AI Made in China

A Dominant Presence on the World Stage

China: a brief history

Before the Industrial Revolution, China generated roughly 30 percent of global economic output. In other words, in those days its share of global economic power was significantly higher than all the G7 countries combined. China was far more advanced than the rest of the world, and was responsible for numerous inventions that changed the course of history, including gunpowder, papermaking, and the compass.

With the advent of the Industrial Revolution, however, China's economic importance began a long, steady decline. The country played at most a subordinate role in all subsequent industrial revolutions. At the low point of this development, China generated just 2 percent or so of global GDP.

Prof. Stefan Asenkerschbaumer
CFO
Robert Bosch

China's meteoric rise

In 1978, China began gradually opening up its economy. This process resulted in average annual growth of 10 percent in the years up to 2010, a development unparalleled in recent history.

Since joining the WTO in 2001, China has tripled its share of global exports and increased its annual automobile production from 2.3 to some 29 million vehicles, leaving the United States and Europe trailing in its wake.

China is once again a dominant economic power, contributing 18 percent of global GDP. Its R&D intensity has tripled over the past 20 years, and is coming ever closer to the levels seen in advanced countries such as the U.S., Japan, and Germany. The country currently ranks at number 17 on the global innovation index – the first time it has ever broken into the top 20.

But China shows no sign of resting on its laurels.

The future – as China sees it

China is determined to be the principal architect of both the impending fourth industrial revolution and of the shape globalization will take in the 21st century.

The country is pursuing a long-term strategy of making itself the undisputed leader among the world's industrialized nations by 2049, when the People's Republic celebrates its centenary.

This long-term strategy has been translated into a number of clearly defined initiatives. The "Made in China 2025" initiative, for example, is a three-stage plan to give China a leading position in many areas of technology. And the "Next Generation Artificial Intelligence Development Plan" aims to make China the global leader in the key area of artificial intelligence (AI) by 2030. Technological initiatives such as these go hand in hand with mammoth infrastructure projects, such as the "One Belt One Road" initiative, which will allow it to secure global trade routes and mineral deposits.

CHINA IS DETERMINED TO BE THE PRINCIPAL ARCHITECT OF BOTH THE IMPENDING FOURTH INDUSTRIAL REVOLUTION AND OF THE SHAPE GLOBALIZATION WILL TAKE IN THE 21ST CENTURY.

"Just as electricity transformed almost everything 100 years ago, today I actually have a hard time thinking of an industry that I don't think AI will transform in the next several years."

—ANDREW NG, *formerly professor at Stanford*

AI: the mother of all technologies

China also has its sights set on AI as a key technology. It's not alone: leading figures from government, industry, and academia in the world's advanced economies agree that artificial intelligence will be the universal technology of the 21st century.

Although the technology has its origins in the United States, both Chinese government and industry quickly identified the potential of artificial intelligence to bring about a new, fourth industrial revolution. This led and continues to lead to heavy investments in this field.

The management consultancy firm PwC predicts that global GDP could increase by as much as an extra 14 percent between 2017 and 2030 as a result of AI – the equivalent of roughly 16 trillion dollars. It also sees AI as the biggest opportunity for economic growth, yet while North America is expected to grow 14.5 percent as a result of AI, in China this growth could reach a colossal 26 percent.

What are the main success factors for AI?

The power of data

China can draw on a huge pool of data. With some 1.1 billion cellphone users and 800 million internet users, this pool is larger than in the United States and India combined. The potential of this pool is amplified by users' everyday habits. Compared with U.S. citizens, for example, the average Chinese use their smartphones to pay for things 50 times more frequently, use rental bikes 300 times more frequently, and order food online ten times more frequently.

The WeChat app that belongs to the tech company Tencent has more than one billion users. Among other things, this means that it processes seven billion photos a day. This is a huge source of data that can be used immediately to improve image recognition.

As explained by the AI pioneer Fred Jelinek, the success of AI hinges first and foremost on data. According to forecasts, the amount of data generated worldwide each year will have increased tenfold between 2016 and 2025, to 163 zettabytes (1 zettabyte = 1 billion terabytes). Experts believe that China's share of this will increase from just under 20 percent today to roughly 30 percent in 2030.

With the huge amount of data at its disposal, therefore, China has a good basis from which to expand its AI expertise. For the West, this means it is crucial to exploit its own data to the utmost, as well as to develop intelligent algorithms that function with smaller amounts of data.

Hungry entrepreneurs – China's startups and corporations

Of the 2,500 AI companies currently in existence around the world, 43 percent are in the United States and 23 percent in China, according to experts. But this balance of power will soon change. In 2017, as much as 48 percent of global investment in AI startups was made in China.

In China, conditions are ideal for AI startups. Even in 2016, there were 8,000 incubators. Furthermore, Chinese startups are faster. Experts estimate that where large startups take between five and eight years to become established in the United States, in China they take just three to five years. In other words, they earn money faster.

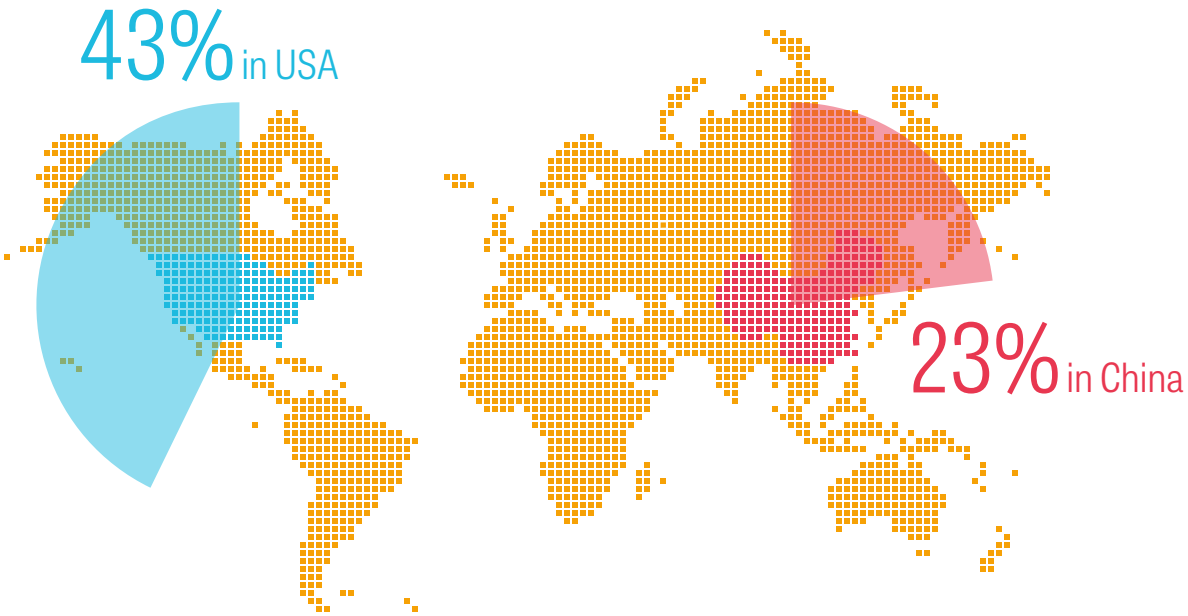
In the past five years, more than 1,000 AI startups were established in China. Only the United States achieved more. The startups related above all to smart robotics, computer vision, financial technology, and NLP (natural language processing). While most of them are still in the preliminary phase, some outstanding startups have already developed into unicorns, such as Face++ and SenseTime in the computer vision field.

Even in the AI chip segment, which is currently dominated by global giants such as NVIDIA and Intel, a number of local startups are emerging whose competitiveness is good, such as Cambricon and DeePhi.

A Global Times study (cited in a paper by the German Ministry of Economic Affairs and Energy) has analyzed Chinese companies' competitiveness in AI-relevant areas such as autonomous driving, big data, speech recognition, image recognition, cloud computing, and machine translation. It concludes that Baidu has the broadest portfolio and the strongest position overall in its development work in all these areas.

Other Chinese IT companies are also strong players. Here, we could name Alibaba in the area of cloud computing and big data, while iFlytek is the leading Chinese company in the areas of translation and language recognition. And in the area of image recognition technology, SenseTime is second only to Baidu.

The Global Times analysis shows just how much potential China has in the AI field. It receives comprehensive state support, and individual Chinese IT companies are already extremely successful. Both these factors strengthen China's competitiveness.



2,500 AI COMPANIES CURRENTLY IN EXISTENCE AROUND THE WORLD

AI research: the war for talent

When it comes to research, the United States is still well ahead of China. In 2017, for example, the U.S. could draw on a talent pool of 78,000 AI researchers, while China had only roughly 40,000. Moreover, U.S. researchers have more professional experience on average. But China is catching up.

The number of AI developers in China is increasing. Many experts have returned to China, and major Chinese companies have set up their own AI institutes outside China to recruit foreign talent.

According to the AI expert Kai-Fu Lee, the office of Microsoft Research Asia alone has trained more than 5,000 AI experts, many of whom are now working as CTOs and leading AI scientists in companies such as Baidu, Alibaba, Tencent, and Lenovo, or have moved on to startups.

But it's not just a question of number. The quality of Chinese AI research is also improving, as is evidenced by the leading role China has now taken alongside the United States in academic publications, papers, competitions such as the Net Large Scale Visual Recognition Challenge, and involvement in bodies such as the Association for the Advancement of Artificial Intelligence.

And 2017 was the first year in which China had more academic publications than any other country. Moreover, in 2016, China ranked second in the number of AI patents filed, with just under 16,000.

CHINESE POLITICS AND SOCIETY ARE WILLING TO EMBRACE AI AND TO RAPIDLY INTEGRATE AI INTO EVER MORE ASPECTS OF EVERYDAY LIFE.

AI-friendly political environment

The political environment in China has a positive effect on these developments. Chinese politics and society are willing to embrace AI and to rapidly integrate AI into ever more aspects of everyday life.

Events such as the defeat of the Go world champion by a smart computer in 2016 served as a "sputnik moment" for the Chinese government, which shortly afterward announced its plan to make China the global center for AI innovation. As a result, Chinese venture capitalists invested even more in AI startups and surpassed the United States in global AI financing.

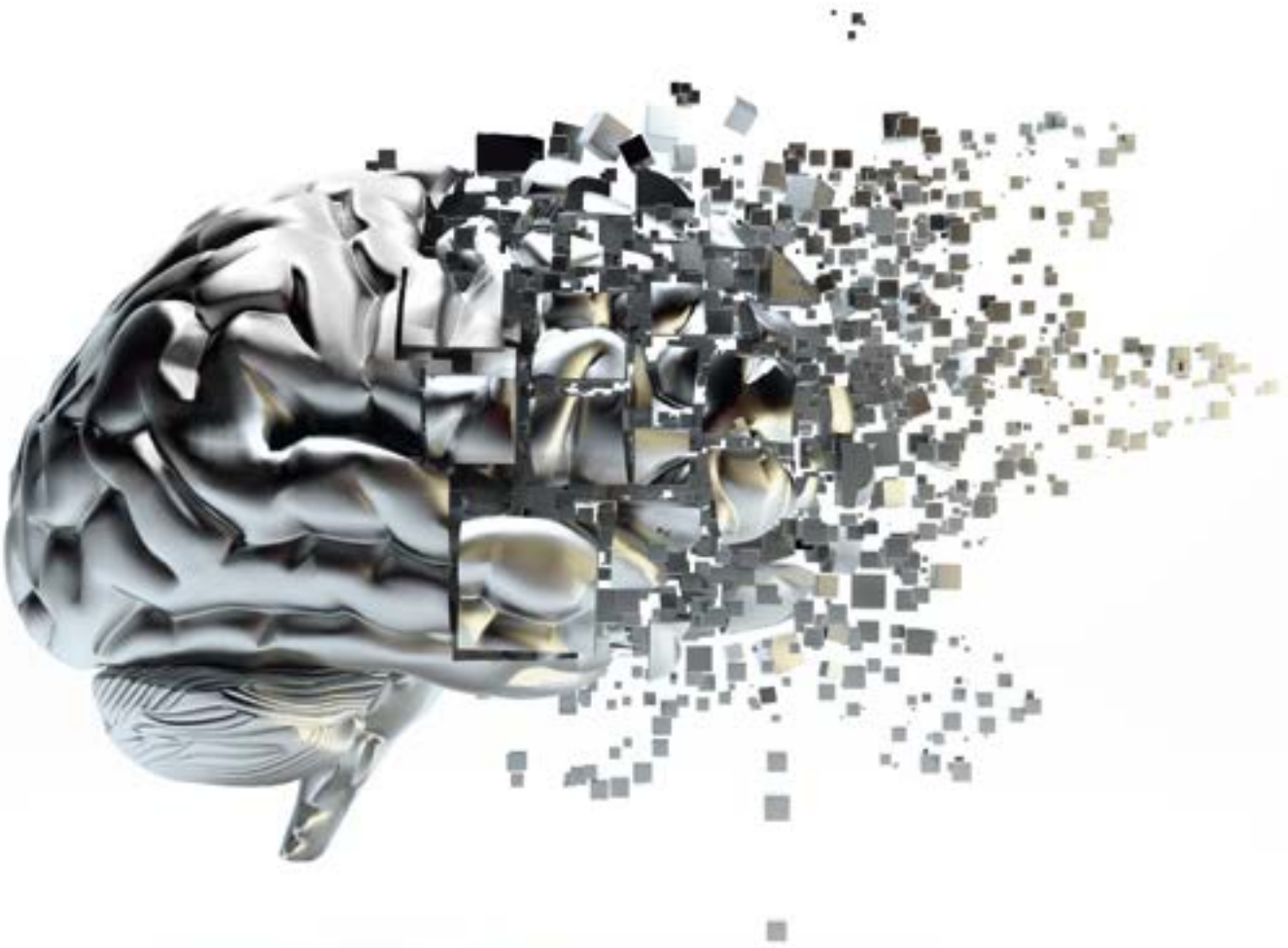
When it comes to the technologies of the future, China's science and technology ministry relies heavily on and collaborates closely with its leading digital corporations, or what is called its "national team" made up of Alibaba, Tencent, Huawei, Baidu, and iFlytek.

Each of these five companies has been assigned a focus area in which China aims to become market leader. The government wants the companies to exchange information and support each other. Baidu has been given the lead in the development of self-driving cars, Alibaba is to turn China's metropolises into smart cities, Tencent to marry medical technology with AI, Huawei to provide cloud and infrastructure, and iFlytek is to concern itself with language recognition. For Hu Yu, the executive president of iFlytek, this is clearly a win-win situation – "We help the government, and it helps us."

In addition, regions are competing with each other and setting up innovation zones. Beijing, for instance, is home to a gigantic AI development park that has space for up to 400 AI companies and a national AI laboratory; another AI park has been set up with the help of an investment fund in Hangzhou, where Alibaba is headquartered. And these are just two of the 19 cities and provinces investing heavily in AI infrastructure.

There are many alliances and joint ventures between China's leading AI companies and either local governments or national organizations such as China's National Engineering Lab for Deep Learning Technologies.

The Chinese government is keeping the market supplied with funds to support AI, while Chinese tech giants are growing and ever more startups are springing up to take advantage of this capital.



Contemporary history is increasingly being written outside Europe. If we want to change this, we need to speed up!

It is awe-inspiring to see how strategically China is shaping its future. In the AI sphere, China is pursuing a clear industrial policy, one of the most comprehensive in the world. It is now at the center of global AI development.

China wants to take the lead, while the United States wants to preserve its lead. As for Europe, it doesn't even feature in most of the above comparisons between the U.S. and China, the two AI superpowers. In the global debate, it is hardly mentioned, if at all. So what should Europe be doing? We have to finally admit that the leading countries in this sphere have a decisive geostrategic advantage.

Europe must quickly make a gargantuan effort if it is to have any chance of competing on equal terms with China and the United States.

What is clear is that governments have recognized the challenges they face. There have been some first steps and initiatives on the part of the EU, and the German federal government has an AI action plan. A Franco-German AI center has also been proposed, and a working group has been asked to draw up a roadmap for it by the end of 2018.

CHINA WANTS TO TAKE THE LEAD, WHILE THE UNITED STATES WANTS TO PRESERVE ITS LEAD.

There are also individual AI regions such as London, Paris, and the Cyber Valley area around Tübingen and Stuttgart. And there are some initial ideas for strengthening the ties between these centers. For example, the Leibniz laureate and Max Planck Institute director Bernhard Schöllkopf has presented his "Ellis" initiative (European Lab for Learning and Intelligent Systems).

But as the China expert Peter Sieren points out, what is still lacking is a clearly coordinated strategy at EU level, with a plan for putting it into action. And in a recently published paper calling for widespread reform, the BDI (federation of German industries) also warned that the EU member states will only remain internationally competitive if they pool their strengths to develop AI systems and make them widely available.

Such a common strategy must be put into practice with resolve and determination, backed up by massive government support. In this process, we have to combine our strengths more effectively and stop any unilateral efforts.

"Artificial intelligence is a global game changer. It will change our lives and our societies. Sometimes people say the best way to control the future is to create it. Let's not leave this to others."

—MORTEN IRGENS, vice-chancellor of Oslo Metropolitan University and co-initiator of "CLAIRE", the Confederation of Laboratories for Artificial Intelligence Research in Europe

The aim must be to make progress quickly and pragmatically. It will be difficult to make up lost ground. European politicians and society have to see AI as a powerful tool with significant potential – if ethical standards are observed – to boost human productivity, security, and wealth. And this ethical question – what values to apply

IT WILL BE DIFFICULT TO MAKE UP LOST GROUND.

when developing and deploying artificial intelligence – is where Europe may possibly have a competitive advantage. If Europe succeeds in becoming a credible player in AI, it could also play an important part in developing such an "ethical" AI.

Many things are still unclear. But one thing is very clear: AI will soon be with us, and with a vengeance. This is something both industry and the scientific community agree on. We Europeans should at last give this subject the attention it deserves.

AI – a research priority for Bosch

Bosch regards artificial intelligence as a key technology of the future, and is pushing ahead with research into practical AI that is safe, robust, and explainable, and that turns things into intelligent partners that complement people's abilities.

While today's AI focuses especially on software applications, established industries give us a basis and an opportunity for promoting smart things. This is where Bosch sees its focal point.

The Bosch Center for Artificial Intelligence (BCAI) is a way for Bosch to expand on its existing AI experience.

The objective of promoting AI research is also served by alliances such as Cyber Valley. This collaboration with partners from the fields of science, politics, and business means that research findings are quickly translated into actual industrial applications. The aim is that Cyber Valley should in this way become an international hotspot for AI experts and thus play a role in the global competition for innovations.

In the AI sphere, Bosch has set itself ambitious aims and defined a clear roadmap for achieving them. Ten years from now, every Bosch product will have AI, or AI will have been involved in developing or manufacturing it.