

# The Quantum Revolution and IP: Advancing and Protecting America's Innovative Edge

The Hudson Institute & The Federalist Society

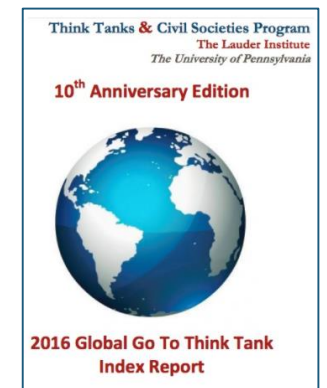
Stephen Ezell  
Vice President, Global Innovation Policy

September 12, 2018

# About ITIF

---

- The world's leading science and technology policy think tank.
- Supports policies driving global, innovation-based economic growth.
- Focuses on a host of issues at the intersection of technology innovation and public policy across several sectors:
  - Innovation and competitiveness
  - IT and data
  - Telecommunications
  - Trade and globalization
  - Life sciences, agricultural biotech, and energy



# IPRs Deliver Five Key Benefits, As They:

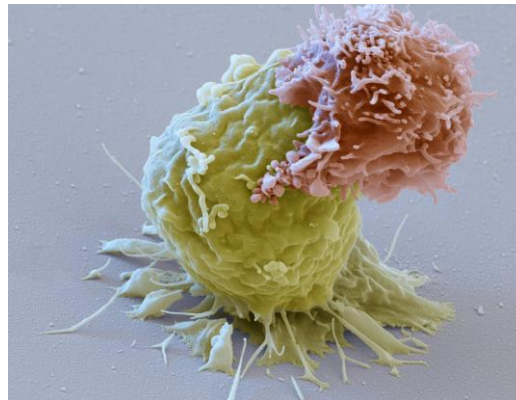
---

1. Create incentives for domestic innovation.
2. Generate revenues enabling investment in future generations of innovation.
3. Induce knowledge spillovers that help others innovate.
4. Ensure companies can focus on innovating; not having to protect their IP.
5. Promote the international diffusion of technology, innovation, and know-how.

# Innovation-Based Industries Share Three Distinct Characteristics

---

1. They compete by inventing next-generation products or services.
2. They are characterized by very high initial fixed costs (e.g., R&D/design), but lower marginal costs of production.
3. They fundamentally embody and depend on intellectual property.



# Implications for Quantum Computing

---

1. Need mechanisms to co-create intellectual property domestically and to ensure its protection internationally.
2. Ensure access to large markets (e.g., economies of scale).
3. Ensure no excess (e.g., non-market-based) competition.



# Why Quantum Computing Leadership Matters For Nations

---

1. The emergence of new computing architectures can shift where global computing leadership resides.
2. QC will become a key enabling technology determining the competitiveness of virtually all downstream industries.
3. A robust source of high-value jobs, output, and exports.
4. Immense national security implications.



# Trends in Global Quantum Computing Patent Applications

Patent applications to 2015, in:

## Quantum computing



## Quantum cryptography



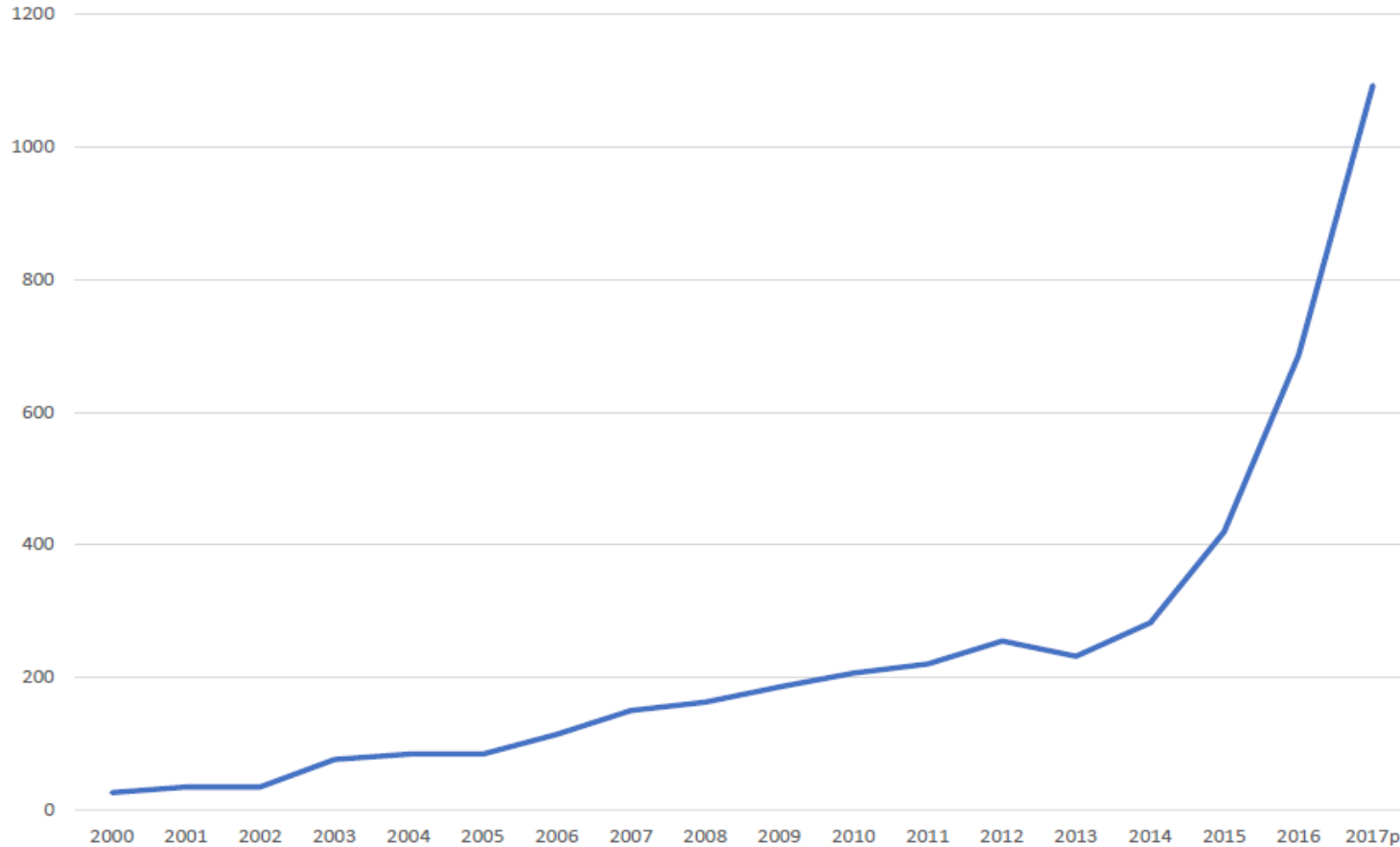
## Quantum sensors



Source: *The Economist*, "Sensing sensibility: Quantum technology is great for measuring" March 9, 2017

# Trends in Global Quantum Computing Patent Applications

Overall Quantum Information Technology Patent Families by Publication Year



430% increase in *quantum computing-related* patent publications, 2014-2017.

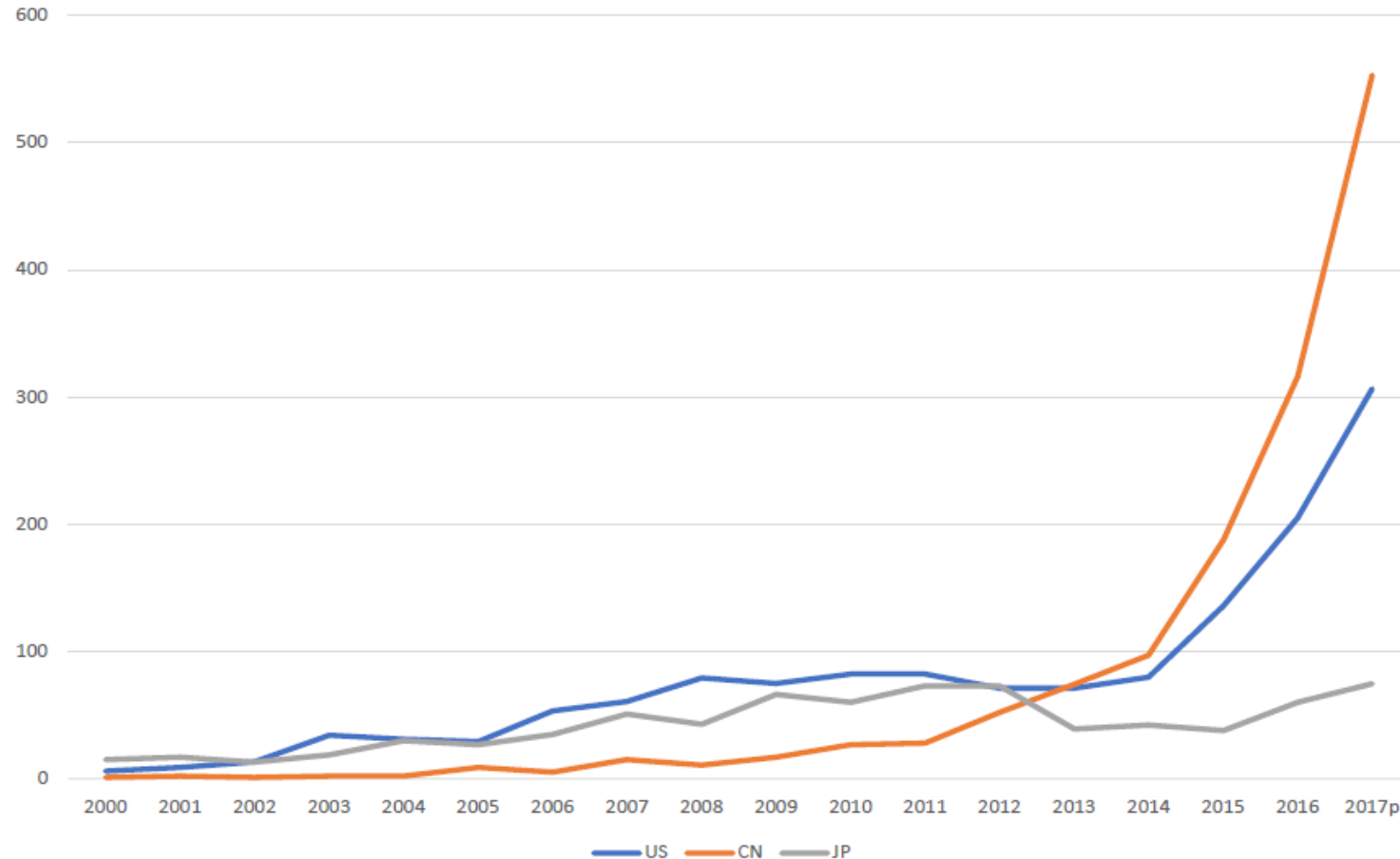
350% increase in *quantum computing applications-related* patent publications, 2014-2017.

Source: *PatinInformatics, LLC*, "Quantum Information Technology (QIT): A Patent Landscape Report" (2017)



# Trends in Global Quantum Computing Patent Applications

## Quantum Information Technology Patent Publications By Priority Country



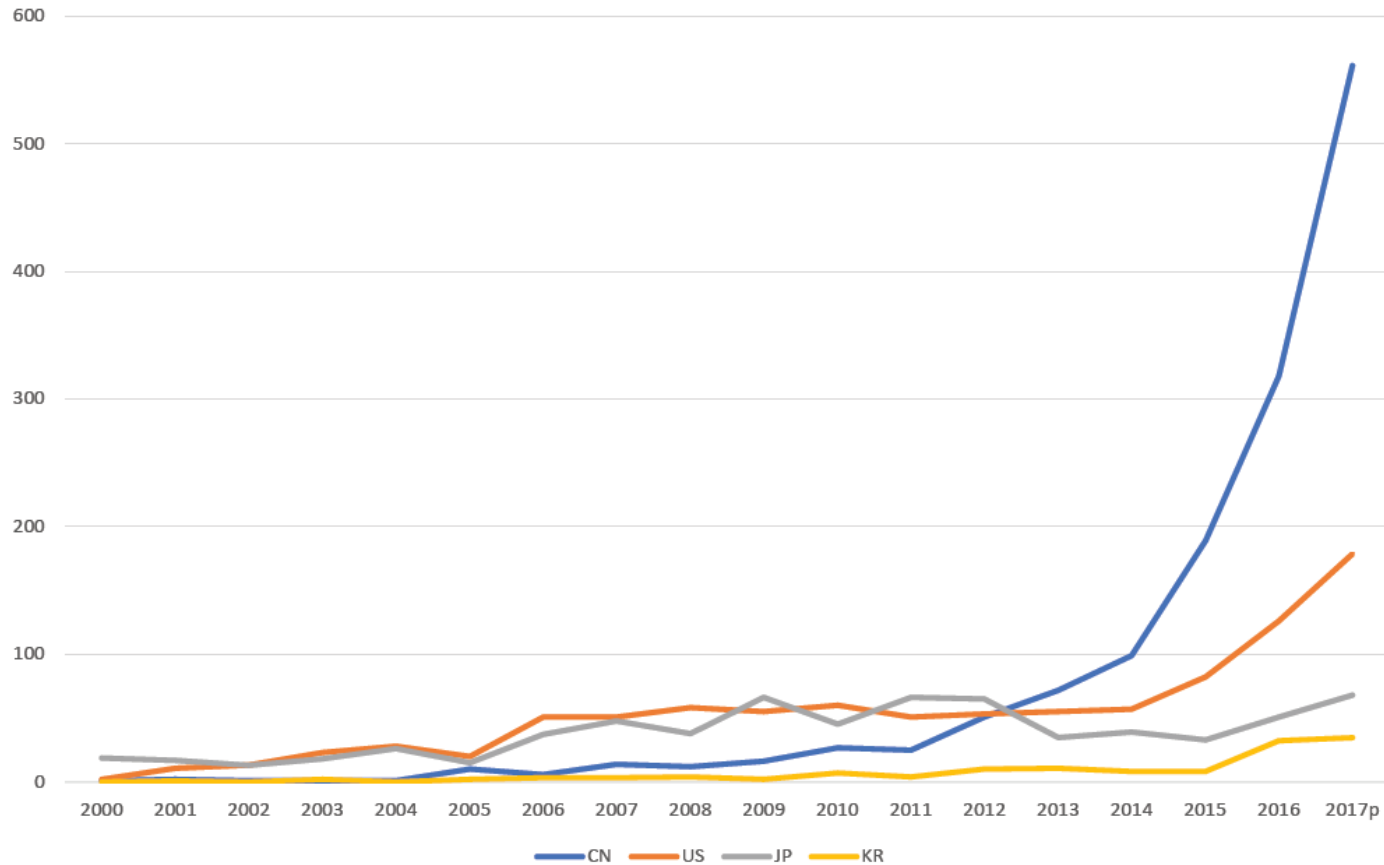
Since 2013, the number of QIT publications listing China as the priority country grew by almost 750%.

72% of the academic patent families published in QIT since 2012 have been from Chinese universities. 12% from the United States.

Source: *PatinInformatics, LLC*, "Quantum Information Technology (QIT): A Patent Landscape Report" (2017)

# Trends in Global Quantum Computing Patent Applications

## Quantum Communication, Cryptology, Algorithm, & Computation Patents



China dominates *quantum applications*, with three times as many patent families projected for 2017 as the United States.

*“North American organizations may control the computer, but Asian ones may control how those machines are used.”*

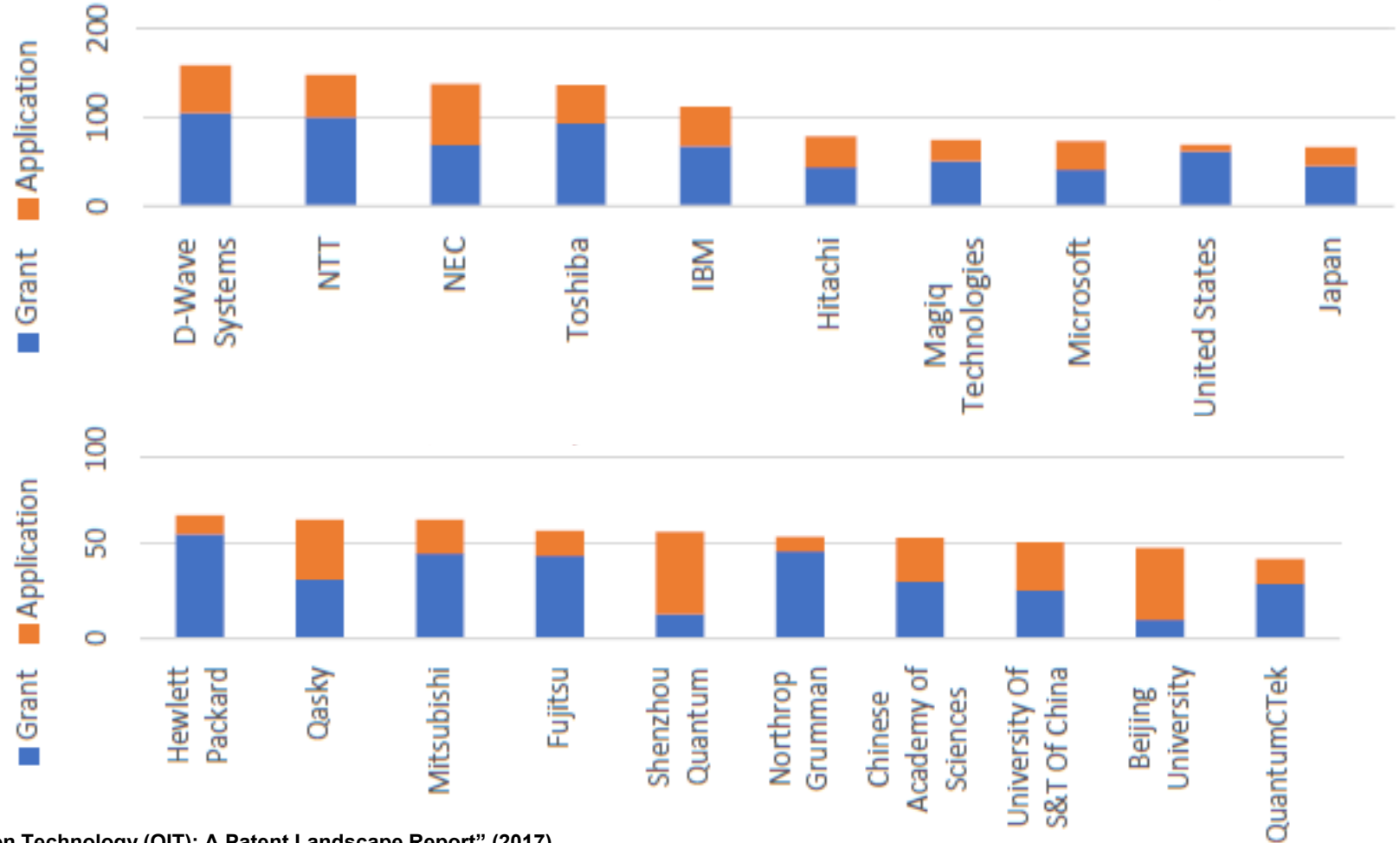
Source: *PatinInformatics, LLC*, “Quantum Information Technology (QIT): A Patent Landscape Report” (2017)

# Trends in Global Quantum Computing Patent Applications

Quantum Information  
Technology Patent  
Families by Organization

Top 10

11-20



Source: *PatinInformatics, LLC*, "Quantum Information Technology (QIT): A Patent Landscape Report" (2017)

# What Are America's Competitors Doing?

---

## *National Laboratory for Quantum Information Sciences*



- \$10B; 4,000-sq. ft. research center in Heifi, China.
- Already fielded a 2,000-km long quantum communications pathway; a quantum communications satellite; satellite-to-ground quantum network.
- Alibaba alone investing \$15B in QC/AI/IoT in the next three years.

*China has stated a clear goal “to surpass the United States in quantum computing leadership within the decade.”*



# What Are America's Competitors Doing?

---

## *UK National Quantum Computing Technologies Program*



- Develop hubs of quantum computing excellence.
- Quantum Innovation Fund offers \$200K prizes to QC innovators.
- \$460M investment. (U.S. would have to invest \$2B to match).

## *EU Flagship Initiative on Quantum Technologies*



- Launched 2018 with €1.2 billion commitment.
- Creates the European Quantum Technologies Roadmap

# What's America Doing?

---



## *National Quantum Computing Initiative Act*

- Calls for 10-year, interagency effort to accelerate progress in quantum information science (QIS) and technology development.
- Create a National Quantum Coordination Office (coordinate agency efforts).
- Allocate \$1.275B to QIS R&D over next five years, including \$125M annually for 5 “National Quantum Information Science Research Centers.”

# Conclusions

---

1. Quantum computing represents a transformative platform technology that will impact the competitiveness of all sectors.
2. U.S. leadership cannot be taken for granted.
3. Countries must make quantum computing leadership a national priority.

# Thank You!

Stephen Ezell | [sezell@itif.org](mailto:sezell@itif.org) | 202.465.2984