Center for International Science and Technology Policy
The George Washington University

Cornerstone

INTERNATIONAL SCIENCE AND TECHNOLOGY POLICY

IAFF 6141
1957 E Street 316
T 17:10-19:00
Fall 2014

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Overview

This course provides a comprehensive overview of the policy issues related to the support, use, management, and regulation of science and technology. It addresses US domestic as well as international issues, is concerned with governmental policies as well as non-governmental decisions, and it is focused on both the economics and politics of science and technology issues.

In today's world, scientific discoveries and technological innovations influence almost every aspect of human existence. Many changes induced by these innovations have been extremely positive, bringing advances in health, communications, material wealth, and quality of life. At the same time, science and Technology have helped create apparently intractable problems, including new risks to human health, pollution of the natural environment, and the existence of weapons capable of mass destruction. Given all of these impacts, making effective and fair choices regarding technologically complex issues is one of the most challenging tasks of modern governance.

Especially demanding is policy-making for international economic competition, which is increasingly defined in terms of technological competence. The diffusion of centers of technological excellence around the world and the progressive convergence of local markets in terms of consumer tastes and preferences have obliged actors to adopt a more global outlook: not only do firms compete internationally, but they also depend on each other's technological, organizational, financial, and marketing strengths to stay afloat. In this course we examine a number of important characteristics of the new international context that are currently related to the technological competence of firms and nations.

Goals

This course is intended to impart: knowledge of the institutions that shape international science and technology policy, with a focus on the U.S. institutions surrounding the

George Washington University; familiarity with policy research and key indicators that shape science and technology policy; an overview of historical and current science and technology policy issues, with a focus on issues under consideration by policymakers in institutions surrounding GWU; the skill of policy analysis – the ability to dissect a problem in science and technology and connect the elements of that problem to the relevant institutions; and the skill of policy formulation – the ability to craft a science or technology policy in a way that might promise success, drawing on historical and/or international experience.

These goals are assessed in the two major exams and policy exercise. Each exam will have questions that are intended to assess mastery of the categories of knowledge, described above, that are developed in the class. The exams are cumulative, in the sense that they make use of the lectures, reading material, and class discussions. They may also introduce new material as well. In general, they consist of a series of short essay questions with short essay answers. They are take-home exams.

Learning Outcomes

Students will be able to critically analyze science and technology policy proposals and supporting data with reference to historical trends and familiarity with key policy institutions.

Students will be able to formulate science and technology policy proposals, support proposals with relevant data or indicators, and critically evaluate their potential effectiveness.

Students will be able to evaluate the economic, political, and social contexts of actual or proposed science and technology policy actions in terms of historical and contemporary settings.

Grades

The final grade will be computed in the following way:

Policy Memo:	15%
Midterm Exam:	25%
Final Exam:	50%
Class Participation	10%

Class participation is graded in a subjective manner. The professor will award credit to those students who helped to shape the discussion, identified good questions, raised interesting points, and found clever insights. All members of the class can potentially receive full credit for participation.

Examinations

This course will have one policy exercise and two take-home examinations. They will be posted on Blackboard and should be submitted via email to the professor. No paper submissions will be accepted.

The policy exercise is to help you understand the process and goals of the class. It will be one-two page memo, an individual exercise.

The examinations will be a collection of short essays that are based on the class discussions and readings. Grades will be based upon the full set of attributes that are important to good policy papers, including accuracy, clarity, logic, relevance, *brevity*, and so on. The mid-term examination will be posted at the end of Part I of the course (October 7). The final examination will be posted at the end of Part II of the course (November 25). Both will be due one week after posting.

Class Policies

Class attendance is expected. There will be no allowance for late work, except by prior arrangement with the instructor. Arrangements for make-up work must be made with the instructor. The instructor has the discretion to grant or refuse requests for late work or make-up work.

Professor Vonortas' Policy on Grade Contestation: Students wishing to contest a grade are required to write a professional memo outlining their case, along with supporting examples from the submitted assignment.

Academic Integrity. Academic dishonesty is defined as cheating of any kind, including misrepresenting one's own work, taking credit for the work of others without crediting them and without appropriate authorization, and the fabrication of information. For the remainder of the code, see: http://www.gwu.edu/~ntegrity/code.html

Religious Holidays. Religiously observant students should notify the instructor the first week of classes regarding any session that will be missed; the courtesy of an absence without penalty will be extended.

Accommodation for Students with Disabilities. To receive accommodations on the basis of disability, a student must give notice and provide proper documentation from the Office of Disability Support Services, Rome Hall. Accommodations will be made based upon recommendations of the DSS Office.

Readings

You are requested to purchase the book:

Homer A. Neal, Tobin L. Smith, and Jennifer B. McCormick, *Beyond Sputnik: U.S. Science Policy in the 21st Century*, University of Michigan Press, Ann Arbor, 2008.

All readings will be posted on Blackboard, except for the book and selective large reports or articles that you can locate on the internet.

Schedule of Meetings and Readings

Readings marked with an asterisk (*) are recommended. Core readings are unmarked.

8/26 COURSE INTRODUCTION

PART I: SCIENCE, TECHNOLOGY AND INNOVATION (STI) POLICY

9/2 FOUNDATIONS OF SCIENCE AND TECHNOLOGY POLICY - HISTORICAL OVERVIEW OF U.S. STI SYSTEM

Neal, Smith, and McCormick, *Beyond Sputnik: U.S. Science Policy in the 21st Century*, University of Michigan Press, Ann Arbor, 2008. [Chs 1, 2]
[1] "Science Policy Defined."
[2] "U.S. Science Policy before and after *Sputnik*."

Branscomb, "What's Next for Technology Policy?" *Issues in Science and Technology*, 2007.
http://www.issues.org/19.4/branscomb.html

* Bush, Vannevar, "Science the Endless Frontier," Washington, Government Printing Office 1945.
http://www.nsf.gov/od/lpa/nsf50/vbush1945.htm

9/9 U.S. STI POLICY: CURRENT AND EVOLVING ISSUES

Neal, Smith, and McCormick, *Beyond Sputnik: U.S. Science Policy in the 21st Century*, University of Michigan Press, Ann Arbor, 2008. [Chs 3-5]
[3] "The Players in Science Policy"
[4] "The Process of Making Science Policy"
[5] "Federal Funding for Research: Rationale, Impact, and Trends"

* Executive Office of the President of the United States, National Economic Council, Office of Science and Technology Policy, "A Strategy for American Innovation: Driving Towards Sustainable Growth and Quality Jobs", September 2009.
http://www.whitehouse.gov/administration/eop/nec/StrategyforAmericanInnovation/

Executive Office of the President of the United States, National Economic Council, Office of Science and Technology Policy, "A Strategy for American Innovation: Securing Our Economic Growth and Prosperity", February 2011.
http://www.whitehouse.gov/innovation/strategy

Kahin, Brian and Christopher T. Hill "United States: The Need for Continuity", *Issues in Science and Technology*, Spring 2010.

9/16 U.S. INSTITUTIONS – R&D FUNDING

Neal, Smith, and McCormick, *Beyond Sputnik: U.S. Science Policy in the 21st Century*, University of Michigan Press, Ann Arbor, 2008. [Chs 6-9]
[6] "Universities"
[7] "Federal Laboratories"
[8] "Industry"
[9] "The States"

National Science Board *Science and Engineering Indicators 2014*, National Science Foundation, 2014. [Ch 4]
[4] "R&D: National Trends and International Comparisons"
http://www.nsf.gov/statistics/seind14/

Executive Office of the President of the United States, Office of Management and Budget & Office for Science and Technology Policy, "OMB-OSTP Memorandum on S&T Priorities for the FY 2016 Budget", July 18, 2014.
http://www.whitehouse.gov/sites/default/files/microsites/ostp/m-14-11.pdf

9/23 U.S. DEFENSE/CIVILIAN GOVERNMENT PROCUREMENT

Neal, Smith, and McCormick, *Beyond Sputnik: U.S. Science Policy in the 21st Century*, University of Michigan Press, Ann Arbor, 2008. [Chs 11, 13, 18]
[11] "Science for National Defense"
[13] "Scientific Infrastructure"
[18] "Science and Homeland Security"

Vonortas, Nicholas S., "Innovation and Public Procurement in the United States", in Charles Edquist, Jakob Edler, Nicholas S. Vonortas, and Jon Mikel Zabala (eds.) *Public Procurement for Innovation*, Edward Elgar, forthcoming.

9/30 STI POLICY IN EUROPE

European Commission "Horizon 2020 - the Framework Programme for Research and Innovation"
http://ec.europa.eu/research/horizon2020/index_en.cfm

European Commission "Innovation Union Scoreboard 2014", European Commission, Directorate-General for Research and Innovation, 2014.

* European Commission "Europe 2020"
http://ec.europa.eu/europe2020/index_en.htm

* Organization of Economic Cooperation and Development (OECD), national reviews of innovation policy (member countries). Selectively.

10/7 STI POLICY IN EMERGING ECONOMIES AND JAPAN

National Research Council, Committee on Global Science and Technology Strategies and Their Effect on U.S. National Security, *S&T Strategies of Six Countries: Implications for the United States*, National Academies Press, Washington DC, 2010. (Brazil, China, Russia, India, Japan, and Singapore)
http://www.nap.edu/catalog/12920.html

Rezende, Sergio Machado "Brazil Challenges and Achievements", *Issues in Science and Technology*, Spring 2010.

"The World Turned Upside Down: A Special Report on Innovation in Emerging Markets", *The Economist*, April 17, 2010.

Ezell, Stephen "Fighting Innovation Mercantilism", *Issues in Science and Technology*, Winter 2011.

PART II: ISSUES

^10/14 ENERGY, ENVIRONMENT, CLIMATE CHANGE

Everett, Bruce "Back to the Basics on Energy Policy", *Issues in Science and Technology*, Fall 2012.

Bonvillian, William B. and Charles Weiss "Stimulating Innovation in Energy Technology", *Issues in Science and Technology*, Fall 2009.

* Webber, Michael E., Roger D. Duncan and Marianne Shivers Gonzalez "Four Technologies and a Conundrum: The Glacial Pace of Energy Innovation", *Issues in Science and Technology*, Winter 2013.

* Executive Office of the President of the United States, National Science and Technology Policy Council "A Policy Framework for the 21st Century Grid: A Progress Report", February 2013.

Bonvillian, William B. "Time for Climate Plan B", *Issues in Science and Technology*, Winter 2011.

* Intergovernmental Panel on Climate Change, *Climate Change 2014: Synthesis Report*, IPCC, Geneva Switzerland, 2014.
http://www.ipcc.ch/report/ar5/

10/21 3RD INDUSTRIAL REVOLUTION: DIGITAL MANUFACTURING, 3D PRINTING (ADVANCED MANUFACURING)

"Print me a Stradivarius", Special Report, The Economist, February 12, 2011.

Ezell, Stephen "Revitalizing U.S. Manufacturing", *Issues in Science and Technology*, Winter 2012.

Executive Office of the President of the United States, National Science and Technology Policy Council "A National Strategic Plan for Advanced Manufacturing", February 2012.
http://www.whitehouse.gov/sites/default/files/microsites/ostp/iam_advancedmanufacturing_strategicplan_2012.pdf

* Executive Office of the President of the United States, President's Council of Advisors on Science and Technology "Report to the President on Capturing Domestic Competitive Advantage in Advanced Manufacturing", July 2012.
http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_amp_steering_committee_report_final_july_27_2012.pdf

10/28 ENTREPRENEURSHIP, INNOVATIVE SMEs

Organization for Economic Cooperation and Development *SMEs, Entrepreneurship and Innovation*, Paris: OECD, 2010.
Chapter 1: Introduction

Auerswald, Philip E. and Lewis M. Branscomb "Start-ups and Spin-offs: Collective Entrepreneurship Between Invention and Innovation" in David M. Hart (ed.) *The Emergence of Entrepreneurship Policy*, Cambridge University Press, 2007.

Pascoe, Cherilyn E. and Nicholas S. Vonortas "University Entrepreneurship: A Survey of U.S. Experience", in Nicholas S. Vonortas, Phoebe C. Rouge and Anwar Aridi (eds) *Innovation Policy: A Practical Introduction*, Springer, forthcoming.

Waggoner, Danny "High Risk Finance", in Nicholas S. Vonortas, Phoebe C. Rouge and Anwar Aridi (eds) *Innovation Policy: A Practical Introduction*, Springer, forthcoming.

^11/4 SPACE

Bilstein, Roger E., and Frank Walter Anderson. *Orders of Magnitude: A History of the NACA and NASA, 1915-1990*. Washington, DC: National Aeronautics and Space Administration, Office of Management, Scientific and Technical Information Division, 1989. [First three Chapters]
http://www.hq.nasa.gov/office/pao/History/SP-4406/contents.html

Commission on the Future of the United States Aerospace Industry. *Final Report of the Commission on the Future of the United States Aerospace Industry*. Arlington, Va: Commission on the Future of the United States Aerospace Industry, 2002.
http://trade.gov/static/aero_rpt_aero_commission.pdf

Cliff, Roger, Chad J. R. Ohlandt, and David Yang. *Ready for Takeoff China's Advancing Aerospace Industry*. Santa Monica, CA: Rand National Security Research Division, 2011.
http://www.rand.org/pubs/monographs/MG1100.html

11/11 INTELLECTUAL PROPERTY RIGHTS, STANDARDS

Williams, Jeffrey and Anwar Aridi "Intellectual Property, Standards", in Nicholas S. Vonortas, Phoebe C. Rouge and Anwar Aridi (eds) *Innovation Policy: A Practical Introduction*, Springer, forthcoming.

"A Market for Ideas", *The Economist*, October 22, 2005.

11/18 STEM EDUCATION, S&E WORKFORCE, JOBS

Neal, Smith, and McCormick, *Beyond Sputnik: U.S. Science Policy in the 21st Century*, University of Michigan Press, Ann Arbor, 2008. [Chs 15, 16]
[15] "Science, Technology, Engineering, and Mathematics Education"
[16] "The Science and Engineering Workforce"

* Committee on Science, Engineering and Public Policy, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, National Academies Press, Washington DC, 2007. Chapter 5: "What Actions Should America Take in K-12 Science and Mathematics Education to Remain Prosperous in the 21st Century"

NSTC, Committee on STEM Education "Federal Science, Technology, Engineering and Mathematics (STEM) Education: 5-Year Strategic Plan", Executive Office of the President of the United States, May 2013. http://www.whitehouse.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf

PART III: THE FUTURE

^11/25 THE FUTURE OF STI POLICY: GLOBALIZATION, GRAND CHALLENGES, OTHER CHALLENGES

Neal, Smith, and McCormick, *Beyond Sputnik: U.S. Science Policy in the 21st Century*, University of Michigan Press, Ann Arbor, 2008. [Chs 17, 19, 20]
[17] "Globalization and Science Policy"
[19] "Grand Challenges for Science and Society"
[20] "Science, Science Policy and the Nation's Future"

* Branscomb, Lewis M. and Richard Florida "Challenges to Technology Policy in a Changing World Economy" in Lewis M. Branscomb and James H. Keller (eds) *Investing in Innovation*, MIT Press, 1998.

Kalil, Tom "The Grand Challenges of the 21st Century", Prepared Remarks at the Information Technology and Innovation Foundation, April 12, 2012.

Executive Office of the President of the United States, President's Council of Advisors on Science and Technology "Transformation and Opportunity: The Future of the U.S. Research Enterprise", November 2012.
http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_future_research_enterprise_20121130.pdf

Guy, Ken "Drivers of Change", JRC Technical Reports, European Commission, 2012.

12/2 Make-up class (if needed) – Final exam is due

Useful Resources

I. **Organizations** (selectively)

AAAS R&D Budget and Policy Program
http://www.aaas.org/spp/rd/

White House Office of Science and Technology Policy
http://www.ostp.gov

The National Academies (NAS, NAE, IOM, NRC)
http://nas.edu/

National Science Foundation (NSF)
http://www.nsf.gov
especially National Science Board
http://www.nsf.gov/nsb/
NSF Science and Engineering Statistics
http://www.nsf.gov/statistics/

Organization for Economic Cooperation and Development (OECD)
http://www.oecd.org/

United Nations Conference on Trade and Development (UNCTAD)
http://unctad.org/en/Pages/Publications.aspx

United Nations Industrial Development Organization (UNIDO)
http://www.unido.org/

The World Bank
http://www.worldbank.org/
especially The Science, Technology and Innovation Program
http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTEDUCATION/0,,contentMDK:20457068%7EmenuPK:1011218%7EpagePK:148956%7EpiPK:216618%7EtheSitePK:282386,00.html

The European Union (EU)
especially Directorate-General (DG) Research and Innovation
http://ec.europa.eu/research/index.cfm?pg=dg
DG Connect
http://ec.europa.eu/dgs/connect/en/content/dg-connect
DG Enterprise and Industry
http://ec.europa.eu/enterprise/index_en.htm
European Space Agency
http://www.esa.int/ESA

Core Academic Journals (selectively)

Science and Public Policy
http://spp.oxfordjournals.org/

Research Policy
http://www.journals.elsevier.com/research-policy/

Journal of Technology Transfer
http://link.springer.com/journal/10961

Technovation
http://www.journals.elsevier.com/technovation/

Economics of Innovation and New Technology
http://www.tandfonline.com/toc/gein20/current#.UhgjquD9Y0M

Industrial and Corporate Change
http://icc.oxfordjournals.org/

Research Evaluation
http://rev.oxfordjournals.org/

Issues in Science and Technology (National Academy of Sciences)
http://www.issues.org/

IEEE Transactions on Engineering Management
http://www.andromeda.rutgers.edu/~ieeetem/

R&D Management
http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1467-9310

Technology Analysis and Strategic Management
http://www.tandfonline.com/toc/ctas20/current#.UhhMTOD9Y0M

Technological Forecasting and Social Change

GW's Aladin system (Gelman Library) typically offers remote access to such organizations and journals and extensive download privileges to publications.