DYNAMIC COSTING FOR BUSINESS DECISIONS*

How cost allocation systems can lead managers astray

By

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I. Introduction

It was about a month ago while waiting for my flight to depart Lambert field in St. Louis when I became engaged in a conversation with a gentleman (Mr. Smith) who seemed even more frustrated than I with the lengthy delay we were experiencing that day. What Mr. Smith was really frustrated about, though I suspect he did not realize this at the time, was not the flight delay but his firm's cost allocation system. Indeed, his story is truly one of *how cost allocation systems can lead managers astray*.

About a month ago, Mr. Smith flew into St. Louis on a commercial airline for a two day business trip. While in St. Louis, he learned that the company plane had flown in the day before and would be departing the same day that he was scheduled to depart. Mr. Smith immediately cashed in his $200 commercial airline ticket and made arrangements to fly back on the company plane. He boarded the plane in St. Louis at the scheduled departure time and flew back home--all the while feeling pretty good about saving his company the $200 commercial airline fare and being able to depart on schedule. One day about two weeks later, Mr. Smith's boss called him into his office. Apparently, Mr. Smith's department had been cross-charged $400 for his having taken the company plane back from St. Louis. Mr. Smith's boss wanted to know why he spent $400 in flying back from St. Louis when the commercial air fare was only $200? He replied only that "the company plane was flying back regardless and there were a number of empty seats."

Mr. Smith's attempt to save his company $200 ended up "costing" his department $400. But how could this happen? The problem was that Mr. Smith recognized, where his company's cost allocation system did not, that the vast majority of the costs associated with flying the plane back home were already sunk and thus unavoidable at the time he made the decision to fly on it. In failing to distinguish between sunk (unavoidable) cost and avoidable cost, the cost allocation system was causing the firm and its managers to make uneconomic business decisions. This became clear. You see, the reason Mr. Smith was so frustrated the day that I ran into him in St. Louis was that his company's plane was sitting on the runway next to the commercial airliner (on which Mr. Smith was booked) with a number of empty seats ready to take-off for the very same destination. Yet there was no way Mr. Smith was going to fly the company plane that day, even though

doing so was the "best business decision" in that it would have saved his company the price of a commercial air fare.

The above story (which, by the way, is true) could be dismissed as an amusing anecdote about corporate bureaucracy if it were limited to the "Mr Smiths of the world" flying on company planes. Unfortunately, it is not. The same cost allocation system (or something closely akin to it) that was frustrating Mr. Smith and causing him to make an uneconomic business decision is pervasive in business today with consequences far more severe than the price of air fare. These cost systems are commonly used to make pricing and production decisions as well with results that can be financially devastating to the firm. But why do firms employ such cost allocation systems if they perpetuate inferior business decisions? As we shall see, in large measure this practice results from a failure on the part of the firm to understand the *dynamic nature of costs* and, perhaps even more importantly, to capture these *dynamics* in their cost measurement systems.

The objectives of this article are primarily two-fold: First, to demonstrate that dynamic costing is a source of competitive advantage for the firm in the sense that it fosters superior decision-making on both the cost and revenue side of the ledger;[1] second, to sketch-out an overview of a simple dynamic costing model that the firm can employ as an integral tool in its decision-making process.

II. Two Fundamental Costing Principles

Critical to the development of a dynamic costing system are two fundamental principles: the *principle of cost causality* and, its corollary, the *principle of cost dynamics.* Collectively, these principles require that efficient and profitable business decisions be premised on information systems that measure costs from a forward-looking rather than an historical perspective. These two principles are stated, respectively, as follows:

> *The only costs that are relevant for a given business decision are those costs that are caused by that decision having been made, or equivalently could be avoided if that decision were not made.*

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[1]See Robin Cooper and Robert S. Kaplan. "Measure Costs Right: Make The Right Decisions." *Harvard Business Review.* September-October 1988.

Costs do not become sunk or unavoidable as a function of time, but as a function of business decisions--each of which has a specific time horizon associated with it.

It is common for measures of cost to be referenced with respect to time such as short-run cost and long-run cost. This practice tends to create considerable confusion because it leads managers to believe that costs become sunk or unavoidable as a function of time rather than as a function of business decisions. Time serves mainly as an index over which to chart the effect of past business decisions in rendering costs either avoidable or unavoidable. In the short run, certain costs are unavoidable as a function of business decisions made in the past. Conversely, in the long run, the effects of all past business decisions have worked themselves out and all costs are avoidable. Since business decisions are constantly overlapping one another, the long run is largely a theoretical construct. Businesses continually find themselves in the short run in which some costs are avoidable and others are not. This is precisely why a dynamic approach to cost measurement is the *sine qua non* for profitable business decision-making.

There could hardly be much debate over the proposition that virtually all business decisions have some semblance of a benefit-cost trade-off at their core. The particular business decision may concern whether a price for a given product or service is "profitable," whether merchandise should be transported by air or rail, and even whether employees should fly commercial or on the company plane.

The *principle of cost causality* explicitly recognizes that the only costs that are relevant in the benefit-cost trade-off are those costs that are caused as a result of that particular business decision having been made, or equivalently could be avoided if that decision were not made. For example, Mr. Smith, at least implicitly, went through a cost-benefit analysis to determine whether he should fly the company plane. He reasoned that given the plane was committed to flying anyway and that his flying on the plane would not displace anyone else who intended to fly on the plane given there were empty seats, that he would actually be causing his firm to incur minimal (if any) costs as a result of his decision. On the benefit side, he was able to save $200 by cashing in his commercial airline ticket.

The *principle of cost dynamics* recognizes that each business decision has a time horizon associated with it that enables costs to be classified

as either avoidable or unavoidable. Those costs rendered unavoidable as a function of a particular decision become irrelevant for any benefit-cost analysis within that particular time horizon. With respect to Mr. Smith, the company plane was already committed to flying back home--independent of his decision to fly on it. As a result, the predominance of the costs associated with that flight, including the capital costs of the airplane, preflight maintenance, pilot, crew and landing fees, were all sunk at the point in time that Mr. Smith made the decision to fly on it. These costs were rendered sunk as a function of the business decision that resulted in the company plane being flown to St. Louis in the first place.

The cost allocation system used by Mr. Smith's firm treated costs that were already sunk and unavoidable as if they were avoidable--having in fact been caused by his decision to fly on the company plane. The economic harm to the firm as a result of such cost allocation systems is immediately apparent. When Mr. Smith was in St. Louis the first time, he made the decision to fly the company plane based on a benefit-cost trade-off that implied the benefit *was* $200 (saved air fare) and the costs were [effectively] zero. That is, the benefit of flying the company plane is exactly equal to the costs avoided in not flying commercial. Conversely, when Mr. Smith was in St. Louis this second time, he made the decision to fly commercial based on a benefit-cost trade-off that implied the benefit of $200 (costs avoided in not flying commercial) were dominated by the cost of $400. The $200 represents what his firm would save if he cashed-in his commercial ticket and the $400 represents what his firm's cost allocation system would charge his department if he flew on the company plane. In this latter case, Mr. Smith made a good (bad) business decision for his department (company) with this divergence the result of his having been given the wrong cost information upon which to base his benefit-cost analysis. The operative cost-benefit analyses for these two cases are shown in tables 1 and 2 below with the benefits and costs measured with respect to the alternative decision.

Table 1

Benefit-Cost Analysis For Mr. Smith's Flight Decision

(Based Upon Dynamic Costing)

FLY	BENEFITS	COST	NET BENEFITS	DECISION
COMPANY	$200	0	$200	YES
COMMERCIAL	0	$200	-$200	NO

Table 2

Benefit-Cost Analysis For Mr. Smith's Flight Decision

(Based Upon Cost Allocations)

FLY	BENEFITS	COST	NET BENEFITS	DECISION
COMPANY	$200	$400	-$200	NO
COMMERCIAL	$400	$200	$200	YES

III. Cost Allocations and Business Decisions

By a cost allocation system, we mean any mechanism employed by the firm to account for all of the costs associated with a given business function or activity. These costs are then partitioned out to various departments, products and services on some arbitrary basis--usually on the basis of relative use. For example, Mr. Smith's department was allocated $400 for his flight on the company plane. While this cost allocation could have been the result of any number of different costing exercises--the most likely case is that the cost allocation system tracked $4000 worth of costs associated with that particular flight and partitioned those costs across the 10 passengers on the plane that day. While the cost allocation system employed by the firm may utilize any number different methodologies--some

even giving the impression of science--the point is that the process of dividing-up costs in this manner is inherently arbitrary, having absolutely no foundation in cost-causation.

Most cost allocation systems breakdown, in the sense that they send the "wrong" signals to managers, because they violate the *principle of cost causality* and the *principle of cost dynamics.* Costs that are already sunk in the sense that they cannot be avoided only serve to obscure and distort the business decision the manager actual faces. Cost allocation systems are inherently flawed on this score because they take an historical perspective rather than a forward-looking perspective on cost measurement. In this sense cost allocation systems rest upon the principle of *cost recovery vis a vis cost causality.* That is, they take costs that are already sunk from an historical perspective and import them into business decisions that are necessarily forward-looking.

It is only natural to pose the question: Why do business firms rely upon cost allocation systems when in fact they foster inferior business decisions? There is probably no unique answer to this question, though a number could be proffered. The primary function of cost measurement in most firms is to ensure that all costs have been accounted for--what we may term the "adding-up property." Business firms are subject to a multitude of externally mandated accounting and reporting requirements by the the IRS, the SEC and various and sundry regulatory agencies. None of these agencies imposes any requirement that costs be developed in accordance with the two fundamental costing principles. Why? Because these agencies are concerned with ensuring accurate reporting of financial information, not with ensuring that firms make profitable business decisions. Since the majority of firms have but one costing system, the "adding-up" property generally takes precedence.[2] Consequently, managers are forced by default to make business decisions on the basis of costs that satisfy a number of externally mandated reporting requirements but have virtually nothing to do with cost causality. Since cost allocation systems definitionally satisfy the "adding-up property," it is only natural that they be utilized to make business decisions as well. Unfortunately, as the following example attests, cost allocations serve only to distort the true benefit-cost trade-off underlying a firm's business decisions.

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[2]See Robert S. Kaplan, "One Cost System Isn't Enough." *Harvard Business Review,* January-February 1988.

Suppose that the up-front capital investment of building a toll bridge is $40 million. The economic life of the bridge is 20 years, after which time safety concerns render it no longer operational. The bridge developer estimates that with a toll price of 25¢ per vehicle, approximately 8.8 million vehicles will demand access to the bridge on an annual basis. The recurring or variable costs associated with operating the bridge are 1¢ per vehicle per crossing. Assuming a zero discount rate, the developer's expected return on this (tax-free) investment is 6 percent.

The bridge is subsequently built and begins operations with a toll set at 25¢. Demand projections are initially tracking well with the developer's expectations regarding capital recovery. Suddenly the market situation changes dramatically. A modern ferry line offering high-speed transport begins operations in direct competition with the new bridge. The bridge owner is subsequently approached by the local trucking company and the local taxi company in attempt to negotiate a lower toll rate per vehicle. These two companies account for a significant share of all bridge traffic. They tell the bridge developer that unless he can reduce the current toll per vehicle to 20¢ from the current toll of 25¢, their companies will soon begin using the competing ferry.

The bridge developer is troubled over this development and subsequently calls in his two most trusted advisers, the corporate accountant and the business strategist. Recently, these two individuals have been debating the relative merits of a dynamic costing system *vis a vis* a traditional cost allocation system. The bridge developer poses the question of toll discounts for these two companies to his advisers and is surprised at the diversity of their replies. The corporate accountant tells the bridge developer that he should not discount the tolls for these two companies because it is unprofitable to levy a toll of 20¢ per vehicle. The corporate accountant informs the bridge developer that the effective price floor is 24¢ and that he must levy a toll of at least this amount in order to recover the capital costs of the bridge and the 1¢ per vehicle avoidable cost. The business strategist cannot support the corporate accountant's assessment of what constitutes the effective price floor because he knows it is based on a failure to recognize the sunk cost (irreversible nature) of the bridge investment. He supplies the bridge developer with a different perspective: As long as the toll levied on any particular vehicle covers its avoidable cost of 1¢, the firm is better off financially allowing the vehicle to use the bridge rather than allowing it

to move to the competing ferry. This proposition holds true as long as those vehicles for which tolls are being discounted do not displace vehicles that would have been willing to pay the full 25¢ toll. The business strategist contends further that any toll over 1¢ makes a contribution to overhead, in this case the capital investment of the bridge, and the firm is better off with this contribution than it would be if the vehicles migrated to the competing ferry. The capital investment in the bridge is, of course, a sunk cost that will be incurred whether vehicles use the bridge or not.

Two questions remain. First, suppose the firm had entered into a contract with the taxi and trucking company prior to bridge construction--would the effective price floor still be 1¢ per vehicle crossing? Second, suppose that the taxi and trucking companies intend to use the bridge exclusively during peak periods when there is traffic gridlock on the bridge. Should the developer still adopt a discounting strategy? These questions are taken up in turn.

With respect to the first question, the answer is "No." To the extent that the business decision to build the bridge is predicated on (caused by) the existence of a contract with the taxi and trucking companies, the effective price floor at the point in time that the contract is entered into (and before the capital is committed) must now reflect the capital costs that could be avoided if the bridge were not built. In other words, the capital costs of the bridge are avoidable before, but not after the bridge is built. Should the contract be broken after the bridge is built, the capital costs are no longer avoidable and the price floor is once again 1¢ per vehicle crossing.

With respect to the second question, the answer is also "No." Discounting tolls during peak periods is a not a profitable business strategy for the firm because traffic willing to pay 25¢ per crossing is being turned away in order to create space for traffic willing to pay only 20¢ per crossing. There is an "opportunity cost" associated with discounting tolls on the bridge (measured in terms of incremental revenues foregone) that must be reflected in the benefit-cost analysis underlying the this business decision. The opportunity cost is zero during off-peak periods because an additional vehicle on the bridge does not cause another vehicle to be displaced. Conversely, the opportunity cost is 25¢ per vehicle crossing during peak periods using the same logic in reverse. The effective price floor for the firm at any given point in time is thus equal

to the greater of avoidable cost and opportunity cost--25¢ during peak periods and 1¢ during off-peak periods. This analysis would in turn recommend a strategy of discounting tolls only during off-peak periods.

The above example attests to the importance of measuring costs dynamically in a manner that explicitly takes into account the two fundamental costing principles. Moreover, the value of cost measurement to the firm is seen to transcend its traditionally benign accounting function to encompass issues of pricing, profitability measurement and even the formulation of competitive strategy.

IV. Toward a Dynamic Model of Cost Measurement

In Section II, we discussed the economic logic underlying the two fundamental costing principles. In Section III, we observed that cost allocation systems in general breakdown because they fail to provide managers with relevant cost information upon which to make profitable business decisions. In this section, the objective is to sketch-out a simple dynamic model of cost measurement that can be used by the firm as a generalized decision-making tool.

It is instructive to return once again to a stylized airplane example to illustrate the basic principles of the model. For reasons that will become clear below, we refer to the model as a *binary cost-matrix model*. Suppose that we identify the following input costs associated with an airplane and its operation: Capital costs, storage, insurance, time-sensitive depreciation, use-sensitive depreciation, ground operations, landing fees, labor, fuel, food, flight coupon processing and printing, baggage handling and passenger taxes.

Suppose in our example the primary user of the cost model is the flight operations manager for the airline. The business decision she is constantly confronted with is that of assessing the price floor for ticket prices--the price below which the sale of the ticket fails to contribute to the profitability of the firm. Three specific scenarios are under consideration. In scenario I, the aircraft is sitting on the runway ready to take-off with 50 percent of its seats empty. The terminal is filled with would-be passengers who are unwilling to pay the regular price but would be willing to pay a discounted fare. How steep should the manager be willing to discount fares in order to fill the empty seats on the plane? In scenario II, there is a second plane sitting in the hangar. One flight

has already taken-off, but a number of would-be passengers remain in the terminal. What costs are relevant for the manager in the benefit-cost analysis underlying her business decision as to whether to schedule a second flight? In scenario III, the manager is considering the purchase of a new jetliner. What costs are relevant for the benefit-cost analysis underlying this business decision? Does it matter that all labor is under long-term contract?

The cost model the flight operations manager is supplied is shown in the table. A "1" in a designated column and row corresponds to a cost that is treated as avoidable for the particular scenario under analysis. Conversely, a "0" in a designated column and row corresponds to a cost that is treated as unavoidable for the particular scenario under analysis. With respect to scenario I (which parallels the "Mr. Smith Case"), all costs are sunk with the exception of the five cost inputs marked with a "1" in the first column.

Table 3

BINARY COST-MATRIX MODEL

FOR AIRLINE EXAMPLE

INPUT COSTS	SCENARIO I	SCENARIO II	SCENARIO III
Capital (Airplane)	0	0	1
Storage	0	0	1
Insurance	0	0	1
Time Depreciation	0	0	1
Use Depreciation	0	1	1
Ground Operations	0	1	1
Landing Fees	0	1	1
Labor/Flight Crew	0	1	1
Fuel	1	1	1
Meals	1	1	1
Flight Coupon/Printing	1	1	1
Baggage Handling	1	1	1
Passenger Taxes	1	1	1

Consequently, as long as the price that the manager assessed would-be passengers covers the fuel, meal, flight coupon, baggage handling and tax costs caused by these passengers, the airline is "better off" from a profitability perspective allowing those passengers to board the plane at a discounted fare rather than turning them away. (Interestingly enough, it

was an argument very similar to this one that the now defunct Civil Aeronautics Board used to justify discounted air fares for stand-by passengers.) With respect to scenario II, the cells marked with a "1" represent the costs that revenues from ticket sales on the second flight must cover in order to satisfy the benefit-cost test for a second flight. Finally, in scenario III, the benefit-cost test related to the purchase of another airplane treats all costs as avoidable and compares them with *expected revenues* that could be generated over the expected life of the aircraft (net of salvage value).

In the event the airline has entered into long-term labor contracts which preclude downsizing the labor force for a designated period of time, these labor costs are appropriately classified as an unavoidable cost for the duration of those contracts and are treated accordingly in the benefit-cost analysis. It is noteworthy further that the scarcity of a given skills set--independent of the existence of long-term labor contracts--will have very much the same effect. The firm will be forced to retain scare skills-set labor during downturns in demand because of the difficulty associated with re-hiring such labor during upturns in demand. In this latter case, scarce skills-set labor is appropriately treated as an unavoidable or overhead cost to the firm for the duration that such labor remains in short supply.

The *binary cost-matrix* model illustrated in the above example can easily be generalized to serve as a decision-making tool for the firm. Unlike a cost allocation system, a dynamic cost measurement model of this genre will help ensure that managers make business decisions that enhance the profitability of the firm.

V. Summary and Conclusion

The essence of the discussion here can be summed up succinctly: The quality of business decisions can be no greater than the quality of the information that goes into them. Cost allocation systems, given their emphasis on cost recovery as opposed to cost causality, are not capable of providing managers with the type of cost information they require in order to make profitable business decisions. The traditional view of cost measurement as a relatively passive accounting tool to track costs and ensure that the sum of the parts add up to the whole is off the mark. Yet,

somewhat paradoxically, most firms will never think to look to their costing systems as a source of competitive advantage, which is precisely what creates market opportunities for those that do.