

**CHAPTER 2**  
Identifying and Estimating Costs and Benefits  
*Solutions*

**REVIEW QUESTIONS**

- 2.1 Costs and benefits are relevant if they differ across decision options.
- 2.2 A cost is controllable if the decision maker can avoid the cost by not choosing a decision option. Equivalently, a controllable cost is one that a decision maker chooses to incur, relative to doing nothing.
- 2.3 Because previously made commitments and contractual obligations expire with the passage of time.
- 2.4 The ability to change the levels of capacity resources related to plant, equipment, and salaried staff.
- 2.5 Because many decisions contain elements of both the short- and long-term. Consider sleeping through a test – this has immediate and, perhaps, longer-term consequences.
- 2.6 Costs and benefits are the result of performing activities.
- 2.7 Revenues typically are variable with respect to sales volume.
- 2.8 Variable costs are proportional to the volume of activity, whereas fixed costs do not change as the volume of activity changes. Mixed costs contain both fixed and variable components.
- 2.9 Traceability is the degree to which we can directly relate a cost or revenue to a decision option.
- 2.10 A cost or revenue that we can uniquely relate to a decision option is a direct cost or a direct benefit. If only a portion of the cost or revenue pertains to a particular decision option, then it is an indirect cost or an indirect benefit.
- 2.11 Step costs stay at the same level for a certain activity range, but jump to a higher amount if the volume of activity increases beyond this range.
- 2.12 There are four kinds of costs in the cost hierarchy – unit, batch, product, and facility.

**DISCUSSION QUESTIONS**

- 2.13 When we define the value of an option as the controllable benefits from that option less the controllable costs of the option, we are implicitly defining value relative to the *status quo* of not doing anything (i.e., not taking any of the options associated with the decision being

considered). Such a definition allows us to equate the value of the option with the net cash flow associated with it. However, focusing on relevant costs and benefits will not give us the same value because some costs and benefits may be common across all options. The only exception is when the status quo of not doing anything is a feasible option. In this case, *all* costs and benefits associated with any option are relevant because there are no costs or benefits associated with the status quo.

- 2.14 Qualitative factors are as relevant as cash flows. Consider the decision of buying fruit in a local grocery store. Let us say that your favorite grocery store is selling fresh grapes for \$3.99 a pound, but in an adjacent store grapes are available for \$1.99 a pound but they are not as fresh. The decision to make is whether you are willing to pay the extra \$2.00 a pound to enjoy fresh grapes. You may well decide to do so. How did you make the trade-off? Clearly, the additional benefit that you get from fresh grapes is not quantifiable. Yet, you are able to use your judgment to make the trade-off.
- 2.15 Suppose you have decided to buy a car. You have already set your heart on buying a Subaru Outback. There are two Subaru dealers nearby, and both offer exactly the same price. In this case, the price of the car is controllable because you may choose not to buy the car (i.e., the status quo). However, given that you have already made the decision to buy, the price of the car is not relevant in deciding which dealer to buy from.

This example establishes that not all controllable costs are relevant *unless* the status quo is also an option. But every relevant cost is controllable because, by definition, relevant costs are costs that differ across decision options. The fact that they differ means that they are controllable.

- 2.16 Generally speaking, sunk costs are not relevant for decision making because these are costs incurred (or committed to) in the past, and, therefore, do not vary across decision options. But, in some instances, there are future tax considerations that may arise from past decisions, and that may be relevant. For example, consider a company that had invested \$10 million dollars five years ago to buy an important piece of equipment. The company enjoys a tax deduction for depreciation for this equipment over the 20 year life of this equipment. Since five years have gone by, 15 years of depreciation tax deduction remain. Let us say, now, the company is contemplating selling this asset and moving into some other new business. While the \$10 million original cost of the equipment is a sunk cost for this decision, the company has to take into account the fact that it will be foregoing the remaining 15 years of tax benefit from depreciation by selling the equipment (the sale price has to be adjusted because the purchaser will now get the tax benefit).

Reputation is another consideration. Let us say a builder implicitly commits to donate his time to building affordable houses in a suburban community for a charity organization. Halfway into the project, the builder gets a lucrative commercial contract from a local real estate developer. While it may not seem financially wise to continue to devote time to the charity cause, switching has potential long-term reputational consequences in the

community. The builder must take these consequences into account before pursuing more profitable avenues.

- 2.17 Let us say you have aspirations to be elected to the United States Senate in 10 years' time. After much research, you realize that the best way to achieve this goal is to first secure a Law degree, then practice law for a few years, get elected to the local legislature to gain legislative experience, and finally do a stint in a Washington policy think tank to gain domestic and foreign policy experience. Over the next few months, you decide to start preparing for admission into law schools.
- 2.18 Opening an additional section for an existing class or reassigning rooms among classes is a short-term decision that most probably applies to the current semester. Offering a new program of study is a long-term decision because the intent presumably is to continue offering the new program over the foreseeable future. Remodeling the cafeteria is also a long-term decision because it is a relatively permanent change (until the next remodeling which is not likely in the next few years).
- 2.19 Product life-cycles are relatively long--extending over several years--in some industries and relatively short—sometimes just a year or two years—in other industries. Consumer electronics, including televisions, is an example of the latter. For companies such as Pioneer, Sony, Toshiba, and Mitsubishi, advertising, promotion, and pricing are short-term decisions that have to be made almost on a weekly basis to stay ahead of the competition.
- 2.20 Assuming that you have decided which automobile to buy, you are committing to the price of the automobile, the cost of car insurance, and the cost of expected routine maintenance. You are not committing to driving the car every day or to buying gasoline on a weekly basis because you can control these expenditures through your usage of the car.
- 2.21 You decide to take a small vacation and spend a weekend in Las Vegas and try your luck in the casinos there. You don't want to lose too much money and so you decide to limit your losses to \$1,000. Lo and behold, lady luck smiles and you win \$50,000! This changes your life because you can now make a down payment for your dream house.
- 2.22 Yes, spillover effects are controllable and must be considered in making decisions. Consider an automobile company like GM which offers two similar SUVs but under different brand names. The decision to drop one of these brands is likely to *increase* the revenues from the other brand (but may *decrease* the total revenues from the two brands). On the other hand, consider an auto repair shop that decides to stop doing simple brake jobs. Such a decision is likely to have negative spillover effects because it will lose revenues from performing other maintenance services that typically surface when cars are brought in by their owners to get their brakes serviced.
- 2.23 When costs or revenues vary, using many possible realizations helps us estimate with greater statistical confidence what these costs or revenues are going to be *on average*. That is, we can estimate their *means* more reliably. On the other hand, the inability to trace costs accurately introduces measurement error or “noise” in our estimation. Such measurement

error increases the variance because we now have to deal with the randomness in this error as well – i.e., the error can assume different values as well.

- 2.24 The minimum charge for a service represents the opportunity cost to the company for committing resources for that service. By not providing that service, the company can use its resources to make a profit by providing the same service to someone else. Consider the caterer example. Let us say you have agreed to pay \$120 to the caterer to host a small dinner party for 10 friends. The caterer charges \$12 per person because s/he has to arrange for food items for each individual and make some profit as well. In this case, the number of persons attending the dinner is a good basis to estimate costs. That is, the caterer's costs and charges are proportional to the number of persons s/he is asked to serve.
- 2.25 This assertion is correct as long as the number of batches produced does not increase, and the number of different products made does not increase. If the volume of production increases because the number of units produced within each batch increases, then batch- and product-level costs will not increase and are therefore not relevant.
- 2.26 The cost of the service agent is a “customer-level” cost. As the number of customers increases, this cost increases as the number of service agents will also increase. In business-to-business marketing involving one company selling its goods and services to other companies (such as Alcoa supplying **Aluminum** to **Anheuser-Busch** to make beer cans), each customer account constitutes a significant source of revenues. In such instances, companies usually dedicate service agents to individual accounts. Let us group costs for such a company serving an industrial market to help decide which company account is profitable, and which is not:

*Customer-level or account specific costs:* Examples include costs to maintain a dedicated field office. These costs vary at the customer level and do not vary with the volume of business with each customer in the short run.

*Order processing costs:* Examples include the costs of resources necessary to process individual orders with each client. These costs are proportional to the order volume from each client.

*Order change costs:* These costs are proportional to the number of change orders requested by each client.

*Materials handling and shipment costs:* These costs are likely proportional to the number of shipments.

*Client on-site support costs:* These costs are likely proportional to the number of visits (and/or the duration of these visits) that each client requires to provide on-site support.

Specific details of cost classification will vary from one company to another, but the main point is that it is necessary to understand and define cost hierarchies as precisely as possible

to measure costs and benefits of various options in a decision context in order to make the right choice.

## EXERCISES

### 2.27 Relevance (LO1).

- The tire cost of \$119 is not **relevant**. This cost is the same across all options Brianna has.
- Yes, the disposal of \$6 is **relevant**. Store B does not charge a separate cost for disposing of the old tires.
- Yes, installation costs are **relevant**. The two stores charge different amounts for installation.

### 2.28 Relevance (LO1).

- No, the tuition cost is not relevant as long as you have decided to enroll for the semester.
- Because the text book costs much less and Class B is equally interesting and has the same reputation as Class A.
- Both classes A and B meet at the same time. So when choosing between Class A and B the class time is not relevant. But Classes A and C meet at different times, so the class time is relevant. Yes, the meeting time is relevant for the overall decision which class to choose because it differs for one of the options.

### 2.29 Relevance (LO1)

- Dinora has two options: (i) the status quo of making 350 pupusas, and selling around 300 pupusas on a typical day and giving away the rest, and (ii) Take the order from the long-standing customer for 350 pupusas.
- Yes, the revenues are different across the two options (both on a per unit basis, and on a total revenue basis).
- No, Dinora's expenditures on ingredients are not relevant because she makes the same number of pupusas under each option. The transportation costs of \$25, however, are relevant.

### 2.30 Relevance (LO1).

- No, the cell phone cost of \$399 is not relevant because this cost is the same regardless of the company you buy the cell phone from. This cost would be relevant only when one of the companies offers it for a different price.
- Yes, the monthly plan costs are different with each company.
- If company C, for example, has greater and better coverage and less dropped calls, then you might be able to justify the extra cost.

### 2.31 Relevance of qualitative considerations (LO1).

- a. There are many reasons to patronize a particular store other than price differences. Considerations such as convenience (how close the store is to your home), ambience, familiarity with where things are, friendly employees that you have come to know and like over time matter a great deal.
- b. Discussed in a. above.

### 2.32 Relevance (LO1).

- a. The amount is **not relevant**. This is a past expenditure and nothing Felicia could do now will change this sunk cost.
- b. The amount is **not relevant**. The amount spent on this item will be the same whether Felicia decides to buy a semester or per-use pass.
- c. The amount is **relevant**. The amount spent on this item will differ based on whether Felicia decides to buy a semester or per-use pass.

### 2.33 Relevance and Controllability (LO1, LO2).

- a. The amount is **not relevant**. This is a past expenditure and nothing Alex could do now will change this sunk cost.
- b. The amount is **not controllable**. Past expenditures are sunk and not controllable.
- c. Alex's only options are to: (1) discard the furniture in the landfill and (2) leave the stuff on the curbside. However, both of these options will lead to the same \$100 penalty being levied by the proprietor. Thus, the amount is **not relevant**.
- d. The \$100 would be incurred only if Alex moves the furniture and not under status quo. Thus, the amount is **controllable** for the decision.
- e. Both options (landfill, leave on curb) in Alex's opportunity set have negative value. Thus, he will obtain negative value from his decision, no matter what his choice is.

If he had a choice, Alex would leave his furniture in the apartment itself, rather than take the effort to landfill it or discard it. However, he does not have this choice, which is the status quo. By definition, status quo has a value of zero – thus, the status quo must not be in the opportunity set for a decision to have negative value. This condition is necessary but is not enough for a decision to have negative value. We also need that every option in the set to have negative value. Then, the decision maker incurs negative value from being forced to choose one of the options.

### 2.34 Relevance (LO1).

Tom and Lynda have two options: (1) **Stay with the status quo, retaining fees at the current level, and (2) reduce the fee by 10%**. More generally, a decision to reduce prices might have many elements because each new price is a separate decision option.

Relevant costs and benefits are those items that differ across the options.

In this case, the **amount of fees** received will change. This is a relevant benefit. A second benefit, which is indirect, might be the effect on **Hercules' reputation**. Members now might perceive the gym as more affordable, potentially expanding its target audience.

The decision affects costs via its effect on the number of members. Reducing the fees would increase the number of members. In turn, the additional membership would increase variable costs such as the cost **of supplies and water**. These costs are therefore controllable for this decision.

Finally, it also is possible that the additional membership increases the wear and tear on equipment, and might even lead to Hercules buying more exercise machines. Thus, these indirect costs too are controllable for this decision. It is quite likely, however, that while they would surely consider variable costs Tom and Lynda might not attach much weight to the change in fixed costs. After all, the effects on equipment are likely to be felt in the long-term and are hard to quantify. Decision makers usually attach lower weight to such subjective estimates.

### 2.35 Relevance (LO1, LO2).

Parking costs, mileage costs and shuttle costs are all relevant because they differ across the two options

*Drive* – the relevant costs for the round trip are:

Parking	\$7.50 per day × 3 days	\$22.50
Operating costs	\$0.30 per mile × 60 miles (round trip)	<u>\$18.00</u>
Total relevant cost		<b><u>\$40.50</u></b>

*Shuttle* – since a one-way trip on the shuttle costs \$25, the relevant costs for the round trip are  $\$25 \times 2 = \underline{\$50}$ .

**Thus, the relevant costs of driving = \$40.50, and the relevant costs of taking the shuttle = \$50.**

### 2.36 Relevance and Controllability (LO1).

- a. The following table provides the classifications, including comments pertaining to the rationale underlying each classification.

<b>Cost Item</b>	<b>Controllable? (C/NC)</b>	<b>Relevant? (R/NR)</b>	<b>Comments</b>
1. Cost of the materials used to make the components.	<u><b>C</b></u>	<u><b>R</b></u>	The decision affects whether HAL incurs this cost. Although the cost relates to both choices, the amount differs for the choices because the supplier expects to use 5% more in materials.
2. Cost of the connectors used to make the components.	<u><b>C</b></u>	<u><b>NR</b></u>	The decision affects whether HAL incurs this cost. However, the amount is the same between the choices, making it not relevant for the decision.
3. Akawasi Sudawa's annual salary of \$105,000.	<u><b>NC</b></u>	<u><b>NR</b></u>	This cost will be incurred regardless of the decision made.

This exercise highlights that relevance is a subset of controllability. While a relevant cost is always controllable, a controllable cost is not always relevant.

- b. When the status quo is part of the opportunity set, controllability and relevance are the same. Further, our classification of controllable costs will not change because, by definition, we measure controllability in terms of the status quo, regardless of whether it is a feasible option.

Given this, for HAL's decision **the set of relevant costs will expand** to match the controllable costs. What does this mean? It means that the cost of the connectors used to make the component is both controllable and relevant. All of our other classifications remain the same.

- c. In this case, **the set of controllable costs shrinks** to the set of relevant costs. Thus, the cost of the connectors used to make the components is not a controllable cost because it does not change in relation to the status quo. All of our other classifications remain the same.

This problem shows how variations in the status quo lead to variations in what is controllable and relevant. This underscores the importance of understanding exactly what the "existing state of affairs" is.



### 2.37 Relevance (LO1).

- a. The following table provides the required classifications, including a brief explanation for each classification. We note that Olivia seems to be committed to taking one job or the other – thus, the status quo of doing nothing (not accepting either job) does not appear to be a viable option.

<u>Cost /Benefit</u>	<u>Relevant?</u>	<u>Rationale</u>
Salaries	Yes	The amount of the benefit differs between Olivia's two options.
Commissions	Yes	The benefit is available with one option only – the stereo store job.
Transportation	No	It is the same for both decision options.
Rent and utilities	No	This cost is the same for both options.

- b. The following table shows the relevant costs and benefits:

<u>Cost/Benefit</u>	<u>Department</u>	
	<u>Store</u>	<u>Stereo Store</u>
Salary	\$640	\$400
Commissions	0	300
<b>Total</b>	<b>\$640</b>	<b>\$700</b>

Considering only relevant costs and benefits, we find that the Stereo Store job is preferred by \$60.

### 2.38 Classifying Decisions According to their Time Horizon (LO2).

- a. The following table provides the decision classifications, including comments pertaining to the rationale underlying each classification (please note that there is room for discussion/debate regarding some of the classifications – as discussed in the chapter, the boundaries between the horizons are fuzzy).

<u>Decision</u>	<u>Description</u>	<u>Horizon Classification &amp; Comments</u>
1	Choosing a major.	<b>Long-term.</b> This decision has multi-year implications such as the prospects of gainful future employment. Moreover, we make this decision not expecting to revisit it for some time.
2	Choosing whether to wake up at	<b>Short-term.</b> The decision's horizon only

- 7:30 a.m. when your alarm goes off or hit the snooze button and wake up in another 9 minutes at 7:39 a.m.
- 3 Choosing whether to buy a desktop or a laptop computer. **Long-term.** Individuals tend to use a particular computer for a relatively long period of time (2-4 years).
- 4 Choosing whether to bring a car to campus or use university and local transportation (i.e., the “bus”). **Short-term/Long-term.** The decision is like choosing a particular business process (e.g., should a company use cardboard or plastic to package goods?) and is likely to be a decision that students make at the beginning of each year (most universities issue parking passes annually). That said, the decision likely can be reversed without excessive cost and on a relatively quick basis, which may lead some to classify it as a short-term decision.
- 5 Choosing whether to take a required course this semester or next semester. **Short-term.** This decision spans one to two semesters, or 4 to 9 months. It is unlikely to have any long-term effects.
- 6 Choosing whether to have pizza or a sub-sandwich for dinner this coming Friday. The decision is purely **short term**. The decision’s horizon only spans a few hours on Friday evening; further, it is unlikely (although not out of the question) that any long-term effects will result from this decision.
- 7 Choosing whether to stay at your current school or transfer to another school. **Long-term** Similar to choosing a major, this decision has multi-year implications related to employment prospects, graduate school and, perhaps, where one ultimately resides.
- 8 Choosing whether to lease a two-bedroom apartment or stay in the dormitory next year. **Short-term/Long-term.** This classification could go either way – one could argue that there are few long-term effects from such a choice. On the other hand, the decision spans roughly a year because most apartment leases last 9 to 12 months – it can be difficult and costly if we change our mind.
- 9 Choosing whether to buy a **Short-term.** We classify this as a short-

semester pass for the fitness center or pay on a per-use basis.

term decision even though one can make a reasonable case for classifying this decision as spanning the long-term. The short-term reasoning comes about because the decision only spans a semester and can be changed at semester end. Also, few costs are controllable with respect to this decision. The decision appears to be one of cost structure (i.e., do you want to spend money as a lump-sum right now or spend it piece meal?)

There is no magic rule that cleanly separates short-term decisions from long-term decisions. Many decisions fall in the gray zone between the short term and the long term. Additionally, many seemingly short-term decisions could have longer-term implications.

We use the distinction mostly to organize our thoughts and to give some structure to the decision problem. Good managers recognize that the classification by horizon is a convenient simplification and is a good start in structuring the problem and identifying costs and benefits – the longer the horizon, the more costs and benefits to consider. They will, however, consider long-term implications as they make their choices from the decision options.

- b. Indisputably, many short-term decisions have longer-term implications, and it frequently is not possible to cleanly separate decisions. For example, repeatedly hitting the snooze button could cause you to miss classes and exams, which, in turn, could lead to poor grades and a less-than desirable job. The decision to buy a laptop versus desktop may affect your ability to afford having a car on campus (or vice-versa).

At some level, we can argue that you face one large problem of how best to manage your life. While true, such a definition is not very helpful to decision making. There are far too many factors to consider and the opportunity set is infinite. The problem becomes impossible to solve.

Faced with cognitive constraints, most decision makers therefore decompose the large problem into many smaller problems. Simplification can take the form of pruning the opportunity set or considering only the most salient (and quantifiable) costs and benefits. This way, the problem becomes manageable. **Classifying decisions via their time horizon greatly assists individuals in simplifying decision making – when confronted with a decision, thinking about the time horizon assists in delineating the costs and benefits of the decision options and when they are likely to materialize.**

Unfortunately, the potential for making bad decisions arises every time we eliminate an entire class of choices (by, e.g., de-coupling decisions) or reduce the number of costs and benefits we consider. Good managers excel at making this tradeoff. They can quickly

narrow the choices to the most viable and exciting options; they also excel at figuring out which costs and benefits are easily quantifiable, and at getting a “gut feel” estimate of the hard to quantify costs and benefits.

### 2.39 Variability and Traceability (LO3).

**False.** The statement is not correct because variability is not the same as controllability. For instance, the cost of materials is variable in the number of units made. Yet, suppose we already have enough material (a special alloy) in stock for the anticipated production. We plan to discontinue the product after this production run. Then, the cost of this alloy, a sunk cost, is not controllable for whether to reduce production by 5% or not. The misconception in the statement arises because variable costs are indeed controllable for most decisions.

**False.** Consider Hercules. The cost of the yoga instructor is a “fixed” cost on a monthly basis. Yet, the cost is controllable for the decision to offer yoga. To reconcile the statements, notice that the fixed and variable classification is only valid for a given time period and for a given activity. Thus, a fixed cost could change because of a decision making it controllable. For another example, most would consider warehouse rent to be a fixed cost. Yet, if a firm doubles its production, it will increase this “fixed” cost because it might have to rent more warehouses. This misconception arises because fixed costs usually are not controllable for short-term decisions.

**False.** A direct cost might be variable or fixed. In the context of Hercules, the cost of the yoga instructor is direct to the option of offering yoga. Yet, this is a step-fixed cost that is not proportional to the number of members.

**False.** This statement too is incorrect. Classifying a cost as fixed relates to how it changes in the underlying activity, usually revenue or sales volume. It does not relate to whether the cost is direct or not. For an example, warehouse rent is a fixed cost. Yet, it is a direct cost for the decision of whether to lease or buy the warehouse.

**True.** This statement is correct. A cost is fixed only with respect to a timeframe and an activity. Almost every cost is variable in the long term. For example, the amount of warehouse rent is variable in the area leased, if we consider a long-enough period.

### 2.40 Variability (LO3).

To determine each cost’s variability, you could graph the relation between each cost (y-axis) and activity levels (x-axis). This graph shows that cost *a* is variable (the cost increases proportionately with volume), cost *b* is mixed (the cost has some fixed and some variable components), and cost *c* is fixed (the cost is the same for all volumes).

We can also make an educated guess by calculating the unit cost in each instance.

	Cost per unit		
	<i>a</i>	<i>B</i>	<i>c</i>
5,000 units	\$5	\$5.60	\$10.00
7,500 units	\$5	\$4.67	\$6.67

From this table, we note that the unit cost of A is the same at all production volumes. Thus, we determine **A to be a variable cost**. The case for B and C is more complex, as we need to consider both the total cost and the per unit cost. Inspection of C shows that the total amount is the same and the per unit amount is decreasing as volume increases. Thus, **C is a fixed cost**. However, while the per unit cost of B also decreases, the total increases as volume increases. Thus, **B is a mixed cost**.

## 2.41 Variability: Choice of Activity (LO3).

a.

<b>Cost #</b>	<b>Description of Cost</b>	<b>Activity</b>
1	Cost of raw materials used	Units produced.
2	Electricity used to operate machines	Machine hours consumed, which is likely proportional to units produced.
3	Cost of packing materials	Units shipped, which is likely to be proportional to units produced.
4	Equipment maintenance	Machine hours consumed, which is likely proportional to units produced.
5	Janitorial supplies used to clean factory	The size of the factory and production levels – more production typically leads to more clean up. In the long-run, factory size is likely the key determinant.
6	Cost of human resources department	The number of employees.
7	Cost of purchasing department	Purchasing activity, as measured by the number of vendors, the number of purchase orders, and the number of distinct products.
8	Sales commission paid	Sales volume, in units or in \$.
9	Travel expenses for sales persons	Number of sales calls made.
10	CEO salary	Intuition suggests a link between firm size (as measured in revenue or assets) and CEO compensation. In the short term, the CEO's <i>salary</i> is not likely to be variable in any measurable way, although the CEO's <i>bonus</i> is likely to vary with income or stock price.

- b. Production levels (and, in turn, sales volume) appear to be a key determinant for costs 1, 2, 3, 4, and 8. Additionally, one could argue that, in the short-term, costs 5, 6, 7, 9, and 10 will also bear some relation to production/sales volume. For instance, greater production volume would lead to a larger factory, all else the same. These linkages give us insight into why firms frequently use a single measure of activity, sales volume, to assess the variability of costs – many costs are proportional to this metric.

### 2.42 Traceability (LO3).

The following table provides the cost classifications, including comments pertaining to the rationale underlying each classification.

<u>Cost #</u>	<u>Description of Cost</u>	<u>Cost Classification &amp; Comments</u>
1	Eastern plant rent.	<u>I</u> – This cost is only partly attributable to Kappa as both Kappa and Gamma are produced in the same plant.
2	Raw materials purchased to produce Kappa.	<u>D</u> – This cost is entirely attributable to Kappa. Kappa and Gamma use different raw materials, allowing us to directly trace the materials costs to each product.
3	Eastern plant utilities and water	<u>I</u> – This cost is only partly attributable to Kappa as the utilities relate to the entire plant and the production of both Kappa and Gamma.
4	Salary of the Eastern plant manager	<u>I</u> – This cost is only partly attributable to Kappa as the plant manager oversees all activities in the plant (i.e., the production of both Kappa and Gamma).
5	Equipment maintenance	<u>I</u> – This cost is only partly attributable to Kappa as the equipment is used to produce both Kappa and Gamma.
6	Salary of a production employee who works the day shift at the Eastern plant	<u>D</u> – This cost is entirely attributable to Kappa as the production employee only works the day shift (when the firm produces Kappa but not Gamma).

This exercise distinguishes between direct and indirect costs. *Traceability depends on the unit of analysis.* For example, while the salary of the plant supervisor is an indirect cost with respect to the Kappa product, it is a direct cost with respect to the Eastern plant as a whole.

### 2.43 Revenue Variability and Traceability, Not for Profit (LO3).

*Option 1: Issue lottery tickets*

The proceeds from the sale of tickets is the only controllable benefit. This revenue is **directly** traceable to the option of offering the lottery. The revenue also is **variable** in the number of tickets sold as revenue = \$50 per ticket × number of tickets.

*Option 2: Host charity dinner*

The revenue from the dinner is a **direct** benefit that is **variable** in the number of attendees.

The discount from the caterer is also a **direct** benefit but is **fixed**. We note that whether we classify a cost reduction as a benefit or as a smaller cost is semantic.

Finally, the goodwill created in prospective donors is a significant, but indirect benefit. The benefit is **indirect** because it is difficult to attribute any future donations solely to the dinner, as the donation is likely the culmination of sustained effort from Foundation staff. It is difficult to classify this benefit with respect to its variability; our inclination is to classify it as **fixed** as we would be hard pressed to select an activity that makes it variable. While one might be inclined to think that more attendees might lead to greater goodwill, fewer attendees might receive greater attention and donate more.

#### *Option 3: Conduct silent auction*

The proceeds from the auction are the **direct** benefit. This benefit is **likely variable** in the number of items sold, although the proportionality is not exact.

The other benefit is the exposure received by local artists. We would classify this benefit as **indirect** because it is hard to trace the exposure (or incremental exposure) to the silent auction. Artist recognition and reputation comes from the accumulation of multiple exposures. Even then, it is difficult to draw a link between exposure and art appreciation. Nevertheless, as it contributes to the background of arts and arts appreciation in the community, we would consider the exposure as an indirect benefit. It is difficult to determine if the benefit is variable. However, one could reasonably expect the exposure to vary in the number of artists participating and/or the number of items sold or up for auction.

#### 2.44 Hierarchical Cost Structure: Cost Classifications (LO4).

The following table provides the cost classifications, including comments pertaining to the rationale underlying each classification:

1 Sand used **Unit-Level**

This is a unit-level cost because it is directly proportional to the number of tiles made.

2 Oven rental for the year **Facility-Level**

This annual cost is required to sustain the facility and does not change in response to the number of tiles, batches, or products. In other words, this cost relates to all of Creative Tiles' products.

3 Power for firing the oven **Batch-Level**

This is a batch-level cost because the tiles are baked in batches of up to 1,000. This cost will not change much whether we bake 750, 900 or 1,000 tiles.

4       Molds used                                       **Product-Level**  
 This is a product-level cost since each tile designed is a unique product and will require its own mold. Accordingly, this cost will depend on the number of products. (Note: We implicitly assume that Creative needs only one mold to produce all the tiles needed with a given design. If this assumption does not hold, the cost of the molds will vary both in the number of products and in the number of units of each product).

5       Hourly wages to employees who mix the clay.       **Unit-Level**  
 This is likely a unit-level cost since the amount of mixing work required likely varies with the number of tiles to be produced. The classification can be disputed, however, as one might argue for a batch-level classification if the clay is mixed in batches.

6       CEO salary                                       **Facility-Level**  
 This cost relates to the entire business and does not vary at the unit-, batch-, or product-level.

7       Prepare leaf print for image                       **Product-Level**  
 This is a product-level cost since each tile is unique and will require a unique leaf print. Thus, we can view each variation in image as a product; the cost therefore depends on the number of products made.

8       Using forklifts to move finished goods from the factory floor to the storeroom.  
           **Batch-Level**  
 This is a batch-level cost since it varies with the number of pallets moved. Within reason, this cost will be the same regardless of the number of tiles in a pallet.

This exercise shows that costs oftentimes do not fall neatly into fixed and variable categories. The cost hierarchy helps managers structure their thinking about the underlying reason for a cost and why a given cost would increase or decrease. In turn, such understanding can facilitate decision making; misclassifications could lead to poor estimates of cost (e.g., assuming a cost is variable or fixed when, in fact, it is a batch- or product-level cost).

#### 2.45 **Hierarchical Cost Structure: Cost Classifications (LO4).**

**Unit-Level.** The cost of food and drinks consumed is likely a unit-level activity – the more people, the more food and drink. While it is not possible to predict food costs perfectly, Sun and Sand will consider the number of members in residence when deciding the amount of food to make. From a control perspective, S&S’s managers likely track the cost of food per member quite closely.

**Batch-Level.** S&S incurs many batch level costs. Consider the cost of posting lifeguards on the beach. The number of lifeguards posted is not strictly proportional to the number of members on the beach. Rather, the head lifeguard probably follows some kind of a gut feel (and local regulations) in posting more lifeguards as more people enter the beach. From experience, the head lifeguard may be able to predict usage patterns and will adjust staffing



schedules accordingly.

**Product-Level.** The cost of maintaining the dolphins in good health is a product level cost. S&S needs to incur this cost even when there are only a few members in residence. That said, there is some correlation with the number of members; beyond a certain number, S&S might have to train more dolphins to swim with humans. This point underscores that it is only the step-size that differs between unit-, batch- and product-level costs. Ultimately, a firm's volume of business influences virtually all of its costs.

**Facility-level.** In addition to rent and executive salaries, the fee charged by the city for erosion control would be an example of S&S's facility level cost. S&S incurs this cost as a part of staying in business. The amount does not depend on the number of members, lifeguards on duty, or program offered.

#### 2.46 Step Costs (LO4).

- a. It is difficult to predict the effects from mis-classifying a step-cost as a unit-level cost. **The estimated cost could be higher or lower than the true cost.** To see this, suppose a supervisor costs \$3,200 per month. Further, assume that the analyst generates the cost estimate with 16 employees and 2 supervisors. In this case, the analyst would compute the cost as \$400 per employee ( $\$3,200 \times 2/16$ ).
- For 5 employees, the analyst will estimate a cost of \$2,000 but we need one supervisor at a cost of \$3,200. The cost is understated.
  - For 20 employees, the estimated cost is \$8,000 but we only need 2 supervisors. The cost equation will over-estimate the cost.

This ambiguity in the direction of error is one reason why it is important to classify costs well. Else, even if we know that we have a wrong estimate, we do not know the direction of the error.

- b. Again, it is difficult to predict the effects from mis-classifying a product-level cost as a unit-level cost. **The estimated cost could be higher or lower than the true cost.** To see this, suppose the product engineer's cost is \$60,000 per year and the expected volume of production is 120,000 units. Then, the cost per unit is \$0.50. However, this estimate gives us an expected cost of \$30,000 at a volume of 60,000 units and \$120,000 at a volume of 240,000 units. In both instances, our true cost remains at \$60,000. Again, this ambiguity in the direction of error is one reason why it is important to classify costs well – as mentioned in part (a), even if we know that we have a wrong estimate, we may not know the direction of the error.

**PROBLEMS****2.47 Relevance and controllability (LO1).**

- a. The following table provides the required classifications, including a brief explanation for each classification. We note that the status quo, or the existing state of affairs, is using 25 suppliers – thus, the status quo is a viable option. As such, relevance and controllability are the same – all controllable costs are also relevant.

<u><i>Cost/Benefit</i></u>	<u><i>Controllable</i></u>	<u><i>Relevant?</i></u>	<u><i>Rationale</i></u>
Cost of goods	Yes	Yes	The cost changes because of the decision. In addition, the amount of the cost differs between the two decision options, as reducing the number of suppliers eliminates the possibility of obtaining a 3% price concession.
Clerical salary	Yes	Yes	The cost changes because of the decision. Further, the amount differs between the two options -- reducing the number of suppliers eliminates the need for one clerical staff.
Manager salary	No	No	The decision does not influence the cost. It also is not relevant, as only controllable costs can be relevant.
Cost savings	Yes	Yes	The amount depends on the decision. It also is available with one option only – the reduce suppliers option.
Rams' salary	No	No	The amount does not depend on the decision. It also is not relevant, as only controllable costs can be relevant. (In the long term, the quality of this and many other decisions will influence Rams' salary but we ignore this possible effect for the decision at hand.)

- b. The table below shows the relevant (and controllable) costs and benefits of the “reduce suppliers to 6” option:

<i>Cost/Benefit</i>	<i>Reduce number of Suppliers</i>	<i>Rationale</i>
Increase in cost of goods	(\$75,000)	$\$2,500,000 \times .03$
Reduction in clerical salaries	35,000	$1 \times \$35,000$
Reduction in service quality costs	100,000	Given
<b>Total</b>	<b>\$60,000</b>	

Considering monetary costs and benefits only, reducing the number of suppliers to 6 has a value of \$60,000. However, the difference between the options is not large. Thus, the decision may hinge on Rams’ subjective estimate of the cost savings associated with reducing the number of suppliers. Such savings are hard to quantify, as they are experienced in small amounts throughout the organization.

#### 2.48 Relevance (LO1).

- a. The table below lists the costs associated with each option. As we can see, all cost items are relevant because they differ across the two options.

<i>Item</i>	<i>Option 1</i>	<i>Option 2</i>
Roundtrip fare to Chicago	\$320	
Car rental to drive from Chicago to Detroit and	\$150	
Hotel stay for Thursday night	\$195	
Estimate for food and incidentals	\$375	
Airfare to Detroit and back from Chicago		\$350
Car rental to drive to Chicago from Detroit		\$225
Hotel stay in Chicago for two nights		\$390
Estimate for food and incidentals		\$350

- b. There are no such items – all costs are relevant for Kat’s decision.

#### 2.49 Relevance and controllability (LO1).

The following three panels provide the required classification for each decision. Notice that in this problem, all controllable items are relevant. *This occurs because the status quo is a viable option for each decision.* Each decision is of the “whether or not” variety where the “not” option implies choosing the status quo (or not taking any action whatsoever). Moreover, all non-controllable items are not relevant.

<i>Item</i>	<i>Give Discount?</i>	<i>Rationale</i>
Revenues from homeowners	<b><u>Controllable and relevant</u></b>	Will change by different amounts based on the decision.
Revenues from contractors	<b><u>Non controllable</u></b>	Not affected by the decision
Direct costs	<b><u>Non controllable.</u></b>	The cost is sunk and therefore not controllable – i.e., the costs for the job have already been incurred.
Rental cost	<b><u>Non-controllable.</u></b>	This cost is unaffected by the decision.
Trucks & other equipment	<b><u>Non-controllable.</u></b>	The cost is sunk and therefore not controllable – i.e., the costs for the job have already been incurred.
Administrative costs	<b><u>Non-controllable.</u></b>	This cost is unaffected by the decision.

<i>Item</i>	<i>Train Technician?</i>	<i>Rationale</i>
Revenues from homeowners	<b><u>Non-controllable.</u></b>	Not affected by the decision as few homeowners need high-voltage work.
Revenues from contractors	<b><u>Controllable and relevant.</u></b>	Brandt's revenues to contractors likely would increase if the technician received the high-voltage training.
Direct costs	<b><u>Controllable and relevant.</u></b>	Controllable and relevant as there would be additional direct costs associated with performing high-voltage work.
Rental cost	<b><u>Non-controllable.</u></b>	This cost is unlikely to be affected by the decision.
Trucks & other equipment	<b><u>Controllable and relevant.</u></b>	It is likely that high-voltage work may need additional equipment. Most certainly, more work increases truck operating and maintenance costs.
Administrative costs	<b><u>Non-controllable</u></b>	This cost is unlikely to be affected by the decision.

<i>Item</i>	<i>Replace Truck?</i>	<i>Rationale</i>
Revenues from homeowners	<b><u>Non-controllable.</u></b>	Not affected by the decision. The

Revenues from contractors	<b><u>Non-controllable.</u></b>	amount of work done is likely to be the same whether or not a new truck is purchased.* Not affected by the decision. The amount of work done is likely to be the same whether or not a new truck is purchased.*
Direct costs	<b><u>Non-controllable.</u></b>	Not affected by the decision. Notice that this item does not include the operating costs of trucks, which will change based on the decision.
Rental cost Trucks & other equipment	<b><u>Non-controllable.</u></b> <b><u>Controllable.</u></b>	Not affected by the decision. Both the cost of the truck and the operating cost change based on the decision.
Administrative costs	<b><u>Non-controllable.</u></b>	Not affected by the decision

\* One could argue that an older truck may break down more often and potentially reduces the ability to service a job. Similarly, newer trucks may present a more “professional” image and enhance reputation, which in turn increases the volume of business. Both of these effects suggest that revenues (and therefore direct costs) are also controllable and relevant. However, these effects seem marginal given that Brandt already enjoys a sterling reputation. Thus, we ignore these effects.

This problem can help highlight that the decision context determines the controllability and relevance of a cost or a benefit. Some decisions, such as giving a discount to a disgruntled customer, may only affect revenue with no discernable cost impact. Other decisions, such as whether to replace a truck, affect costs with no discernable revenue impact. Most decisions, however, affect both revenues and costs. Even for these decisions, only some costs and benefits are controllable. Revenues and direct costs from other products or market segments are not controllable if the decision pertains only to some products or market segments.

## 2.50 Relevance (LO1).

- a. The relevant costs for the make option are:

### Relevant Costs – Make Option

<i>Item</i>	<i>Amount per unit</i>	<i>Total (100 units)</i>
Brass	\$200	\$20,000
Special Wood	\$75	\$7,500*
Labor	\$250	\$25,000
<i>Total Relevant Costs</i>		<u>\$52,500</u>

Because \$10,000 worth of special wood is already in inventory and its opportunity cost is zero, the relevant cost is \$7,500.

b. The relevant costs for the buy option are:

<b>Relevant Costs – Buy Option</b>		
<i>Item</i>	<i>Amount per unit</i>	<i>Total (100 units)</i>
Purchase Price	\$500	\$50,000
<i>Total Relevant Costs</i>		<u>\$50,000</u>

Using the principle of relevance, we find that Motown prefers the buy option because its cost is \$2,500 less than the cost of the buy option.

### 2.51 Relevance and controllability (LO1, LO2).

a. The following decision options are available to Gamma Machinery:

- Option 1: Keep the current lathe and do not purchase the new lathe.
- Option 2: Purchase the new lathe today for \$400,000 and sell its current lathe today for \$170,000.
- Option 3: Purchase the new lathe today for \$400,000 and keep its current lathe for two years.

For Gamma, the status quo is keeping its current lathe and not purchasing the new lathe. Since this corresponds to option 1, the status quo is a feasible option.

b. The following cash flows are both controllable and relevant for option 2:

#### Controllable and Relevant Cash Flows – Option 2:

Additional cash inflow of \$130,000 per year from the new lathe (= \$250,000 – \$120,000) × two years	\$260,000
+ Cash inflow from selling the existing lathe today	\$170,000
- Cash outflow to purchase new lathe	(\$400,000)

Thus, the **value of Option 2**, measured in terms of net cash inflows, = **\$30,000**.

The following cash inflows and outflows are controllable for option 3.

#### Controllable and Relevant Cash Flows – Option 3:

Additional cash inflow of \$130,000 per year from the new lathe (= \$250,000 – \$120,000) × two years	\$260,000
Cash inflow of \$50,000 per year from operating the current lathe × two years	\$100,000
- Cash outflow to purchase new lathe	(\$400,000)

Thus, the **value of Option 3**, measured in terms of net cash inflows, = **(\$40,000)**.

Because option 2 has the highest value, this is Gamma's best option. (as the status quo, the value of option 1 = \$0).

- c. If the status quo is no longer feasible, controllability and relevance could differ. The controllable costs and benefits for Gamma's two options are identical to those we computed in part [b].

In terms of relevant costs and benefits, the only items that differ between the two options are the cash inflow from selling the existing lathe (\$170,000) and the cash inflow from operating the current lathe for the next two years (\$100,000). While controllable, both the cash outflow to purchase the new lathe (\$400,000) and the cash inflow associated with the new lathe (\$260,000) are not relevant as they do not differ between Gamma's two options.

## 2.52 Classifying decisions by horizon (LO2).

The following table provides the required information.

<i>Decision</i>	<i>Price &amp; Quantity effects</i>
Advertising	<b>Short term. No price effect</b> is likely. The decision trades off the outflow for advertising with the <b>additional volume</b> of business.
Points program	<b>Short term.</b> There is a <b>price effect</b> as the points program is like a price discount. A <b>volume effect</b> is also present as the program breeds customer loyalty and boosts volume.
Increase variety in number of coffees	<b>Long term.</b> Likely, there is <b>no price effect</b> as Terrapin will not change prices if it adds more flavors of coffee. Market considerations often set the prices for such goods. A <b>volume effect</b> is likely as customers now may have a more favorable view of the store.
Add to product variety (goat milk etc)	<b>Long term.</b> There is a <b>price effect</b> as product differentiation allows Terrapin to charge different amounts. A <b>volume effect</b> is also present; Terrapin needs to estimate the popularity of the new offerings, and revenue is a function of both price and quantity.
Reconfigure layout	<b>Long-term</b> Again, there is <b>no price effect</b> as it is unlikely that Terrapin will change prices. A <b>volume effect</b> is likely as customers now may have a more favorable view of the store.
New branch	<b>Long-term.</b> There is a possible <b>price effect</b> . Terrapin may be able to offer products at different prices exploiting the fact that the two stores cater to potentially differing market segments. (We note, however, that there are good arguments for keeping the prices the same at both stores). There is a <b>volume effect</b> . Like advertising (a tactical decision), the new branch (an investment

decision) trades off a certain outflow in return for an expected bump in volume.

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The problem highlights at least two points. Except in perfectly inelastic markets where quantity is price independent, any action that tinkers with price will also affect volume. This is true for decisions in any horizon. This is because market demand functions have a negative relation between price and quantity.

We also can conceive of decisions in any horizon that do or do not have a price effect. Thus, revenue controllability could arise because of price and/or quantity effects in every horizon.

We also note the fine line between the answers for the decision to increase the number of coffee flavors and the decision to add product lines. There is a price effect if part of the expansion in flavors includes “organic” or other coffees that are differentiated from the “regular” flavors. Adding “organic” coffee is akin to expanding the product line, while adding more flavors is like adding more colors of an existing product. However, after a certain point, even the number of flavors (“31 flavors for Baskin-Robbins”) itself becomes a point of differentiation, and could positively affect the firm’s ability to set prices.

**Note:** For advanced classes, it is useful to link this problem with demand functions. When considering price changes, we must consider both price and quantity effects as these two go hand-in-hand. Conceptually, tweaking prices takes the demand function as given. The choices move the firm to a different point in the demand curve. However, we can also think of advertising and other actions as changing the market size and/or customer preferences and perceptions. We can view these actions as altering product demand by tweaking the demand function itself. That is, these are choices among alternate demand functions.

We also ignore the counter-examples posed by Giffin goods.

### 2.53 Controllability and Time (LO2).

- a. Changing themes is a **long-term decision** as it fundamentally affects the nature of the restaurant’s business. This decision entails costly commitments as the décor has to be changed accordingly. The decision also is not easily reversible as perceptions take time to change.

Deciding which chefs to invite is a **short-term decision**. The decision affects a number of costs and benefits, and alters the demand for the restaurant’s services – thus, one could classify the decision as having long-term effects. However, almost all costs and benefits associated with a particular chef are likely realized within a short period.

Accepting a booking for a wedding reception is a **short-term decision**. The decision does not fundamentally alter the nature of the business. Few costs and benefits are affected and they are realized almost immediately.



b. The following table provides the required classifications.

<i>Cost/Benefit</i>	<i>Changing theme</i>	<i>Celebrity Chefs</i>	<i>Book reception</i>
Average revenue per patron.	Controllable	Controllable	Controllable
Cost of meals served.	Controllable	Controllable	Controllable
Cost of printing menus.	Controllable	Controllable	Non-Controllable
Salaries to chef and other kitchen staff	Controllable	Non-controllable	Non-Controllable
Building rental cost.	Non-controllable	Non-controllable	Non-Controllable

Notice that the number of controllable costs and benefits increases with the decision horizon. However, not all costs are controllable, even for some decisions that span an extended horizon.

#### 2.54 Classifying Decisions by Time; Cost Commitment (LO2).

a. The following table provides the decision classifications, including comments pertaining to the rationale underlying each classification. We note that there clearly is room for discussion/debate regarding some of the classifications – as discussed in the chapter, the boundaries between the horizons can be fuzzy.

<u>Decision</u>	<u>Description</u>	<u>Classification &amp; Comments</u>
1	Reconsider the decision to get an MBA. (Anne has not yet quit her job)	<b><u>Long-term.</u></b> This decision clearly has multi-year implications as most MBA programs are two years; additionally, this decision will affect all aspects of Anne's life (e.g., her job, where she lives, etc.).
2	Decide whether to pay first semester tuition by check or by credit card. (Each month, Anne pays her credit card balance in full.)	<b><u>Short-term.</u></b> This decision affects the timing of Anne's cash flows by less than a month. Since Anne pays off her credit cards each month, this decision has a very short-term effect on Anne's life.
3	Choose a major (accounting, finance, or marketing).	<b><u>Long-term.</u></b> This decision has multi-year implications such as the prospects of gainful employment. However, one may also view this decision like choosing a product portfolio – the choice of a major

often can be altered after one or two semesters. Additionally, it is possible for Anne to look for an accounting job even if she majors in finance. Thus, it can be argued that this decision is a *short-term decision*.

- |   |   |   |
|---|---|---|
| 4 | Choose the courses to take in the first semester.   | <b><u>Short-term</u></b> . This decision only commits Anne for a semester. Because of program requirements and pre-requisite courses, this decision could also affect what Anne takes next semester – thus, it does have longer-term implications.  |
| 5 | Decide whether to buy new clothes (to fit the student lifestyle) or to make do with her current business clothes.                         | <b><u>Short-term</u></b> . This decision commits Anne for several months. Anne can easily postpone, or reverse, this decision. For example, halfway into the new semester, Anne may decide to buy new clothes.  |
| 6 | Decide whether to have a part-time job while in the MBA program.  | <b><u>Long-term</u></b> . This decision commits Anne for at least several months because most hires (even part time) are made with the intent of keeping the arrangement going for several months, if not a year. That said, the decision can be easily reversed (Anne can always give two-weeks notice), and one can make a good argument for a short-term classification. |
| 7 | Decide whether to spend the next few weeks brushing up on math and economics or to spend the time taking a vacation before school starts. | <b><u>Short-term / long-term</u></b> . This is a tough one. At some level, this is a short-term decision because it only lasts for a few weeks. However, the decision to study (or vacation) now could have longer-term implications (e.g., studying now may translate to better grades and a better job, etc.).  |
| 8 | Decide whether to live in a studio apartment or to share a two-bedroom apartment.   | <b><u>Long-term</u></b> . This decision commits Anne for a year or so (most apartments have a year long lease).   |
| 9 | Choosing which of the two MBA programs to join.   | <b><u>Long-term</u></b> . Similar to deciding whether to obtain an MBA or deciding a major,   |

this decision will affect Anne's life for years to come. Such a decision possibly affects Anne's employment prospects and her long-term friendships, etc. For a business, this decision is like deciding where to site the plant.

- b. For decision 1 (reconsider the decision to get an MBA), the costs associated with tuition, housing, and books have yet to be incurred (i.e., all three costs are controllable). That is, by making a decision regarding whether to obtain an MBA, Anne also decides whether she will incur these costs.

For decision 2 (Choosing whether to pay first semester tuition by check or by credit card; each month, Anne pays her credit card balance in full), the costs associated with tuition, housing, and books are not controllable. That is, Anne has already made her decision to obtain an MBA, selected her school, and her courses.

Notice that there is a striking relation between the number of controllable costs and the decision horizon. For decision 1, an investment horizon decision, all three costs are controllable. For decision 2, a short-term decision, all three costs are non controllable. Moreover, more costs become controllable as the decision horizon expands.

Also notice, in line with the framework, the cascading nature of decisions. Decisions such as whether to pay tuition by credit card or check follow naturally from Anne's decision regarding whether to obtain an MBA.

### 2.55 Variability and relevance (LO1, LO3).

The following provides the cost classifications, including comments pertaining to the rationale underlying each classification:

#### 1. Sales commissions – **Variable & relevant**

These costs are directly proportional to sales volume and, thus, are variable. They are relevant because sales commissions would increase if the new store opens.

#### 2. Cost of merchandise – **Variable & relevant**

Similar to sales commissions, these costs are directly proportional to sales volume and, thus, are variable. Additionally, they are relevant because merchandise costs will increase if the new store opens.

#### 3. Salaries to sales staff – **Fixed (at least in the short term) & relevant**

This cost is fixed once Malabar has committed to the number of staff – thus, it is not likely to change with sales in the short term. However, the number of staff likely will vary in sales volume – increases in sales will necessitate increases in sales staff (as over the Holidays, for example). Further, the cost will change if a new store is opened, making it relevant for the decision regarding whether to open the new store.

4. *Salary to the store manager* – **Fixed & relevant**

The cost is fixed, although one might argue that a larger store may need a more “seasoned” manager who commands a higher salary. However, the change in salary is likely to be small. The cost is relevant with regard to the decision to open the new store because Malabar will need a manager to run the Chicago store.

5. *Display and Stocking expenses* – **Mixed & relevant**

This is likely a mixed cost because the store would incur a minimum cost (e.g., to change displays for seasons) even absent any sales revenue. In addition, the amount of shelf-stocking would depend on sales volume. The greater the sales volume, the greater the amount of time devoted to restocking goods. The cost also is traceable to a specific store and would disappear if a store were to close. Thus, it is a relevant cost.

6. *Advertising on national television* – **Fixed & Not relevant**

This is a fixed cost with respect to sales volume in any given store. While discretionary, the cost likely varies with aggregate sales volume. Estimating the cost function, though, may be difficult, because advertising expenses often lead sales, and can exhibit a negative relation with contemporaneous sales. For instance, a firm may choose to advertise more to rectify sagging sales.

The cost is not relevant for opening a store. The total amount of advertising is likely to be the same whether Malabar opens a new store or not.

7. *Advertising in local newspapers* – **Fixed & relevant**

This is a discretionary fixed cost with respect to the sales volume in any given store. Similar to national advertising, estimating the cost function may be difficult. The cost is relevant for opening the Chicago store as the cost will only be incurred if the new store is opened.

8. *Store cleaning and maintenance* – **Mixed & relevant**

This is a mixed cost because the store would incur a minimum cost (e.g., to clean the floors, mop, and dust) even absent any sales revenue. However, the amount needed would change with sales volume; the greater the traffic through the store, the greater the amount of cleaning needed.

One can make a reasonable argument that the salary to the cleaning staff is likely a step cost. The overall cost function is likely quite complex. Detailed analysis requires that we decompose the overall cost into smaller pieces (e.g., salaries and supplies) so that we can better predict each cost element.

The cost is traceable to a specific store and would disappear if the store were to close. Thus, it is a relevant cost with regard to the decision to open the Chicago store.

9. *Transportation of goods to stores* – **Mixed & relevant**

This is a mixed cost because the store would incur a minimum cost (e.g., to deliver new merchandise) even absent any sales revenue. The amount needed would change with sales volume. The greater the traffic through the store, the greater the number of trips needed.

The cost is traceable to a specific store and would disappear if the store were to close. Thus, it is a relevant cost with regard to the decision to open the Chicago store.

10. *Central purchasing department* – **Fixed & Not Relevant**

This cost is likely to be fixed with respect to the sales volume in any given store. It also is unlikely that Malabar would add more purchasing staff because the firm added one store to the 70 stores already in place. Thus, the cost is not relevant for the decision regarding opening the Chicago store.

Note: This problem shows that variable costs, by and large, are relevant. It also illustrates that while many fixed costs are not relevant, they also can be relevant, particularly for decisions that span a longer horizon (such as opening a new store).

2.56 **Cost Traceability and Decision Contexts (LO3).**

The following table provides the required classifications:

	<i>Produce Deluxe version?</i>	<i>Drop farm toys line?</i>	<i>Shut plant?</i>
Cost of special die used to make the deluxe version of farm toys. Each die can make enough toys to meet a year's demand.	<b><u>(D)Traceable</u></b> as we can attribute the entire cost of the die to the decision to produce the deluxe version.	<b><u>(D)Traceable.</u></b> We will incur the cost only if we retain the product line.	<b><u>(D)Traceable.</u></b> We will incur the cost only if we retain the product line and, thus, decide to keep the plant.
Labor used to make the deluxe farm toy.	<b><u>(D)Traceable</u></b> as we can attribute the entire cost to the decision to produce the deluxe version.	<b><u>(D)Traceable.</u></b> We will incur the cost only if we retain the product line.	<b><u>(D)Traceable.</u></b> We will incur the cost only if we retain the product line and, thus, decide to keep

Cost of dedicated machines used to make farm toys.	<b><u>(I)Not traceable.</u></b> The machines are used to produce both regular and deluxe models.	<b><u>(D)Traceable</u></b> as we can attribute the entire cost to the decision to produce this line.	the plant. <b><u>(D)Traceable</u></b> as we can attribute the entire cost to the decision to keep the plant.
Engineering support provided to maintain the farm toy line.	<b><u>(I)Not traceable.</u></b> The support cost is shared with the regular model.	<b><u>(D)Traceable</u></b> as we can attribute the entire cost to the decision to produce this line.	<b><u>(D)Traceable</u></b> as we can attribute the entire cost to the decision to keep the plant.
Advertising for farm toys.	<b><u>(I)Not traceable.</u></b> The cost is shared with the regular model.	<b><u>(D)Traceable</u></b> as we can attribute the entire cost to the decision to produce this line.	<b><u>(D)Traceable</u></b> as we can attribute the entire cost to the decision to keep the plant.
Salary paid to the manager of the Grand Junction plant.	<b><u>Not traceable.</u></b> The cost is shared by both regular and deluxe models.	<b><u>Not traceable.</u></b> The salary cost pertains to the other product line, miniature cars, as well.	<b><u>Traceable</u></b> as we can attribute the entire cost to the decision to keep the plant.
Factory rent	<b><u>(I)Not traceable.</u></b> The cost is shared by both regular and deluxe models.	<b><u>(I)Not traceable.</u></b> The rental cost pertains to the other product line as well.	<b><u>(D)Traceable</u></b> as we can attribute the entire cost to the decision to keep the plant.
IT support provided by the head office to the Grand Junction plant.	<b><u>(I)Not traceable.</u></b> The cost pertains to both regular and deluxe models.	<b><u>(I)Not traceable.</u></b> The cost pertains to both product lines.	<b><u>(I)Not traceable.</u></b> The IT department likely provides support to many plants.

This problem illustrates that traceability is context specific. The same cost could be traceable for some decisions but not for others. We also see that as the unit of analysis increases (i.e.,

as we move from a version of a product to a product line to the plant), more costs become traceable. Indeed, virtually all costs are traceable to the firm as a whole.

### 2.57 Relevance and Cost Hierarchy (LO1, LO4).

- a. The following table provides the required classification.

Cost of goods purchased for resale	<b>Unit level.</b> This cost changes in direct proportion to the volume of sales.
Conduct orientation session for new employees.	<b>Batch level.</b> It is likely that the firm conducts this session for groups of employees. The weekly scheduling supports this intuition.
Setting up seasonal display of items	This is a <b>product level</b> cost. For instance, the retailer might set up a gardening display in early spring, or decorate for Halloween in the fall.
Cost of shelving used in store.	This is a <b>facility-level</b> cost. This cost depends primarily on the size of the facility and the kinds of items stocked.

- b.

Whether to offer a 10% price discount on specific items?	<b>Short-term.</b> This decision affects only the item on sale, and can be executed or reversed almost immediately.
Whether to schedule orientation sessions on a weekly or bi-weekly basis.	<b>Short-term.</b> This decision can be easily altered/reversed within a few months.
How often to change seasonal displays.	This is a <b>Short to Long-term</b> decision. It is likely that the store changes displays 10 or fewer times in a year. Changing the number of displays will affect sales and costs over the entire store for many months. Moreover, while such changes are reversible, they are time-consuming and somewhat costly.
Whether to change store layout to improve traffic patterns.	This is a <b>long-term</b> decision. The choice here is costly and could affect costs and revenues for many years.

c.

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Whether to offer a 10% price discount on specific items?	<b>Only cost A</b> is relevant for this decision. The other costs are likely unaffected by this decision.
Whether to schedule sessions on a weekly or bi-weekly basis.	<b>B only.</b> This decision is unlikely to change the volume of sales (related to cost A) and surely does not influence costs C and D.
How often to change seasonal display	<b>A, B, and C.</b> Changing the number of seasonal displays affects C directly. It also affects A because the decision likely changes sales volume. The change in sales might spur changes in the number hired, leading to a change in cost B.
Whether to change store layout to improve traffic patterns.	<b>A, B, C and D.</b> Changing the store layout is likely to affect all of these costs, including the amount and types of goods purchased, employee training, seasonal displays, and shelving. The choice here is relatively costly and could affect costs and revenues for many years to come.

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- c. One inference that leaps out is that higher-order costs seem relevant when we consider longer-term decisions. This intuition is generally true. In the long-run, we can alter the nature of the business and the associated processes. Such change is required for us to influence facility and product-level costs.

### 2.58 Traceability and Cost hierarchy (LO3, LO4).

At some level, Erika's argument is valid. Ultimately, the revenue from the units produced and sold must cover all costs for the plant to turn a profit. It does not matter whether the cost is unit-, batch- or a facility-level cost. However, many higher-level costs are not traceable at the unit level. Consequently, many firms allocate these costs to units in some fashion (we see more of this in [Chapter 3](#)), and determine a unit cost. The idea is that the product's price should cover this fully loaded cost.

This thinking is not quite right, however. The cost hierarchy helps us make better decisions by helping us determine controllable and relevant costs. Usually, the longer the decision horizon, the greater the number (and level) of costs that become controllable relevant. Thus, it does not make sense to treat all costs as if they were controllable at the unit level.



That said, we still need to recover all costs. The hierarchy just tells us that unit-level costs are the floor for prices. For a batch of goods, our revenue must exceed unit-level and batch-level costs. We need to consider product-level revenues when analyzing product-level decisions, and the revenue for the entire facility when making decisions that affect facility-level costs. That is, the hierarchy helps us align the costs we should consider with the unit of analysis for our decisions.

- 2.59 **Traceability and Variability (LO1, LO3).** Changing the way we organize for production changes the traceability of costs. In the traditional organization, we could trace direct labor costs to units, as workers often were paid on a piece-rate basis. However, the blurring of the lines between direct and indirect labor means that such traceability does not exist. A self-directed work team might perform several functions, and producing units might be just one of the functions. However, traceability at the level of the product line increases. The concept of a factory within a factory means that previously allocated costs (e.g., machines, engineers) now become traceable to the product line.

Many more costs are controllable for decisions that change product lines and such decisions are often the strategic decisions that make or break the firm. Because it improves traceability at this level, the modern organization structure gives us greater confidence regarding decisions at the product line level. We have less control over unit-level decisions, however. Because of the mingling of direct and indirect labor, firms lose a degree of control over these costs.

**Note:** Many managers argue that materials are the only costs that firms could control at the unit level. These managers claim that labor is more like a semi-fixed cost because it is difficult, if not impossible, to adjust the labor cost to correspond exactly with production volume. The controllability of cost under the modern production system meshes nicely with this world view. The instructor could also tie this problem to the theory of constraints. This theory advocates that we only consider the cost of materials for short-term decisions, and that we focus on maximizing the usage of the bottleneck resource.

- 2.60 Outsourcing usually increases the variability of costs. For example, consider buying units from a supplier instead of making them internally. With outsourcing, the cost is almost proportional to volume. But, internal production might involve many indirect costs such as the cost of supervision, machinery, plant and so on. However, it is not true that variability always increases with outsourcing. Many such contracts have fixed fee payments in return for an expected volume of work. Turn-key projects (where the supplier provides a fully finished project) often are for a fixed amount as well. Intuitively, it would seem that traceability of costs also increases because we can uniquely identify the payments to the supplier. However, the opposite is usually true. Suppose we outsource an entire function. Then, the outsourced cost is traceable to decisions that affect the entire function but not to individual components. In contrast, performing the function (e.g., handle customer enquiries) ourselves might allow for finer traceability of items.

Cost controllability also usually increases with outsourcing. It is common for firms to negotiate contracts that specify the unit price but leave the delivery quantity and schedule open. The buyer then coordinates with the supplier to procure items on a just-in-time basis. The contracts also are more easily altered than changing one's own operations. However, this additional flexibility comes at a cost because the supplier will demand some margin over their costs and, more important, the buyer loses some degree of control over intangibles such as quality and design. Firms combat these problems by reducing the number of suppliers and closely cooperating with the chosen few. In some sense, the supplier becomes a part of the firm's "extended family." This arrangement allows firms to reap the best of both worlds – having some distance to allow for hard negotiations but close enough to foster a long-term view.

### MINI-CASES

#### 2.61 Traceability, Variability, and Relevance (LO1, LO3).

- a. The following table provides the cost classifications, including comments pertaining to the rationale underlying each classification.

Gasoline	<b><u>Direct for trip, Indirect for person</u></b>
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The friends incur the cost of the gasoline for the trip. It is not possible to figure out how much gas each person consumed.

Cost of food and drink	<b><u>Direct for both</u></b>
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Because each person pays for his or her own food and drink, we can identify the cost incurred by each person. Note that shared meals would render the food costs indirect for persons. Further, (like the cost of gasoline) because food and drinks are consumed during the trip, the cost also is traceable to the trip as a whole.

Cost of chalet rental	<b><u>Direct for trip, Indirect for person</u></b>
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Like the gas, this common cost is not traceable to any given friend, but clearly relates to the trip as a whole.

These classifications help the friends identify what costs will be paid directly by each person and what costs need to be allocated. We also see that traceability depends on the unit of analysis – costs become more traceable as the unit of analysis increases.

- b. The following table provides the cost classifications, including comments pertaining to the rationale underlying each classification.

Cost of gasoline	<b><u>Variable</u></b>
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Miles driven. The more the friends have to drive, the greater the cost of gasoline.

Cost of food and drink	<b><u>Variable</u></b>
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Number of meals. The amount of food and drink consumed clearly is determined, in part, by the number of persons and the length of the trip.

Chalet rental for the first 3 nights	<b><u>Fixed</u></b>
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This cost is fixed as the friends have made a non-refundable deposit.

Chalet rental after the first three nights      **Variable**

Number of nights stayed after the third night. The more nights the friends decide to stay at the ski resort, the greater the cost of the chalet.

The friends can use these classifications to better estimate the cost of the trip. For example, the friends can estimate the total fixed and total variable costs as follows (we note that there may be fixed and variable costs in addition to the ones we are considering):

**Total fixed costs for the trip** = Chalet rental for first three nights

**Total variable costs for the trip** = [Chalet rate  $\times$  (# of nights – 3)] + (Miles driven  $\times$  cost of gasoline per mile) + (Cost of each meal  $\times$  # of meals)

The total cost for the trip would then be the sum of the fixed and variable costs (as the friends have already reserved the chalet for the first three nights, the total controllable costs are the variable costs, since the friends could still choose not to go on the trip). This part of the problem shows that costs vary with different activities. Further, the problem shows that variability and traceability do not necessarily coincide. For example, the cost of gasoline is variable with respect to miles driven but is not traceable to each person on the trip.

c. Food and Drink      **Unit level**

This cost is proportional to the number of people on the trip.

Chalet rental      **Batch level / Step-Cost**

Suppose the chalet rental is a fixed amount based on time and the number of people (up to some maximum). Then, we classify the cost as a batch level cost, with the occupancy limit as the batch size. We could also describe the cost as a step cost.

Some chalets, however, have a fixed fee plus an additional charge per person (again, up to a maximum). In this case, the fixed fee is the batch level cost and the additional charge is a unit level cost. This cost is a variant of the mixed costs that we considered in the chapter.

Premium TV      **Product level**

This cost uniquely pertains to the activity of watching premium channels. The cost is unrelated to the number of people or the amount of time spent in front of a TV (which, we hope is not large at a ski resort).

Time spent in planning      **Facility level**

The determinant or causal reason for this cost is not clear. Further, we must incur this cost for the trip to occur, whether it is for 3 or 5 persons. This cost, in some sense, is the administrative overhead for the trip.

d. Operating costs for car      **Relevant**  
 This cost is avoidable and is only incurred if the friends decide to drive to the ski resort.

Bus fare      **Relevant**  
 This cost is avoidable and is only incurred if the friends decide to take the bus to the ski resort.

Chalet rental for the first three nights      **Not relevant**  
 This cost would be the same for both transportation options and is not relevant since the friends have made a non-refundable deposit.

Chalet rental after the first three nights      **Not Relevant**  
 This cost is controllable (because the friends have discretion over the length of stay after the first three days) but would be the same for both transportation options (unless taking the bus or driving leads the friends to stay longer), rendering it not relevant.

#### 2.62 Cost Variability, Step Costs (LO3, LO4).

The following table provides the cost classifications, including comments pertaining to the rationale underlying each classification. Please note that there clearly is room for discussion/debate regarding some of the classifications. Without knowledge of the exact operating conditions and contracts with outside parties, there invariably is some subjectivity involved.

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<b><u>Cost #</u></b>	<b><u>Description of Cost</u></b>	<b><u>Cost Classification &amp; Comments</u></b>
1	Rent on school building	<b><u>F</u></b> – The amount of rent paid is unlikely to vary based on the number of students enrolled in the coming term. Christine probably has a long-term lease on her facility with fixed monthly payments.
2	Lunches and lunch supplies	<b><u>V</u></b> – One would think that lunch costs would be proportional to the number of students. This is likely true for Christine because she buys lunches from a caterer. That said, one could argue that the cost is mixed (M) if the school had, for example, their own chef on staff, or the caterer had a minimum volume requirement.
3	Teacher salaries	<b><u>S</u></b> – More students imply the need for more teachers. However, each teacher

4	Utilities and water	probably can work with 20-30 students (the class size would be the step). <b>M</b> – Some portion of the utility bill is fixed. In addition, there probably is a portion that depends on the number of students. For example, as the number of students increases, restroom usage increases.
5	Bus driver salaries	<b>S</b> – More students imply more bus drivers. However, each bus driver probably can transport approximately 50 children (in this case, the step size would be 50).
6	Art supplies	<b>V</b> – One would tend to think that the cost of art supplies (brushes, paints, and so on) would increase directly with student volume. We could conceive the cost as being mixed ( <b>M</b> ) if we include the cost of fixed supplies such as kilns or easels.
7	Janitorial services	<b>M</b> – The school likely has a full-time janitor and his/her salary probably is fixed. Cleaning supply usage, though, probably relates to the number of students (more students = more mess).
8	Brochures and pamphlets (including monthly newsletter)	<b>M</b> – There likely are fixed costs associated with designing and producing the brochures. Additionally, the production and distribution costs (e.g., postage) increase as the number of students increases.
9	Receptionist salary	<b>F</b> – There probably is only one receptionist for the school and his/her salary likely is unrelated to the number of students (unless the school's size changed dramatically).
10	Field trip to The Museum of Science and Industry	<b>M</b> – There are certain fixed costs associated with organizing the trip, but other costs (e.g., admission) likely vary directly with the number of students.
11	Repainting the hallway	<b>F</b> – Once the school has made the decision to repaint an area of the school, the cost is fixed and unrelated to the number of students.
12	Fuel for buses	<b>M</b> – This is a tough one. If the school has pre-specified bus stops (as numerous public school systems do), we might

argue that the cost is a fixed cost (F). If, though, the school picks up and drops off students at their homes, then the cost likely is mixed since there are fixed costs of going to, e.g., a neighborhood and incremental variable costs for picking up each child in the neighborhood. The cost would be purely variable if the school individually chauffeured each student.

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This exercise shows us that few costs are purely fixed or purely variable (of course, in the long run, all costs are variable). Rather, many of an organization's costs are likely to be mixed or follow a step pattern. That said, for many decisions, organizations do classify costs as being purely fixed or purely variable, perhaps because the ease of resulting computations outweighs the errors introduced by the classification.