

Cost Estimation Overview



Now...let's start estimating costs...

Science and engineering are often about using your best estimates; fortunately, there are tools and methods to help...



Cost Estimation Techniques

Cost Estimation: an integral part of the investment analysis process

- Provides information necessary to establish price
- Determines if product (or service) can be sold profitably (Revenues > Costs)
- Defines how much capital (\$) can be justified
- Establishes benchmarks for future improvements in our estimation process!

Cost Estimation Techniques

Two general approaches to cost estimation:

Top-Down Approach:

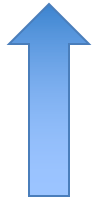


Uses historical data from similar efforts, accounting for inflation, size, energy consumption, etc.

Usually a rough, “back-of-the-envelope” calculation

Often used early in the planning process

Bottoms-Up Approach:



Breaks project down into small elements

Costs estimated for each piece

Add the individual costs together

Much more detailed approach; often done when accuracy is important

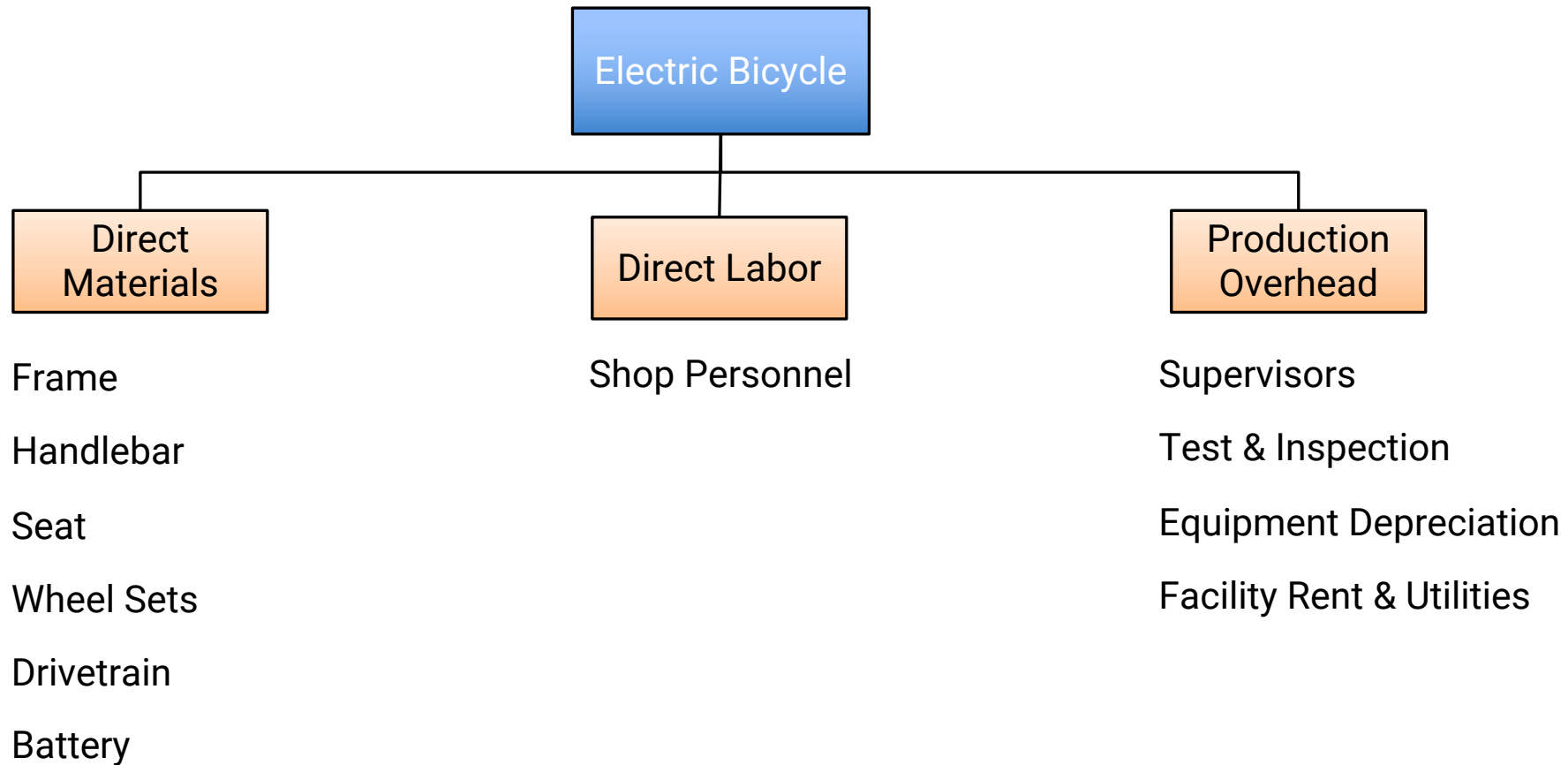
A Top-Down Approach

How would you approach a top-down cost estimate for an electric bicycle, especially if your company made electric bicycles?

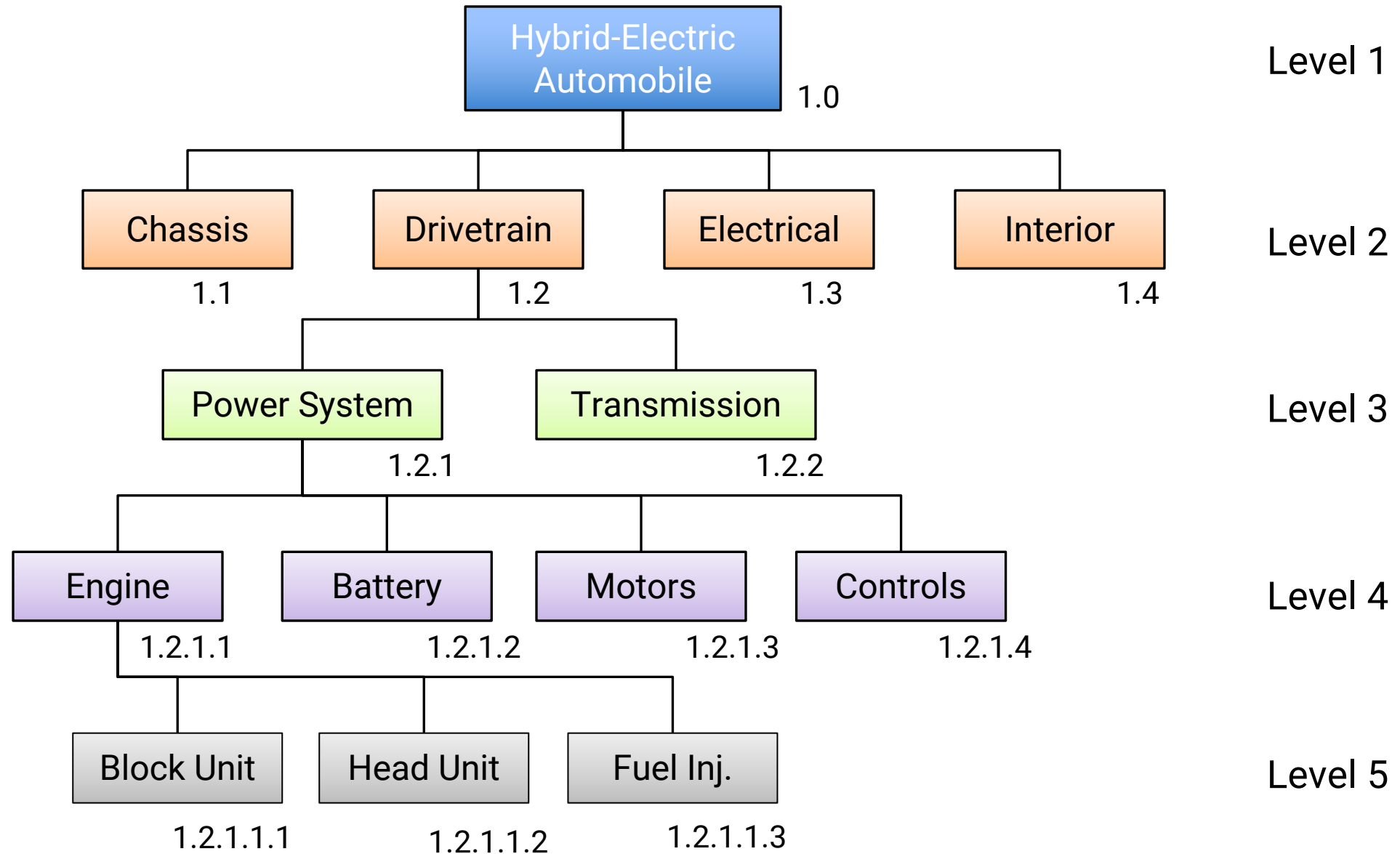


The Work Breakdown Structure – “WBS”

This WBS is a bottoms-up approach to cost estimation...



The WBS in Product Cost Estimation



Approaches to Cost Estimation

I. Order of Magnitude – top-down, “back of the envelope” estimate

- Common early in the process (Level 1 of WBS)
- Considerable uncertainty (perhaps +/- 50%)
- Requires little time
- But doesn't cost much to do

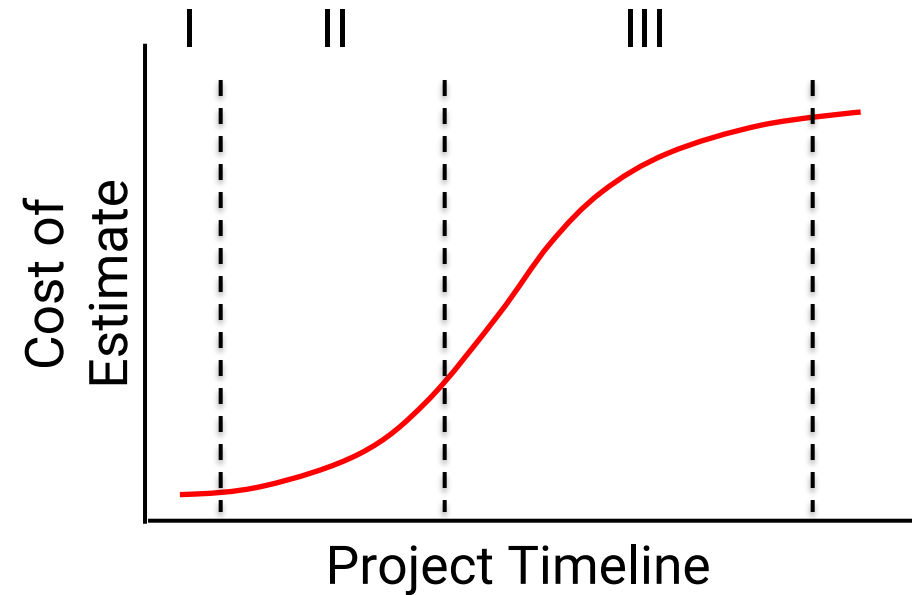
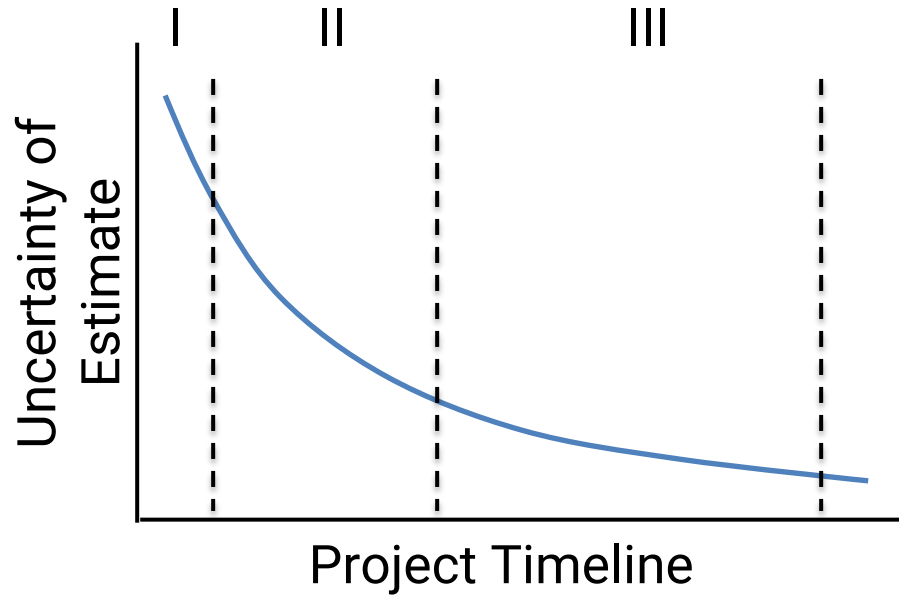
II. Budget (Semi-Detailed) Estimate – more detailed

- Covers first few Levels of WBS
- More accurate (+/- 20%)
- Takes more time to conduct due to additional research
- Costs start to increase

III. Detailed Estimate – bottoms-up approach; complete WBS

- Very accurate, but takes more time to research
- Used in final stages of engineering design and production
- Uncertainty is very low (+/- 5%)
- Costs increase dramatically

Approaches to Cost Estimation



- I. Initial Estimate: High Uncertainty, Little Time & Cost
- III. Final Estimate: Low Uncertainty, Considerable Time & Cost

Example: Initial Cost Estimates

Your boss is heading to a meeting in 15 minutes and asks you to estimate the cost to produce a 100 hp compressor.

You do a little research and find out the prices of comparable compressors range between \$30,000-35,000.

You know your company have a Costs of Goods Sold (COGS) of 60%, so it would likely cost your company \$18,000-21,000 to produce.

As your boss is running to the meeting, you state that while a “rough order of magnitude”, a reasonable cost estimate is between \$18,000-21,000.

Time to generate the estimate: 10 minutes (0.167 hrs)

Cost of Engineering Time: \$100/hr

Cost of the Estimate: \$17

Example: A Little More Accuracy

You are the Project Leader estimating the cost of designing, engineering and building a complex satellite system.

You meet with your team of 6 people every week for 4 hours for the next six months. How much are you spending just for the meetings?

$$(6 \text{ people}) * (4\text{hrs/wk}) * (26\text{wks}) = 624 \text{ hours}$$

Assuming \$100/hr as an average cost of each person:

$$\text{\$100/hr} * 624 \text{ hrs} = \text{\$62,400}$$

And this is just for the meetings!

The next step is for each person to estimate the costs of each element of their part of the project...

Main Takeaways...

- Estimating costs is part of what we do as scientists and engineers, and we need to get comfortable with the uncertainty associated with them.
- Early in the project timeline, estimates are high-level, often “back-of-the-envelope” estimates that might have a high degree of uncertainty but did not cost much to obtain and are therefore appropriate at this point in the project.
- As the project progresses, knowledge is gained and estimates get much more accurate. However, all that knowledge costs money – so these estimates ultimately are more expensive to obtain.

Cost estimation is part of any project, from a top-down approach at the beginning to a comprehensive, bottoms-up WBS approach prior to final design!

Next Time...

Cost Estimation Techniques



Credits & References

Slide 1: One arrow hitting center target, horizontal banner by Olivier Le Moal, Adobe Stock (36961324.jpeg).

Slide 2: Pensive office worker wondering looking at side by Antonioguillen, Adobe Stock (201792382.jpeg).

Slide 5: Black electric bike isolated with clipping path by eshma, Adobe Stock (222853589.jpeg).

Slide 14: One arrow hitting center target, horizontal banner by Olivier Le Moal, Adobe Stock (36961324.jpeg).