

No More Sputnik: The Tripartite Alliance Fifty Years Later

CSIS / ASTRA - Fifty Years After Sputnik

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Comparative Advantage

- ◆ Old Model - David Ricardo
 - ◆ Comparative advantage based on natural resource advantage - was permanent
- ◆ U.S. Model - Comparative Advantage in Innovation
 - ◆ WW2 - development of massive federal R&D support under V. Bush - Rad Lab ex.
 - ◆ V. Bush - “Endless Frontier” - federal postwar support for basic science and talent
 - ◆ Sputnik drove a major new influx of R&D funding and science talent support
 - ◆ Comparative advantage in innovation has become the new economic model worldwide

The Innovation Change Sputnik Forced

- ◆ WW2 - connected model - Vannevar Bush at NRDC connected all stages, R,D,prototype, production
- ◆ Post War - Bush salvages basic research, but it was a disconnected model - R&D Valley of Death
- ◆ DARPA / Eisenhower story
 - ◆ The services ran three space programs in three separate service stovepipes
 - ◆ Eisenhower removed space from the services and gave it to ARPA in Feb. '58
 - ◆ Then he founded NASA in April; ARPA does IT instead
 - ◆ DARPA brought Defense R&D back toward a connected model
 - ◆ like the organizational ethos at the RAD Lab and Los Alamos but leaner - DARPA sponsored research it didn't do it
 - ◆ SO: WE CELEBRATE SPUTNIK; ALSO SHOULD CELEBRATE THE REVIVAL OF THE CONNECTED MODEL AT DARPA

National Innovation System

- ◆ SPUTNIK ERA: we had a national innovation system:
- ◆ Solow and Romer:
 - ◆ Two direct innovation factors: economic growth based on 1) “technological and related innovation,” and 2) “human capital engaged in research”
 - ◆ Robert M. Solow (Prof. of Economics, MIT), Growth Theory, An Exposition (Oxford Univ. Press, New York, Oxford, 2nd edition 2000), pp. ix-xxvi (Nobel Prize Lecture, Dec. 8, 1987)
 - ◆ Paul Romer (Prof. of Economics, Stanford) Endogenous Technological Change, Journal of Political Economy, vol. 98, (1990), pp. 72-102
- ◆ Richard Nelson -
 - ◆ Innovation operates in a system
 - ◆ Best understood as operating at the national level
 - ◆ Complex system of institutions, firms, organizations, and public and private policies and practices that enable tech innovation
 - ◆ 1970’s institutional mix: Basic research, grad sci ed, gov’t and corp labs, gov’t R&D agencies, R&D tax incentives, etc.
 - ◆ Richard R. Nelson (Prof. of Economics, Columbia), National Systems of Innovation (Oxford Univ. Press 1993) pp. 3-21, 505-523 [growth economic treatise on elements of innovation systems from a range of nations]

Is Innovation Still National?

- ◆ Significant argument that innovation is going international - that the "nation" is not the right measurement unit for innovation systems
 - ◆ But: the two key direct innovation factors still overwhelmingly dependant on the nation state
 - ◆ Basic research - overwhelmingly from national gov't
 - ◆ Sci/Tech talent still major support from national gov't
 - ◆ Also: gov't via defense & health role, dominates early stage innovation launch
 - ◆ (Vernon Ruttan, *Is War Necessary for Economic Growth* (Oxford 2006))
 - ◆ So: The nation state still owns a large part of the innovation system - particularly for radical / breakthrough innovation

Traditional Innovation Allies Splitting Apart

- ◆ Old Model - WW2 through Sputnik era through first competitiveness period with Japan
 - ◆ The tripartite alliance: DOD, universities, industry were close interactive innovation allies, there was a unified, connected whole
- ◆ New Model - major split developing
 - ◆ Industry going global
 - ◆ Universities uncertain, thinking international but still anchored in national innovation system deeply tied to gov't R&D and talent support
 - ◆ Engineering - historically tied to nation state because the state built their projects; Science - international religion
 - ◆ National security leadership tied to innovation leadership
 - ◆ DOD faces serious problems with this split up

Global Economics

- ◆ Globalized world economy
 - ◆ growing number of prosperous nations - there will be more innovation system competitors;
 - ◆ China/India: leapfrog approach - can be developing and have advantages of developed
 - ◆ Basic science can be performed in many places - cheaply
 - ◆ IT enables dispersal of R&D
 - ◆ R&D can be tied to emerging global markets
 - ◆ US industry outsourcing R&D (REALLY "D")
 - ◆ "open innovation" by industry is a growing reality
 - ◆ Suzanne Berger, US following distributed manufacturing model (Suzanne Berger, How We Compete (Currency 2005))
 - ◆ Old system: like model airplane - each piece has to be individually fitted, requires mfg. integration
 - ◆ New system: like Legos - IT based standards, design - each Lego fits no matter where made
 - ◆ Ipod made all over the world - perfect fit - truly distributed mfg.
 - ◆ DISTRIBUTED R&D?

Innovation Wave Theory

- ◆ We are in *interim stage of the IT innovation wave* - 15 years into 40/50 year wave
 - ◆ Focus on secondary/incremental technologies not initial breakthrough enabling technologies
 - ◆ Carlotta Perez, Rob Atkinson, innovation wave theory
 - ◆ Carlota Perez (Research Fellow, Univ. of Essex, U.K.), Technological Revolutions and Financial Capital (Edward Elgar 2002), pp. 3-46
 - ◆ Robert D. Atkinson (Pres., ISTI), The Past and Future of America's Economy – Long Waves of Innovation that Power Cycles of Growth (Edward Elgar 2004), pp. 3-40
 - ◆ Co's: Google, My Space, EBay, vs. semiconductors in 60-90
 - ◆ Secondary technology co's vs. radical innovation based co's
 - ◆ Now: more focus on business models, synthesis of science with design, interdisciplinary, social science integration
 - ◆ "Post-Scientific" era- less focus on breakthrough innovation, more on incremental (Chris Hill, Issues In Sci&Tech (Fall 07))
 - ◆ Because we are in an *interim phase, less focus on the need for radical innovation - dispersal is a possibility in secondary and incremental advances*

What's Happened in the Global Economy to Comparative Advantage?

- ◆ US - historically three phases of US attitudes to dispersal of its economic power
 - ◆ Hamilton - US political liberty from Europe depended on building a strong, independent, commercial mfg. base - lasted through WW2
 - ◆ Cold War - could allow economic integration with allies (Europe, Korea, Japan, etc.) - limited dispersal as geopolitical exercise of soft power
 - ◆ Now - end of the Cold War - dispersal is "just happening" - implications not fully thought through

What does Samuelson say?

- ◆ Comparative advantage in innovation is not permanent like a comparative advantage in resources - it can shift as competitors acquire innovation advantage

- (Paul A. Samuelson, "Where Ricardo and Mill Rebut and Confirm Arguments of Mainstream Economists Supporting Globalization", Jour. of Economic Perspectives, Vol. 18, No. 3 (Summer 04))

Samuelson: Economic history is replete with the story of capturing comparative advantage:

- ◆ Example: Farming moves from east US to midwest two centuries ago
- ◆ Example: Textile and shoe mfg. moved from new England to the low-wage South early last century
- ◆ Example: English mfg. leadership shifted to the US starting in the middle of the 19th century
- ◆ “Even where the leaders continued to progress in absolute growth, their rate of growth tended to be attenuated by an adverse headwind generated from low wage competitors and other technical imitators.”¹¹

Samuelson's Conclusions:

- ◆ So: "a productivity gain in one country [esp. when coupled with a wage differential] can benefit that country alone, while permanently hurting the other country by reducing the gains from trade possible between the two countries" – all this is "long run Schumpeterian [the creative destruction of capitalism] effects"
- ◆ There is a "roulette wheel of evolving comparative advantage" in a world of free trade
- ◆ "Comparative advantage cannot be counted on to create...net gains greater than the net losses from trade"
- ◆ But if you respond with tariffs and protectionism, you may be breeding "economic arteriosclerosis"¹²

Dispersing Research vs. Dispersing Innovation

- ◆ Innovation itself (not plain vanilla incremental R&D) is still like real estate - location location location.
- ◆ Unlike invention and discovery, innovation requires great groups in deep face-to-face connection
- ◆ Innovation is radical by its nature not incremental or secondary
- ◆ Research is still and will indefinitely remain entirely funded on a nation state model
 - ◆ the minute the nation state gets the idea that the gains are flowing elsewhere the spigot will be turned off
- ◆ And there is no international research funding model
- ◆ The gains of innovation into the intermediate stages will remain local, there are "increasing returns" at this stage, so low cost not critical, even if intermediate stage mfg may be distributed
- ◆ Perhaps research also can, but true innovation great groups can't.
- ◆ However, figuring out how to obtain national gain from collaborative R+D would be a useful pursuit

Where is Congress?

- ◆ Established firms (not startups) going offshore, although residual stake in the domestic economy
- ◆ Univ's still deeply tied to national innovation model for R&D and talent support - and tend to be in radical/startup side not incremental (industry role)
- ◆ Congress just passed America COMPETES Act
 - ◆ Led by industry and univ. advocacy
 - ◆ Theory: US economic wellbeing tied to US ability to innovate - which is tied to R&D and talent
 - ◆ Heart of bill: double physical science R&D (NSF, DOE Office of Sci., NIST); invest in science talent
- ◆ Congress believes that Comparative Advantage between regions and nations is still alive and well
 - ◆ Regional advantage appears critical, and the political system understands economic advantage of regions, and role of innovative firms and universities in advancing regions
 - ◆ Varied wealth of nations also indicates reality of innovation-based comparative advantage

Congress' Concerns

- ◆ House Science - June 27th - hearing on the globalization of universities
 - ◆ Committee has been highly responsive to univ. case to increase R&D for US economic gain
 - ◆ But: starting to ask where is federal R&D investment going? To univ's to create jobs abroad?
- ◆ Univ's called to testify before Rep. Dingell during Japan competitiveness period, based on ties to Japanese research support
- ◆ Strong anti-university movement now on left and right - the conservative and populist sides - re costs
 - ◆ House Education - tuition price controls
 - ◆ Senate Finance Committee wants to control univ. endowments
 - ◆ Yet it's this financial flexibility that made US universities strong -
 - ◆ 17 of the top 20 in the world; compare to continental Europe's univ's
- ◆ If Congress gets the idea that univ's are using federal taxpayer R&D investments to advantage non-US firms and jeopardize US employment....

Systemic US Advantages

- ◆ Of course, it's not just R&D and talent behind US innovation system, as critical as those factors are
- ◆ Other US systemic advantages:
 - ◆ Culture of risk-taking, tolerance of failure
 - ◆ New models of VC and angel capital promote entrepreneurial advantage key to standing up radical innovation vs. incremental innovation
 - ◆ Flexible and open workforce; openness to immigrant talent (Richard Freeman, America Works (Sage Foundation 2007))
 - ◆ Former Sputnik-era U.S. advantage: connected science
 - ◆ DARPA, Sputnik era creation to cross the "valley of death" between R&D, research and invention, via connected, translational research model tied to breakthrough science
 - ◆ Created basis for IT revolution/wave
 - ◆ This connected science model is in decline - makes it harder for US to do breakthrough radical innovation

Need for a Conscious Approach

- ◆ The innovation community needs a “foreign policy” - to think through its directions abroad, not an ad hoc approach
- ◆ Where should the tripartite alliance be?
 - ◆ DOD in many ways is critical -
 - ◆ it is the key historical supporter of US innovation waves (it launched 5 major ones in the 20th century, from aircraft to computing), but has lost track of its technology strategy
 - ◆ DOD needs to reengage
 - ◆ Univ's
 - ◆ Need to draw talent from around the world - connect next-generation talent to US
 - ◆ Need for US students to understand int'l economy and be able to participate in it
 - ◆ Key to US co's and US employment

A Conscious Approach, Con't

- ◆ What kinds of relationships abroad should R&D players have?
 - ◆ What is optimal - for the players and from the perspective of US R&D support?
 - ◆ Where is comparative advantage in collaborative R&D?
- ◆ Guided by what policies?
 - ◆ For student education and understanding?
 - ◆ For research, including use of federal R&D funds, and collaboration with foreign-based firms?
- ◆ Need: stated policy that is defensible in a government/ Congressional context that the players are prepared to testify to
- ◆ Should be possible to create a stronger and more flexible system in next gen innovation legislation₈