Institute for International Science and Technology Policy
The George Washington University

Cornerstone
SCIENCE AND TECHNOLOGY POLICY ANALYSIS SEMINAR

IAFF 6143.10
GOV 104
M 17:10-19:00
Spring 2022

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Note Spring 2022: This course will start online and may change to in-person with online accommodation

Overview

Many of the most important and salient policy decisions taken by governments, whether for war or peace, and whether they address everyday needs or long-term global grand challenges, involve science, technology, and innovation. Climate change; the debate over immunization against diseases such as COVID-19, measles and rubella; the decisions involving nuclear weapons; space exploration; the generation and diffusion of emerging technologies such as artificial intelligence, quantum computing, gene-editing technologies like CRISPR; the widespread use of robotics, nanotechnology, 3-D printing, and advanced energy storage technologies; the internet of things (IoT); advanced manufacturing; the oncoming of the 4th industrial revolution (I4.0); the transition to a carbon neutral economy. These are policy issues that involve science and technology, and their application (innovation), to a great degree.

The second in the sequence of required core courses for the ISTP program, this seminar course offers the opportunity to go deeper and ask more probing questions about select contemporary topics in science, technology and innovation (STI) policy like those listed above.[1] How policymakers use science to make decisions, how policy affects STI, how risk and uncertainty are accounted for in decision-making, and how the public impacts science policy decisions are all of concern in addressing the topics of interest. The course will take an international perspective and provide opportunities for comparative analysis across both developed market economies and emerging economies.

[1] The first course of this sequence is the cornerstone IAFF 6141. It serves as a prerequisite for IAFF 6143. Exemptions can be granted by the instructor following a specific request.

Learning Outcomes

- Students will learn to think critically about science and technology policy issues.
- Students will be exposed to a variety of views and will learn to discern good analysis.
- Students will employ research methods to explore a number of issues in more depth and will learn to persuade the reader on a number of issues.
- Students will become familiar with a variety of issues in the science policy arena, both domestic and international.
- Students will improve their presentation skills and their ability to discuss clearly topics at hand through class discussions.

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.

Class Policies

Requirements:

The most important requirement in this course is to keep up with the readings and participate in class discussions. That means that readings for the assigned day MUST be completed before class. The reason for this is that you are required to take part in class discussions of the topics at hand.

All written assignments must be submitted electronically two hours before the start of class on the day they are due. All work should be original and new – no recycled papers from previous classes, please.

Class participation is a very important part of your grade; you will be graded on your ability to discuss the readings, the way in which you respond to questions asked/discussed in class, the questions you yourself pose to the class, and the way in which you lead your assigned seminar. Class participation is a very important part of this course; we learn by discussing. If you do not actively participate, you will receive a grade of "C" for the participation portion of the course.

A final note on participation. Three students will be assigned the note-taker role each week. Note-takers will upload their notes into a shared document within 48 hours from the end of the class meeting. All students will then be able to comment on the same document based on their own notes from the class session. Your comments on the collaborative notes will be considered in your reading responses / note taker assignment grade.

Assignments:

Reading Responses / Class notes: Four times during the semester (choice is up to you), you need to hand in 1-2 pages of insights or questions generated by the assigned reading for that class. These don't have to be formal treatises, but they should at least meet the standard of well-stylized notes.
In addition, you will serve as a note-taker in one class session and will comment on the notes of your classmates on the shared document every week.

Moderated Discussion: Once during the semester you will be assigned to lead the discussion of the readings. Each class meeting will have three moderators. The moderators will be responsible to summarize the arguments in the readings as well as significant points made, add their own analysis, and develop questions based on the readings to initiate a class discussion. A presentation of 15-20 minutes can initiate the class.

Policy Brief: This is an opportunity to practice a tool used in the policy-making process: the briefing memo. These are short (2 pages single-spaced maximum) memoranda that address a current science, technology or innovation policy issue. In the memo you must describe the issue, explain its significance, briefly explain the policy options for dealing with it and their pros and cons, and finally recommend a policy position for your decision-maker. This policy position should be based on evidence to back up this position. I will assign the topic of the assignment.

Term Paper: There will be one long research paper due in class at the end of the semester. This paper will examine a science, technology or innovation policy issue of your choosing (you must first get your topic approved by me). The paper must explain why the policy issue is significant, what the various points of view on the topic are, and, in making your case for the policy, you must use evidence and argument. In addition to outside references on your specific topic, you will be required to refer to a selection of readings from class to examine the topic in detail. You MUST use citations or footnotes and include a list of references at the end. This paper must show your ability to complete an in-depth research assignment and therefore must be thorough and present a reasoned argument for your case. Papers should be 20-25 double-spaced pages long.

Grading:

Class participation	20%
Brief (short paper)	20%
Long Paper	40%
Moderated Discussion	10%
Reading Responses / Note-taker Assignment	10%

Assigned Book:
Mazzucato, Mariana (2021) *Mission Economy: A Moonshot Guide to Changing Capitalism*, New York: Harper Collins Publishers.

Classroom Etiquette:

Use of laptop computers and tablets are acceptable for note-taking purposes and for reference to weekly readings. If you are found to be using these devices for other purposes, you will no longer be able to use them in class and be docked 2% from your total grade. Cellphones are not permitted. This class is centered around participation and student-to-student learning experiences. Use of electronics for non-class purposes impacts your peers' learning outcomes.

Absences:

Class attendance is expected. Because readings and class discussion are important, class absences must be explained before class (if physically possible). If you are sick or traveling and will need to miss a class, please phone or email the instructor ahead of time. Only one class absence is allowed during the semester.

Late work:

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.

Plagiarism:

Plagiarism is unacceptable. Please see the GW plagiarism statement attached at end of syllabus under academic integrity. Plagiarism is a very serious offense and will likely result in failure of the course. All papers will be examined for plagiarism upon submittal.

SCHEDULE OF MEETINGS AND READINGS

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

1/10 *COURSE INTRODUCTION / HOUSEKEEPING*

* Romero, Jessie (2012) "What We Don't Know About Innovation", Federal Reserve Bank of Richmond.

1/24 *I. SCIENCE AND TECHNOLOGY AS ENGINES OF GROWTH*

Rosenberg, Nathan and L. E. Birdzwell, Jr. (1986) "The Link Between Science and Wealth" in How the West Grew Rich, Basic Books. [Ch.8]
[Ch 8] "The Link Between Science and Wealth"

Landes, David S. (2006) "Why Europe and the West? Why Not China?", Journal of Economic Perspectives, 20(2): 3-22.

Nelson, Richard R. and Gavin Wright (1992) "The Rise and Fall of American Technological Leadership: The Postwar Era in Historical Perspective," Journal of Economic Literature, XXX(4): 1931-1964.

II. STI INDICATORS AND TECHNOLOGICAL COMPETENCE

1/31 *1. Early Roots to Maturity*

Fusfeld, Herbert I. (1994) Industry's Future. [Chs 3, 4]
[Ch 3] "Origins and Growth to World War II"
[Ch 4] "Expansion Features of 1950 to 1980"

2. Current R&D Efforts and Competitiveness

National Science Board Science and Engineering Indicators 2022, National Science Foundation
https://ncses.nsf.gov/pubs/nsb20221

Hourihan, Matt (2021) "A Primer on Federal R&D Budget Trends", AAAS, Feb.

2/7 *3. The Nature of Invention and Innovation*

Fusfeld, Herbert I. (1994) Industry's Future. [Chs 1, 2, 8]
[Ch 1] "The Nature of Industrial Research"
[Ch 2] "Fruits of Industrial Research"
[Ch 8] "Corporate Environment"

Nelson, Richard R. (2004) "The Market Economy and the Scientific Commons", Research Policy, 33: 455-471.

Lazonick, William (2005) "The Innovative Firm", in J. Fagerberg et al. (eds) The Oxford Handbook of Innovation, Oxford University Press.

2/9 POLICY BRIEF

2/14 *4. Megatrends Affecting Science, Technology and Innovation*

Organization for Economic Cooperation and Development (2016) Science, Technology and Innovation Outlook 2016, Paris: OECD. [Chs 1, 2]
[Ch1] "Megatrends Affecting Science, Technology and Innovation"
[Ch2] "Future Technology Trends"

United Nations Conference on Trade and Development (UNCTAD) (2021) Technology and Innovation Report 2021: Catching Technological Waves – Innovation with Equity, NY: UN Publications. [Part II]
[Part II] "Forging Ahead at the Digital Frontiers"

Seeking Alpha "A Decade of Change: How Tech Evolved in the 2010s and What's in Store for the 2020s". Online, Accessed 2/16/2020.

Arthur, W. Brian (2017) "Where is Technology Taking the Economy?", McKinsey Quarterly, October.

* Schwab, Klaus (2016) "The Fourth Industrial Revolution: What it means, How to Respond", World Economic Forum.
https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/

IV. KEY ISSUES AFFECTING GLOBAL INNOVATION

2/28 *Global Value Chains – Multinational Corporations – R&D Internationalization*
[Speaker: Dr. Francisco Moris-Orengo, National Science Foundation]

Organization for Economic Cooperation and Development (2013) Interconnected Economies: Benefitting from Global Value Chains, Paris: OECD. [Chs 1, 4]
[Ch 1] "The Rise of Global Value Chains"
[Ch 4] "Global Value Chains and International Investment"

World Bank (2020) *World Development Report: Trading for Development in the Age of Global Value Chains*, Washington, D.C.: World Bank Group. [ES & Chs 1-2]
"Overview"
[Ch 1] "The New Face of Trade"
[Ch 2] "Drivers of Participation"

Belderbos, Rene, Leo Sleuwaegen, Dieter Somers, and Koen de Backer (2016) "Where to Locate Innovative Activities in Global Value Chains", OECD Science, Technology and Industry Policy Papers, No. 30, OECD Publishing, Paris.

* Semiconductor Industry Association and Nathan Associates (2016) "Beyond Borders – The Global Semiconductor Value Chain: How an Interconnected Industry Promotes Innovation and Growth" Report, SIA.

* Hall, Bronwyn H. (2011) "The Internationalization of R&D".

3/7 *Small Firms - Knowledge Entrepreneurship*

Economist (2014) "A Cambrian Moment".

Auerswald, Philip E. and Lewis M. Branscomb (2003) "Start-ups and Spin-offs: Collective Entrepreneurship between Invention and Innovation", in D. Hart (ed.) The Emergence of Entrepreneurship Policy, Cambridge University Press.

Klepper, Steven (2009) "Spinoffs: A review and Synthesis", European Management Review, 6:159-171.

Organization for Economic Cooperation and Development (2021) SME and Entrepreneurship Outlook 2021, Paris: OECD. [Executive Summary]

LONG PAPER TOPIC DUE

3/21 *The Geography of Innovation I*

World Intellectual Property Report (2019) The Geography of Innovation: Local Hotspots, Global Networks, Geneva, WIPO [Chs 1-2]
[Ch 1] "The Changing Global Geography of Innovation"
[Ch 2] "Global Networks and Innovation Hotspots"

Chatterji, Aaron, Edward Glaeser, and William Kerr (2013) "Clusters of Entrepreneurship and Innovation", Paper, Innovation Policy and the Economy Forum, NBER.

Vonortas, Nicholas S., Phoebe C. Rouge, and Anwar Aridi (eds) (2014) *Innovation Policy: A Practical Introduction*, Springer. [Ch 5]
[Ch 5] Benjamin Boroughs "Clusters / Science Parks / Knowledge Business Incubators"

3/28 *The Geography of Innovation II: Clusters / Science Parks / Innovation Districts / Incubators / Accelerators*
[Speaker: Prof. Bruno Brandao Fischer, University of Campinas, Brazil]

Katz, Bruce and Julie Wagner (2014) "The Rise of Innovation Districts: A New Geography of Innovation in America", Brookings.

World Bank (2015) Competitive Cities for Jobs and Growth, Washington, DC: The World Bank Group. [Selectively]

Saxenian, Annalee (2007) "Brain Circulation and Regional Innovation: The Silicon Valley – Hsinchu – Shanghai Triangle", in Karen R. Polenske (ed) The Economic Geography of Innovation, Cambridge University Press.

* Feldman Maryannn P. (2007) "Perspectives on Entrepreneurship and Cluster Formation: Biotechnology in the US Capitol Region", in Karen R. Polenske (ed) The Economic Geography of Innovation, Cambridge University Press.

4/4 *Bioeconomy*
[Speaker: Prof. Senay Agca, George Washington University]

Congressional Research Service (2021) "The Bioeconomy: A Primer", CRS Report R46881

TEConomy / BIO (2020) "The Bioscience Economy: Propelling Life-Saving Treatments, Supporting State and Local Communities", Washington.

Bioeconomy Workshop Report (forthcoming)

4/11 *Private (Risk) Finance / Public Financing of Innovation*

Vonortas et al. (eds) (2014) [Ch 6]
[Ch 6] Daniel Waggoner "High Risk Finance"

Lerner, Josh (2020) "Government Incentives for Entrepreneurship", National Bureau of Economic Research, Working Paper 26884.

Mazzucato, Mariana and Gregor Semieniuk (2017) "Public Financing of Innovation: New Questions", Oxford Review of Economic Policy, 33(1): 24-48.

4/18 *Intellectual Property Protection*

Vonortas et al. (2014), op. cit. [Ch 7]
[Ch 7] Jeffrey Williams and Anwar Aridi "Intellectual Property, Standards"

World Intellectual Property Organization (2021) World Intellectual Property Indicators, Geneva: WIPO. [Various, selectively]
"Key Numbers" (p.7)
"Overview of IP Filling Activity" (pp. 8-10)
"Patents" (pp. 11-23)
"Trademarks" (pp. 76-85)
"Industrial Designs" (pp. 129-136)
"Plant Varieties" (pp. 171-175)
"Geographical Indications" (pp. 187-193)

David, Paul A. (1992) "Intellectual Property Institutions and the Panda's Thumb: Patents, Copyrights, and Trade Secrets in Economic Theory and History" in National Research Council Global Dimensions of Intellectual property Rights in Science and Technology, National Academy Press.

4/25 *Emerging Industrial Policy Approaches*
[Speaker: Prof. William B. Bonvillian, MIT]

Bonvillian, William B. (2021) "Emerging Industrial Policy Approaches in the U.S.", Working Paper, August.

Mazzucato, Mariana (2021) *Mission Economy: A Moonshot Guide to Changing Capitalism*, New York: Harper Collins Publishers. [Chs 2, 3]
[Ch 2] "Capitalism in Crisis"
[Ch 3] "Bad Theory, Bad Practice: Five Myths that Impede Progress"

* TEConomy (2021) "Seizing the Manufacturing 4.0 Opportunity: A Strategic Plan for Iowa's Manufacturing Industry", Report to the Iowa Economic Development Authority, January. [Executive Summary]

4/27 *Policy Lessons*

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

Mazzucato, Mariana (2021) *op. cit*. [Chs 5, 6]
[Ch 5] "Aiming Higher: Mission-Oriented Policies on Earth"
[Ch 6] "Good Theory, Good Practice: Seven Principles for a New Political Economy"

* ITIF (2016) "Innovation, Productivity, and Competitiveness", memo to President -Elect Trump (November).

* Cases Federal: Economist "Cloning DARPA", June 5, 2021.
Federal: Ruth Cooper "ARPAe"
State: Hanwen Fan "Georgia"
State: Frank Spellman "New York"
Foreign: Nick Vonortas "Israel"

5/2 LONG PAPER DUE

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.

University Counseling Center (UCC) 202-994-5300
The University Counseling Center (UCC) 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, counselling services (individual and small group), and referrals

http://counselingcenter.gwu.edu/

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 Marvin Center, Suite 242, to establish eligibility and to coordinate reasonable accommodations. For additional information please refer to:
http://gwired.gwu.edu/dss/

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.