



METROPOLITAN  
HORIZONS

## Innovation in China and China's Global Innovation Initiatives

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AUSTRIA CONNECT GREATER CHINA 2019, Hong Kong  
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# The first Impression

## - a Methaphor for Approaching the Unknown



Yesterday evening during an exploratory walk along the seashore of Deep Water Bay on Hong Kong Island something unexpected happened:

**an unknown object on the flurry surface of the waves appeared**

...a disturbing then fascinating impression like a painting of Vincent van Gogh

**What was it?** Obviously something I haven't seen before, something innovative, a strange alien hovering above the surface of the water...

**With curiosity, openness and the desire to learn I started to collect evidence and data...**

# Innovation Performance of People's Republic of China

## China's Innovation Performance - an initial approach to the Unknown

Three basic questions:

Can Chinese people be **creative and innovative**?

What is the status-quo and performance of the **National Innovation System (NIS) of People's Republic of China**?

How does a Chinese firm **manage its talent, innovation ecosystem and entrepreneurial spirit**?

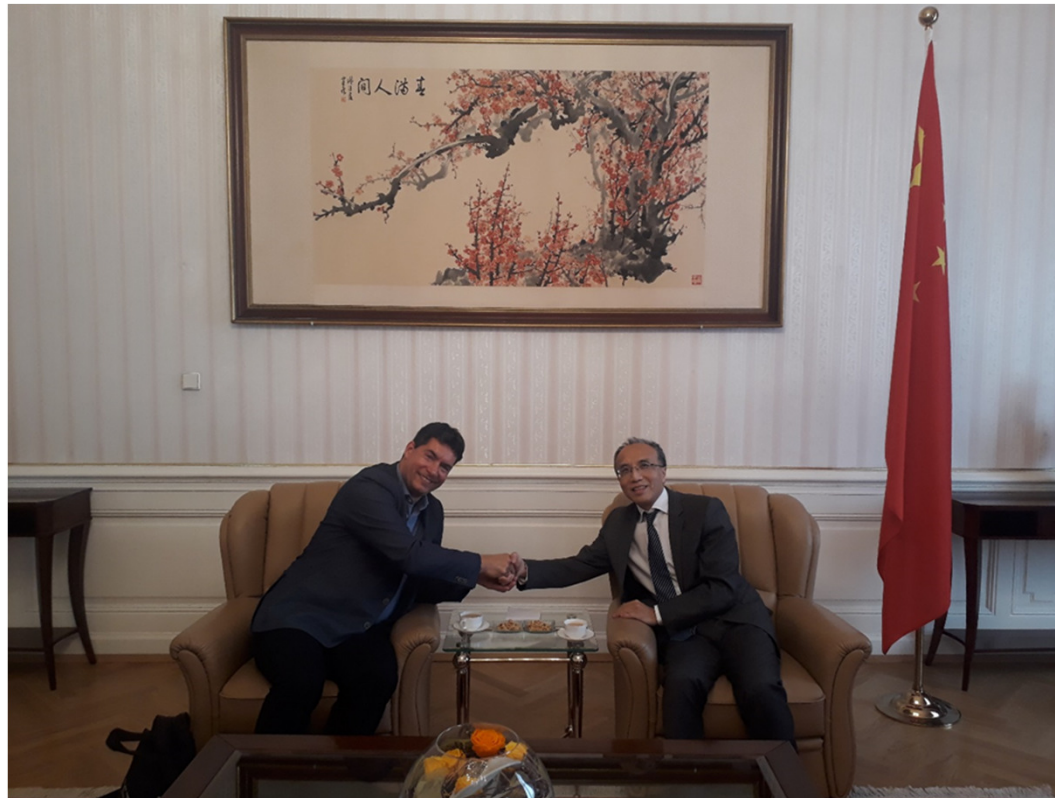
## 1<sup>st</sup> Lecture on China's NIS at a European University - started at UASTW in September 2018



- **Title „From ‚Made in China‘ to Created in China‘**
- **Lecturer: Alexander G. Welzl**
- **Focus on National Innovation System (NIS) of PR China, corporate management of innovation and creativity in Chinese (owned) enterprises doing business in Austria and CEE, BRI, digital transformation & green economy in China**
- **Guest lectures from CEOs of Chinese (owned) companies, international experts and scholars eg Prof. Aihua Qin CASS IES, Beijing**



## UASTW Lecture on China's NIS officially supported by Chinese Embassy



Bilateral meeting at the  
Chinese Embassy in Austria,  
Vienna 24 June 2019,

from right to left:

**H.E. Ambassador LI Xiaosi**

(Ambassador of the People's  
Republic of China to Austria),

**Alexander G. WELZL**

# China's and Asia's Industrial Transformation - Towards an Innovation-driven Development



Source: <http://english.boaoforum.org/en/index.html>

## Premier Li Keqiang's Keynote Speech at Boao Forum for Asia 2019

Boao, Hainan Province, March 28, 2019 - a quote of his speech (source China Daily, March 30-31, 2019):

*„After years of fairly fast growth, Asian countries now face the challenge of shifting from old drivers of growth to new ones, and we must rely on innovation to foster the latter. (...) we (...) must tap into our advantages in human capital (...) to intensify cooperation on innovation. (...) We need to (...) clear the way for the unimpeded flow of factors of innovation resources and outcome, setting the stage for the steady progress of Asia's innovation-driven development.“*

## From Capitalism to Talentism - World Economic Forum 2012



**Prof. Klaus Schwab**

Source: Wikipedia

At the opening press conference of the World Economic Forum (WEF) Klaus Schwab claimed a shift from capitalism to talentism with human capital and innovation power becoming countries', cities' and companies' major competitive asset:

*“Capital is being superseded by **creativity and the ability to innovate** - and therefore by human talents - as the most important factors of production.”*



# China's Innovation Performance

## - A Legacy of Millennia of Development



*Black pottery*  
Hemudu culture  
(5000 - 3000 BC)  
Source: Wikipedia



*Painted pottery*  
Western Han  
dynasty (202 BC -  
9 AD)  
Source: Wikipedia

- A history of Innovation taking place in China (provincial region Zhejiang): *'Half of the history of Chinese ceramics took place in Zhejiang'* (Chen Wenli). Exhibition at Zhejiang Provincial Museum at Westlake.
- The **first pottery** was made during the **Palaeolithic era**. Pottery dating from **20,000 years ago** was found at the **Xianrendong Cave** site in **Jiangxi province**, making it among the earliest pottery yet found.
- Porcelain was a Chinese invention and is so identified with China that it is still called "china" in everyday English usage. On some Chinese definitions, the **first porcelain was made in Zhejiang province** during the Han dynasty (206 BC - 220 AD).

## Part of the ‚Chinese Dream‘ - The Dawn of the Quantum Era



Source: australasianscience.com.au

It was on **Monday, 16 August 2016** when a new era was ushered in:

**Quantum satellite MICIUS was launched at 1:40 local China time** from “the launch pad 603 located at LC43 complex at the Jiuquan space centre in Jiuquan, north-west China.”

“The scientist who first proposed the idea to the European Space Agency (ESA in 2001) is University of Vienna physicist Anton Zeilinger.”

Prof. Anton Zeilinger today is the President of the Austrian Academy of Sciences and closely works together with CAS in Beijing.

Source: <https://www.bbc.com/news/world-asia-china-37091833>

## Geopolitics of Knowledge - a 'Long-run' Game and the Big Picture

Article in 'The Diplomat', February 2018:

**“China’s bet on knowledge is already paying off; but this game, which requires lots of strategic thinking and stamina, is to be played in the long run.**

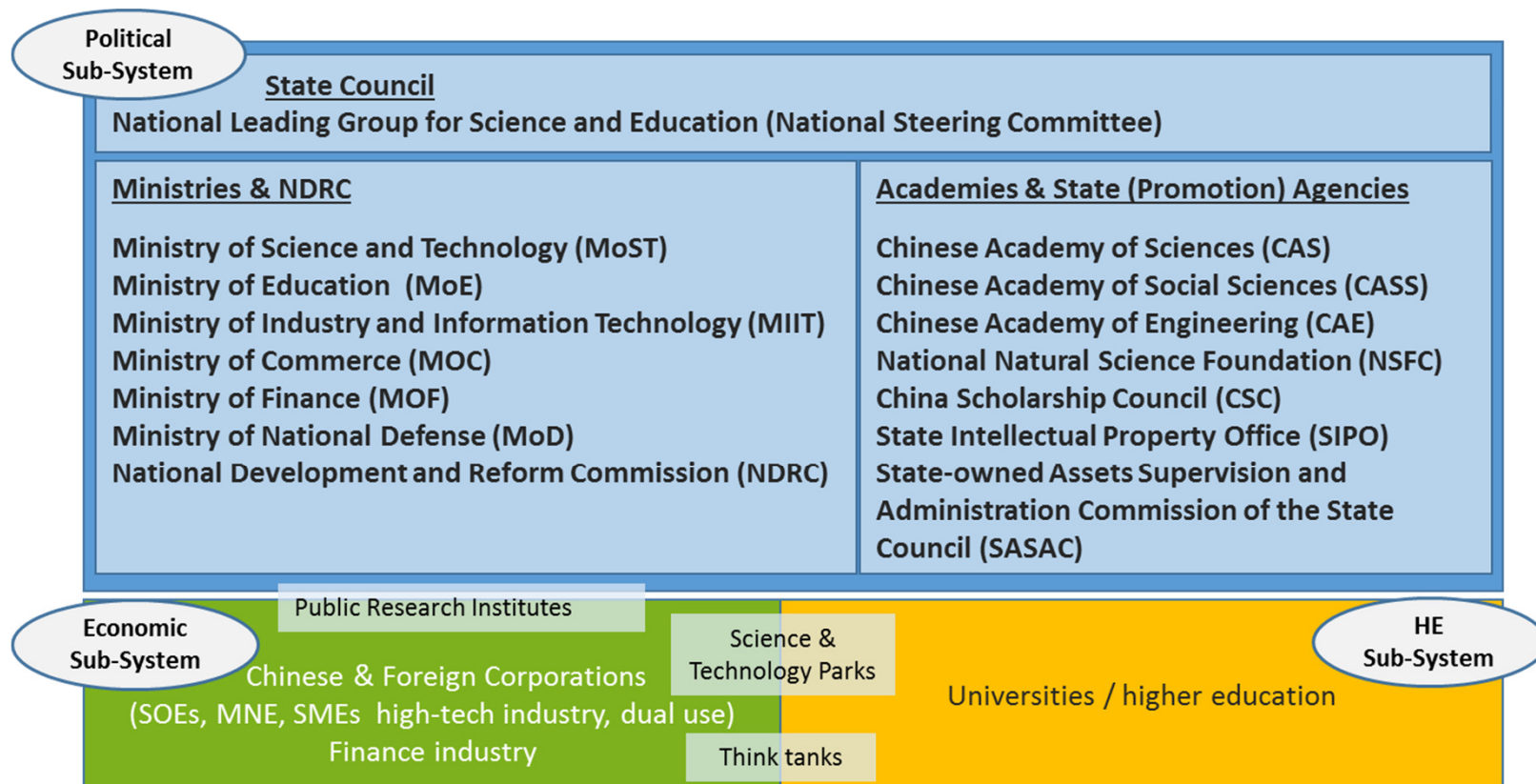
(...) China’s approach to knowledge is already bearing fruit in terms of making foreign policy. A collection of topics as cognitively sophisticated and even futuristic as the exploration and use of outer space, (...) information technology and connectivity, (...) quantum physics (...) and so on, have become the bread and butter of Chinese career diplomats, thus catering to the country’s most urgent present and future needs.”

Source: The Diplomat, February 27, 2018

**Innovation & Innovative  
Governance for the New Era  
in PR China**

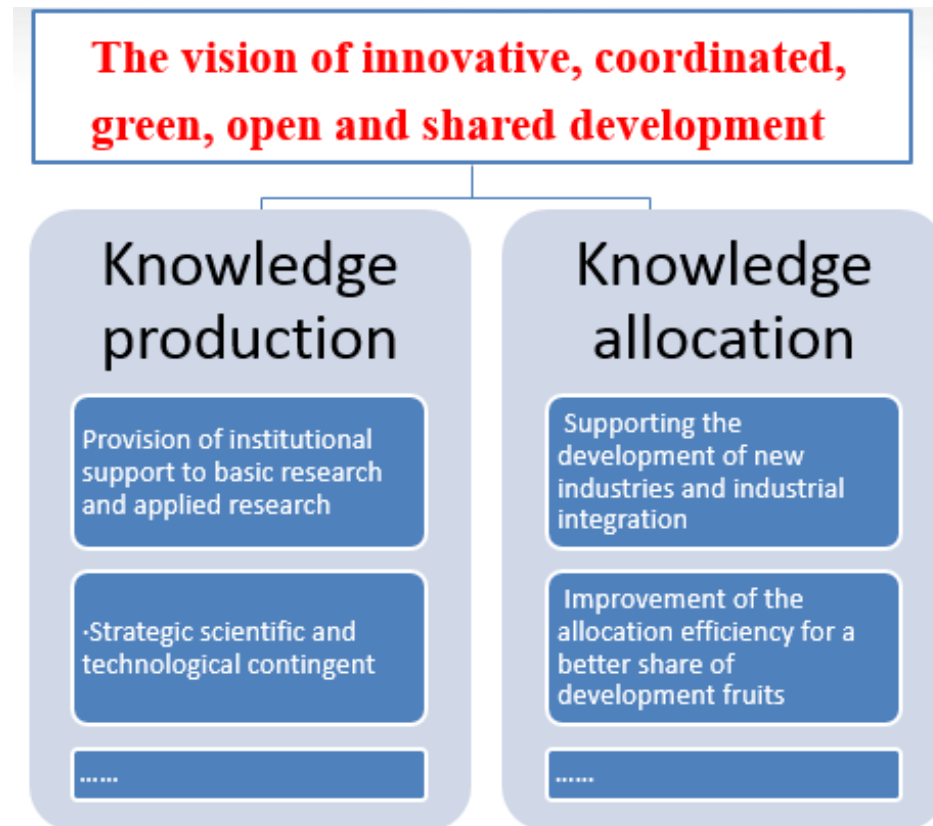
# National Innovation System of PR China

## Three-tier Structure, Sub-Systems & Main Players



Source: Federal Ministry of Education and Research (2015), Bichler (2012), Welzl (2018) modified

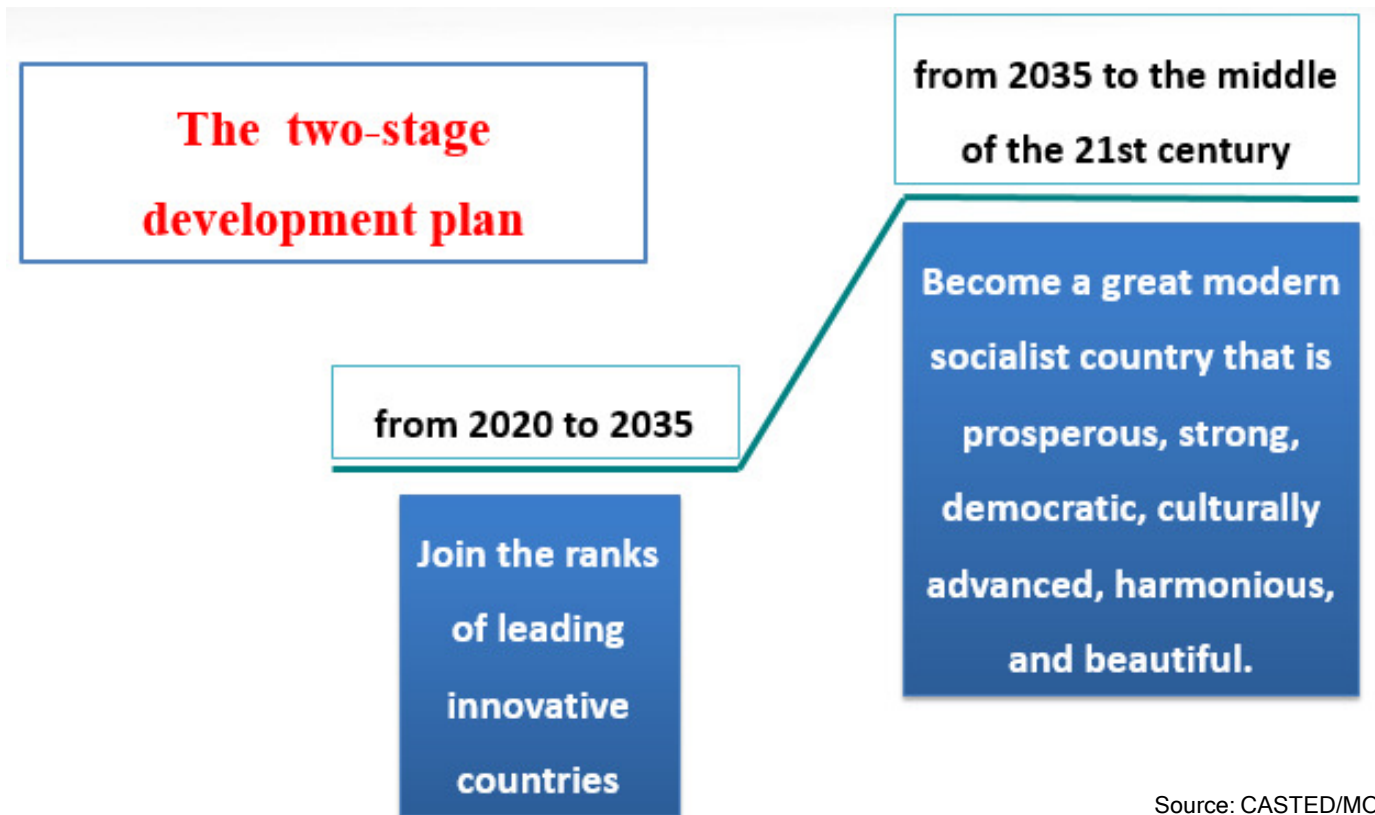
## Chinese Government: the Evolutionary Direction of China's National Innovation System (MOST)



Source: CASTED/MOST, 2018



## Chinese Government: the main Difference lies in the Claim and Strategic Execution (MOST)

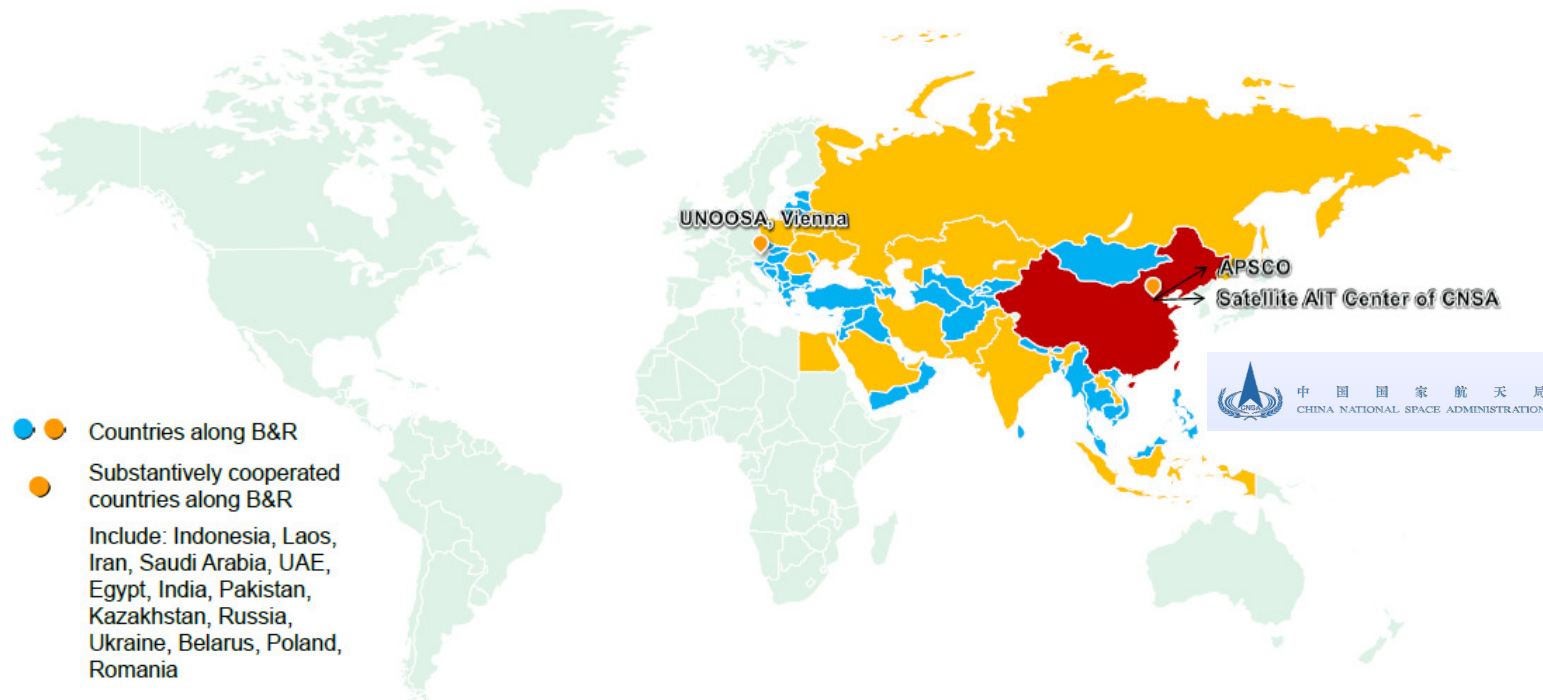


Source: CASTED/MOST, 2018

# The Digital Silk Road in Space and on the Ground

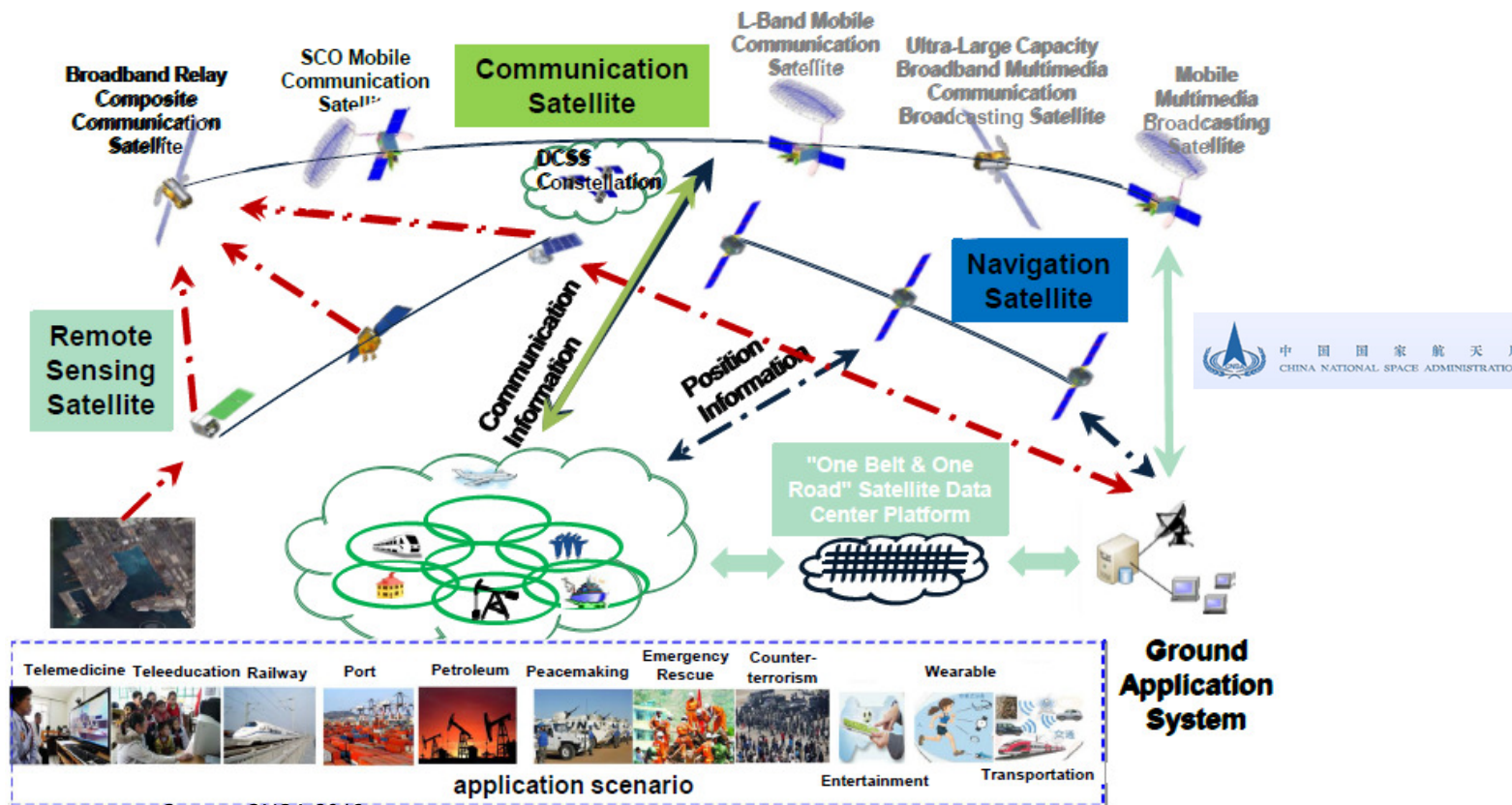
# PR China's Belt & Road Spatial Information Corridor I

## - Current Cooperation with BRI-Countries in Space

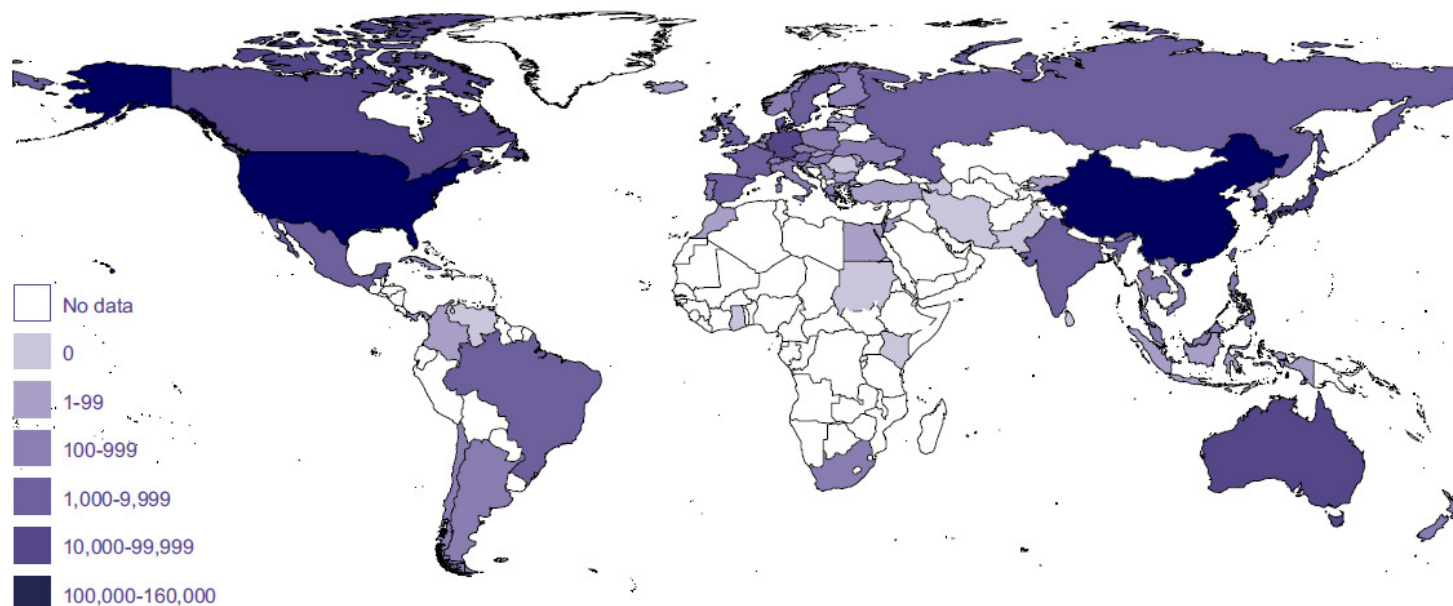


Source: CNSA 2018

# PR China's Belt & Road Spatial Information Corridor II - Components/Applications, Space/Ground (CNSA 2018)

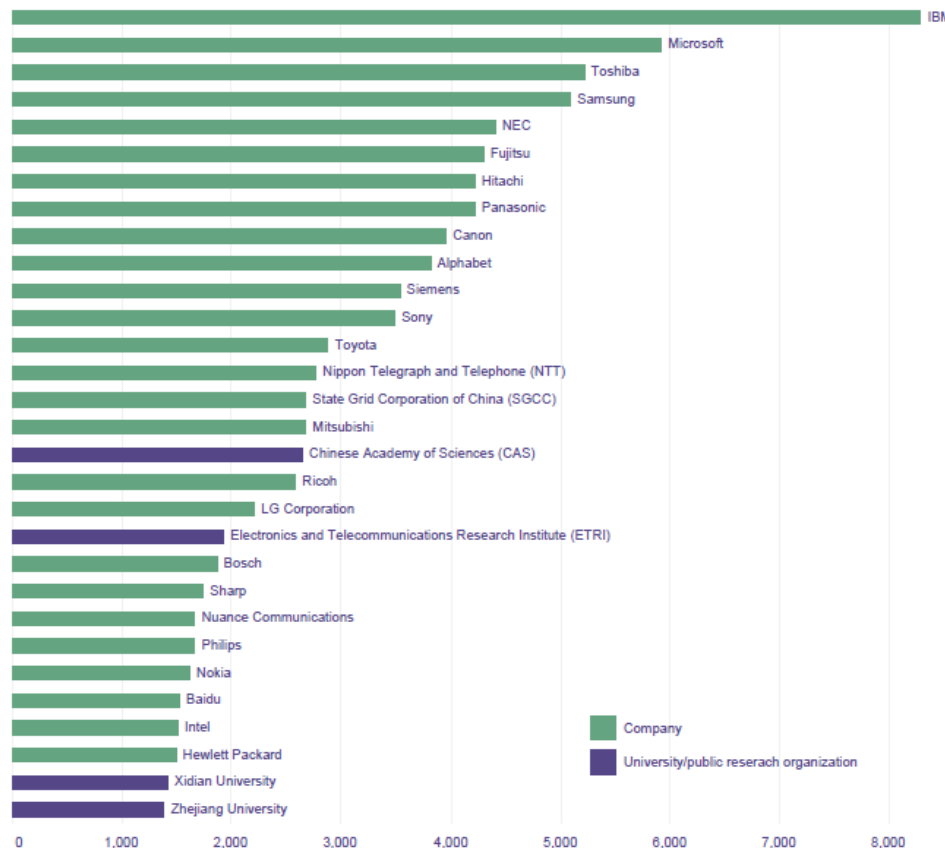


## Artificial Intelligence (AI): China as a global Hot-spot of AI Patent Applications (by Patent Office, 2019)



Source: WIPO Technology Trends 2019 – Artificial Intelligence

## Global Top 30 AI Patent Applicants - 16% of Chinese Origin (2019)



Companies represent 26 of the top 30 AI patent applicants (by number of patent families) worldwide

China well represented (16%):

State Grid Corporation of China

Baidu

Chinese Academy of Sciences

Xidian University

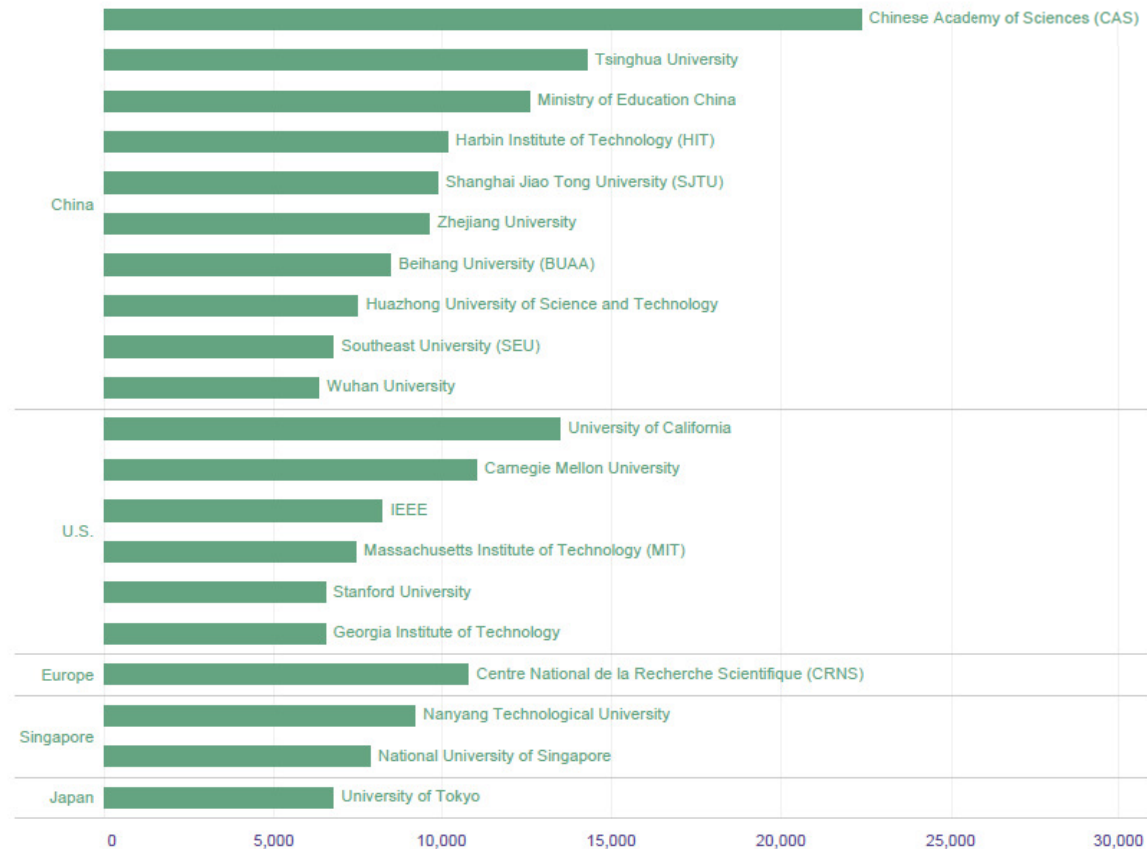
Zhejiang University

Source: WIPO Technology Trends  
2019 - Artificial Intelligence



## AI Scientific Publications of Universities

- 10 of the top 20 organizations are in China



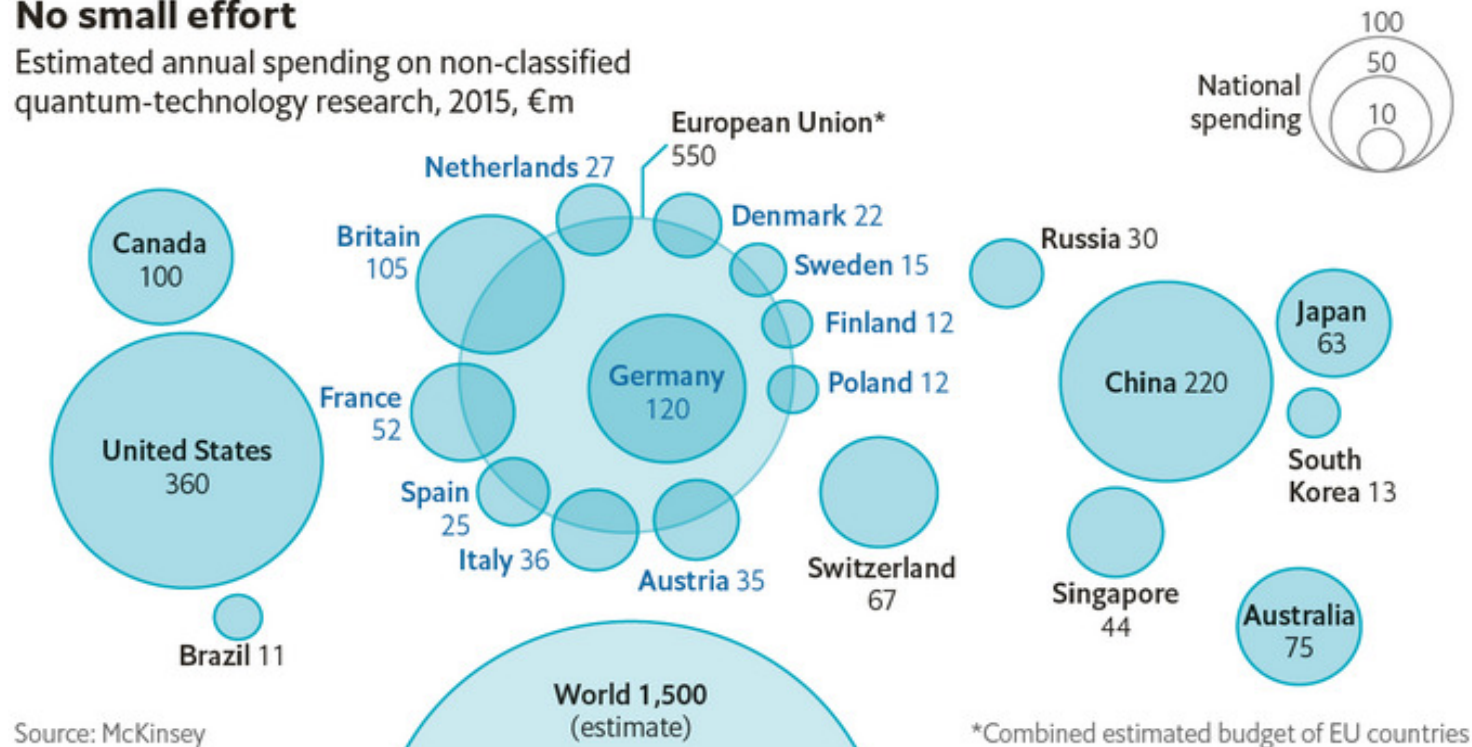
Source: WIPO Technology Trends 2019 - Artificial Intelligence

# The Global Quantum Quest

- PR China approx. 15% of Global Spending in 2015

## No small effort

Estimated annual spending on non-classified quantum-technology research, 2015, €m

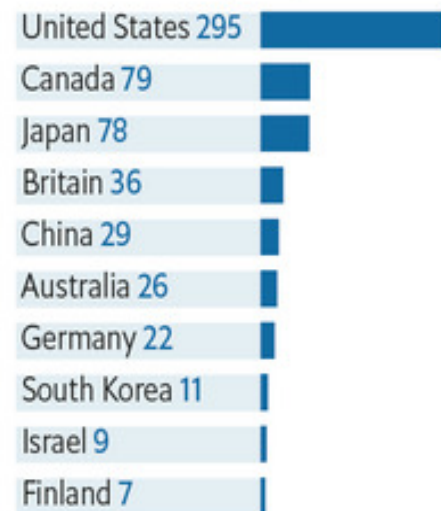


# Knowledge Transfer & Innovation

## - China's Applied Quantum Performance in Comparison

Patent applications to 2015, in:

### Quantum computing



### Quantum cryptography



### Quantum sensors



Source: The Economist - Technology Quarterly

## What does this mean on Firm Level?

- Huawei's global Innovation Value Chain



Source: Huawei (2019)

# Huawei's European R&D - Centers Network Research projects & Activities

- 200+** Research projects
- 150+** Academic institutions are partners
- 22+** Participation in H2020 projects.

## ERI - European Research Institute

1. **1600+** employees, **400+** contractors, **80%+** recruited locally
2. **19** R&D centres in EU, Russia, Ukraine, Belarus and Israel, with ERI HQ based in Leuven
3. Munich Research Center is the largest European Huawei Research Center



Source: Huawei (2019)

## Research Activities

5G & Wireless  
Optical Communications  
Data Communications  
Photonics  
Cyber security & Privacy  
Quantum Technologies  
Semiconductors  
Thermal Technologies  
AI/ML/CV  
RF IC  
NFV/SDN  
Cloud/Big Data  
Aesthetics  
User experience



## The Case of Hanson Robotics (Hong Kong)

### - Leading-edge humanoid AI-Robot ,Sophia‘



Picture credit: Alexander G. Welzl, Metropolitan Horizons (2019)

Hanson Robotics has achieved something that no other robotics or AI company has come close to: creating a robot persona that has become a global celebrity.

Sophia has chatted with dozens of world leaders, been offered Saudi citizenship, been retained by the UN as a delegate for technology and women's empowerment, spoken at over 100 major conferences, been appointed brand ambassador for major brands, and appeared in films, TV, and fashion magazine covers.

She had logged literally billions of social media views. People message her as if she were an actual human.

Sophia gets paid for her celebrity, just like movie stars do: \$6.5 million in 2018.

Hanson Robotics is raising money to expand hardware and software development, to add features, skills and scalability to the Sophia platform. As the platform evolves, it will address larger and larger portions of the \$50 billion (IDC) service robot market.

Eventually, the platform may closely emulate human, self-aware communications.



# Green Economy and a Better Life in China

# China's Clean Air Laws Challenge the EU

## - the Case of Hangzhou/Zhejiang Province



### Clean Air Action Planning in Hangzhou

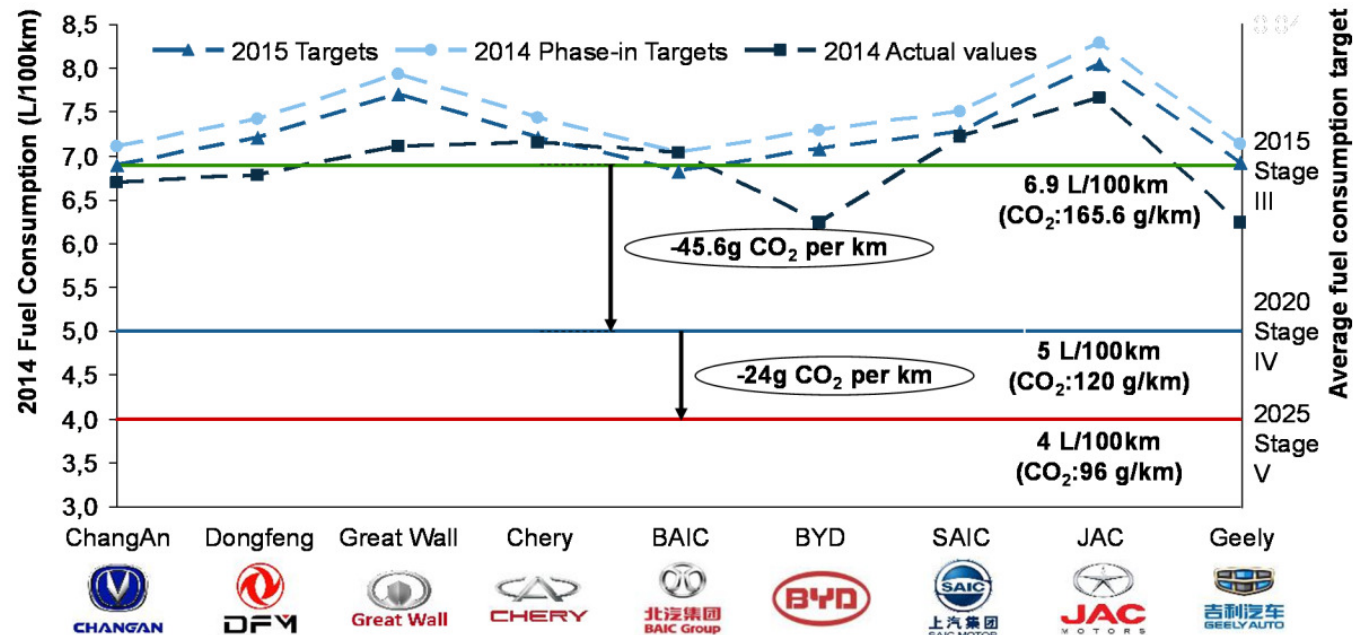
Start of improvements and introduction of strategic goals by provincial and city government some 5 years ago

Goal: to facilitate 'Blue Sky' living conditions for metropolitan inhabitants

2019: goal has been reached

**Amongst others 100% of motorbikes and mopeds were electrified!**

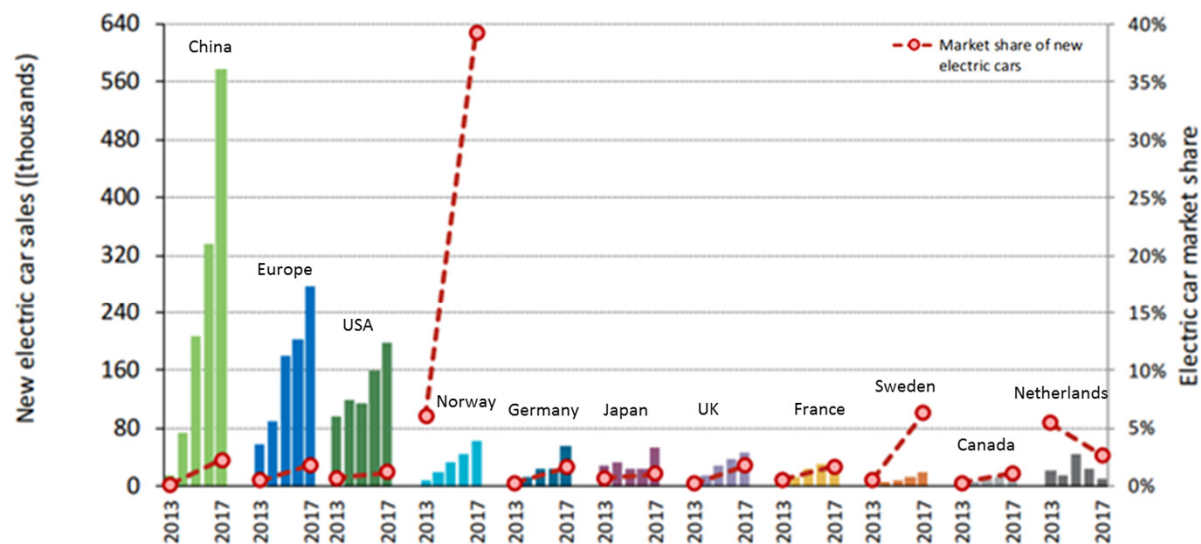
# Challenges for the Automotive Industry in China



**Only solution: eCars !**

Source: Upcoming Emissions legislations –  
Consequences for PT strategies, technologies and costs;  
Koehler, Motor und Umwelt, 2016

## China - World's Largest Electric Car Market



Source: Global EV Outlook 2018, IEA, 2018

<http://www.ev-volumes.com/country/china/>

China = world's largest electric car market

2017: 580.000 NEVs

2018: 1.100.000 NEVs

NEV growth +90%

74 % BEVs, 26 % PHEV

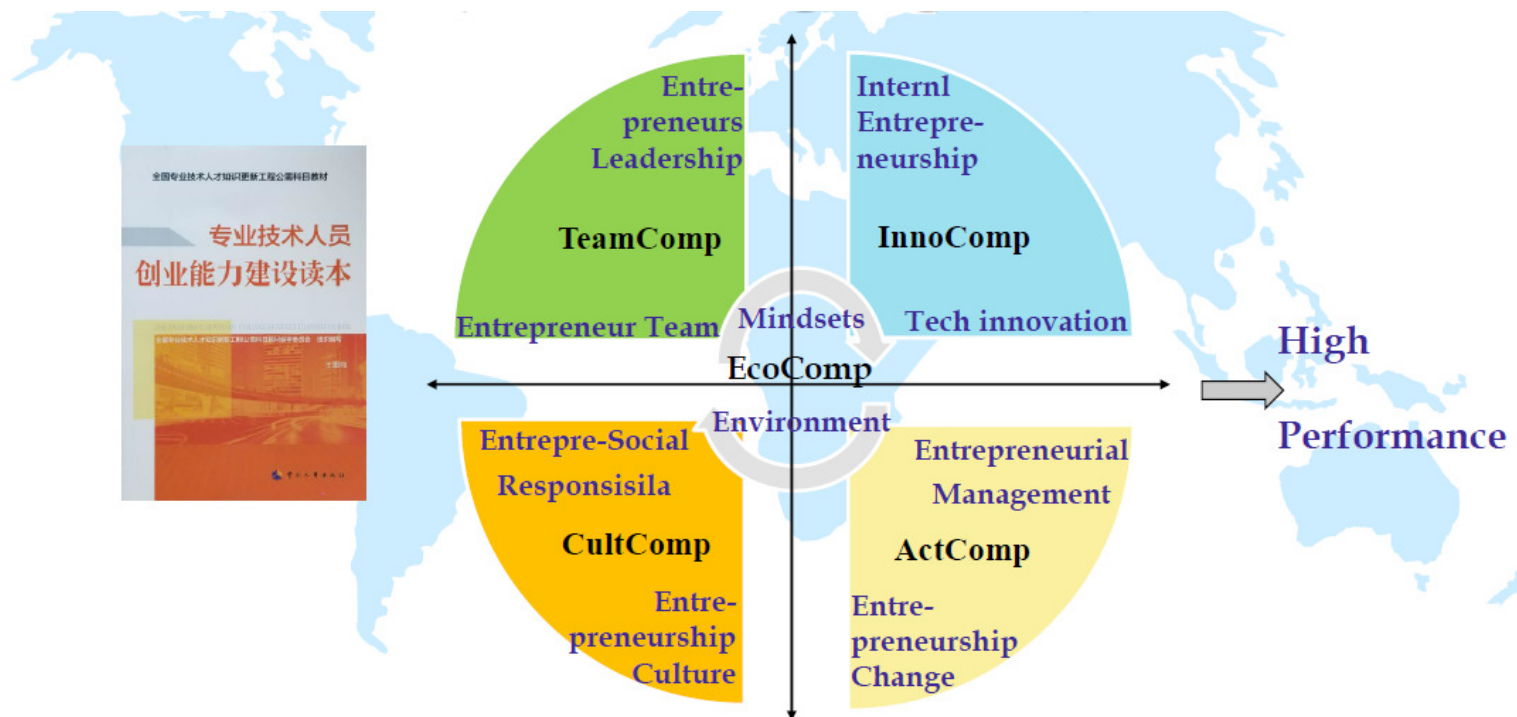
Total 26,3 million cars

4,2% NEV share

**Novel & Innovative  
Corporate Management Techniques  
in China**

# The Five-Competence Model of Entrepreneurship (Prof. WANG Zhongming, Zhejiang University 2015)

**A corporate innovation ecosystem approach for Chinese firms going global:**



Source: Wang (2019)



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Thank you for your attention!

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