A decade of unprecedented growth
China's impact on the semiconductor industry 2014 update

Technology Institute

Section 3: *Manufacturing, Greater China, Growth Scenarios*

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Introduction

For this, our 2014 update to our annual report, *China's impact on the semiconductor industry,* we have once again elected to release the report in sections in order to provide the information to you as early in the year as possible. Our regular readers should note that all of the considerations described in the 2012 Update appendix, "Interpreting Chinese semiconductor statistics" and the "About this report" sections remain relevant to this update and should be referred to as needed. They may be updated as appropriate with the final release of this year's report. These documents, as well as all of our previously issued reports, are available at our website at www.pwc.com/chinasemicon.

This, the third of three releases for 2014, contains the following sections:

Please note that numbering of figures and tables are continuous through each release. Thus, this section begins with Table 6 and Figure 23.

The first release of this year's report provided a market and industry overview. It can be found at www.pwc.com/chinasemicon. The second release covered IC design and manufacturing. A final report, featuring an executive summary, updated statistics (if any of the data has changed over the months) and an overall conclusion, will be available at the end of the year. Any revisions to text or data that become necessary due to new data or information will be reflected in the pdf file on our website and in the final report. We will also revise the appendix sections ("About this report" and "Interpreting Chinese statistics") at this time as well.

Individual sections, the final, full report and the updated appendix documents will be available on our website at www.pwc.com/chinasemicon.

China's domestic OEM buying power

Table 6 is a listing of the top ten Chinese OEMs (original equipment manufacturers) taken from China's Ministry of Industry and Information Technology (MIIT) report of "Top 10 Chinese Electronic Information Enterprises in 2014." MIIT ranks these companies based upon a comprehensive assessment of revenue, profit, assets, R&D, etc. rather than revenue alone. Each of the top ten had 2013 revenues of US$7.3bn or more. These ten largest Chinese OEMs had a 10% increase in their combined revenues during 2013 after a 9% increase in 2012 to reach a record total of US$206bn. Their combined revenue increase was somewhat less than that of China's electronic information industry which increased 13%, measured in US dollars (or 10% reported in RMB) during 2013. Assuming the semiconductor content of their products was 27% (the average for all of China's electronic equipment production in 2013), these ten Chinese OEMs or their semiconductor consuming subsidiaries could have been responsible for semiconductor consumption of US$55bn, or 30% of China's total semiconductor consumption market.

During the past nine years—since 2004—the MIIT top ten Chinese OEMs have achieved an average CAGR (compound annual growth rate) of 21% per year. Seven companies have been included among the MIIT top ten Chinese OEMs every year since 2004: Huawei (ranked No. 6 in 2004); Lenovo (No. 4); Haier Group (No. 1); Hisense Group (No. 3); ZTE (No. 5); Changhong (No. 9) and TCL (No. 2). Since 2004, Midea Group (No. 7) was reclassified as other than an electronic information enterprise, while Konka Group (No. 8) and Skyworth (No. 10) were reclassified to the second tier of the top 20 and those three were replaced in the MIIT top ten by China Electronics Corp., Founder Group Co., and BYD, which was later replaced in 2013 by Inspur Group.

The US$55bn semiconductor consumption that these top OEMs could have been possibly responsible for is usually identified as "Brand TAM" (total available market), meaning the total semiconductor devices consumed in all the products branded with any of the OEM's brands or names even though some of those products were designed and/or manufactured by other ODM (original design manufacturers) or EMS (electronic manufacturing services) companies. For example, the motherboard of Lenovo PCs are usually made by ODMs (such as Quanta), rather than by Lenovo itself. Since 2009 we have had analysts estimate the semiconductor consumption by OEMs based upon design (semiconductor selection by OEM engineers), which is identified as "Design TAM". We feel this provides a more meaningful insight relative to the market influence of the various Chinese OEMs. The top ten OEM 2013 Design TAM semiconductor consumption was reported to be US$19.0bn, an increase of slightly more than 13% from 2012, but still just 10.5% of China's total semiconductor market, which is just up fractionally from 2012.

Table 6: Chinese Top OEMs by revenue and semiconductor consumption 2010–2013 (US$bn)

	Rank (per MIIT)		Revenue			Semiconductor consumption (Design TAM)			Purchase TAM		
Name of company	**2012**	**2013**	**2012**	**2013**	**Change %**	**2012**	**2013**	**Change %**	**2012**	**2013**	**Change %**
Huawei	1	1	35.4	38.6	9.1%	4.3	4.9	14.2%	2.9	3.1	6.3%
Lenovo	2	2	33.9	38.7	14.3%	6.1	7.3	19.7%	5.2	6.3	20.2%
China Electronics Corp.	3	3	29.0	31.3	7.8%	0.1	0.1	5.8%	0.2	0.2	-14.3%
Haier Group Company	4	4	25.8	29.1	12.6%	0.5	0.6	20.0%	0.5	0.6	21.0%
Hisense Group	6	5	12.8	15.0	17.2%	0.5	0.7	31.7%	0.5	0.7	28.7%
ZTE	5	6	13.3	12.1	-9.0%	3.1	2.8	-11.2%	2.9	2.7	-8.0%
Changhong Electric Co.	7	7	8.3	9.5	14.6%	0.3	0.4	26.2%	0.3	0.4	33.3%
TCL	8	8	11.0	13.8	24.8%	1.5	1.7	19.2%	1.6	1.9	18.3%
Founder Group Co.	9	9	9.8	11.0	12.2%						
Inspur Group	11	10	6.4	7.3	14.6%	0.1	0.2	139.8%	0.1	0.2	139.8%
BYD Company Ltd.	10	11	7.7	8.6	16.2%	0.2	0.3	10.0%	0.8	0.7	-11.0%
Total top ten			**186.8**	**206.4**	**10.5%**	**16.7**	**19.0**	**13.4%**	**15.0**	**16.7**	**10.9%**

Notes: Inspur replaced BYD as No.10 in 2013 and is included in 2013 Top Ten total but not 2012 total. BYD was included in the 2012 total and not the 2013 total.
China Electronics Corp. (CEC) includes Great Wall and Kaifa Technologies, but Great Wall's purchasing TAM and Kaifa's designTAM are too small to be tracked separately.
Founder Electronics TAM included in Acer TAM since 2010.

% Semi penetration						**9.1%**	**9.3%**		**8.2%**	**8.2%**	
Semiconductor consuming subsidiaries											
Great Wall Technology	3	3	15.4	15.1	-1.9%	0.1	0.1				
Kaifa Technology									0.2	0.2	-14.3%
Haier Electronics Group	4	4	8.9	10.1	13.1%	0.5	0.6	20.0%	0.5	0.6	21.0%
Hisense Electric Co.	6	5	4.1	4.6	12.2%	0.5	0.7	31.7%	0.5	0.7	28.7%
Companies tracked from previous years											
BYD Company Ltd.	10	11	7.4	8.6	16.2%	0.2	0.3	10.0%			
Skyworth	13	13	4.5	4.9	9.4%	0.5	0.5	7.2%	0.6		
Konka Group	17	18	2.9	3.2	11.1%	0.4	0.5	29.3%	0.4		

Source: MIIT, Gartner, Thomson Reuters, Company reports

This top ten OEM Design TAM has averaged about 10% of China's semiconductor market for the past four years, an increase from 8.1% in 2009. Similarly, the calculated Design TAM semiconductor content of the combined revenues of these top ten OEMs increased from 8.3% in 2009 to 9.1% in 2012 and to 9.3% in 2013.

Another way of measuring the influence of these OEMs on semiconductor consumption is based upon their direct purchases. This is identified as "Purchasing TAM". The top ten OEM 2013 Purchasing TAM semiconductor consumption was reported to be US$16.7bn, an 11% increase from their 2012 reported Purchasing TAM. These values are less than their Design TAM because some of the OEMs (for example Lenovo) will design a product specifying key components and then consign manufacturing and purchasing to an EMS company.

As a result of this analysis, we continue to believe that Chinese OEMs influence and/or purchase a significant and increasing number of semiconductor devices. They could be important customers for many of the international semiconductor companies intending to participate in the continuing growth of the Chinese semiconductor market. However, we also expect that their design and purchasing decisions will be influenced by the recently (24 June 2014) released Chinese government "New Document 4", "Guidelines to Promote National IC Industry Development". As a result, the strategies of these OEMs could affect the design and sales operations of several international semiconductor companies.

Top Chinese semiconductor manufacturers

Table 7 lists the 50 largest semiconductor manufacturers in China—those reporting 2013 revenues of US$171mn or more. This revenue threshold is up 25% from the US$137mn threshold in our 2013 update, which reflects the continuing growth in number and size of Chinese semiconductor manufacturers.

The combined 2013 revenues reported for these top 50 enterprises is US$29.9bn, representing 45% of China's total 2013 semiconductor industry revenue of US$65.8bn. This is an increase in combined revenue, but a decrease in share from the revised US$28.7bn, or 51% of US$56.3bn now reported for 2012. China's industry continues to be noticeably less concentrated than the worldwide industry, where the top 10 companies accounted for 53% of the total market. The combined reported revenues of the continuing 49 of these top 50 manufacturers increased by 3.1% in 2013, which is significantly less than the increase (13.7%) reported by China's total semiconductor industry. Almost all of this difference

Table 7: Major Chinese semiconductor manufacturers (including groups) in 2013

	Rank		Sales revenue (RMB: 100mn)				Sales revenue (US$mn)		
Name of company	2012	2013	2012	2013	Change	Sector	2012	2013	Change
HiSilicon Technologies Co., Ltd.	4	1	74.19	130.40	75.8%	●	1,178	2,120	80.0%
SK Hynix Semiconductor (China) (incl Hitech JV)	2	2	171.15	129.40	-24.4%	■◆	2,717	2,104	-22.6%
SMIC (Semiconductor Manufacturing International Corp.)	3	3	106.76	126.50	18.5%	⬣	1,695	2,057	21.4%
Intel Products/Semiconductor (Chengdu/Dalian) Co., Ltd.	1	4	314.00	93.10	-70.4%	■◆	4,984	1,514	-69.6%
XINCHAO Group	5	5	66.49	77.20	16.1%	◆	1,055	1,255	18.9%
Micron Semiconductor (Xi'an) Co., Ltd.	6	6	66.23	73.21	10.5%	◆	1,051	1,190	13.2%
Freescale Semiconductor (China) & (Tianjin) Co., Ltd.	7	7	65.05	66.80	2.7%	●◆	1,033	1,086	5.2%
Spreadtrum Communications Inc.	12	8	44.00	62.30	41.6%	●	698	1,013	45.0%
Samsung Electronics (Suzhou Semi & LED) Co., Ltd.	8	9	55.41	59.60	7.6%	●▼◆	880	969	10.2%
RFMD (RF Micro Devices (Beijing) Co., Ltd.	11	10	45.00	56.00	24.4%	◆	714	911	27.5%
Huizhou Cree	10	11	45.70	52.60	15.1%	▼	725	855	17.9%
Nantong Huada Microelectronics Group Co., Ltd.	14	12	41.33	45.40	9.8%	◆	656	738	12.5%

● IC design ▲ Discrete ▼ Discrete (LED) ⬣ Foundry ■ IDM ◆ Packaging and testing

Table 7: Major Chinese semiconductor manufacturers (including groups) in 2013 (continued)

	Rank		Sales revenue (RMB: 100mn)				Sales revenue (US$mn)		
Name of company	2012	2013	2012	2013	Change	Sector	2012	2013	Change
ASE Assembly & Test (Shanghai+ Khunshan+WeiHai +Suzhou) Ltd.	13	13	44.10	41.33	-6.3%	◆	700	672	-4.0%
China Resources Microelectronics (Holdings) Ltd.	15	14	35.20	39.20	11.4%	▲●■	559	637	14.1%
Renesas Semiconductor (Beijing & Suzhou) Co., Ltd.	18	15	32.63	37.88	16.1%	●◆	518	616	18.9%
TianJIn ZhongHuan Semiconductor Co., Ltd.	20	16	11.78	37.30	216.6%	▲	187	607	224.4%
Diodes Shanghai Co., Ltd.	19	17	28.90	35.90	24.2%	◆	459	584	27.3%
Tianshui Huatian Technology Co., Ltd.	31	18	18.32	35.40	93.2%	◆	291	576	97.9%
TSMC (Shanghai) Co., Ltd.	16	19	34.17	35.30	3.3%	⬣	542	574	5.8%
Shanghai Huahong (Group) Company Ltd.	9	20	46.01	35.20	-23.5%	●⬣	730	572	-21.6%
Lite-On Technology	21	21	24.80	29.60	19.4%	▼	394	481	22.3%
Everlight Electronics	27	22	21.90	28.50	30.1%	▼	348	463	33.3%
RDA Microelectronics, Inc.	22	23	24.69	28.00	13.4%	●	392	455	16.2%
Shangahi Panasonic Semiconductor Co., Ltd.	17	24	33.70	27.70	-17.8%	◆	535	450	-15.8%
Infineon Technologies (Wuxi) Co., Ltd.	23	25	23.00	27.00	17.4%	◆	365	439	20.3%
SanDisk Semiconductor (Shanghai) Co., Ltd.	25	26	22.50	27.00	20.0%	◆	357	439	22.9%
Amkor Technology China Ltd.	29	27	19.56	25.00	27.8%	◆	310	407	30.9%
Datang Semiconductor Design Co., Ltd.		28	18.93	24.00	26.8%	●	300	390	29.9%
Beijing Nari Smart Chip Microelectronics Co., Ltd.		29		21.50		●		350	
Sanan Optoelectronics	33	30	16.40	21.40	30.5%	▼	260	348	33.7%
No. 55 Research Institute of China Electronics Technology Group Corporation	28	31	19.70	20.05	1.8%	■	313	326	4.3%
STATS ChipPAC	24	32	22.66	20.00	-11.7%	◆	360	325	-9.6%
ST Microelectronics	30	33	19.23	19.98	3.9%	◆	305	325	6.4%
MLS Co., Ltd.		34	9.40	19.60	108.5%	▼	149	319	113.6%
Siliconware Technology (Suzhou) Co., Ltd.	36	35	13.81	18.22	31.9%	◆	219	296	35.1%
Hangzhou Silan Microelectronics Co., Ltd.	38	36	12.64	18.00	42.4%	●▲⬣	201	293	45.9%
China Huada Integrated Circuits Design (Group) Co., Ltd.	34	37	16.12	17.90	11.1%	●	256	291	13.8%
Galaxycore Inc.	39	38	11.80	16.80	42.4%	●	187	273	45.8%
Xi'an Microelectronics Technology Institute		39	2.16	15.90	635.4%	■	34	259	653.4%
Beijing Vimicro Co., Ltd.	43	40	11.00	15.40	40.0%	●	175	250	43.4%
Shenzhen ZTE Microelectronics Technology Co., Ltd.	41	41	11.50	15.32	33.2%	●	183	249	36.5%
Shenzhen National Holdings Co., Ltd.	40	42	11.50	14.96	30.1%	●	183	243	33.3%
HeJian Technology (Suzhou) Co., Ltd.	37	43	13.48	13.70	1.6%	⬣	214	223	4.1%
Leshan Phoenix Semiconductor Co., Ltd. (ON Semi JV)		44	12.35	13.26	7.4%	◆	196	216	10.0%
Jilin Sino Microelectronics Co., Ltd.	45	45	10.55	12.50	18.4%	▲	168	203	21.3%
Shenzhen Netcom Electronics Co., Ltd.	49	46	9.37	12.19	30.1%	●	149	198	33.2%
Allwinner Technology	44	47	10.58	11.69	10.5%	●	168	190	13.2%
UTAC Dongguan, Shanghai Ltd.	35	48	14.36	11.07	-22.9%	◆	228	180	-21.1%
Fairchild Semiconductor (Suzhou) Co., Ltd.	36	49	10.27	10.71	4.3%	◆	163	174	6.8%
Elec-Tech International Co., Ltd.	47	50	10.27	10.52	2.4%	▼	163	171	4.9%

● IC design ▲ Discrete ▼ Discrete (LED) ⬣ Foundry ■ IDM ◆ Packaging and testing

Source: MIIT, Gartner, Thomson Reuters, Company reports, PwC

in rate of increase was the result of a 70% reduction in the reported 2013 revenues of Intel's operations in China, which reflects a combination of changes in factory loading, product mix and transfer pricing. During 2013 these top 50 enterprises accounted for 71% of China's IC chip manufacturing (foundry and IDM) revenues; 69% of IC packaging and testing revenues; 49% of IC design (fabless) revenues; but only 18% of O-S-D revenues.

The top 50's share of 2013 IC chip manufacturing and IC packaging and testing are fifteen to twenty percentage points lower than the 2012 share due to the 70% reduction in the reported 2013 revenues of Intel's operations in China.

This table includes eight groups that each own one or more companies in the various sectors of China's semiconductor industry.

These groups are listed rather than their several individual companies in order to better reflect their increasing significance in the growth and concentration of China's semiconductor industry.

This approach also corresponds to the CSIA's (China Semiconductor Industry Association's) current reporting practice, which reports the group totals (by industry sector) in response to requests by the groups.

The eight groups with their most significant companies are:

	Revenue (US$mn)			
	2010	**2011**	**2012**	**2013**
China Resources Microelectronics (Holdings) Ltd.	669	631	559	637
Wuxi China Resources Microelectronics Co., Ltd. (CR Micro) (former CSMC)–Foundry	179	169		
Wuxi China Resources Huajing Microelectronics Co., Ltd.–Discrete	168	134		
Wuxi China Resources Semico Microelectronics Co., Ltd.–IC design	91	124	100	132
XINCHAO Group	944	969	1,055	1,255
JECT (Jinangsu Changjiang Electronics Technology Co., Ltd.)–Pkg & Test	531	611	714	850
Natong Huada Microelectronics Group Co., Ltd.	618	620	656	738
Natong Fujitsu Microelectronics (NFME)–Pkg & Test	254	251	251	287
Shanghai Huahong (Group) Co., Ltd.	555	671	730	572
HHNEC (Shanghai Huahong NEC Electronics Co., Ltd.)–Foundry	367	389	372	
GSMC (Grace Semiconductor Manufacturing Co.)–Foundry		231	233	
Shanghai Huahong IC Co., Ltd.–IC design	96	94	106	110
China Huada Integrated Circuits Design (Group) Co., Ltd. (CIDC Group)	215	246	256	291
CEC Huada Electronics Design Co., Ltd.–IC design	74	127	149	171
Beijing Huada Zhaibao Electronic Systems Co., Ltd.–IC design	55	75	63	85
Nationz Technologies Inc.	104	88	68	70
Shenzhen National Holdings Co., Ltd.	163	173	183	243
Shenzhen State Microelectronics–IC design	61	73	71	71
Shenzhen Sunmoon Microelectronics–IC design				
Shenzhen State Micro Technology–OEM				
Hangzhou Silan Microelectronics Co., Ltd.	224	206	201	293
Hangzhou Silan Microelectronics Co., Ltd.–Design	96			
Hangzhou Silan Integrated Circuit Co., Ltd.–IDM/Foundry		96		
Hangzhou Silan Azure Co., Ltd–LED	58	53	29	29
Tian Shui Hua Tian Technology Co., Ltd. (TSHT)	216	275	291	576
Tianshui Huatian Technology Co., Ltd.–Pkg & Test		203		
Tianshui Huatian Microelectronics Co., Ltd.–Pkg & Test			257	398

Table 8: Top 10 Chinese semiconductor manufacturers 2003-2013

	Rank										
Name of company	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
HiSilicon Technology					24	11	7	8	5	4	1
SK Hynix				11	4	1	2	2	2	2	2
SMIC	2	2	1	1	2	3	3	3	3	3	3
Intel	7	8	10	9	17	17	1	1	1	1	4
Xinchao Group	8	7	5	7	7	8	6	6	6	5	5
Micron										6	6
Freescale	1	1	2	2	1	2	4	4	4	7	7
Spreadtrum								15	8	12	8
Samsung			18	21	18	15	15	18	7	8	9
RFMD		4	4	4	5	7	5	5	16	11	10
Huahong Group	4	3	7	5	8	12	11	12	9	9	20
Hangzhou Cree									12	10	11
ASE					20	18	16	14	10	13	13
Natong Huada Micro	10	9	12	13	12	13	13	9	13	14	12
China Resources Micro	24	13	15	16	6	6	8	7	11	15	14
Panasonic	16	16	11	8	10	9	10	11	14	17	24
Renesas	3	5	6	10	9	5	9	10	15	18	15
Leshan Radio	5	10	13	15	15	16	14	16			
ST Microelectornics	6	11	3	6	11	10	12	13	18		
ASMC	9	12	19	17	25						
HeJian Technology		6	8	12	14	23	22	25			
Infineon/Quimonda			9	3	3	4	17	17	22	23	25

China semiconductor industry revenue (US $mn)	8,282	12,006	16,053	21,660	27,431	31,434	29,171	38,053	51,402	56,325	65,758
Total Top 10 manufacturers (US$mn)	2,372	3,752	4,354	6,709	8,954	9,605	9,409	12,015	14,503	16,048	13,724
Top 10% China semiconductor industry	28.6%	31.3%	27.1%	31.0%	32.6%	30.6%	32.3%	31.6%	28.2%	28.5%	20.9%

Source: CCID, CSIA

In addition to these eight groups, Table 7 also lists a single entry for each of several multinational semiconductor companies that have more than one manufacturing facility in China though each facility may be legally organized as a separate company. These companies include ASE, Diodes, Freescale, Hynex, Intel, Renesas, RFMD, Samsung Electronics, ST Microelectronics and UTAC. Each listing reflects the combined revenues of all the companies' manufacturing facilities in China.

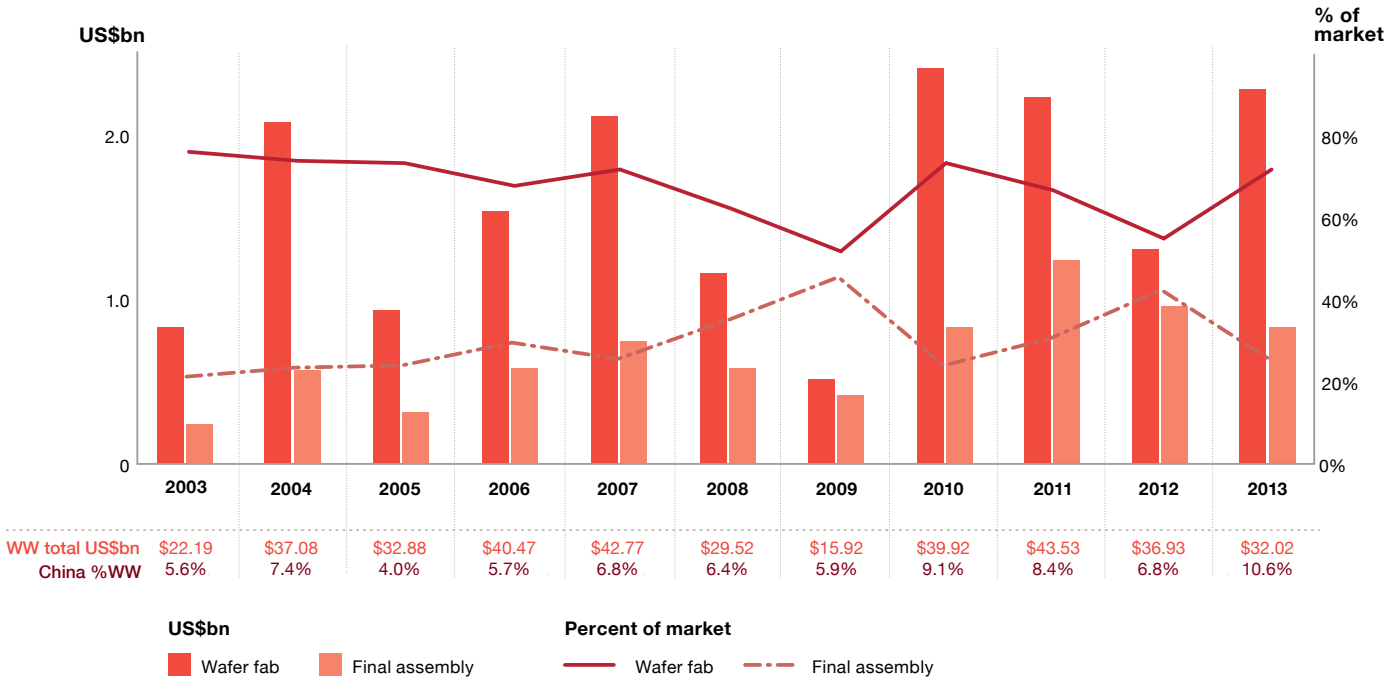
Ten years ago, our table of Major Semiconductor Manufacturers in China, 2003 consisted of only 30 enterprises with revenues exceeding US$20mn. The combined revenue of those 2003 top 30 manufacturers was US$3.32bn compared to the US$24.9bn combined 2013 revenue of the top 30 manufacturers of Table 7. During the past ten years since 2003 the average revenue of China's top 30 semiconductor manufacturers has increased by more than 640% and the minimum revenue threshold for inclusion in that group has increased by more than 1,600% from US$20mn to US$348mn. Only 17 of the 2003 top 30 Chinese semiconductor manufacturers have continued to be among the 2013 top 50 manufacturers. All of the 2003 top ten manufacturers continued to be among the 2013 top 50, but only four of those were among the 2013 top ten manufacturers: Intel, SMIC, Xinchao Group and Freescale. The other six 2003 top ten manufacturers—Renesas, Huahong (Group), Leshan Radio, ST Microelectronics, ASMC and Natong Fujitsu—were ranked anywhere from number 13 to 50 among the 2013 top 50 manufacturers.

Table 8 shows the relative ranking history of China's top ten semiconductor manufacturers during the period from 2003 through 2013. The composition of the top ten manufacturers has been notably more dynamic than that of the top ten suppliers shown in Table 3. There have been twenty-two different groups or companies that have been among China's top ten manufacturers during one or more of the years from 2003 through 2013. Only three—SMIC, Xinchao Group and Freescale—have been among the top ten for every year during that period. By contrast, three others—ASMC, ASE and Spreadtrum—have only been among the top ten for one single year during that period. During the period from 2003 through 2013 China's top ten semiconductor manufacturers have accounted for an average 28.4% of China's total semiconductor industry revenues.

Semiconductor equipment

China's semiconductor equipment market continues to remain a relatively small share of the worldwide market. In fact, 2013 was the first year in which China accounted for 10% or more of the worldwide semiconductor equipment market. That is compatible with our estimate that in 2013 China's semiconductor industry accounted for about 12% of worldwide semiconductor value added. A portion of China's semiconductor industry capacity has been increased during the past ten years by the acquisition or transfer of previously owned equipment from other locations. During the past ten years, from 2003 through 2013, China's aggregate semiconductor equipment market accounted for just 7.1% of the worldwide aggregate market and was split 70% wafer fabrication and 30% final assembly and test. China's share of the worldwide semiconductor equipment market has varied from 5.6% in 2003 to a low of 4% in 2005 and a previous peak of 9.3% in 2010, followed by 8.4% and 6.8% in 2011 and 2012 before reaching 10.6% in 2013. Despite that variation, China's semiconductor equipment market growth has been much stronger that the worldwide market. It has grown at a 10% ten year CAGR, second only to Taiwan at 13.3% and much stronger than the worldwide market growth rate of 3.8%.

Figure 23: China's semiconductor equipment market size and distribution



Source: SEMI, Solid State Technology 2006-2009, 2013

Interview

Cristiano Amon

Executive Vice President, Qualcomm Technologies, Inc. and Co-President of QCT

Qualcomm Incorporated is a world leader in 3G, 4G and next-generation wireless technologies.

How has China impacted your company over the past ten years? What's different about your company because of China?

We introduced our technology and products in China well over a decade ago, during the deployment of the second generation (2G) of wireless communications. We began working with Chinese manufacturers, not just the infrastructure vendors at the time, but also the handset manufacturers, as the industry transitioned from 2G to third generation (3G).

In the mid-2000s Chinese OEMs signed up for 3G licenses, and were able to start building 3G networks and are now moving fast to 4G.

At the same time, the Chinese handset manufacturers have been not only supporting China in China, but outside China as well. Many of them are now global companies. And we have had a very long history of collaboration working with the Chinese wireless industry in the deployment of 3G and 4G technologies in China and outside China as well as supplying chipsets to their 3G and 4G smartphones and tablets.

So China provided a market you wouldn't have had otherwise. But how has that made your company different? Or is it just a bigger market?

The wireless industry has been in constant evolution. You'll remember at some point—in the early days of cellular—you had companies like Motorola, Ericsson and Nokia.

Later, those companies were joined by companies such as LG, Samsung and Pantech from Korea. Then you had newcomers such as Blackberry and now you have Apple with the iPhone, as well as smartphones made from companies in Taiwan like HTC.

What we see now is, as the landscape in China evolves, a lot of the Chinese manufacturers are not solely focused on China, but also on moving outside the region to become part of the global wireless industry.

One of the great things about being in the wireless industry is that it is one of the largest industries in consumer electronics, with growth opportunities for many players to enter the space. To answer your question about how China has impacted our company over the past ten years, we've had the opportunity to work with many Chinese customers to help develop their own products. Many of our customers have become household names in China and, increasingly, overseas. We help them become global, making wireless a lot more diverse not only by expanding the total size of the ecosystem with the growth in China, but also with the growth in many of those areas from

OEMs that are based in China. And Qualcomm continues to invest in research and development in China, expanding existing relationships and launching new technology collaborations.

Does Qualcomm have any operations in China?

Yes. If you look at our semiconductor business today, we support a lot of customers. If you look at total number of customer engagements, there are more than 50 different customers in China just on the handset manufacturing, design and supplier, of smartphones and tablets.

We have a large organization that supports all of those customers by assisting with the design of their products using our chipsets. We also have a lot of engineers doing R&D. We have branches in Beijing, Shanghai, Shenzhen and Xi'an. We have two R&D centers, one in Beijing and one in Shanghai. And we employ more than 1,200 engineers in China.

How would you compare your operations in China to your other operations worldwide?

That's an interesting question. I think we are truly a global company. For example, when we think of R&D, we have R&D in China for China and also as part of our global R&D. We have R&D in the United States. We have R&D in Europe. We have R&D in India.

So I think the best way to answer your question is we started operations in China well over ten years ago. But because we look at the industry as one global opportunity we don't look at China in a stand-alone manner.

I think we have an R&D organization that is very global. We have people that are focused on China operations, but they're not necessarily only in China. They're in China; they're in the United States and Europe; they're in India.

China as a country probably has the largest number of OEMs and our customer engagements continue to increase.

You have many different brands of OEMs and ODMs that are based in China. So in terms of customer engagement per country, China has the largest number of handset OEM brands.

How do you feel that China has impacted the total semiconductor industry over the past ten years? What's different about the industry because of China?

Let me try to address your question in two pieces. The first thing is scale. China is a growing economy. But in terms of the wireless industry, it's also a very vibrant, innovative region.

Customers are upgrading, they're moving into higher tier phones and higher tier technology. So I think what China brings is two things.

So the scale of China itself and the growth scale of the Chinese-based handset manufacturers that are becoming global is the first part. And then the other part is that China is very focused on the speed of innovation.

While the transition from 2G to 3G took some time in China, the transition to 4G is probably one of the fastest deployment rates of 4G in the industry.

And I think that basically creates a very good virtual cycle for the semiconductor industry; creates opportunity for new technology that drives our new chipsets for a growing opportunity.

Are most of Qualcomm's sales in China to Chinese OEMs?

I can't be precise about this. But we look at the China industry. It's a global industry. So we sell our chipsets to, by definition, global OEMs. And those OEMs, whether they're based in the United States or Korea or China, they will be selling their products globally.

So, when you look at the presence of our products in China, we have domestic OEMs that buy our products for use both in China and outside China. But we also have global OEMs that buy our products in different locations to use globally as well as in China. Like I said, we look at the whole wireless industry as one global opportunity for Qualcomm.

China now represents more than 50% of the total worldwide semiconductor market and it's been there for at least the last couple of years. When you look at that, two things stand out.

One, the vast majority of the integrated circuit sector consumed in China is still being sold by non-Chinese companies. And most of the usage is basically for non-Chinese.

Basically its products that get assembled, tested and manufactured in China but then get exported out of China. The other read we have is that basically as a consumer of semiconductors, China has gone from being the smallest region to the largest region in a very short period of time—from 2003 to around 2007.

That said, how do you think China is going to impact the semiconductor industry over the next five or ten years?

Can I come back and make a comment about what you said about the semiconductor industry in China before answering this new question?

Certainly.

What's interesting is that today you can observe both of those scenarios that you outlined. For example, let's just say you have OEMs that are based in Korea and you have OEMs that are based in the United States. They both have manufacturing operations in China and will consume semiconductors in China to manufacture their products and sell them, sometimes in China, and sometimes globally.

But you also have Chinese manufacturers. Examples of those include new and upcoming very successful OEMs like Xiaomi. Other ones, such as Oppo, are headquartered in China and they consume chipsets for production that they build not only for China's domestic consumption but also global consumption.

I think we will see the co-existence of these two types of scenarios. However, another thing to notice is that the Chinese OEMs that are global players are, in many cases, gaining new business and gaining share outside China.

So, we may have a situation where we start to see the reverse of what you described earlier. There's a growing amount of Chinese semiconductor consumption based on Chinese OEMs. They're buying semiconductor technology not only for their domestic consumption, but also for global consumption.

So what do you think is going to happen over the next five to ten years? How do you relate to that?

I think the fact that China took an important step in leading the world in speed of transition of their networks to the latest technology such as LTE is creating an interesting phenomenon in the industry where consumers will look at their mobile device and their smartphone as their primary vehicle to access the Internet, and we'll see continued growth.

China has a very vibrant number of Internet players. With the LTE technology, I think the cycle of upgrades and desire for more technology in those phones is going to be faster. They will want more CPU speed, more GPU speed for graphics performance, more connectivity and the latest modem as well as higher display resolution.

All that is going to create a very important virtual cycle for the semiconductor industry in China with both the adoption of new technologies in one vector and the other vector being the scale provided by China itself and the ambitions of the Chinese OEMs to grow into opportunities outside China.

What factors or influences do you think either enhance or limit China's participation and impact in the semiconductor industry?

Can you define for me what you mean by China's participation in the semiconductor industry?

Well right now if you look at China's reported semiconductor manufacturing revenues including their fabless semiconductor sector, which they describe as IC design; their chip manufacturing, which would include SMIC, Huahong Grace and their other wafer fabs; and all their packaging and testing operations. You take all of that revenue that they report and you compare it to worldwide, they represent about 12% of the worldwide value added in semiconductors.

Understood.

Okay. About ten years ago they probably were 2% of the worldwide. So that's grown noticeably. But the question is what influences it going forward or what's going to limit it going forward?

So I think as the opportunity in China increases, we're likely to see China's participation in semiconductor manufacturing to be much larger. And I think, in essence, the opportunity and collaboration that we have with SMIC, which has been publicly announced, is along those lines.

We think that China's commitment to invest in semiconductor manufacturing and foundry combined with the technology transition and a virtual cycle of more technology innovation into the mobile space in China creates an opportunity that could significantly increase Chinese participation in the semiconductor industry.

And I think Qualcomm, as a company that is a customer of the semiconductor manufacturing industry, is looking at China in a very positive light as we collaborate to help build their foundry industry with companies like SMIC.

Our read is that right now SMIC is one or two generations behind leading edge. Do you feel that they ultimately will catch up?

Yes. And I think you actually hit a very, very important point. That's actually one of the value adds of our relationship. We're a company that bases its products on the leading edge. And I think one of the things that we bring to the Chinese foundry industry is actually the ability to collaborate to help the Chinese foundry industry reduce their development time on the leading edge.

One of the key value adds of our relationship with the China semiconductor industry is our ability to help those companies tackle this growth opportunity in the wireless industry, to be able to offer leading-edge technology.

What challenges or opportunities is China going to represent for your company over the next five years to ten years?

From a business opportunity it's the usual things: speed, scale, agility to anticipate industry needs. One of the good things about the tech industry is you have to always adapt and you have to always anticipate the industry requirements and be the first to respond.

I think the industry is full of examples of what happens when you don't follow the growth opportunity. And I think that's what we have to do for our customers in China. We expect the same from our suppliers.

But I think the other opportunity in China is a great opportunity for the entire industry. I think China is now very well positioned in this whole transformation happening in the industry worldwide. And we're very happy being part of that.

One other thing we didn't talk about is that Qualcomm previously announced plans to invest up to US$150 million intended to help support the creation and growth of new Chinese technology companies through our venture capital arm, Qualcomm Ventures.

China this year announced a big national IC development fund valued at 120 billion RMB, which is about US$19 billion over ten years.

They're also supporting several regional funds with a number being quoted of 600 billion RMB, which is well over US$100 billion. Is your fund involved in that?

I believe it's independent, but I think it aligns to the vectors you just outlined. But it's being run independently by our corporate venture capital arm.

Do you see those announced initiatives as being competitive to Qualcomm or complementary to Qualcomm?

Our point of view on that is it's complementary because we're looking at helping to further catalyze that start-up ecosystem. So we actually see that as a positive. You know, one plus one equals three.

Do you have any Chinese direct competitors?

I think we're probably in the most competitive industry on the planet. We have lots of competitors. And there are multiple vectors of competition. We have competitors in China in multiple technologies. For example, in the cellular industry we have competitors in connectivity, competitors in Bluetooth, competitors in CPU, application processors and in modems.

There's probably a number of Chinese semiconductor design companies that compete with us. And on top of that there's a full force of global competitors in the semiconductor industry.

We talked a lot about wireless. Are there unique Chinese design standards and specifications that impact the semiconductor industry or your business?

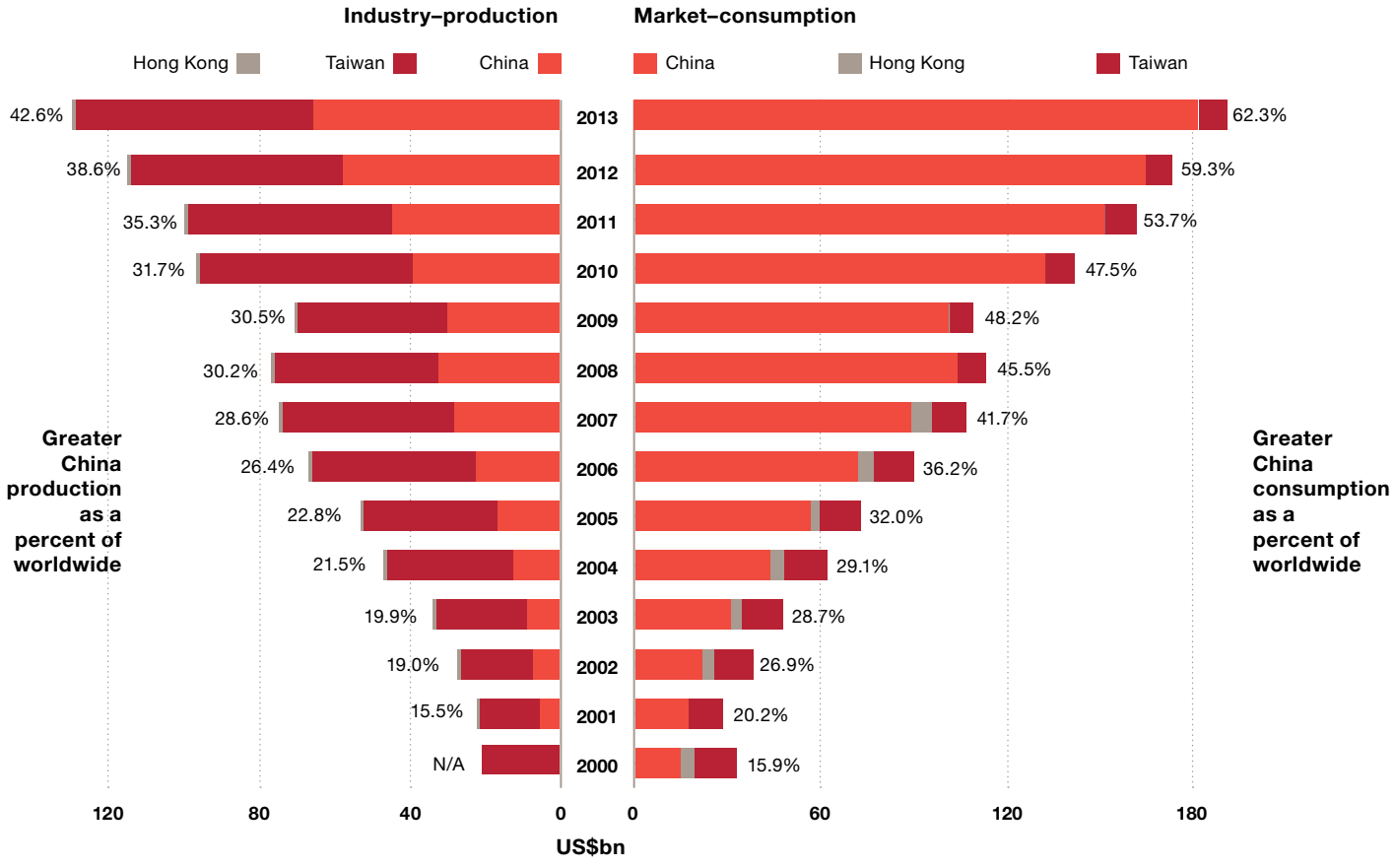
We don't think so. What is interesting about China, since we are talking about the semiconductor industry in general, is its position as a player in the global industry. The OEMs in China are looking for the ability to use what they produce for the China domestic industry so they can export and gain share globally. That is creating a very positive momentum towards globalized standards and technologies.

Greater China

Greater China's consumption and production of semiconductors continued to grow much faster than the worldwide semiconductor market to reach new record levels during 2013. Measured in US dollars, Greater China, which includes mainland China, Hong Kong and Taiwan, accounted for more than 62% of the worldwide semiconductor consumption market in 2013.

Taiwan's semiconductor industry continues to play an important and strategic role in the global and Greater China markets. The advantages of cost efficiency, flexibility and speed resulting from a vertically-integrated infrastructure and an industry cluster effect have made it one of the major IC producers in the world. At the same time, Taiwan's growing economic relationship with mainland China and

Figure 24: Greater China share of the worldwide semiconductor industry, 2000-2013



Source: *CCID, CSIA, TSIA, SIA/WSTS, PwC*

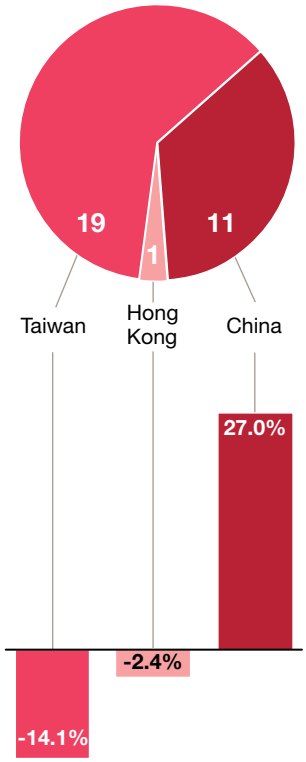
Table 9: Greater China companies among worldwide top 100 OEM/ODM companies by Semiconductor Design TAM

Company	Market	Design TAM (US$mn) 2011	2012	2013	% change 2011-2013
Ability	TWN	715	643	432	-39.6%
Acer	TWN	4,257	3,439	2,621	-38.4%
A-Data	TWN	476	418	442	-7.1%
ASUSTeK	TWN	2,773	3,244	3,199	15.4%
Changhong	CN	326	332	419	28.5%
Compal Electronics	TWN	1,504	1,359	1,406	-6.5%
Coolpad	CN	190	551	738	288.4%
Delta Electronics	TWN	474	463	457	-3.6%
ECS	TWN	509	457	450	-11.6%
Gigabyte	TWN	577	542	541	-6.2%
Haier	CN	567	513	611	7.8%
Hisense	CN	384	517	681	77.3%
Hon Hai	TWN	3,894	3,316	2,988	-23.3%
HTC	TWN	2,453	1,741	1,019	-58.5%
Huawei	CN	3,811	4,331	4,945	29.8%
Inventec	TWN	840	704	707	-15.8%
Lenovo	CN	7,717	8,064	9,548	23.7%
Lite-On	TWN	494	641	923	86.8%
MSI	TWN	833	672	556	-33.3%
Oppo Electronics	CN	111	172	402	262.2%
Pegatron	TWN	1,308	1,251	1,219	-6.8%
Qisda	TWN	1,176	1,169	1,204	2.4%
Quanta	TWN	1,330	1,716	1,694	27.4%
Skyworth	CN	337	456	489	45.1%
TCL	CN	1,735	1,651	1,694	-2.4%
TPV	HKG	1,158	1,462	1,743	50.5%
Transcend	TWN	716	648	800	11.7%
USI	TWN	420	450	512	21.9%
Wistron	TWN	1,361	1,158	1,263	-7.2%
Xiaomi	CN	19	111	491	2484.2%
ZTE	CN	2,749	3,130	2,779	1.1%
Grand total = 31		**45,791**	**45,510**	**46,924**	**2.5%**

Source: *Gartner*

Greater China's total OEM/ODM companies by Design TAM

Number of companies by market by 2011-2013 growth



Even though Taiwan numbered the most companies, it experienced the lowest Design TAM growth from 2011-2013.

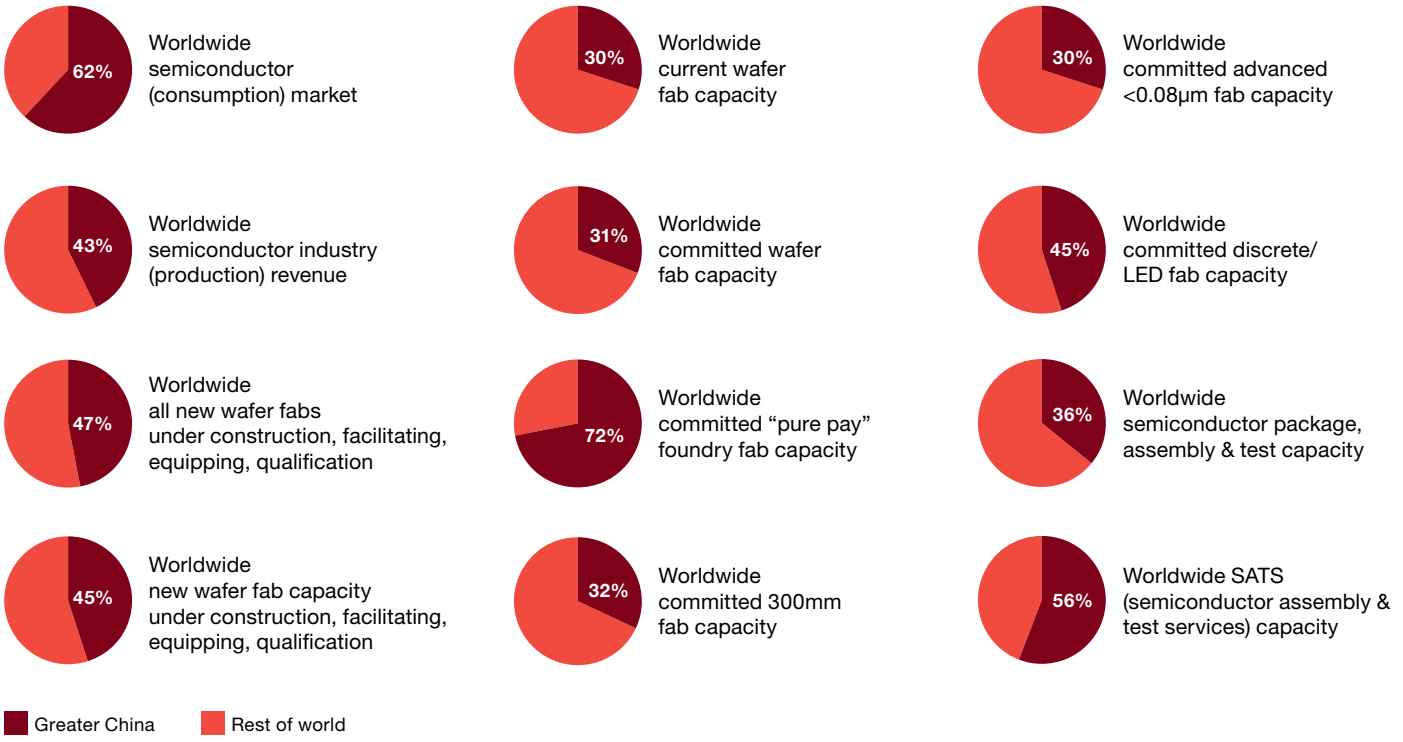
the gradual loosening of investment restrictions between the two sides have helped accelerate the integration of their respective semiconductor industries.

Taiwan's IC industry revenues as a whole (including design, manufacturing, packaging and testing) grew 15.6% to US$63.4bn in 2013, accounting for around 20% of the worldwide semiconductor market, according to the Taiwan Semiconductor Industry Association (TSIA). The TSIA projects overall local industry growth of 16.4% in 2014, largely driven by continuing strong demand from the mobile device market, led by smartphones and tablets, as well as opportunities from the development of the Internet of Things (IoT).

The output value of Taiwan's IC design or fabless semiconductor sector grew 16.9% to US$16.2bn in 2013, ranking second globally behind the US. Consolidation and M&A activity in Taiwan's fabless sector has accelerated this year, particularly in the mobile driver IC space, amid rapid growth in the market for wearable and IoT devices. International chipset vendors are increasingly looking to tie up with Taiwan-based IC design houses, primarily small players with single specializations, in order to meet end-market demand as well as to expand their business ecosystems in China.

Taiwan remains the clear leader in the dedicated IC foundry segment of the semiconductor industry. Taiwan's foundry sales grew 17.1% to US$25.5bn in 2013, accounting for around 60% of global foundry revenues. Taiwanese contract chipmakers continue to aggressively expand production and develop new technology to fend off competition, maintaining their capital and R&D spending at record levels to ensure sufficient 28nm and below capacity in future years to meet growing demand for high-end chips.

Figure 25: In 2013 Greater China represented:



Source: *CCID, Gartner, IC Insights, SEMI World Fab Watch, TSIA, WSTS, PwC 2012*

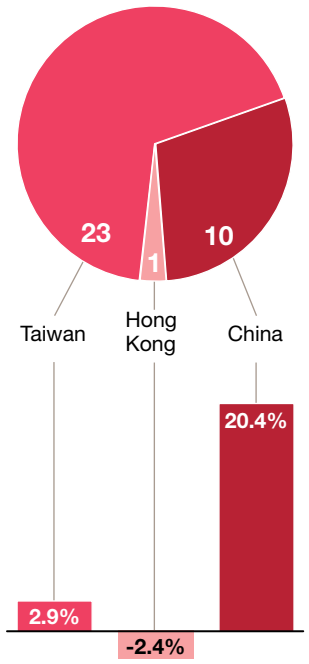
Table 10: Greater China companies among worldwide top 100 OEM, ODM and EMS companies by Semiconductor Purchasing TAM

Company	Market	Purchasing TAM (US$mn) 2011	2012	2013	% change 2011-2013
Ability	TWN	816	729	469	-42.5%
Acer	TWN	2,239	1,780	1,410	-37.0%
A-Data	TWN	476	418	442	-7.1%
ASUSTeK	TWN	1,637	2,040	2,195	34.1%
BYD	CN	847	790	703	-17.0%
Cal-comp	TWN	772	849	718	-7.0%
Changhong	CN	389	395	485	24.7%
Compal Communications	TWN	208	479	412	98.1%
Compal Electronics	TWN	4,909	4,496	4,827	-1.7%
Coolpad	CN	190	551	738	288.4%
Delta Electronics	TWN	482	470	464	-3.7%
ECS	TWN	1,013	918	903	-10.9%
Gigabyte	TWN	1,106	1,065	1,057	-4.4%
Haier	CN	513	487	578	12.7%
Hisense	CN	421	554	720	71.0%
Hon Hai	TWN	18,522	20,376	20,521	10.8%
HTC	TWN	2,671	1,743	983	-63.2%
Huawei	CN	2,674	2,869	3,050	14.1%
Inventec	TWN	2,590	2,131	2,131	-17.7%
Lenovo	CN	5,863	5,793	6,742	15.0%
Lite-On	TWN	622	776	1,059	70.3%
Mitac	TWN	508	526	519	2.2%
MSI	TWN	1,252	1,079	870	-30.5%
Pegatron	TWN	5,305	6,018	7,161	35.0%
Qisda	TWN	752	817	787	4.7%
Quanta	TWN	6,177	6,237	6,273	1.6%
Skyworth	CN	413	532	569	37.8%
TCL	CN	1,435	1,742	2,032	41.6%
TPV	HKG	1,765	1,677	1,722	-2.4%
Transcend	TWN	716	648	800	11.7%
TSMT	TWN	662	676	725	9.5%
USI	TWN	971	1,018	1,124	15.8%
Wistron	TWN	3,486	3,278	3,723	6.8%
ZTE	CN	2,454	2,914	2,680	9.2%
Grand total = 34		**74,856**	**76,871**	**79,592**	**6.3%**

Source: *Gartner*

Greater China's total OEM, ODM & EMS companies by Purchasing TAM

Number of companies by market by 2011-2013 growth



China, with its 10 companies, experienced more than 20% Purchasing TAM growth from 2011-2013.

Taiwan's foundry sales grew 17.1% to US$25.5bn in 2013, accounting for around 60% of global foundry revenues.

Although it accounts for only a small portion of the global market, Taiwan is making a comeback in the memory-chip manufacturing segment. Taiwan's DRAM revenues grew 31.2% to US$8bn in 2013. The local sector is healthier now than at any point in the past few years, in part because of consolidation spurred by the decision of US-based Micron Technology to greatly increase its stake in Taiwan. Another contributing factor is the product diversification to more applications, reducing dependence on PC DRAM.

Taiwan is also the world's leading provider of IC packaging and testing outsourcing services. The annual production value of the local sector grew 4.4% in 2013, to US$13.7bn, accounting for about 55% of the global market for IC SATS (semiconductor assembly and test services). With the continuing trend towards smaller, more lightweight electronic products, Taiwanese IC SATS suppliers are increasing spending on production equipment for advanced technologies, in particular to cater to high-end communications chip makers.

There has been a gradual relaxation in Taiwan's restrictions on China-bound semiconductor investments in recent years, reflecting the closer economic links with China. In October 2013, the Taiwanese government allowed local chip makers to invest in existing facilities in mainland China, providing they use production technologies at least one generation behind the most up-to-date one in Taiwan, up from a two-generation gap previously.

Taiwanese foundries TSMC and UMC both operate 8-inch (200mm) chip plants in the East China. TSMC's Shanghai plant focuses on production of high voltage process products, MCUs, smartcards and embedded SoCs. UMC's Suhzhou fab is run by its Chinese subsidiary, Hejian Technology, and focuses on production of LCD driver and power management ICs. The two foundry companies are ramping up production capacity in China to cope with rising demand.

UMC announced in October 2014 that it also plans to invest US$1.35bn over the next five years in a three-way joint venture with the Xiamen City Government and Fujian Electronics and Information Group to build a 12-inch fab in Xiamen. The new venture will use relatively mature 55nm and 40nm processes, which will be one generation less advanced than the 28nm technology that UMC uses in Taiwan. UMC expects its funding to progress in installments starting in 2015, pending approval from the Taiwanese government. This development was prompted in large part by China's strategic push to build up its semiconductor industry.

Greater Chinese companies have grown to dominate worldwide semiconductor outsourced manufacturing. With the merger of China's HHNEC and GSMC (Grace Semiconductor Manufacturing Company) in 2012 and UMC's completed acquisition of Hejian, four of the top five (3 Taiwanese +1 Chinese), seven of the top ten (5 Taiwanese + 2 Chinese) and 11 of the top 20 (6 Taiwanese + 5 Chinese) pure-play semiconductor wafer foundries were Greater China companies, accounting for US$29bn, 81%, of total worldwide 2013 foundry revenues. By the end of 2013, Greater China also represented 71% of worldwide pure play wafer foundry capacity. Similarly, six of the top ten (5 Taiwanese + 1 Chinese) and 11 of the top 20 (8 Taiwanese + 3 Chinese) SATS suppliers were Greater China companies, accounting for US$12bn or 48% of total worldwide 2013 SATS revenue. Also by the end of 2013, Greater China represented 64% of worldwide SATS manufacturing floor space capacity.

Driven by the Chinese market, Greater China's semiconductor consumption increased to a record level of US$191bn in 2013, growing by 10% or US$18bn, during the year. China's consumption of semiconductors continued to be more than eighteen times that of Taiwan's in 2013, with a significant portion of that consumption created by Taiwanese EMS and ODM companies operating in China.

Greater China's semiconductor industry (production) revenue also increased to a new record level of US$130bn in 2013. Both the Chinese and Taiwanese industry sectors significantly exceeded the worldwide industry, growing by 17% and 14%, respectively, in 2013, while the worldwide industry only grew by 5%. During the past ten years, from 2003 through 2013, China's IC industry has grown at a 25.4% CAGR, while Taiwan's industry has only grown at a 10.3% CAGR. As a result, Taiwan's IC industry revenues were only 1.5 times as large as China's reported IC industry revenues in 2013, down from being more than 5.5 times as large in 2003.

2013 was the first year in which Greater China's IC production growth slightly exceeded its IC consumption growth. As a result, while Greater China's IC consumption still exceeds its IC production, Greater China's annual IC consumption/production gap decreased fractionally in 2013 to slightly less than US$55bn. This ends a trend of over a decade of steady growth from 2000 through 2012. While this gap is still significantly less than that of China's alone, it continues to account for more than 21% of the total worldwide IC market.

There were 31 Greater China OEM and ODM companies among the worldwide top ten semiconductor consumers in 2013 based upon Design TAM, up from 27 such companies in 2012 and 24 in 2011. Compared to the 27 Greater China top semiconductor Design TAM consuming companies in 2012, one company from Taiwan, Yulong, did not qualify, while one new company from Taiwan, USI, and four from China—Changhong, Coolpad, Oppo Electronics and Xiaomi—joined the 2013 top semiconductor consumers.

Of these 31 companies, 19 are in Taiwan, eleven in China and one in Hong Kong. Their combined total Design TAM accounted for 15% of worldwide in 2013 as it had for the prior two years. However, the mix within Greater China has changed. Since 2011, the Design TAM of the 19 Taiwanese companies has decreased by 14% and that of the one Hong Kong company by 3%, while the Design TAM of the 11 Chinese companies has increased by 27%. Samsung Electronics, at US$30.1bn, is reported to have the largest Design TAM worldwide in 2013, up a significant 65% from 2011, while Lenovo at US$9.5bn is reported to have the largest Design TAM in Greater China, up 24% from 2011.

There were 34 Greater Chinese OEM, ODM and EMS companies among the worldwide top ten semiconductor consumers in 2012 based upon Purchasing TAM. This is an increase from 33 such companies in 2012 and 30 in 2011. Compared to the Greater China 33 top semiconductor Purchasing TAM consuming companies in 2012, two companies from Taiwan, Largan Precision and Yulong, did not qualify, while two new companies from China, BYD and Coolpad, plus one from Taiwan (USI), joined the 2013 top Purchasing TAM semiconductor consuming companies.

Of these 34 companies, 23 are in Taiwan, ten in China and only one in Hong Kong. Their combined total Purchasing TAM accounted for 25% of worldwide in 2013, a fractional decrease from 26% in 2012, but an increase from 24% in 2011. Their combined Purchasing TAM increased by US$5bn from US$75bn in 2011 to US$80bn in 2013, with US$3bn of that increase reported by the ten companies in China. Samsung Electronics is also reported to have the largest Purchasing TAM worldwide in 2013, at US$29.5bn, up a dramatic 69% from 2011 and 44% greater than the second largest, Hon Hai. However, Hon Hai is reported to have the largest Purchasing TAM in Greater China at US$20.5bn, up 11% from 2011.

Both the Chinese and Taiwanese industry sectors significantly exceeded the worldwide industry, growing by 17% and 14%, respectively, in 2013, while the worldwide industry only grew by 5%.

Government considerations

The Chinese government has been offering incentives to promote the development of the semiconductor industry for more than a decade. As discussed in our 2012 Update, State Council Rule 4 (2011) was intended to be the most important government policy for the Chinese semiconductor industry during the 12th Five Year Plan (FYP) period (2011 through 2015) and to be the successor to the policies of State Council Rule 18 (2000), which applied during the 10th and 11th FYP periods. As a result of those policies, China's semiconductor industry has grown to account for more than 12% of the worldwide semiconductor industry in 2013, up from 1.5% in 2000.

Likewise, the number of IC design enterprises in China has grown from about 100 in 2000 to almost 600 by the end of 2013. However, there continues to be considerable scepticism about the size and make up of these enterprises and many are reported to be small-scale operations without much competitiveness. China's IC consumption continues to greatly exceed IC production, and more than 90% of its consumption still relies on imported ICs. Chinese government stakeholders have been reconsidering the risks posed by the country's heavy reliance on others for semiconductor components and capabilities and have initiated policy changes that are intended to correct this dependence.

In June of 2014 the Chinese central authorities announced new "Guidelines to Promote National IC Industry Development", otherwise known as "New Document 4", unveiling a program to promote the IC industry by setting up a state-level lending group and special national and regional investment funds. The "Guidelines" are intended to stimulate the dynamism and creativity of IC companies and accelerate the pace at which China's IC industry catches up with international leaders. They call for focusing on design and manufacture, with great efforts made to boost the IC packaging and testing industry and make breakthroughs in key equipment and materials usage.

The basic principles underlying the "Guidelines" were identified as: Demand-oriented; Innovation-driven; Software and hardware combined; Key points breakthrough and Open development.

The "Guidelines" set ambitious development targets for China's domestic IC industry including:

a) By 2015 achieve IC revenue greater than RMB 350bn (US$57bn) per year; large scale manufacture of 32/28 nm chips; high-end packaging test to account for 30% of total packaging test revenues; and achieve production application of 65-45 nm critical equipment, 12-inch wafers, and other critical materials.

b) By 2020 achieve at least 20% annual industry-wide revenue growth; large-scale manufacture of 16/14 nm chips; packaging test technology at the international advanced level; IC design of mobile end-product, network communication, cloud computing, IoT and Big Data devices at the international advanced level and Chinese critical equipment and materials included in the international procurement system.

c) By 2030 become an acknowledged and accepted global leader in all primary segments of the IC industry supply chain.

The "Guidelines", which continued and extended the incentives of the earlier Document 18 (2000) and Document 4 (2011) policies, also included the establishment of a National Industry Investment Fund of RMB 120bn (US$19.5bn) to be invested between 2014 and 2017 to support the development of IC and related industries and promote industrial restructuring and upgrading. The reported purposes of the fund are: 1) National level support and funding; 2) Support target IC enterprises and 3) Facilitate the IC industry consolidation and enhance the competitiveness of the leading IC enterprises. The fund is to be allocated as follows: 40% wafer manufacturing; 30% chip design and 30% packaging and testing. The National Industry Investment Fund was set up at the end of September 2014 and is expected to start official operation by the end of 2014.

The "Guidelines" also provide for the establishment of several regional local government and private equity investment funds for a total of an additional RMB 600bn (US$97.5bn). The reported purpose of this pacesetting fund is to promote resource integration and M&A through investment in key enterprise projects and innovative entities or platforms. Beijing had already established an IC Industry Equity Investment Fund of RMB 30bn (US$4.9bn) in June of 2013 and the central government followed suit by introducing the National Industry Investment Fund. Other provinces and cities including Anhui, Shanghai, Shandong, Tianjin, Wuhan and Shenzhen are following the Beijing model, establishing local funds to support the IC industry. Government funds are to act as a lead to attract more private equity investment. As a result, equity investments will likely replace monetary subsidies as the major form of government support for the semiconductor industry in the future. Local analysts predict that by the end of 2015 the total equity funds established by China's central and local governments for the semiconductor industry will exceed RMB 200bn (US$32.5bn).

To avoid dissipating these investment funds by fragmentation, the government will focus on creating national champions—a small set of leaders in each critical segment of the semiconductor value chain (including design, chip manufacturing, assembly and test, and equipment)—in a few provinces in which there is the potential to develop industry clusters. One example of this focus on creating national champions is the acquisition of two of the 2013 top three Chinese fabless semiconductor companies, Spreadtrum and RDA, by

the state-owned Tsinghua Unigroup with the aim of combining them into a single entity. An example of the focus on potential industry clusters is the cooperative agreements SMIC made with the national and local governments to secure a US$1.2bn joint investment for their new 300mm wafer fab facility to be built in the Beijing Economic and Technology Development Area. The investors include Beijing Municipal Commission of Economy and Information Technology, the Institute of Microelectronics of the Chinese Academy of Science and the Beijing city government.

It is not clearly stated in the new Document 4 whether the National Industry Investment Fund may limit its investments to Chinese semiconductor companies or place certain restrictions on investments for wholly owned foreign owned enterprises (WFOE) or Sino-foreign joint venture (JV) semiconductor companies. However since one of the key spirits of the new Document is to protect national security it may be sensitive for foreign invested companies to be involved in projects that may have information security concerns. Also since the new Document encourages technology innovation and aims to make Chinese semiconductor companies become first ranked players in the global market place it seems to indicate the government will be more willing to support domestic semiconductor companies who develop and own IP in China. Therefore, while Document 4 does not clearly disallow WFOE or JV to apply for the investment fund, government authorities may have their internal guidelines on which entities are entitled to enjoy benefits which may restrict WFOE and JV participation.

After many years of planning China's first Anti-Monopoly Law (AML) was enacted in 2007 and became effective in August 2008, but specific enforcement was modest until new Chinese leadership came into office. The AML first introduced the concept of "Concentration of Business Operations" and subsequently a number of regulations or guiding opinions on the "Concentration of Business Operations" have been enacted by the Ministry of Commerce (MOFCOM). In January 2011 the enforcement authorities in China- the National Development and Reform Commission (NRDC) and the State Administration for Industry and Commerce (SAIC) published five new regulations implementing the AML.

Since then more antitrust activities were seen over the last 21 months than the previous four years as China is making more efforts to put its laws to work. Several large multinational companies, including leading IT and semiconductor companies have been subject to antitrust investigations. These investigations come after crackdowns in 2013 which saw Chinese regulators impose record fines of $242mn for market abuse. Observers advance several rationales for these recent developments including: China trying to protect domestic firms; China trying to control prices in politically sensitive sectors; Pressure from domestic firms that feel premium prices for goods they use are reducing their already razor-thin profits; China's increasing awareness of antitrust activities in other countries/ regions against the same firms; and Anti-monopoly regulators at central and local government level trying to impress top Chinese party and government officials who have stressed the need for China to move up the value-added chain, and cybersecurity. In response to US and European trade groups saying China's antitrust investigators were unfairly targeting foreign business, Chinese antitrust regulators have reported that only about 10 percent of their anti-monopoly investigations have involved foreign businesses.

Antitrust oversight in China is shared among three government agencies plus one coordinating committee. It is called the "3+1" mode for enforcement of the anti-monopoly regime in China.

The Ministry of Commerce (MOFCOM) of the Government of the People's Republic of China, formerly Ministry of Foreign Trade and Economic Co-operation (MOFTEC) is an executive agency of the State Council of China. It is responsible for formulating policy on foreign trade, export and import regulations, foreign direct investments, consumer protection, market

Equity investments will likely replace monetary subsidies as the major form of government support for the semiconductor industry in the future.

competition and negotiating bilateral and multilateral trade agreements. The Anti-monopoly Bureau of MOFCOM is responsible for reviewing on concentrations of undertakings according to law and investigating into cases on concentrations of undertakings reported by anti-monopoly enforcement authorities. It has jurisdiction over antitrust cases which involve the legality of mergers and acquisitions.

The National Development and Reform Commission (NDRC) of the Government of the People's Republic of China, formerly State Planning Commission, is a macroeconomic management agency under the Chinese State Council, which has broad administrative and planning control over the Chinese economy. The Department of Price Supervision of the NDRC is in charge of drafting administrative laws and regulations for price supervision and inspection; guiding and organizing price supervision and inspection, and handling activities and cases related to commodity prices, service prices and fee collection involving violation of price-related laws by central government agencies, handling price monopoly activities and reconsideration cases and appeals concerning the punishment of price violations and decisions. It has jurisdiction over antitrust cases which involve pricing.

The State Administration for Industry and Commerce (SAIC) is the authority in the People's Republic of China responsible for advancing legislation concerning the administration of industry and commerce in the People's Republic. The function of the Enforcement Office for Anti-Monopoly and Countering Unfair Competition of the SAIC is to stipulate regulations on anti-monopoly and countering unfair competition issues: to enforce the work of anti-monopoly, to investigate unfair competition, bribery claims, smuggling and other illegal economic cases. It is mainly responsible for enforcement work regarding agreements, the abuse of dominant market position and the abuse of administrative power to eliminate or restrict competition (except for price-fixing behavior. Therefore it has jurisdiction for all other anti-competition cases. Unlike NDRC it has conducted most of its investigations to date at the sub-national level, via provincial and local associations of industry and commerce.

In addition, the Anti-Monopoly Committee founded by the State Council in 2008 is responsible for coordination of the above three agencies.

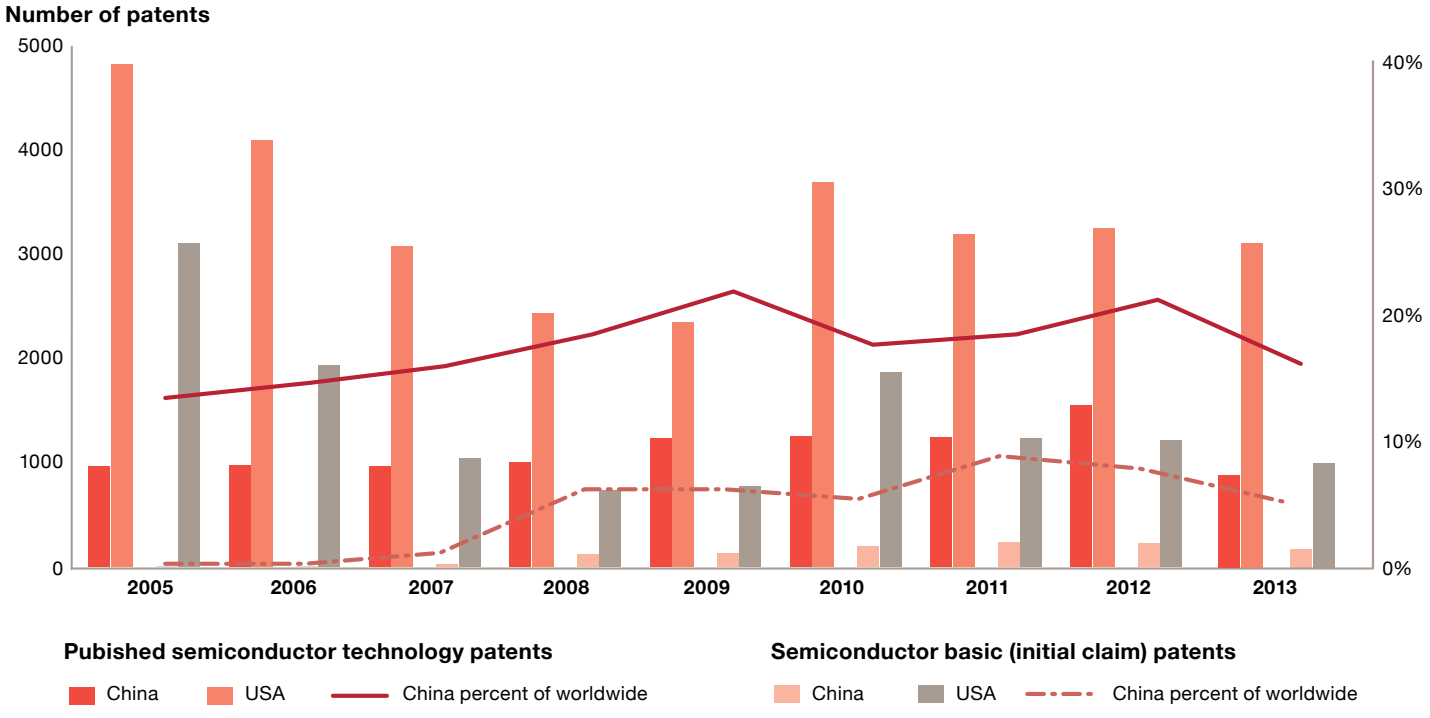
It is important for all companies doing business in China to be aware of China's relatively recent focus on antitrust law enforcement. China's antitrust law enforcement is undeniably at the initial stage and it is likely that changes will be made as authorities become more experienced in dealing with the multitude of antitrust investigations. There are reasons to believe the China's market environment purified through antitrust probes will be helpful for Chinese and foreign companies to compete in a fair market for the ultimate benefit of foreign and Chinese consumers. Therefore companies should keep China's antitrust law enforcement in mind as they set strategies and tactics for their participation in China.

Semiconductor patents

Intellectual property (IP) and its protection continues to be an area of specific focus in China's 12th FYP. One of the policy objectives of the 12th FYP for the semiconductor industry is to foster a group of semiconductor firms that will develop into global leaders in terms of both technology standards and market share. The government has implemented various tax and other incentives to support this objective for new/high technology enterprises (NHTEs).

One of the qualification criteria for NHTE status is core proprietary IP rights. Since 2005, China's share of worldwide semiconductor patents published by year has increased from 7.6% in 2005 to a peak of 14.9% in 2009 then varied between 10.7% and 12.7% for the next three years before declining to 10.7% in 2013. (These values for China's share of worldwide semiconductor patents published during 2005 through 2012 are somewhat lower than those

Figure 26: China versus worldwide semiconductor patents 2005-2013



Source: *Derwent 2013*

reported in our 2013 update as a result of our reference to a new Thomson Innovations patent database with a more comprehensive coverage of total worldwide patents).

What may be of more interest is the gradual growth of China's share of the first instance of a semiconductor patent publication, referred to as the basic patent statistic. According to data from the Thomson Innovation patent database, China, which had less than a 1.0% share in 2005 or 2006, started to grow its share of worldwide semiconductor basic patents published from 1.1% in 2007 to 9.8% in 2011, 10.7% in 2012 before declining to 7.3% in 2013. During the past five years, from 2009 through 2013, slightly less than 8% of patents on semiconductor inventions have been first issued in China compared to 51% in the US.

Further research with the Thomson Innovation patent database reveals that most of these Chinese semiconductor patents are still being issued to companies outside of China. There was only one Chinese company or institution, Ocean's King Lighting Science & Technology, among the top ten assignees.

The top ten assignees, accounting for 25% of the 1,102 semiconductor technology patents/ applications issued/ published in China in 2013, were the following multinational companies:

Company	# of patents
Taiwan Semiconductor Manufacturing Co., Ltd. (TSMC)	77
Semiconductor Energy Laboratory Co. (SEME)	48
Samsung Electronics Co., Ltd. (SMSU)	25
Sharp Corporation (SHAF)	24
Sony Corporation (SONY)	20
LG Innotek Co. Ltd.	19
Fujitsu Ltd.	17
Ocean's King Lighting Science and Technology Co., Ltd.	17
Toshiba Corporation	15
IBM Corp. (IBMC)	13

Source: *Thomson Innovations*

Correspondingly, the top ten assignees, accounting for 34% of the 213 semiconductor basic (initial claim) patents/applications issued/published in China in 2013, were the following Chinese companies and institutions:

Ocean's King Lighting Science and Technology Co., Ltd.	16
Institute of Microelectronics of Chinese Academy of Science	12
Tsonghua University	10
Semiconductor Manufacturing International Corp. (SMIC)	8
Peking University	5
Fudan University	5
Hongfujin Precision Industry (Shenzhen) Co., Ltd.	5
University of Electronic Science & Technology of China	4
Chinese Academy of Science Institute Chemistry	4
Shenzhen Huaxing Optoelectronic Technology Co., Ltd.	4

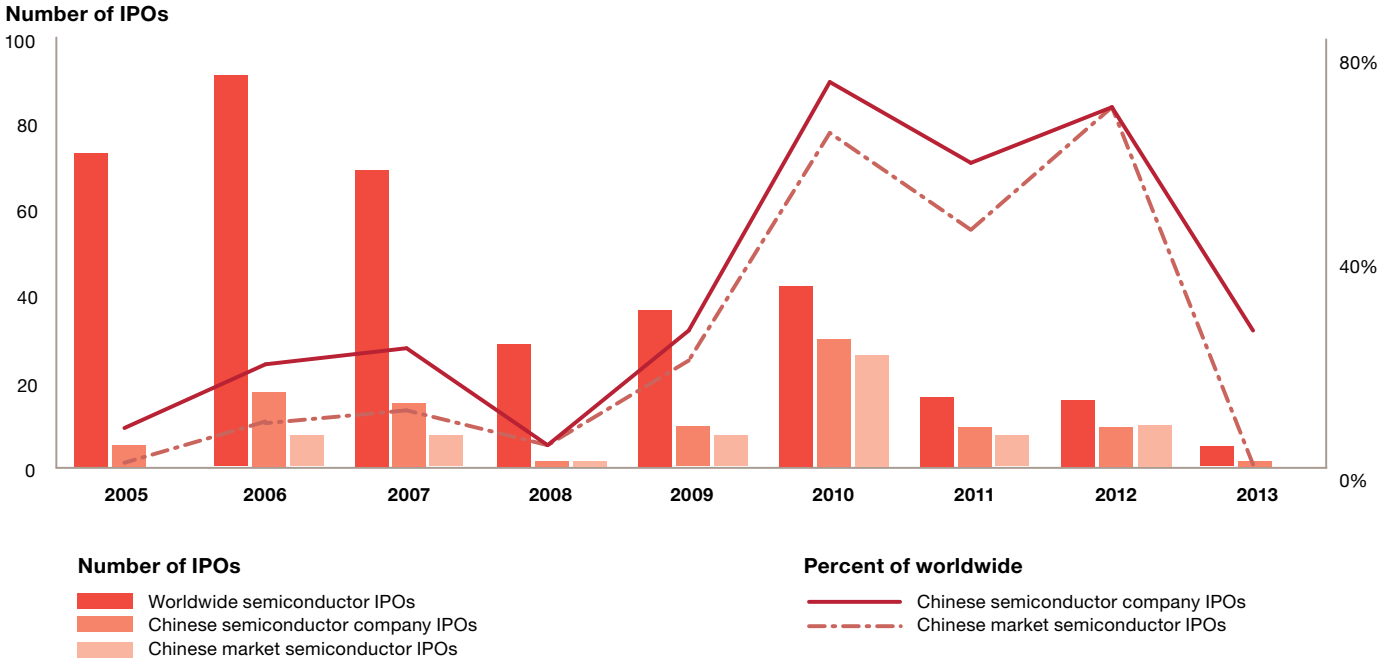
Source: *Thomson Innovations*

Financial markets and IPO funding

As reported in our prior updates, China had emerged in 2009 as a significant source of new companies and financial funding for semiconductor start-ups. According to PwC's Global Technology IPO Reviews, that momentum continued through 2010 as China overshadowed the US and the rest of the world with the most technology IPOs (with proceeds greater than US$40mn) and China's Shenzhen exchange displaced NASDAQ as the leading exchange for those technology IPOs. China's predominance in technology IPOs continued through 2011, even as the global market for technology IPOs started to decline.

China's technology IPOs and money raised experienced a steady decline during 2012. By Q4 2012 China had only one technology IPO and had no semiconductor IPOs since Q2 2012. After three years of growth in IPOs, the decline in economic growth led to lower numbers of technology companies listing in both China and Greater China.

Figure 27: China versus worldwide semiconductor IPOs 2005-2013



Source: *Thomson Financial 2010, 2011, 2012, 2013, 2014*
Chinese semiconductor company = domiciled in China

According to Thomson Reuters, since 2005, China has been the fourth largest acquirer nation for semiconductor M&As, with 6.7% of all worldwide deals.

China saw technology IPO activity decline throughout 2012 due to slowing growth and change in posture by the Chinese Security and Regulatory Commission (CSRC) relative to new filings. China's share of total IPOs in 2013 was negatively impacted by the freezing of the local IPO market in late 2012 by the CSRC. Consequently, no technology IPOS were listed on Chinese stock exchanges in 2013 compared to 46% of the worldwide total in 2012 and 43% in 2011. As a result, Chinese companies accounted for just 13% of worldwide technology IPOs in 2013 as compared to 46% in 2012 and 56% in 2011. However, a Chinese company did account for one of the four (25%) worldwide semiconductor IPOs in 2013. It was listed on the NASDAQ rather than a Chinese stock exchange and accounted for 23% of worldwide semiconductor IPO proceeds in 2013.

When the CSRC announced in late 2013 it would resume IPO approval, it was expected that 2014 would be robust for Chinese IPOs. Eleven Chinese companies, 42% of the worldwide total technology IPOs, went public in Q1 2014, all on the two Chinese exchanges. Thirteen Chinese companies went public in Q2 2014, however, eight listed in the US and three on the Hong Kong exchange. The Chinese exchanges had only two technology IPOs in Q2 2014 due to an ongoing regulatory backlog from the IPO freeze which began in Q4 2012 and went to Q4 2013. During Q2 2014 China's regulators announced they would limit IPOs in China to around 100 during the second half of 2014, a move that was expected to encourage Chinese firms to consider an overseas listing. However, Chinese technology companies continued their comeback, with ten companies, 56% of the worldwide total, going public in Q3 2014; six listed on the two Chinese exchanges and two on the Hong Kong exchange. Notably these Chinese technology IPOs included Alibaba—the largest IPO on record—which, by successfully listing on the NYSE, set the stage for a continued healthy flow of Chinese companies going public on cross-border exchanges. Four of the Chinese IPOs were the only semiconductor companies listed in Q3 2014 with two each listed on the Shanghai and Shenzhen exchanges. The Chinese stock market has been steadily processing the large backlog of applicants in the pipeline. Furthermore, the potential amendment relaxing the profit requirement rule for internet/mobile internet companies could encourage more technology companies to list on Chinese exchanges in the future.

In addition to IPOs, Chinese companies have also become a significant participant in semiconductor mergers and acquisitions (M&As). According to Thomson Reuters, since 2005, China has been the fourth largest acquirer nation for semiconductor M&As, with 6.7% of all worldwide deals, following the US (30.5%), South Korea (13.6%) and Japan (7.8%). During the same period, China was the third largest target nation for semiconductor M&As, at 7.7% of all worldwide deals, following the US (28.7%) and South Korea (14,1%). Further, as noted in our 2011 update, recent changes in China's tax incentives for semiconductor NHTEs (New High Technology Enterprises) may increase the degree of concentration in China's semiconductor industry and indirectly work to accelerate mergers between companies in the industry. According to Thomson Reuters, Chinese companies have been the target of 119 and the acquirer of 127 semiconductor industry related M&A deals since 2010. Chinese companies were the acquirer for 36 deals completed in 2011, 32 completed in 2012, 42 completed in 2013 and 17 completed during the first three quarters of 2014. Of these 127 Chinese semiconductor M&A deals, 103 involved the acquisition of other Chinese assets and 24 of foreign assets, including ten from the US, five from Germany, and two each from Italy and Taiwan.

Table 11: China versus worldwide semiconductor IPOs 2005–Q3 2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	Q1/14	Q2/14	Q3/14	Total 9.75 Yrs 2005–Q3/14
Worldwide semiconductor IPOs													
Number of IPOs	73	91	69	28	36	42	16	15	16	5	5	4	400
Proceeds (US$mn)	3,006.0	3,663.8	3,727.1	678.2	1,693.6	6,202.6	2,645.0	1,445.4	325.3	154.5	490.6	533.0	24,565.10
Chinese semiconductor company IPOs													
Number of IPOs	5	17	15	1	9	30	9	10	1	2	2	4	105
% of worldwide	6.8%	18.7%	21.7%	3.6%	25.0%	71.4%	56.3%	66.7%	6.3%	40.0%	40.0%	100.0%	26.3%
Proceeds (US$mn)	407.9	743.6	1,109.5	37.4	1,308.9	4,493.6	1,323.0	1,020.0	71.0	134.6	347.8	533.0	11,530.30
% of worldwide	13.6%	20.3%	29.8%	5.5%	77.3%	72.4%	50.0%	70.6%	21.8%	87.1%	70.9%	100.0%	46.9%
Chinese market semiconductor IPOs													
Number of IPOs	0	7	7	1	7	26	7	10	0	2	2	4	73
% of worldwide	0.0%	7.7%	10.1%	3.6%	19.4%	61.9%	43.8%	66.7%	0.0%	40.0%	40.0%	100.0%	18.3%
Proceeds (US$mn)	0.0	285.5	351.6	37.4	1,270.7	4,062.5	1,220.0	1,020.0	0.0	134.6	347.8	533.0	9,263.10
% of worldwide	0.0%	7.8%	9.4%	5.5%	75.0%	65.5%	46.1%	70.6%	0.0%	87.1%	70.9%	100.0%	37.7%

Chinese semiconductor company = domiciled in China
Source: Thomson Reuters 2010-2014

Production growth scenarios

Since our original 2004 report, PwC has examined the effects that different levels of growth in the Chinese integrated circuit (IC) semiconductor industry would have on the greater industry. We initially used scenarios that spanned the time period from 2003 through 2010, analyzing the developments, investments and milestones that would have to be accomplished for China to achieve each level of growth during the forecast period. With the start of China's 12th Five Year Plan we revised the basic assumptions and business models used for our further scenario analysis of China's IC industry.

The following is a concise summary of our analysis of the revised (2011) conservative, moderate and aggressive growth scenarios developed for China's IC industry over the period from 2010 through 2015. The conservative and moderate scenarios reflect China's capabilities, while the aggressive scenario reflects its stated intentions. The analysis covers the assumptions, business models, developments, investments and milestones for each scenario over that five-year period. These scenarios are described in considerable detail in our 2011 update.

The moderate scenario is based upon an assumption that China completes and fully equips all the current and the two committed IC wafer fabs facilities that were under construction at the end of 2010, ramps them into full production and operates them at a utilization and effectiveness that averages 90% of their WFW nominal capacity and earns an average of US$600 per 8-inch equivalent wafer. It further assumes that all of the resulting wafer fab output is packaged and tested in China in addition to the 2010 volume of imported wafer devices packaged and tested in China, and that China's IC design sector grows at a moderately higher CAGR to meet the MIIT's 12th FYP objectives.

The conservative scenario is based upon similar wafer fab completion assumptions reduced to 70% of nominal WFW capacity, with all of the resulting wafer fab output packaged and tested in China in addition to the 2010 volume of imported wafer devices packaged and tested in China. It also assumes that China's IC design grows at a 10% CAGR, slightly higher than China's forecast GDP growth.

The aggressive scenario assumes that China's IC industry and IC design sectors achieve the goals established by MIIT as part of China's 12th FYP. Those goals were for China's IC industry to achieve revenue of RMB 330bn and China's IC design sector to have revenue of RMB 70bn by 2015. At the 2012 average FX rate, these goals equate to US$52.3bn and US$11.1bn.

The IC consumption scenario is based upon China's MIIT's 12th FYP expectations for 2015 coordinated with the CSIA forecast for earlier years.

Figure 28 illustrates these three scenarios along with China's reported IC industry performance. Although China's IC consumption market exceeded worldwide semiconductor market growth for a third consecutive year in 2013, it missed the CSIA forecast growth by just 1.3%. However, based upon the current CSIA reports, China's IC industry production revenue has exceeded the aggressive growth scenarios for the three consecutive years of 2011, 2012 and 2013.

There has been a significant increase in the volume of imported wafer devices packaged and tested in China. There has also been an increase in the revenue earned per wafer start capacity resulting from improvements in wafer fab capacity utilization and technology/price increases. During the last three years, China's IC industry has reported a 20.3% RMB and 24.2% US dollar CAGR. During this period, China's IC design sector reported a 34.7% US dollar CAGR, IC packaging and testing 24.3% and IC manufacturing 13.9%. Based upon these results, it seems reasonably probable that China's IC industry will follow or exceed the last (2011) aggressive growth scenario through 2015 and achieve the MIIT revenue goals of RMB 330bn, with IC design reaching RMB 70bn. During 2013, more than US$9bn of additional fixed-asset investments were made in China's IC industry to bring the total for the last three years to almost US$20bn. This increase in investment rate clearly supports the aggressive growth scenario requirements.

Considering China's progress and status compared to the current (2011) scenarios, it now seems appropriate and reasonable to develop a further (2014) revision of those scenarios covering the next five years for analysis and reference.

This (2014) revised moderate growth scenario is based upon an assumption that China completes and fully equips all the current and the five committed IC wafer fabs facilities that were under construction at the end of 2013, ramps them into full production and operates them at a utilization and effectiveness that averages 90% of their WFW nominal capacity and earns an average of US$640 per 8-inch equivalent wafer. It further assumes that all of the resulting wafer fab output is packaged and tested in China in addition to a volume of imported wafer devices packaged and tested in China

that grows at the same rate as the wafer fab output, and that China's IC design sector grows at the CCID/CSIA forecast (2016/2013) CAGR of 21.9%. According to this moderate scenario, China's IC industry revenues would reach US$72.6bn in 2018.

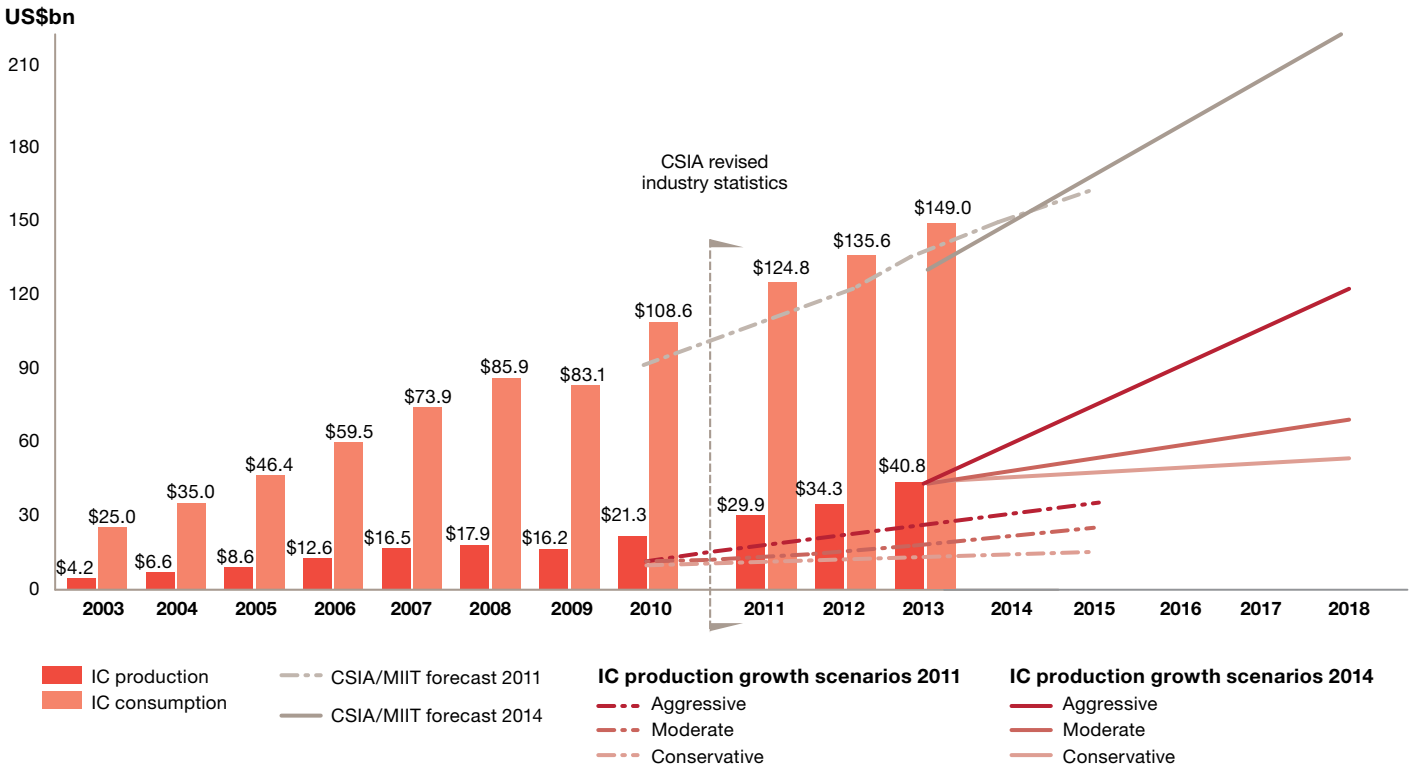
This (2014) revised conservative growth scenario is based upon similar wafer fab completion assumptions reduced to 75% of nominal WFW capacity and an average of US$600 per 8-inch equivalent wafer, with all of the resulting wafer fab output packaged and tested in China in addition to a volume of imported wafer devices packaged and tested in China that grows at the same rate as the wafer fab output. It also assumes that China's IC design grows at a 10% CAGR, slightly higher than China's forecast GDP growth. According to this conservative scenario, China's IC industry revenues would only reach US$50.2bn in 2018.

This (2014) revised aggressive growth scenario is based upon the assumption that China's IC industry is able to continue to grow at the same 25.4% CAGR that it achieved between 2003 and 2013. According to this very aggressive scenario, China's IC industry revenues could reach US$126bn and represent 21% of worldwide IC industry value added in 2018.

This (2014) revised IC consumption scenario is based upon the assumption that the CSIA 2014 forecast for an 8.7% CAGR IC market demand growth rate from 2013 through 2016 will continue through 2018. According to this scenario, China's IC consumption will grow to US$226bn in 2018 and represent almost 66% of worldwide IC consumption.

In conclusion, this set of (2014) revised growth and consumption scenarios project that even with the most aggressive growth it will be 2018 before China's IC industry revenues meet the MIIT objectives of equalling at least 50% of IC consumption.

Figure 28: China's integrated circuit production and consumption 2011 and 2014 growth scenarios compared with actual



Source: *CSIA CCID, World Fab Watch, PwC*

Conclusion

This concludes the third and final section of this year's update. In the following weeks we will release a final, full report which will contain all three sections, updated as appropriate, an executive summary and a ten-year perspective.

All sections of this year's update, the full report and updated appendix will be available at www.pwc.com/chinasemicon.

PwC can help

If your company needs assistance doing business in China, or you just want to have a deeper discussion about what's happening in the market and how we can help, please reach out to one of the technology industry leaders listed here.

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