

## How the Intellectual Property (IP) System Benefits Innovation

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- Digital revolution and Industry 4.0. inventions
- Patent applications in Industry 4.0. technologies at the EPO
- Focus on Europe: Innovation centres in Industry 4.0 technologies
- Industry 4.0 in Central and Eastern Europe
- Conclusions: How is digital revolution changing the role of patents in protecting innovations?

- to show the dynamics of different technology fields underpinning innovation related to the Fourth Industrial Revolution
- to identify the performance and specialization profiles of the EU member states in the industry 4.0 as reflected in European patent application at the European Patent Office (EPO)

- **Many dimensions of digital transformation, such as for example:**
  - the Internet of Things,
  - big data analytics,
  - artificial intelligence, cloud computing,
  - 3D printing
- **Fourth industrial revolution has brought new ways of creating economic value through data, software, new business models etc.- new challenges to patent system**

### **Why protecting innovation through patents?**

- to benefit those who have knowledge and inventive power (an incentive to encourage innovation)
- to increase the costs of access to those without knowledge or inventive power (by limiting the use of innovation; monopoly of innovator)

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- **3 groups of technologies for Industry 4.0 according to EPO:**
    - **Core technologies** – embodied in connected objects: *hardware* (e.g. sensors), *software* (e.g. adaptive databases, intelligent data storage), *connectivity* (e.g. network; protocols, for connected devices)
    - **Enabling technologies** (e.g. AI, 3D printing, adaptive security systems)
    - **Application domains** (smart manufacturing, smart home, smart city)

Source: EPO, 2017, *Patents and the Fourth Industrial Revolution*

- The number of patent applications in technologies related to Industry 4.0. began to rise in the mid-1990s, increasing from around **300 in 1995 to 944 in 2000 and to 5,500 in 2016**
- In 2016 there were almost twice as many patent applications in Industry 4.0. than in 2011
- **The share** of all applications at the EPO is small - in 2016 they constitute **3.3%** of all European patent applications (but grew from 1% in the 1990s)

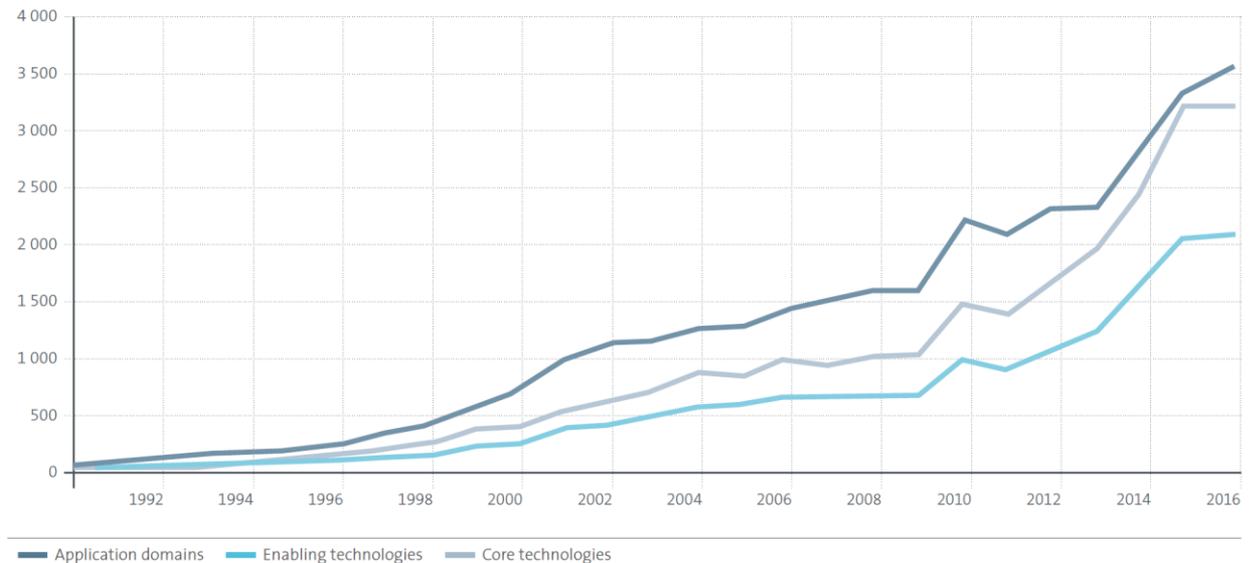
- **Inventions in Industry 4.0. technologies at the EPO have been dominated by the USA, Europe and Japan.**
- **The increase in patent applications in Industry 4.0. is driven by a limited number of applicants.**
- **In 2011-2016, a group of 25 applicants accounted for 48% of all applications in Industry 4.0. filed at the EPO**

- Out of the top 25 applicants at the EPO in Industry 4.0 technologies there are:
  - **12 Asian companies:** 7 are from Japan (e.g. Sony, Panasonic), 3 from China (e.g. HUAWEI Technologies Co, ZTE) and 2 from Korea (e.g. Samsung, LG)
  - **7 from US** (e.g. Qualcomm, Intel, Google)
  - **5 from Europe** (e.g. Nokia, Koninklijke Philips N.V., Ericsson)
  - **1 from Canada** (Blackberry Ltd)

## Patent applications in Industry 4.0. technologies at the EPO

- **Application domains have the largest share**, followed by inventions in core technologies (but the latter recently growing at a faster rate)
- The number of inventions relating to **enabling technologies** has been **the smallest**

Trends in patent applications by sector 1990-2016



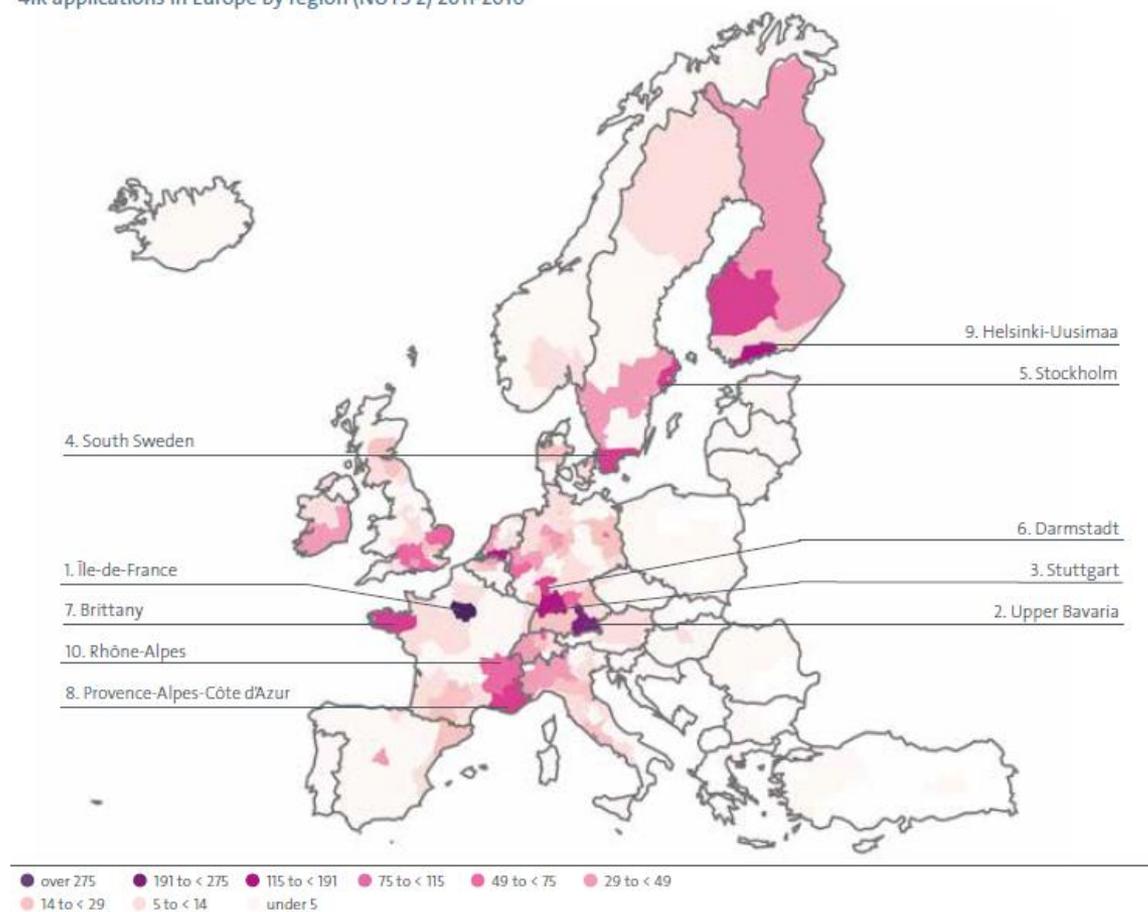
Source: European Patent Office

- About **30%** of patent applications come from inventors from **Europe**
- In Europe there is a strong geographical concentration of Industry 4.0. patents: **Germany** is the leader in Europe, followed by **France** and **the United Kingdom**, followed by **Sweden**, **Finland**, **the Netherlands**, **Switzerland**.

- In **core technologies** of Industry 4.0 European countries are the strongest in *Connectivity* (DE, FR, UK, SE, FI) and the weakest in *Hardware*
- In **enabling technologies** Europe is quite strong in *Artificial intelligence* (FR, DE, UK, FI, CH) and *Security*, but has relative lower position in *Energy Supply* (DE, UK, FI, SE).
- In **application domains** European countries rank highly for inventions in *Vehicles* and *Infrastructures* (in both DE is the leader)

## Regional concentration of inventive activity in Industry 4.0

4IR applications in Europe by region (NUTS 2) 2011-2016

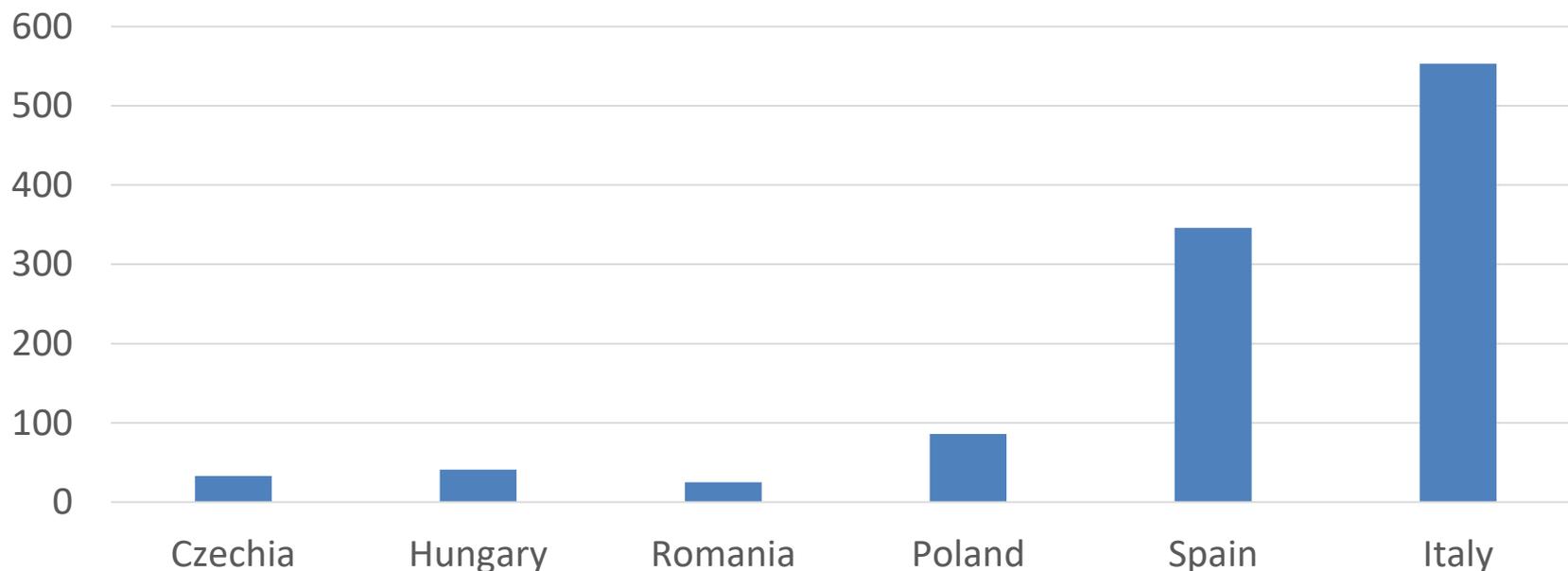


Source: European Patent Office

Leading regions in Europe:

- Île-de-France in France
- Upper Bavaria in Germany
- Stockholm and South Sweden in Sweden
- Helsinki-Uusimaa in Finland
- North Brabant in the Netherlands

No of patent applications in 1990-2016 in selected CEE countries compared to their peers



Source: Based on EPO data- EPO, 2017, *Patents and the Fourth Industrial Revolution*

- Relatively low inventive activity in CEEC - **a digital divide in Europe** EXAMPLE: Poland
- In 1990-2016, only 86 Polish patent applications related to Industry 4.0 were registered in the EPO, while in Spain (similar in terms of population) the number was four times higher, and in Italy has six times higher.

## Conclusions: How is digital revolution changing the role of patents in protecting innovations?

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- **Digital divide** - different innovation modes (innovation versus imitation), diffusion
  - **In fast developing digital industries protection of innovative solutions has been changing:**
    - innovators might not be interested in protecting new solutions through patents (too much time needed to finalize patent procedures)
    - protection of digital innovations might not be possible (e.g. big data use; computer programmes)
    - diffusions and imitation of innovation is faster than before
  - **Conclusion:** new challenges to IP system and innovation policy in the digital era
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**Thank you for your attention**  
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