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:

Class participation: 25%
• This portion of the grade is based on students’ attendance, frequency and quality of participation in class discussion. There are two components. First, active engagement in class discussions during lectures, as prompted. Second, replying to a set of standard questions after each class lecture (posted on Blackboard).

Policy memorandum: 25%
• This portion of the grade is based on student performance on a short policy exercise. A policy-related question will be distributed on October 4. Students will work individually to prepare a 1-2 pages memo to a policy decision-maker in a couple of days.

Final Examination: 50%
• Students work individually. The examination will be a collection of short essays based on class discussions and readings during the course. A set of three questions will be distributed on December 6 (last class). Answers will be due a week later.
• Grades will be based upon the full set of attributes that are important to good policy papers, including accuracy, clarity, logic, and relevance. Referencing sources of information sources is highly desirable.

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:


An extensive report by UNESCO (737 pages) provides excellent background material on various countries/regions around the world, difficult to find elsewhere in such a comparative manner. The report has been published just recently:


*All other readings will be posted on Blackboard, except for selective large reports that you can locate on the internet.*
# Summary Schedule of Class Meetings

## INTRODUCTION

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>8/30</td>
<td>Course Introduction</td>
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## SCIENCE, TECHNOLOGY AND INNOVATION (STI) POLICY

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>9/6</td>
<td>U.S. STI System I</td>
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<td>9/13</td>
<td>U.S. STI System II</td>
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<tr>
<td>9/20</td>
<td>U.S. STI System III</td>
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<tr>
<td>9/27</td>
<td>STI Policy in Europe</td>
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<tr>
<td>10/4</td>
<td>STI Policy in Other Countries</td>
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</tbody>
</table>

## CORE TECHNOLOGY AREAS

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>10/11</td>
<td>Digital Economy I</td>
</tr>
<tr>
<td>10/18</td>
<td>Digital Economy II</td>
</tr>
<tr>
<td>11/1</td>
<td>Energy, Environment, Climate</td>
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<tr>
<td>11/8</td>
<td>Pharmaceuticals, Public Health</td>
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## SYSTEM MANAGEMENT AND THE FUTURE

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>11/15</td>
<td>STEM Education, S&amp;E Workforce, Jobs</td>
</tr>
<tr>
<td>11/22</td>
<td>Entrepreneurship, Innovative SMEs</td>
</tr>
<tr>
<td>11/29</td>
<td>Technology Sovereignty – Industrial Policy Revival</td>
</tr>
<tr>
<td>12/6</td>
<td>The Future of STI Policy: Globalization, Grand Challenges</td>
</tr>
</tbody>
</table>
Analytical Schedule of Meetings and Readings
Core readings are unmarked. Readings marked with an asterisk (*) are recommended.

8/30

COURSE INTRODUCTION

(i) Course Introduction

(ii) Megatrends / Technology Trends in Context of Future Research Policy
Organization for Economic Cooperation and Development Science, Technology and Innovation Outlook 2016, Paris: OECD. [Chs 1, 2]
[Ch1] “Megatrends Affecting Science, Technology and Innovation”
[Ch2] “Future Technology Trends”


(iii) Pandemics in Human History

SCIENCE, TECHNOLOGY AND INNOVATION (STI) POLICY

9/6

U.S. STI SYSTEM I

(i) Foundations of STI Policy – Historical Overview of STI Development
[Ch 1] “Science Policy Defined.”
[Ch 2] “U.S. Science Policy before and after Sputnik.”

(ii) Current and Evolving Issues

Neal, Homer A., Tobin L. Smith, and Jennifer B. McCormick (2008), op.cit. [Chs 3-4]

9/13 U.S. STI SYSTEM II

(i) Institutions – R&D Funding

Neal, Homer A., Tobin L. Smith, and Jennifer B. McCormick (2008), op.cit. [Chs 6-9]
[Ch 6] “Universities”
[Ch 7] “Federal Laboratories”
[Ch 8] “Industry”
[Ch 9] “The States”

(2) “R&D: National Trends and International Comparisons”
https://ncses.nsf.gov/pubs/nsb20225

[Ch 5] Vonortas, Nicholas S. with Brennan Hoban and Connor Rabb “United States of America”

* Executive Office of the President of the United States, Office of Management and Budget (OMB) & Office for Science and Technology Policy (OSTP), “Multi-Agency R&D Priorities for Fiscal Year 2024 Budget”, 7/22/2022.

9/20 U.S. STI SYSTEM III

(i) National Defense – Security

Neal, Homer A., Tobin L. Smith, and Jennifer B. McCormick (2008), op.cit. [Chs 11, 13, 18]

(ii) Space


[1] The next 50 years in space
[2] Using the force
[3] Star laws
[4] Apollo’s sister


9/29

**STI POLICY IN EUROPE**

United Nations Educational, Scientific and Cultural Organization (2021) *op. cit. [Ch. 9]*

[Ch 9] Soete, Luc, Sylvia Schwaag Serger, Johan Stierna, and Hugo Hollanders “European Union”


[ES] “Executive Summary”

[Ch 2] “Innovation Performance and Trends”

[Ch 3] “Innovation Dimensions”

[Ch 4] “Benchmarking Innovation Performance with non-EU Countries”

[Ch 5] “Country Profiles”

European Commission *Horizon Europe - the Framework Programme for Research and Innovation.*
https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en

10/4  
**STI POLICY IN OTHER COUNTRIES**

United Nations Educational, Scientific and Cultural Organization (2021), *op.cit.* [Chs 7, 16, 22, 23]  
[Ch 7] Latin America  
[Ch 16] Israel  
[Ch 22] India  
[Ch 23] China

*Policy Exercise (Memorandum) posted*

**CORE TECHNOLOGY AREAS**

10/11  
**DIGITAL ECONOMY I**

(i) *The New Knowledge-Driven Paradigm; 4th Industrial Revolution*

https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/

(ii) *Advanced Manufacturing*

[Ch2] “Artificial Intelligence and the Next Production Revolution”


[1] Reaching into other worlds  
[2] Reality bytes  
[3] The promise and the reality  
[5] What is real, anyway
DIGITAL ECONOMY II

(i) Artificial Intelligence; The Data Economy;


[ES] “Executive Summary”
[Ch 1] “Introduction”
[Ch 2] “Trends in Artificial Intelligence”


[1] Mirror worlds
[2] Digital plurality
[3] Spreading out
[5] Virtual nationalism
[6] And the winner is….


[1] Reality check
[2] Not so big
[5] Road block
[6] Autumn is coming

ENERGY, ENVIRONMENT, CLIMATE

(i) Energy


“R&D and Technology Innovation”

(ii) Environment, Climate Change


“Climate Brief”, *The Economist*, 2020 (various)

[1] “Politics of climate action”, April 25
[2] “Modelling the greenhouse effect”, May 2
[3] “Carbon cycle”, May 9
[4] “Bad times”, May 16
[5] “Burn”, May 23


[1] The great disrupter  
[2] A grim outlook  
[3] Costs of carbon  
[4] Guilty by emission  
[6] Directing the disruption

11/8 PHARMACEUTICALS, PUBLIC HEALTH


SYSTEM MANAGEMENT AND THE FUTURE

11/15 STEM EDUCATION, S&E WORKFORCE, JOBS

Neal, Homer A., Tobin L. Smith, and Jennifer B. McCormick (2008), op.cit. [Chs 15, 16]  
[Ch 15] “Science, Technology, Engineering, and Mathematics Education”  
[Ch 16] “The Science and Engineering Workforce”


ENTREPRENEURSHIP, INNOVATIVE SMEs


TECHNOLOGY SOVEREIGNTY – INDUSTRIAL POLICY REVIVAL


THE FUTURE OF STI POLICY: GLOBALIZATION, GRAND CHALLENGES

Neal, Homer A., Tobin L. Smith, and Jennifer B. McCormick (2008), op.cit. [Chs 17, 19]  
[19] “Grand Challenges for Science and Society”


*Final Exam posted*
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

National Science Board
http://www.nsf.gov/nsb/

NSF Science and Engineering 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/

The European Union (EU)
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#.UhgijquD9Y0M

*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*
https://www.journals.elsevier.com/technological-forecasting-and-social-change

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