China's IP Development and R&D Investment
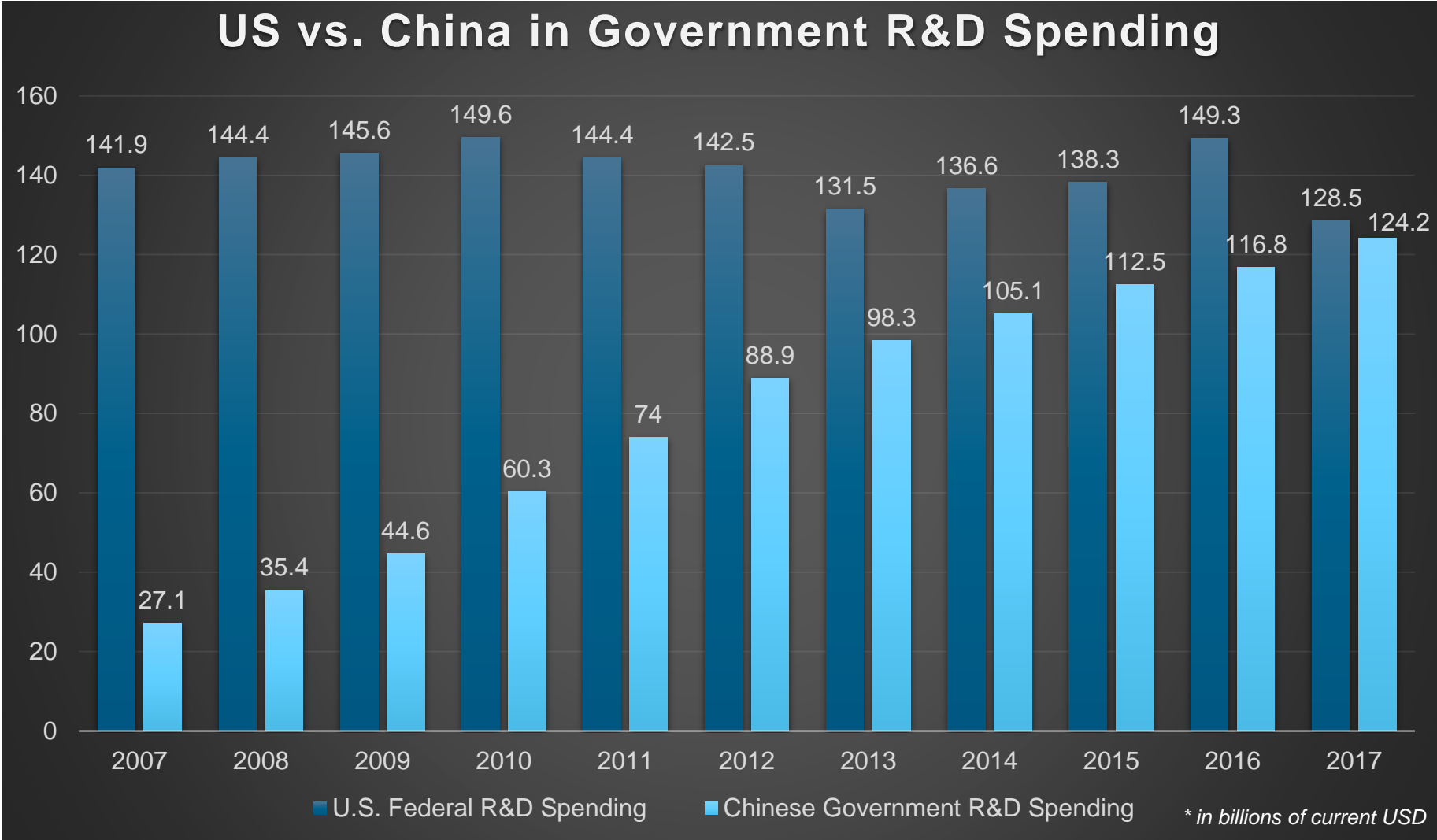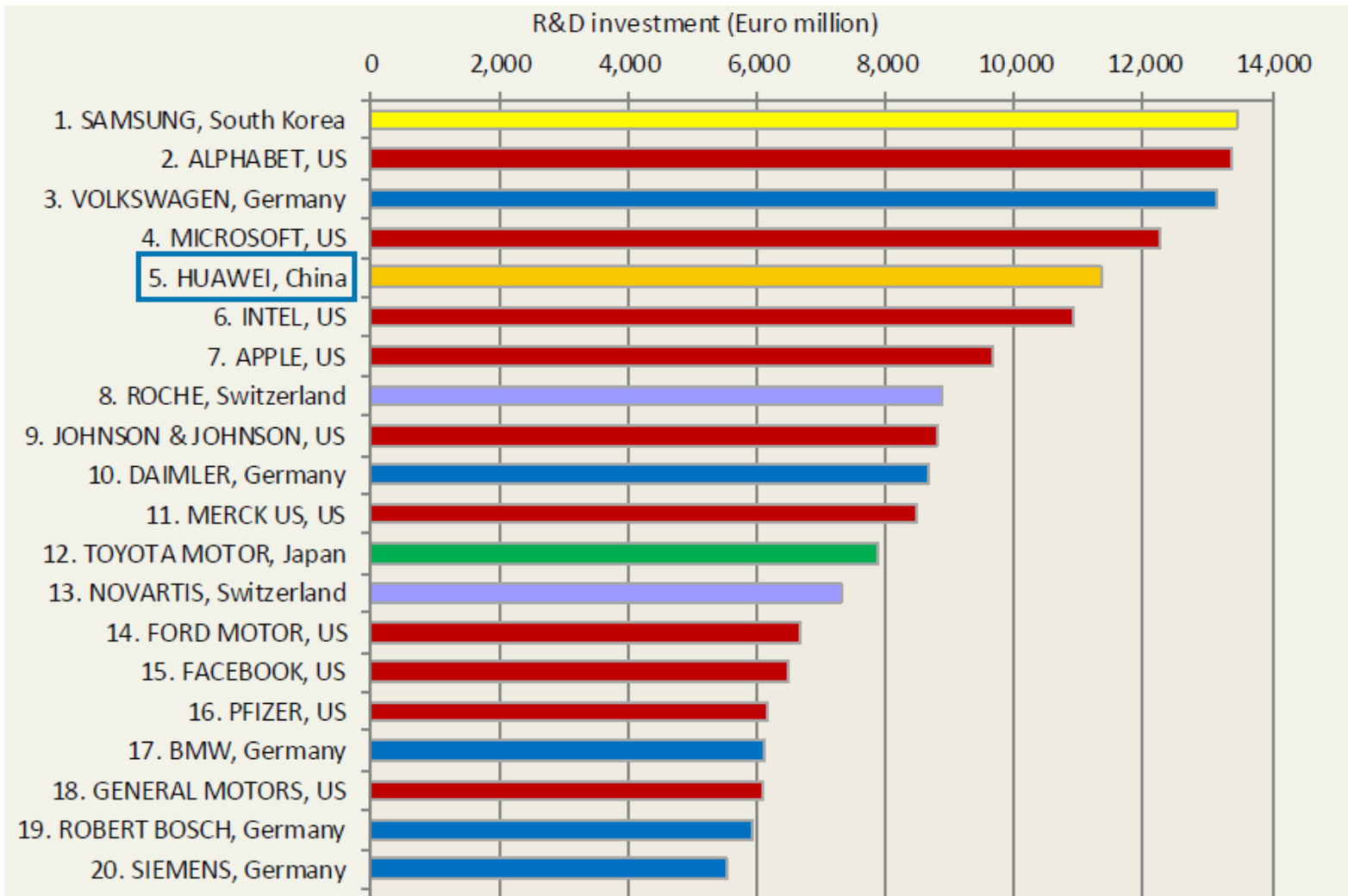
Made in China 2025 Conference

January 15, 2019

Is State Sponsorship of R&D Unique to China?
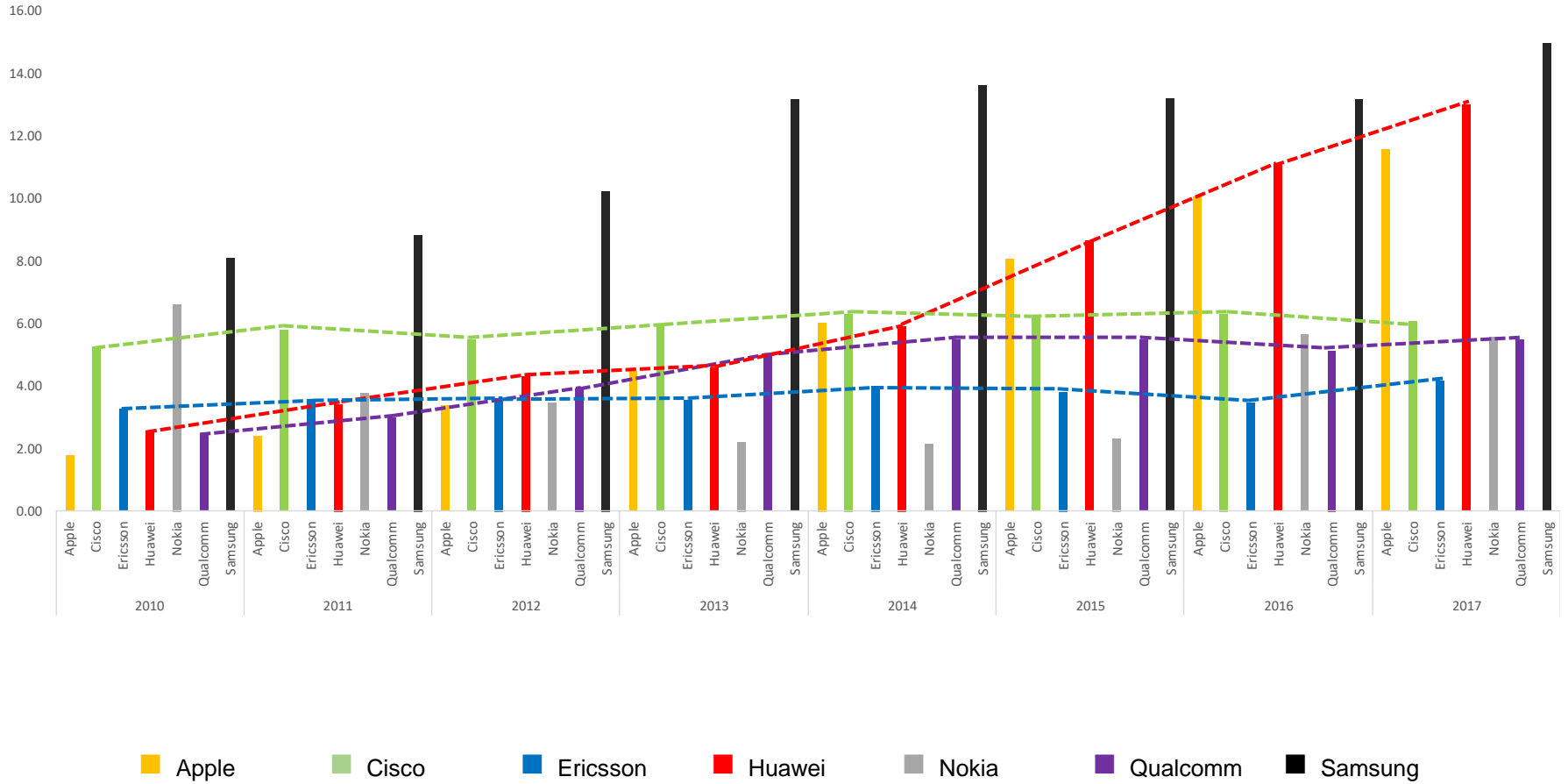

US vs. China in Government R&D Spending

Year	U.S. Federal R&D Spending	Chinese Government R&D Spending
2007	141.9	27.1
2008	144.4	35.4
2009	145.6	44.6
2010	149.6	60.3
2011	144.4	74
2012	142.5	88.9
2013	131.5	98.3
2014	136.6	105.1
2015	138.3	112.5
2016	149.3	116.8
2017	128.5	124.2

■ U.S. Federal R&D Spending   ■ Chinese Government R&D Spending

in billions of current USD

The world's top 20 companies by their total R&D Investment in 2018

R&D investment (Euro million)

1. SAMSUNG, South Korea
2. ALPHABET, US
3. VOLKSWAGEN, Germany
4. MICROSOFT, US
5. HUAWEI, China
6. INTEL, US
7. APPLE, US
8. ROCHE, Switzerland
9. JOHNSON & JOHNSON, US
10. DAIMLER, Germany
11. MERCK US, US
12. TOYOTA MOTOR, Japan
13. NOVARTIS, Switzerland
14. FORD MOTOR, US
15. FACEBOOK, US
16. PFIZER, US
17. BMW, Germany
18. GENERAL MOTORS, US
19. ROBERT BOSCH, Germany
20. SIEMENS, Germany

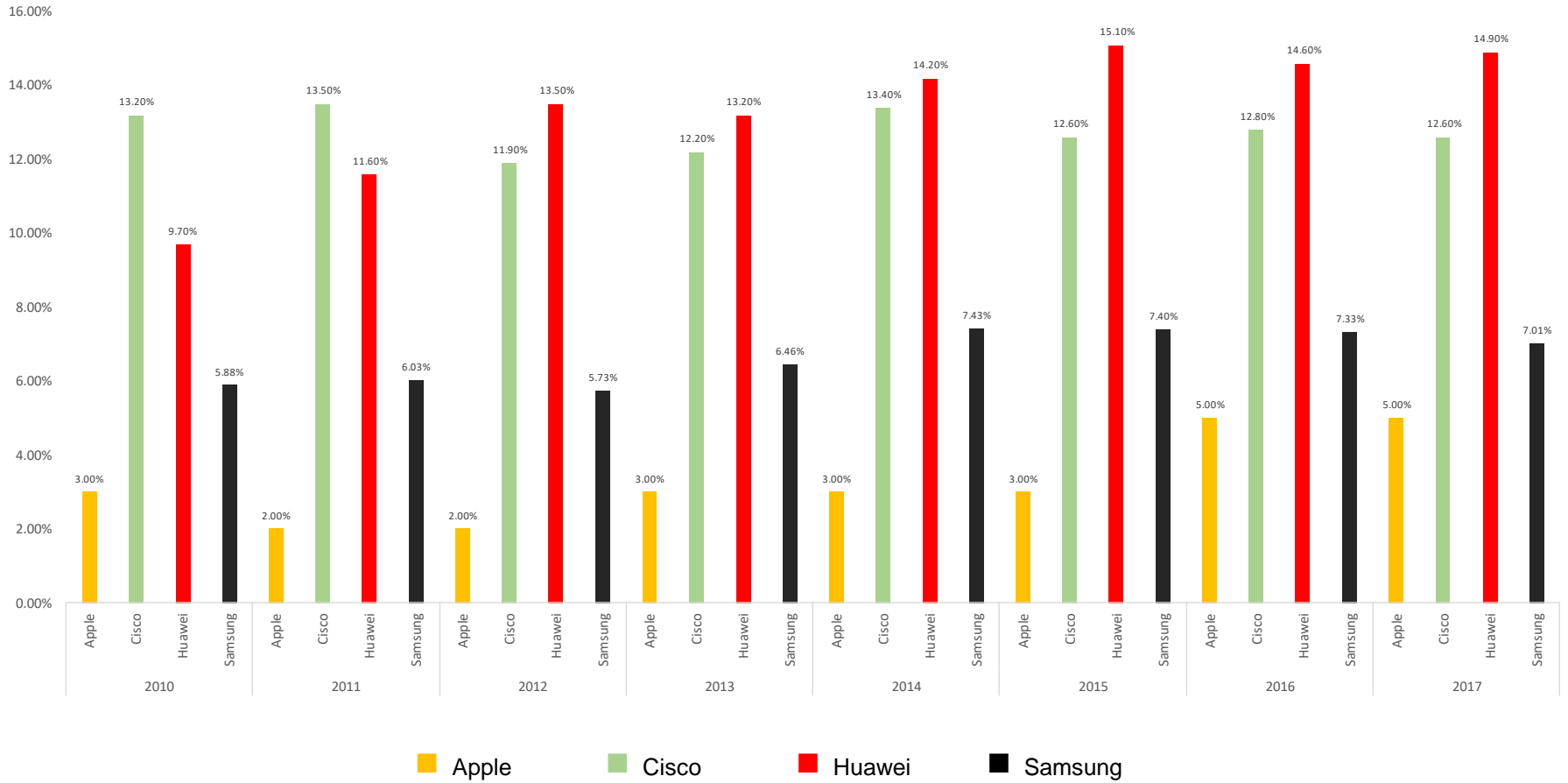*Source: The 2018 EU Industrial R&D Investment Scoreboard*

R&D Spending (US$ in Billions)

* Data extracted from respective annual reports of the above companies
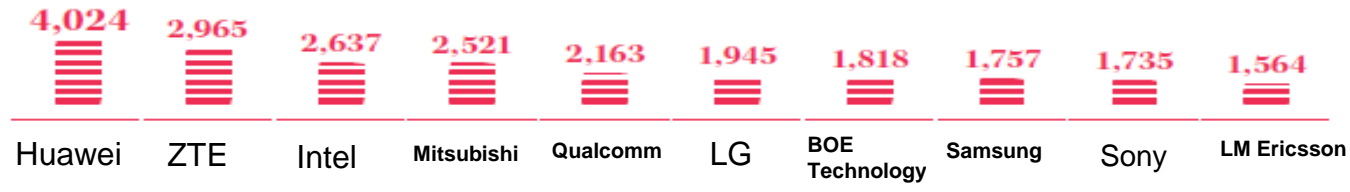
4

R&D Spending (Percentage to Net Sale)

Data extracted from respective annual reports of the above companies

Who filed the most PCT patent applications in 2017?
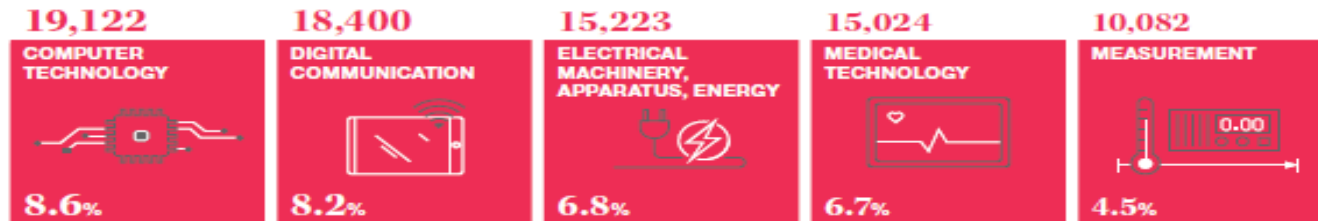
TOTAL NUMBER OF APPLICATIONS   **243,500**   ↑ **4.5%**
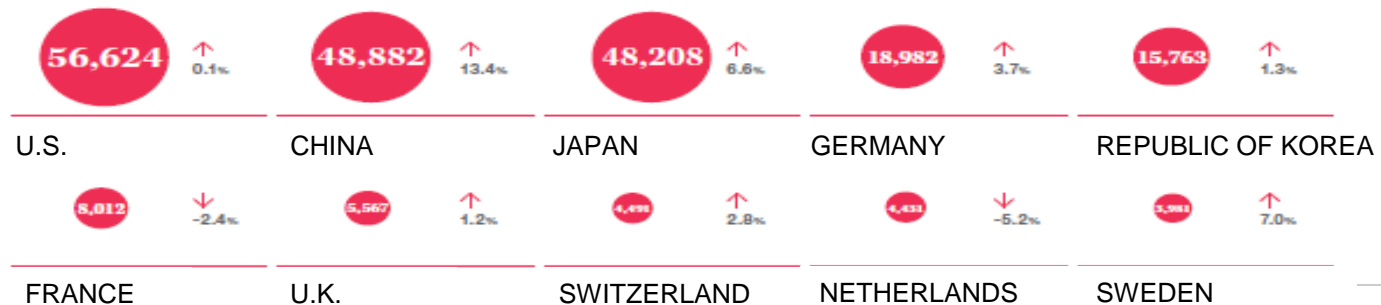
TOP 10 PCT APPLICANTS
Number of published PCT applications

Huawei	ZTE	Intel	Mitsubishi	Qualcomm	LG	BOE Technology	Samsung	Sony	LM Ericsson
4,024	2,965	2,637	2,521	2,163	1,945	1,818	1,757	1,735	1,564

TOP 5 FIELDS OF TECHNOLOGY
Number of published applications and share of total

19,122	18,400	15,223	15,024	10,082
COMPUTER TECHNOLOGY	DIGITAL COMMUNICATION	ELECTRICAL MACHINERY, APPARATUS, ENERGY	MEDICAL TECHNOLOGY	MEASUREMENT
8.6%	8.2%	6.8%	6.7%	4.5%

TOP 10 COUNTRIES
Number of PCT applications and % growth since 2016

U.S.	CHINA	JAPAN	GERMANY	REPUBLIC OF KOREA
56,624 ↑ 0.1%	48,882 ↑ 13.4%	48,208 ↑ 6.6%	18,982 ↑ 3.7%	15,763 ↑ 1.3%

FRANCE	U.K.	SWITZERLAND	NETHERLANDS	SWEDEN
8,012 ↓ -2.4%	5,567 ↑ 1.2%	4,496 ↑ 2.8%	4,431 ↓ -5.2%	3,981 ↑ 7.0%

GPS

- Initially developed by DoD by for military purpose in the 1970s[1]
- Allowed for civilian applications in the 1980s [2]
- Congress provided over $1.42 billion to fund the Air Force GPS program in Fiscal Year 2019 ($1.18 billion in 2018)[3]

Hey Siri

- Personalized Assistant that Learns (PAL), funded by DARPA[4]
- A cognitive computing systems to make military decision-making more efficient and more effective[5]
- Siri Inc. was launched in 2007 to put the technology to civilian use, later acquired by Apple Inc. [6]

1.2. *See Wikipedia.* https://en.wikipedia.org/wiki/Global_Positioning_System
3. *See gps.gov.* https://www.gps.gov/policy/funding/2019/
4,5.6. *See Personal Assistant That Learns (PAL)*, DARPA. https://www.darpa.mil/about-us/timeline/personalized-assistant-that-learns

Touchscreen

- Invented by scientists funded by NSF and CIA/DCI[7]
- The inventors founded the company FingerWorks[8]
- Acquired by Apple in 2005[9]

Internet

- Started as Arpanet - an unprecedented network of computers[10]
- Initially funded by DARPA[11]
- A decentralized communication system sought during the cold war, to survive envisioned enemy attack[12]

7.10. *See The iphone at 10: how the smartphone became so smart*, BBC News, https://www.bbc.com/news/business-38320198

8.9. *See Wikipedia* https://en.wikipedia.org/wiki/FingerWorks

11.12. *See Encyclopædia Britannica*, https://www.britannica.com/topic/ARPANET

What Makes an iPhone so Smart?

DRAM Cache
DARPA

Click-wheel
CERN

Multi-touch Screen
DoE, CIA/NSF DoD

NAVSTAR-GPS
DoD/NAVY

Lithium-ion batteries
DoE

SIRI
DARPA

Signal Compression
Army Research Office

First Generation iPod
(2001)

iPod Touch and iPhone (2007)
iPad (2010)

Liquid-crystal Display
NIH, NSF, DoD

HTTP/HTML
CERN

Micro Hard Drive
DoE/ DARPA

Microprocessor
DARPA

Cellular Technology
US Military

Internet
DARPA