

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

PROJECT EVALUATION (1.011)

Spring 2011

Instructors: Professor Joseph Sussman (JS)
Carl Martland (CDM)

Teaching Assistants:
Nihit Jain (NJ)
Edna Edzell (EE)

Assignment 1.1 – Basic Concepts 1

Distributed: Lecture 2

Due: Lecture 5

Apart from the last question, the problems on this assignment are drawn from Martland's text, with some minor editing.

Chapter 4 (Martland)

(Essay and Discussion Question 4.4 with a short addition)

1. In the United States, most power plants use fossil fuels to generate electricity, despite the availability of nuclear power plants that are much cleaner and require no fossil fuel. Most intercity transport involves automobiles and airplanes, despite the availability of more energy-efficient rail and bus services. Nuclear power plants, which have experienced no fatal accidents in the United States, are feared as too risky whereas automobiles, which in fact cause 30,000 or more fatalities per year, are viewed as essential. Discuss some of the ways that public policy, technological development, and public perceptions of risk have influenced or could influence the extent to which the United States depends upon imported fossil fuels for generating electricity and for transportation. What kinds of projects would you advocate for reducing our dependence upon imported fossil fuels? *In general terms, how might you evaluate these project?*

(20% of assignment)

(Problem 4.1)

2. Identify the major economic, environmental, and social impacts likely to be associated with one the following projects:
 - a. Construction of a superhighway through an urban area
 - b. Construction of a major dam that is intended to control flooding, generate electricity, and provide irrigation to the surrounding region
 - c. Construction of a nuclear power plant near the coast in a region that depends heavily on tourism and ocean-based recreation (Once the nuclear plant is operating, a nearby coal-fired power plant will be closed.)
 - d. Construction of a wind farm along a ridge in the rural part of a region that is noted for two things: its beauty and its poverty

(15% of assignment)

Chapter 5 (Martland)

(Problem 5.7)

3. Consider a proposed project in which an initial investment of \$100 million would produce an annual financial benefit of \$3 million. The project is intended to improve water quality and increase the efficiency of the water delivery system in the region. The financial benefits relate to two factors: There would be less leakage in the pipes used to transport water to the city from the reservoir. The proposed treatment program would be more efficient. The life of the project is expected to be 100 years. Two-thirds of investment is related to replacing the pipes to eliminate the leakage, while the rest is related to upgrading the treatment facility. The project would be financed either by selling bonds or borrowing money from a local bank; either way, the annual interest rate would be about 4–5%. A hearing has been scheduled for the project, and several speakers have been asked to present their viewpoints. What is the main point that you expect each of the following people to make at the hearing?
 - a. A banker whose bank has made many loans to the city to finance a variety of projects (The banker is known to prefer projects whose financial benefits are sufficient to cover the financial costs of the investment.)
 - b. An environmental advocate who recently wrote an article entitled “Discounting Is Unethical—We Must Not Overlook Benefits to Future Generations.”
 - c. A doctor who believes that the new water treatment system will lead to a measurable improvement in health for the region
 - d. A farmer whose crops depend upon a reliable supply of water

- e. A politician who is in the midst of an election campaign; his slogan is “It’s high time for low taxes.”
- f. His opponent, whose slogan is “Build now for our children and for their children.”
- g. A civil engineer at the local university who recently completed a study of the water supply system (Among the results of the study was a finding that two major leaks caused 80% of the loss of water; these leaks could be fixed for less than \$5 million, and the rest of the system should continue in reasonable condition for another 20–30 years.)
- h. The chair of a citizen’s advisory committee that advises the mayor on all major infrastructure projects that involve use of taxes to cover operations or investment (This group used the federally recommended discount rate of 7% to determine that the benefits of \$3 million per year over the life of the project would have a present value of more than \$40 million.)
- i. Finally, since you are related to the mayor and you are known to be an excellent student with an interest in infrastructure, you have been asked to listen to all of the previous speakers and summarize what you feel should be done.

(20% of assignment)

(Problem 5.12)

- 4. There are four options for building a new road that would shorten the distance between two cities, reduce congestion on existing roads, and improve safety by diverting traffic from a narrow road with many dangerous curves. A committee has been formed to select the best option, and they are reviewing the results of analyses as presented in the following table. Explain how you would create a single measure that encompasses all of these criteria.

(15 % of assignment)

Problem 5.12: Options for Building a New Road

Option	Investment Cost	Maintenance Cost/Year	Miles Saved Relative to Existing Route	Ex ir
A	\$100 million	\$10 million	1	
B	\$120 million	\$10 million	1	
C	\$140 million	\$ 8 million	2	
D	\$160 million	\$ 7 million	3	

Macro-engineering

5. China now has the second largest GDP in the world, behind only the U.S and is growing at 9% annually (although on the measure of GDP per capita, they trail many other countries). China has a huge geographical scale as well. For centuries, China has “thought big”. In ancient times, they built the Great Wall and today they are building a vast network of high-speed trains at a dramatically rapid rate and the Three Gorges Dam, a project of huge scale.

We asked you to read Chapter 2 of *Macro-Engineering: Global Infrastructure Solutions*. The second part of that chapter is entitled *A Medieval Chinese Macro-Engineer, Liu An—His Way of Reconstructing the Grand Canal in the Eighth Century* and describes an macro-engineering project of substantial scale and national importance in China thirteen centuries ago.

We also attach a short recent news article (January 24, 2011) entitled *China to create largest mega city in the world with 42 million people*. This article discusses a plan to “merge together the nine cities that lie around the Pearl River Delta” You can google Pearl River Delta to set this area geographically. The article also mentions several other mega city projects in China even more ambitious in scale.

Now obviously, the Grand Canal and the Pearl River mega city are different in many ways. As you would expect, the technologies and structure of these projects are not alike and they exist in different political structures. Yet, these projects are alike as well from the viewpoint of the motivation for building them (in the modern case, possibly building them), their goals and objectives, the barriers to success they face (or faced) and others you may think of.

- a) Please write a 500-word essay discussing the ways in which these projects are alike and what lessons the contemporary project could take from the Grand Canal project.
- b) Comment in 500-words on China’s strategy of creating mega cities. How would you use the principles of project evaluation to decide whether this is a wise strategy?

(30% of assignment)

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