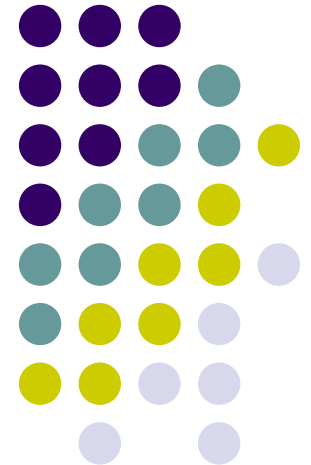
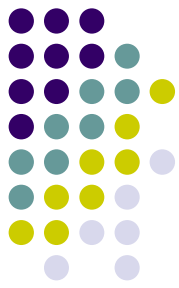


Brain circulation networks

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UC Berkeley School of Information
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The view from





Explaining innovation in the periphery

The rise of “brain circulation” has fundamentally altered developmental opportunities in the periphery

- Model: Taiwan, peripheral in 1970s, became a center of technology entrepreneurship and innovation when the “brain drain” was reversed in the 1980s and 1990s
- Cases: The experience of China and India demonstrate the transformative impact of brain circulation as well as the enduring power of domestic political and economic institutions to shape developmental trajectories

Beyond core and periphery



Core-periphery model: Technology, capital, and skill reside in wealthy, developed nations (**core.**) Poor nations (**periphery**) remain underdeveloped suppliers of natural resources or cheap labor for corporations based in core.

New variant I: Alliance of domestic corporations and nation-state in periphery to master mass manufacturing--become “fast followers” but not innovators or leaders.

New variant II: Major corporations from core create global supply chains to tap skill and resources in periphery--but maintain hierarchical control over production networks

=> “**Dependent development**”

Rethinking actors in global economy



Not just global corporations

- *The New Argonauts*: Cross-border professional and technical communities transfer technical, market, & business information rapidly between distant regions

Not just the nation-state

- Dynamic clusters of skill and technology in peripheral regions--supported by aggressive local policymakers

Not just low-cost labor

- Entrepreneurial experimentation and innovation support upgrading and rapidly rising wages in peripheral regions

Why now? A new global environment



1. Radical reductions in transportation and communication costs expand professional options for immigrants
 2. Decentralization of corporate hierarchies and vertical specialization of production lower barriers to entry
 3. Open supplier networks and advanced software platforms support real-time long distance collaboration
- => The new Argonauts create entrepreneurial ecosystem and “regional advantage” in periphery by linking home regions to more advanced regions**



The new Argonauts in action

What do they do?

Identify under-utilized skill, talent, and knowledge in home country and collaborate with former classmates and colleagues to link them into global networks

How?

- Set up local development operations, start new firms, advise and/invest in new or established firms, build cross-regional partnerships, etc.
- Collaborate with local policymakers and industry leaders to identify and remove obstacles to local development (education, capital markets, research, regulation, etc.)

Origins: the postwar “brain drain”



- Following WWII the best and brightest students from developing nations gained access to US education
- Most students remained in US or European host country due to superior professional and economic opportunities
- US accused of creating a vicious cycle: the brain drain made peripheral nations poorer and rich nations richer
- The analysis was not wrong – but the brain drain has created unanticipated benefits in recent decades

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Immigrant professional networks



- Immigrants built associations to support integration and professional advancement in Silicon Valley
 - Helped immigrants find jobs or promotions when “glass ceilings” limited advancement within companies
 - A source of skill, relationships, and learning the Silicon Valley model of entrepreneurship and experimentation
- Although many groups had associations, Chinese associations were especially strong and numerous...

Ethnic professional/technical associations



Started in Silicon Valley, from oldest to newest....

- Chinese Institute of Engineers (CIE-USA)
- Chinese Software Professionals Association (CSPA)
- Silicon Valley Chinese Engineers Association (SCEA)
- Silicon Valley Indian Professionals Association (SIPA)
- Monte Jade Science and Technology Association
- Chinese American Semiconductor Professionals Association
- The Indus Entrepreneur (TiE)
- Chinese Information and Networking Association (CINA)
- Hua Yuan Science and Technology Association
- Sivan Group (Israeli)
 - and many more, including alumni associations

Immigrant impact on Silicon Valley



- Indian and Chinese started ~27% of technology companies in Silicon Valley, 1980 -2000
 - 4,146 companies
 - 122,386 jobs
 - \$37 billion sales
- High profile successes build confidence and reputation in home countries
 - Hotmail's Sabeer Bathia
 - Yahoo's Jerry Yang

The new Argonauts set sail



Silicon Valley's immigrants seek wealth and professional success in their home countries--like Jason and the Argonauts of Greek mythology who faced hardship in search of the golden fleece



From brain drain to brain circulation



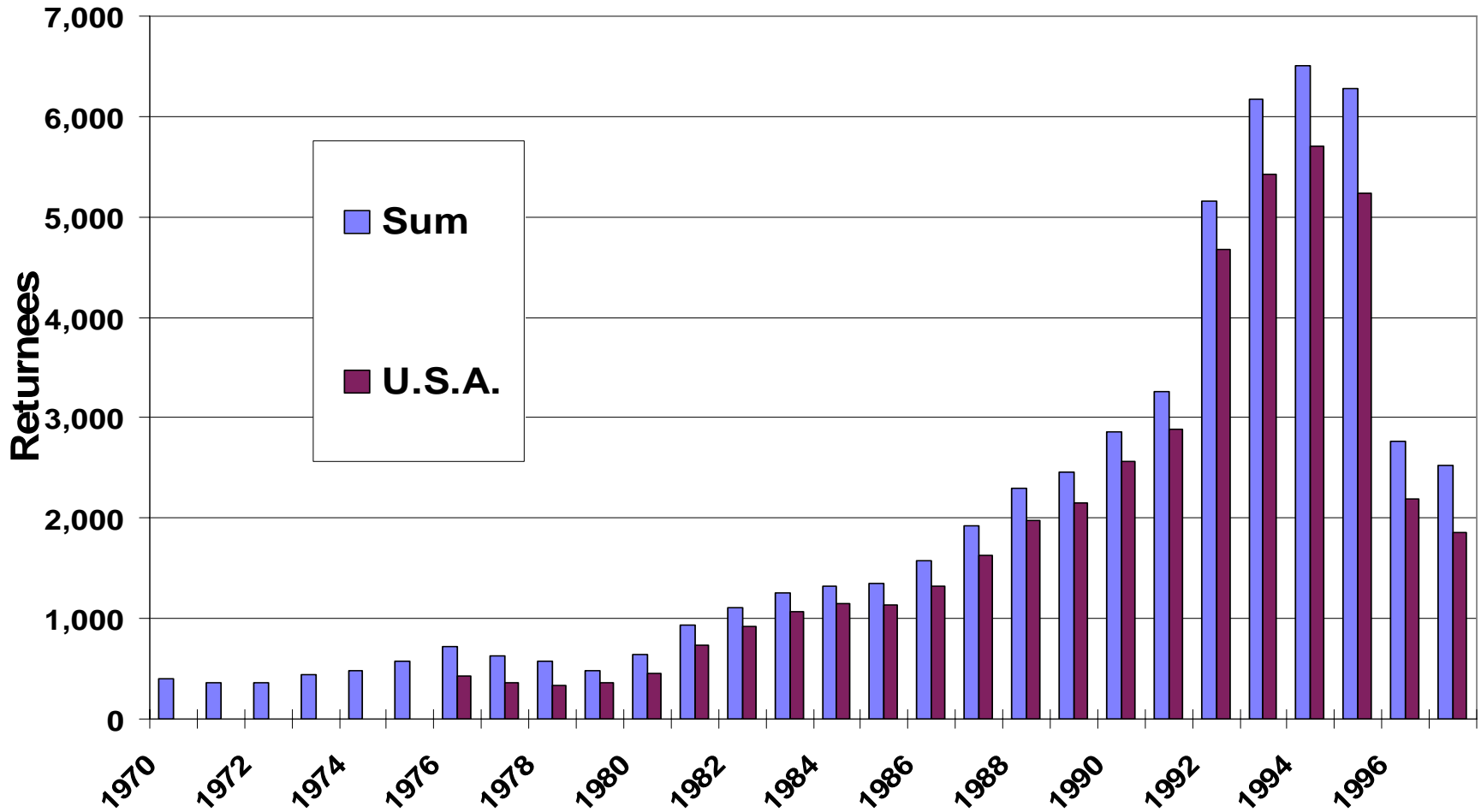
- Associations build initial connections to home countries via relationships with policymakers, classmates
- Returnees bring focus on transparency, minimization of hierarchy and venture capital-based entrepreneurship(to countries dominated by state or family-run firms)
- Returnees build local as well as global partnerships, especially with Silicon Valley
- The new Argonauts work with policymakers, managers and universities to improve domestic environment

Origins of Taiwan's technology cluster



- 1970s: Taiwanese policymakers work with Overseas Chinese to develop technology policy and environment
- 1980s: Creation of technology infrastructure: creation of venture capital framework, strategy for government R&D agencies ERSO/ITRI, upgrading of universities, alumni & professional associations provide links
- Consciously created an environment that would attract Overseas Chinese to relocate from Silicon Valley to start or invest in technology companies

Returnees to Taiwan, 1970-1997



Hsinchu Science Park: Silicon Valley sibling

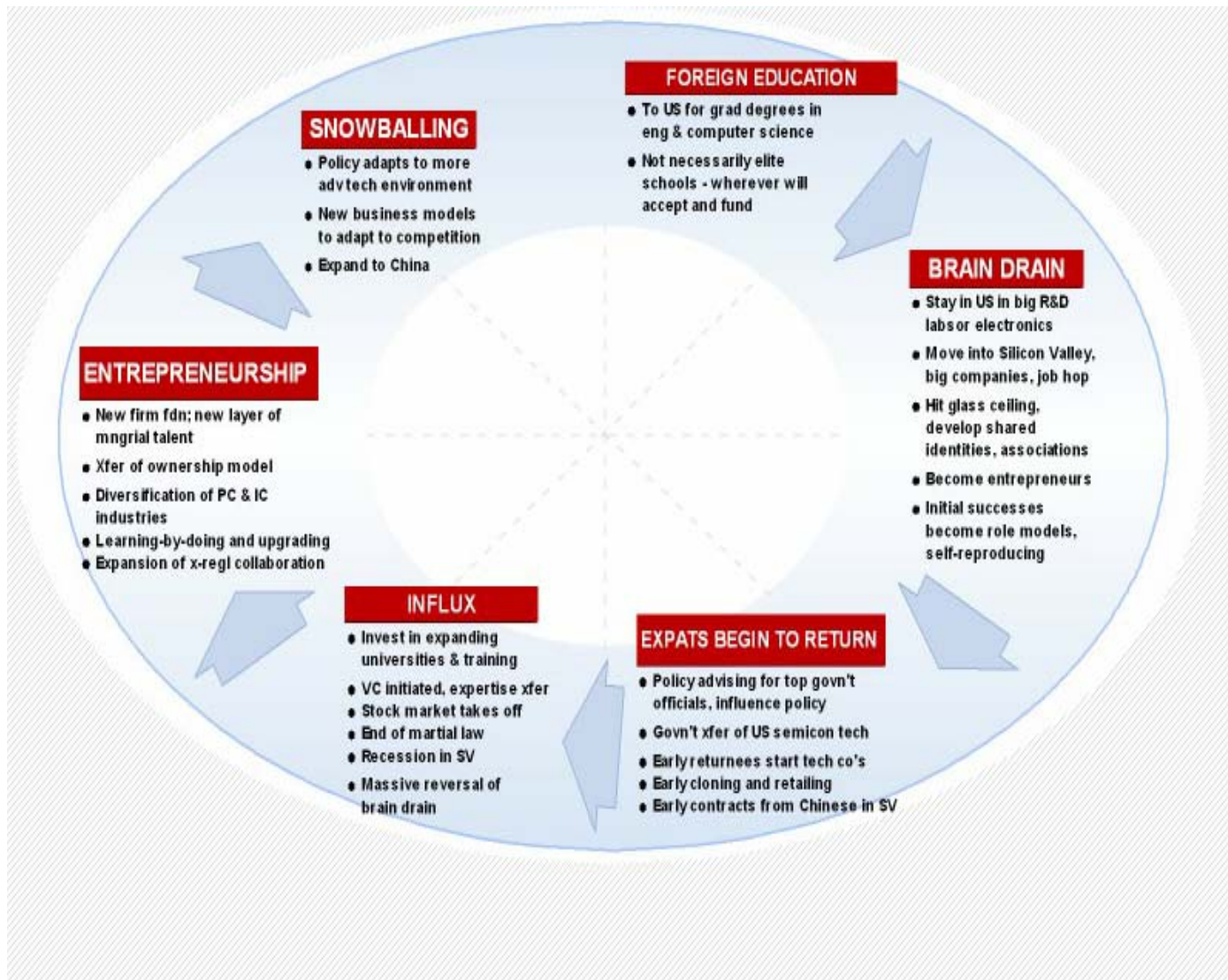
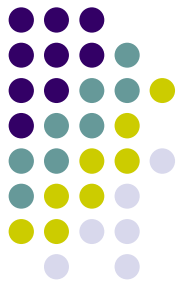


Silicon Valley-Hsinchu connection: 1990s



- Stock market booms, entrepreneurship takes off: approx 10,000 specialized firms in IT industry
- Cross-regional investors and networked firms support co-design, co-production
- Incremental innovation and upgrading of PC, IC, and systems manufacturing: OEM-ODM
- Hsinchu matures from sibling to partner
 - Perfects flexible, low cost, high quality IT manufacturing
- Silicon Valley moves up value chain
 - Pioneer of new product definition, architecture, technology

Brain circulation: Taiwan case



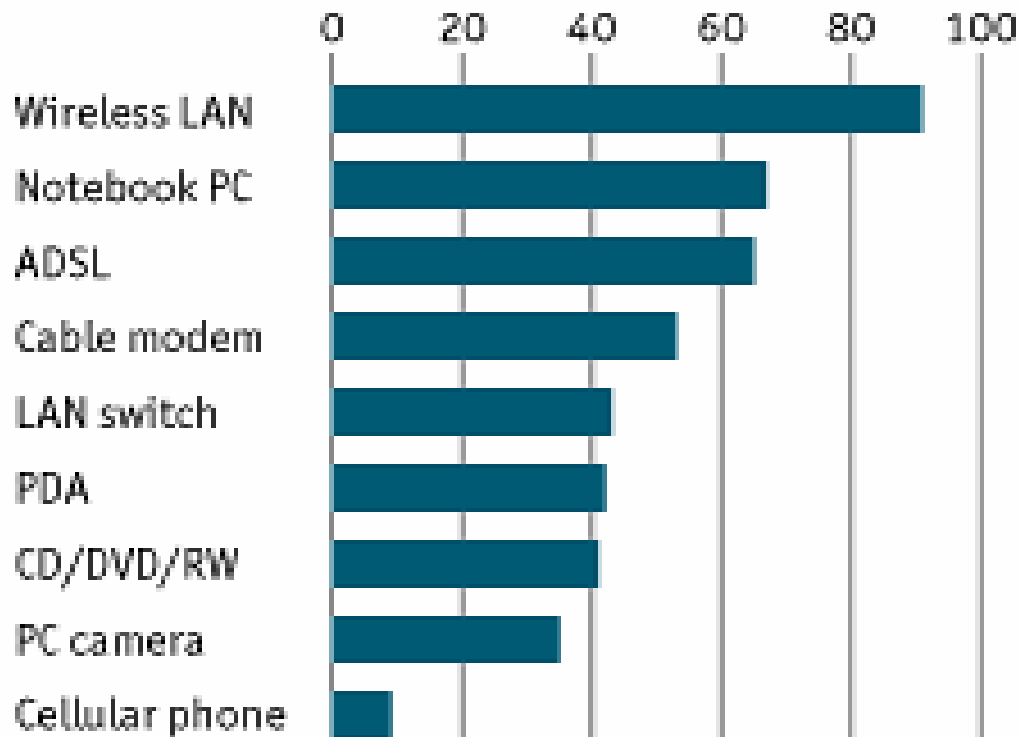


Taiwan dominates hardware markets

Cornering the market

5

Products and applications made by Taiwanese companies, 2003 world market share, %



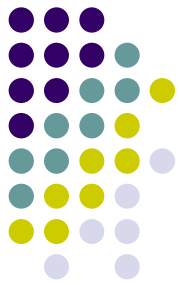
Source: Industrial Technology Research Institute

The Hsinchu-Shanghai connection



- Taiwan's electronic systems manufacturers expand across straits to Yangtze River Delta for lower cost labor
- Cross-regional investment in large scale IC manufacturing in Shanghai (SMIC, Grace, etc.)
- Shanghai area boasts complete IT supply chain but dominated by foreign investment and technology
- Hsinchu moves up value chain to specialize in global logistics and design, even new brands (OBM)

Silicon Shanghai



Shanghai-Silicon Valley connection



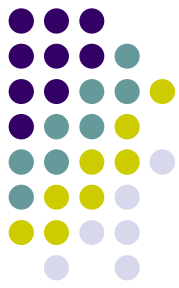
- Silicon Valley's IC suppliers and professional services (venture capital, legal, banking) move to Shanghai
- Returnee and cross-regional firms emerge such as Newave, UTStarcom, WebEx, Linktone, and Verisilicon
- To date new technology startups have had limited success and seen only modest reinvestment
 - Capital markets and venture capital industry immature
 - Shortages of managerial, marketing and experienced technical talent
 - Limited interaction with established domestic IT firms

Bangalore-Silicon Valley connection



- India in 1980s and 90s provides low-cost low value added software coding and maintenance services
 - Infosys, TCS, Wipro serve US corporations, onsite
 - Silicon Valley-based Indian managers pioneer MNC development centers in Bangalore
- Indian firms and MNCs improve quality and complexity of services, no longer just low cost (CMM SEI leaders)
- Cross-regional venture capital and start-ups pioneer IC design, consulting, and internet services
- Poor infrastructure, limited skill base, and enclave development may limit potential for upgrading

Bangalore: a software services partner



The new Argonauts and IT networks



- The new Argonauts have led capability building, cross-regional collaboration, and upgrading of IT supply chain
 - Silicon Valley remains a pioneer of new product definition, architectures, leading edge technologies
 - Taiwan specializes in global logistics and design
 - Shanghai leads low cost, high quality manufacturing
 - Bangalore leads low cost, high quality software and services
- As cross-regional collaborations mature, regions deepen their capabilities and innovative capacity, benefiting entire IT supply chain

New approach to development



- The new Argonauts seed development in periphery by tapping local skill and knowledge, reshaping policy
- Global connection to other specialized regions combined with local experimentation supports capability building
- Dynamic regions continue to attract skill, capital and technology in spite of rising costs--*regional advantage*
- Cross-regional collaborations enable co-design and mutually beneficial innovation across network
- New regional partners have potential to contribute to creation of entirely new products, industries and markets

Long term scenario



- Brain circulation replaces brain drain in global economy
- Global network of specialized, high wage regional economies replaces core-periphery development
- Open systems allow co-design and mutually beneficial upgrading and innovation across the value chain
- New pattern creates challenge of enclave development and uneven development within national economies
- But potential for more widely distributed and sustained growth of global economy

