

Center for International Science and Technology Policy
The George Washington University

Cornerstone

INTERNATIONAL SCIENCE AND TECHNOLOGY POLICY

IAFF 6141
1957 E 316
T 17:10-19:00
Fall 2017

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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 GW; 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 the 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 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.

Out of Class and Independent Learning Expected per Week

For this 3-credit graduate class students are expected to spend at least 350 minutes per week outside the classroom on preparation and class assignments.

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 17). The final examination will be posted at the end of Part II of the course (December 5). 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. Students are always welcome to discuss grades with the Professor. However, students wishing to formally contest a grade are required to write a memo outlining their case, along with supporting examples from the submitted assignment.

University Policies & Services

Academic Integrity Code. 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 details and complete code, see: studentconduct.gwu.edu/code-academic-integrity

Sharing of Course Content. Unauthorized downloading, distributing, or sharing of any part of a recorded lecture or course materials, as well as using provided information for purposes other than the student's own learning may be deemed a violation of GW's Student Conduct Code.

Use of Student Work (FERPA). The professor will use academic work that you complete during this semester for educational purposes in this course during this semester. Your registration and continued enrollment constitute your consent.

Accommodations for Students with Disabilities. Any student who may need an accommodation based on the potential impact of a disability should contact the Disability Support Services office at 202-994-8250 in the Rome Hall, Suite 102, to establish eligibility and to coordinate reasonable accommodations. For additional information see: disabilitysupport.gwu.edu/

Religious Observances. In accordance with University policy, students should notify faculty during the first week of the semester of their intention to be absent from class on their day(s) of religious observance. For details and policy, see: students.gwu.edu/accommodations-religious-holidays.

Mental Health Services 202-994-5300. The University's Mental Health Services offers 24/7 assistance and referral to address students' personal, social, career, and study skills problems. Services for students include: crisis and emergency mental health consultations confidential assessment, counseling services (individual and small group), and referrals. For additional information see: counselingcenter.gwu.edu/

GW Security and Safety Policy. In the case of an emergency, if at all possible, the class should shelter in place. If the building that the class is in is affected, follow the evacuation procedures for the building. After evacuation, seek shelter at a predetermined rendezvous location.

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.

An extensive report by UNESCO (900 pages) provides excellent background material on various countries/regions around the world, difficult to find elsewhere in such a comparative manner.

United Nations Educational, Scientific and Cultural Organization *UNESCO Science Report: Towards 2030*, UNESCO Printing, 2015. (Revised 2016) [free download]

All readings will be posted on Blackboard, except for the book chapters 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.

- 8/29 COURSE INTRODUCTION
- * Thomson Reuters *Disruptive, Game-Changing Innovation: 2016 State of Innovation*, Report, 2016.
 - * Organization for Economic Cooperation and Development *An OECD Horizon Scan of Megatrends and Technology Trends in the Context of Future Research Policy*, Paris: OECD, 2016.

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

- 9/5 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*.”

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

- 9/12 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: Securing Our Economic Growth and Prosperity”, February 2011.

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

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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 2016*, National Science Foundation, 2016. [Ch 4]

[4] “R&D: National Trends and International Comparisons”

<http://www.nsf.gov/statistics/seind14/>

Congressional Research Service (2017) Office of Science and Technology Policy (OSTP): History and Overview, CRS Report, August.

- * Executive Office of the President of the United States, Office of Management and Budget & Office for Science and Technology Policy, “OMB-OSTP Memorandum on Multi-Agency S&T Priorities for the FY 2017 Budget”, July 9, 2015.

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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, 2015.

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STI POLICY IN EUROPE

United Nations Educational, Scientific and Cultural Organization *UNESCO Science Report: Towards 2030*, UNESCO Printing, 2015.

(Revised 2016) [relevant Chs]

<http://en.unesco.org/USR-contents>

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 2016*, European Commission, Directorate-General for Research and Innovation, 2016.

http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en

* European Commission *Europe 2020.*

http://ec.europa.eu/europe2020/index_en.htm

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STI POLICY IN EMERGING ECONOMIES

United Nations Educational, Scientific and Cultural Organization
UNESCO Science Report: Towards 2030, UNESCO Printing, 2015.
(Revised 2016) [Relevant Chs]

<http://en.unesco.org/USR-contents>

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>

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

PART II: ISSUES

10/24 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.

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

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

8/31 DIGITAL ECONOMY 4th INDUSTRIAL REVOLUTION: ADVANCED MANUFACTURING, 3D-PRINTING, ARTIFICIAL INTELLIGENCE

“Artificial Intelligence: The Return of the Machinery Question”, Report, *The Economist*, June 25, 2016.

“Double, Double, Toil and Trouble”, Special Report, *The Economist*, March 12, 2016.

“A Printed Smile”, *The Economist*, April 30, 2016.

- * Bonvillian, William (2017) “Advanced Manufacturing: A New Policy Challenge”, *Annals of Science and Technology*, 1(1):1-131.
- * Executive Office of the President of the United States, National Science and Technology Policy Council “A National Strategic Plan for Advanced Manufacturing”, February 2012.

11/7 ENTREPRENEURSHIP, INNOVATIVE SMEs

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, Cheryl 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, 2014.

Waggoner, Danny “High Risk Finance”, in Nicholas S. Vonortas, Phoebe C. Rouge and Anwar Aridi (eds) *Innovation Policy: A Practical Introduction*, Springer, 2014.

* Organization for Economic Cooperation and Development *Financing SMEs and Entrepreneurs: an OECD Scoreboard*, Paris: OECD, 2016.

11/14 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, 2014.

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

11/21 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”

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.

11/28 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>

PART III: THE FUTURE

12/5 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”

Edler, Jakob and Jan Fagerberg (2017) “Innovation Policy: What, Why, and How”, *Oxford Review of Economic Policy*, 33(1): 2-23.

Manyika, James, Gary Pinkus, Sree Ramaswamy, Katy George, John Warner, and Andrea Serafino (2017) “Making it in America”, Report McKinsey Global Institute, June.

* One Hundred Year Study on Artificial Intelligence (2016) “Artificial Intelligence and Life in 2030”, Report of the 2015 Study Panel, Stanford University.

<https://ai100.stanford.edu>

12/12 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](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.