The Chinese economy is consolidating. The days of two-digit increasing rates are gone. President Xi Jinping targeted a 6.5%-GDP (gross domestic product) growth for 2017. The People’s Republic faces a lot of challenges. In the automotive business, the most important market for CAN, the sign stood on green: In 2016, 24.4 million cars were sold, which is an annual increase of 15%. Even if in 2017, these figures will not be achieved, the domestic brands growing last year by 21% according to the China Association of Automobile Manufacturers will gain market shares from German and Japanese carmakers.

The government pushes e-cars and fosters the domestic brands. Great Wall Motor, the largest Chinese SUV provider, sold more than one million vehicles in 2016. Also the number one, Chongqing Changan Automobile produced more than one million cars. Even the sales of private-owned Geely increased to 760 000 cars. Volvo owned by Geely since 2010 had also a successful year: more than 500 000 cars worldwide including 90 000 sold in China. These numbers are still low compared with the biggest carmakers producing about 10 million vehicles per year.

The domestic car industry has adapted CAN technology and is looking forward to use CAN FD networks. Still struggling with the physical network design, the Chinese carmakers are already working on new in-vehicle network (IVN) architectures using CAN FD. The Chinese government forces domestic suppliers to develop CAN silicon and CAN-connectable electronic control units and devices are still rare.

The e-cars need tested power batteries. “This is one of the most potential Chinese CAN markets in 2017,” said Kiko Yue from Guangzhou Zhiyuan Electronics. “We plan to launch an 8-channel CAN FD board, which will greatly improve the power battery testing intelligent level.” In general, the CAN business for automobiles is also in China of strategic importance. NXP, the market-leader in CAN transceivers and a major player in the CAN controller market after acquiring Freescale, introduced recently at the CES 2017 in Las Vegas (USA) a partnership with Geely, a Chinese carmaker, who bought Volvo from Ford a couple of years ago. Geely regards high-end technology as a driving factor behind its growth plans. Volvo uses for example NXP chips in its prototype platform for self-driving cars.

The US government is a little bit nervous about China’s semiconductor industry. China’s objective to foster its domestic semiconductor industry by means of US-$ 150 billion over the next decade is watched like hawks. The Obama administration already warned in a report: “We found that Chinese policies are distorting markets in ways that undermine innovation, subtract from U.S. market share, and put U.S. national security at risk.” Already in August last year, U.S. President Barack Obama tried to block an acquisition of Axtron, a German machine builder specialized in manufacturing metal-organic chemical vapor deposition equipment for clients in the semiconductor industry, by the Chinese Fujian Grand Investment Fund. Donald Trump is also not happy about the semiconductor industry sponsoring by the Chinese government. He twittered already in more or less clear words about a trade war between the world’s two biggest economies.

In the last years, the CAN controller business was leaded by European and Japanese brands: Infineon, NXP, Renesas, and ST Microelectronics are just of few examples. US chipmakers were not involved in the IVN business; Microchip is not yet a heavy weight in this market. This changed with acquisition of NXP by the U.S. company Qualcomm in 2016. But what is about the Chinese chipmakers? Last year,
Tsinghua Unigroup, China’s largest chip designer, acquired a majority stake in XMC, one of China’s leading chipmakers. The newly formed Yangtze River Storage Technology holding is not yet focused on IVN controllers. Also the other Chinese micro-controller vendors are not heavily involved in the automotive business. As Shanghai Huali Microelectronics, most of the Chinese foundries are suppliers for the Chinese companies assembling smartphones, digital cameras, etc. But this may change with increasing success of domestic carmakers.

China plans to cut emissions

Although the Chinese government sponsors the development of e-cars, in order to improve the air-quality its megacities, there is second strategic plan to reduce smog: public transportation instead of individual traffic. The Middle Kingdom will cut, especially, the pollution of sulphur dioxide by 15 % in the next three years. Therefore, the share of public transportation should be raised to 30 % of the total traffic in the megacities.

The Chinese government wants to merge Beijing, Tianjin, and the Hebei region into a super-city with 130 million citizens. Nickname is Jing-Jin-Ji. The planned metropolitan area of the new city is six-times larger than New York. The idea is to link the facilities of Beijing with the Tianjin port-city. One of the challenges is to move the offices, factories out of Beijing in to the Hebei region. For this purpose, an efficient public transportation system is necessary. Unlike urban and metro areas that grow-up step-by-step, the Jing-Jin-Ji project is built on the drawing board. Besides high-speed trains, you need commuter trains and other local public transportation.

This will be a big business. No doubt the CRRC group, a state-owned enterprise, will take a big bite of the high-speed train business. In 2014, this group was so-to-say re-established by merging CNR and CSR, two companies separated in 2000. The regional and commuter trains as well light rail vehicles and metros are also produced by other enterprises. Even newcomers are approaching: BYD is an example. Known as carmaker, the company has already started with the development of mono-rail systems. It is intended to use a CANopen-based control system. CANopen-based control systems have some history in Chinese metros and trams. Swiss-based Selectron introduced CANopen in China a couple of years ago.

The Jing-Jin-Ji project also will boost the construction machine business, which suffered in the last years. Whereas machinery sales in China are significantly down in almost all construction machinery product sectors, Off-highway Research identified a slight year-on-year increase in asphalt pavers of 4 %. In 2015 alone, 11 000 km of new highways were built, which makes Moba – the market-leading supplier of CANopen-based leveling and control systems for pavers – smile. Of course, Chinese competitors such as Jiangsu Siming &T exist, but their quality of sensor products is lower than the German supplier’s.

All the controller manufacturers suffered and are still suffering from the collapsing Chinese construction machine business. In 2015, the sale of road rollers dropped by 27,2 %, wheel cranes by 33,8 %, excavators by 41,4 %, loaders by 52,9 %, and tower cranes even by 60,5 % – just to give a few examples. This was an additional decrease compared to 2014, which was also a year of decreasing businesses. And worse, some customers (such as Sany) delayed payment of invoices significantly. Bankrupted companies paid not at all.

This should change, when the Jing-Jin-Ji megalcity is going to take shape. Besides the above-mentioned railroads, bridges, and tunnels, there are also eight regional airports to be renovated and additional highways to be constructed. In the construction machine business, CAN and CANopen are set. This means, companies such as Cross-control, Epec, ifm, Shanghai Smart Control, and STW are looking towards a brighter future. At the Bauma Shanghai tradeshow in November 2016, they discussed new projects and developments.

This heavy-duty vehicle business is not limited to road construction machines and cranes. Recently, Liugong has launched its 45-ton CLG2450 reach stacker for container loading and unloading. The machine comprises advanced technology including negative flow feedback control, constant power variable control, temperature variable cooling control, touch control, and unified management of engine, gearbox, hydraulic sand braking systems using embedded CAN networks.

The New Silk Road: One belt, one road

The Chinese machine-builders benefit also from the central government’s Belt and Road Initiative. This refers to the Silk Road Economy Belt and 21st Century Maritime Silk Road. The strategy was launched in 2013 with the intention of promoting infrastructure business in the neighboring regions. Due to this initiative, Sany has managed to boost its sales in foreign countries and to reduce its reliance on the Chinese market. XCMG, one of the leading state-owned Chinese OEMs, has invested US-$ 150 million in a manufacturing unit in India through partnership with Schwing Stetter India. Schwing, a Germany-based concrete pump manufacturer is part of XCMG. Competitor Putzmeister, also headquartered in Germany, has been acquired by the private-owned Sany, another Chinese OEM.
The New Silk Road strategy is not limited to construction machines and to Chinese neighbor countries. Beginning of 2017, a freight train left Zheijang province in eastern China to travel 12,000 km to London. Up to now, the U.S. administration regarded the New Silk Road as a bringer of security and of stability to Central Asia. But this may change: Donald Trump may see the Chinese export activities as a hawkish posture. Also the ancient Silk Road was connecting the Far East with Europe. It was a bi-directional link. The New Silk Road is also a two-way connection: Europe provides technology including CAN and gets back machines and other equipment. China has invested about US-$ 250 billion into the New Silk Road. This includes energy projects, railroads, and port facilities in Europe and around the rim of the Indian Ocean. This is not just an investment, but part of a geopolitical strategy.

The Chinese “robot army” is growing

In the past, labor costs were low in China. In the meantime, machines installed in Chinese factories are increasingly sophisticated. They require educated and trained users. Those employees do not work for peanuts; they want to get a fair salary. Many of the machines developed in China use CAN and CANopen as embedded networks. Schneider Electric, Lenze Schmidhauser and other mainly European suppliers have equipped a lot of machines developed and manufactured in China with CANopen-based controllers and drives. Local brands have adapted CANopen in PLCs, servo controllers, and stepper motors as well as HMI devices. Kinco, a long-time CiA member, is just one example. The company also supplies to the medical device and healthcare manufacturers.

The next step is already announced: Chinese companies will heavily use robots in their factories. Foxconn, the Taiwanese enterprise manufacturing Apple’s iPhone in China mainland, is going to fully automate the production. The company said it has a three-phase plan to introduce robots. In the first phase, just the work that is either dangerous or involves repetitive labor humans are unwilling to do will be done by robots. The second phase involves improving efficiency by streamlining production lines to reduce the number of excess robots in use. In the final phase, only a minimal number of workers assigned for production, logistics, testing, and inspection processes are in the factories. Foxconn likes to automate 30% of all production by 2020.

According to the market researcher from ABI, industrial robots increase annually in average by 16% in the next four years. This will sum to US-$ 30-billion revenue in 2020. The automotive industry will be still the most important market, even if other applications such as electronics and plastic processing will catch up. But food and food packaging, pharmaceutical, and cosmetics production will have the higher growth rates.

"The industrial robotic market is driven by the demand for increasing levels of speed, precision, and production flexibility," said Philip Solis from ABI Research. "Other demand contributors include the introduction of robotics automations into industries that did not previously benefit from robotic industrial automation or new classes of applications. Governmental and political manufacturing initiatives, such as entrepreneurship and investment programs, as well as public-private partnerships and re-shoring efforts, also provide momentum for the sector."

U.S. President Donald Trump regards the labor market as a zero-sum game. In last decades, many U.S. companies have moved production to China. Trump promised to bring those jobs back home. But many of the qualifications needed for the homecoming jobs are not more available. It is hard to re-shore jobs that no longer exist.

It took 50 years to install the first million industrial robots. The next million will need only eight years. And most of the growth is coming from China, which has an aging population with a decreasing number of workers. This is one major reason why China is installing more industrial robots than any other country. United Nations already warned last year, that two-thirds of jobs in developing countries are at risk. The U.S. government should be concerned because the middle-classes in China are potential customers for U.S. products. If they have no jobs anymore, they also have no money to buy goods made in U.S. Economy is not that simple as Donald Trump describes in his Tweets.

Kuka acquired last year by the Chinese Midea Group estimates a typical industrial robot costs about € 5 per hour. German manufacturers spend about € 50 an hour for a worker, in China it is just € 10. The return of investment for an automotive welding robot in China has fallen to less than two years. This means, what Donald Trump could increasingly bring back home are robots, not jobs for U.S. citizens.
Most of the industrial robots are used in Far East countries. This makes about 65 % of the world market. One third of the global market goes to China. ABB accounts for nearly one-half of worldwide shipments, with Yaskawa Electric, Kuka Robotics, Fanuc, Kawasaki Precision Machinery, Yamaha Robotics, Stäubli, Nachi Fujikoshi, and Epson Robots as other major suppliers. So, it is not surprising the Chinese Midea Group acquired recently Kuka, one of the leading robot company. The price was US-$ 5.2 billion. China tries to catch up in technology by buying European companies, a strategy already known from the construction machine industry. The latest acquisition is Gimatic, an Italian pneumatic and electric grippers, sensors, and positioners maker, by Agic Capital for far more than US-$ 100 million. Last year, Agic has purchased in cooperation with Chemchina and the state-owned investment company Guoxin Krauss-Maffei, a German industrial robot integrator and plastic-processing machine builder for about US-$ one billion. The Chinese companies are also shopping in the U.S. Wanfeng bought Paslin, a Michigan integrator of welding robots, automation systems and tooling, for about US-$ 302 million. Siasun Robot & Automation, a Chinese robot manufacturer, announced that they are planning to acquire competitive and domestic as well as international device manufacturers.

According to the International Federation of Robotics (IFR), annual robot sales between 2005 and 2015, rose 9 % worldwide, while the growth in China was reported as 25 %. International vendors produce more than two-thirds of the robots purchased in China, but this ratio will change in the future. The current 5-years plan requires an increased use of robots. Some of these robots implement CAN-based embedded networks linking sensors and servo drives as well as other devices.

The robot market is not limited to industrial applications. China and the other Asian countries, in particular Japan and South Korean, are developing service robots (see page 26). Service robots and industrial robots cooperating with human beings have a lot of similarities. Standardizing of electronic module interfaces would allow using devices for both applications. CANopen is a good candidate. Some robots already implement CANopen (see page 30).

China needs robots to keep the production growing, said a study by McKinsey Global. Without robots and automated production, China will be short 600 million workers to achieve the planned GDP growth rates. China has an industrial robot density of 49 per 10 000 workers, while South Korea has 531, the highest density. But China is already the biggest robot market, said the IFR. The “Made in China 2025” initiative launched in 2015 requests to modernize the factories with more robots.

Low-cost CAN boards

Professional CAN-connectable devices are increasingly developed and produced in China. But most of the sophisticated and advanced CAN products are imported from Europe. There is one exception: Low-cost equipment for hobbyists, “makers”, and researchers. CAN shields for open-source hardware come from the Middle Kingdom. They are mainly based on Microchip’s CAN stand-alone controller and transceiver chips. Also low-cost drones and multi-copters are a domain of Chinese companies. Some of them are equipped with a CAN interface.

CAN technology is popular in China. But the knowledge is still limited. Available literature is product-oriented and does not provide background information to make proper hardware and software designs. This changes – but not that fast, as it is necessary. What is missing is a better education in the university on the basics of technical communication systems. Engineers designing embedded networks and deeply embedded networks also need to understand the application. Young engineers coming from the universities are not educated in this direction.

Low-cost is a key criterion in China. For example, Chinese companies have taken over the solar power business from European suppliers. Nowadays, most of the photovoltaic panels are produced in China – for a lower price, of course. The government has financially supported this industry. In the meantime, Chinese companies are also designing complete renewable energy systems. For example, two Chinese companies, a subsidiary of Golden Concord and state-owned China National Machinery, plan to invest US-$ one billion for a solar farm on land contaminated by the nuclear accident in Ukraine in 1986, reports the Climate News Network. The 1-GW plant will be built and run by the Chinese enterprises. Solar plants with sun-trucking panels often use embedded CAN networks to interconnect the inclinometers. Sometimes also the inverters are CAN connected. There are increasingly Chinese suppliers developing inclinometers and other equipment for photovoltaic systems implementing CAN connectivity.

Figure 4: Professional CANopen products designed and manufactured in China are still rare, the CANopen stepper motors by Kinco are used for example in the shown corrugated slitting machine (Photo: Kinco)