# Boosting Europe's Competitiveness in Artificial Intelligence: building an EU approach

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*By Alexander Prenter.*

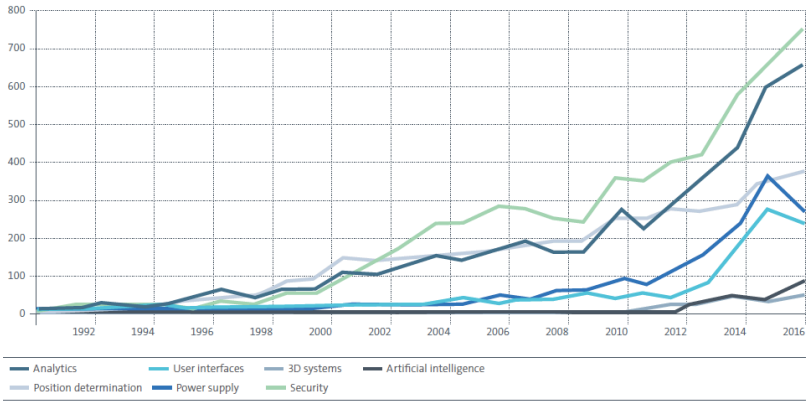
**The implications of Intelligent and Autonomous Systems** (I/AS) **are far reaching**, **with some heralding its widespread use as the dawn of a new Fourth Industrial Revolution** (4IR) which will fundamentally change our economies, societies and ethics. The European Union has given thought to these issues and is preparing early to maintain European competitiveness internationally.

**The idea of an artificially intelligent system is not a new concept**. Allen Turing famously predicted A/IS would come to dominate by the end of the 20th century.[1] The accuracy of his prediction was off, but essence nonetheless remains. With the development of Deep Learning[2] in 2012, A/IS development has advanced significantly and we are on the brink of a revolution that will impact every sector of the economy.

### ▸ The European Union is lagging behind

**A good proxy to measure innovativeness in the economy it to track patent applications**.[3] Data from the European Patent Office (EPO) shows that patent application for A/IS between 2011 and 2016 grew 43% and is now the fastest growing sector of 4IR technologies *(Figure 1)*.

***Figure 1:*** *Patent Applications in enabling technologies 1990-2016*



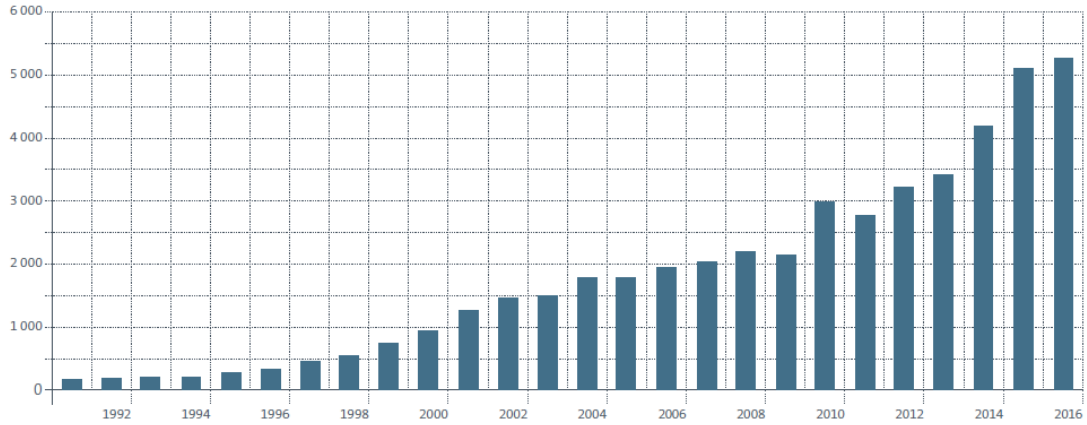

*Source: European Patent Office*

[1] Alan Turing predicted in 1950 that by the late 20th century computers will have beaten the "Imitation Game" to relatively high degree so much so that a judge would not be able to tell the difference between a human or a machine (e.g., through a text-based interaction between both).
[2] Deep learning is a machine learning method based on learning data representations, as opposed to task-specific algorithms.
[3] Patent applications indicate both past and future performance since patents take on average three years to be granted.

Lighthouse Europe Bruxelles
Avenue Adolphe Lacomblé, 59
1030 Bruxelles - Belgique
Tél. : +32 2 743 29 94
Fax : +32 2 743 29 90
info@lighthouseeurope.com
www.lighthouseeurope.com

**Data further suggests that A/IS technologies have passed the emerging phase of the technological life cycle**[4] and are maturing into a growth phase of widespread adoption in the market *(Figure 2)*. The commercial development of A/IS is advancing to a stage where companies are attaining a peak return on investment with low marginal diminishing returns.

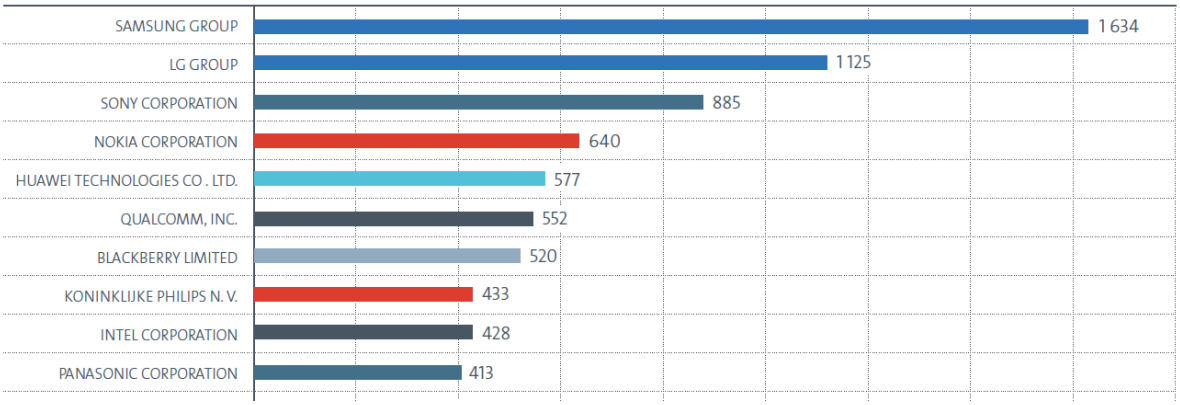
***Figure 2:*** *Fourth Industrial Revolution patent applications at the EPO 1990-2016*




*Source: European Patent Office*

**EPO data also indicates that Europe is beginning to lag behind other regions such as Asia and the United States** *(Figure 3)***.** The top applicants for patents in technologies associated with the Fourth Industrial Revolution are companies from these regions including, Samsung, LG, Sony, Huawei, Intel and Qualcomm. Of the top ten companies, only two come from Europe (Nokia and Philips) registering together 1,073 patent applications. Meanwhile, the top two companies (Samsung and LG), both from South Korea, together made 2,759 patent applications between 2011 and 2016. Samsung alone outperformed Europe's top two companies.

***Figure 3****: Top 10 Fourth Industrial Revolution Companies at the EPO 2011-2016*




*Source: European Patent Office*

[4] The 'technological life cycle' describes the commercial gain of a product through the expense of research and development phase, and the financial return during its "vital life". The term applies not to individual products but to an entire technology or generation of a technology.

## The Public Policy Response from the European Union

**The increase of A/IS investment in the last number of years outside of Europe combined with lagging investment within the European Union suggests that a coordinated policy response is needed** to ensure that Europe remains competitive internationally. The response from the European Union, as articulated in its April 2018 Communication, identifies the strengths of the European market and tailors the policy aims in direct relation to these strengths:

- *Europe has a highly skilled workforce and world-class innovation hubs*, which include many public institutions such as universities and research centres that can provide the necessary base for further development of A/IS in Europe.
- *The EU is one of the world's leading manufacturers of high-end industrial products and services* that can benefit the most from AI by increasing productivity and production efficiencies.

**The steps forward for the EU are to secure enough funding to boost the EU's presence internationally.** Europe only invested €2.4 billion in 2016 in I/AS as compared with €6.5 billion in Asia and €12.1 in the United States. According the European Commission, the EU as a whole, public and private sectors combined, should aim to increase investment to at least €20 billion by the end of 2020. To achieve this target, the European Commission is increasing funding through the Horizon 2020[5] programme by 70% to €1.5 billion, which should trigger an additional €2.5 billion in public-private partnerships.

**The European Union is still to foster rapid and widespread uptake of A/IS technologies to ensure that European industry remains internationally competitive.** The European Commission aims to leverage the expertise of its new European Innovation Council[6] to support €2.7 billion in funding helping 1,000 breakthrough projects reach market. For small and medium sized enterprises, the European Commission will launch an "AI on-demand platform" to provide a single access point that offers services and support users to integrate A/IS into their business operations.

**With the European Commission having laid forth its plan for the future of A/IS in the European Union, only time will tell if the policy goals and targets are met**. Should these measures be successful, we should expect levels of investment in A/IS to improve within Europe which will translate in the number of patent applications filed by European companies.

**With the trend towards A/IS set to continue, Europe is situating itself early** for the coming changes to the economy and society while taking a long-term view to place Europe at the forefront of A/IS development. Setting the right investment framework will ensure that Europe remains competitive in the international market.

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[5] Horizon 2020 or H2020 is the European program for research and development for the period 2014-2020. In the next Multiannual Financial Framework, the program will be called Horizon Europe for the period 2021-2027.

[6] The European Innovation Council is a pilot program of the European Commission with the mission of supporting the commercialization of technologies in the European Union.