

Technology, Science, and Innovation: Institutions and Governance
PUBP-820
Fall, 2007

Professor David M. Hart
School of Public Policy
George Mason University

Times, Places, and Contact Information

Class meetings: Krug Hall 3, Wednesdays, 4:30-7:10 p.m.
Office hours: Wednesdays, 1:00-2:00 p.m. or by appointment.
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Objectives

New technologies present extraordinary opportunities for achieving major public policy objectives, such as economic growth, environmental sustainability, public health, military security, and the advancement of knowledge. Yet, they may also place the very same objectives in jeopardy. Whether the public benefits from technological change depends on how well the processes of research, innovation, and diffusion are governed.

This course provides an understanding of the workings of the technical and scientific communities and their interactions with the cultural, economic, and political institutions that shape what these communities do. (Please note that these institutions “shape,” rather than determine, the outcomes of research, innovation, and diffusion; technology and science have substantial “internal” momentum as well.) Students will become familiar with the main theoretical frameworks that seek to explain these complex governance processes over time and across geographical and jurisdictional levels (regional, national, supranational, and global). The course places particular emphasis on the globalization of technological innovation and its implications for contemporary policy-makers.

Participants

PUBP-820 welcomes all SPP doctoral students and aims to support their progress toward field exams and dissertation proposals. The course is open to students enrolled in other programs as well, if they have a deep interest in and appropriate background for it, space permitting and subject to the instructor’s approval.

Course Texts and Materials

Course readings will be made available through e-reserves or the course website.

Format

Each class meeting (excluding the first and last) will have two distinct components. The first half of the class will revolve around short papers prepared by the students, as described below, that focus on concepts introduced in the previous week. The second half will be composed primarily of a lecture that lays out core concepts, building on the readings and augmented by clarifying and critical discussion among all participants.

Assignments and Grading

Each student will prepare five essays of approximately 1500 words each. The class will be divided into two groups, each writing an essay every other week on a staggered basis, so that approximately half of the students will have an essay to share each week. (Each student will have leeway to skip one date for their group.) The essays will not require research, but rather will be critical assessments of course concepts and related scholarly and policy questions. Detailed guidance for these essays will be provided in the first class. The essays will be weighed equally in the semester grade.

Participation

This class depends vitally on preparation and active participation. No formal weight in the semester grade will be assigned to participation, but failure to participate adequately will result in lowering of assignment grades. Students in risk of this penalty will be given adequate notice and generous opportunity to avoid it.

Students with Special Needs

If you are a student with a disability and you need academic accommodations, please see the instructor and contact the Disability Resource Center (DRC) at 993-2474. All academic accommodations must be arranged through the DRC.

Please read the plagiarism policy attached to the end of this syllabus. Ignorance of or failure to understand the policy will not lead to lenience in case of violation.

**PUBP-820: Technology, Science, and Innovation: Institutions and Governance
Reading List**

1. Technology, Science, and Innovation: Autonomy, Evolution, and Control

August 29

- Bill Joy, “Why the Future Doesn’t Need Us,” *Wired*, April 2000.
- Robert L. Heilbroner, “Do Machines Make History?,” *Technology and Culture* 8(3):335-345 (1967). (Also reprinted in Marx and Smith, eds., reference below.)
- Thomas P. Hughes, “Technological Momentum,” in Leo Marx and Merritt Roe Smith, eds., *Does Technology Drive History?* (MIT Press, 1994), 101-114.
- Johann Peter Murmann, *Knowledge and Competitive Advantage* (Cambridge University Press, 2003), 8-24.
- Alvin M. Weinberg, “Can Technology Replace Social Engineering?,” *Bulletin of the Atomic Scientists* 22:12 (December 1966): 4-8.

I. Technology, Science, and Innovation: The Inner Workings

2. Research: Norms and Other Incentives

September 5

- Robert K. Merton, “The Normative Structure of Science,” (1942) in Merton, *Sociology of Science* (University of Chicago Press, 1973).
- Michael Mulkay, “The Mediating Role of the Scientific Elite,” *Social Studies of Science* 6(3-4):445-470 (September 1976).
- Henry Etzkowitz, “The Norms of Entrepreneurial Science: Cognitive Effects of the New University–Industry Linkages,” *Research Policy* 27(8):823-833 (December 1998).
- National Science Board, *Science and Engineering Indicators 2006* (NSB 2006), chapter 5 (skim).

3. Innovation: From Invention to Use

September 12

- Stephen J. Kline, “Innovation Is Not a Linear Process,” *Research Management*, July/August 1985, 36-45.
- Edward W. Constant II, “Communities and Hierarchies: Structure in the Practice of Science and Technology,” in Rachel Laudan, ed., *The Nature of Technological Knowledge* (D. Reidel, 1984), 27-46.
- W. Bernard Carlson and Michael E. Gorman, “Understanding Invention as a Cognitive Process: The Case of Thomas Edison and Early Motion Pictures, 1888-1891,” *Social Studies of Science* 20(3):387-430 (August 1990)
- Eric Von Hippel, “Innovation Communities,” chapter 7 in *Democratizing Innovation* (MIT Press, 2005), 93-106.
- National Science Board, *Science and Engineering Indicators 2006* (NSB 2006), chapters 4, 6 (skim).

II. “Background” Governance Institutions

4. Firms and Markets

September 19

- Joseph A. Schumpeter, “The Process of Creative Destruction,” chapter 7 in *Capitalism, Socialism, and Democracy* (Harper, 1942), 81-86.
- Nathan Rosenberg, “Economic Experiments,” in Rosenberg, *Exploring the Black Box* (Cambridge University Press, 1994), 87-108.
- David C. Mowery, “The Boundaries of the U.S. Firm in R&D,” chapter 5 in Naomi R. Lamoreaux and Daniel M. G. Raff, eds., *Coordination and Information: Historical Perspectives on the Organization of Enterprise* (University of Chicago, 1995).
- David J. Teece, “Profiting From Technological Innovation - Implications for Integration, Collaboration, Licensing and Public Policy,” *Research Policy* 15 (6): 285-305 (1986) .
- Annalee Saxenian, “The Origins and Dynamics of Production Networks in Silicon Valley,” *Research Policy* 20:423-437 (1991).

5. Law and Finance

September 26

- B. Zorina Khan, “Technological Innovations and Endogenous Changes in U.S. Legal Institutions, 1790-1920,” National Bureau of Economic Research, working paper 10346, March 2004.
- Laurence H. Tribe, “Legal Frameworks for the Assessment and Control of Technology,” *Minerva* 9:243-255 (1971).
- Mary O’Sullivan, “Finance and Innovation,” in *Oxford Handbook of Innovation* (Oxford University Press, 2005), 240-265.
- Paul Gompers and Josh Lerner, “The Venture Capital Revolution,” *Journal of Economic Perspectives* 15(2):145-168 (2001).

6. Culture and Education

October 3

- Douglass C. North, “Economic Performance Through Time,” *American Economic Review* 84(3):359-368 (1994).
- David S. Landes, “The Meiji Restoration,” chapter 23 in *The Wealth and Poverty of Nations* (Norton, 1998), 371-391.
- G. Pascal Zachary, “Mongrelize or Die!,” chapter 3 in *The Diversity Advantage* (Westview, 2003), 56-81.
- Anisya S. Thomas, Stephen L Mueller, “A Case for Comparative Entrepreneurship: Assessing the Relevance of Culture,” *Journal of International Business Studies* 31(2):287-301 (2000).
- National Science Board, *Science and Engineering Indicators 2006* (NSB 2006), chapter 7 (skim).

III. Public Policy: The Regional, National, and Supranational Levels

7. Regional (Provincial, State, and Local) Policies

October 10

- Lynne G. Zucker, Michael R. Darby, and Marilyn B. Brewer, "Intellectual Human Capital and the Birth of U.S. Biotechnology Enterprises," *American Economic Review* 88(1):290-306 (1998).
- Michael E. Porter, "Clusters and the New Economics of Competition," *Harvard Business Review* November/December, 1998.
- Paul Almeida and Bruce Kogut, "The Exploration of Technological Diversity and Geographic Localization in Innovation: Start-Up Firms in the Semiconductor Industry," *Small Business Economics* 9(1):21-31 (February 1997).
- Maryann P. Feldman and Roger Martin, "Constructing Jurisdictional Advantage," *Research Policy* 34(8):1235-1249 (2005).
- Stuart Leslie, "Regional Disadvantage: Replicating Silicon Valley in New York's Capital Region," *Technology and Culture* 42(2):236-264 (2001).

8. R&D Spending and Tax Incentives

October 17

- David M. Hart, "Private Technological Capabilities as Products of National Innovation Systems: Four Ways of Looking at the State," *Science and Public Policy* 29:181-188 (2002).
- Stephen Toulmin, "The Complexity of Scientific Choice: A Stock-Taking," *Minerva* 2:343-359 (1964).
- Cockburn, Iain, and Rebecca Henderson, "Public-Private Interaction in Pharmaceutical Research," *Proceedings of the National Academy of Sciences* 93:12725-30 (12 November 1996).
- Robert M. Cook-Deegan, "Does NIH Need a DARPA?," *Issues in Science and Technology*, Winter 1996-97, 25-28.
- Bronwyn Hall and John van Reenen, "How Effective Are Fiscal Incentives for R&D? A Review of the Evidence," *Research Policy* 29:449-469 (2000).

9. Public Procurement and Regulation

October 24

- William P. Rogerson, "Economic Incentives and the Defense Procurement Process," *Journal of Economic Perspectives* 8(4):65-90 (Fall, 1994).
- Linda R. Cohen and Paroma Sanyal, "R&D Choice in Restructured Industries: In-House vs. Collaborative Research in the U.S. Electricity Industry," June 2004.
- Vicki Norberg-Bohm, "Stimulating Green Technological Innovation: An Analysis of Alternative Policy Mechanisms," *Policy Sciences* 32(1):13-38 (1999).
- Margaret R. Taylor, Edward S. Rubin, and David A. Hounshell, "Effect of Government Actions on Technological Innovation for SO₂ Control," *Environmental Science & Technology* 37(20):4527-4534 (15 Oct 2003).

10. National and Supranational Politics: Democracy and the “Management” of “Creative Destruction”

October 31

- Joel Mokyr, "Innovation and Its Enemies: The Economic and Political Roots of Technological Inertia" in Mancur Olson and Satu Kähkönen, eds., *A Not so Dismal Science* (Oxford University Press, 2000), 61-91.
- Paul Slovic, James H. Flynn, and Mark Layman, “Perceived Risk, Trust, And The Politics Of Nuclear Waste,” *Science* 254:1603-1607 (13 Dec 1991).
- Thomas Bernauer and Erika Meins, “Technological Revolution Meets Policy and the Market: Explaining Cross-National Differences in Agricultural Biotechnology Regulation,” *European Journal of Political Research* 42(5):643-683 (2003).
- David Guston and Daniel Sarewitz, “Real-Time Technology Assessment,” *Technology in Society* 24(1-2):93-109 (2002).

IV. International Competition and Global Governance

11. International Competition: Staying Ahead (Or Not)

November 7

- Bengt-Ake Lundvall, “Introduction,” in Lundvall, ed., *National Systems of Innovation* (London: Pinter, 1992), 1-19.
- Manuel Castells and Pekka Himanen, “Innovation About Innovating,” chapter 3 in *The Information Society and the Welfare State - the Finnish Model* (Oxford University Press 2002), 45-63,71-73.
- Luc Soete, “A Knowledge Economy Paradigm and Its Consequences,” UNU-MERIT, working paper #1, January 2006.
- Antonello Zanfei, “Transnational Firms and the Changing Organization of Innovation,” *Cambridge Journal of Economics* 24:515-542 (2000).
- Samuel J. Palmisano, “The Globally Integrated Enterprise,” *Foreign Affairs*, May/June 2006, 127-136.

12. International Competition: Catching Up (Or Not)

November 14

- Aleksander Gerschenkron, “Economic Backwardness in Historical Perspective” ch. 1 in *ibid.* (Belknap, 1962).
- Michael E. Porter, “Building the Microeconomic Foundations of Competitiveness,” chapter 1.2 in *Global Competitiveness Report 2002-2003* (Davos: World Economic Forum, 2003).
- Jeffrey L. Furman and Richard Hayes, “Catching Up or Standing Still? National Innovative Productivity Among ‘Follower’ Countries, 1978-1999,” *Research Policy* 33:1329-1354 (1999).
- John A. Matthews, “National Systems of Economic Learning: The Case of Technology Diffusion Management in East Asia,” *International Journal of Technology Management* 22(5/6):455-479 (2001).

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- Yasheng Huang and Tarun Khanna, “Can India overtake China?,” *Foreign Policy*, Jul/Aug 2003, 74-81.
- David M. Hart, “From Brain Drain to Mutual Gain,” *Issues in Science and Technology*, Fall 2006.

November 21: Thanksgiving Break

13. Global Governance: Rules

November 28

- John G. Ruggie, “Reconstituting the Global Public Domain: Issues, Actors, and Practices,” Kennedy School of Government working paper RWP04-031, 2004.
- Keith E. Maskus and Jerome H. Reichman, “The Globalization of Private Knowledge Goods and the Privatization of Global Public Goods,” *Journal of International Economic Law* 7(2):279-320 (2004).
- Edward A. Parson, *Protecting the Ozone Layer: Science and Strategy* (New York: Oxford University Press, 2003), 173-196.
- Edward A. Parson, “The Technology Assessment Approach to Climate Change,” *Issues in Science and Technology* Summer 2002, 65-72.
- Tyndall Center for Climate Change Research, “New Lessons for Technology Policy and Climate Change,” Tyndall briefing note no. 13, April 2005.

14. Global Governance: Public Goods

December 5

- Joseph Stiglitz, “Knowledge as a Global Public Good,” in Inge Kaul, Isabelle Grunberg, and Marc A Stern, eds., *Global Public Goods: International Cooperation in the 21st Century* (Oxford University Press, 1999).
- Robert E. Evenson, “Besting Malthus: The Green Revolution,” *Proceedings of the American Philosophical Society* 149(4):469-486 (December 2005).
- Michael Kremer, “Creating Markets for New Vaccines, Part I: Rationale,” National Bureau of Economic Research working paper 7716, May 2000.
- Steven Weber, “Generalizing Open Source,” in *The Success of Open Source* (Harvard University Press, 2004), 264-272.
- “The Cambia BIOS Initiative: Biological Innovation for an Open Society,” 2004 (14 pp.)

SPP Policy on Plagiarism

The profession of scholarship and the intellectual life of a university as well as the field of public policy inquiry depend fundamentally on a foundation of trust. Thus any act of plagiarism strikes at the heart of the meaning of the university and the purpose of the School of Public Policy. It constitutes a serious breach of professional ethics and it is unacceptable.

Plagiarism is the use of another's words or ideas presented as one's own. It includes, among other things, the use of specific words, ideas, or frameworks that are the product of another's work. Honesty and thoroughness in citing sources is essential to professional accountability and personal responsibility. Appropriate citation is necessary so that arguments, evidence, and claims can be critically examined.

Plagiarism is wrong because of the injustice it does to the person whose ideas are stolen. But it is also wrong because it constitutes lying to one's professional colleagues. From a prudential perspective, it is shortsighted and self-defeating, and it can ruin a professional career.

The faculty of the School of Public Policy takes plagiarism seriously and has adopted a zero tolerance policy. Any plagiarized assignment will receive an automatic grade of "F." This may lead to failure for the course, resulting in dismissal from the University. This dismissal will be noted on the student's transcript. For foreign students who are on a university-sponsored visa (eg. F-1, J-1 or J-2), dismissal also results in the revocation of their visa.

To help enforce the SPP policy on plagiarism, all written work submitted in partial fulfillment of course or degree requirements must be available in electronic form so that it can be compared with electronic databases, as well as submitted to commercial services to which the School subscribes. Faculty may at any time submit student's work without prior permission from the student. Individual instructors may require that written work be submitted in electronic as well as printed form. The SPP policy on plagiarism is supplementary to the George Mason University Honor Code; it is not intended to replace it or substitute for it. (<http://www.gmu.edu/facstaff/handbook/aD.html>)

Professor Hart's Addendum

I believe deeply that intellectual integrity is a fundamental element of learning. I firmly support the School's zero tolerance policy on plagiarism and will enforce it stringently. Ignorance is not an excuse. To avoid plagiarism, a simple rule of thumb may be of help: when in doubt, include a citation. Citations, including those to web sources, should include sufficient information to allow a reader to verify the source. Further details on when and how to cite sources will be discussed in class. However, providing a citation to a block of text taken with minimal change from a source is not sufficient to avoid plagiarism. You must put the block in quotation marks, thereby acknowledging the source's contribution of specific words as well as ideas in the block.