SUMA SP5020: Cost-Benefit Analysis  
Mondays, 6:10-8:00pm  
Credits: 3

Instructor: Alexander Heil, PhD; 347-616-9039; ah3182@columbia.edu
Office Hours: By Appointment Only
Response Policy: Preferred contact via email. I usually respond to all emails within 48 hours. If it is an urgent matter, please contact me via cell phone.

Faculty Support Assistants:  
Samreen Afzal, sa3944@columbia.edu  
Frank N. Agwuncha, fna2113@columbia.edu
Office Hours: By Appointment Only
Response Policy: Please use email as the preferred way of contact.

Course Overview
Cost-Benefit Analysis (CBA) is a policy assessment method that quantifies the value of policy or investment consequences in monetary terms to all members of society. The purpose of a CBA is to help effective social decision making through efficient allocation of society's resources when markets fail. When markets fail and resources are used inefficiently, CBA can be used to clarify which of the potential alternative programs, policies, or projects (including the status quo) is the most efficient.

The course introduces students to the techniques of preparing a CBA, including microeconomic foundations, valuation methods, discounting, the impact of uncertainty, and distributional consequences. The course provides a basic introduction to revealed preference, contingent valuation, and benefits transfer method of valuing environmental impacts. The use and interpretation of CBA in specific cases is critically evaluated. Case studies are integral to each topic. A specific emphasis is placed on the analysis of infrastructure in sectors such as water & wastewater, energy, and transportation. In many cases, projects in these areas require massive investments, and, once constructed, have useful lives of many decades. The understanding of these long-term benefit and cost dynamics is therefore critical to the assessment of development strategies in industrialized as well as developing countries.

Learning Objectives
The objective of this course is to provide an overview of the principles and applications of cost-benefit analysis (CBA) with a particular emphasis on infrastructure [because of my personal background and expertise in this field]. But we will certainly also cover policy analyses in various fields. The expectation is that at the end of the semester you will be skilled at conducting an independent CBA, critique existing CBA studies, and participate in the public debate over how to allocate scarce financial resources to rival projects or policies. The course equally addresses the quantitative skills necessary for CBA as well as practical real-world case studies.

Readings

A selection of additional readings will be required and posted to the course website. These include academic articles and public filings such as reports and environmental disclosures prepared by government agencies and businesses. In addition, the course will draw on texts, articles and other readings on reserve or on CourseWorks.

Resources
Columbia University Library
Columbia’s extensive library system ranks in the top five academic libraries in the nation, with many of its services and resources available online: http://library.columbia.edu/

SPS Academic Resources
The Office of Student Affairs provides students with academic counseling and support services such as online tutoring and career coaching: http://spslife.columbia.edu/student-life-and-alumni-relations/academic-resources.
Course Requirements (Assignments)

Attendance & Participation
Regular attendance and active participation in class are required. Students are expected to have done the readings for each lecture before class. Participation will account for 10% of the final grade. Students will be required to contribute to class discussions. Contributing to class discussions means enhancing the quality of the class experience for yourself and others. It involves making relevant, useful, and non-obvious comments, or posing pertinent questions, in clear and succinct language.

You can utilize the discussion forum feature in CourseWorks to communicate with your group members about the project that you are working on. In addition, you can utilize a discussion thread to exchange information, post comments, and ask questions involving everyone else. However, there is no explicit graded component to CourseWorks discussion.

5-Minute Presentation & response
You are required to provide a 5-minute presentation on a topic related to cost-benefit analysis. This presentation is supposed to contain a maximum of five PowerPoint slides accompanied by an audio file both of which will be uploaded to CourseWorks, not personally presented in class. In addition, you need to respond via Courseworks to another student’s presentation and provide some critical feedback and comments, potentially sparking a discussion of that topic among a wider group.

Group Project
You will be assigned to a group by week 3 of this course. Preferences can be expressed if you have any other individuals that you desire to team up with. Please see me or our TAs before making a final decision about your project and to confirm that it is feasible for the project.

There are four deliverables that are part of the group project:
1. Project Selection & Background: Each group will provide a short memo [2-3 pages] outlining the selected project and the project’s background [energy, water, transportation etc]. This memo is worth 5% of the total grade.

2. Project Methodology & Data Needs: Each group will submit a short memo [2-3 pages] outlining the methodologies likely to be used for the CBA as well as the necessary data. I regard this memo as a work-in-progress deliverable and that changes will likely be made before the completion of the project. This memo is worth 10% of the total grade.

3. Presentation: Specific requirements for the presentation [length, number of slides etc] will be provided on CourseWorks. The presentation is worth 10% of the total grade.

4. Project paper: Each group will compose a paper that outlines and discusses the CBA. The paper will be 10-15 pages in length and include a detailed discussion of the data, assumptions, analysis, and findings of your work. Any Excel calculations need to be included as an appendix, and the Excel file also needs to be submitted electronically. Further details will be provided in class. The paper is worth 25% of the total grade.

Exams
There is one midterm exam (15% of the final grade) and a final exam (15% of the final grade). The midterm is tentatively scheduled for week 7. The final exam will be given during the designated finals week at the end of the semester.

Evaluation/Grading

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<tr>
<th>Component</th>
<th>Percentage</th>
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<tr>
<td>Attendance &amp; Participation</td>
<td>10%</td>
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<tr>
<td>5-minute Presentation &amp; response</td>
<td>10%</td>
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<td>Midterm Exam</td>
<td>15%</td>
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<tr>
<td>Group Project Selection &amp; Background</td>
<td>5%</td>
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<td>Group Project Methodology &amp; Data Needs</td>
<td>5%</td>
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<td>Group Presentation</td>
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<td>Group Paper</td>
<td>30%</td>
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<td>Final Exam</td>
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<td><strong>TOTAL</strong></td>
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Late assignment penalty: Students are expected to submit all their work on time and via Canvas. **There will be a 10% grade deduction for all work submitted late.**

**NOTE:** Academic dishonesty will not be tolerated. This includes failure to properly cite ideas in your work that are not originally yours. Please also refer to the university’s code of conduct for guidance if needed.

**FINAL GRADING SCALE**

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<tr>
<th>Grade</th>
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<tr>
<td>A+</td>
<td>98– 100%</td>
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<tr>
<td>A</td>
<td>93– 97.9%</td>
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<tr>
<td>A-</td>
<td>90– 92.9%</td>
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<tr>
<td>B+</td>
<td>87– 89.9%</td>
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<tr>
<td>B</td>
<td>83– 86.9%</td>
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<tr>
<td>B-</td>
<td>80– 82.9%</td>
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<tr>
<td>C+</td>
<td>77– 79.9%</td>
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<tr>
<td>C</td>
<td>73– 76.9%</td>
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<tr>
<td>C-</td>
<td>70– 72.9%</td>
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<tr>
<td>D</td>
<td>60– 69.9%</td>
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<tr>
<td>F</td>
<td>59.9% and below</td>
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**Course Policies**

* Citation & Submission*
All written assignments must use an acceptable academic formatting standard, cite sources, and be submitted to the course website (not via email).

**School Policies**

* Copyright Policy*
Please note—Due to copyright restrictions, online access to this material is limited to instructors and students currently registered for this course. Please be advised that by clicking the link to the electronic materials in this course, you have read and accept the following:

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted materials. Under certain conditions specified in the law, libraries and archives are authorized to furnish a photocopy or other reproduction. One of these specified conditions is that the photocopy or reproduction is not to be "used for any purpose other than private study, scholarship, or research." If a user makes a request for, or later uses, a photocopy or reproduction for purposes in excess of "fair use," that user may be liable for copyright infringement.

* Academic Integrity*
Columbia University expects its students to act with honesty and propriety at all times and to respect the rights of others. It is fundamental University policy that academic dishonesty in any guise or personal conduct of any sort that disrupts the life of the University or denigrates or endangers members of the University community is unacceptable and will be dealt with severely. It is essential to the academic integrity and vitality of this community that individuals do their own work and properly acknowledge the circumstances, ideas, sources, and assistance upon which that work is based. Academic honesty in class assignments and exams is expected of all students at all times.
SPS holds each member of its community responsible for understanding and abiding by the SPS Academic Integrity and Community Standards posted at http://sps.columbia.edu/student-life-and-alumni-relations/academic-integrity-and-community-standards. You are required to read these standards within the first few days of class. Ignorance of the School's policy concerning academic dishonesty shall not be a defense in any disciplinary proceedings.

School Policies and Expectations:

Accessibility Statement – I want you to succeed in this course. Contact disability@columbia.edu for learning accommodations.

Names/Pronouns – You deserve to be addressed in a manner that reflects your identity. You are welcome to tell me your pronoun(s) and/or name (if different from University records) at any time, either in person or via email.

Discrimination – We embrace the diversity of gender, gender identity & expression, sex, sexual orientation, race, ethnicity, national origin, age, religion, disability status, family status, socioeconomic background, and other visible and non-visible identities. Columbia University does not tolerate unlawful discrimination, discriminatory harassment, sexual assault, domestic violence, dating violence, stalking, or sexual exploitation and all such conduct is forbidden by Columbia University Policy.

Duty to Report – You deserve a University community free from discrimination, harassment, and gender-based misconduct including sexual harassment, sexual assault, domestic and dating violence, stalking, and sexual exploitation. It is therefore University policy to require Columbia faculty and staff to report to EOAA any instance or allegation of prohibited conduct involving any undergraduate or any graduate student that is disclosed to, observed by, or otherwise known to that employee. This requirement to report is in place to help ensure that students are provided appropriate resources and to allow the University to mitigate harm to our community.

Confidential Resources - There are confidential resources on campus who do not have a Duty to Report, including:

- Sexual Violence Response & Rape Crisis/Anti-Violence Support Center (SVR)
- Ombuds Office
- Medical Services
- University Counseling and Psychological Services
- University Pastoral Counseling
- Columbia Office of Disability Services

University employees working in a confidential capacity will not report information shared with them.

Inclusion - In the M.S. in Sustainability Management program, faculty and staff are committed to the creation and maintenance of “inclusive learning” spaces – classrooms and other places of learning where you will be treated with respect and dignity, and where all individuals are provided equitable opportunity to participate, contribute, and succeed.

In our classroom, all students are welcome regardless of race/ethnicity, gender identities, gender expressions, sexual orientation, socio-economic status, age, disabilities, religion, regional background, Veteran status, citizenship status, nationality and other diverse identities that we each bring to class.

Accessibility
Columbia is committed to providing equal access to qualified students with documented disabilities. A student’s disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process. For more information regarding this service, please visit the University’s Health Services website: http://health.columbia.edu/services/ods/support.
Course Schedule/Course Calendar

Most readings will be posted as pdf files in the weekly folders. Some changes to these anticipated readings or the course schedule in general might be made based on student interest and course progress.

General useful resources [there are many more]:


Session 1                January 23

**Topic:** Course Overview & Introduction

Economic Terminology

**Required Readings:**

- BM 1 & 2
- European Commission Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020, December 2014. [This publication is a good general resource that will be useful throughout the entire course and beyond.]
- Richard O. Zerbe and Tyler Scott A Primer for Understanding Benefit-Cost Analysis, Benefit-Cost Analysis Center, The Daniel J. Evans School of Public Affairs, University of Washington

Session 2                January 30

**Topic:** Economic Principles/Review of Microeconomics

**Case Study:** Road Transportation: Completion of the Appalachian Development Highway System

**Required Readings:**

- You may want to consult a standard microeconomics text [I will provide an electronic version of the Mankiw textbook.]
- BM 3
- Website maintained by Transportation Economics Committee at the Transportation Research Board: Cost-Benefit Analysis [https://sites.google.com/site/benefitcostanalysis/](https://sites.google.com/site/benefitcostanalysis/) [There is a lot of excellent material here including links to tools and studies. Exploring this resource will be helpful for some of the other topics covered in this course.]

Session 3                February 6

**Topic:** Valuation of Benefits

Overview of Benefits Methodologies
Experiments

**Case Study:** Environmental Investment: Green Roof Infrastructure
Environmental Policy: Plastic Bag Ban

**Required Readings:**

- BM 11 & 12
Master of Science in Sustainability Management  

Syllabus as of 12/30/2022


**Session 4**  February 13

**Topic:** Valuation of Benefits [continued]
- Direct estimation of demand curves
- Indirect Market Methods

**Case Study:**  Aviation: Heathrow Airport Expansion

**Required Readings:**
- BM 4, 13 & 14

**Assignment Due:**  Project Selection & Background Memo

**Session 5**  February 20

**Topic:** Valuation of Benefits [continued]
- Contingent Valuation
- Shadow prices

**Case Study:**  Water & Sanitation: Global Water & Sanitation Investments
- Climate Change Mitigation: Hurricane Bubble Curtain

**Required Readings:**
- BM 15, 16 & 17

**Session 6**  February 27

**Topic:** Valuation of Benefits [continued]
- Contingent Valuation
- Present Value & Discounting

**Case Study:**  Transit: Bus Rapid Transit Systems & Expansion of Bay Area Rapid Transit
- Vehicle transportation: Vehicle mileage standards

**Required Readings:**
- BM 6 & 10

**Assignment Due:**  Project Methodology & Data Needs Memo
### Session 7  March 6

**Topic:** Present Value & Discounting [continued]

**Social Discount Rate**

**Case Study:** Climate Change Investment: Storm Surge Barrier for New York City

**Required Readings:**

- BM 6 & 10
- US Army Corps of Engineers *NY & NJ Harbor & Tributaries Focus Area Feasibility Study (HATS)*
  

**Assignment Due:** Midterm Exam

### Session 8  March 20

**Topic:** Uncertainty

**Sensitivity Analysis**

**Case Study:** Energy: Three Gorges Dam & Smart Grid

Health: Vaccinations

**Required Readings:**

- BM 7
- Electric Power Research Institute *Guidebook for Cost/Benefit Analysis of Smart Grid, Demonstration Projects* Revision 1, Measuring Impacts and Monetizing Benefits, 1025734

### Session 9  March 27

**Topic:** Critiques of CBA

**Case Study:** Freight Transportation: Bayonne Bridge

Technology: Investment in internet connectivity in Malawi

**Required Readings:**

- BM 20

### Session 10  April 3

**Topic:** Other types of analysis
**Master of Science in Sustainability Management**

**Economic Impact Analysis**
Financial cost-benefit analysis
Cost effectiveness analysis
Lifecycle cost analysis

**Case Study:**  Passengers Rail: High speed rail in California

**Required Readings:**
- BM 18

**Session 11**  
April 10

**Topic:** Course summary & review

**Case Study:**  Ecosystem Services: Bees
Wastewater reclamation

- Food and Agriculture Organization of the United Nations *Economic Valuation of Pollination Services: Review of Methods* 2006

**Session 12**  
April 17

**Topic:**  Peer review & discussion of student topics & projects

**Assignments Due:**  Group Presentations

**Session 13**  
April 24

**Topic:**  Peer review & discussion of student topics & projects

**Assignments Due:**  Group Presentations

**Session 14**  
May 1

**Topic:** Peer review & discussion of student topics & projects

**Assignments Due:**  Group Presentations
Group Project Paper
Final Exam