

Semiconductor Hubs for Research & Innovation

Overview of the report

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Scope

- The report aims to analyze the leading global hubs for semiconductor research and innovation talent and ecosystem
- A structured mechanism was used to identify the leading destinations for globalizing semiconductor R&D. The report provides key insights on the identified locations (highlighted in the map) including

- University Ecosystem
- Competitive landscape
- Government initiatives and incentives
 - Financial incentives
 - Special programs
 - Infrastructure investment
- Talent Heat map
 - Installed Base
 - Technology Depth
 - Fresh Graduate
 - Mobility



Note: This Preview report has summary of only the top 10 cities

Agenda

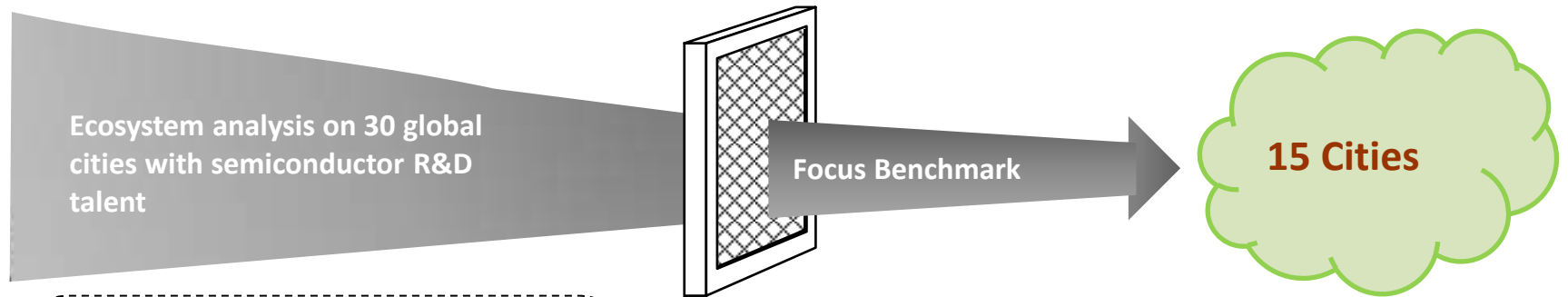
1

Semiconductor R&D hubs – an overview

2

Location insights

A structured mechanism was used to identify the top locations for semiconductor R&D



Ecosystem analysis on 30 global cities with semiconductor R&D talent

Focus Benchmark

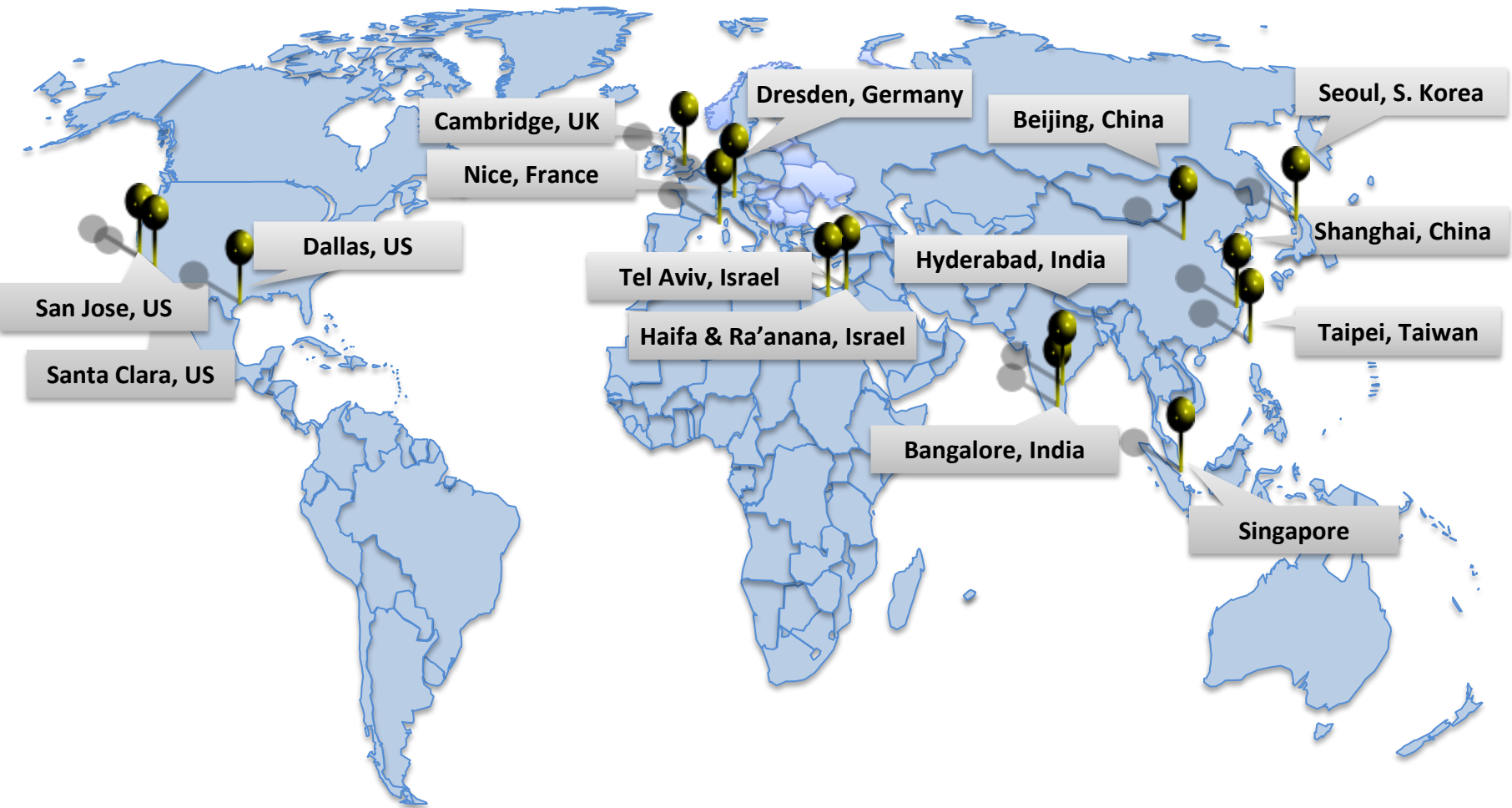
15 Cities

1. Presence of semiconductor MNC firms
2. Competitive domestic players in the semiconductor market
3. Large base of skilled manpower
4. Vibrant startup community
5. Strong university ecosystem
6. Supportive government policies

Cities	
Taipei, Taiwan	Shanghai, China
Seoul, South Korea	Bangalore, India
Nice, France	Hyderabad, India
Singapore	Dallas, US
Cambridge, UK	San Jose, US
Haifa, Israel	Santa Clara, US
Tel Aviv, Israel	Dresden, Germany
Beijing, China	

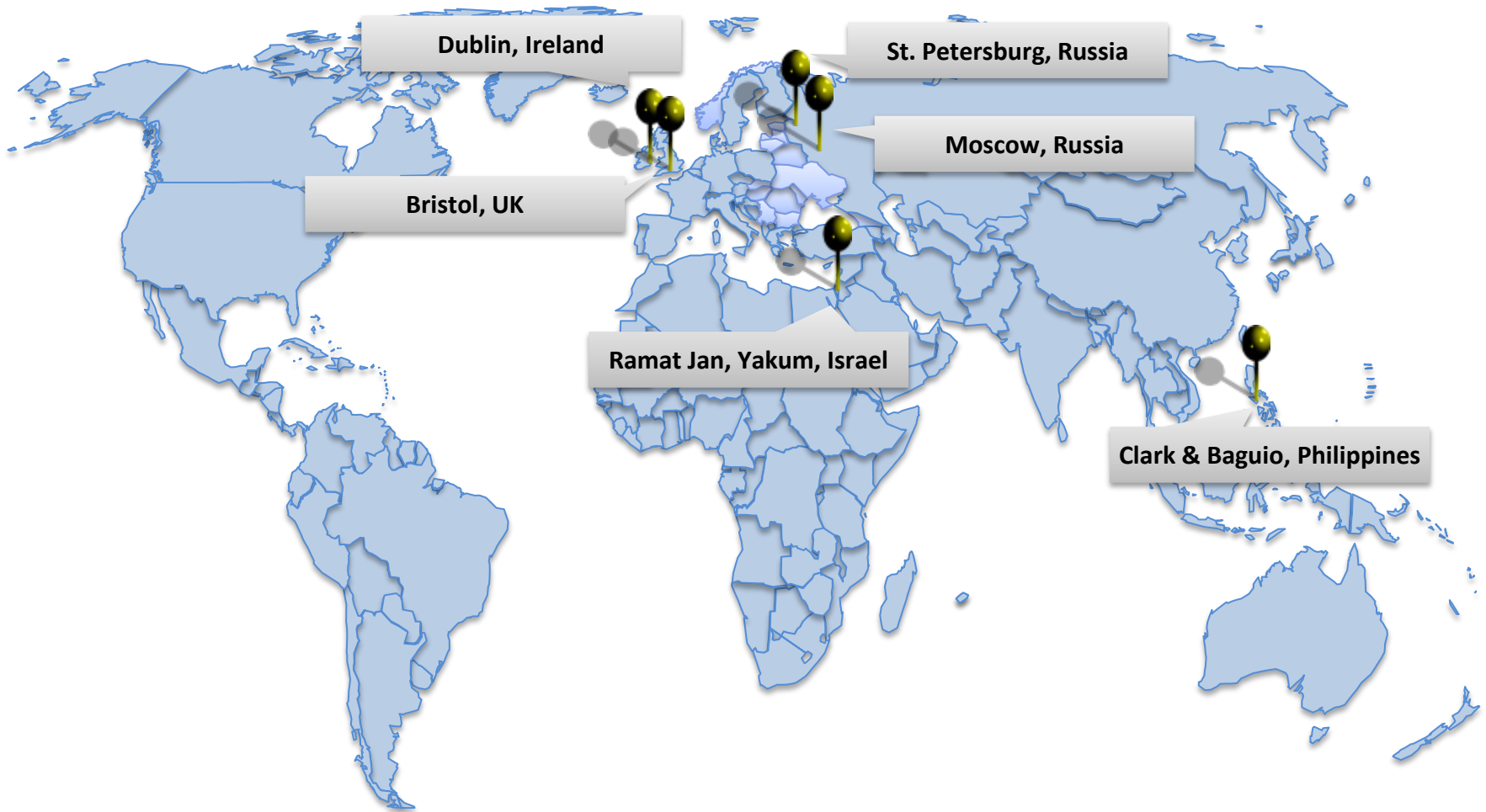
Asian and European cities emerged as the most suitable destinations for semiconductor related work

Top destinations for semiconductor research and innovation

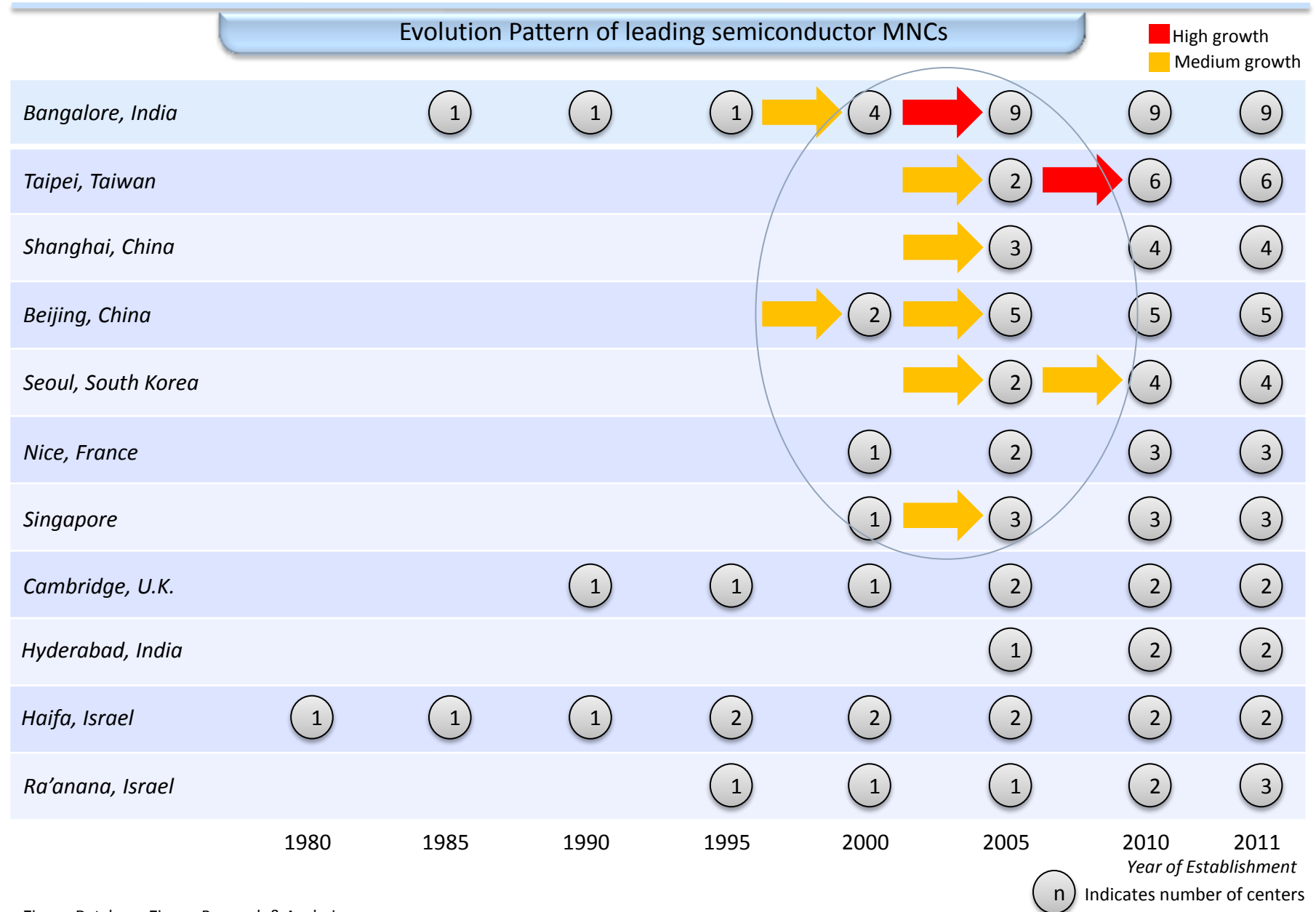


Eight cities have been identified to be fast emerging as next preferred locations for semiconductor offshoring

Emerging Locations for Semiconductor Offshoring

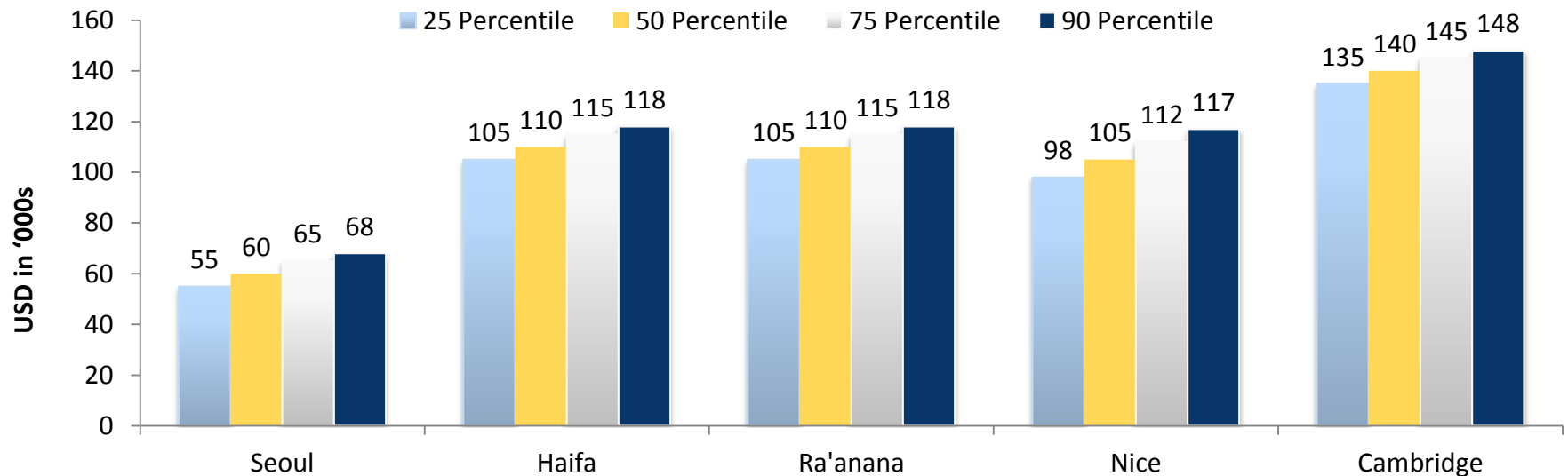
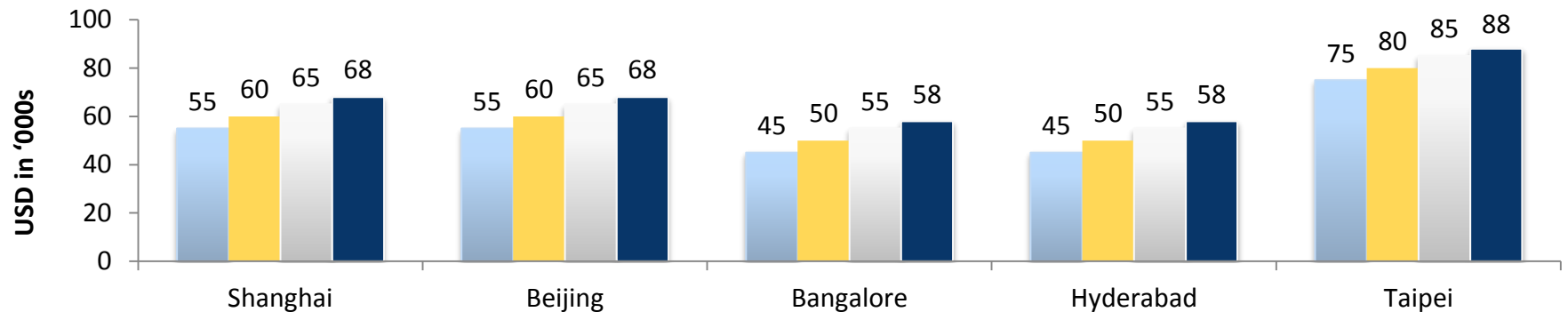


Though global sourcing began primarily in the 1990s, the most active period in the globalization of semiconductor R&D was in the years 2000 - 2005

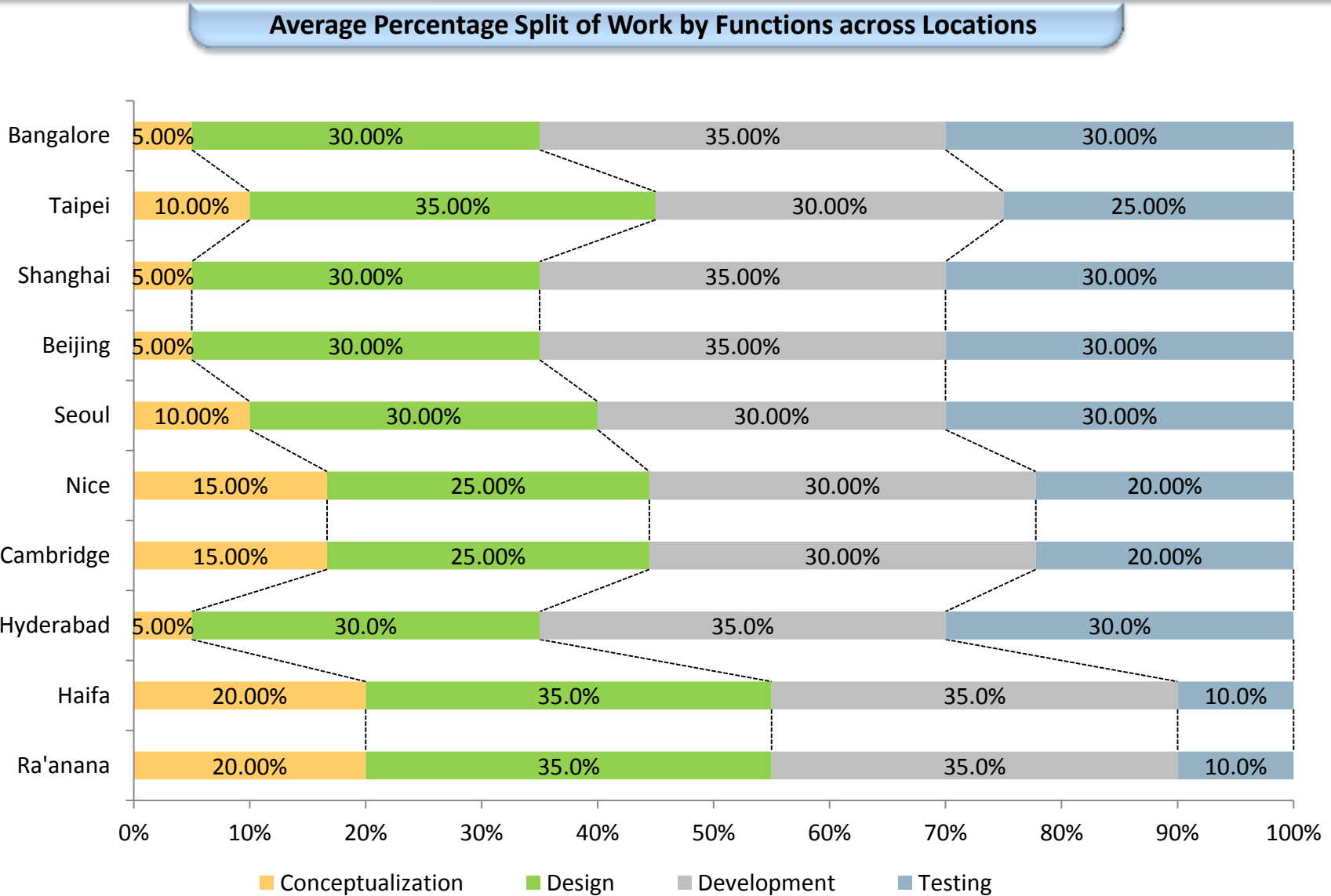


Cities in India and China witnessed the most activity during globalization as costs in these locations were competitive, and continue to be so, when compared to other locations

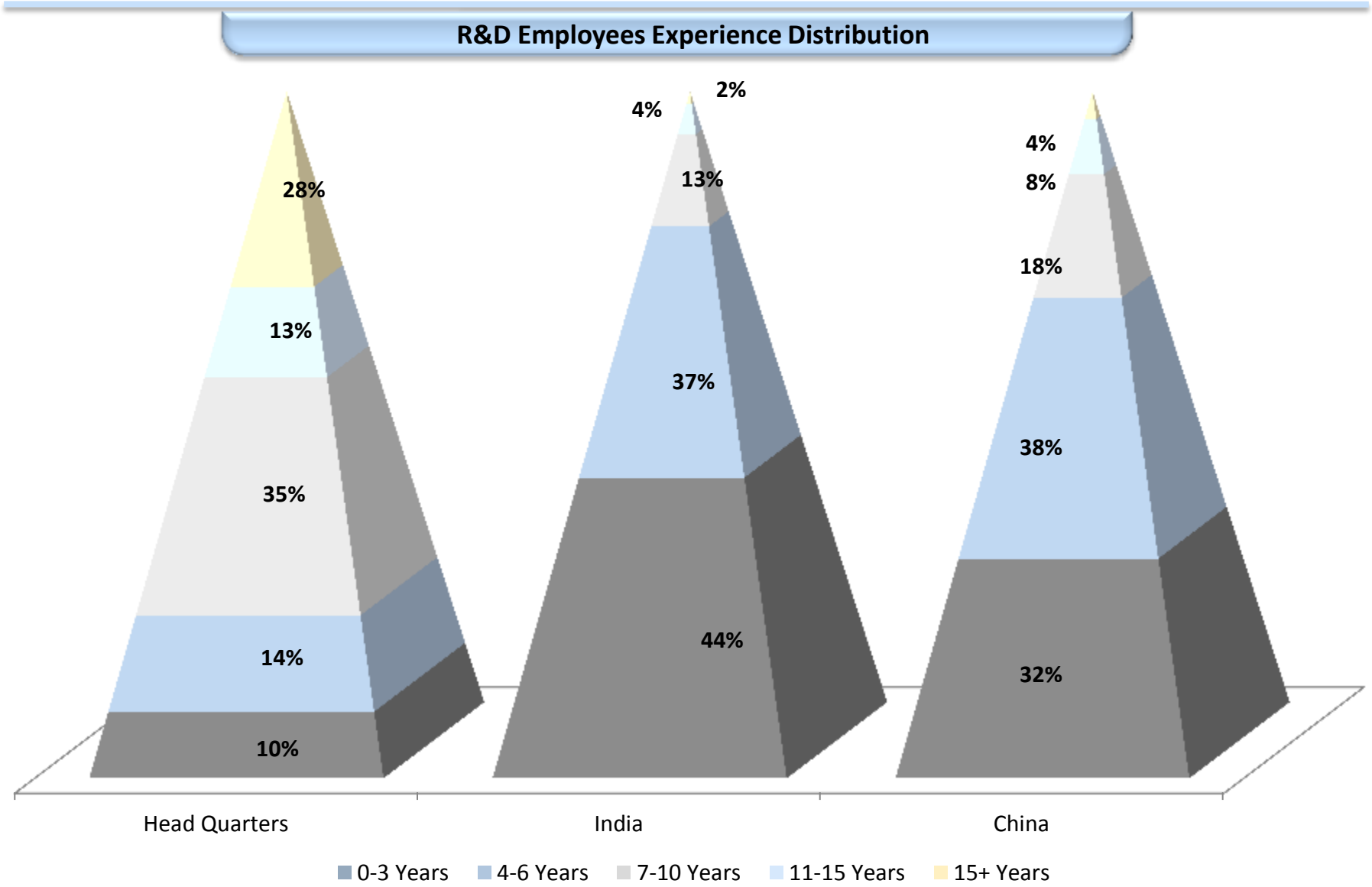
Average Cost per FTE across selected global locations



Predominant activity in low cost locations in India & China is development & testing; in comparison, high cost locations like Israel & UK have a higher share of conceptualization



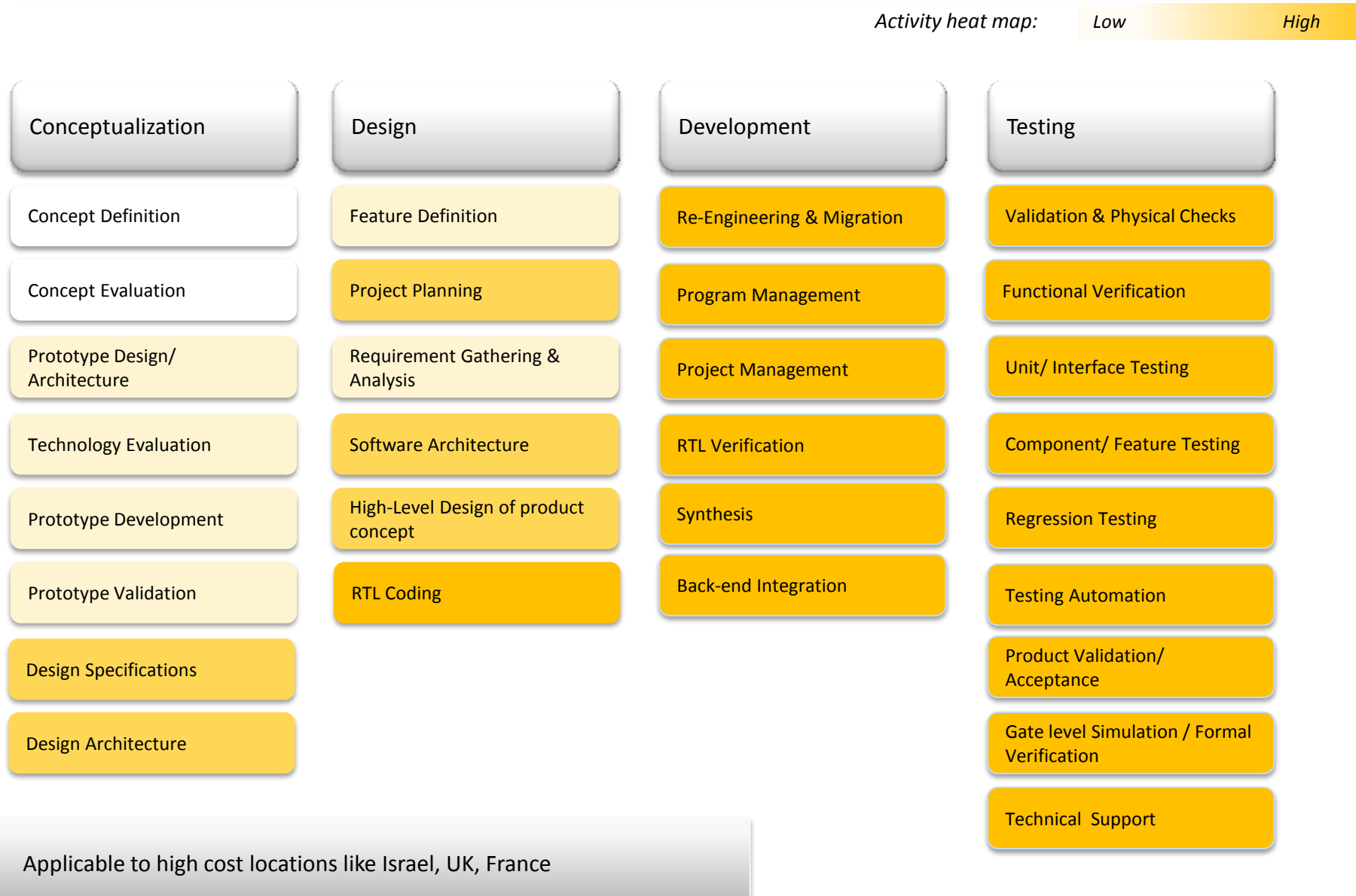
The depth of technical leadership in India and China centers is low and this impacts their ability to contribute at the higher end of the product value chain



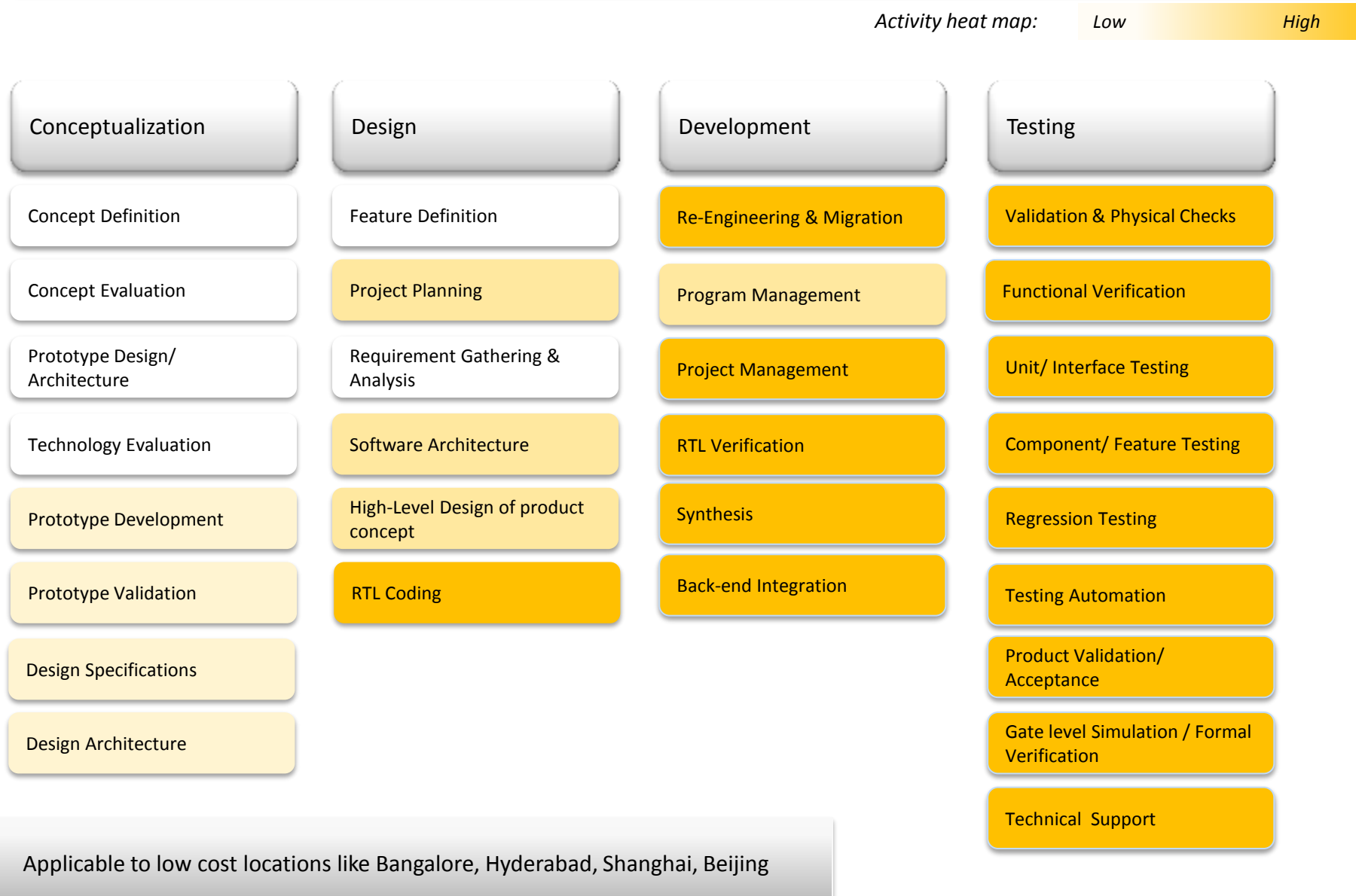
Head Quarters (HQ) has end-to-end product ownership with main focus on upstream activities such as conceptualization and design



A few high cost offshoring locations have total product ownership and serve as a design center along with development and testing



Total product ownership seldom occurs in low cost offshoring locations, major focus is on downstream activities such as development and testing



Agenda

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Location insights

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Bangalore & Hyderabad, India

5

Seoul, Korea

2

Shanghai & Beijing, China

6

Haifa & Ra'anana, Israel

3

Nice, France

7

Taipei, Taiwan

4

Cambridge, UK

8

Singapore

Note: This Preview report has summary of only the top 10 cities

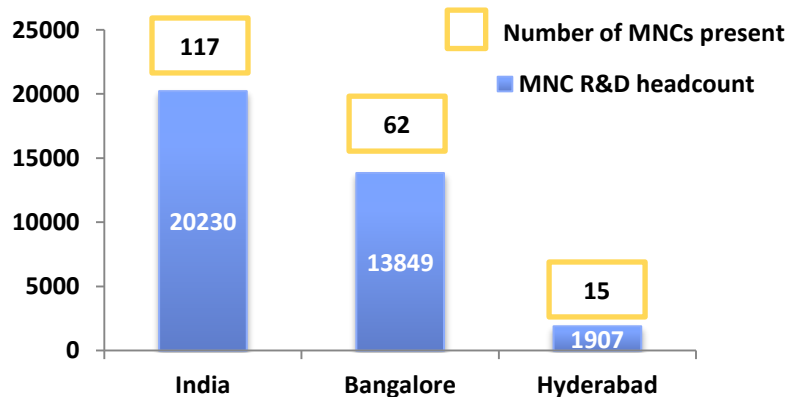
Indian government is incentivizing and funding the talent development for semiconductor industry to propel growth

Bangalore & Hyderabad

Bangalore & Hyderabad, India

- Indian semiconductor design industry comprises of VLSI design, board design and embedded software companies
- 9 out of top 10 semiconductor companies have their presence in the region
- India's manufacturing index is low; it manufactures only 46% of the products consumed, so there's a greater opportunity for the industry

Talent Pool & University ecosystem



- Bangalore and Hyderabad together account for ~80% of the total MNC talent pool for semiconductor R&D in India
- Bangalore has ~75-90 colleges producing ~20,000 engineering graduates per year

Competitive landscape

- All global top ten fabless design companies have India operations
- 19 of the top 25 semiconductor companies have presence in India

Government initiatives & incentives

Financial incentives

- **10 year tax holiday** equal to 100 percent of taxable profits to companies registered in India that carry on scientific R&D
- Up to **150 percent deduction of R&D expenses** incurred for companies engaged in electronic equipment manufacturing
- **Special Incentive Package Scheme** for setting up semicon fabs and other micro and nanotechnology manufacturing industries in India
- **Karnataka Fund for Semiconductor Excellence** aimed at attracting electronics and hardware companies to the state. The state has committed to set up with a corpus of US\$ 2.14 million to encourage R&D in chip design

Special programs




- **National Semiconductor Policy (NSP)** or Fab Policy was set up to become self-reliant in chip manufacturing and encourage global semiconductor companies to set up manufacturing plants in India

ITFM Talent Heat Map for semiconductor talent pool in Bangalore & Hyderabad, India

Bangalore & Hyderabad

ITFM Talent Heat Map – Bangalore & Hyderabad

	I nstalled Base	T echnology Depth	F resh Graduate	M obility
	<ul style="list-style-type: none"> Availability of well trained suitable talent to perform the type of work defined. 	<ul style="list-style-type: none"> Technology depth of talent to perform activities with at par productivity to HQ and under full ownership (minimum guidance) 	<ul style="list-style-type: none"> Availability of university ecosystem and fresh talent. This indicates the pipeline of fresh talent that can be tapped into the city 	<ul style="list-style-type: none"> Ecosystem to support mobility of talent from other cities within the country, other global cities (Expatriates)
Bangalore				
Conceptualization				
Design				
Development				
Verification & Testing				
Hyderabad				
Conceptualization				
Design				
Development				
Verification & Testing				

High  Moderate  Low 

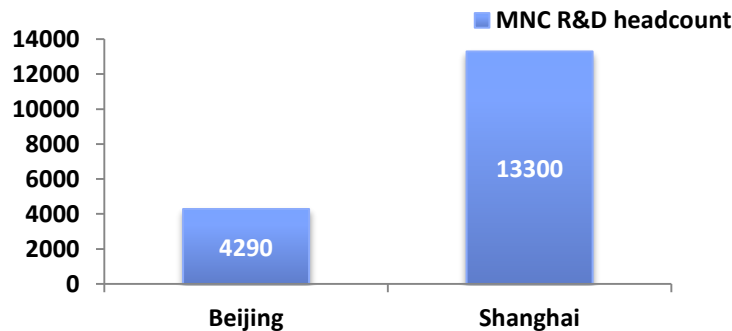
Beijing & Shanghai have a large Research & Development talent Pool across sectors which gives them a competitive advantage over other locations

Shanghai & Beijing

Shanghai & Beijing, China

- China is home to number of large semiconductor companies. Foreign companies dominate the landscape; a number of domestic firms have also gained in scale and global presence
- Besides being a strategic market location, Shanghai & Beijing have a large R&D talent Pool across sectors which gives it a competitive advantage over other locations
- China's government played a key role in promoting R&D investment in the region

Talent Pool & University ecosystem



- Beijing houses 70 graduate and post graduate colleges. Two of the Chinese National Universities are based out of Beijing
- Shanghai is a major center of higher education and research with ~30 colleges and universities. 6 of the country's prestigious universities are based out of Shanghai

Competitive landscape

- China has more than 600 companies in semiconductor vertical, including 472 IC design enterprises
- Foreign companies dominate the semiconductor industry; some of the domestic players have also grown significantly and established global presence

Government initiatives & incentives

Financial incentives

- Companies incurring R&D expenses in the production of new technologies, products, or techniques may enjoy a **50 percent "super deduction"** over and above actual expense deduction
- Taxation laws for semiconductor manufacturing sector allow a **5 year tax holiday** involving full exemption from corporate income tax for first 5 years, starting when the business becomes profitable
- To promote the IC design industry, **state-owned research institutes were privatized** and also private companies were provided financial assistance to conduct R&D activities
- IC manufacturers are **exempt from paying import duties** and 17% VAT on IC production equipment and machinery. They are also granted easy customs clearance

Technology park/ R&D cluster

- China has more than **100 "high-technology parks"** scattered throughout the country. Relatively large and more concentrated clusters are emerging in Zhangjiang, Suzhou and Beijing

ITFM Talent Heat Map for semiconductor talent pool in Shanghai & Beijing, China

Shanghai & Beijing

ITFM Talent Heat Map – Shanghai & Beijing

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Design				
Development				
Verification & Testing				

High  Moderate  Low 

Nice has a internationally famous technology park called Sophia Antipolis, which attracts R&D companies and research communities from around the world

Nice

Nice,
France

- Nice houses several companies in the field of electronics. A number of research institutes and universities focused on semiconductor R&D are located in close proximity with these companies
- This has helped the location turn into a key destination for the research and innovation

Talent Pool & University ecosystem

- Sophia Antipolis is a major innovation hub southwest of Nice, France and is home to ~1400 companies with R&D capacity who provide ~30,000 jobs
- There are more than 5,000 students in the Universities present in Sophia Antipolis
- Sophia Antipolis also houses engineering schools for electronics and computer sciences which has helped build a rich pool of engineering expertise over the years
- In parallel, international schools are developing to meet the need for a highly-qualified and bilingual workforce.

Competitive landscape

- Most companies establishing in Sophia Antipolis, Nice (France) choose to place their R&D departments in the region to collaborate with other companies. One fourth of the activities are being run by international companies - most of them US based
- A leading semiconductor company designs & develops new architecture & processor cores and also new variants of existing cores
- Another leading company has set up an R&D center in Sophia Antipolis to develop platform for next-gen mobile devices focusing on GSM and upcoming mobile standards.

Government initiatives & incentives

Financial incentives

- **Research Tax Credit:** Public grant aimed at increasing companies' competitiveness by backing their R&D efforts. The tax credit equals 30% of the annual R&D expenditure (up to 100 million € of the expenditure) or 5% of annual R&D expenditure (over 100 million €)

Technology park/ R&D cluster




- 40% of companies in **Sophia Antipolis technology park** are active in R&D and the area numbers around 4,000 Researchers in Companies and Research Institutes

ITFM Talent Heat Map for semiconductor talent pool in Nice, France

Nice

ITFM Talent Heat Map - Nice

	I nstalled Base	T echnology Depth	F resh Graduate	M obility
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High  Moderate  Low 

The creation and support of the cluster in the Cambridge region “Silicon Fen” has led to the formulation of the well-established Semiconductor Industry in UK

Cambridge

Cambridge,
UK

- Cambridge in East England has a healthy number of semiconductor design companies focused on device- and application-based markets
- Oxford, Southampton and Surrey in Southeast England are focused on application engineering and hardware design in the semiconductor ecosystem

University ecosystem

- Cambridge is the home to world famous ‘**University of Cambridge**’ which has student population of about 18,000. It has produced 88 Noble prize winners
- The University is credited for the supply of competitive manpower that addresses the need of the semiconductor sector, which is highly knowledge-intensive
- Also of importance is Cambridge Universities' liberal attitude to IP rights which has allowed the 'spinning off' of companies from research

Competitive landscape

- The creation and support of the cluster in the Cambridge region “Silicon Fen” has led to the formulation of the well-established Semiconductor Industry in the UK
- A top semiconductor major focuses on development of DSP architectures and compilers and embedded software
- Another specializes in technologies, tools and design for mobile UI with engineering and design teams working on embedded mobile handset and server-side technologies

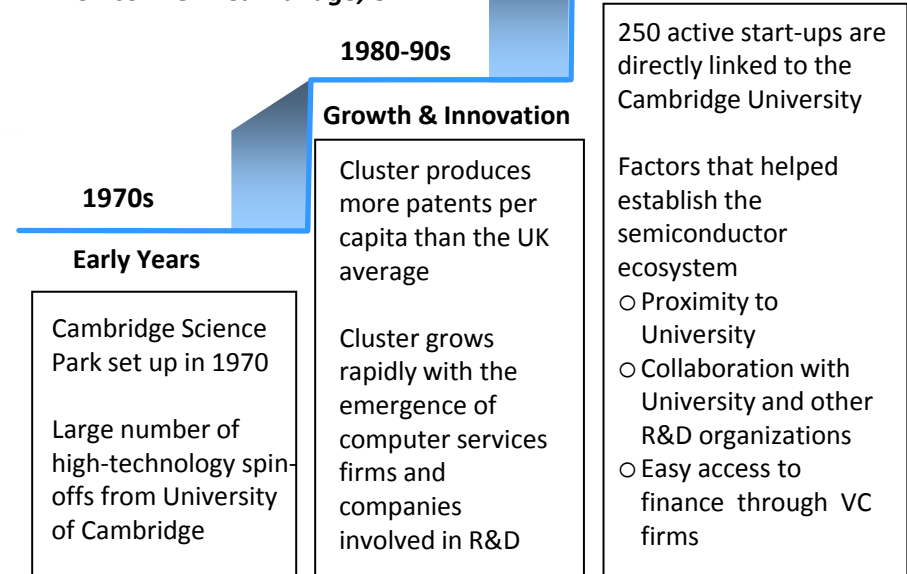
Government initiatives & incentives

Financial incentives

- R&D companies can claim a deduction on their taxable profits if they spend at least £10,000 annually on qualifying R&D activities
- While SMEs can claim 175%, large companies can claim 130% of qualifying expenditure

Technology park/ R&D cluster

“Silicon Fen” Cambridge, UK





ITFM Talent Heat Map for semiconductor talent pool in Cambridge, UK

Cambridge

ITFM Talent Heat Map - Cambridge

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Seoul focuses on both financial incentives & clusters to support its semiconductor industry

Seoul

Seoul,
S. Korea

- S. Korean Semiconductor industry is anticipated to be worth around US\$ 40 Bn by 2013
- Factors that have helped the country to emerge as a global semiconductor leader include strong government support, aggressive industry investments and rising exports
- Investment of US\$ 54 Mn until 2015 in analog chip industry will also help boost the country's semiconductor market

Talent Pool & University ecosystem

- In 2010, Seoul had more than **17,000 employees** working in semiconductor and related sector
- Seoul houses around 20 Universities , including Korea's four most prestigious Universities
- Korea Advanced Institute of Science & Technology has an excellent research infrastructure and collaborations with leading semiconductor industry giants

Competitive landscape

- S. Korea has about 370 large, small and mid sized semiconductor companies , which includes 150 fabless companies

Government initiatives & incentives

Financial incentives

- Tax Support for Tech. Firms
 - Corporate Tax Reduction
 - Local Tax (acquisition/registration/property tax) reduction or Exemption
 - Exemption of Customs Duties etc.
 - Tax Support for Dividends
- In cases where foreign investment satisfies certain conditions, the central and local governments of Korea provide **cash grant** for the construction of a new factory, technology investment etc
- Foreign investment zones, free trade zones, and free economic zones in S. Korea offer investment environment favorable to foreign investors

Technology park/ R&D cluster




- **Seoul Digital Industrial Complex** is the largest IT complex in the country with the total number of employees hired by its resident companies exceeding 100,000
 - The complex attracts diverse technology companies each of which are eligible for 100 percent exemption from acquisition and registration taxes and a 5 year reduction of property tax
- **Magok District:** The hi-tech industrial complex (total area of 742,442m²) aims to become a global R&D hub with links to industry clusters

ITFM Talent Heat Map for semiconductor talent pool in Seoul, South Korea

Seoul

ITFM Talent Heat Map - Seoul

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High  Moderate  Low 

Israel supports the ecosystem for semiconductor industry through grants, funds & technological incubators

Haifa & Ra'anana

Haifa &
Ra'anana,
Israel

- Israel's fabless sector is third only to the USA and Taiwan
- Israel has over 150 fabless semiconductor companies, R&D facilities and design centers, of which over 30 are foreign corporations
- Between 1995 and 2002, almost 150 Israeli companies in the semiconductor industry were acquired by overseas concerns

Talent Pool & University ecosystem

- **~7000 engineers** are employed in the semiconductor domain in Israel
- Close to 10% of the world's electronic designers make their home in Israel. Over 60% of all electronics industry employees in Israel are highly educated engineers and scientists.
- Israel Universities are among top 100 worldwide in Science & Engineering. The world's first nano-wire (3 times thinner than those used in microchips) was created at the Technion-Israel Inst. of Tech.
- Number of engineering graduates from Israel annually: 8,000
- The country has the highest number of engineers per capita (135 per 10,000, compared to 85 in the US). Its researchers publish the highest number of scientific papers in international journals (110 for every 10,000 people)

Competitive landscape

- Israel also has over 150 fabless semiconductor companies, R&D facilities and design centers
- The entry point for most multinational majors has been via active acquisition of startups or smaller companies at Israel

Government initiatives & incentives

Financial incentives

- Foreign investors in Israel are eligible for a **ten-percent corporate income tax rate**, and if located in central Israel, can also be eligible for **two-year full exemption from that tax**
- Funds & Grants
 - Qualified R&D plan makes the company eligible for grants ranging between 20% and 50% of R&D expenses
 - The Hezrek-Seed Fund through which the government matches an investor's investment in the share capital of a seed company, later giving the investors an option to purchase the government shares
 - Funding of R&D projects from the Office of the Chief Scientist
 - Employment Grants for R&D Centers

Special programs




- **Magneton and Noffar** programs: Support for applied academic research in all areas and especially in biotechnology and nanotechnology
 - promote the transfer of the technology to the industry.
 - grants are up to 66% and 90% of the approved expenses
- **Technological Incubators** provide a framework and support (including grants of up to 85% of approved expenses) for nascent companies to develop innovative technologies

ITFM Talent Heat Map for semiconductor talent pool in Haifa & Ra'anana, Israel

Haifa & Ra'anana

ITFM Talent Heat Map - Haifa & Ra'anana

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High  Moderate  Low 

Taipei has seen rapid economic development and has become an important global city in the production of high technology

Taipei

Taipei,
Taiwan

- Taiwan is a leading exporter of electronic goods. High demand from overseas countries for devices such as Smartphones, 3G enabled handsets and Netbooks is supporting growth of the semiconductor industry
- The government has played a key role in the growth of the semiconductor industry

University ecosystem

- Taipei has around twenty Universities, including Taiwan's top five Technology Universities.
- Engineering degrees account for over a quarter of the bachelor degrees awarded in Taiwan.
- In 2009, enrollment in Electronics Engineering accounted for about 18% of the total enrollment in Engineering (30,255 students)
- Taiwan planned to increase its university faculty staff by 85 positions annually for three years, for a total of 255 new university instructors specializing in VLSI education

Competitive landscape

- Taiwan, which has adopted a cluster-based approach, is home to a number of design companies, as it has a well-developed semiconductor ecosystem with fabrication, assembly testing and packaging (ATP) units, along with design units
- Taiwan's semiconductor industry companies mainly are distributed in Hsinchu and the Great Taipei
- Taipei houses more than 90 IC design companies.

Government initiatives & incentives

Financial incentives

- Hi-tech industry provided **5 year tax holiday** on corporate income, applicable to entire income for new company, and on incremental income from new construction/expansion for pre-existing companies
- Products manufactured for export in designated science parks also provided **zero tax exemption from import** duties & certain other taxes
- A company may take a **35 tax percent credit** for R&D expenses and personnel training against income tax payable for 5 consecutive years

Special programs

- **Si-Soft Project** to promote Taiwanese human resources in microelectronics; includes opening a semiconductor "design park" and invest roughly \$250 mn in R&D funds in optoelectronics, embedded processor design, and wireless technology

Technology park/ R&D cluster




- **Hsin-chu Science-based Industrial Park** following the model of Silicon Valley in the US to create an environment conducive to the development of a high-technology industry (including semiconductors)
 - Proximity to two of Taiwan's oldest universities gives the park advantages of skilled labor supply & low training costs
- Institutions such as **Industrial Technology Research Institute** collaborate with private-sector companies to build research competitiveness

ITFM Talent Heat Map for semiconductor talent pool in Taipei, Taiwan

Taipei

ITFM Talent Heat Map - Taipei

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Singapore government Economic Development Board (EDB) has made major investments to nurture talent ecosystem specifically for its semiconductor industry

Singapore

Singapore

- Singapore's semiconductor industry started more than 30 years ago when some leading MNCs set up their plants in the region
- Today, Singapore is home to more than 40 multinational and indigenous semiconductor companies spanning the full semiconductor value chain of activities
- Semiconductor Industry accounts for 48 percent of the total Electronics output

Talent Pool & University ecosystem

- Semiconductor industry employs more than 40,000 people currently and grew by 64% in 2010
- Engineering degrees account for 30% of bachelor degrees. Singapore has around 3 major Research Institutes and 3 Universities in Microelectronics and IC Design area
- Singapore govt. Economic Development Board (EDB) has invested \$8 million to encourage undergraduates to specialize in semiconductor wafer fabrication, with the objective of training 900 engineers

Competitive landscape

- One of the largest suppliers of fabless chips has a test center which carries out design verification and failure analysis for its new products and technologies designed in its design centers in India, China, Taiwan, and Korea.
- Over 20 IC design and system design companies in Singapore formed **Microelectronics IC Design And System Association (MIDAS)**, to develop an environment where members interact & feed off each other

Government initiatives & incentives

Financial incentives

- Singapore grants a **5-year tax exemption** on foreign-sourced royalties or income used for R&D in Singapore under its Research and Development and Intellectual Property Management Hub program
- Firms qualifying as “pioneer companies” may be **exempt from income tax** on qualifying income for up to 15 years, and thereafter for another five years may enjoy a rate as low as five percent pursuant to a development and expansion incentive
- **Research Incentive Scheme for Companies (RISC)**: Co-funding to support the set-up of R&D centers, and/or the development of in-house R&D capabilities in strategic areas of technology supportable project costs
- **Initiatives in New Technology (INTECH)**: Co-funding to support the manpower development in the application of new technologies, industrial R&D and professional know-how

Technology park/ R&D cluster




- **Fab Parks**: With a first-class physical infrastructure comprising of 4 specialized wafer fab parks that occupy ~200 hectares, and end-to-end semiconductor R&D capabilities from IC design and process enhancement to embedded software and system development

ITFM Talent Heat Map for semiconductor talent pool in Singapore

Singapore

ITFM Talent Heat Map - Singapore

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High  Moderate  Low 

Additional Information

- The full report provides **information on global semiconductor hubs** which include the following cities
 - Taipei, Taiwan
 - Seoul, South Korea
 - Nice, France
 - Singapore
 - Cambridge, UK
 - Haifa, Israel
 - Tel Aviv, Israel
 - Beijing, China
 - Shanghai, China
 - Bangalore, India
 - Hyderabad, India
 - Dallas, US
 - San Jose, US
 - Santa Clara, US
 - Dresden, Germany

- Full report on Semiconductor hotspots can be accessed at Zinnov 's **Global Location & Talent Pool Portal**.
 - Sign up today for a free trial account http://zinnov.com/US/demo_signup.php
 - Or, email us at info@zinnov.com

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5th Block, Koramangala
Bangalore – 560095
Phone: +91-80-41127925/6

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Paras Downtown Center,
Golf Course Road, Sector 53,
Gurgaon – 122002
Phone: +91-124- 4378211/13

Thank You



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