

ENGG105 Tutorial Week 10 – Project Costing

Learning Outcomes

By the end of this tutorial, students will have had an opportunity to:

- Appreciate the impact of different costs on engineering design decisions
- Develop a framework for estimating financial costs of the project
- Consider non-financial factors in a cost-benefit analysis
- Develop a costing plan for their design project.

Resources

- Cost-Benefit Analysis worksheet

Tutorial overview

This week, you will use the tutorial time to commence a project cost estimation, then develop a Cost-Benefit Analysis considering the lifecycle of your design. It is not expected that you will have enough information to complete your costing in-class – you should leave today's class with a number of questions and avenues for further research.

Tutorial Plan

Task 1 – Team progress updates

Task 2a – Top-down estimation

In this task, you will use the 'top-down' approach to start developing a rough estimate of your project financial cost. In this approach, your team must identify the major components of your proposal. These could be the major components of the design that each individual team member is responsible for. They could also be identified as major stages of a project if this is appropriate.

Once the components have been identified, you can work individually, or as a team to develop a list of details they need to start putting a rough costing together for each major component. A useful approach is to identify **analogous designs/products/projects** where final costs are available to use as a basis for a cost estimate. These don't have to be identical designs/products/projects, the cost estimate could be developed by scaling up or down the final cost of an analogous design.

Task 2b – Information sharing (Delphi technique)

Cost estimation is a difficult task, particularly for the inexperienced. The Delphi technique develops certainty by drawing on the wisdom of those outside the core project team to facilitate an iterative approach to estimation. This task is an opportunity to take advantage of the collective wisdom of the class. Each team has 3 minutes to report back on one component of their proposal they believe can be easily estimated (or they have already estimated), and one component they are having difficulty working out how to estimate. After each presentation, the class and your tutor can offer suggestions as to how the team could develop an estimation.

Task 2c – Responding to outside input (Delphi technique, part 2)

Following up on suggestions from the class and other ideas presented, you will now work as a team to re-examine the more difficult components of your cost estimation and further develop an estimate. A genuine Delphi study would involve several iterations of input and refinement. After this class consider seeking further input by discussing your estimations with peers from other classes or practicing engineers if you know any.

Task 3 – Bottom-up estimation

The purpose of a bottom up analysis is to break down the major components identified in the top-down analysis into their smaller components. For example, an earth moving project stage could be broken into unit costs such as equipment hire rates, \$/m³ of soil removed, hourly worker rates, then a model developed for estimating the quantity required of each. This granular approach to estimation can then be compared to the rough cost estimation determined using the top-down approach. The purpose of doing both approaches is to develop confidence in the overall cost estimation – if a figure that seems reasonable for a major component is lower than the detailed costing, cost-savings may have to be found, or contingency funds must be included in the costing. If the two approaches match, there can be confidence that the estimation is accurate.

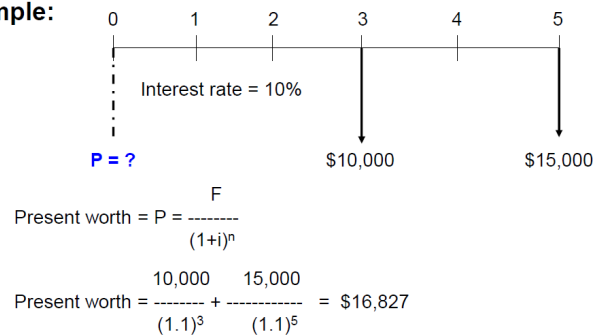
In this task, start working on a bottom-up estimation for one of the more challenging major components your team identified in the previous task.

Task 4 – Non-financial factors in project costing: Cost-Benefit analysis and the triple bottom line

Consider the concept of cost benefit analysis (CBA) and Triple Bottom Line. This is an important process for successfully justifying the financial cost of their design by potentially offsetting these costs with social and environmental benefits (or vice versa). For the this activity, you will also need to determine a 'planning-horizon', a time period for the operation or cost payback period for your design.

This task can be separated in to the design components that individual team members are responsible for. This is an important exercise as you will be expected to include a costing in your final report (see milestone 5 assessment criteria).

Example:



EVERYONE. EVERY PROJECT. EVERYWHERE. WE ARE ALL IN.

Triple Bottom Line Cost Benefit Analysis: Boarding Area B

	Financial NPV		Social & Environmental NPV		Sustainable NPV	Sustainable BCR	
Green Roof	-\$1,052,555	+	\$6,340,104	=	5,287,549	4.07	➡
Electrochromic Glazing	-\$3,287,126	+	\$6,255,624	=	2,968,498	1.90	➡
Motorized Window Shades	-\$7,593,481	+	\$6,255,624	=	-1,337,857	0.84	
Interior Landscaping	-\$8,480,450	+	\$11,392,549	=	2,912,099	1.34	➡
Radiant Heating and Cooling	-\$2,842,986	+	\$435,498	=	-2,407,488	0.61	
Ground Source Heat Pump	-\$5,821,573	+	\$594,152	=	-5,227,421	0.40	

- 50 year study period
- Risk-adjusted outcomes
- Apples to apples, objective case for prioritization

Use this table, or one similar to start planning your Cost-Benefit Analysis. Do this using a Triple Bottom Line (TBL) approach which considers costs and benefits in financial, Human and Environmental terms.

Planning Horizon >>>>>>>>	Timeline	Cost (-) or Benefit (+)		
		Financial	Human	Environmental
	Totals:			