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The US Talents Sanctions: Unprecedented Challenges for China's High-Tech Industry

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SYNOPSIS

*The most recent US sanctions on China's technology sector forbid "US persons" from being involved in any activity that may facilitate China's development of advanced semiconductors. According to **YANG BINYI** and **LI MINGJIANG**, these restrictions undermine the foundation of China's chips industry, posing perhaps the most significant challenge so far to Beijing's plan for achieving self-sufficiency in the semiconductor sector.*

COMMENTARY

On 7 October 2022, the US Department of Commerce's Bureau of Industry and Security (BIS) released a new set of sanctions that essentially banned exports of US semiconductor manufacturing equipment, components, and accessories to China. The new regulations also tightened licence requirements and expanded the number of Chinese companies on what is known as the "Entity List", the individuals, businesses and other entities subjected to such requirements. Compared with other updates to sanctions imposed by BIS since April 2020, this round may be the most comprehensive and unprecedented.

It is the first time that BIS has issued restrictions prohibiting "US persons" — i.e., US citizens, green card holders and foreign nationals who live in the United States — from supporting China with technology, software and equipment that could be used in producing advanced computing chips (e.g., those processing performance capacities

of 4,800 tera operations per second (TOP) or more or aggregate bidirectional transfer rate over all inputs and outputs of 600 gigabytes per second or more) and supercomputers. This unprecedented action may seriously undermine the foundation of China's semiconductor sector. Beijing would need a lot more time and far more efforts to deal with the challenges arising from this new round of US sanctions.

Immediate Negative Impacts

In the short run, the restrictions on US persons may cripple the Chinese semiconductor industry by causing a shortage of manufacturing equipment and the absence of key R&D and management talents.

On the day that the new regulations were issued, ASML, the world's top chip-making tool provider, sent an in-mail asking its US employees to refrain from directly or indirectly servicing, shipping or providing support to any customer in China until further notice. ASML has a monopoly in extreme ultraviolet (EUV) lithography systems, which have been regarded as an area where there is a bottleneck for Chinese semiconductor companies to develop the most advanced microchips (7 nanometre [nm], 5nm, and 3nm nodes). The recent controls on US persons may cut off new contracts for EUV systems and the maintenance of the existing EUV equipment in China. According to ASML's 2021 annual report, nearly 50% of its employees work in the United States, and of its total of seven R&D centres, three are in the United States.

China's domestic chip giants have already started to feel the pain. On the one hand, their key US suppliers are planning to stop the installation and maintenance of equipment in China and pull back their R&D staff in Chinese companies. US suppliers like KLA Corp and Lam Research, for instance, have started to temporarily cut off their connections with Yangtze Memory Technologies Co (YMTC), a leading state-owned semiconductor company in China. YMTC is just one of the many Chinese companies affected; other domestic chip giants like Changxin Memory Technologies, HFC Semiconductor Corp, and Shanghai IC R&D Center all are struggling with the new restrictions.

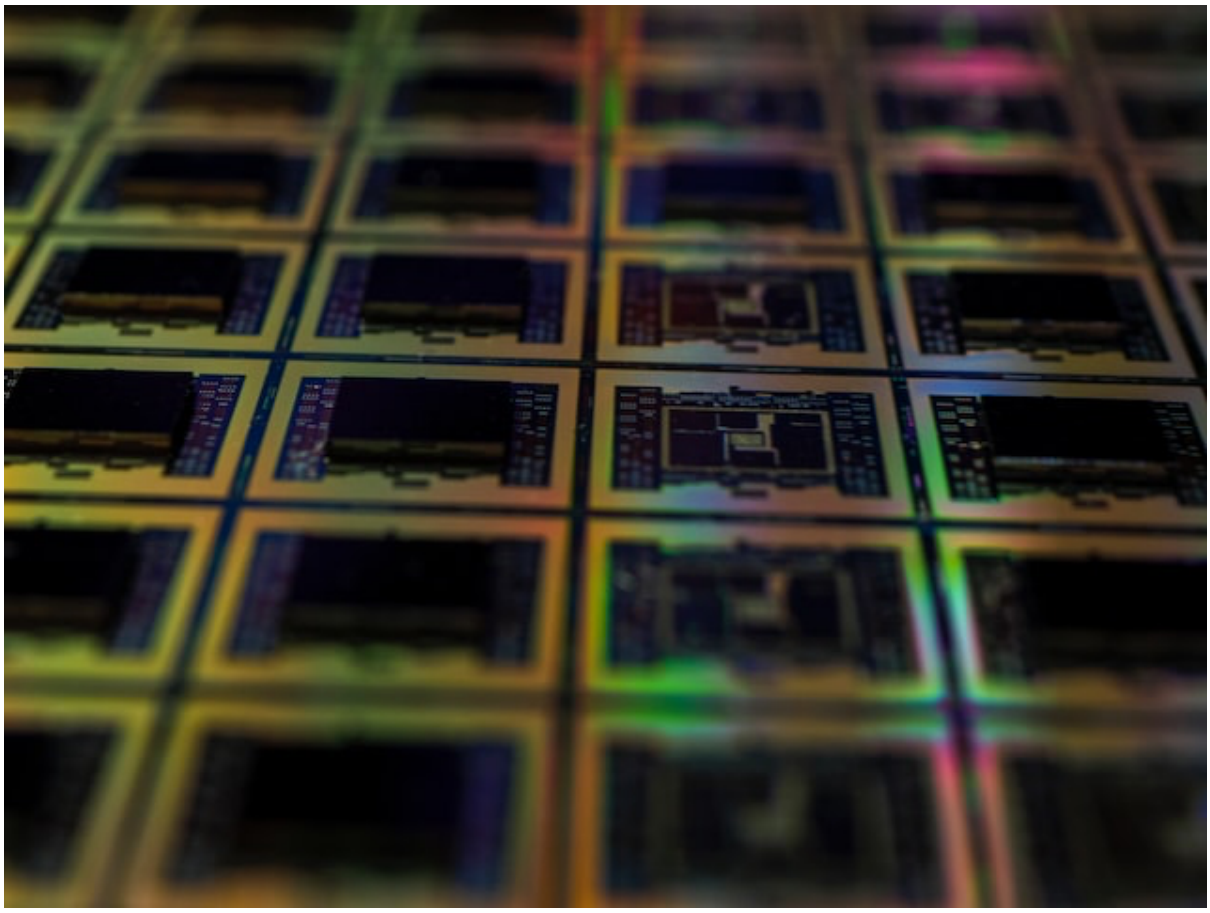
On the other hand, the founders of Chinese semiconductor champions like AMEC and ACM Research are all "US persons". It remains to be seen how these top executives will choose between their US identities and their positions in China. What is more, the new regulations may even affect some Chinese local governments' "strategic emerging industries projects". For some of these projects, the local governments had invited US professionals to be their technology consultants. These American talents would also need to make a choice now.

Long-Term Challenges

Since the Biden administration has considered its tech rivalry with China as a source of long-term strategic competition, the new regulations may pose a substantial threat to China's ambitions to become a high-tech powerhouse.

The new ban may worsen the current talent shortage in China's semiconductor industry. The 2020 White Paper on Talents in China's Integrated Circuit Industry projected that China would still have a shortage of about 250,000 specialists by 2022.

The recall of US talents may be irreversible. Before the latest American sanctions were announced, some US tech talents had already left China because of China's draconian COVID-related restrictions. The new regulations may be the last straw for those talents who had hesitated to leave. In the years to come, the restrictions may also discourage Chinese chip talents currently studying overseas from returning to China. Without enough talents, it would be challenging for Beijing to achieve self-sufficiency in chips.



Without self-sufficiency in the production of semiconductors, China's high-tech industries are potentially at the mercy of the US Government's latest decision to impose further restrictions on exports of semiconductors, manufacturing equipment, components and accessories to China. *Photo by Maxence Pira on Unsplash.*

Furthermore, the negative impacts are expected to spill over into other sectors, such as smart cars, big data, AI, and cloud computing. Even worse, controls on people and software may obstruct the free flow of ideas, which may slow down innovation in China.

To what extent these new restrictions will affect China will be partially determined by the US determination to implement the new bans. Chip giants like SK Hynix Semiconductor Inc, Samsung Electronics, and TSMC have already received approval for a one-year exemption from the latest export control measures. Exemptions could be renewed for these Asian companies, and new licences could be granted to US companies to continue their commercial activities with China's semiconductor and advanced computing industries.

Chinese Responses

China's leaders certainly understand that they cannot and should not rely on Washington's mercy. They have realised that US high-tech pressures on China may only become more challenging in the coming years. China's already existing technological capability may be helpful, to a limited extent, in dealing with the US bans. For instance, SMIC reportedly has developed a serviceable first generation 7nm process.

In the long run, China will double down on its efforts to push for "indigenous innovation" and achieve science and technology independence. Earlier this year, some top executives in the China Integrated Circuit Industry Investment Fund were arrested for corruption. This crackdown suggests that China is trying to manage semiconductor funding in a more targeted and professional way instead of simply chanting political slogans

Moreover, China has also been trying to transform its cumbersome R&D management system, hoping to give more freedom to researchers to innovate. Various Chinese universities and research institutions have been significantly expanding their training programmes in semiconductor technology. Local governments have also joined this campaign. Shanghai, for instance, has set up three campuses to train personnel in this sector.

The recent 20th National Congress of the Chinese Communist Party was said to have highlighted the urgency of developing China's own high-tech sector, especially the chip industry. The selection of some senior officials for the party's Central Committee membership was reportedly based on the criterion of whether they were prepared to "struggle" to overcome the technology strangulations imposed by the United States. Despite this strategic priority and related policies, it remains to be seen whether China can effectively deal with such technology challenges from the United States and its allies in the coming decade.

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