Civil & Environmental Engineering 482
Evaluation and Decision Making for Infrastructure Systems

Joseph L. Schofer Spring 2023

Overview

In this course we will learn about strategies and methods for evaluation and decision making for infrastructure projects and systems, focusing primarily on transportation.

We will study three kinds of evaluation: *assessment* of existing facilities and systems; *a priori* evaluation of proposed options, and *ex post* evaluation of actions already taken, with the objective of learning how to conduct evaluations and provide support for decision making.

We'll learn about principles and theories, examine some cases – decision problems requiring evaluation, evaluations done by others, and some broader infrastructure decision issues. We'll explore how decision makers use information, what kinds of information may be most useful, ways to develop and deliver that information, and what others have done in this space.

There will be some lectures spread through the course, but we expect a small class and so we will work together to read, discuss, and work, individually and collaboratively, in and outside of class, on some evaluation problems.

Our learning objectives are these:

- Learn the role, function and some methods of evaluation and decision making
- Learn how people and organizations actually use information to make decisions about investing in and managing infrastructure systems

The class will meet on Tuesdays and Thursdays from 2:00 to 4:00 CDT (GMT -5) in Tech LG62. Our first class will be on Thursday, March 30th. I expect you to attend class; If you must miss a session, please let me know in advance. For some classes we will not meet because I must be traveling. These are work sessions for you. Do not waste them. If our end-of-quarter presentations must spill over, we will find an additional date after June 1st.

Requirements for students:

1. Read assigned materials and come to class prepared to discuss them. Participation in these discussions is expected and will be assessed in terms of both quantity and quality of your contribution. Part of your class contribution will be bringing contemporary evaluation issues to the class – issues you may find in credible news sources on the Internet or in newspapers. Grading weight: approximately 20%.
2. Select a topic from the list under Assignment 2, study the topic in depth using sources posted on Canvas and others, and prepare a comprehensives PowerPoint report to the class near the end of the quarter. Each presentation will be allocated about one-third class period. One mid-course progress report is required, in class supported by a single page update submitted in advance of the in-class report. I invite you to meet with me to discuss your plans and progress, either by Zoom or in person. Grading weight: approximately 50%.

4. We will work together on at least 2 team problem solving sessions, listed as assignments 3 and 4 and delivered in class. Grading weight: approximately 30%.

Collaboration Days – No Classes

April 11, Tuesday
May 2, Tuesday
May 4, Tuesday
May 25, Thursday

Access to Me

I will not post formal office hours. I will generally hang around Tech after classes, particularly on Tuesdays. I can meet you before or after class on an appointment basis. Or we can set up a Zoom or face to face meeting at a mutually convenient time, including evenings and weekends. When you want to have a conversation, send me an e-mail and we'll make a plan.

Calendar – subject to adjustment

March 30

Thursday

Introduction Plans for the course; Introduction to evaluation functions and types.
Class exercise – Assignment 1: traffic management for Northwestern's new stadium: In advance of class - develop framework and criteria for evaluating a quick traffic study for concert events (not football games) for this new facility. In class, evaluate the study itself (to be provided) and suggest how we might approach the task.
Evaluation frameworks
Introduction to logic models: sharpening and sharing our system concept.

April 4 – 6

Tuesday, Thursday

Evaluation is about decisions, decision making, decision processes and decision makers.
Theory – how people make decisions.

- Watch 45 minute video in advance and prepare to discuss in class: Daniel Kahneman, "Thinking That We Know," the 12th Annual Sackler Lecture on the Science of Science Communication, National Academies of Science, Engineering and Medicine, https://www.youtube.com/watch?v=di6kl4ViWgk . What is the relevance, implication for delivering information to inform decision makers

Models of decision making; Rational models, empirical models; factors affecting decision makers, and why don't they listen to me? Role of the analyst/planner/engineer. Public vs. private decision criteria – who is our ultimate customer?

- Read and be prepared to discuss William T. Gormley, Jr., "From Science to Policy in Early Childhood Education," Science Vol. 333, pp. 978-981 (August 19, 2011); DOI: 10.1126/science.1206150. How to influence policy makers.

April 11 – 13

April 11 - NO CLASS MEETING I will be chairing supply chain resilience conference in DC
April 13 Thursday

Types of evaluation and their connection to decisions: *A priori* and before/after evaluation – connections to real decisions. Assessments – not immediately connected to decision.

Overview of a priori evaluation – project evaluation applications, tools
The logic of benefit cost analysis

- Foster & Beesley, "Estimating the Social Benefits of Constructing an Underground Railway in London," *J. Royal Statistical Society*, V. 126, N. 1, 1963.
- Jonas Eliasson & Mattias Lundberg, "Do cost-benefit analyses influence transport investment decisions? Experiences from the Swedish transport investment plan 2010-21," *Transportation Reviews*, V. 32, N. 1 pp. 29-48, 2012.
- M. Lawrence, A. Hachey, G. Bahar, and F. Gross, *Highway Safety Benefit-Cost Analysis Guide,* Federal Highway Administration Office of Safety, February 2018, chapters 2, 4 & 6.

April 18 –20

A priori evaluation continued

BCA Applications: What is included, excluded? Strict vs flexible applications. Resilience, equity examples. Monetization of everything.

Role of politics and politicians
Multi-criteria evaluation
Discussion – can we replaced DM with AI? Should we?
The forecast challenge

April 25-27

Before and after evaluation: why and how; natural experiments: applications, methods, complexities

May 2-4 NO CLASS THIS WEEK!

Work on Assignment 3, the LaGuardia Access Project (an *a priori* evaluation) and your own reports

May 9, 11

Tuesday, May 9: **All-class report: LaGuardia Access Project** – a lightweight alternatives analysis

Assignment 4 starts: **The Case for Investing in Metra** – deep dive exercise begins

Introduction to funding and finance

Thursday, May 11 Guest expert: Robert Peskin, PhD on transit finance

May 16-18

Tuesday May 16 Before-after evaluation wrap up: Empirical Bayes; meta-analysis, and other methods

Risky decision, managing and conveying risk

Thursday May 18 Getting to decisions in risky situations, and what happens when we fail

In class team workshop on Assignment 4: the case for investing in Metra

May 23 – 25

Tuesday May 23 – Present Assignment 4: the Case for Investing in Metra

Thursday, May 25 NO CLASS MEETING – FINISH YOUR PAPERS (Assignment 2)

May 30 – June 1

Tuesday, Thursday: Student Project Presentations and Discussions

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