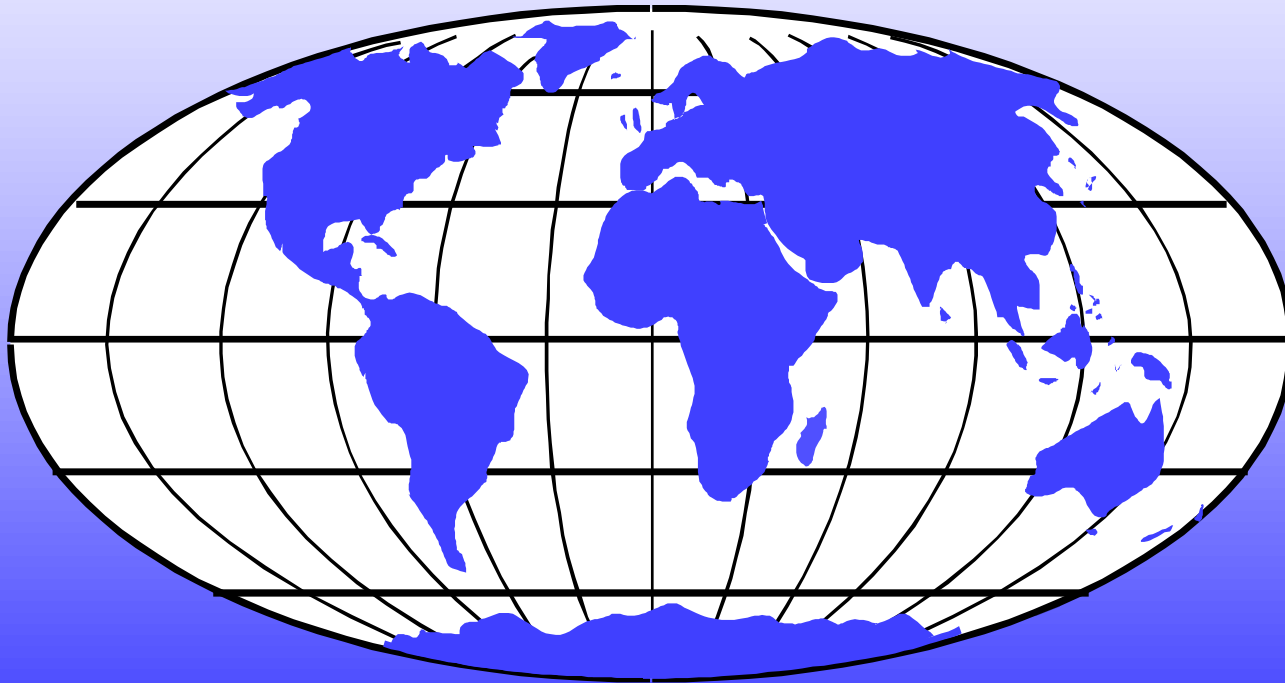


SIA WEBINAR: EXAMINING CHINA'S SEMICONDUCTOR SELF-SUFFICIENCY: PRESENT AND FUTURE PROSPECTS

NOVEMBER 17, 2020



INTERNATIONAL BUSINESS STRATEGIES, INC.

632 Industrial Way | Los Gatos CA 95030 | USA | 408 395 9585 | 408 395 5389 (fax)

www.ibs-inc.net | info@ibs-inc.net

INTERNATIONAL BUSINESS STRATEGIES BACKGROUND

IBS

- Has been in business for over 30 years
- Interface with most global leaders in electronics industry, with customers in U.S., Europe, South Korea, Japan, Taiwan, China, India, and others
- Interface with and support major global corporations such as Intel, Qualcomm, Broadcom, Microsoft, Nokia, Samsung, SK Hynix, Sony, Toshiba, Apple, Cisco, Huawei, IBM, Fujitsu, Canon, NEC, Hitachi, Renesas, TSMC, STMicroelectronics, TI, ARM, Cadence, Synopsys, Mentor Graphics, Seagate, Globalfoundries, SMIC, NXP, and others
- Interface with and support financial institutions such as Goldman Sachs, Carlyle, Blackstone, CitiGroup, Warburg Pincus, Walden, KKR, Morgan Stanley, Credit Suisse, BNP Paribas, Bain Capital, Bank of America, TPG, and others
- Published following books on China: [*China's Globalization \(How China Becomes No. 1\)*](#), [*Chinamerica*](#) (McGraw Hill), and [*Artificial Intelligence: How AI and IA Reshape the Future*](#)

Contributed to Wall Street Journal, Economist, New York Times, Forbes blogs, China Daily, Global Times editorials, EE Times, Xinhua, and others

IBS HAS HIGH MARKET SHARE ON TECHNOLOGY AND STRATEGY BUSINESS

AREAS WHERE CHINA IS MOVING AHEAD OF U.S.

5G INFRASTRUCTURE

Key activities	Comments
<p>China plans to install over 600,000 new 5G base stations by end of 2020, with plan to install approximately six million 5G base stations by end of 2024</p> <p>Huawei is global leader in 5G infrastructure technology but needs semiconductors from companies in U.S. Europe, South Korea, etc</p>	<p>5G will provide high bandwidth and low latency for many industries, including autonomous transportation, manufacturing with smart robots, logistics with drones and other vehicles, telemedicine, high-definition video and interactive gaming, and other applications</p> <p>China is global leader in 5G technology and in establishing 5G infrastructure</p> <p>5G patent portfolio among Chinese companies is extensive</p>

AREAS WHERE CHINA IS MOVING AHEAD OF U.S. (CONTINUED)

5G SMARTPHONES

Key activities	Comments
<p>China has over 1.6 billion mobile subscribers and large market in China for smartphones</p> <p>Smartphones of Chinese companies are competitive in global market</p> <p>Smartphones will become superphones, which will be hubs with strong AI capabilities as well as stream data to and from cloud</p> <p>AI capabilities are being enhanced to provide local data analytics to reduce bandwidth constraints</p> <p>Migration to $\leq 5\text{nm}$ is critical for smartphones</p>	<p>High percentage of population in China have smartphones and use smartphones for financial transactions, access to high-definition content, and health monitoring and tracking</p> <p>5G smartphones will be extensions of people, have wide range of sensors, and improve productivity for many activities</p> <p>New architectures for neural network processors are being developed for smartphones, with AI analytics as key area of emphasis</p>

AREAS WHERE CHINA IS MOVING AHEAD OF U.S. (CONTINUED)

5G SMARTPHONE VOLUME

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
4G and below (MU)	1,608	1,493	1,098	1,024	957	879	786	716	672	630	598	576	562
Growth rate (%)	NA	(7.2)	(26.5)	(6.7)	(6.5)	(8.2)	(10.6)	(8.9)	(6.1)	(6.3)	(5.1)	(3.7)	(2.4)
Percent total (%)	100.0	98.6	83.9	69.5	59.0	50.8	43.3	36.7	32.6	29.0	26.1	24.0	22.3
China (MU)	1,030	958	699	630	566	512	465	418	381	342	311	290	277
Growth rate (%)	NA	(7.0)	(27.0)	(9.9)	(10.2)	(9.5)	(9.2)	(10.1)	(8.9)	(10.2)	(9.1)	(6.8)	(4.5)
Percent 4G and below (%)	64.1	64.2	63.7	61.5	59.1	58.2	59.2	58.4	56.7	54.3	52.0	50.3	49.3
Other	578	535	399	394	391	367	321	298	291	288	287	286	285
Growth rate (%)	NA	(7.4)	(25.4)	(1.3)	(0.8)	(6.1)	(12.5)	(7.2)	(2.3)	(1.0)	(0.3)	(0.3)	(0.3)
Percent 4G and below (%)	35.9	35.8	36.3	38.5	40.9	41.8	40.8	41.6	43.3	45.7	48.0	49.7	50.7
5G (MU)	--	21	210	450	665	850	1,031	1,234	1,392	1,545	1,690	1,826	1,959
Growth rate (%)	--	NA	900.0	114.3	47.8	27.8	21.3	19.7	12.8	11.0	9.4	8.0	7.3
Percent total (%)	--	1.4	16.1	30.5	41.0	49.2	56.7	63.3	67.4	71.0	73.9	76.0	77.7
China (MU)	--	14	152	276	379	478	577	697	799	904	1,009	1,112	1,217
Growth rate (%)	--	NA	985.7	81.6	37.3	26.1	20.7	20.8	14.6	13.1	11.6	10.2	9.4
Percent 5G (%)	--	66.7	72.4	61.3	57.0	56.2	56.0	56.5	57.4	58.5	59.7	60.9	62.1
Other	--	7	58	174	286	372	454	537	593	641	681	714	742
Growth rate (%)	--	NA	728.6	200.0	64.4	30.1	22.0	18.3	10.4	8.1	6.2	4.8	3.9
Percent 5G (%)	--	33.3	27.6	38.7	43.0	43.8	44.0	43.5	42.6	41.5	40.3	39.1	37.9
TOTAL (MU)	1,608	1,514	1,308	1,474	1,622	1,729	1,817	1,950	2,064	2,175	2,288	2,402	2,521
Growth rate (%)	NA	(5.8)	(13.6)	12.7	10.0	6.6	5.1	7.3	5.8	5.4	5.2	5.0	5.0

**5G SMARTPHONES REPRESENT PLATFORMS FOR
FINTECH, TELEMEDICINE, AND OTHERS**

AREAS WHERE CHINA IS MOVING AHEAD OF U.S. (CONTINUED)

DIGITAL HEALTH

Key activities	Comments
<p>Controlling and monitoring COVID-19 have resulted in China demonstrating high effectiveness in testing and using AI to isolate problem areas</p> <p>3D facial recognition and location tracking is effective from economic perspective, but with limitations on people's flexibility</p> <p>3D facial recognition is becoming mainstream</p> <p>Will need access to wide range of semiconductor products</p>	<p>Capabilities developed for COVID-19 monitoring will be applied to other health-related areas, including measurement of blood sugar-level to prevent and control diabetes</p> <p>AI-based health monitoring in China will be significantly ahead of other countries in future because of large investments in AI and supporting capabilities, including 5G and 6G</p> <p>China will need access to better sensors, and many leading capabilities are in Europe</p>

DIGITAL HEALTH WILL BE ONE OF BIGGEST SEGMENTS OF ELECTRONICS INDUSTRY IN 2030 TO 2040

AREAS WHERE CHINA IS MOVING AHEAD OF U.S. (CONTINUED)

ROBOTS

Key activities	Comments
<p>Industrial robots will continue to be increasingly used in manufacturing, but volume of robot is low</p> <p>Consumer and service robots, however, will be in high volume and represent key areas of development in new technologies</p> <p>There is growth in robots with human image recognition technology</p> <p>Will need access to precision analog and signal processing semiconductor products</p>	<p>Robots complement people in many service industries such as food supply, healthcare, and other areas</p> <p>Expectation is that robots are already key part of supply chains</p> <p>Robots will obsolete half of billion factory workers, and similar number of service workers in future</p> <p>New employment opportunities will need to be developed in China</p> <p>China is making large investments in new robot design and manufacturing</p>

ROBOTS COMBINED WITH AI WILL HAVE DRAMATIC IMPACT ON MANY INDUSTRIES, AND CHINA IS MAKING LARGE INVESTMENTS TO MANUFACTURE AND CREATE DEMAND FOR ROBOTS

AREAS WHERE CHINA IS MOVING AHEAD OF U.S. (CONTINUED)

AUTONOMOUS TRANSPORTATION

Key activities	Comments
<p>China is testing levels 4 and 5 autonomous transportation of goods and people</p> <p>Xiong'an New Area in China is being designed for autonomous transportation</p> <p>Didi Chuxing Technology, Baidu, Alibaba, Geely, and others have robotaxi activities</p> <p>Large cities plan to extensively use robotaxis in 2025</p> <p>Robotaxis will need access to fusion processors, image sensors, radar, and other semiconductors</p>	<p>China already implemented processors and algorithms for level 3 autonomous driving, with indications of reduction in accidents</p> <p>Processors for level 4 are being developed in China</p> <p>Key challenge is to upgrade fleet of vehicles in China as well as manufacturing new vehicles that have ADAS capabilities</p> <p>Large investments in electric vehicles and battery manufacturing capacity are complementary to autonomous transportation</p>

AUTOMOBILES REPRESENT ONE PART OF AUTONOMOUS TRANSPORTATION

**LARGE HIGH-SPEED TRAIN ECOSYSTEM IN CHINA IS ALSO AUTONOMOUS
(SHANGHAI MAGLEV TRAIN TRAVELS FROM SHANGHAI TO NANJING IN 60
MINUTES)**

AREAS WHERE CHINA IS MOVING AHEAD OF U.S. (CONTINUED)

SMART CITIES

Key activities	Comments
<p>Smart cities are being established to support autonomous transportation, smart shopping, digital currency transactions, smart health, and smart homes</p> <p>Cities will take 10 to 20 years to become very smart but will result in major changes in lifestyle of people</p> <p>China has taken many initial steps in establishing smart cities, with utilization of new technologies such as vision processing to improve efficiency of many services</p>	<p>Smart cities need tens of millions of sensors, high-performance processors, high-bandwidth connectivity, and multiple levels of cloud processing and storage infrastructures</p> <p>Implementation of smart cities and smart homes will be gradual because it will be difficult to make major changes in layout of existing cities</p> <p>Use of AI will be key factor in establishing smart cities, and people and things are part of national databases in China</p>

AI, 3D FACIAL RECOGNITION, AND PEOPLE TRACKING ARE IMPORTANT

AREAS WHERE CHINA CONTINUES TO LAG

- **Equipment for manufacturing advanced semiconductor products:** Large investments in China, but with major technical challenges
- **Wafer fab capacity for $\leq 5\text{nm}$:** Need EUV, but U.S. government blocked sales of EUV scanners
- **EDA tools for designing semiconductors:** Complexity of EDA tools is very high
- **1z-nm and 1 α -nm DRAM:** Need EUV, and device structures are very complex
- **128-layer 3D NAND:** YMTC could be exception, but with lag time of few years

CHINA IS LAGGING IN SOME KEY AREAS AND CONTINUES TO NEED ACCESS TO TECHNOLOGIES AND PRODUCTS FROM U.S. AND OTHER COUNTRIES

CONCLUSION

- China's progress in becoming high technology over last five years has been dramatic

Key reasons include:

- Large markets in China
- Effectiveness in exporting
- High entrepreneurship
- Funding from government and other sources
- Determination to be successful

- AI is key area of emphasis in China due to improvement of productivity in many industries

Alipay, WeChat Pay, and other apps are highly dependent on AI and provide highly efficient financial transactions

Digital currency activities of Chinese government are also based on AI and will improve efficiency

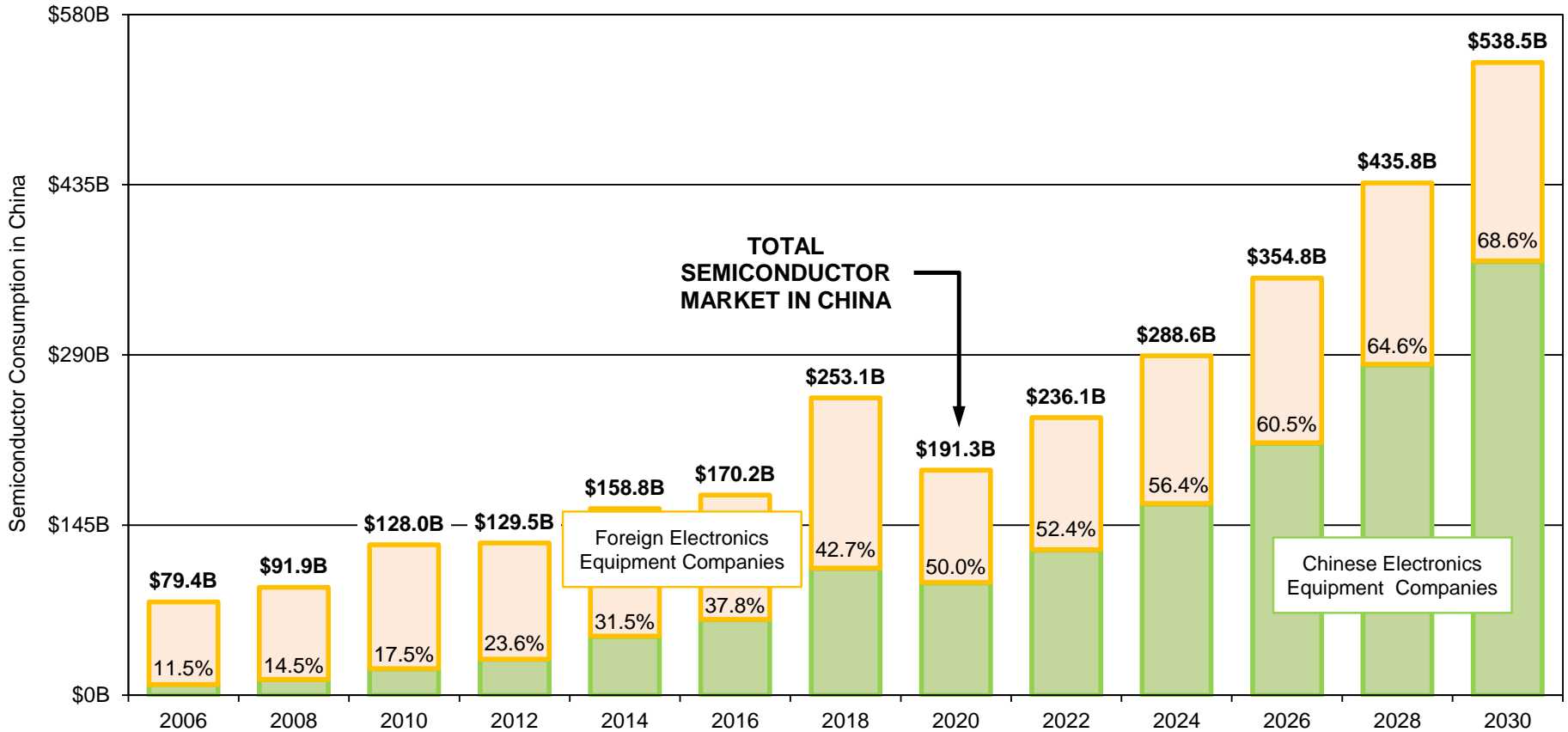
Enhancements in logistics of Alibaba, JD.com, Meituan, and others are AI based

CONCLUSION (CONTINUED)

- Smartphones are key consumer and business platform for AI and other areas
High bandwidth and low latency from 5G are foundations for AI
- China is focused on key industries that can provide long-term employment for college graduates and others
Investments are being made in these industries to build companies that will provide new areas of employment
These investments are important in longer-term strategies
- Semiconductors are foundation of many high-technology industries
China continues to lag in many key areas of technology
However, situation in 5 to 10 years will be different because China will close gap in number of areas
Best approach is for semiconductor industry ecosystem to operate within open environment and without trade conflicts

THERE IS STRONG FOCUS ON ELECTRONICS INDUSTRY IN CHINA DUE TO WIDE RANGE OF LONG-TERM BENEFITS

CONSUMPTION OF SEMICONDUCTORS IN CHINA



SEMICONDUCTOR SUPPLY IN CHINA

