial policy”
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TECHNOLOGICAL INTEGRATION IN INDUSTRY 4.0: WHAT DRIVES THE EMERSION OF EUROPEAN CHAMPIONS?

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HR EXCELLENCE IN RESEARCH

We are living an age of profound changes of the economic system as we know it

- A broader renewal of interest in the role of manufacturing (EC, 2013)
- The process of tertiarisation is still at the centre of the political agenda, but we have started to deal with the future of manufacturing
  - National strategies in Italy, Germany, France, the UK
- Industry 4.0 is about changing the production process in the way it is systematically connected, informed and controlled

The gap

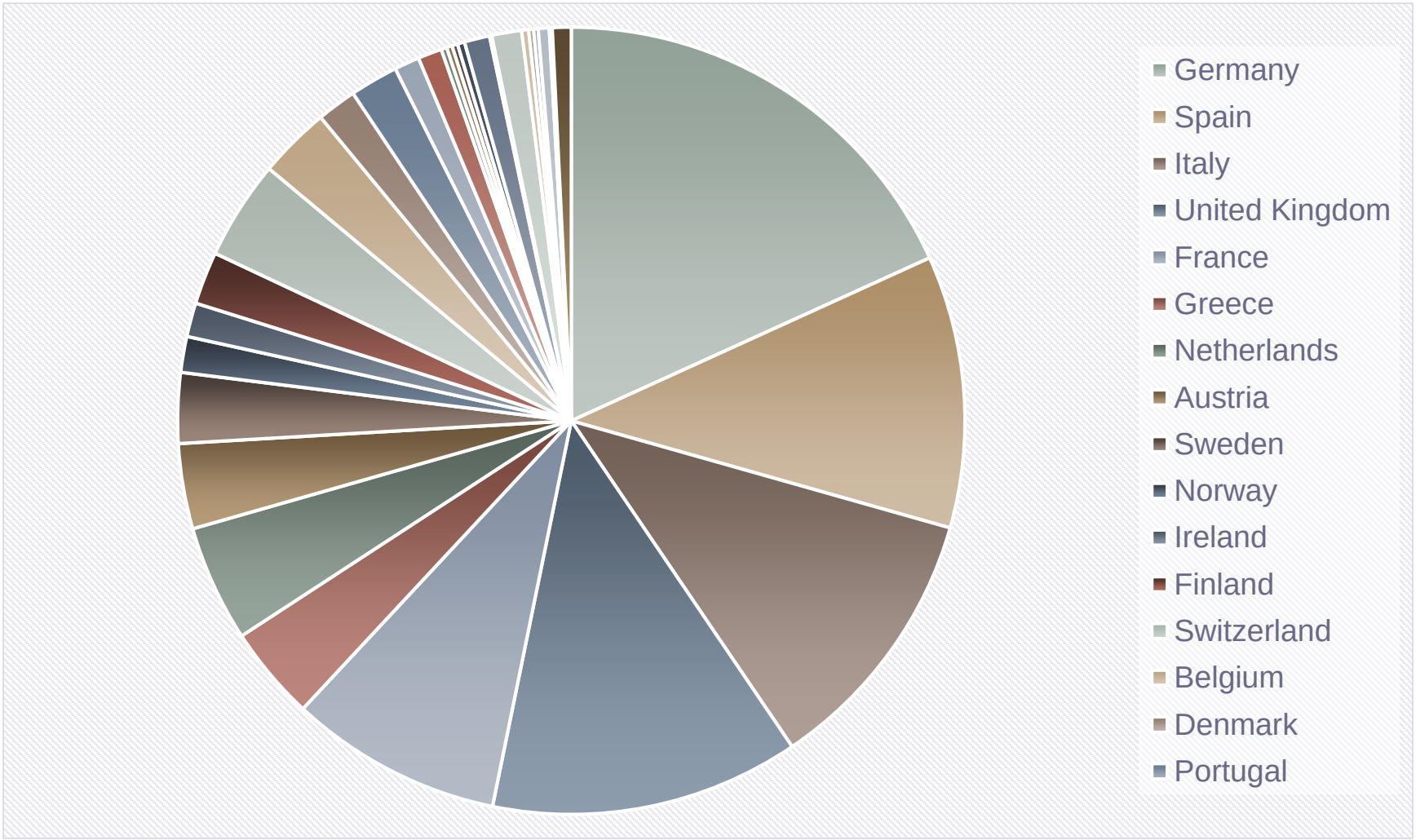
- Economists have failed to realise the pervasive effects of Industry 4.0
- Little information about the distribution of competencies across the EU
  - No official classification of Industry 4.0 activities

- We focus on the enabling technologies developed with the support of the EC
- Data drawn from the RED database of approximately 10,000 research cooperation projects
  - FP7, "Cooperation" and "Capacities" programmes
  - Source: Ismeri Europa, CORDIS data

The list of enabling technologies defined in the Italian plan for Industry 4.0

- Advanced Manufacturing Solutions
  - Interconnected, easily programmable collaborative robots
- Additive Manufacturing
  - 3D printers connected to digital development software
- Augmented Reality
  - Augmented reality supporting production processes
- Simulation
  - Simulation between interconnected machines to optimise processes
- Horizontal/Vertical Integration
  - Integration of information along the value chain, from suppliers to consumers
- Industrial Internet
  - Multidirectional communication between production processes and products
- Cloud
  - Management of big data on open systems
- Cyber-security
  - Security in network operations and on open systems
- Big Data and Analytics
  - Big data analysis to optimise products and processes

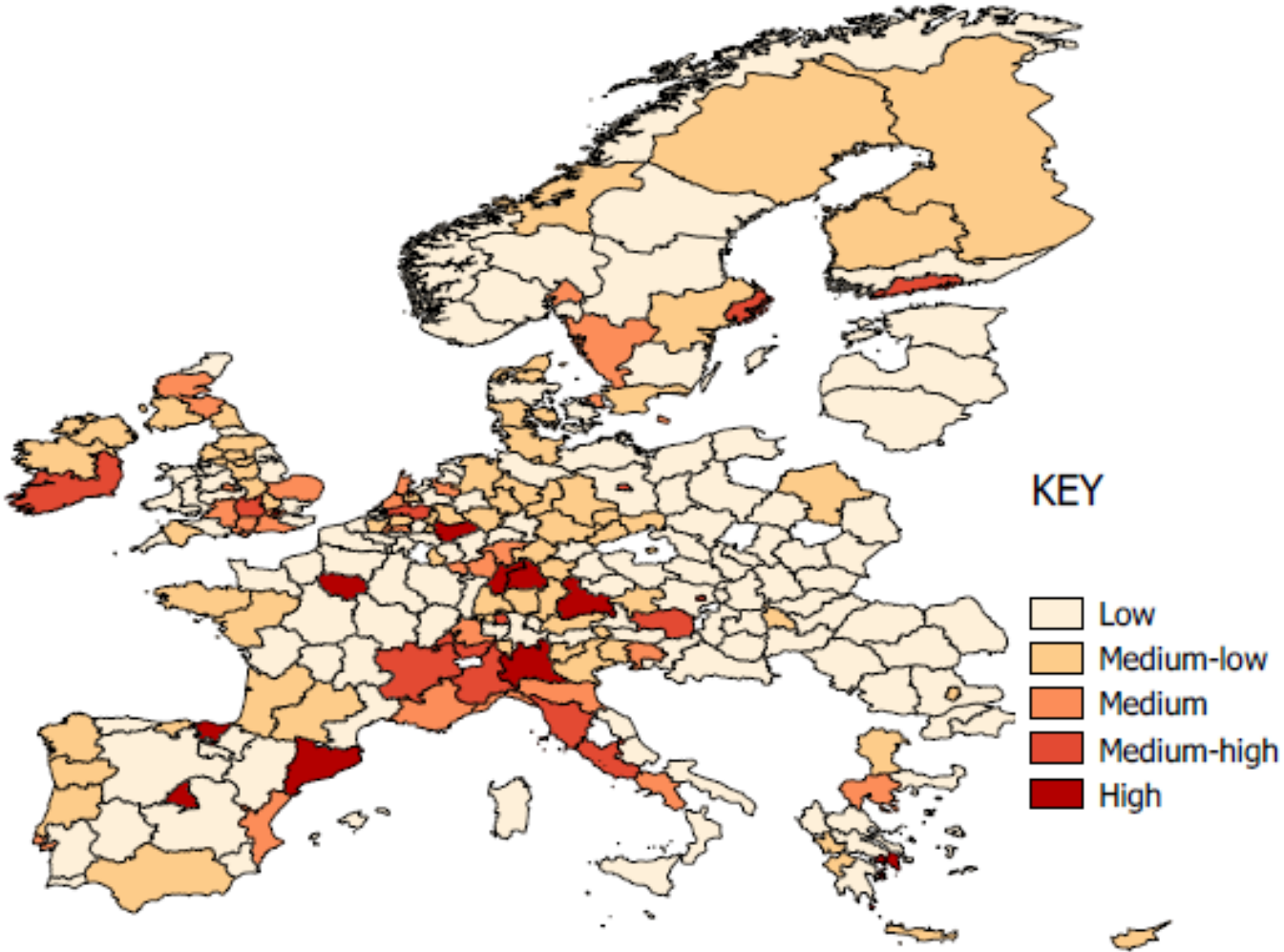
Total participations



The national “clubs”

1. Germany - lead country in Industry 4.0, both in terms of projects coordination and participation
    1. Wide participation of national firms in collaborative projects
2. Spain, Italy and the UK - upper half of a strong second tier of countries with original capacities
    1. Project leadership in over 40% of cases
    2. Balanced participation of RI and enterprises
3. France, Greece, the Netherlands and Austria - lower half of a strong second tier of countries with original capacities
    1. Switzerland, lower rate of project coordination, but relatively high rate of participation
4. All other Member States - laggards, not possessing many original capacities in any of the fields of Industry 4.0

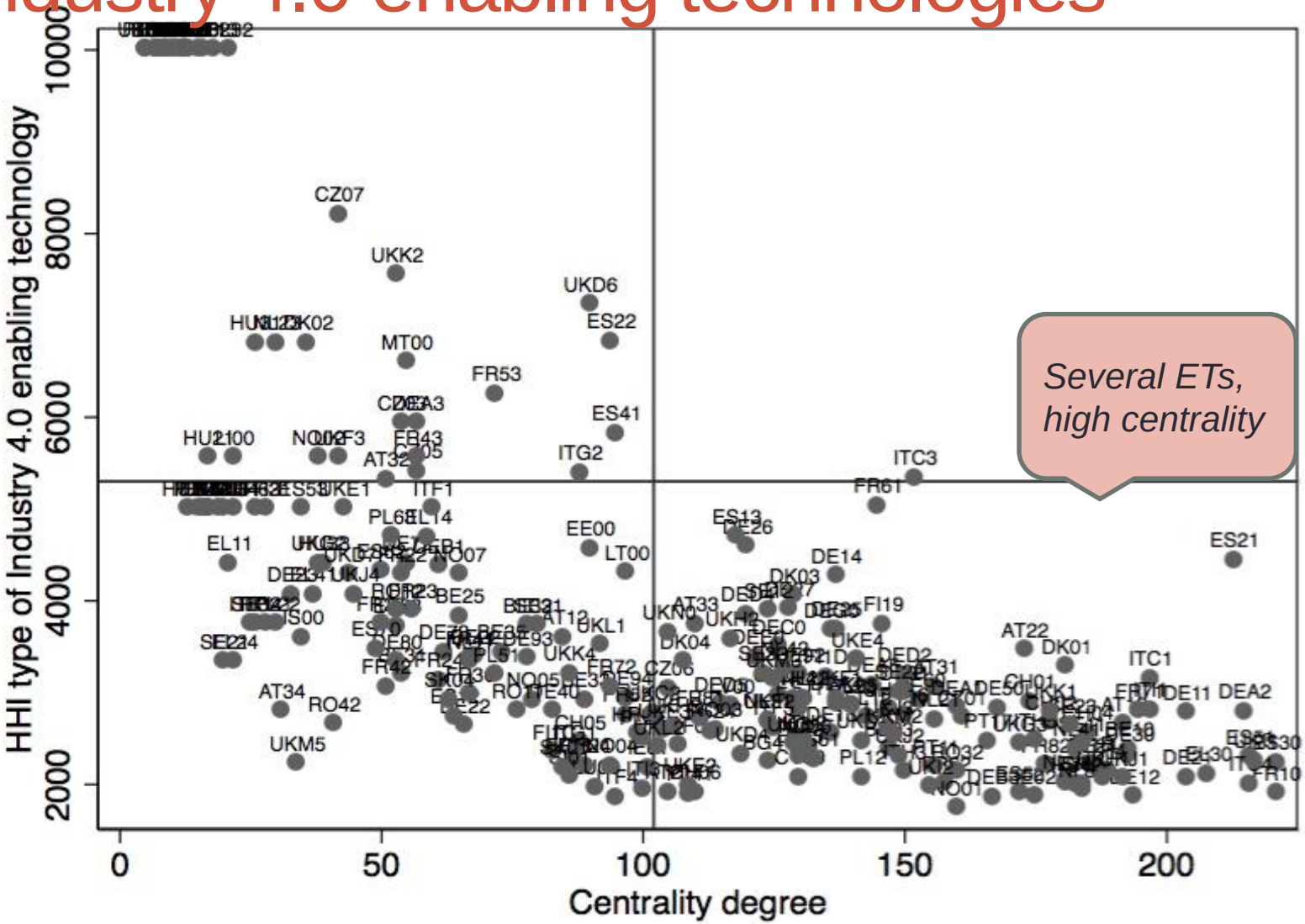
Regional distribution of FP7 investments on Industry 4.0



Note: graduated intervals based on natural breaks (Jenks); classes: low (≤ EUR 7.1 million); medium-low (>7.1 and ≤18.9 million); medium (>18.9 and ≤38.1 million); medium-high (>38.1 and ≤60.9 million); high (>60.9 and ≤138.2 million).

HOW DO REGIONS SPECIALISE?

Regional centrality and specialization on Industry 4.0 enabling technologies



The regional “clubs”

Peripheral specialised systems Second tiers in Industry 4.0 technologies. Their technological activities are more limited and less diverse, but still reach a certain critical mass. They can connect to European hubs but they strive to remain connected to central research networks in Europe.	**Isolated systems** A relatively high number of regions (39 units, 13.3% of the total NUTS2) is not involved in any Industry 4.0 project. A range of opportunities for collaboration exist at the national level, **but regional integration needs to be leveraged.**
Peripheral generalist systems First tiers in terms of capacity to develop Industry 4.0 technologies. **Peripheral with respect to the first group and have not specialised in any technology in particular.** Their RIS may be less competitive than those of the 'generalist hubs'.	**Generalist hubs** Many regions located in central Europe enjoy multiple and strong links to many other regions in a relatively wide range of enabling technologies. Polycentric systems, competitive companies and RIs. **Hubs of wide inter-regional systems of technological cooperation.**

What drives regional participation? And Technological diversity?

VARIABLES	*Frequency*	*Diversity*
GERD per capita (Ln)	-0.005	0.015
	[0.025]	[0.015]
Employment manuf. (Ln)	0.242**	0.030
	[0.043]	[0.020]
Tertiary education (Ln)	0.465**	0.113*
	[0.098]	[0.049]
FP7 contribution (Ln, IV)	0.201**	0.068**
	[0.031]	[0.015]
Network centrality	34.952**	2.195**
	[1.726]	[0.800]
Outward orientation	0.320**	-0.049+
	[0.066]	[0.029]
Outliers	yes	yes
Constant	-3.606**	-0.229
	[0.658]	[0.291]
Observations	222	222
R-squared		0.574
Pseudo R-squared	0.337	
Robust standard errors in brackets		
** p<0.01, * p<0.05, + p<0.1		

- Education
- FP7 funding
- Network centrality
- Outward orientation +/-

Conclusions

- Interregional cooperation in Industry 4.0 falls short of what might be desirable for the purpose of European integration and cohesion
- This opens room for a stronger role of national policy in reducing intra-country regional disparities, fostering European integration and cohesion
- Promoting education and regional networking should be at the core of our future agenda