RBC BlueBay
Asset Management

China: from copycat to innovation engine

Notes from the road

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As a team, we have visited different cities in China over the past few years, yet it never fails to amaze us that we see something new each time we return. Here we discuss the rise of China's technological advancements.

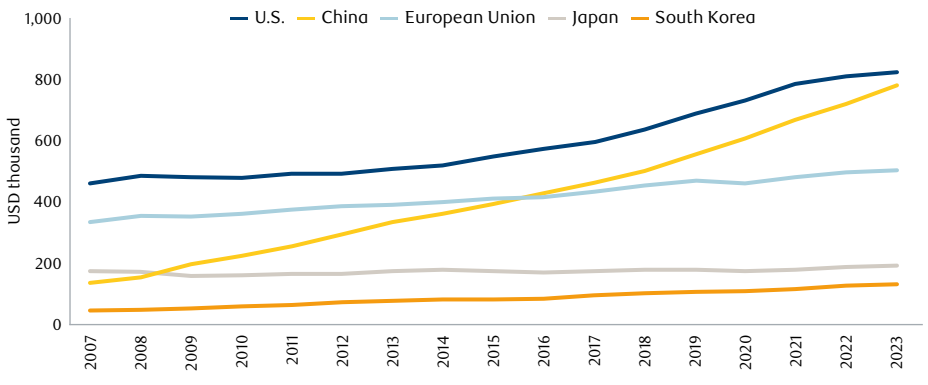
This year, we observed much busier activity in major tier-1 cities such as Beijing, Shanghai, and Guangzhou compared to previous visits, from bustling restaurants to crowded airports. Although China's economy has faced challenges in recent years and remains in a phase of gradual recovery, the steady and impactful advancements the country has made on the technology front are often overlooked, despite their growing significance. When we landed at Shenzhen Airport, we could not help but notice the ads for AI and data centre storage everywhere, from the moment we stepped off the plane into the arrivals hall. It felt like a statement on China's dedication to the global tech race, a tone the country has consistently set since the launch of the 'Made in China 2025' initiative in 2015.

"Substantial investments in research, innovation, and high-tech industries – now the second highest globally in terms of gross domestic expenditure – have propelled China to higher positions in global innovation rankings."

The rapid rise of AI start-up DeepSeek has put a spotlight on China's growing tech ambitions. However, this story is just one aspect of the country's technological developments. The country is surging ahead in electric vehicles (EVs), autonomous driving, drones, and robotics – fields where it increasingly sets the pace globally. In the past, China was often associated with copying technology rather than creating it. However, over the past two decades, the nation has achieved remarkable progress in innovation, transforming from a manufacturing hub into a global leader across numerous technology sectors. Substantial investments in research, innovation, and high-tech industries – now the second highest globally in terms of gross domestic expenditure – have propelled China to higher positions in global innovation rankings (Exhibit 1).

Exhibit 1: China's R&D investment – narrowing the gap with the U.S.

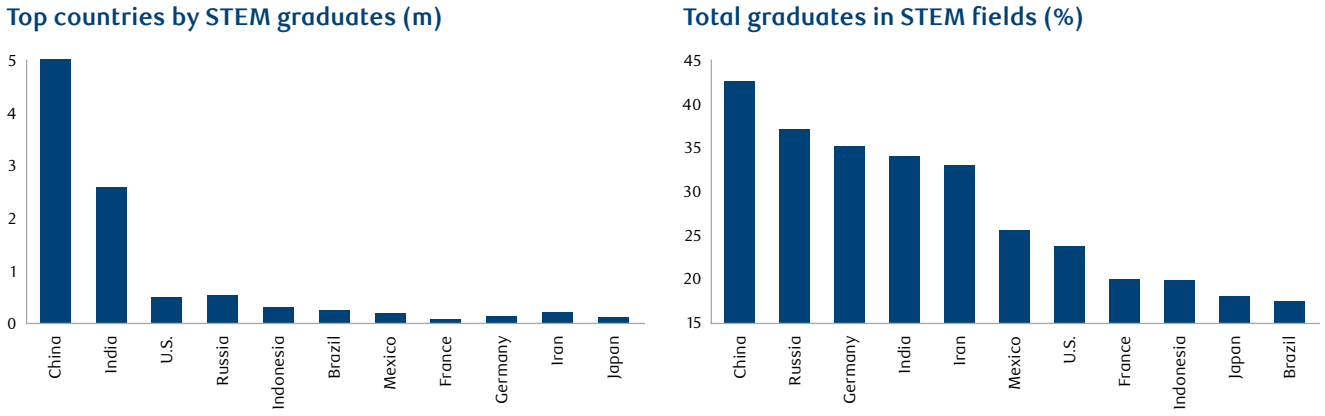
Gross domestic expenditure on R&D for select economies (constant USD PPPs, million)



Source: OECD, as at March 2025.

In 2009, China accounted for just 7.5% of the world's international patent filings[1]. By 2023, that figure had increased to 25.5%, surpassing both the U.S. and Japan[2]. Equally significant, China produces one of the world's largest pools of STEM (science, technology, engineering, and maths) graduates, with millions of engineers and scientists entering the workforce annually, solidifying its role as a key driver of future innovation and technological progress (Exhibit 2).

Exhibit 2: China produces one of the world's largest pools of STEM graduates



Source: OECD (2021), UNESCO (2022), China state media (2024), JPMorgan.

EVs

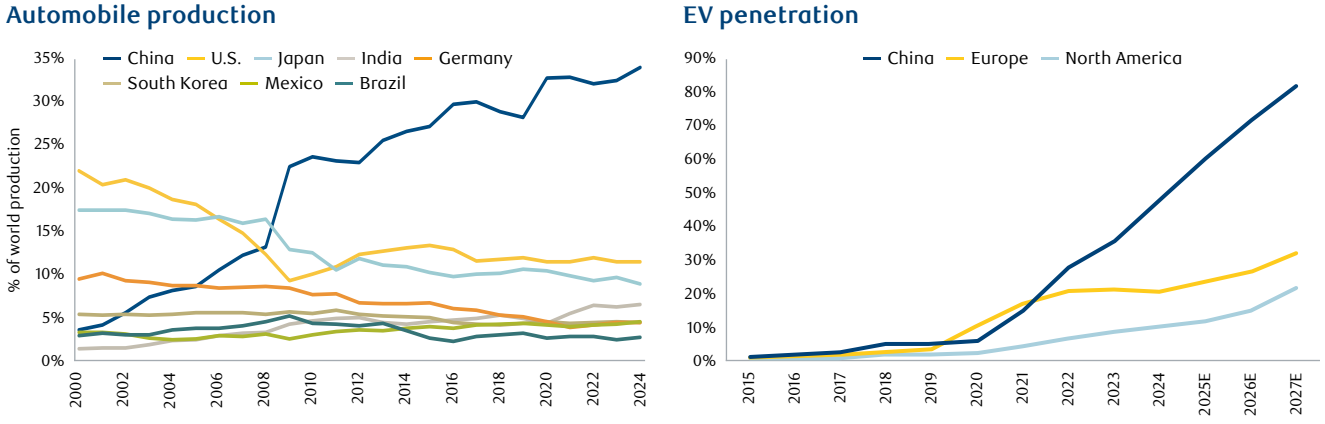
China has been the world's largest automobile producer since 2009. In 2023, the country manufactured 30.2 million vehicles[3], nearly one-third of all cars worldwide. It is remarkable how every factory we visited operates on such a massive scale of production with highly automated processes.

Along the way, the growth of EVs has played a significant role in this expansion. China is now the largest market for new passenger vehicles and a major player in EV innovation, drawing comparisons to Japan's rise in auto manufacturing during its economic boom (Exhibit 3). During the trip, we could see how China leads the world with the highest EV penetration rate – these vehicles are a common sight on streets everywhere.

In addition to government support through subsidies, which is similar to approaches seen in developed markets, advancements in product development by Chinese EV manufacturers and competitive pricing, often lower than traditional internal combustion engine (ICE) models, have contributed to the increased adoption of EVs. This perspective was echoed by local drivers and showroom staff we spoke with.

China is in a much later stage of the EV development cycle and far ahead of many other countries, where competition among manufacturers is gradually shifting from merely pricing and interior design to AI-driven features, particularly autonomous driving (AD). As a result, the adoption of AD technology has accelerated.

Exhibit 3: China has been the largest auto producer since 2009



Source: Organisation Internationale des Constructeurs d'Automobiles (OICA), JPMorgan.

Source: HSBC research, 2025.

[1, 2] RBC GAM, as at July 2025.
[3] German carmakers upbeat on China market, green push - Chinadaily.com.cn.

In 2023, 57% of new passenger vehicles sold in China were classified as "smart cars," and were equipped with some level of AD functionality[4]. We had the opportunity to experience a drive in a robotaxi, and it was both smooth and impressive. The ride was very quiet and safe. With no driver in sight, the clean dashboard featured only a screen displaying the route, and a music playlist. As we glided through city streets, the car handled lane changes and lights, and merged with seamless precision and quiet confidence. There were no sudden stops and moments of hesitation. It was easy to forget there was no-one behind the wheel.

"We had the opportunity to experience a drive in a robotaxi, and it was both smooth and impressive."

While the Chinese government continues to refine regulations to ensure consumer safety, AD is viewed as a long-term growth area. In our view, the adoption rate of AD features is on a clear upward trajectory, especially as economies of scale come into play, driving down production costs for EV manufacturers and making these technologies more accessible.

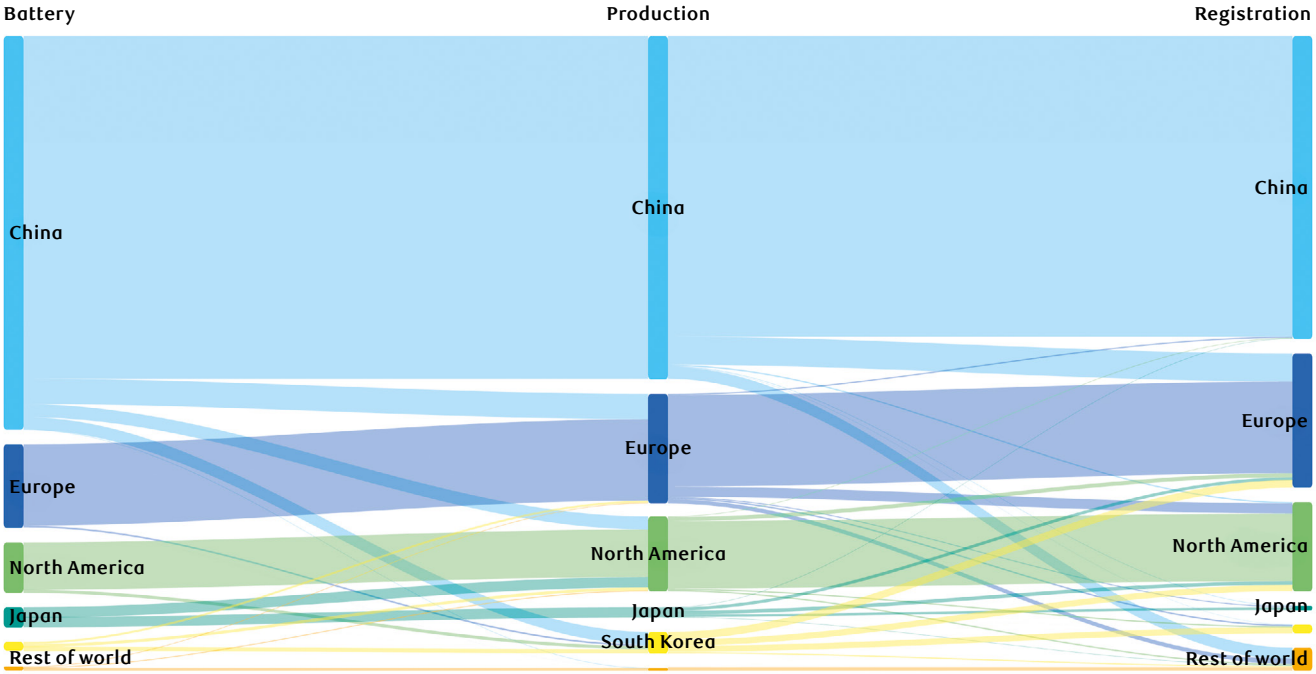
EV supply chain

Beyond vehicle production, China dominates the entire EV supply chain, especially the mid and downstream stages of battery manufacturing and processing of critical battery materials. During factory visits and roadside stops, we saw signs of a vast, highly integrated supply chain. According to Benchmark's Lithium-Ion Battery Database, China accounted for 85% of global battery production in 2024. It also produced 82% of global cathode active materials and 93% of anode active materials, giving it a near-monopoly on crucial components of the EV revolution (Exhibit 4).

Among the companies driving this transformation, CATL stands out as a global leader not only in production volume but also in product innovation. The company continues to maintain its competitive edge with high performance offerings such as the Shenxing PLUS (LFP battery) and the Qilin battery, known for its ultra-high discharge power. As of 2024, CATL commanded 43% of China's EV battery market and it dominates the premium segment, holding a 72% market share in EVs priced above RMB250,000[5]. This serves as a strong example of the significant yet understated technological advancements China has achieved in recent years.

Exhibit 4: China's strength in global EV supply chain

Global trade flows for lithium-ion batteries and electric cars, 2023



Source: Bloomberg NEF, ICC. Battery.
Notes: 2023 price from BNEF's Lithium-ion Battery Price Survey. 2024 prices from January-April from ICC Battery. The unit is GWh. Flows represent battery packs produced and sold as EVs. Battery net trade is simulated accounting for the battery needs of each region for each battery manufacturer, and assuming that domestic production is prioritised over imports. The eventual gap between domestic production and battery needs is filled through imports, which is assigned as a function of the unused manufacturing capacity of the other regions after satisfying their internal demand. This analysis does not consider battery production for stationary or portable electronics applications or stockpiling.

[4] RBC GAM, as at July 2025.
[5] Leading Battery Maker CATL Riding on Electric Vehicle Tailwind | Morningstar.

AI and robotics

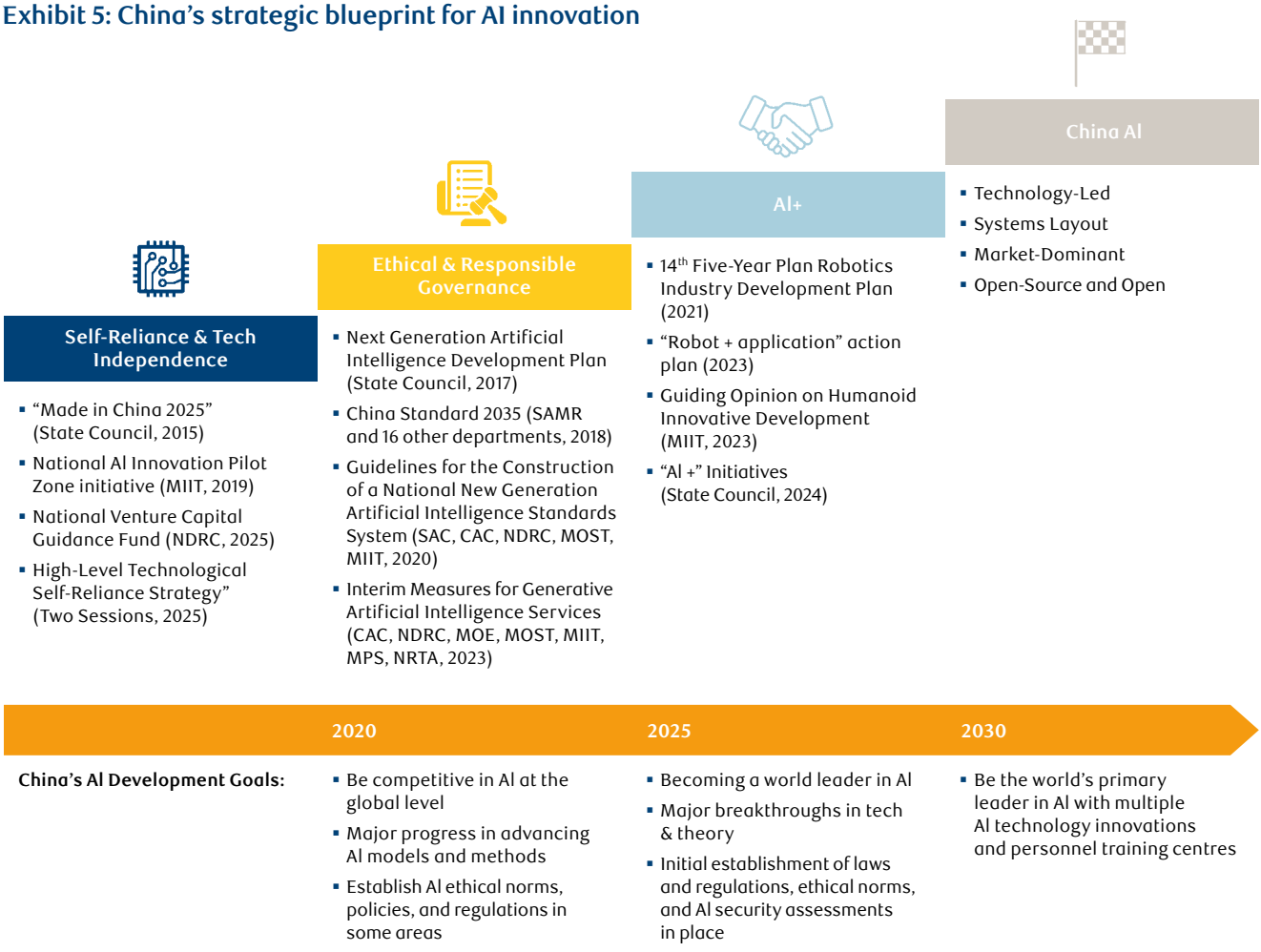
AI and robotics are two fields where China is emerging as a strong competitor to the US in many respects. Currently, China has the largest number of developers working on large language models (LLMs) and AI systems outside of major US tech platforms[6], while also fostering a rapidly growing and dynamic AI ecosystem. Unlike the approach seen in the US, China's primary focus is less on developing the most advanced AI capabilities and more on accelerating AI adoption by achieving cost efficiencies in AI production.

China has set an ambitious goal of becoming a global leader in AI innovation by 2030, following the introduction of its national AI strategy in 2017 (Exhibit 5). During our research trip to Hangzhou and Shanghai, it became evident that the Chinese government views this objective as a political priority. Companies within the AI supply chain that we engaged with appeared deeply committed to achieving technological breakthroughs and narrowing the gap with the US, despite challenges posed by an uncertain chip supply.

Investors are particularly focused on three key areas: i) the technological gaps between Chinese companies and global peers; ii) the localisation rate of the supply chain; and iii) the commercialisation pathways for AI technologies. At this stage, most companies we spoke with were cautious about disclosing specific advancements but have set clear internal targets for localising components and chip production, underscoring their determination to strengthen domestic capabilities.

While concerns persist regarding the impact of chip constraints on China's AI progress, feedback from the companies we engaged with suggests that chip restrictions are not the primary bottleneck for training. Instead, the focus remains on optimising computing power. In light of current dynamics, leading AI startups, such as Deepseek and Zhipu, are placing greater emphasis on understanding chip design and optimising their language models to fully capitalise on its capabilities.

Exhibit 5: China's strategic blueprint for AI innovation



Source: The State Council of the People's Republic of China (released 20 July 2017), Morgan Stanley research.

[6] Morgan Stanley research, May 2025.

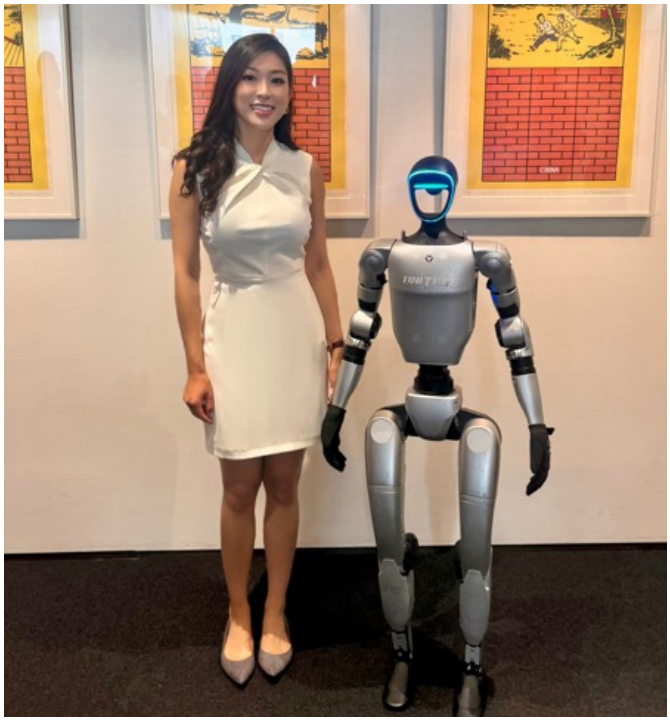
As AI technology continues to mature, conceptual ideas like the humanoid model are no longer mere dreams. We viewed a humanoid robot manufactured by Unitree, a prominent Chinese robotics start-up specialising in high-performance quadruped and humanoid robots, widely recognised as an industry pioneer in China.

We were impressed by the robot's rhythmic walking and the smooth articulation of its joints in fluid arcs. While there is room for improvement in the precision of its movements, the robot demonstrated quick reactions to obstacles. It could stay upright even when pushed, without falling over. Currently, the company is operating at full manufacturing capacity, indicating a strong demand for these robots in China.

"From an investment standpoint, China's technological progress presents both opportunities and challenges for private companies, underscoring the importance of a selective and strategic approach."

Again, the AI industry is still in the early stages of its development, and competition between Chinese companies and their global counterparts is unlikely to progress in a linear fashion due to technological disparities between regions. While the technological breakthroughs needed for humanoid robots and their commercialisation pathways remain uncertain, we were encouraged to see the proactive efforts of Chinese companies in this field.

What stands out is their unwavering commitment to continuous technological innovation and the exploration of potential commercial applications. This once again reflects the innovation-driven spirit observed in other areas of technology in the country. When it comes to real-life applications, we believe adoption will begin with industry-specific use cases, driven by the availability and accessibility of relevant databases.



Meeting a Unitree humanoid robot.

Conclusion

Overall, we found the technological progress achieved over the past few decades to be impressive. The quiet yet profound realities we observed on the ground reinforced our belief that, as the adoption and application of these advancements continue to expand, they are poised to have a net positive impact on China's overall economy, particularly in areas such as labour inputs. However, the scale of this benefit will largely depend on the specific sectors where these advancements are implemented. Additionally, the economic gains from certain innovations may take time to fully materialise.

From an investment standpoint, China's technological progress presents both opportunities and challenges for private companies, underscoring the importance of a selective and strategic approach. As a result, we look to generally invest in Chinese companies later in the cycle, once leadership becomes clearly established and the market more consolidated.

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Angel is an associate portfolio manager on the RBC Emerging Markets Equity team at RBC GAM, assuming this role in 2023. She works closely with portfolio managers to support both top-down and bottom-up research. Before joining the organisation in 2019, Angel completed a number of internships in Hong Kong, which included roles at a global assurance, tax, and consulting services firm, a U.S. management consulting firm, and a major Chinese firm offering investment banking and securities brokerage services. She started her career in the investment industry in 2019.

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