Government Best Practices to Support Semiconductor Sector Innovation

Stephen Ezell
Vice President, Global Innovation Policy
Information Technology and Innovation Foundation

October 31, 2017
About ITIF

- One of the world’s top science and tech policy think tanks.
- Formulates and promotes policy solutions that accelerate innovation and boost productivity to spur growth, opportunity, and progress.
- Focuses on a host of issues at the intersection of technology innovation and public policy:
  - Innovation processes, policy, and metrics
  - Science policy related to economic growth
  - E-commerce, e-government, e-voting, e-health
  - IT and economic productivity
  - Innovation and trade policy
Today's Presentation

1. Maximizing Innovation in the Global Economy
2. Maximizing Innovation in Semiconductors
Innovation Industries Share Three Distinct Characteristics

1. They compete by inventing next-generation products or services.

2. They are characterized by very high initial fixed costs (e.g., R&D and design), but very low marginal costs.

3. They embody and depend on intellectual property (IP).
Conditions Needed for Global Innovation to Flourish

1. Access to large markets (e.g., economies of scale).
2. No artificial, non-market-based competition.
3. No “forced localization requirements” that unnecessarily fragment global production systems.
4. Protection of IP rights.
Maximizing Semiconductor Sector Innovation

Appropriate Roles for Government

- Invest in basic and applied scientific research.
- Fund university R&D and industrial Ph.D.’s.
- Convene and fund sectoral PPPs focused on pre-competitive research, tech roadmaps, testbeds.
- Fund proof of concept grants for small businesses.
- Design tax policy to spur industrial competitiveness.
- Protect intellectual property rights (IPRs).
- Procure on a “best value” basis.

Inappropriate Roles for Government

- Erect barriers to semiconductor trade.
- Deploy import substitution policies.
- Fund private-sector M&A/FDI activity.
- Direct private-sector procurement.
- Provide weak IPR protection/enforcement.
- Restrict investment/immigration activity.
- Focus on national champions at the expense of innovative start-ups.
Invest Robustly in Semiconductor R&D

R&D Expenditures as % Sales, By Industry, 2014

- **Semiconductors**: 16.0
- **Pharma and biotech**: 14.62
- **Software and computer services**: 10.15
- **Tech hardware and equipment**: 8.08
- **Leisure goods**: 5.54
- **Aerospace and defense**: 4.62
- **Electronic and electrical equipment**: 4.54
- **Automobiles and parts**: 4.46
- **Healthcare equipment and services**: 3.85
- **Industrial engineering**: 2.92
- **Chemicals**: 2.62
- **General Industries**: 2.54

Data for world’s top 2,500 companies in sectors, 2014

Source: McKinsey on Semiconductors, 2017; SIA Factbook 2017
Foster Semiconductor Sector PPPs

- Semiconductor Technology Advanced Research Network (STARnet)
  - Engages 8 companies/46 universities to find paths around the fundamental physical limits threatening the long-term growth of the microelectronics industry.

- CEA-Leti helps companies performing micro- and nanotechnology research bridge the gap between basic research and manufacturing.
  - 37 companies have been formed as Leti spinoffs, resulting in the creation of more than 2,500 jobs.
Embrace Open Trade Policy to Participate Fully in ICT GVCs

Membership and Participation in ICT GVCs

![Chart showing membership and participation in ICT GVCs from 1995 to 2009 for ITA Members and Non-ITA Members. ITA came into effect in 1996.]

Embrace Open Trade Policy to Participate Fully in ICT GVCs

ICT Exports as Percentage of Total Goods Exports, 2015

Source: World Bank
Government Intervention in Markets Usually Ineffective

- The value added by Brazil and India’s semiconductor industry declined by 50% and 32%, respectively, from 2007-2014.
- Brazil’s semiconductor exports 10% less in 2014 than 2000.

Preference for Domestically Manufactured Electronic Goods (PMA)

The Ministry of Electronics and Information Technology (MeitY) has notified the Policy for providing preference to domestically manufactured electronic products in Government procurement for its own use and not with a view to commercial resale or with a view to use in the production of goods for commercial sale on 23.12.2013.

Global Supply Chains Maximize Production and Value

Beyond Borders: Semiconductors are a Uniquely Global Industry
Typical semiconductor production process spans multiple countries: 4+ Countries, 4+ States, 3+ trips around the world, 25,000 miles travelled, 100 days TPT, 12 days in transit.

1. Silicon ingots cut into wafers
2. Bare wafer into fab wafer
3. Fab wafer sorted, cut into die
4. Die are assembled, packaged, tested
5. Final product shipped for inventory
6. Chip integrated into consumer good by end product manufacturer
7. Customer buys end product

$1,340 Billion in Global Trade
Top Participants in Global Trade: Semiconductor Goods
- China
- Hong Kong
- Singapore
- Taiwan
- Korea
- USA
- Malaysia
- Japan
- Germany
- Philippines

$36.8 Billion in Global Trade
Top Participants in Global Trade: Fabrication Material Goods
- China
- USA
- Japan
- Germany
- Korea
- Taiwan
- UAE
- Singapore
- UK
- France
- Mexico
- Netherlands
- Brazil

$23.7 Billion in Global Trade
Top Participants in Global Trade: Assembly, Test, Packaging Goods
- China
- Germany
- USA
- Japan
- Korea
- Hong Kong
- Italy
- France
- Netherlands
- Poland
- Canada
- Belgium

Source: Nathan Associates, *The Semiconductor Global Value Chain*
Summary

- Government intervention to create industries that aren’t market facing are unlikely to achieve long-term success.

- When governments invest in industries’ innovation capacity—e.g., science, talent, infrastructure, etc.—they’re far more likely to foster enterprises that can flourish in market-based global competition.
Thank You!

Stephen Ezell  |  sezell@itif.org  |  202.449.1349