1.011 Project Evaluation

Carl D. Martland
(This template by Lexcie Lu)

Assignment 7 Grading Template

This is the second of a series of assignments designed to assist the student in putting their final project together. Some students wrote the assignment in prose form, including exhibits that could easily become a first draft for the final report, while others treated it as more of a problem set and answered each question.

The assignment is graded out of 120, to reward students who have put extra effort into any of the sections.

Part A

Many different types of risks could be identified, for example, political, economic, forecasting risks, construction risks, etc. The student was expected to give examples of each type of risk and relating it to the project they are investigating. Some students went above and beyond identifying the risks by discussing them in detail and perhaps talk about their mitigation. Such response earned the bonus points at the instructor's discretion.

It is important to distinguish between problems and risks in this section. An example of a problem would be the collapse of the bridge during construction. A risk is the possibility that the soil conditions might be bad and the engineers might have miscalculated the amount of weight the soil can support, causing a bridge collapse. Thus, the student needed to go above and beyond simply recounting the problems that were actually encountered during the project's construction; the student should identify why the problems arose and clearly specify exactly what *caused* the problem.

Part B

For each of the risks identified in Part A, the student should discuss how the risks might have been evaluated. If the risk was that the soil conditions might not be right for building a bridge. One way to evaluate this risk might be to conduct field surveys at the proposed sites, thereby becoming more confident about the geology of the area. In this case the survey is an evaluation as well as a mitigation strategy. In other cases, the risk cannot necessarily be mitigated. For instance, if the risk was that travel demand would not materialize, one way to evaluate that risk might be to conduct travel demand surveys to see if the demand is really there. Understanding how the travel demand might vary with other variables, such as the state of the economy, could give us an idea as to under what circumstances the travel demand would not be met – or indeed what is the chance of the travel demand not meeting the expectations. The chance that the travel demand would not meet expectations is a quantitative evaluation of the risk.

Some student may talk about formal risk assessment methodologies as applied to transportation accident risk or hazardous materials handling risk. These are acceptable solutions to the question, provided that it is understood the reason those risk assessment methodologies are used is to figure out the chance of something going wrong – and if the methodology is properly related to the project in question.

Part C – Scenario Analyses

Scenario analyses differ from sensitivity analyses in that a scenario analysis should involve variation of a set of variables in a consistent fashion. For example, if the project in question was construction of a tolled turnpike, one scenario might be that gas prices are doubled due to political uncertainty in oil-producing regions. The effect of that might be widespread: (1) gas price might go up; (2) people might drive less, so turnpike will see less traffic; (3) the economy might slow down, so people might be less willing to pay for turnpike versus the parallel freeway; (4) transportation of aggregate might become more expensive, since it is very energy-intensive and can realistically only be done by trucks; (5) but labor might become cheaper, due to the economic slowdown; (6) interest rates might become lower, because of government policy to kick-start the economy and spur investment. While each of these effects would affect the costs and benefits of the turnpike project in different ways, those effects have a single root cause. The benefits might be lower, but the cost of the turnpike might also be lower because of the lower interest rates and labor costs. This scenario might then be labelled as a 'gas price doubles' scenario.

Some understanding of macroeconomics and input-output model can be beneficial to answering this part of the assignment, although this is not required. Macroeconomic models can help predict the effects of costs of various materials on one another, and their effects on demand for various products. This is especially important in evaluation of large infrastructure projects. The timing of the economic cycle could also play an important role – for instance, projects such as the Hoover Dam were built in the times of economic depression as a catalyst for rebuilding the economy. The projects were usually timed to finish just as the economy recovers, thus the benefits occur at a time when the prices are high, while the costs (especially labor) occur at time when prices are low. Some of these projects were more successful than others, but if the students choose to write about one such project, they should identify scenarios that are related to the general state of the economy.

To a certain extent, the student's success in grasping this part of the assignment is dependent on the granularity of their revenue and cost models. For a toll road, if the revenues are simply based on a fee multiplied by the number of daily vehicles, and costs based on the number of lane-miles, then it is not clear how the state of the economy would affect these variables. However, if the revenue model was based on some analysis of transportation demand, and cost model based on an evaluation of labor, material, and other costs, then it is clear that the variables are connected and should be changed in a coherent manner. Thus, the more detailed the cost and revenue models, the higher the likelihood of success in this part of the problem set.

In summary, the student should understand that changing a single variable without changing any other is not realistic, and understand the difference between a scenario analysis and a sensitivity analysis. The student should also understand that changes to benefits, costs, and other variables are interrelated in a complex fashion, tied together by macroeconomic systems. The precise relationship does not matter at this stage; the issue at hand is that they are related, and in a somewhat logical manner.

Part C – Risks & Uncertainties

Risks are as detailed in Part A. Uncertainties are something different – they are things that you're not too sure about. The travel demand might not materialize is a risk in the project. Risks are relatively well defined, and it is possible to quantify the probability of a lack of travel demand through sophisticated studies. On the other hand, the state of the economy in five years' time is an uncertainty, since no one really knows what shape the economy would be in at that point (some experts argue that the economic cycle is really chaotic, and driven by random events). Risks are in general quantifiable through a risk assessment process, whereas uncertainty is much fluffier – involves either chaotic variables, or fear of the unknown.

Those who are interested in this topic can consult economic literature. Here is a short extract from a website that deals with such matters:

> In economics, the definitions of risk and uncertainty are different, and the distinction between the two is clearer. Frank H. Knight established the economic definition of the terms in his landmark book, *Risk, Uncertainty, and Profit* (1921):
>
> **risk** is present when future events occur with measurable probability
> **uncertainty** is present when the likelihood of future events is indefinite or incalculable
>
> *Morgan Rose*, http://www.econlib.org/library/Columns/Teachers/riskuncertainty.html

The student should also identify concrete ways to reduce risks and uncertainty as related to their project. This is in part duplicated in the requirements for Part A of this problem set. In Part A, the students were required to identify risks more qualitatively, whereas in Part C, the mitigation strategies should have some quantitative basis, based on the scenario analyses conducted.

Instructions for the Instructor

The instructor should print out the template detailed on page 4, and staple one copy to each of the students' assignments for EZ-grading.

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Problem Set 7 – Risks & Uncertainty
Mark Scheme

Part A – Identify Four Type of Risks [25]

Risk #1 /5	
Risk #2 /5	
Risk #3 /5	
Risk #4 /5	
Bonus /10	

Part B – Discuss Evaluation of Problems [25]

Problem #1 /5	
Problem #2 /5	
Problem #3 /5	
Problem #4 /5	
Bonus /10	

Part C – Scenario Analysis [50]

Scenarios /5	
ΔCosts & ΔBnft /5	
Results /10	
Bonus /10	

Critical Risks /5	
Uncertainties /5	
Risk Mitigation /10	
Bonus /10	

General Comments

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